D.T.S.65.

BRITISH RAILWAYS - WESTERN REGION

INSTRUCTIONS AND INFORMATION FOR CARRIAGE AND WAGON EXAMINERS

SECTION C

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BRITISH RAILWAYS - WESTERN REGION.

INSTRUCTIONS AND INFORMATION FOR CARRIAGE AND WAGON EXAMINERS.

SECTION C.

C.M. & E.E. Training Sch...
SWINDON.

AUGUST 1977
1ST EDITION

This book has been devised to give a Carriage and Wagon examiner as much relevant information as possible to assist him in carrying out his duties in an efficient manner.

The book is a precis of lectures given on the Carriage and Wagon training course and is for training purposes only.

It must be stressed that this book is only a guide and the examiner must keep himself conversant with any issues, amendments or alterations to Standing Orders, Maintenance Instructions, etc., issued by the C.M. & E.E. Paddington.

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SECTION "C".

WHEELS.

The examiner must be fully conversant with all aspects regarding wheels so that he will be able to notice any defects on a pair of wheels during his examination, thereby preventing a vehicle leaving his station, yard or siding in an unsafe condition.

To assist the examiner in this vital task he is issued with several aids, either on a personal basis or to the cabin for general use of the examiners in that yard.

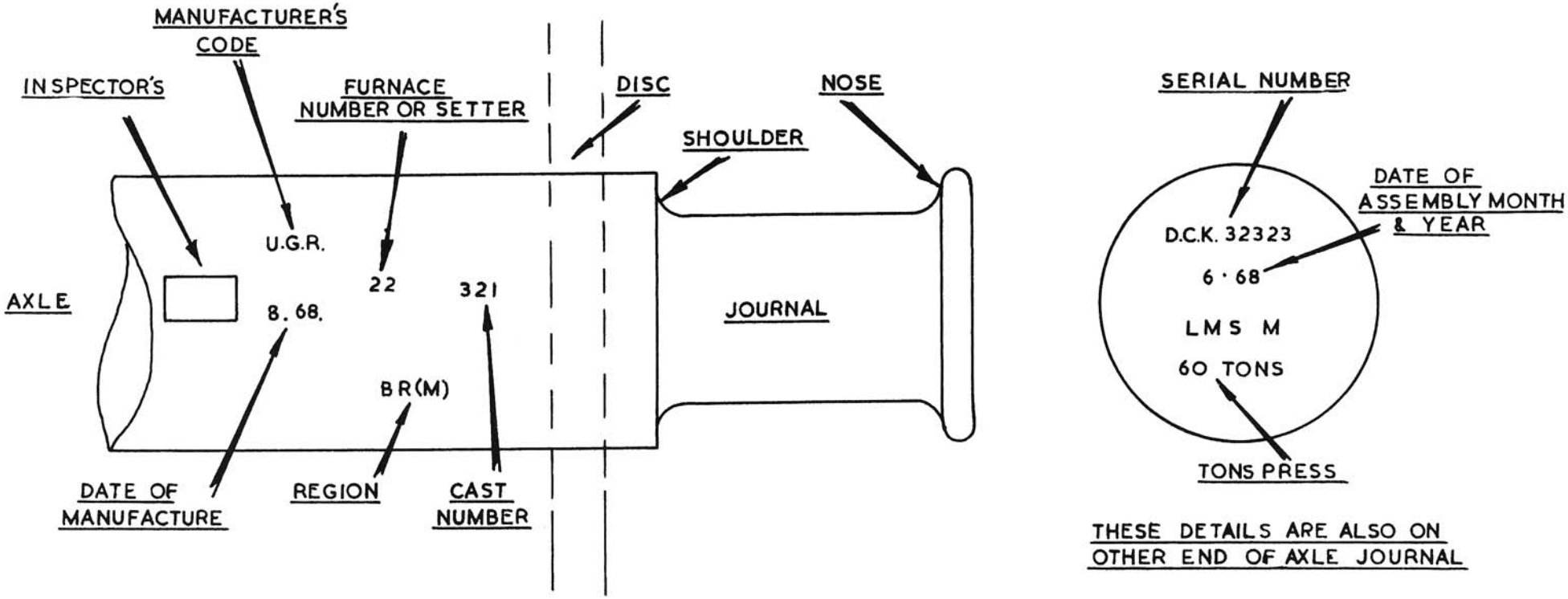
Each examiner is issued personally with a long shafted hammer. He should always carry this hammer with him during his examination of vehicles. As he comes to each wheel he is able to strike the tyre without bending; the sound will give him an indication of the soundness of the wheel, providing the brakes are off. Hence the examiner is often called "the Wheel Tapper".

Several other aids will be mentioned later on in this section.

The constructional details of the wheels are the same for freight vehicles and coaching stock, but maximum and minimum sizes can vary. Therefore this section will be devoted to freight stock only with regard to sizes etc.

The relevant coaching stock information will be included in the coaching stock section on wheels.

FIG. 1. STAMPING DETAILS ON WHEEL AXLE



THESE DETAILS ARE ALSO ON OTHER END OF AXLE JOURNAL

MAXIMUM ALLOWABLE WEAR ON ANY JOURNAL LENGTH = 1/8"

" " " " " " DIAMETER = 1/4"

Defects Applicable to the Gibson Fastening Wheel Only.

Tyre	-	loose or shifted.
Key Ring	-	broken, loose, worn, cracked, missing.
Skeleton	-	broken, flawed, worn
Spokes	-	bent, broken, loose, flawed, undersize.

Testing Key Ring for Tightness.

A visual indication is often present if the ring is loose. Dust etc., is disturbed by the vibration and can be seen on the disc by the key ring.

Place finger-tips lightly on the key ring on one side of the wheel.

Strike the key ring with a hammer on the side opposite to the fingers.

A vibration will be felt by the finger-tips if the key ring is loose.

Suspected Type Shifted.

Place three marks, approximately $\frac{1}{2}$" wide, equally spaced around the wheel side. The same $\frac{1}{2}$" marks to be made on the disc in line with the marks on the tyre.

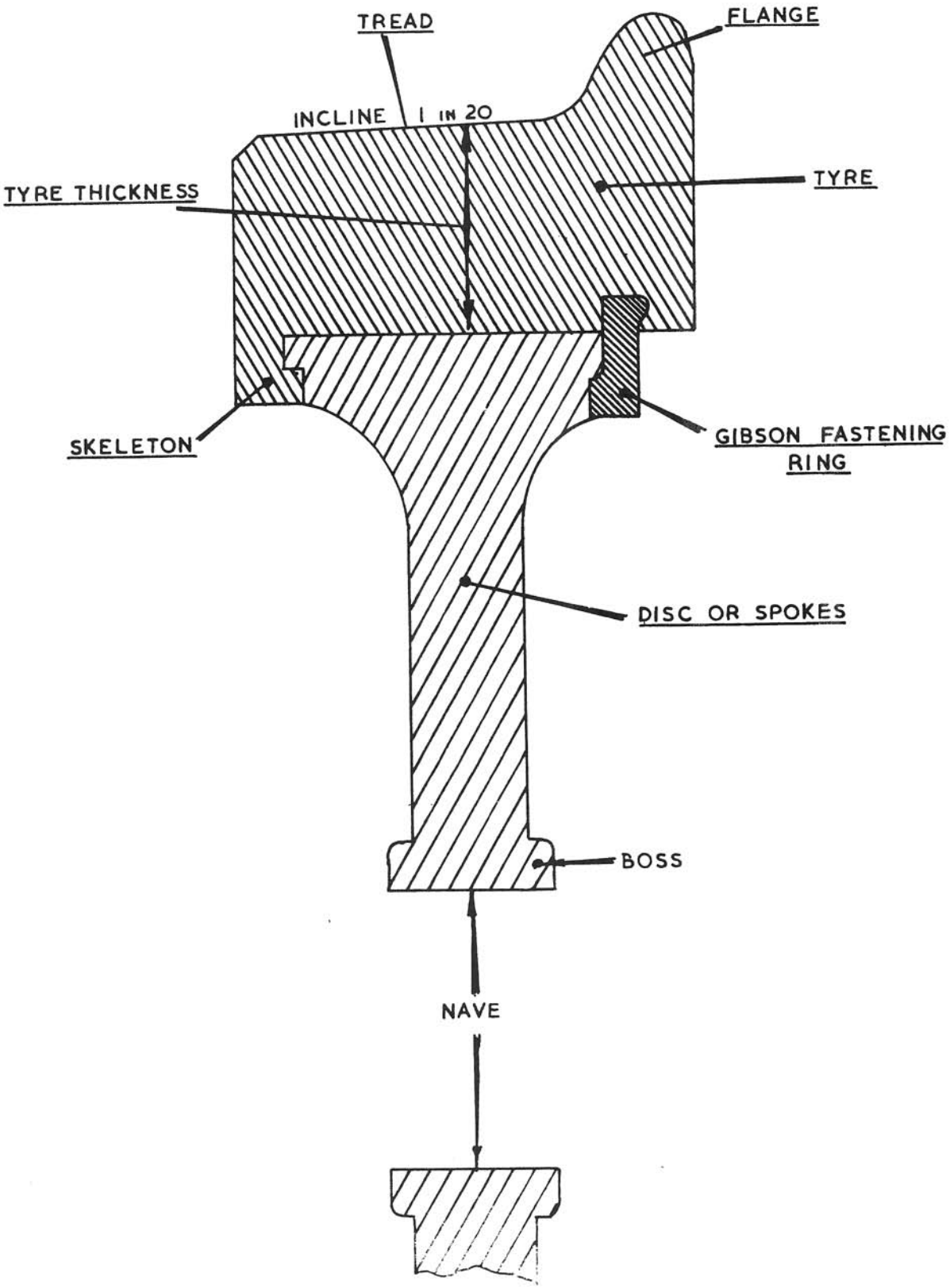
The marks to be checked on the return of the vehicle after a journey.

If movement of the tyre has taken place, the marks on the tyre will be out of line with the marks on the disc.

Minimum Tyre Thicknesses for Gibson Fastening Wheel.

Standard wagons, up to and including 9" x $4\frac{1}{2}$" journals	-	15/16" or 24 mm.
" " over 9" x $4\frac{1}{4}$" journals.	-	$1\frac{1}{4}$" or 32 mm.
" " Roller bearings	-	$1\frac{1}{4}$" or 32 mm.

Minimum width of the tyre (B.R.)	-	$4\frac{7}{8}$"
Maximum width of the tyre (B.R.)	-	$5\frac{1}{8}$"



TYRE THICKNESS GAUGE (GIBSON FASTENING).

This gauge is designed to give the correct tyre thickness of a Gibson fastening wheel to determine whether the tyre is below minimum thickness and needs retyring.

The tyre must be free from burrs, roll over of metal etc., at the section to be gauged.

Press the gauge firmly against the outer face of the tyre and bring down until the stop touches the tyre tread. The measurement in inches can then be read at the bottom of the skeleton (millimeter scale is on the other side). Gauge to be tested for accuracy every five years.

NOTE:- The skeleton is not part of the tyre thickness but an allowance of $\frac{3}{4}$" has been made on the gauge before the markings commence to give the correct measurement. When an ordinary rule is used deduct $\frac{3}{4}$" from the overall measurement at the outside of the tyre to obtain the correct measurement.

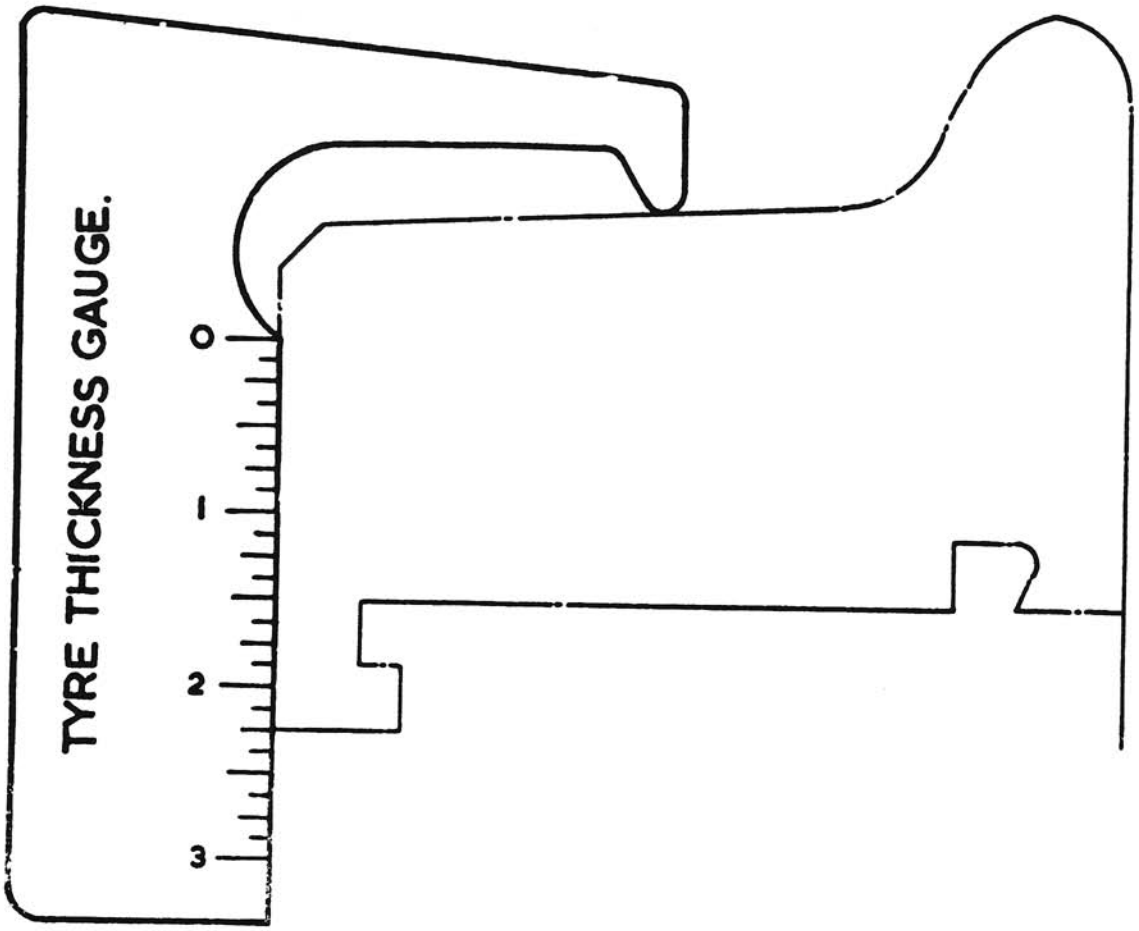


FIG.3 TYRE THICKNESS GAUGE

MINIMUM TYRE THICKNESS (GIBSON FASTENING).

This gauge was devised to enable an examiner to determine whether the Gibson fastening wheels were below minimum tyre thickness without measurement.

An allowance of $\frac{3}{4}$" for the skeleton is included in the width of the cut-out section, i.e.:-

Up to and including 9" x $4\frac{1}{4}$" journals - 15"16" + $\frac{3}{4}$" = 1.11/16"

Over 9" x $4\frac{1}{4}$" journals - $1\frac{1}{4}$" + $\frac{3}{4}$" = 2"

If the appropriate cut-out section of the gauge goes over the outside face of the tyre, the tyre is below the minimum dimension.

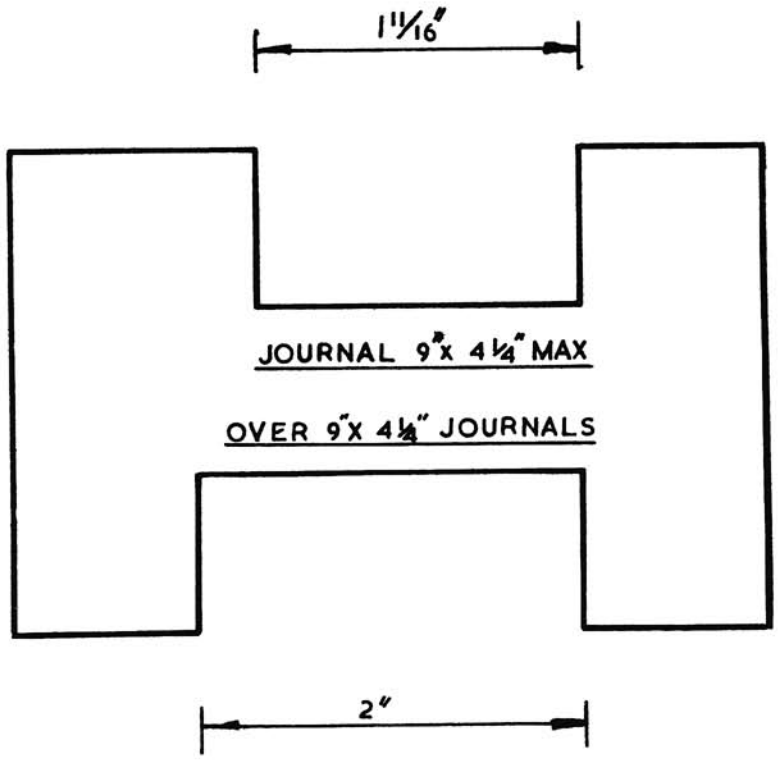


FIG.4. MINIMUM TYRE THICKNESS (GIBSON FASTENING)

The wheel is not built up as the Gibson fastening was, but rolled out in one piece, including the disc. This type of wheel, therefore, has no skeleton key ring, or spokes, but the remainder of the parts will be the same.

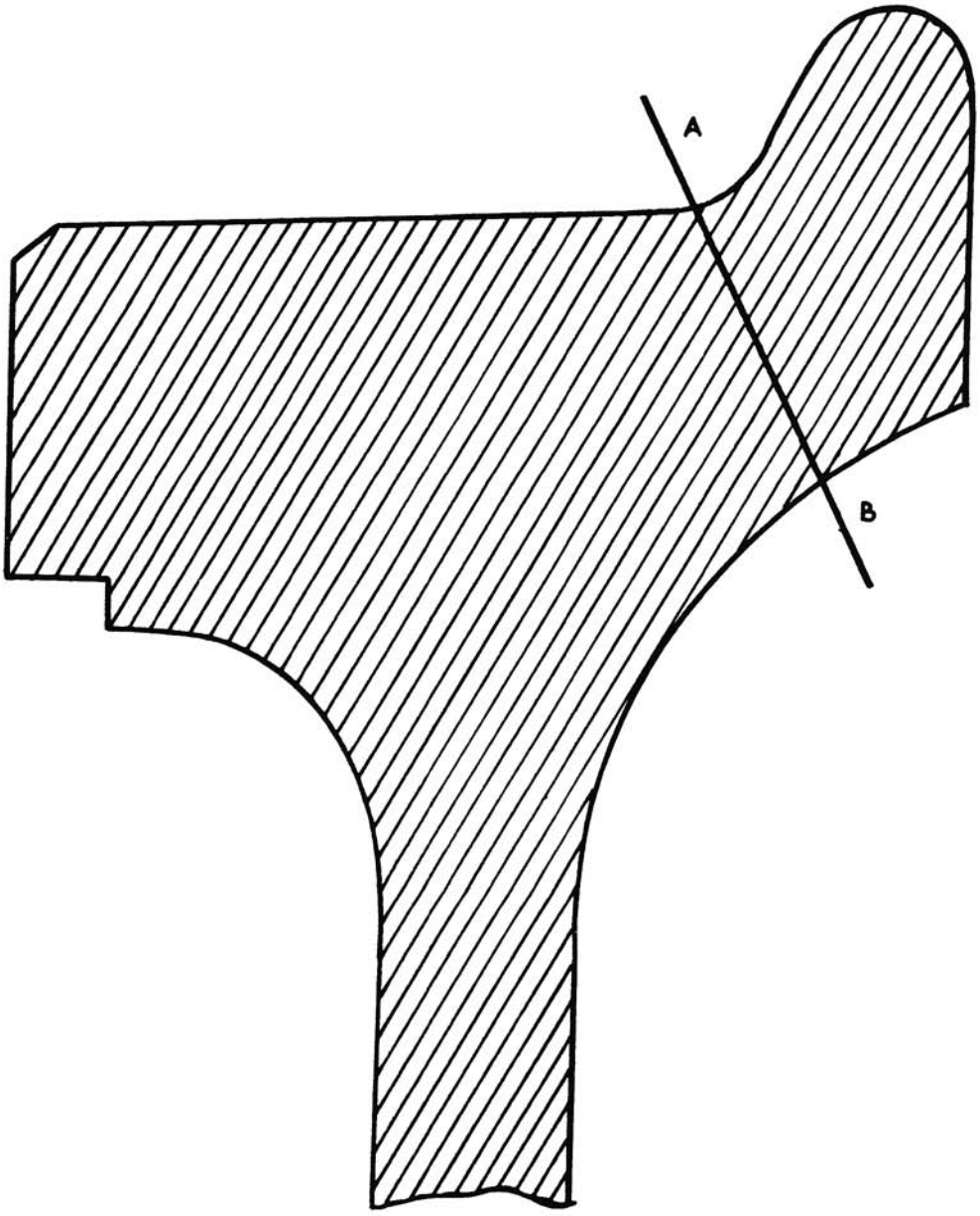


FIG.5. A-B MEASUREMENT POINT FOR THICKNESS USING A THROAT GAUGE

Parts of a Solid Rolled Wheel.

Flange)
Tread) making up the profile.
Tyre)

Disc
Boss
Nave

Throat Gauge for Solid Rolled Wheel Tyres.

This gauge is designed to determine whether the tyre thickness of a solid rolled wheel is minimum thickness.

The gauge is of the caliper type and closes over the throat of the wheel (A-B on the drawing of the wheel). If the stop of the gauge is reached the tyre has reached the scrapping size.

There are two dimensions to suit different journal sizes which means two separate gauges.

The examiner must ensure he uses the correct throat gauge to suit the wheel journal size.

Plain Bearings.

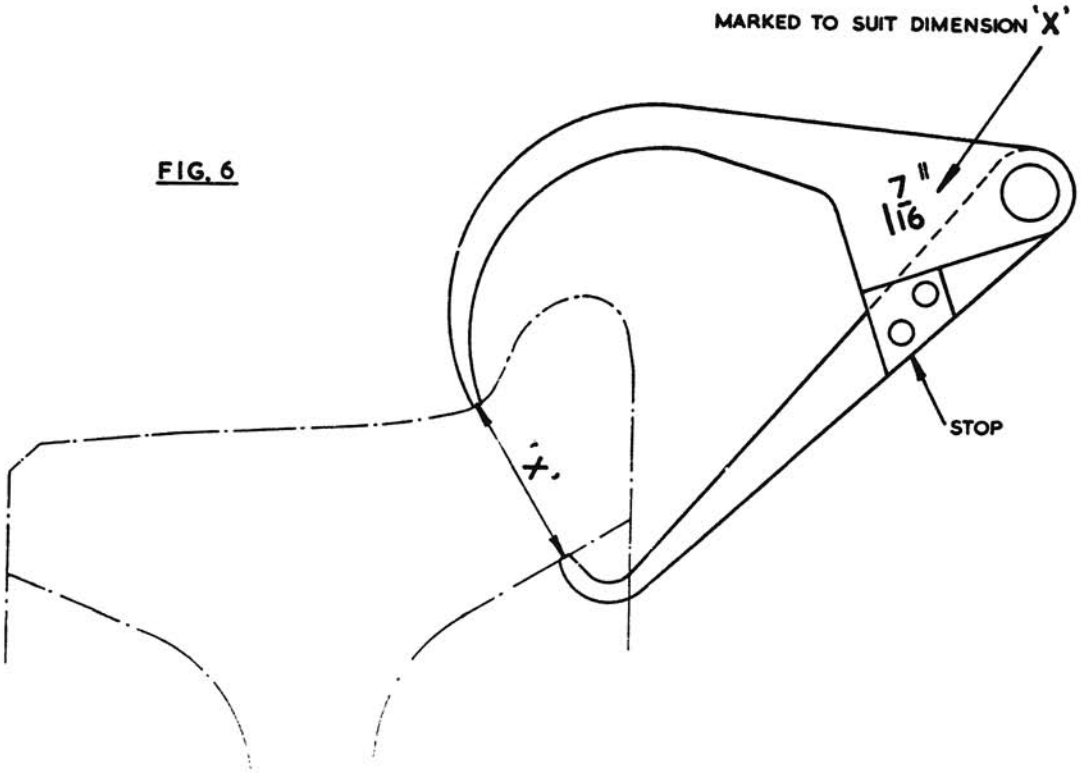
Up to and including 9" x 4½" journals	1.3/16" or 30 mm.
Over 9" x 4½" journals	1.7/16" or 36.5 mm.

Roller Bearings.

4⅜" diameter journals	1.3/16" or 30 mm.
Above 4⅜" diameter journals	1.7/16" or 36.5 mm.

The gauge must be checked for accuracy every 5 years.

FIG. 6



TYRE PROFILE GAUGE.

The shape of the flange and tread of the tyre make up the profile. Particular types of vehicles require a profile as laid down by B.R.B. Each type of profile gauge is manufactured to the maximum tolerances permitted by that profile drawing. Each gauge is stamped with its appropriate letter and number.

When the gauging edge has its ceramic coating worn away the gauge should be replaced.

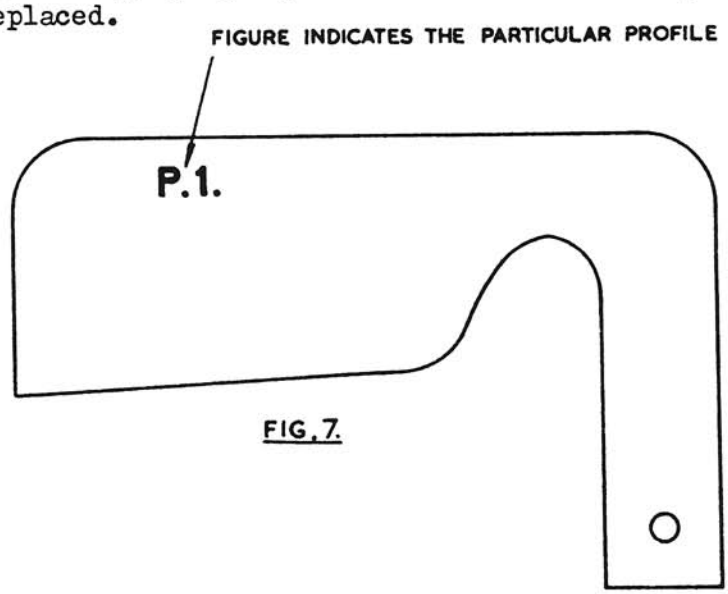


FIG.7.

A symbol of the profile, including the profile letter and number, is painted in white in the centre of the right hand bogie side plate on bogie vehicles, or on the solebar over the right hand wheel on non-bogie vehicles.

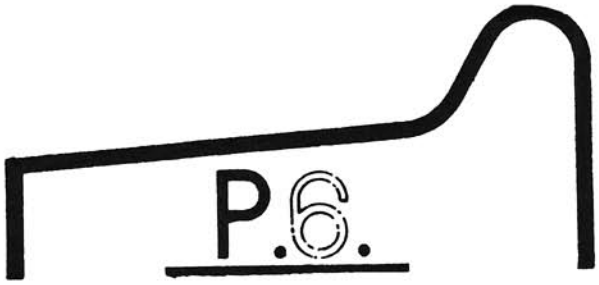


FIG.8.

The profile identification letter and number are also stamped in $\frac{3}{8}$" letters as follows:-

(a) Gibson Fastening Wheels.

On the outside of the tyre adjacent to the cast number etc.

(b) Solid Rolled Wheels.

On the inner side of the boss following the B.R. stamp, or the last digit of Private Owners vehicles.

NOTE:- Vehicles with P.1 profiles will not carry identification and by that will be recognised as the P.1 profile.

Profile Types.

P.1. Standard 1 in 20 profile.

P.2. Heuman tyre profile. (Non-standard).

P.3. U.I.C. tyre profile (for wheels greater than 840 mm diameter).

P.4. U.I.C. tyre profile (for wheels 840 mm. and less diameter).

P.5. Tyre profile (for wheels greater than 840 mm. diameter).

P.6. R.D.5 tyre profile.

P.7. R.D.5-A tyre profile)
P.8. R.D.4 tyre profile) Non-standard.

P.9. Thin flange tyre profile.

Depth of Hollow Wear Gauge.

This gauge is designed to ascertain the depth of the hollow wear on the wheel/tyre tread and it is suitable for use with all profiles.

A jockey needle is incorporated which allows the registered hollow wear to be read when the gauge has been removed from the wheel/tyre tread.

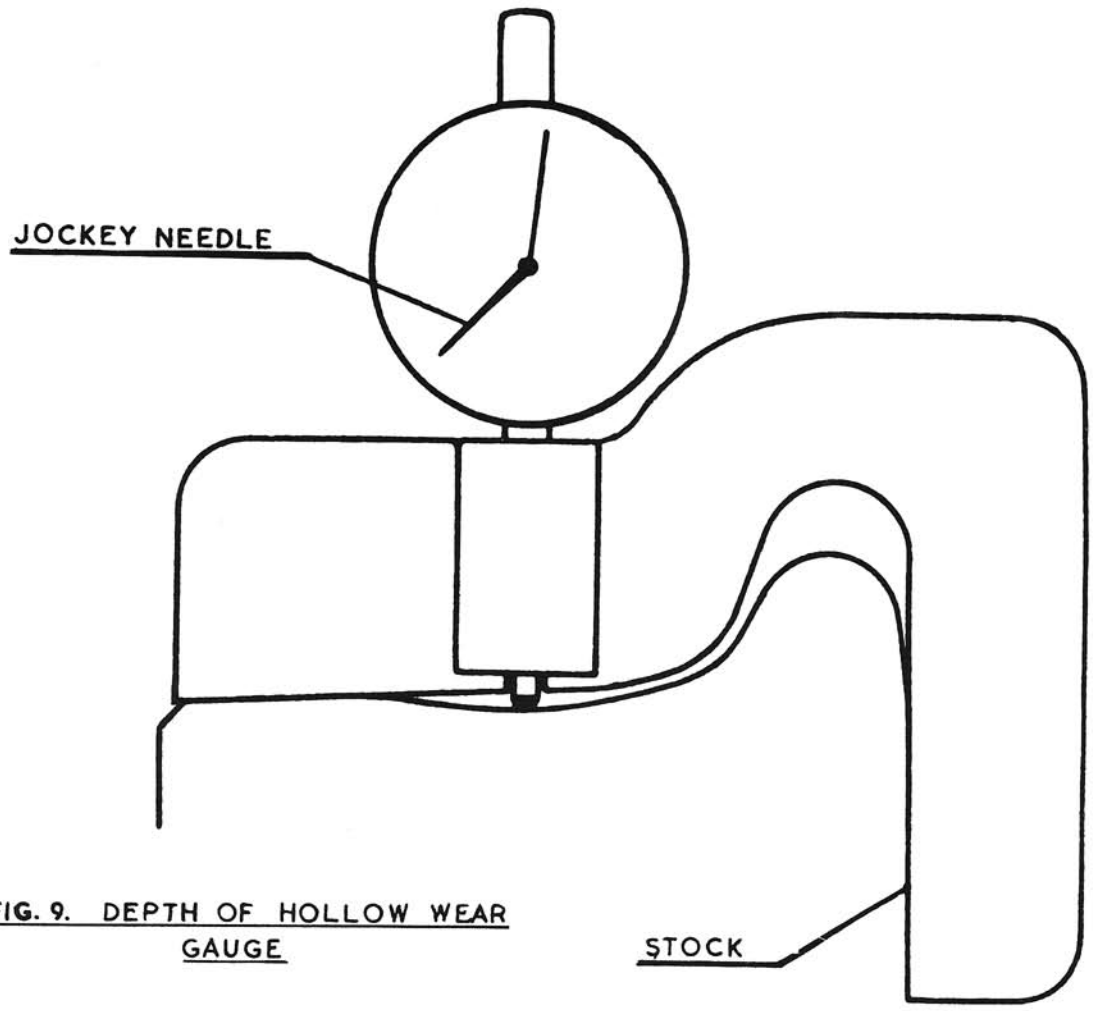


FIG. 9. DEPTH OF HOLLOW WEAR GAUGE

To ensure accurate use of the gauge the section to be gauged must be free from any roll overs, burrs etc.

Reset jockey needle by turning needle anti-clockwise until it hits the stop.

The gauge must be radially in alignment with the wheel centre. Press the stock firmly against the back of the flange. Lower the gauge gently (to avoid false readings) on to the wheel until the plate touches the tread.

The dial needle will register the depth of hollow wear present on the tread.

The dial face is marked in imperial units (Red).

The dial will only turn one revolution to a maximum reading of 0.300 inches or 7.5 millimetres.

The gauge must be checked for accuracy every 5 years.

Maximum Allowable Depth of Hollow Wear.

P.1, P.3, P.4, P.5	-	3/16" or 4.80 mm.
P.2, P.6.	-	¼" or 6.80 mm.
All milk tank wagons.		3/32" or 2.40 mm.

NOTE:-

The R.I.V. hollow wear gauge must be used when gauging continental vehicles.

R.I.V. Gauge (International Traffic Marked R.I.V.).

This gauge is designed for use on wheel sets fitted to vehicles in International traffic and is clearly stamped R.I.V.

The gauge is used to determine the following conditions which require the tyre profile to be re-turned:-

1. Minimum flange thickness.
2. Maximum tread wear (hollow wear).
3. Maximum allowable flats on the tyre tread.
4. Check for maximum allowable groove wear on axle.

The section to be gauged must be free from burrs, roll-overs etc.

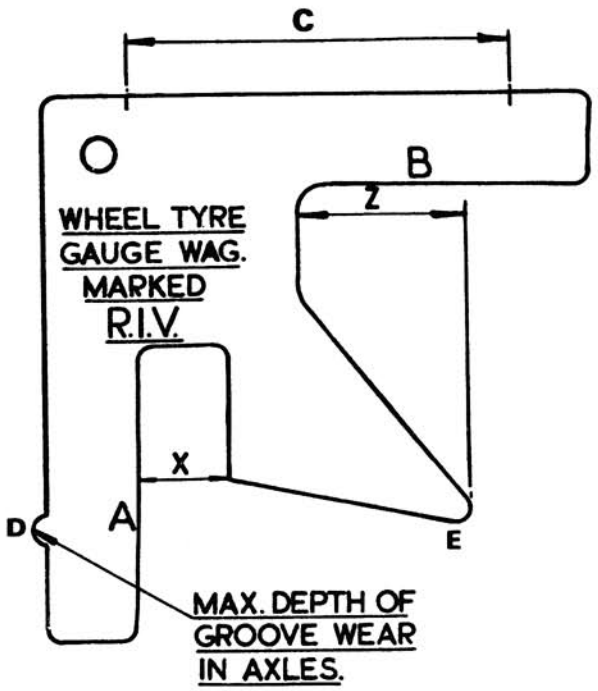


FIG 9 [illegible]

1. Minimum Flange Thickness.

Press face "A" of the gauge against the back of the flange. Draw the gauge down radially to the wheel centre until either the flange is contacted at "X" or the tread is contacted at "E".

If the tread is contacted at "E", minimum flange thickness is indicated and the tyre profile requires re-turning.

2. Maximum Tread Hollow Wear.

Press face "B" of the gauge against the back of the flange. Draw the gauge down radially to the wheel centre until either the tread is contacted at "E" or the top of the flange is contacted at "Z".

If the gauge is in contact with the top of the flange at "Z", maximum tread hollow wear is indicated and the tyre profile requires re-turning.

3. Maximum Allowable Flats on the Tyre Tread.

The maximum allowable worn flat on the tyre tread is indicated by "C" which is the distance between the two saw cuts.

4. Maximum Groove Wear in Axles.

Groove wear can appear on any part of the axle, due to brake linkage etc. fouling the axle when in service. The maximum depth of groove wear must not exceed the dimple "D".

The R.I.V. gauge must be checked for accuracy every 5 years.

R.I.V. Flange Slope Wear Gauge.

This gauge is designed for use on wheel sets fitted to vehicles in International traffic and is clearly marked R.I.V.

The gauge is used to determine when the flange slope is worn to the minimum condition on British Railways owned R.I.V. vehicles leaving Britain. Normal B.R. gauging system is adequate for all other points.

The section to be gauged must be free from burrs, roll-overs etc.

Lower the gauge radially to the wheel centre on to the tyre tread "A"; the top of the flange "D" and "B" must also be touching the slope of the flange.

If "C" does not contact the flange slope the wear is acceptable.

If "C" touches the flange slope, the tyre profile requires re-turning.

The gauge must be checked for accuracy every 5 years.

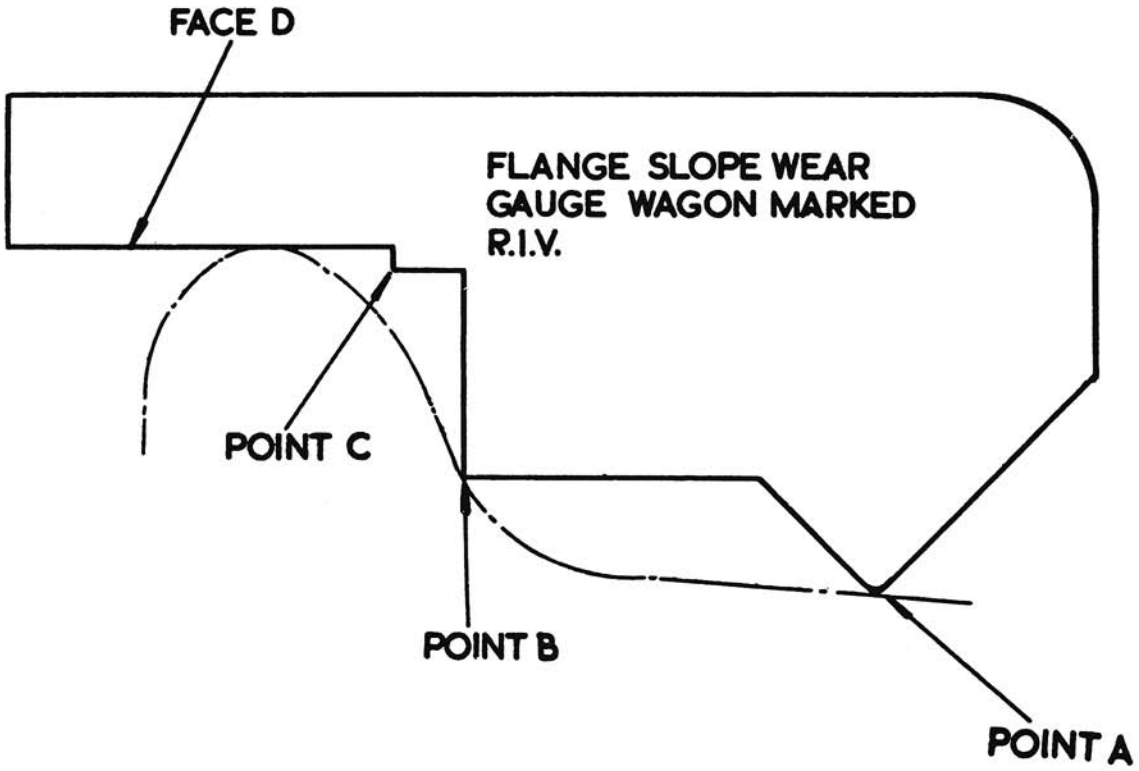


FIG.11. R.I.V. FLANGE SLOPE WEAR GAUGE

Sliding Gauge (Road Gauge).

This gauge is designed to check the following:-

1. Back to back measurement of wheel sets is within allowable limits.

2. The alignment of the tyre profiles and the line of the relief gradient.

3. Bent axles.

Two profile plates for each of profiles P.1, P.3, P.4, P.5, P.6, are provided with each gauge. A slip gauge is also provided to cover P.1, P.5, P.6, also one for P.3 and another for P.4. The P.3 and P.4 slip gauges are the same dimensions.

The section to be gauged must be free of burrs and roll-overs etc. to ensure the accuracy of the gauge.

1. Back to Back Measurement of Wheel Sets.

Set the gauge as shown in Fig. 12, using the correct profile plates and slip gauge according to the profile of the wheel set being checked.

Check wheel set with the slip gauge narrow end in position. The profile plates must contact the tyre treads.

With the slip gauge wide end in position the profile plates should NOT contact the tyre treads.

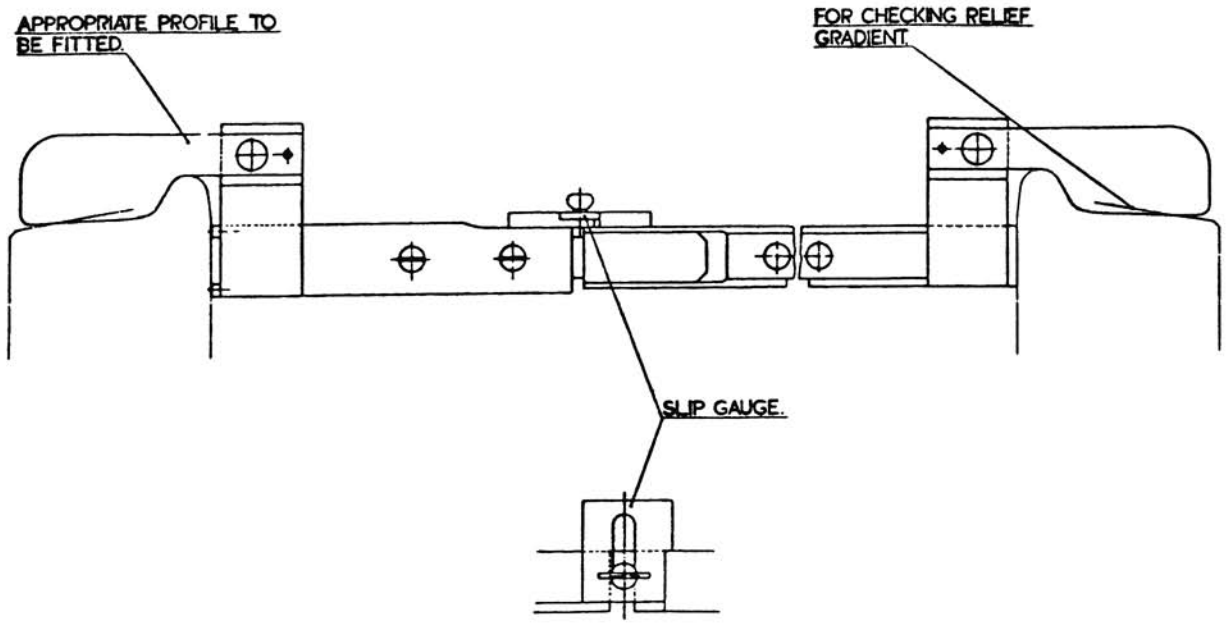


FIG. 12. ROAD GAUGE (USING GAUGE SLIPS)

If the wheel set passes these two tests it is within the allowable limits for back to back measurement.

2. Alignment of the Tyre Profiles and the Line of the Relief Gradient.

With the gauge in position on the wheel set, i.e. the narrow end of the slip gauge in position and the profile plates touching the tread the tyre profiles can be checked against the outline of the profile plates.

The relief gradients of the tyre treads can also be checked against a straight edge placed in alignment with the scribed marks on the profile plates.

3. Bent Axles.

Place the road gauge with the narrow end of the slip gauge in position and the profile plates touching the tyre tread.

Repeat in several different positions around the diameter of the wheel set.

If the gauge does not rest correctly on the wheel set in each position it will denote a bent axle.

The slip gauge must be checked for accuracy every 5 years.

"Go" and "Not to Go" Gauge for Back to Back Measurements.

The "Go" and "Not to Go" gauge is designed to check that the distance between the wheel backs is within the allowable limits.

Profile P.1, P.5, P.6.

"Go"			"Not to Go"		
53.625"	or	1.362 mm.	53.675"	or	1.363.25 mm.

Profiles P.3, P.4.

53.542"	or	1.360 mm.	53.622"	or	1.362 mm.

The section to be gauged must be free from burrs, roll-overs etc. to ensure the accurate use of the gauge. The gauge should be aligned with the axle and applied as near to the horizontal centre line as possible.

The "Go" side of the gauge should pass between the wheel backs but the "Not to Go" side should not pass between if the back distance is within the allowable limits.

When using the gauge to check for bent axles it is necessary to move the wheel so that all the checks are made as near as possible to the horizontal centre line.

The gauge must be checked for accuracy every 5 years.

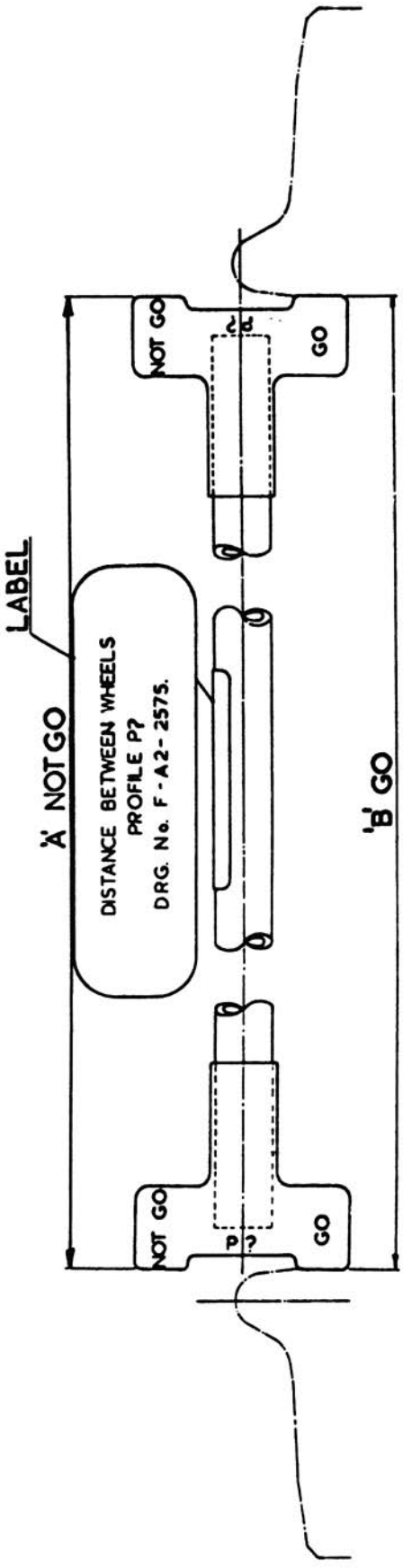


FIG. 13. GO-NOT GO GAUGE FOR DISTANCE BETWEEN WHEELS

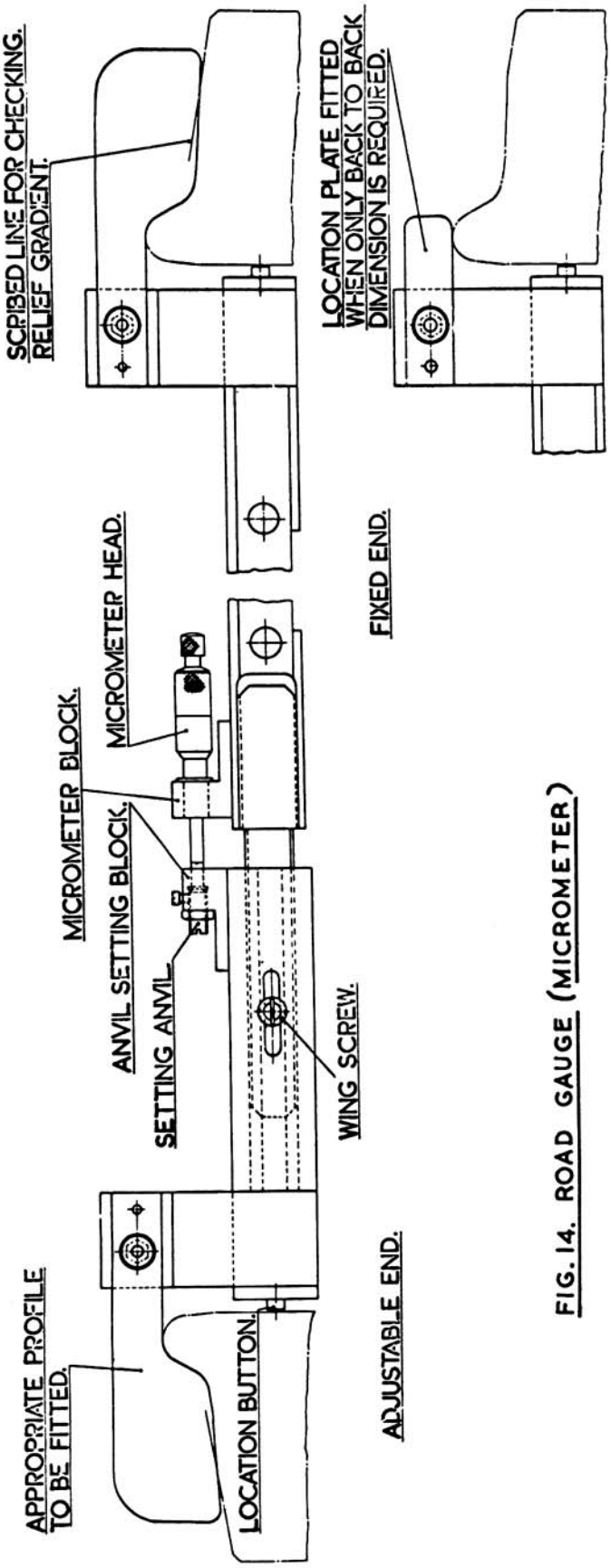


FIG. 14. ROAD GAUGE (MICROMETER)

Micrometer Gauge (Road Gauge).

9.1. Function.

This gauge is primarily designed to ascertain the precise measurement between the backs of tyre/wheel flanges of wheel sets.

It can also be used to check the alignment of the tyre profiles and the relief gradient for which purpose two plate gauges for each of profiles P.1, P.3 and P.5, P.4 and P.6 are provided with each gauge.

This gauge can be used for checking bent axles.

9.2. Using the Gauge.

To ensure accurate use of the gauge the tyre/wheel must be free from burrs, roll-overs, etc., at the section to be gauged.

Checking precise measurement between flange backs.

The gauge to be as shown in Fig. 14, page 18.

Set the micrometer at 0.000.

Slide the fixed anvil to contact the micrometer anvil and finger tighten the wing screw.

This gives a set measurement over location buttons 53.000 inches.

Aligning the gauge with the axle bring the plain location plates on to the toe of the tyre/wheel flanges, place the fixed end location button against the tyre/wheel back, loosen the wing screw, slide the adjustable end outwards until the location button at this end makes contact with the tyre/wheel back, adjust the micrometer until the two anvils make contact.

The reading on the micrometer added to 53.000 inches thus gives the precise measurement between flange backs at this particular position.

Checking alignment of profiles and line of relief gradient.

The gauge to be as shown in Fig. 14, page 18, with the correct profile plates fitted according to the profile of the wheel set being gauged. The profile plates to be fitted after a precise measurement between flange backs has been taken.

Aligning the gauge with the axle, draw the gauge radially down onto the wheel set until either one or both profile plates make contact with the tyre/wheel flanges. The alignment of the tyre/wheel profiles can then be checked against the outline of the profile plates.

With the gauge in situ on the wheel set, the relief gradient of the tyre/wheel can be checked by using a suitable straight edge in alignment with the scribed line marked on the profile plates.

9.3. When not in use the micrometer is to be unwound to -0.050" to prevent damage to anvil faces.

When setting gauge, micrometer to be unwound to -0.050".

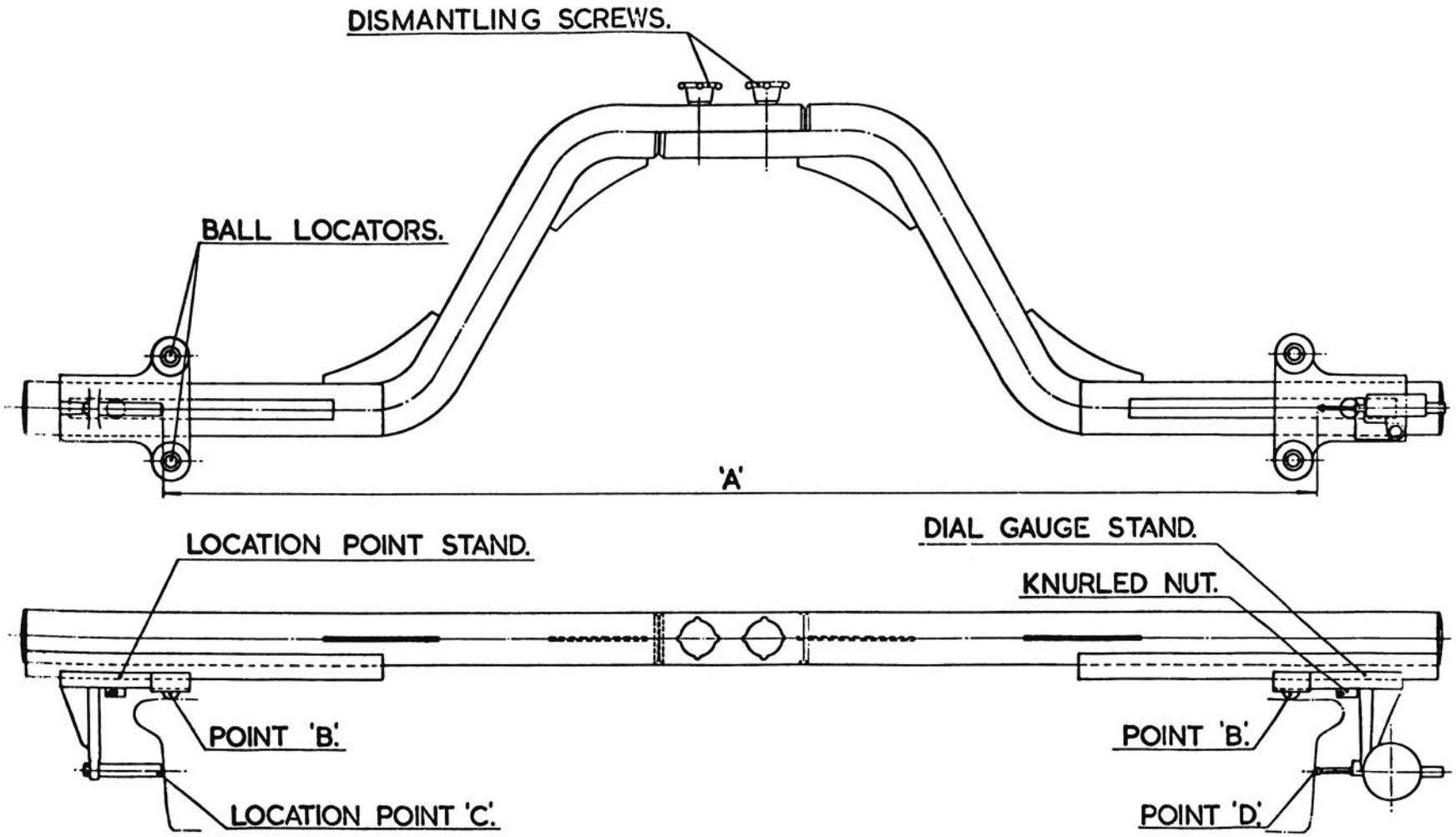


FIG.15. TREAD DIAMETER COMPARISON GAUGE

9.4. Checking Accuracy of Gauge.

The gauge must be checked every 5 years for accuracy of the micrometer and measurement over location buttons.

The gauge should always be checked if it is suspected that the micrometer anvil has been moved, or the anvil locknut has become loose.

TREAD DIAMETER COMPARISON GAUGE.

10.1. Function.

This gauge is primarily designed to check that the diameter of one wheel on the axle is within 0.010 in. of the diameter of the other wheel for carriage stock, and within 0.020 in. of the diameter of the other wheel for freight stock. It can also be used to find the exact diameter of a wheel when used with an inside micrometer.

10.2. Using the Gauge.

To ensure accurate use of gauge the tyre/wheel must be free from burrs, roll-overs, etc., at the section to be gauged.

(a) Comparison of Wheel Diameters.

When adjusting gauge length 'A', the knurled nuts must firstly be loosened on the location point stand and the dial gauge stand, then setting the location point 'C' and point 'D' (dial gauge roller stylus) so that they equal approximately the diameter of the wheel 'A' to be checked.

Ensurung that the ball locators 'B' are against the flange-back and the location point 'C' is up against the tread, rotate the dial stylus 'D' over the circumference of the wheel. The MAXIMUM registered dial reading must be recorded for the comparison against the other wheel.

Repeat the procedure for the other wheel. The two dial readings must be within the prescribed limits laid down.

The comparison of the wheel diameters is made by taking the flange backs as the datum for the ball locators 'B' which positions the location point 'C'.

(b) Finding the Diameter of a Wheel.

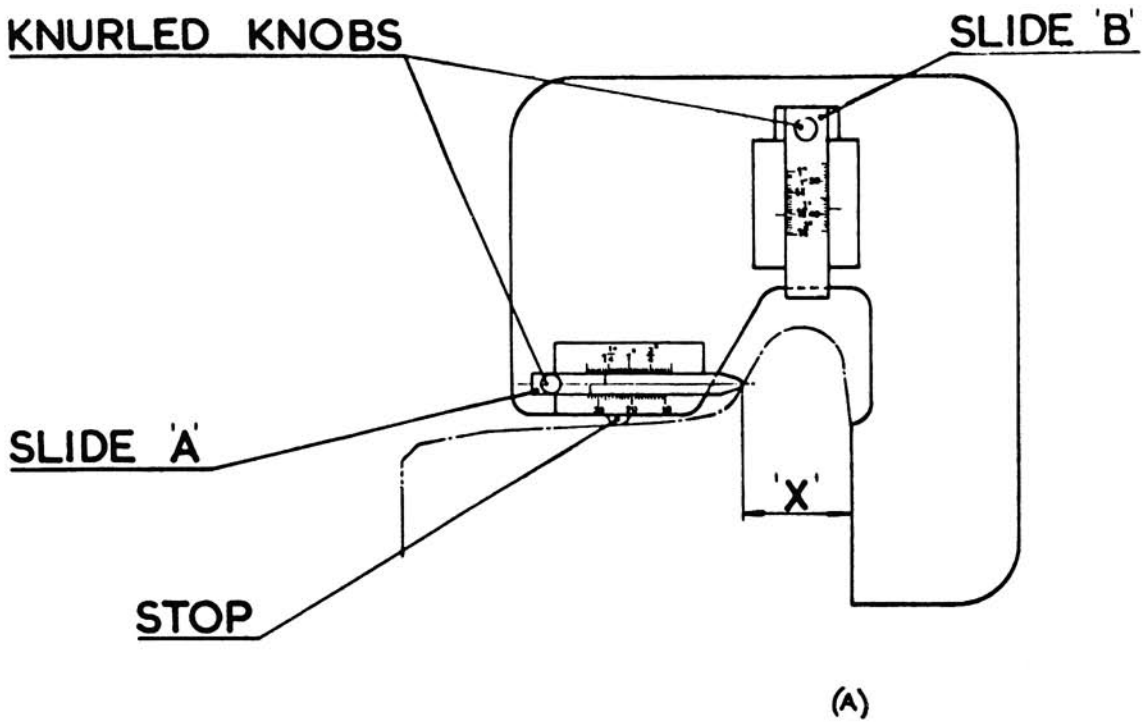
Follow the procedure set down in (a). Remove the gauge, place an inside micrometer on the location point 'C', and adjust the inside micrometer until its other end touches the roller stylus and the dial gauge registers the reading that has been recorded. The dimension then shown on the inside micrometer is the wheel diameter of that particular wheel.

(c) Storage and Transport of Gauge.

If required the gauge can be split into two halves after removing the dismantling screws. The location point stand and the dial gauge stand can be removed by unscrewing the knurled nuts.

10.3. Checking Accuracy of the Gauge.

The tread diameter comparison gauge must be checked for accuracy every 5 years.



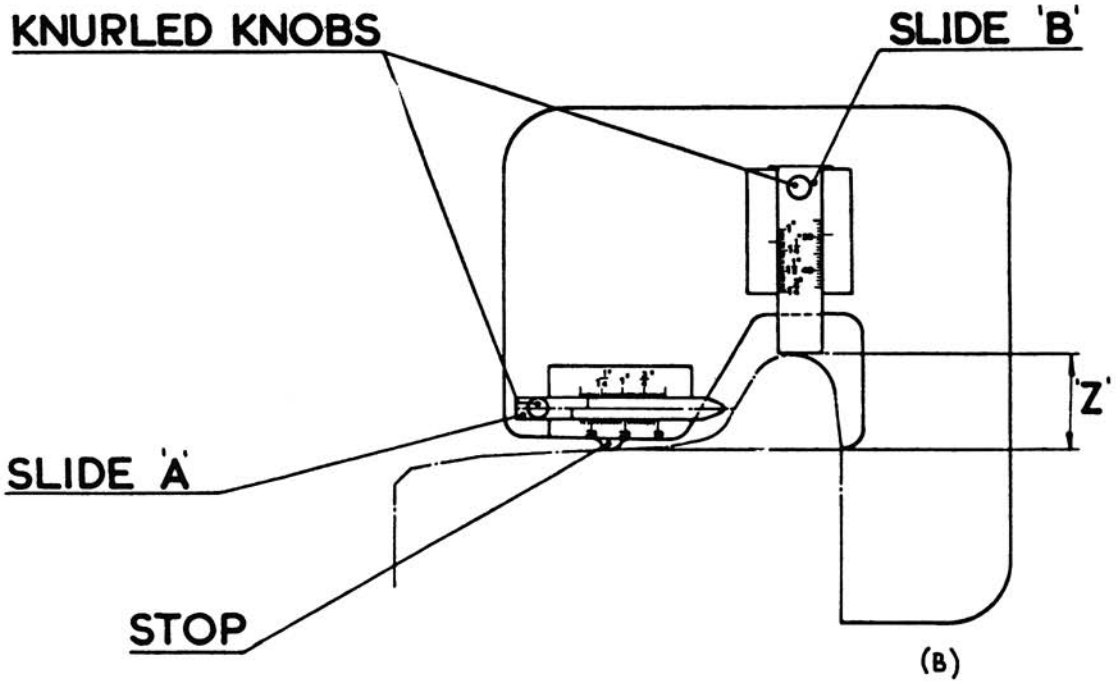


FIG. 16. FLANGE THICKNESS AND HEIGHT GAUGE

FLANGE THICKNESS AND HEIGHT GAUGE.

3.1. Function.

This gauge is designed to measure flange thickness and flange height from the tread and is for use only where precise measurement is required, and determines, in conjunction with the Table below and Fig. 16 page 22, when a tyre/wheel requires re-turning.

3.2. Using the Gauge.

To ensure accurate use of gauge the tyre/wheel must be free from burrs, roll-overs, etc. at the section to be gauged.

Checking the Flange Thickness.

Slide 'B' (see Fig. 16, page 22) is not required for determining the flange thickness and must be set clear of the flange.

To determine the flange thickness, press the gauge against the back of the flange and draw the gauge down radially until the stop contacts the tread (Fig. 16, page 22). Adjust slide 'A' by means of the knurled knob until the slide point just touches the flange. The flange thickness is indicated on the graduated scale 'A' and can be read in either inches or millimetres.

The minimum permissible dimension (dimension 'X' on Fig. 16A, page 22) for all profiles are listed in the Table below.

Checking Flange Height.

Slide 'A' (see Fig.16, page 22) is not required for determing the flange height and must remain clear of the flange.

To determine the flange height, press the gauge against the back of the flange and draw the gauge down radially until the stop contacts the tread (Fig. 16, page 22).

Adjust Slide 'B' by means of the knurled knob until the slide just touches the top of the flange. The flange height is indicated on the graduated scale 'B' and can be read either in inches or millimetres.

The maximum permissible flange height (dimension 'Z' as shown on Fig. 16B, page 22) for all profiles, are listed in the Table below.

3.3. Checking Accuracy of Gauge.

The flange thickness and height gauge must be checked for accuracy every 5 years.

TABLE.

PROFILE IDENTIFICATION NO.	MIN. PERMISSIBLE DIMENSION X.		MAX. FLANGE HEIGHT.	
	in.	mm.	in.	mm.
P1	15/16	24	1.3/8	35
P2	1.1/16	27	1.7/16	36.5
P3	1.1/16	27	1.5/16	33
P4	1.1/16	27	1.7/16	36.5
P5	1.1/16	27	1.5/16	33
P6		25.4	1.7/16	36.5

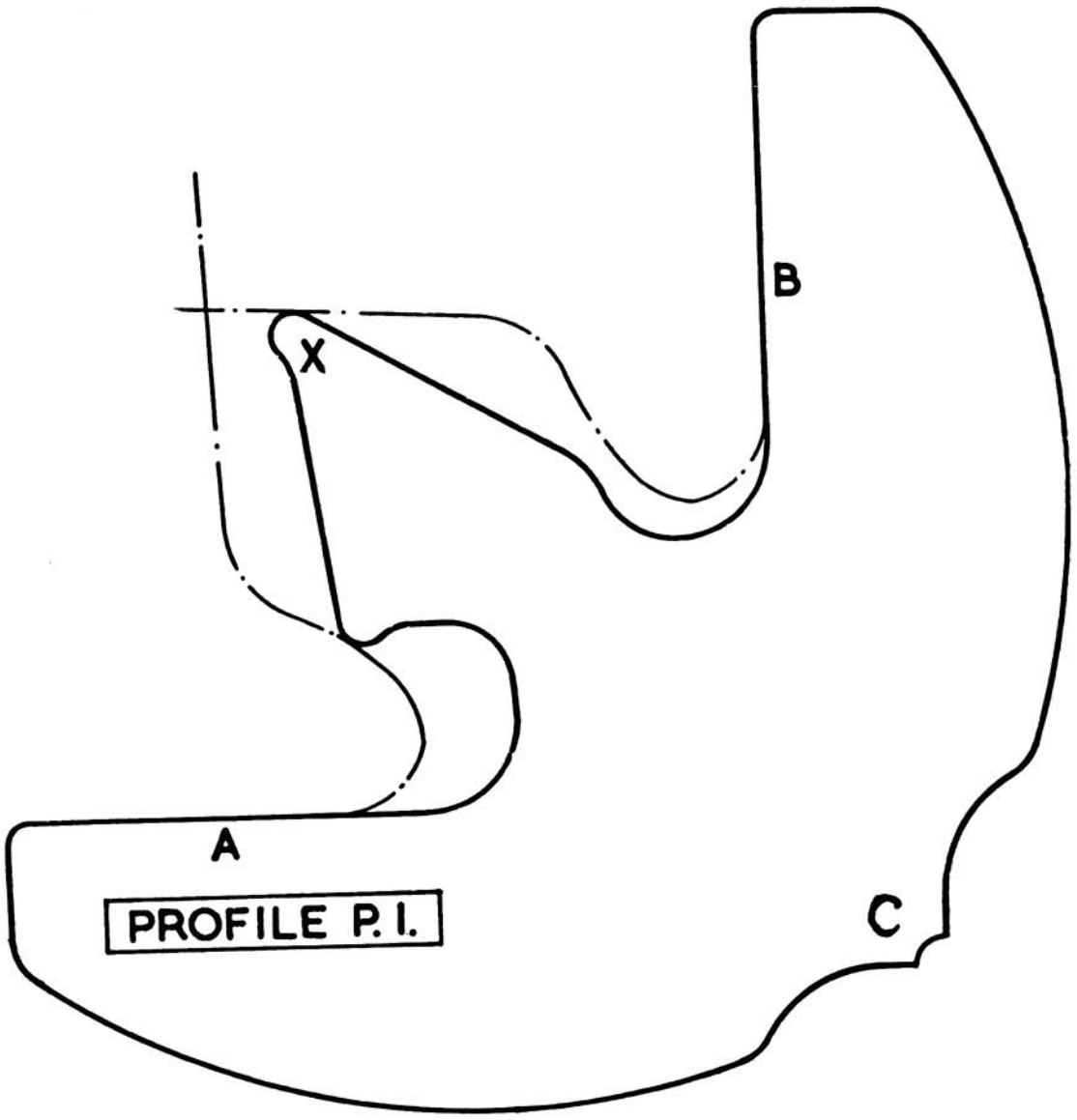


FIG.17. GO-NOT GO FLANGE THICKNESS AND HEIGHT GAUGE

"GO" OR "NOT TO GO" FLANGE THICKNESS AND HEIGHT GAUGE.

4.1. Function.

This gauge is designed for determining the two following flange conditions which require a tyre/wheel profile to be re-turned:-

(a) Minimum flange thickness.

(b) Maximum flange thickness.

Several gauges are supplied to cover the various profiles and are clearly marked with the identification letters and numbers of the profiles on which they can be used (i.e. 'P1' 'P2 P4' 'P3 P5' 'P6').

4.2. Using the Gauge.

To ensure accurate use of gauge the tyre/wheel must be free from burrs, roll-overs, etc., at the section to be gauged.

Minimum Flange Thickness.

This condition is determined by pressing face 'A' of the gauge (Fig. 17, page 24) against the back of the flange and drawing the gauge down radially (to the wheel centre) until EITHER the 'X' or the 'unmarked' stop touch the profile. Should the 'X' stop touch the tyre/wheel first, MINIMUM flange thickness is indicated, hence requiring the profile to be re-turned.

The 'unmarked' stop touching the flange prior to the 'X' stop contacting the tread indicates permissible flange thickness.

Maximum Flange Height.

This condition is determined by pressing face 'B' of the gauge against the back of the flange (Fig. 17, page 24) and drawing the gauge down radially (to the wheel centre) until either:-

(a) The top of the flange is contacted

or

(b) The 'X' stop contacts the tyre/wheel tread.

Case (a) denotes MAXIMUM flange height and hence the profile requires re-turning. Case (b) indicates permissible flange height.

The arc at 'C' is to determine the maximum build up on the toe of the flange.

If the gauge will rock when 'C' is on the build up on the toe of the flange, the build up is above maximum allowance and the tyre profile requires re-turning.

4.3. Checking of Gauge.

When the ceramic coating on the gauging edges is worn away or damaged at any point exposing the plastic edge, the gauge should then be scrapped and replaced.

WHEEL FLANGE TOE RADIUS GAUGE.

5.1. Function.

This gauge is designed for determining the maximum permissible build-up of material on the toe radius of the flange.

5.2. Using the Gauge.

To ensure accurate use of gauge the tyre/wheel must be free from burrs, roll-overs, etc., at the section to be gauged.

Maximum permissible build-up of material on the toe radius of the tyre/wheel flange.

This condition is determined by the quadrant as shown below in Fig. 18 being brought into contact with the toe radius. If a MAXIMUM build-up of material is present the gauge will rock at some point on the build-up. If this condition applies the profile requires re-turning.

5.3. Checking Accuracy of Gauge.

The wheel flange toe radius gauge must be checked for accuracy every 5 years.

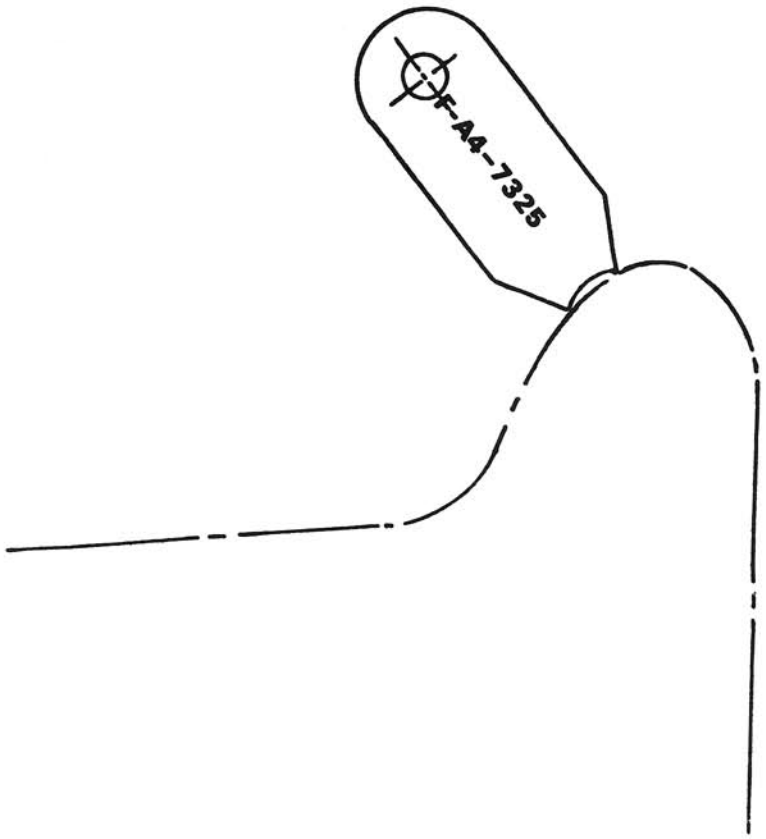


FIG.18. WHEEL FLANGE TOE RADIUS GAUGE

GENERAL WHEEL DEFECTS.

Flange	-	Sharp, square, worn, build up on toe.
Tyre	-	Cracked, undersize (thickness).
Tread	-	Hollow wear, flat, scaly, shelling (pitting).
Profile	-	Incorrect profiles for the vehicle.
Disc	-	Cracked or flawed.
Boss	-	Cracked.
Nave Wheel Seat	-	Worn, resulting in wheel loose or shifted on axle.
Axle	-	Bent, flawed, broken, worn.
Journal	-	Scored, flawed, broken, bent, worn shoulder or nose (above maximum length), undersize, brass penetration.

Gauges to be used to ensure a wheel set is suitable to be placed under a vehicle.

Flange thickness and height gauge.

Hollow wear gauge.

Profile gauge to suit vehicle.

Tyre thickness gauge (for Gibson fastening wheels).

Throat gauge (for solid rolled wheels).

Diameter comparison gauge.

Road gauge.

Pair of calipers.

Rule.

Wheel Base of a Vehicle.

Bearing point of the wheel on the rail to bearing point of the wheel on the rail the same side of the vehicle.

Any two points taken on vertical lines down through the centres of the journals on the same side of the vehicle can be used to determine the wheel base of the vehicle, i.e. spring stop centre to spring stop centre the same side of the vehicle, or spring buckle rivet to spring buckle rivet on the same side of the vehicle.

Allowable Variations in Wheel Diameters (Freight Vehicles).

Opposite ends of an ordinary wagon	-	1"
Opposite ends of a 4 wheeled tank wagon	-	1"
Opposite ends of a bogied freight vehicle	-	1"
Opposite ends of the same bogie	-	½"
6 wheeled tank wagon	-	⅛"

Smallest diameter wheels to be in the centre.

Wheels on the same axle after turning 0.020".

Width of Tyre.

B.R. profiles P.1, P.5, P.6.

Minimum $4\frac{7}{8}$" Maximum $5\frac{1}{8}$".

Continental vehicles, maximum width $5\frac{1}{2}$".

Notes for the Guidance of an Examiner Regarding Defects on Wheels, Axles and Tyres.

1. Defects occuring in wheels, axles and tyres not attributable to normal wear, should be reported in each case on the appropriate form B.R.9454 and the C. & W. Supervisor informed.

   The C. & W. Supervisor must authorise any movement of the vehicle. This includes all cases of a fracture.

2. An uneven pattern of flange wear could indicate a bent axle.

3. Flats caused by wheels skidding (freight vehicles.) Vehicle can remain in service with a flat not longer than $2\frac{1}{2}$" (unless otherwise restricted).

4. Shelling or pitting where areas of the tread surface fall out due to development of shallow fractures in the tread surfaces. Vehicles must not be allowed to remain in service unless the damage area is small and the C. & W. Supervisor's authority obtained.

5. Scaling or build-up of metal on the tread caused by excessive temperature at the braking surface. This may indicate a dragging brake. In most cases the damage is slight and providing the brake is working satisfactorily, the vehicle can remain in service.

   Advice should be obtained from the C. & W. Supervisor.

6. Loose tyres. If a loose tyre is found or suspected, the vehicle must be withdrawn from service immediately. Overheating caused by dragging brakes can loosen a tyre, therefore any tyres found hot or discoloured from previous heating should be specially examined for possible looseness or other defect.

   If there are signs of movement of the tyre, but it appears tight, the vehicle must be held for further examination.

7. Salt wagon axles (except Presflo) used regularly for salt traffic. Axles to be inspected every 6 months and a complete overhaul and painting every 3 years. The dates when inspection and overhaul are due can be found on the right hand quarter.

   Vehicles requiring axle attention must be carded and disposal instructions obtained.

8. On certain wheels (usually R.I.V.) a groove on the outer face of the rim indicates limit of turning.

DRAWGEAR (FREIGHT VEHICLES).

Purpose.

To provide a means of attaching one vehicle to another, or to a locomotive.

To spread the drawing strain of each vehicle evenly throughout the length of the train.

Draw-hooks.

1. Gedge carbon steel.

2. Gedge high tensile steel (identified by a small raised dimple behind the gedge slot or fluting of the draw-hook).

   The various positions for the minimum peripheral measurements and the maximum widths of the gedge slot are shown in Figure 19.

   These dimensions represent the amount of wear that may take place before the hook requires changing.

Minimum peripheral dimensions.

A	B	C	D
7¾"	10¼"	9¾"	8¼"

Maximum widths of the gedge slot.

E	F
2"	1.3/16"

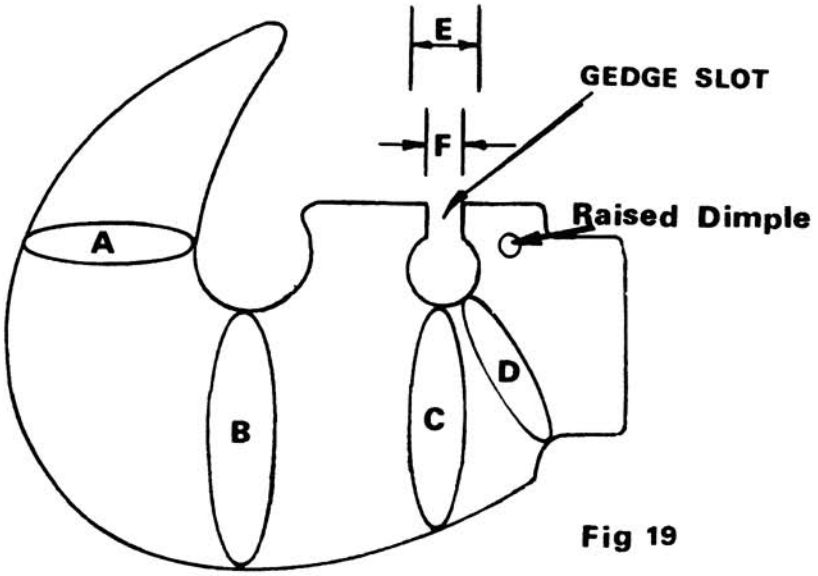


Fig 19

Minimum diameter of drawbar rod. - 1½"

All drawgear must be in a sound condition and properly cottered.

Drawhook must be changed if:-

1. Strained out of shape.
2. Gedge slot has opened out more than 1.3/16".
3. The wear at the points of contact with the coupling links or shackles exceeds ⅜".
4. The tail rod is bent or worn at any point to less than 1½".
5. Screw threads stripped or badly worn.

Build-up of worn drawbar hooks by welding is not allowed.

3. Continental Drawhook.

The continental drawhook is thicker in section than a standard drawhook and the hook is much shorter. It has no gedge slot.

The continental screw coupling is attached to the drawhook by a pin which passes through a hole in the shoulder of the drawhook.

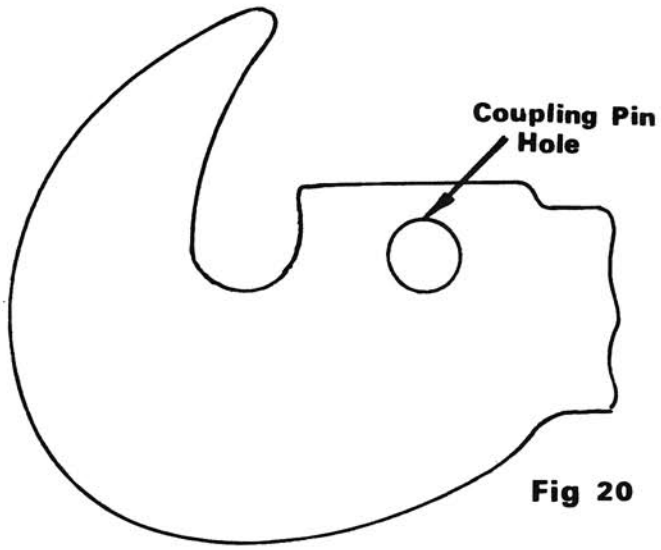


Fig 20

DRAWGEAR.

1. Rigid Drawgear.

The rigid drawgear consists of a short gedge drawbar, a threaded end 2" steel nut and a ⅜" cotter pin, coil spring or I.R. packing, two steel washers.

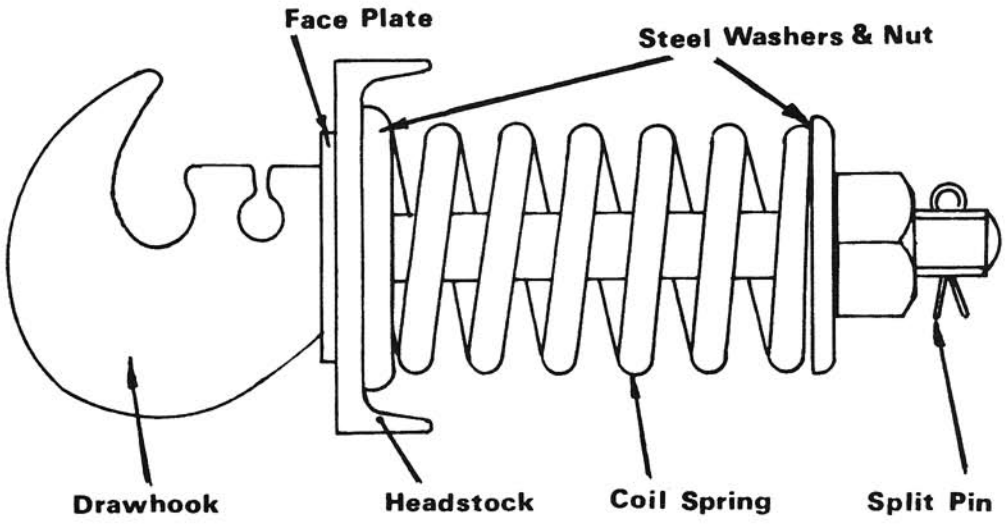


Fig 21

2. Standard Drawgear.

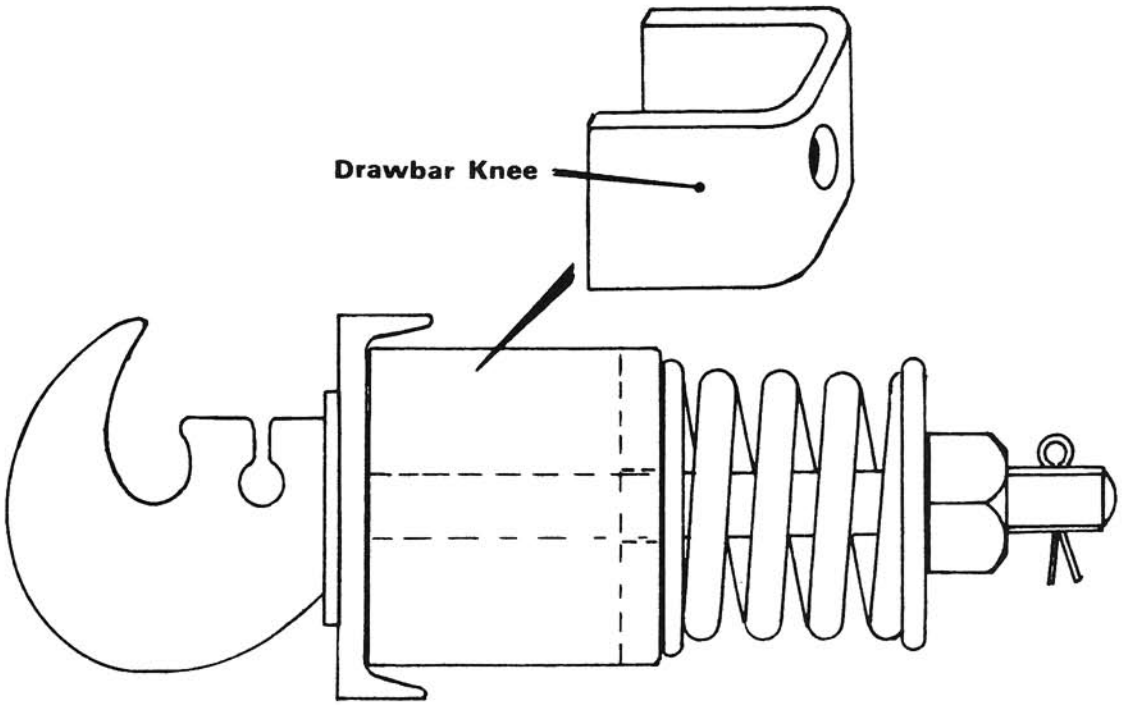


Fig 22

Fig 23 Drawbar Articulated Assembly

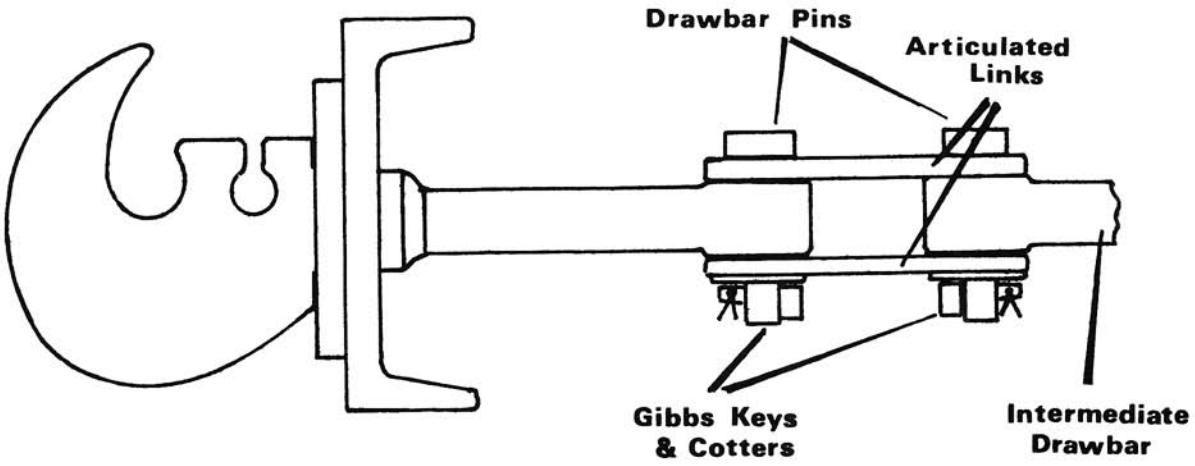
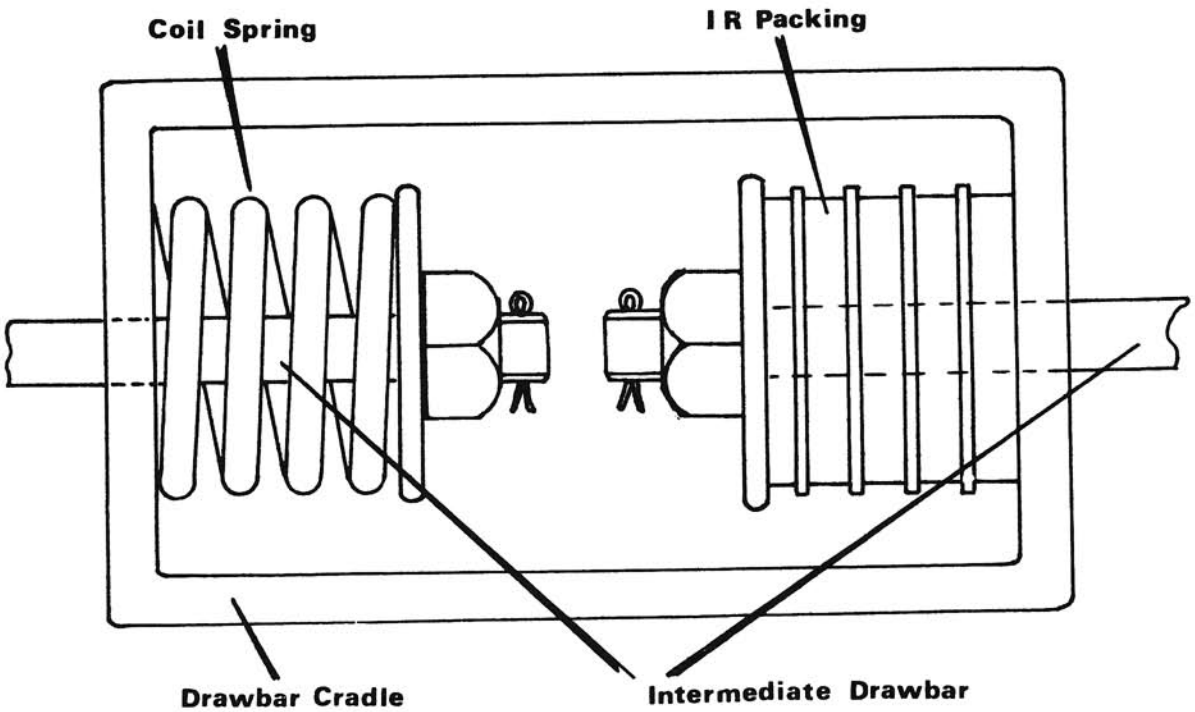


Fig 24 Cradle Assembly



3. Articulated Drawgear.

Purpose.

To allow lateral movement of the drawbar, enabling a long wheelbase vehicle to negotiate curves safely.

Construction (Fig.23).

A gedge hook with a non-threaded end. The end of the rod has a hole to accommodate a drawbar pin which connects the drawbar to an intermediate drawbar by means of articulated links, drawbar pins, Gibbs keys and cotters.

The drawbar is made continuous by connecting the two intermediate drawbars in the centre of the vehicle by a drawbar cradle. The drawbar springs are also housed in the cradle.

COUPLINGS.

1. Instanter.

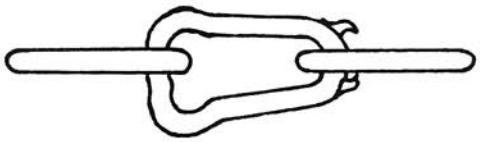


FIG. 25. LONG POSITION

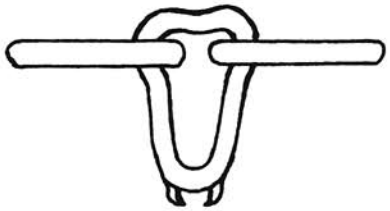


FIG.26. SHORT POSITION

The centre link is pear-shaped and by altering its position will change the overall length of the coupling.

The coupling is normally used with vehicles fitted with 18" projection buffers.

Some vehicles are fitted with thick headstock face plates to allow the instanter coupling to be fitted, if the vehicle has 20½" projection buffers.

Types of links:-

Round section	(welded)
Oval section	(stamped)
Fluted or flat section	(stamped)

Overall length	2' 9¾"
Inside length	2' 6¾"

Minimum or maximum dimensions.

End links.

Minimum thickness at ends	1.3/16"
Minimum distance between sides	2⅜"

Centre instanter link (round section).

Minimum thickness (long or short position)	1.11/16"
Maximum inside length	10⅝"

Oval section.

Minimum thickness at top in long position	1¾"
Minimum thickness at bottom in long position	1.7/16"
Minimum thickness in short position	1⅞"
Maximum inside length in long position	10⅝"

Flat or fluted section.

Minimum thickness at the top in long position	2¼"
Minimum thickness at the bottom in long position	1.15/16"
Minimum thickness in short position	9⅞"
Maximum inside length of complete coupling providing it remains at least 4" above rail level.	2' 8"

2. Screw Coupling (Freight Vehicles).

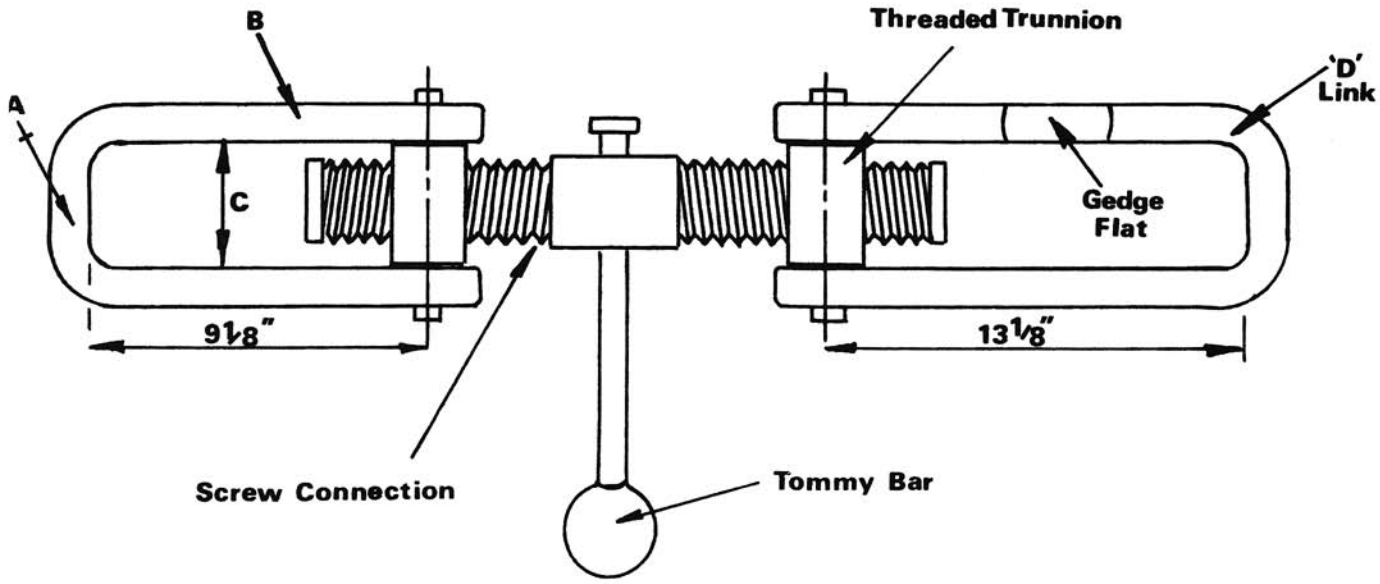


Fig 27 Screw Coupling

The screw coupling is constructed by using two end "D" links on threaded trunnions (one left hand and one right thread). The two "D" links are connected by a correspondingly threaded rod which has a tommy bar in the centre. When the centre rod is turned by the tommy bar the overall length can be shortened or lengthened depending on which way the centre rod is turned.

The longer "D" link has a gedge flat for attachment to drawbar hook. The normal buffer projection is 20½" with a screw coupling fitted to the vehicle.

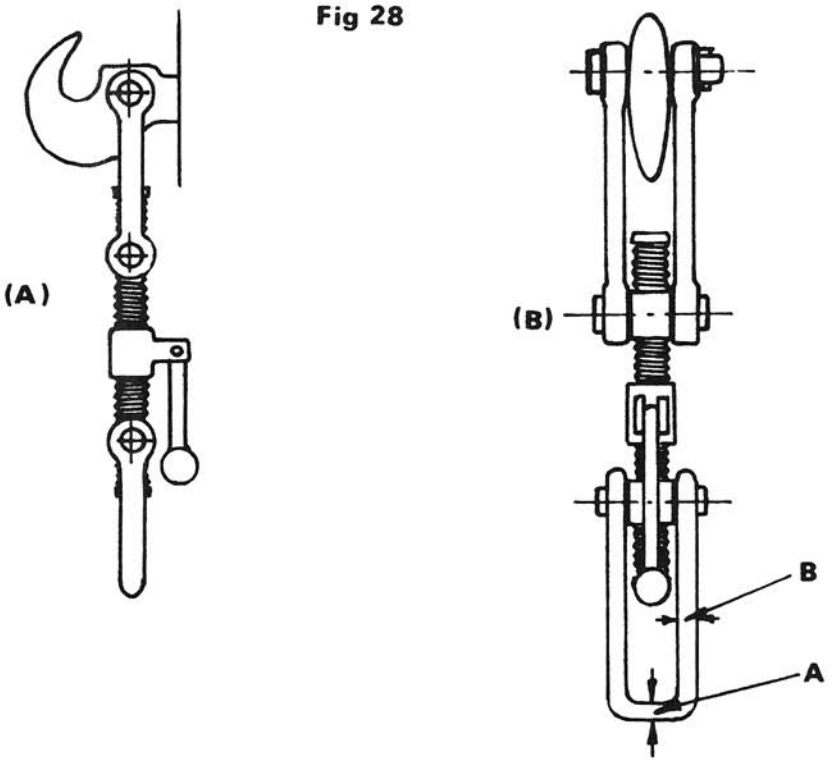
A -	Minimum thickness at the end of the "D" links	1.3/16"
B -	Minimum thickness at the side of the "D" links	1.9/32"
C -	Minimum width inside the "D" links	2⅜"

Minimum length of screw coupling No. 9.	2 - 5⅝"
Maximum length of screw doupling No. 9.	2 - 11"
Minimum distance between the end of the coupling and rail level.	4"

Stiff couplings can cause uncoupling. They should either be eased and lubricated or replaced.

3. Continental Screw Coupling.

Fig 28



Continental Screw Coupling - Construction.

The free end of the continental coupling is a "D" link on a threaded trunnion. The other end is composed of two flat connecting links on a threaded trunnion connected to the drawbar hook by means of a pin.

The tommy bar has a hinged joint.

When this type of drawgear is next to a vehicle fitted with standard drawbar hooks, the continental coupling must always be used for connection. There is a risk that the vehicles will uncouple if the B.R. standard coupling is used owing to the shallowness of the continental drawbar hook.

Minimum thickness at the end of the "D" link	$1\frac{3}{8}$"
Minimum thickness at the side of the "D" link	1.9/64"
Minimum width between the "D" link	$2\frac{3}{8}$"

4. Solid Bar Coupler - Freightliners.

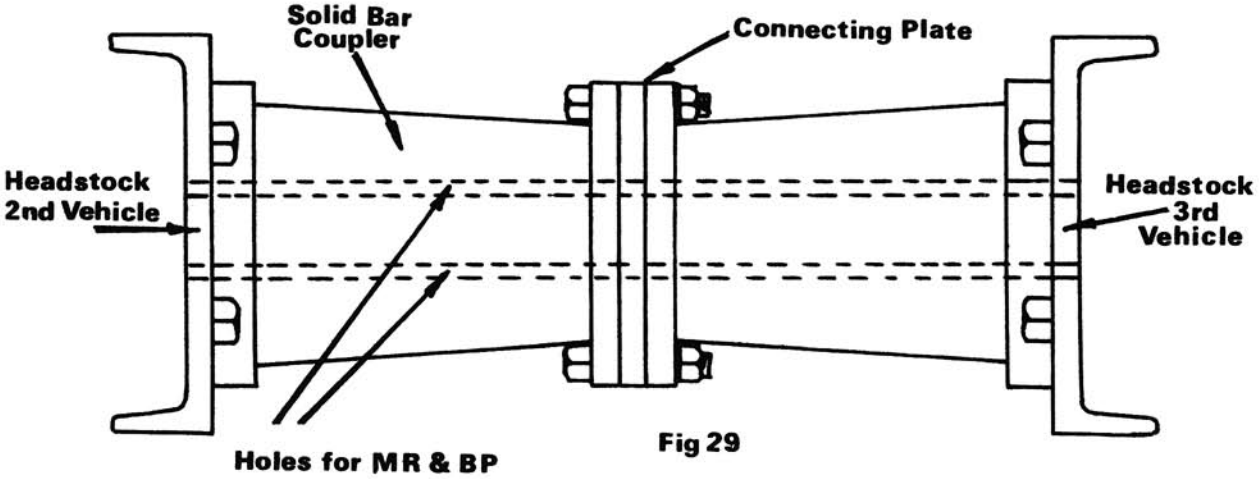


Fig 29

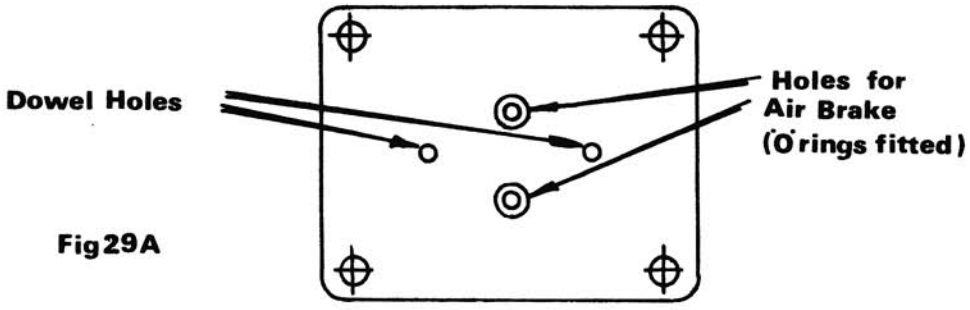


Fig 29A

The bar coupling is used on freightliner vehicles which normally work together in sets of five and uncoupling is not required.

To enable air to pass from one vehicle to the next, the bar coupling has two holes running through, one is for the brake pipe air and the other for main reservoir air.

A dividing plate with corresponding holes to match the bar coupling (both sides of the air holes being encircled by rubber "O" rings in

recesses) is placed between the two bar couplings to ensure an air-tight seal between them.

If the bolts joining the bar couplings together need tightening for any reason, the vehicle must be labelled to shops for torque tightening of the nuts.

Fig 30

5 vehicles in the formation of a freightliner set

Outer vehicles with buffers one end

Inner vehicles have no buffers

5. Emergency Coupling (Freightliners).

The emergency screw coupling is found on a bracket on the headstock of the outer vehicle. The "D" links are both 9⅛" long and the coupling is painted yellow.

There is not a gedge flat on the "D" link and this emergency coupling is the only type to be used on Freightliner vehicles.

6. Rotary Tippler Coupler.

This type of coupler has been fitted to vehicles which will be unloaded on a tippler. It is designed to allow vehicles in the train to be discharged of their load on a tippler without uncoupling.

Each vehicle is fitted with a rotary coupling one end and a non-rotary coupling the other end.

When coupling vehicles together, the rotary and non-rotary couplings must be connected on each vehicle.

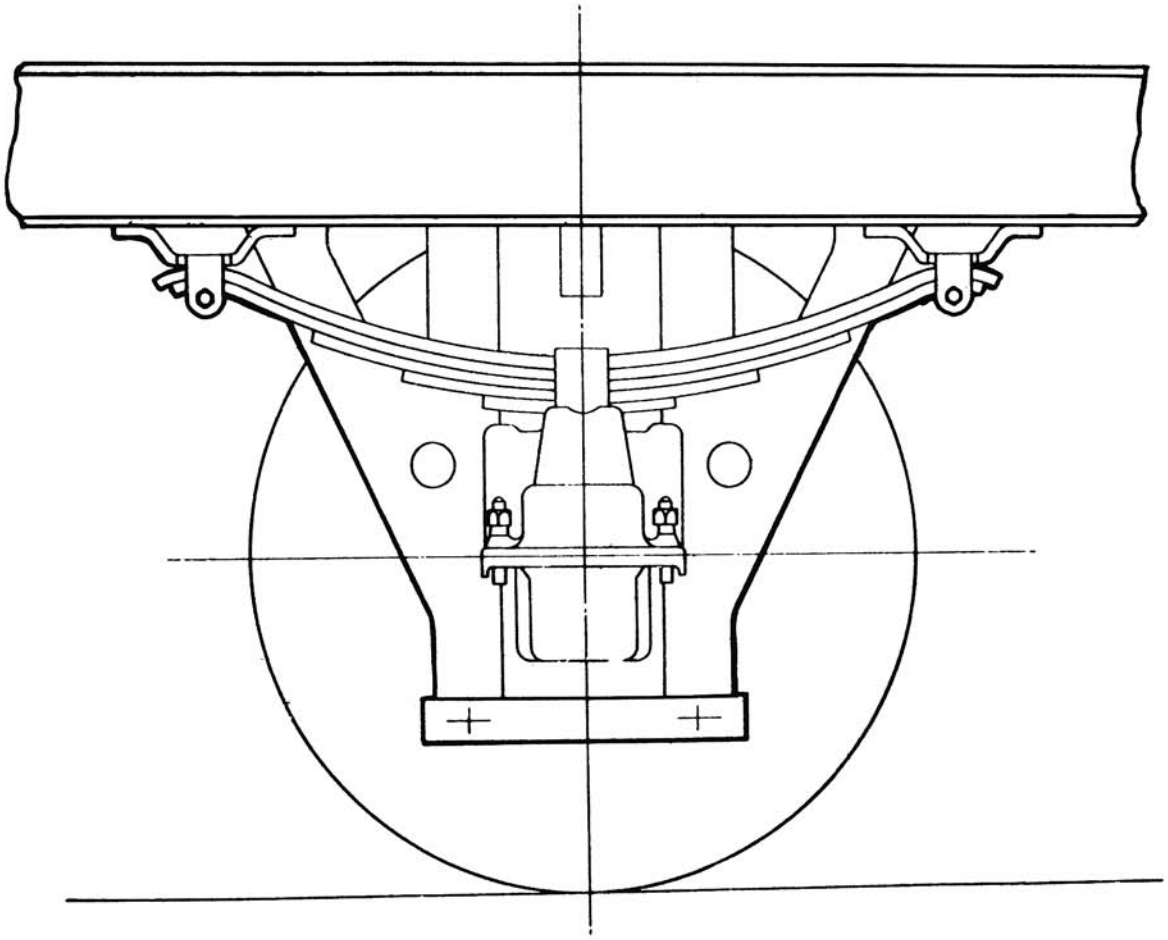


FIG. 31. SHOE SUSPENSION

FREIGHT VEHICLE SPRING SUSPENSION.

Purpose.

To absorb shock transmitted from wheels to body of vehicle.

Types in use on B.R.

There are various types, but basically these fall into two groups, laminated and coil.

The most common type in use on freight stock are laminated springs. These are manufactured in two materials, carbon steel and the more modern spring from Silico Manganese steel.

Identification.

The end of each plate on the carbon steel spring is cut in a tapered fashion, or to use the B.R. term "speared" as in Figure 32.

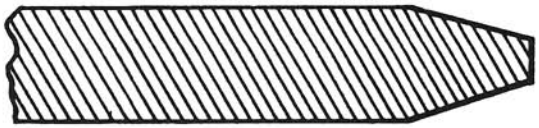


FIG. 32.

Whilst on the Silico Manganese each plate is "chopped" straight across (see Fig. 33).

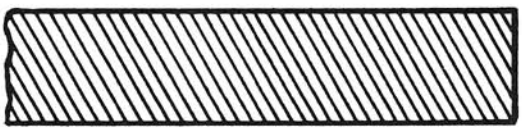


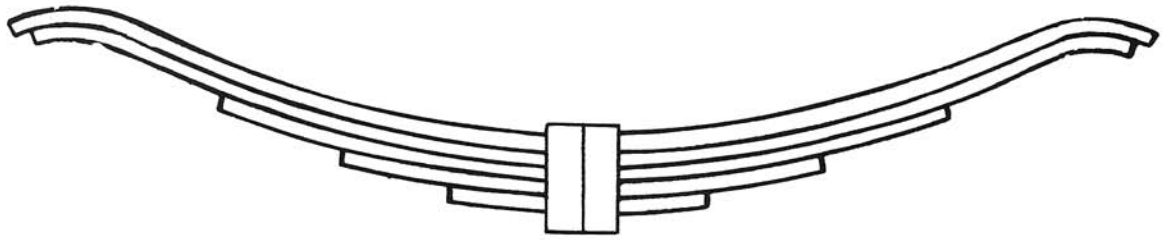
FIG. 33

Construction - Carbon Steel Spring.

A number of plates of varying lengths are held together at the centre by a steel band or buckle. A rivet is then passed through the buckle and the centre of each plate. A typical spring is shown in Figure 34. This would be described as a second plate hook end spring which is the type most widely used on freight stock.

The number of plates used will depend upon the tonnage of the vehicle, e.g. a vehicle with a capacity of 12 tons would require a spring comprised of five plates; a vehicle with a capacity of 16 tons would require a six plate spring, and so on.

FIG. 34.



Changing a Defective Spring.

Whenever it is necessary to change a side spring, both springs on the same axle must be changed. The replacement springs being of the same type and camber. When the "Tare" weight of the vehicle exceeds 12 tons, one spring only may be changed.

Some silico manganese springs do not have a rivet in the buckle. The top of each plate has a groove running along the centre and the underneath of the plate has a corresponding raised vee.

Method of Attachment to Vehicles.

The most common method is the "Shoe Type" (Fig. 31). The shoe is rivetted to the underside of the solebar. The second plate of the spring ends are curved to fit over the "Shoe Bolt" as shown. When fitting the spring to the vehicle the curved end is passed between the sides of the shoes, and the shoe bolt is then inserted under the spring plate and secured with the shoe bolt and split pin.

Bearing spring shoes can be bolted with grover spring washers and split pins as a temporary measure to enable the vehicle to travel to a repair depot.

"For Repair" B.R.11224 labels to be attached to the vehicle.

Examination of Side Spring Shoe Suspension.

1. Check security of shoe rivets.

2. Shoe bolt is in place and correctly nutted and cottered.
   NOTE:- Shoe bolt should always be fitted with nut towards the outside.

3. No fractures in side plates of shoes.

4. No excessive wear (Fig. 35A) where spring plate contacts underside of shoe. Maximum allowed 3/16".

5. Side springs of equal camber, not broken or displaced.

6. Side spring buckle rivet not broken, loose or missing.

7. Maximum variation allowed in camber of side springs on vehicles in service:-

Wagon	-	½"
4 Wheel tank	-	¼"

8. Maximum variations allowed in camber of side springs on vehicles coming out from "Shops":-

Wagon	-	⅛"
Tank	-	1/16"

(a) To find the camber of side spring "ON" a wagon, measure from underside of solebar to the top plate of the spring nearest to buckle.

(b) To find the camber of a side spring "OFF" a wagon, place a straight edge across the top plate; measure from straight edge to the bottom of the buckle, taking the overall height of the spring.

9. There must be no movement of the plates located in the buckle with a rivet.

On springs without rivets:-

Maximum movement of top plate next to the buckle	-	¼"
Maximum movement of other plates	-	½"

Auxiliary Suspension.

This is also of the laminated type, but is assisted by the addition of India Rubber (I.R.) packing (see Fig. 37).

The first plate of the spring is turned completely to form an eye, as shown in Fig. 36.

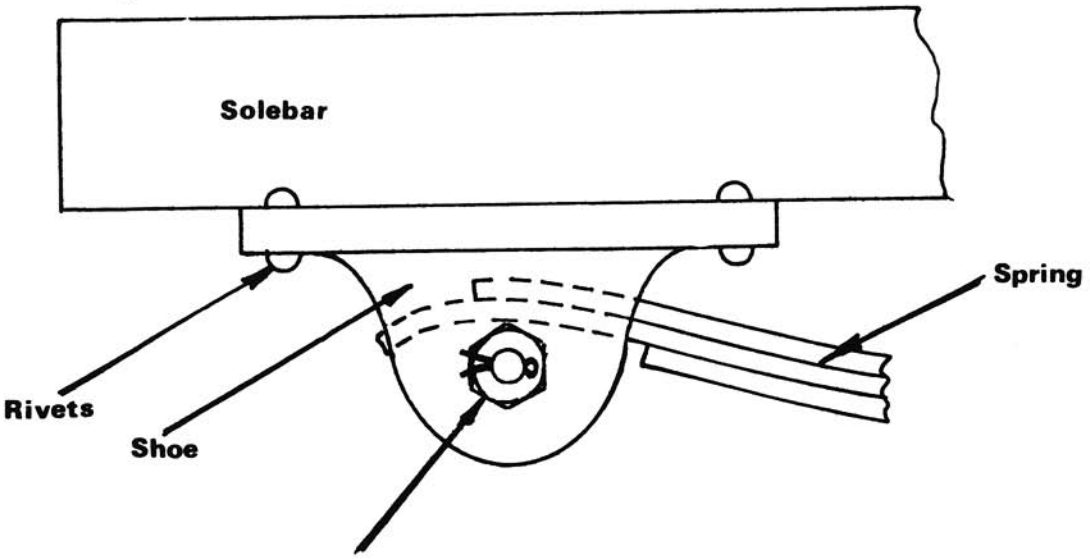
A scroll iron is attached to the solebar. It is this component which carries the I.R. packing and eye bolt (see Fig. 37).

When any weight is put on the suspension, it is initially absorbed by the I.R. packing. When this can no longer compress the side spring will begin to deflect to give combined suspension.

Examination.

1. Check all eye bolts are an equal distance from underside of solebar ("A" Fig.37).

Fig 35



Shoe bolt with nut and split pin

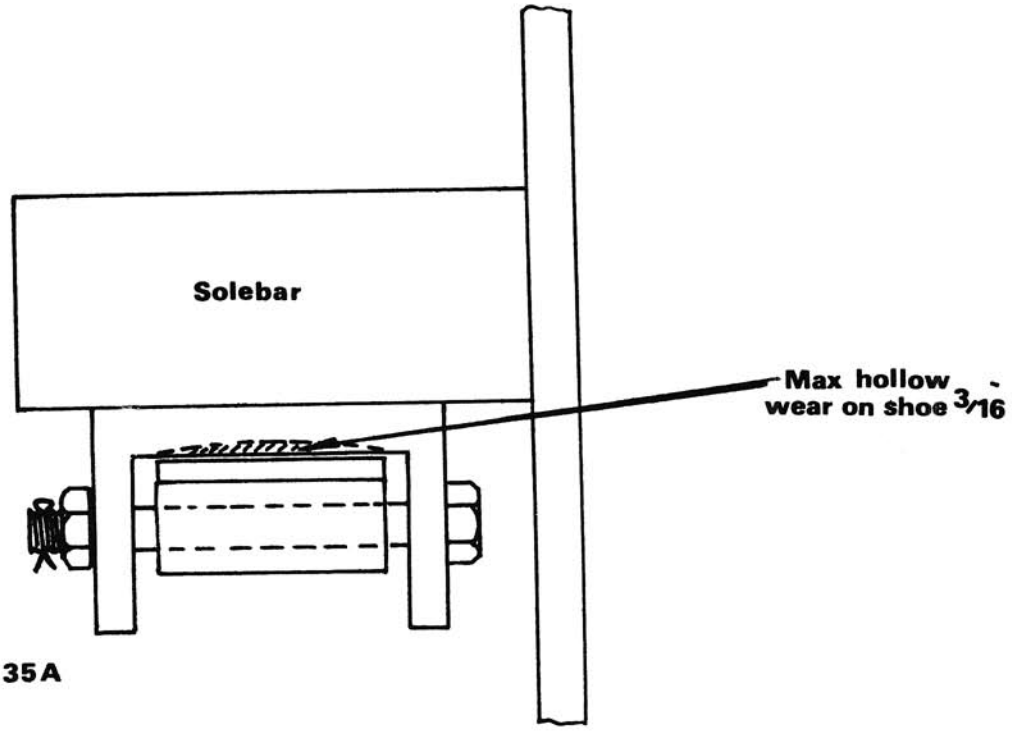
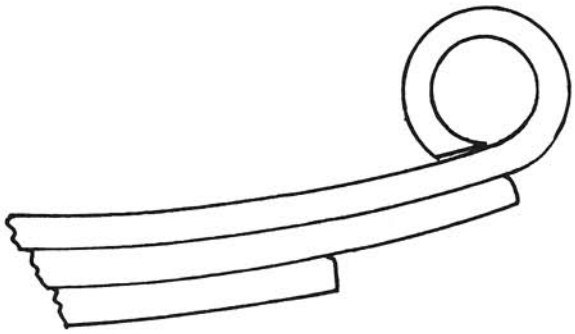


Fig 35A

FIG. 36.



2. Scroll iron secure and not broken or worn.

3. All eye bolt pins correctly cottered.

4. Eye bolt pins not missing, broken or worn. Maximum wear on diameter 1/16".

5. Steel washers not broken or worn.

6. I.R. packing not broken, perished or missing.

7. Adjusting nut (7) (Fig.37) is held in correct position by locknut (8) (Fig. 37).

8. Eye bolt cotters not missing and correctly opened.

9. Eye bolts not bent, broken or worn. Maximum wear on dia. 1/16".

10. Side spring plates not broken, worn or displaced.

11. Buckle rivet not broken, loose or missing.

NOTE:- When eye bolt adjustment has been carried out, locknut (8) must be "Spot Welded" in place. Except in the case of tank vehicles and guard's brake vans.

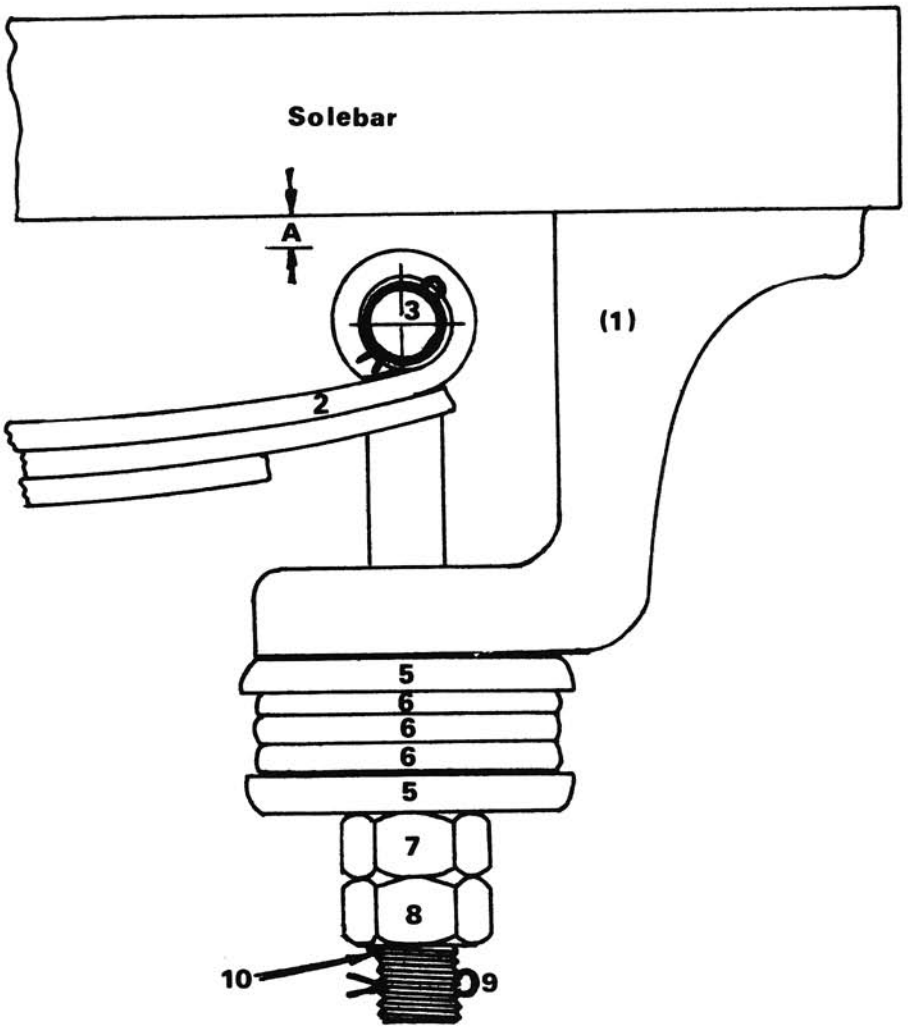


Fig 37 Auxiliary Suspension

1	Scroll Iron
2	Laminated Side Spring
3	Eye Bolt Pin & Cotter
4	Eye Bolt
5	Steel Washer
6	Rubber Packing
7	Eye Bolt Adjusting Nut
8	Lock Nut
9	Eye Bolt Cotter
10	Spot Weld (except Tank Vehicles and Guards Brake Van)

Coil Springs.

This is the usual type of suspension for bogied vehicles. A number of coil springs are placed between the bolster frame and spring plank. To inspect all springs thoroughly it is necessary to lift the vehicle, but as this is not practicable under normal conditions, an examination of the springs "in situ" has to be carried out. If this is done correctly a weak or broken coil spring can usually be detected by close visual examination.

Method of Examination.

1. Examine the spring at eye level.

2. Ensure no visible breaks.

3. All spaces between coils to be equal. If spaces are not equal, suspect a broken coil or weak spring. All springs to be of equal height.

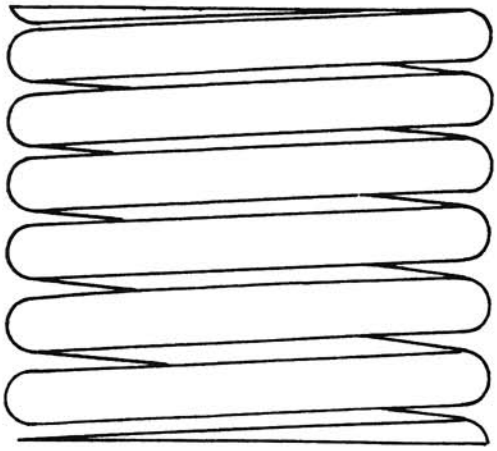


FIG. 38. COIL TYPE SPRING

U.I.C. (Link Suspension).

This type of suspension consists of (see Fig.39):-

Support brackets.
Suspension links.
Link pins.
Bearing pads
Laminated "Eye "nd" side spring.

Purpose.

To allow for extra deflection to take place via the linkage, without undue strain on the side spring.

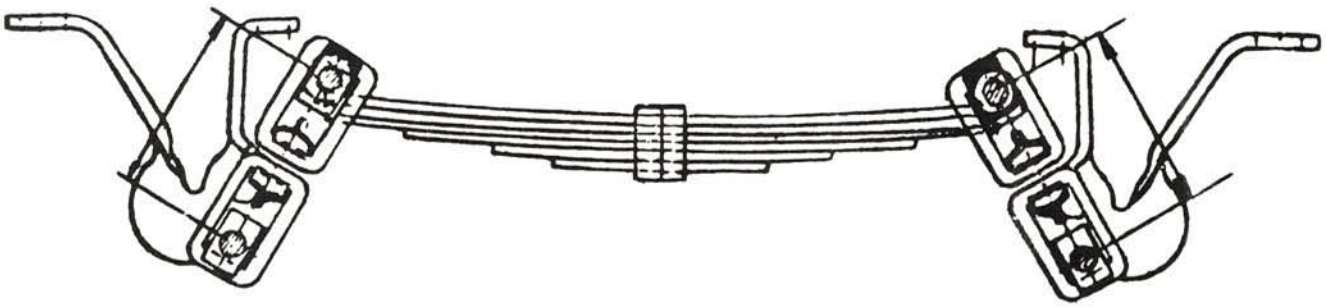


FIG. 39. U.I.C LINK SUSPENSION

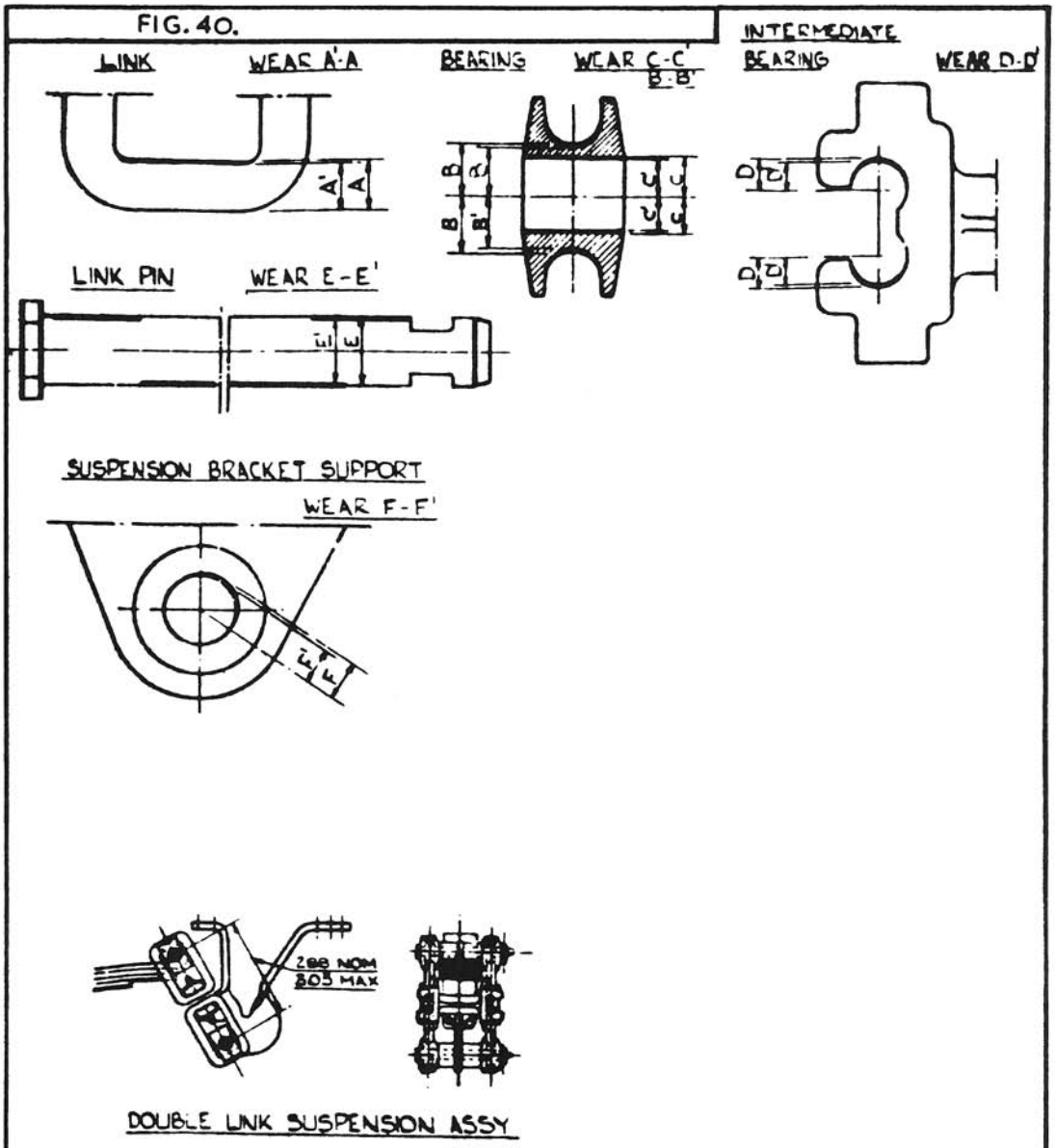
Examination.

1. Side springs must be of equal camber.

2. Spring plates not broken or displaced.

3. Limits of wear on support bracket, link pins, and bearing pads not to exceed those shown in Figure 40.

FIG. 40.



THESE LIMITS DO NOT APPLY TO VEHICLES USED ON CONTINENTAL WORKING

LIMIT OF WEAR TO SUSPENSION DETAILS		
DETAILS	POSITION OF WEAR	LIMIT OF WEAR
LINK	A - A'	1 MM.
BEARING : GROOVE	B - B'	2 MM.
: PIN HOLE	C - C'	2 MM.
INTERMEDIATE BEARING : GROOVE	D - D'	1,5 MM
PIN	E - E'	3 MM
SUSPENSION BRACKET SUPPORT	F - F'	2 MM
CENTRE OF PIN IN THE SUSPENSION BRACKET TO THE CENTRE OF THE PIN IN THE SPRING EYE NOT TO EXCEED 15 MM OF TOTAL WEAR WITH ALL PARTS ASSEMBLED.		

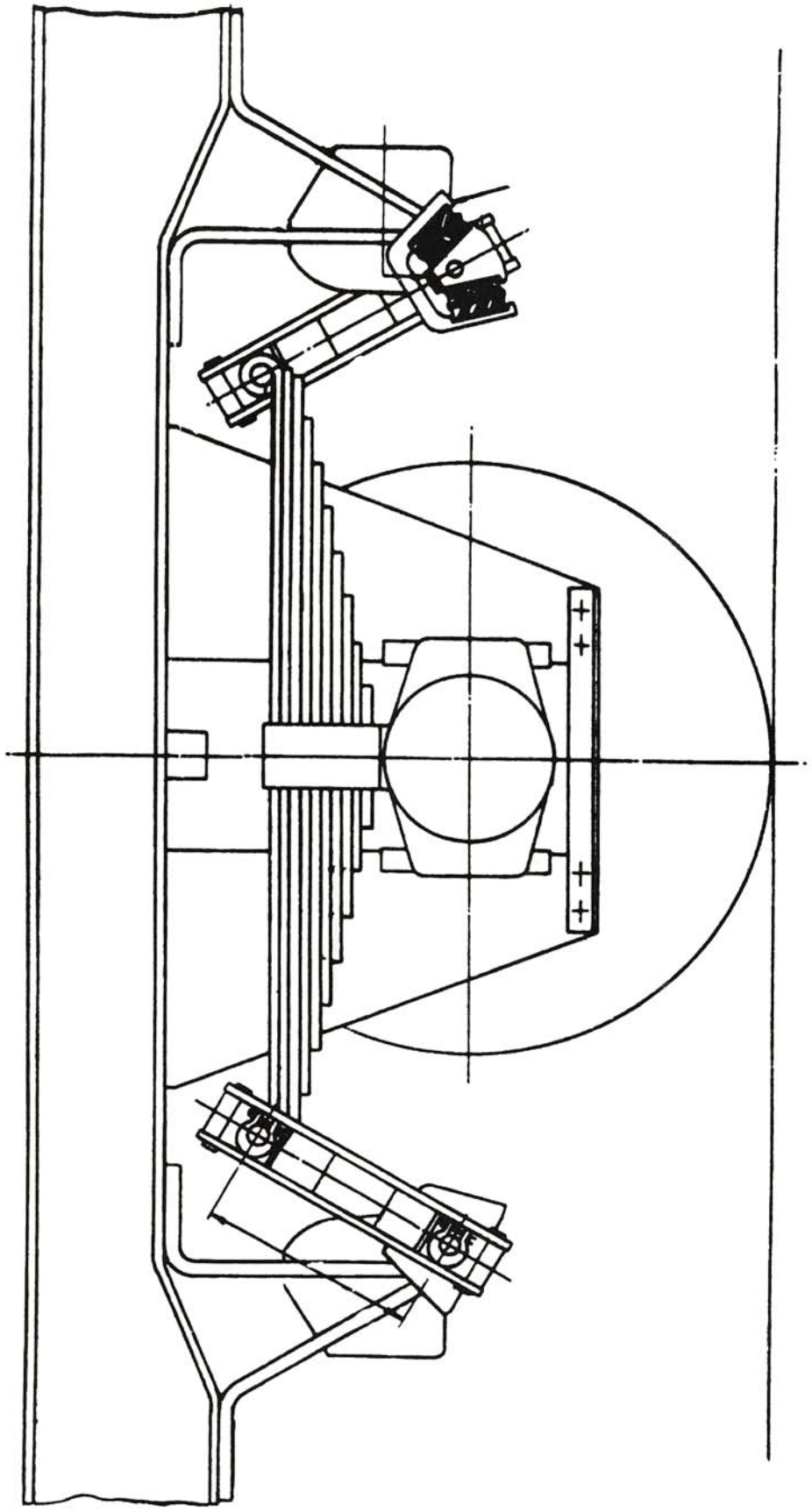


FIG. 41. FRICTION LINK SUSPENSION

Crack Detection.

The spring is debuckled. Each plate is then coated with paraffin and passed under an ultra violet lamp. If any cracks, or flaws, are present these will show up as yellow lines. If any defects are found the plate is scrapped.

Load Testing.

The complete spring is placed on test machine, as shown in Fig. 42. Plunger "A" is then mechanically forced down, depressing the spring and the clock above registers the tonnage being applied. When a load in excess of three tons has been placed on the spring several times, the load is reduced until the gauge registers a load of two tons; it is then held whilst a measurement is taken from the highest point of the spring buckle to the baseplate (position "B", Fig. 42). The overall height of the spring under a load of two tons is notes and painted in 2" white letters on the top plate of the spring , i.e. 2 tons $8\frac{7}{8}$, and the date this measurement was taken is painted on the side of the spring buckle.

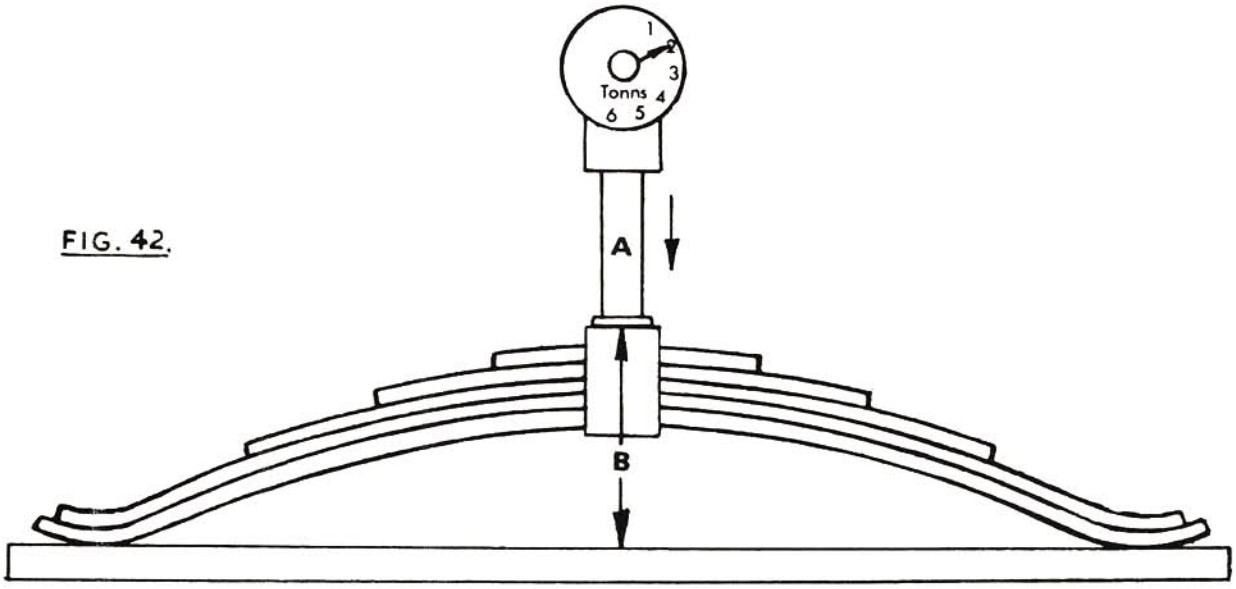


FIG. 42.