Technical specifications of the Leyland 154

I have a lot of documents which were published by Leyland Tractors to help dealers, salesmen and users with their Leyland tractors. A lot of these documents were also used in colleges as teaching aids.

One such set of documents that I have uncovered recently is a series of technical information about the different models, including the Leyland 154 tractor. Others in the similar series include the Leyland 285 and the Leyland 245, 255 and 270 models.

Here I am going to publish information on the Leyland 154, which includes the following sections on:
- The construction of the Leyland 154
- Leyland 154 engine, clutch and PTO
- Leyland 154 hydraulics
- 'Free linkage' system for Leyland 154 tractors

I have not double checked any of the below information, but I hope that you find this information useful.

Construction 154

DIMENSIONS on 5.00 x 15 front end and 10 x 24 rear tyres

LENGTH	in (m)	102.4	(2.54)
MINIMUM WIDTH	in (m)	59.4	(1.47)
STEERING WHEEL HEIGHT	in (m)	50.6	(1.25)
SILENCER HEIGHT	in (m)	74.5	(1.91)

TURNING CIRCLE

RADIUS	in(m)	117	(2.90)
DIAMETER	in(m)	234	(5.80)
	without brakes		

WEIGHTS

Front lb (kg)	960	(408)	43 %
Rear lb (kg)	1260	(572)	57 %
Total lb (kg)	2220	(1007)	

DRAWBAR PULL

First gear on 10 x 24 tyres – related to weight

Unballasted lb (kg)	2500	(1130)
Ballasted lb (kg)	3250	(1473)

OIL CAPACITIES

Gearbox	pints	(litres)	19	(10.8)	22.8 US PTS
Each final drive	pints	(litres)	2.5	(1.3)	3.0 US PTS
Hydraulics	pints	(litres)	16	(9.0)	19.2 US PTS

MONO CONSTRUCTION

This type of construction involves attaching each component to the next. Results in lightweight tractor which forms the basis of its versatility.
Several mounting points are designed into the unit for fitting loaders, cabs etc.

TRANSMISSION

Constant mesh gearbox which allows on the move gear changes to be made. Two levers operate a three-speed gearbox and a three forward, one reverse range box.
Results in 9 forward and 3 reverse speeds.
A fourth position on the left-hand gear lever provides an out of gear safety start device.
By gearbox design forward and reverse motion is quickly obtained by one movement of the right-hand range lever between medium forward and reverse ranges, whose road speeds are the same.

FINAL DRIVE

Through spiral bevel and straight spur gears.
Overall reduction ration 21.14:1
Incorporates HAND CONTROLLED differential lock.

ROAD SPEED

On 10 x 24 tyres at 2500 engines rev/min

Range –	1st gear mph (kph)	0.99	(1.59)
	9th gear mph (kph)	14.00	(22.53)

BRAKES

4-inch (102) diameter dry discs
Located on high speed reduction shaft.
Unique 3 pedal system incorporates twin independent steering brakes which are combined and balanced by the third overriding pedal for road use.
Pre-selective parking latch locks pedal down
Additional 9 inch (230) mm drum system operated by hand lever – optional.

STEERING

16-inch (40.6 cm) diameter steering wheel operates twin drop arms through worm and peg steering gear box. 3.2 turns from lock to lock.
Twin drag links, one either side, operate the stub axles.
Centre point steering gives light steering.

FRONT AXLE

Front axle pivots on a central trunnion which allows for swing 11° above and below the horitontal.
Radius arms support the front axle and are so designed that they are not affected by the track width.
Static axle loading 56-inch track 3,500 lb (1590 kg) maximum).

TRACK SETTINGS		Minimum	Maximum
Front	in (m)	44 (1.22)	68 (1.73)
Rear	in (m)	44 (1.12)	72 (1.83)

Adjustable in 4-inch (102 mm) steps

DRAWBAR

Two positions: Close coupled and extended
Extended position gives B S 14-inch measurement from end of PTO shaft to hitch point.
Can swing or be locked into any of seven positions on the quadrant.
Eight height adjustments between 10.4 in (26.4 cm)
21.2 in (53.8 cm)

	Close	Extended
Swing in (cm)	24 (60)	27.5 (70)
Max load lbs (kg)	700 (318)	500 (227)

LIGHTING

Twin dipping headlamps, side and tail lamps, plough lamp, number plate lamp and electrical trailer socket.

LEYLAND 154 ENGINE/CLUTCH/PTO

ENGINE SPECIFICATIONS

No of cylinders	4
Bore in (mm)	2.9 (73)

Stroke in (mm)	3.5 (89)
Capacity in^3 (litres)	90.9 (1489)
Compression ratio	23:1
Max BHP at 2,500 rev/min	24.9
Max torque lbf ft (kgf m) at 1750 rev/min	61 (8.7)

CLUTCHES

Type	Single dry plate
Diameter	9 inch

PTO

540 range

540 rpm @ 2260 erpm PTO hp	21.5
598 rpm @ 2500 erpm PTO hp	22.9

1000 range

1000 rpm @ 2440 erpm PTO hp	23.0
1024 rpm @ 2500 erpm PTO hp	23.6
Height above ground in (mm)	17.4 (457)
No of Splines	6
Shaft diameter in (mm)	$1^3/_8$ (34.9)

COMBUSTION

Indirect injection is used because swirling of air above small pistons is insufficient to obtain a uniform air/fuel mixture. Piston weight is also a limiting factor in small engine design. Good starting from cold is achieved by using 9-volt heater plugs. The pistons run in dry block cylinders without liners. Liners can be fitted when necessary.

FUEL SYSTEM

Fuel tank with 6.5-gallon (7.8 US Gall) capacity mounted under the driver's seat.
Fuel lift pump mounted on the left side of the engine and operated by the camshaft.
Injection pump is a CAV distributor type with hydraulic governor.

FILTRATION

a Pencil filter in the bottom of the fuel tank
b Gauze filter in the fuel lift pump
c Sediment bowl attached to lift pump
d Single replaceable paper element filter
e Nylon gauze filter in the fuel injection pump

ELECTRICAL SYSTEM

Starter:	LUCAS 12-volt M45G Pre-engaged type
Battery:	LUCAS 12 volt with 76-amp hr capacity
Generator:	LUCAS 12 volt
Regulator:	LUCAS 12 volt rubber mounted

AIR FILTRATION

Oil bath air filter fitted with pre-cleaner.

COOLING SYSTEM

'No loss' pressurised system. Overflow tank pressure cap opens at 7 lbf/in^2.
Standard 'V' section fan belt drives the 6-bladed plastic fan.

INSTRUMENTS

Tractometer	-	Engine revs and speeds in all gears plus hour meter
Gauges	-	Oil pressure. Ammeter.
Warning lights	-	Generator. Heater plugs.

CLUTCH

Single dry plate 9-inch clutch which is used to engage both the engine drive and the two speed PTO.

POWER TAKE OFF

Two speed PTO standard.
Selection lever on near side of transmission casing.
Gives either 540 rev/min or 1000 rev/min ranges.

LEYLAND 154 HYDRAULICS

SPECIFICATIONS

PUMP	-	Dowty Gear Type
OUTPUT	-	3.2 gal/min (14.5 ltr/min 3.84 US gal/min
MAX PRESSURE	-	2200 – 2500 lbf/in^2 (154-175 kgf/cm^2)
MAX LIFT AT END OF LOWER LINKS	-	1000 lb (454 kg)

OIL SUPPLY	-	16 PINTS (9 litres 19.2 US PINTS)
DRAUGHT CONTROL	-	Free Linkage
LINKAGE	-	Cat 1
NUMBER OF FILTERS	-	Nylon filter on Suction) full Micro paper filter on return) flow
RECOMMENDED LIFT ROD LENGTH	-	15 inches

SELF CONTAINED UNIT

Separate hydraulic oil supply
Live pump drive belt driven from engine.

ADVANTAGES OF SELF-CONTAINED HYDRAULIC UNITS

Correct grades of hydraulic fluids can be used for specific hydraulic requirements if necessary.
Hydraulic fluid free from transmission swarf
Total fluid capacity can be used without danger to transmission.
Easy for fault finding servicing.

HYDRAULICS CONTROL VALVE

Four positions:
Lift
Hold (Neutral)
Drop
Crash drop

Lever returns to neutral from lift position when maximum lift pressure is attained.
main pressure relief valve to safeguard systems
Crash drop spring loaded to avoid accidental selection
Crash drop useful for loader and trailer

OIL SUPPLIED TO:
Lift cylinder
Loader kit (standard)
Auxilliary Tapping (Optional extra)

LIFT LOCK

Pre-selective mechanical lock
Used for transporting equipment.

FEATURES

Hydraulic piping let into transmission casing
1 Avoids damage
2 Enhances appearance
Loader kit fitted standard

1 At base of steering column
2 Can be tapped for front and mid mounted equipment

REAR LINKAGE (viewed from rear)

Category one only
Interrupted thread on each lift rod for quick levelling
Second interrupted thread on right hand rod to show safe limit of travel when extending.
Five retaining positions for lower links

CHECK CHAINS

Always pin check chains to the same hole on the check chain plate as the lower draught links are attached to their retaining brackets.

STABILISERS

Brackets fitted as an option
Can only be used when draught links are positioned in holes 3 or 5.

'FREE LINKAGE' SYSTEM FOR LEYLAND 154 TRACTORS

INTRODUCTION

'Free linkage' is an ingenious means of implement depth control without restraining the links by the tractor hydraulics or by a depth wheel on the implement. The implement is free to float, and the linkage geometry is arranged so that any departure from the set working depth creates a force which swings the implement back to its original position.

The action is similar to that of a pendulum. If displaced to one side or the other, it automatically swings back to its equilibrium position. The same principle applies to the lateral control of implements on existing 3-point linkage arrangements. If the implement is forcibly moved off to one side the converging lower links pull it back to the equilibrium position.

On the Leyland 154 Tractor a standard Category 1 linkage is provided, with the lower links attached to the tractor at the brackets which give five alternative pin positions – No. 1 the top position and No. 5 the bottom position.

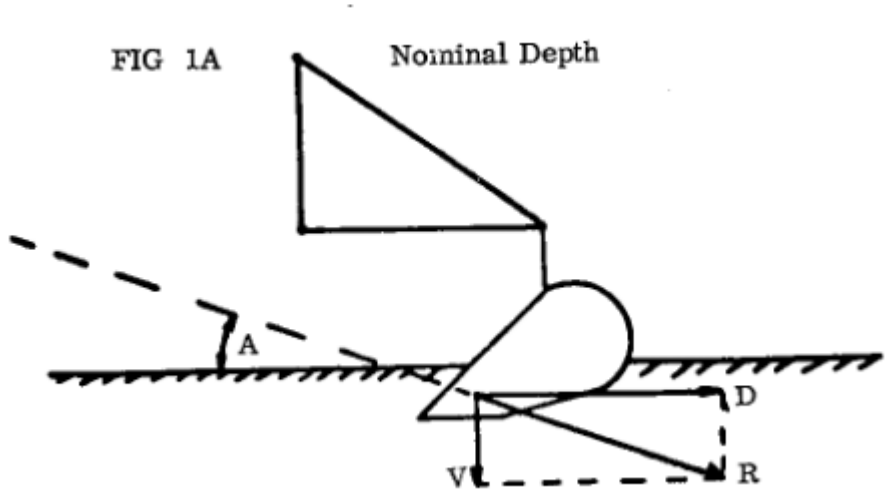
Briefly, the operation is to start with the centre pin position (No. 3) and move up the brackets if less depth is required and down the brackets if more depth is required. It is only necessary to use the extreme positions of No. 1 for implements with a high weight/draught ratio and No. 5 for implements with low eight/draught ratio.

IMPLEMENT FORCES:

The following deals specifically with ploughing but applies in principle to all non-PTO driven, soil engaging implements mounted on the linkage.

Considering the plough in the accompanying diagram (Fig. 1a) the main forces can be collected in the horizontal or draught force D and the vertical force V. Force D acts on the plough as it is moved through the soil and is the resistance the plough feels as it cuts, moves and to some extent breaks up

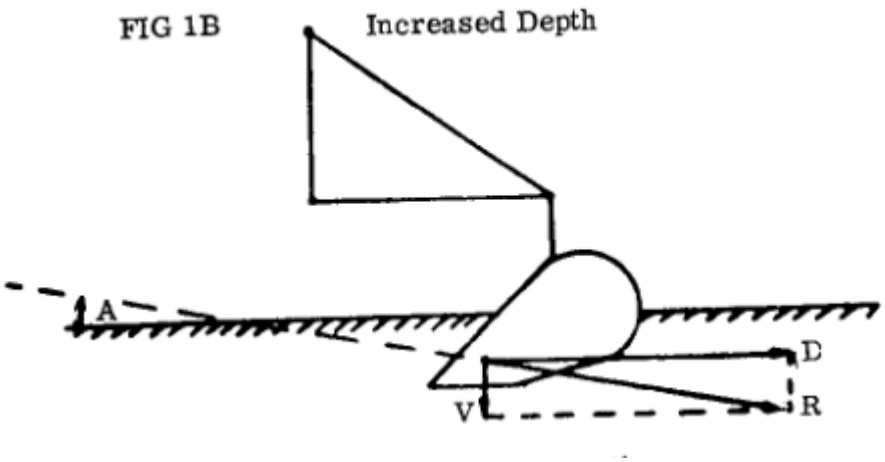
the furrow slice. The size of this force depends on the size of the plough but for a given plough it depends on the nature of the soil, the forward speed and the ploughing depth.

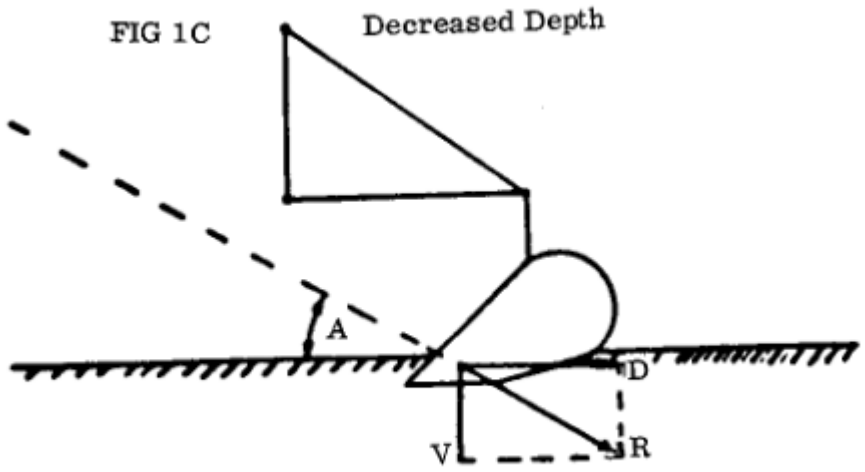


The draught force does not vary greatly with speed until around 5 mph and with soil conditions fairly constant the draught force D is mainly dependent upon the depth with a particular plough.

The vertical force V mainly derives from the plough weight plus some soil forces which may act upwards or downwards. At shallow depths V will approach or even exceed the plough weight with the addition of soil weight and plough suck, but as the depth increases soil forces oppose the plough weight and force V decreases.

The two main force components D and V can be combined, by completing the rectangle, into a single (or resultant) force R acting at an angle A to the horizontal (Fig. 1a). From the previous explanation of the forces V and D it can be seen that with an increase in depth, V decreases and D increases: therefore, the angle A decreases (Fig. 1b) and similarly with a reduction in depth the angle A increases (Fig. 1c). It is this change in angle A with depth which is used to give depth control with 'free linkage'. Also, for a given implement it is this angle which initially determines the pin position to be used.





TRACTOR IMPLEMENT COMBINATION:

It is understood that for given plough and soil conditions the forces acting on the moving plough can be resolved into one force R and in free linkage it is this force which the tractor opposes. If the plough is joined to the tractor by a chain along the line of force R (Fig. 2) then the tractor would maintain the plough at the same depth.

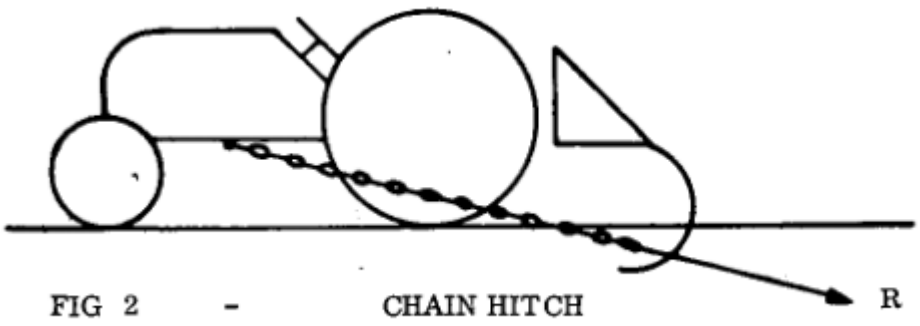


FIG 2 - CHAIN HITCH

The same effect can be produced by extending the plough beam and connecting it to a pivot point near the centre of the tractor. This principle has been used on 'beam ploughs' with the beam passing under the tractor rear axle and connected to an adjustable pivot point under the tractor belly (Fig. 3). The plough will always adjust its depth until the resultant R passes through the pivot point P. If the depth increases the angle A decreases and the force passed below the hitch point; the turning moment about P swings the plough up to its original depth when the force passed through the hitch point again. Thus, we have a pendulum action described above.

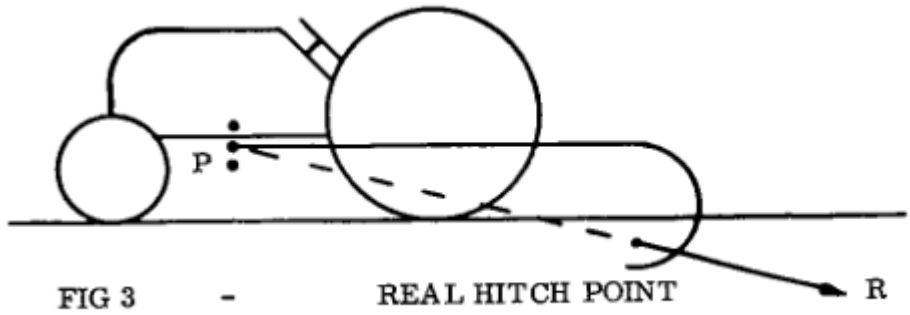


FIG 3 - REAL HITCH POINT

On the Leyland 154 the linkage is arranged such that if the line of the top and lower links were extended forward they would intersect at a point on the line of the force R. This point V (Fig. 4) is called the 'Virtual Hitch Point'. The effect being the same as if the plough were hitched to the tractor by a chain or beam extension fixed at V. As above any change in depth alters the angle A and the force R passed above or below V. Immediately the turning action pivots about V until the force passed through it again.

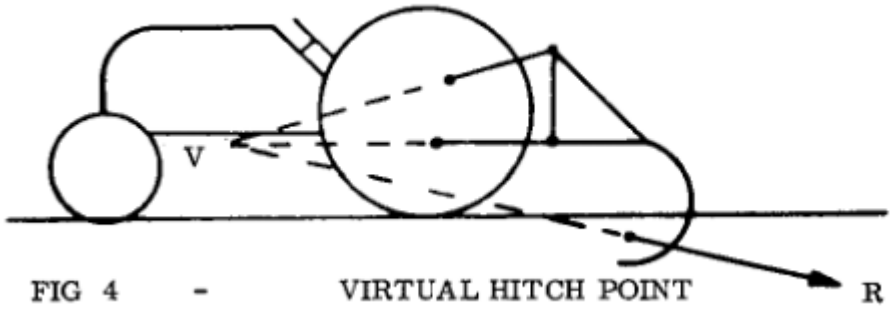


FIG 4 - VIRTUAL HITCH POINT

Suppose the plough is working in depth with the links in pin 3. If the links are now moved up to Pin 2 then the position of the 'Virtual Hitch Point' is raised (Fig. 5) and the plough will adjust itself until the force R passes through the new position of V. In order to do this the angle A must be increased and this is achieved by reducing the depth.

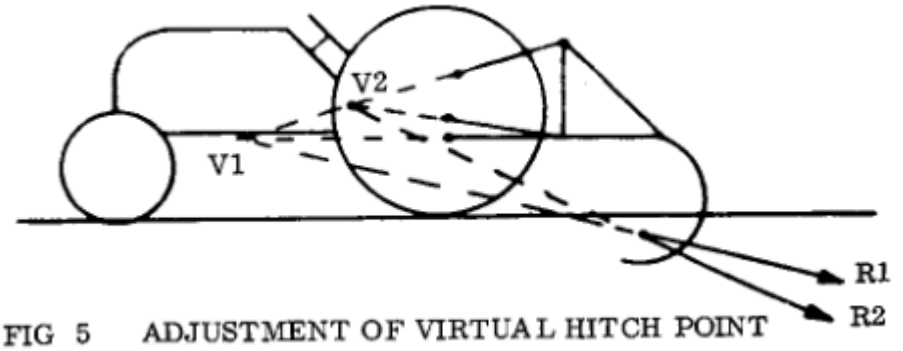


FIG 5 ADJUSTMENT OF VIRTUAL HITCH POINT

<u>WEIGHT TRANSFER:</u>

We have considered how free linkage works and the following will explain why British Leyland Motor Corporation decided to use this means of depth control. The most important consideration in the increased traction achieved by weight transfer from the front wheels to the rear.

When the tractor is working the axles and gear train effectively connect the rear wheels to the chassis so that any forces applied by the implement at the rear tend to tip the tractor about the line of contact of the rear wheels with the ground. From Fig. 6 it can be seen that the amount of weight depends on the magnitude of the force R and the distance 'h' from the wheel contact lines. Obviously the harder the tractor is working the greater is R and the more weight is transferred. The distance 'h' depends on the implement and the prevailing soil conditions. If the weight/draught ratio is high then the angle A is large and if the implement extends well to the rear then both these factors increase 'h' and hence give the situation of high weight transfer.

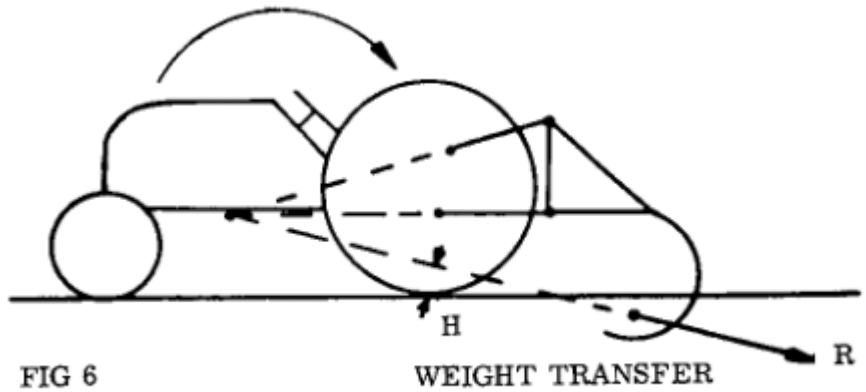


FIG 6 WEIGHT TRANSFER

It is important to realise that the amount of weight transfer available depends upon the implement being used, the soil conditions and the depth of work. Raising the V.H.P. to increase weight transfer (and hence traction) must result in a loss of working depth – 'free linkage' always gives the maximum weight transfer available at a given depth.

DISADVANTAGES OF 'FREE LINKAGE'

1 No finger-tip control for depth changes whether stationary move (to allow for soil variation)
2 Design limitations for operating implements with high weight/draught ratio hitched well back from the tractor. This is the main factor limiting the system to tractors below 25 h.p.
3 Depth adjustment over the range is in steps
4

ADVANTAGES OF 'FREE LINKAGE'

1 Inexpensive – this is particularly important on a low-cost tractor as the cost of hydraulic depth control varies little with tractor size
2 It is simple and extremely robust, reducing servicing to a minimum
3 Weight transfer is continuous and always at a maximum for a given implement, soil conditions and working depth
4 Depth control system absorbs no power and generates no heat. In work the hydraulics are an open circuit and even with cold oil will absorb less than 0.1 h.p. (compared with around 2 h.p. on some hydraulic depth control systems).

'FREE LINKAGE' OPERATION

1 Tractor control valve must be in lower detent to exhaust the lift cylinder and allow full floating action.

2 Selection of pin position initially a question of trial and error but quickly becomes one of experience. As a guide, implements with high/weight/draught ratio require a high pin position and vice-versa. In most cases Pin 3 is a good starting point, moving up the range to shallow off and down the range to increase depth.

3 Normal rules of plough setting apply.

4 In a given pin position small depth changes can be achieved by discriminate adjustment of top link length. This technique is particularly useful when 'opening' or 'closing' with a plough.

5 If, under very extreme conditions, Pin 1 gives too great a depth, then a depth wheel must be used on the implement. This will still give ample weight transfer and will be advantageous in helping to prevent front end 'rear'.

6 At the other end of the rage, if Pin 5 does not give sufficient depth then the implement should be ballasted. However, it is much more likely that lack of traction will be the limiting factor.

Before this situation arises:-

7 When working near the traction limit it is possible to achieve a momentary increase in weight transfer to get through a sticky patch – by moving the control valve handle towards 'lift'. Since 'free linkage' is giving the maximum weight transfer available, this increase must result in a momentary loss of depth.

THE ATTACHED DIAGRAMS SHOW THE PRINCIPLES OF OPERATION OF THE 'FREE LINKAGE' SYSTEM ON THE LEYLAND 154 TRACTOR.

LEYLAND 154 TRACTOR

FREE LINKAGE DIAGRAMS

FIG 1A Nominal Depth

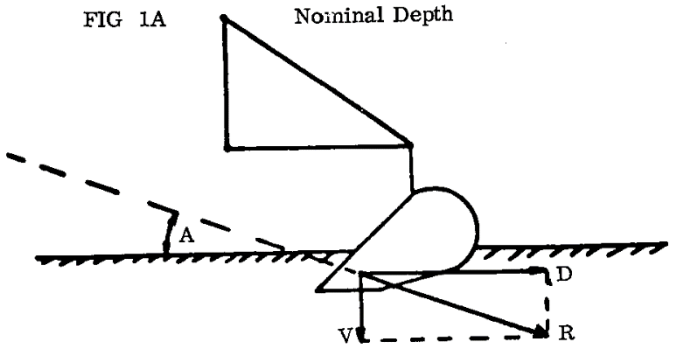


FIG 1B Increased Depth

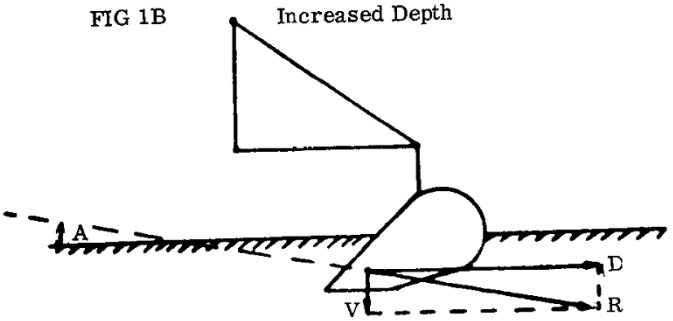
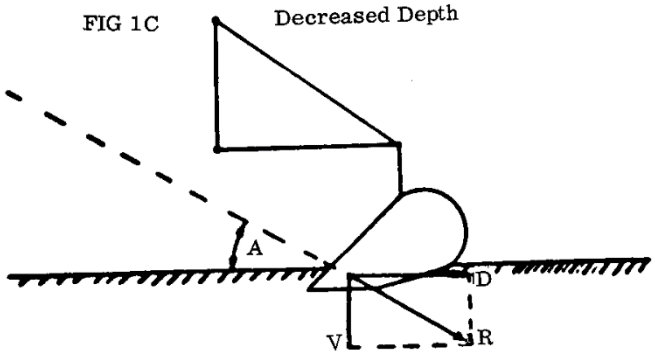


FIG 1C Decreased Depth



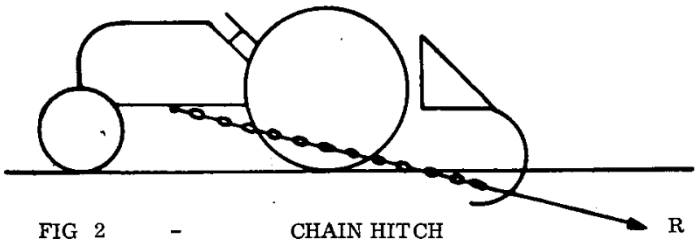


FIG 2 - CHAIN HITCH

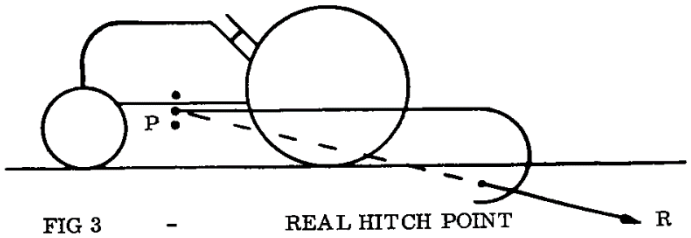


FIG 3 - REAL HITCH POINT

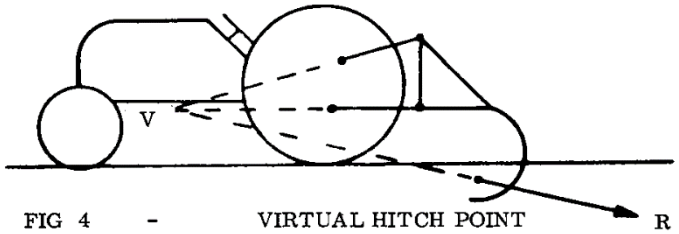


FIG 4 - VIRTUAL HITCH POINT

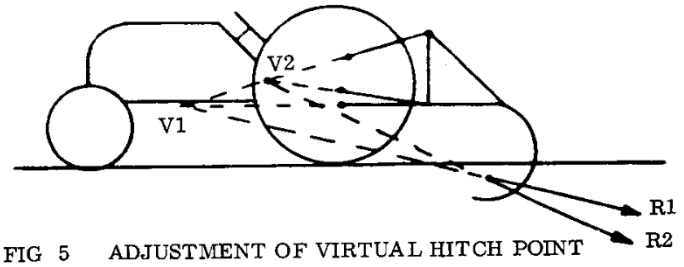


FIG 5 ADJUSTMENT OF VIRTUAL HITCH POINT

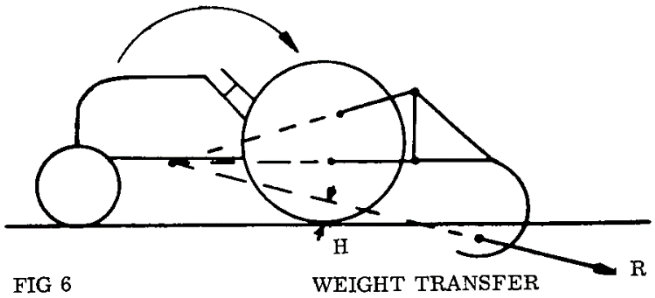


FIG 6 WEIGHT TRANSFER