U18PCAU6L1 - Two & Three Wheelers Lab

LAB MANUAL

B.Tech III Year – 6th semester

DEPARTMENT OF AUTOMOBILE ENGINEERING

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

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Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956

Department of Automobile Engineering

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LIST OF EXPERIMENTS

1. Dismantling And Assembling Of Two Wheeler Gear Box And Finding Gear Ratios
2. Dismantling And Assembling Of Three Wheeler Gear Box And Finding Gear Ratios
3. Dismantling And Assembling Of Three Wheeler Steering System
4. Study Of Three Wheeler Chassis Frame And Power Transmission System
5. Two Wheeler Brake And Clutch Play Adjustment
6. Three Wheeler Brake And Clutch Play Adjustment
7. Performance Test On Coil Spring
8. Performance Test Of A Shock Absorber
9. Measurement Of Maximum Power & Maximum Torque Of The Given Vehicle Using Chassis Dynamometer
10. Two Wheeler Chain Tension Test And Adjustment

DISMANTLING AND ASSEMBLING OF TWO WHEELER GEAR BOX AND FINDING GEAR RATIOS.

Ex.No. 1
Date :

AIM :

To Dismantle and assemble of two wheeler gearbox and find gear ratio.

TOOLS REQUIRED :

Tool set.

OBSERVATION :

Gear box is the integral part of drive line whose function as follows as,

1. To provide different leverage at different driving speed.
2. To provide necessary Torque, which starting the vehicle from rest.

GEARBOX :

1. Power comes from engine to clutch shaft and clutch gear, which is always in mesh with a gear on the lay shaft.
2. Helical gears are in mesh always. Helical gears are setting the power with the help of fork, dogteeth and collar. Dogteeth clutch are splined to gear shaft.
3. Gears are provided with integral dogteeth.
4. Collar having internal teeth locks the dogteeth on gear and dogteeth is fixed to the input shaft.
5. Collar is operated by means of fork lever.
6. Lay shaft is a forged component integral with built in gears.
7. Lay shaft is supported in the gearbox housing with the help of bearings.

PROCEDURE :

1. First the main gear assembly is removed.
2. Then the counter gear assembly is removed.
3. Then the lay out assembly is removed.
4. Finally all the gears are removed and count the number of teeth on each gear and found out the gear ratio.
5. Then lay shaft assembly fixed.
6. Now, the counter shaft gear assembly is fixed & bearings are fixed.
7. Finally the main gear assembly is fixed.

STUDY :

Now the number of teeth of each gear counted and using the calculation, the gear ratio is found.

CALCULATION :

Finding gear ratio:

1^{st} gear = PR *(T_8/T_9)

2^{nd} gear= PR*(T_6/T_5)

3^{rd} gear= PR*(T_4/T_3)

4^{th} gear= 1:1

Permanent reduction (PR) = (T_2/T_1)

T_4, T_6, T_8 → No. of teeth on driven
T_3, T_5, T_7 → No. of teeth on driver

RESULT :

Thus the given two-wheeler gearbox is dismantled, studied and assembled.

TWO WHEELER TRANSMISSION SYSTEM

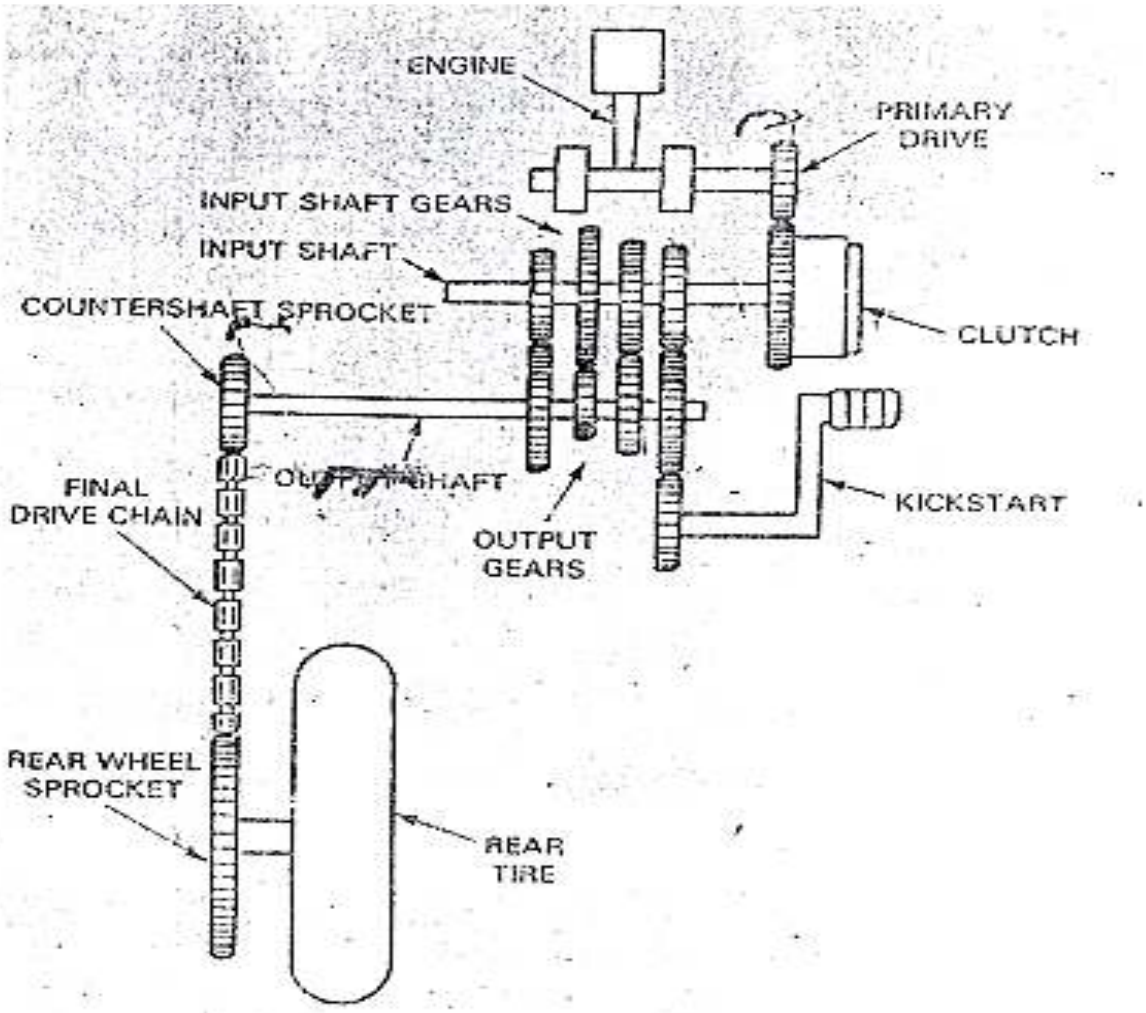


Fig. 7-27. This illustration shows main components of a motorcycle drive train, in particular, note two gearbox shafts.

DISMANTLING AND ASSEMBLING OF THREE WHEELER GEAR BOX AND FINDING GEAR RATIOS.

Ex.No. 2
Date :

AIM :

To Dismantle and assemble of three wheeler gearbox and find gear ratio.

TOOLS REQUIRED :

Tool set.

OBSERVATION :

Gear box is the integral part of drive line whose function as follows as,

1. To provide different leverage at different driving speed.
2. To provide necessary Torque, which starting the vehicle from rest.

GEARBOX :

1. Power comes from engine to clutch shaft and clutch gear that is always in mesh with a gear on the lay shaft.
2. Helical gears are in mesh always. Helical gears are setting the power with the help of fork, dogteeth and collar. Dogteeth clutch are splined to gear shaft.
3. Gears are provided with integral dogteeth.
4. Collar having internal teeth locks the dogteeth on gear and dogteeth is fixed to the input shaft.
5. Collar is operated by means of fork lever.
6. Lay shaft is a forged component integral with built in gears.
7. Lay shaft is supported in the gearbox housing with the help of bearings.

PROCEDURE :

1. First the main gear assembly is removed.
2. Then the counter gear assembly is removed.
3. Then the lay out assembly is removed.
4. Finally all the gears are removed and count the number of teeth on each gear and found out the gear ratio.
5. Then lay shaft assembly fixed.
6. Now, the counter shaft gear assembly is fixed & bearings are fixed.
7. Finally the main gear assembly is fixed.

STUDY :

Now the number of teeth of each gear counted and using the calculation, the gear ratio is found.

CALCULATION :

Finding gear ratio:

1^{st} gear = PR *(T_8/T_9)

2^{nd} gear= PR*(T_6/T_5)

3^{rd} gear= PR*(T_4/T_3)

4^{th} gear= 1:1

Permanent reduction (PR) = (T_2/T_1)

T_4, T_6, T_8 → No. of teeth on driven
T_3, T_5, T_7 → No. of teeth on driver

RESULT :

Thus the given three-wheeler gearbox is dismantled, studied and assembled.

DISMANTLING AND ASSEMBLING OF THREE WHEELER STEERING SYSTEM.

Ex.No. 3
Date :

AIM :

To dismantle, assemble and study of three-wheeler steering system.

TOOLS REQUIRED :

Tool set.

INTRODUCTION :

1. Steering system is used to allow a driver to guide the vehicle along the road and turn it to either direction left or right.
2. Steering arrangement is governed by steering geometry.
3. Steering system consists of front suspension forks, steering stem, steering lock and handle bar.
4. Front suspension forks carry the front wheel assembly. Steering stem is attached to the top of the front suspension forks.
5. Steering stem permits turning of front wheel and hence the vehicle in the desired direction.

PROCEDURE :

1. First remove the pinch bolt.
2. Then remove the crown retaining bolt/ nut.
3. After removing the crown nut, remove the steering stem nut.
4. Remove the bearing.
5. Finally, remove the steering stem.
6. Now all the parts are dismantled and studied.
7. Now reassembling all the parts of reverse order of dismantling.

RESULTS :

Thus the given steering system is dismantled, studied & assembled.

STUDY OF THREE WHEELER CHASSIS FRAME AND POWER TRANSMISSION SYSTEM.

Ex.No. 4
Date :

AIM :

To study the various features and measure the various dimension of the chassis frame of three wheeler and power transmission system.

TOOLS REQUIRED :

Measuring tape.

PROCEDURE :

Using the measuring tape, note that

Wheelbase: It is the distance between the centre points of front wheel to the centre point of rear wheel.

Wheel track: It is the distance between the centre points of two rear wheels.

Over all length: It is the through out distance between front side to the vehicle.

Over all width: It is the distance taken from top portion of the vehicle to the ground level.

Ground clearance: It is the distance taken between nearest part or portion towards ground level. (ex: differential)

POWER TRANSMISSION SYSTEM :

The system by which the power from engine is transmitted to the wheels is called transmission system. Transmission system carries engine power to the rear wheel. Power at the rear wheels move the vehicle forward overcoming external forces. Clutch is located between the engine and gearbox. Clutch transmits engine power to the gearbox. In Three-wheeler, multiple clutches is used. When the clutch is in the disengaged position, the power transfer is interrupted. Such power interruption will enable shifting of gears smoothly with out damaging gear teeth. Gearbox provides different torque at the rear wheel according to the requirements by engaging different gear combination.

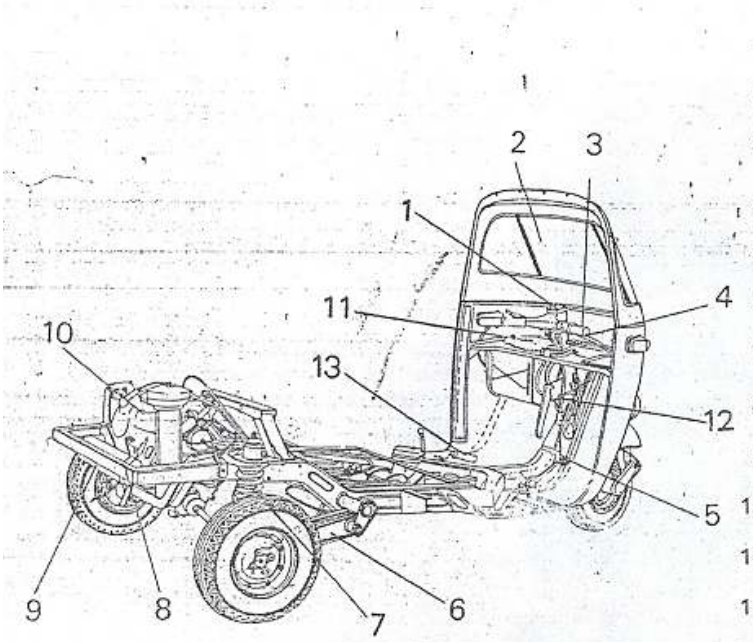
PROPELLER SHAFT DRIVE :

This system is mostly used in three-wheeler. Like four wheelers, the propeller shaft in this system also consists of a sliding joint at one end and universal joints at both the ends.

RESULT :

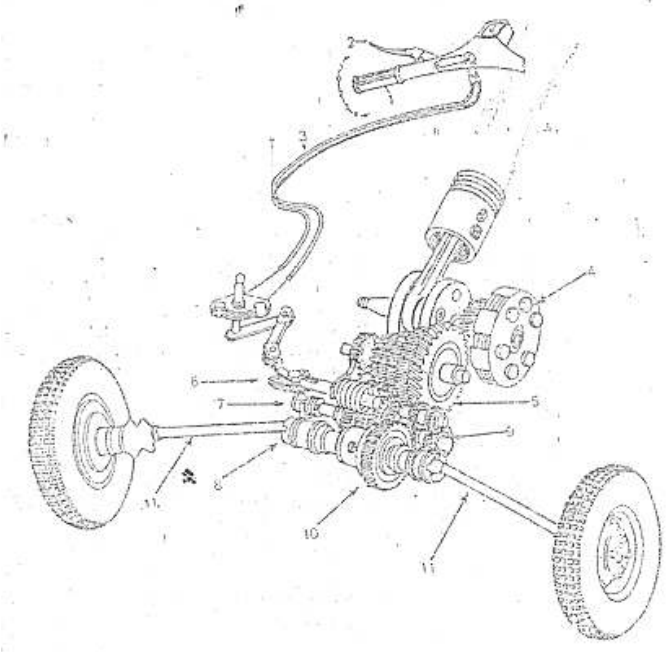
Thus the various features of the chassis are studied & its dimensions have been measured and the power transmission system also studied.

THREE WHEELER CHASSIS FRAME



1. Speedometer
2. Windshield
3. Accelerator twist grip
4. Front brake lever
5. Rear brake pedal
6. Trailing arm
7. Shock-absorber with co-axial spring
8. Silencer
9. Rear Frame
10. Engine
11. Tool box
12. Reverse gear control lever
13. Starter lever

TRANSMISSION SYSTEM



1. Twist grip
2. Clutch control lever
3. Gear cables
4. Clutch
5. Corona gear
6. Sector
7. Stem and guide bush
8. Flange
9. Reverse control gear
10. Differential gear
11. Propeller shaft

TWO WHEELER BRAKE AND CLUTCH PLAY ADJUSTMENT

Ex.No. 5
Date :

AIM :

To adjustment of brake and clutch as per specification.

TOOLS REQUIRED :

Tool set.

DESCRIPTION :

Due to the continuous use of the brakes, wear take place of the brake lining, linkage etc., which necessitate periodic inspection of the braking system and to make suitable adjustment. The brake adjustments can be broadly divided in to two types, viz, the minor and major adjustments.

Minor adjustment mainly includes the adjustment of brake shoes to compensate lining wear and is done without removing the wheels. A major adjustment on the other hand, has to be done after installation of new shoes or relining the old shoes. If the following conditions are not found, the minor adjustment is usually sufficient;

1. Worn out or out of the round brake drum
2. Brake lining soaked in oil
3. Brake lining worn upto the rivet heads

PROCEDURE :

To perform minor adjustment, on turning the adjustment nut the cam is also turned. This cam is fitted on the brake shoe and the adjusting nut is provided on the back plate. Turning this nut with spanner in the clockwise direction causes the shoes move closer to the brake drum.

To perform major adjustment, remove all brake drums and inspect linings and drums. If the drums are worn out, turn them in case the damage is with in limits or else replace them. In case of linings having reached upto within 1mm of rivet heads, remove the same and reinstall the new ones.

DESCRIPTION :

Clutch assembly is fitted between engine and gearbox. The purpose of the clutch assembly to transmit power of the engine to the rest of the transmission system, by disconnecting & connecting the power is required.

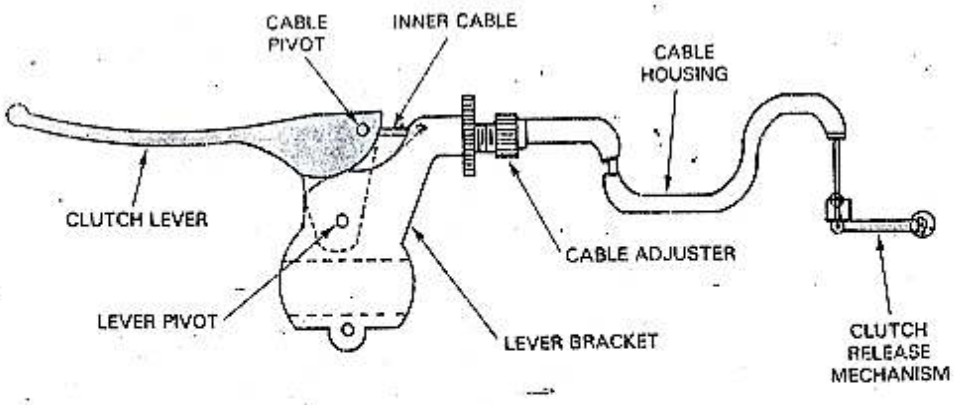
CLUTCH ADJUSTMENT :

The only adjustment required in a clutch is of the free lever play, which is necessitated on account of wear of the friction lining due to continuous use or with the wear of the throw out bearing carbon ring due to the habit of the driver to press his hand always on the clutch lever. The wear of the friction lining decreases the free lever play. An adjustment nut is provided at the lower end of the clutch lever. To slacken the lock nut first, make the desired adjustment with the adjusting nut and retighten the lock nut.

RESULT :

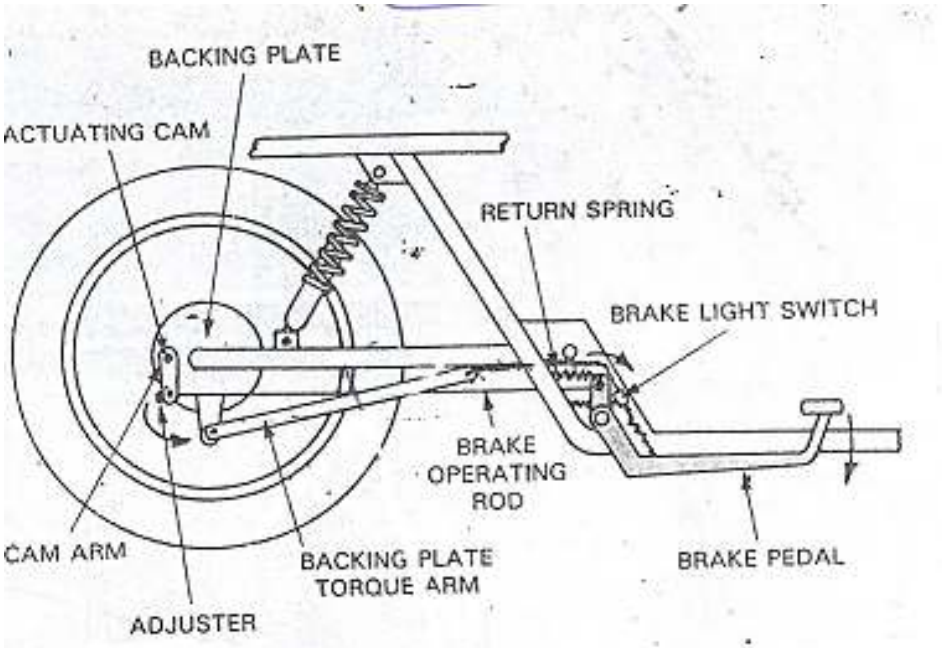
Thus the adjustment of brake and clutch as per specification is performed.

CLUTCH ADJUSTMENT



When clutch lever is pulled, inner cable slides inside outer cable housing to provide movement of clutch release mechanism.

BRAKE ADJUSTMENT



Brake is applied by pressing down on brake pedal. This movement causes rotation of actuating cam which forces brake shoes into drum. Torque arm prevents backing plate from turning. Resulting friction slows down motorcycle.

THREE WHEELER BRAKE AND CLUTCH PLAY ADJUSTMENT

Ex.No. 6
Date :

AIM :

To adjustment of brake and clutch as per specification.

TOOLS REQUIRED :

Tool set.

DESCRIPTION :

Three wheelers use hydraulic operated foot brake on the two rear wheels with an additional hand brake mechanically operated on the front wheel.

In hydraulic brakes, care must be taken that not even small quantities of air enter in to the braking system. The air being compressible, it gets compressed when the brake pedal is pressed. The result is that fluid pressure is not transmitted to the brakes. Which, as a consequence, are not actuated.

Due to the continuous use of the brakes, wear take place of the brake lining, linkage etc., which necessitate periodic inspection of the braking system and to make suitable adjustment. The brake adjustments can be broadly divided in to two types, viz, the minor and major adjustments.

Minor adjustment mainly includes the adjustment of brake shoes to compensate lining wear and is done without removing the wheels. A major adjustment on the other hand, has to be done after installation of new shoes or relining the old shoes.

PROCEDURE:

The procedure of driving air out of the braking system is called bleeding. A special bleeding valve is provided for this purpose on the back plate. For bleeding, the master cylinder is topped up completely with the brake fluid and a pipe is connected to the bleeding valve. The other end of this pipe is dipped in the brake fluid contained in some jar. One person sits on the driver's seat and presses the brake pedal, after which the bleeder valve is opened by the second person, when some air bubbles will come out of the pipe and escape through the brake fluid in to the atmosphere.

The bleeder valve is now closed and the brake pedal released and pressed once more after which the bleeder valve is opened again when some more air bubbles will come out. This procedure is repeated till on pressing the brake pedal, no more air bubbles are noted. Now with the pedal in the pressed position in the bleeder valve is closed.

To perform minor adjustment, on turning the adjustment nut the cam is also turned. This cam is fitted on the brake shoe and the adjusting nut is provided on the back plate. Turning this nut with spanner in the clockwise direction causes the shoes move closer to the brake drum.

To perform major adjustment, remove all brake drums and inspect linings and drums. If the drums are worn out, turn them in case the damage is with in limits or else replace them. In case of linings having reached upto within 1mm of rivet heads, remove the same and reinstall the new ones.

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Clutch assembly is fitted between engine and gearbox. The purpose of the clutch assembly to transmit power of the engine to the rest of the transmission system, by disconnecting & connecting the power is required.

CLUTCH ADJUSTMENT :

The only adjustment required in a clutch is of the free lever play, which is necessitated on account of wear of the friction lining due to continuous use or with the wear of the throw out bearing carbon ring due to the habit of the driver to press his hand always on the clutch lever. The wear of the friction lining decreases the free lever play. An adjustment nut is provided at the lower end of the clutch lever. To slacken the lock nut first, make the desired adjustment with the adjusting nut and retighten the lock nut.

RESULT :

Thus the adjustment of brake and clutch as per specification is performed.

HYDRAULIC BRAKE ARRANGEMENT

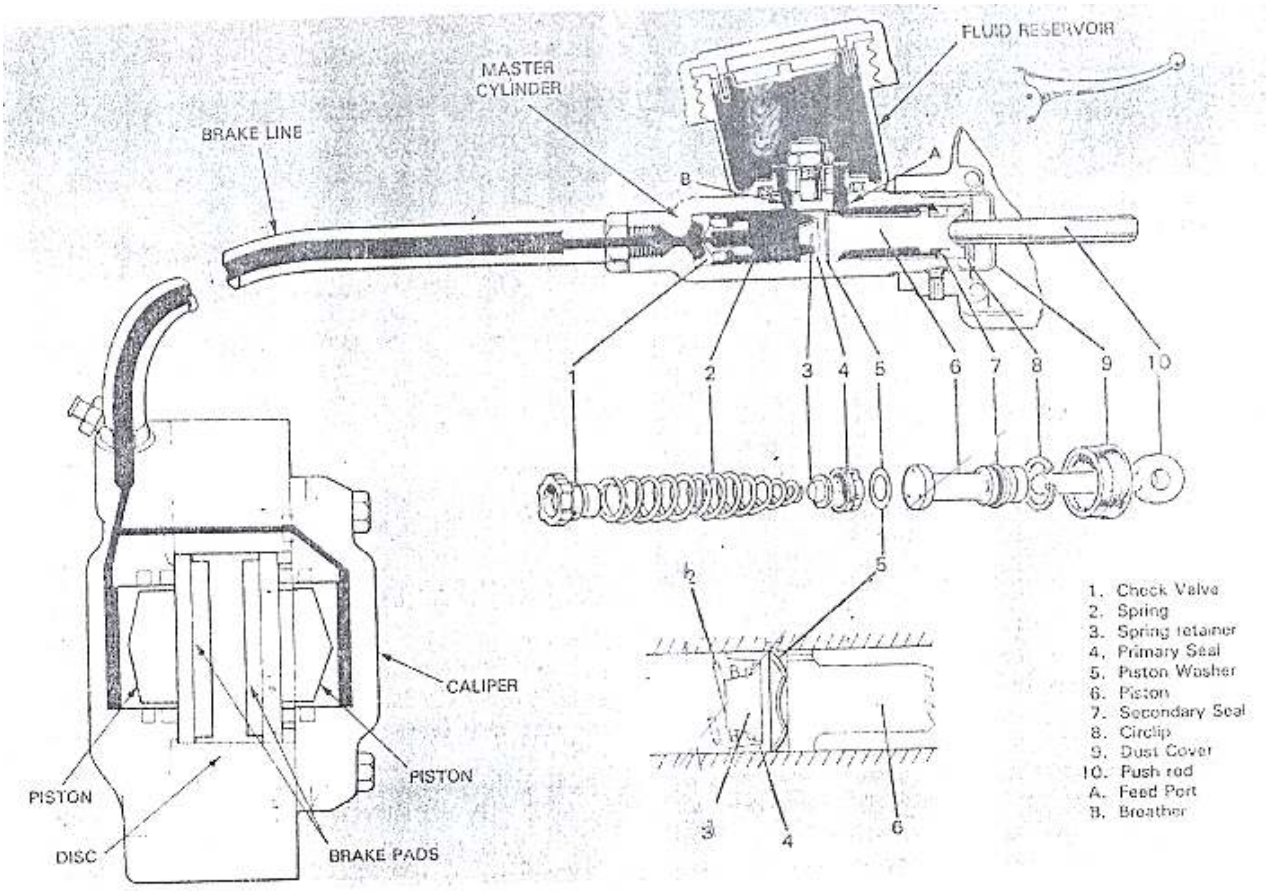


Fig. 20-39. When brake lever is pulled, it causes pushrod to move piston forward. Piston movement traps and pressurizes brake fluid in brake line and caliper. Line pressure causes caliper pistons to force brake pads against disc. (Triumph Motorcycles [Meriden] Ltd.)

PERFORMANCE TEST ON COIL SPRING

Ex.No. 7
Date :

AIM :

To determine the following properties of a coil spring.

1. Stiffness of the given coil spring.
2. Modulus of rigidity.

APPARATUS REQUIRED :

Spring testing machine, coil spring, vernier caliper.

PROCEDURE :

1. The spring is placed centrally over the lower plate slowly rotate the plate handle.
2. Measure the thickness of spring and calculate the number of turns.
3. Measure the outer diameter and inner diameter of spring using vernier caliber.
4. Keep the spring in such a way that top and bottom plate just touches the spring.
5. Adjust the pointer on the dial to read zero loads.
6. Note the deflections reading on the gauge apply the load on the spring and note the deflection reading.
7. Note the deflection while unloading and also get the average deflection.
8. Plot the graph between load and deflection.
9. The deflection of a spring is obtained from the help of the graph.

CALCULATION :

Formula,

Modulus of rigidity $G = [(64nWR^3)/ (\delta d^4)]$ N/mm^2

where,

W - Load applied in N

δ – Deflection in mm

R – Mean coil radius of given spring in mm

d – Diameter of the spring wire in mm

n – Number of turns in the given spring

Stiffness of the spring $k = (W/\delta)$ N/mm

Mean radius $R = [(d_o-t)/2]$ mm

d_o – outer diameter

t – Thickness

RESULT :

Modulus of rigidity of spring = N/mm^2

Stiffness of spring = N/mm

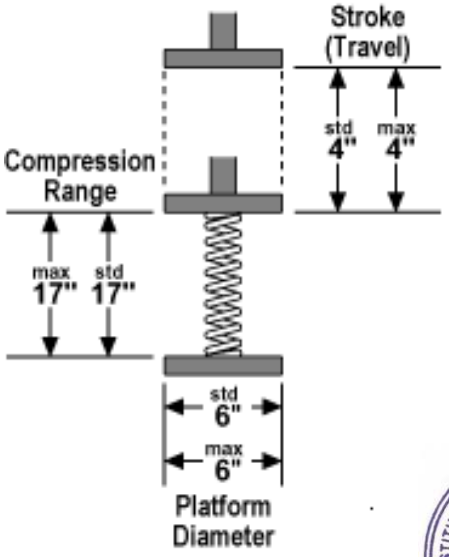
TABULATION :

Sl. No	Load		Deflection (mm)		Mean deflection (mm)
	Kg	N	Loading	Unloading	

Mean radius of spring:

	MSR (mm)	VSC (mm)	TR = MSR+ VSC*LC
Outer diameter (d_o) Thickness (t)			

DIAGRAM:



PERFORMANCE TEST OF A SHOCK ABSORBER

Ex.No. 8
Date :

AIM :

To study the characteristics of a shock absorber.

APPARATUS REQUIRED :

Shock absorbFer test rig

OBJECTS OF THE SUSPENSION ARE :

1. To prevent road shocks from being transmitted to the vehicle components.
2. To safeguard the occupants from road shocks.
3. To preserve the stability of the vehicle in pitching or rolling in motion.

MAIN FUNCTIONS OF SHOCK ABSORBERS :

1. To control quick bouncing of wheels on road surface.
2. To control slow bouncing of the body on the suspension springs.

PROCEDURE

Step – 1

Fit the shock absorber in the slot and tighten with bolt and switch on the system

Step – 2

Using the FRL unit set the pressure to the required level by adjusting the knob provided.

Step – 3

Press the CYCLE START & COMPRESSION switch once in the control panel

Step – 4

The shock will travel to the preset distance and stop

Step – 5

Note the elapsed time on the PLC provided on the control panel and value on the load indicator and note the displacement reading

Step – 6

At the same pressure press the REBOUND switch once in the control panel

Step – 7

The shock will retract and stop at the original position

Step – 8

Note the retraction time on the PLC provided on the control panel and value on the load indicator and note the displacement reading

Step – 9

Now adjust the air Regulator and run the same test at higher pressure

Step – 10

Write down the elapsed times and load cell output for this higher pressure

Testing at 3, 4, 6,8 Bar are good pressure to test the shock absorber and always run the test from slower to higher Bar to get the better results.

Tabulation

Output Energy

Sl.No	Pressure value PSI	With Shock absorber		Load Cell O/P Kgs	L1 mm	L2 mm
		compression Secs	Retraction Secs			
1	20					
2	40					
3	60					
4	80					
5	100					

Input Energy

Sl.No	Pressure value PSI	Without Shock absorber		L1 mm	L2 mm
		compression Secs	Retraction Secs		
1	20				
2	40				
3	60				
4	80				
5	100				

Formula

1. Convert the Load to Newton by multiply 9.81 N (1 kg = 9.81 N)
2. Find out the velocity = Displacement / time in m/s
3. Find out the area of the piston using known values (Φ = 63 mm)
4. Find out the input load applied Force using the standard value (100 psi =168 Kg)
5. Find out Input Energy = ½ x m x $\acute{\omega}^2$ Joules

Where

M = Force

$\acute{\omega}$ = Velocity

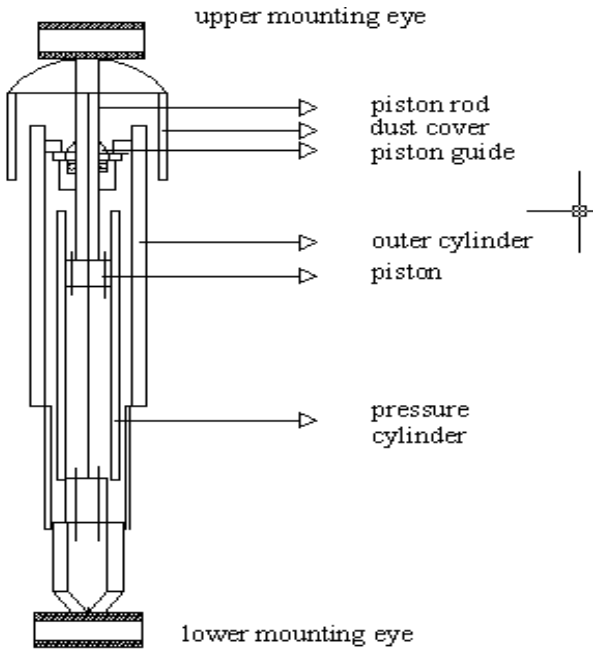
6. Find out Output Energy = ½ x m x $\acute{\omega}^2$ Joules

7. Find out Loss in Energy = Input Energy – Output energy

RESULT:

Thus the characteristic of a shock absorber has been studied.

Schematic representation of a shock absorber:



DAMPER

MEASUREMENT OF MAXIMUM POWER & MAXIMUM TORQUE OF THE GIVEN VEHICLE USING CHASSIS DYNAMOMETER

Ex.No. 9
Date :

Aim: The aim of the experiment is to find out the maximum Horse Power and Maximum Torque of the given two wheeler

Apparatus Required:

1. Chassis Dynamometer
2. Engine RPM pickup probe (Red Probe)

Pre-test inspections

1. Check the tyre pressure

Procedure:

1. Load the vehicle on the test rig

2. Lock the front wheel so that the centre of the rear wheel rest on the roller circumference (Centre of the rear wheel and centre of the roller should be perpendicular)

3. Fix the RPM probe (red Probe) on the High tension lead from the Spark Plug

4. Run the Chassis Dynamometer software by clicking the shortcut on the desktop of the PC. Now the main menu will open.

5. Click the triangle icon on the menu or press F5

6. Now a message screen will popup informing to start and WARMUP the Engine.

7. Start the two wheeler and keep it in Neutral gear and WARM UP for few minutes

8. Enter the file name

9. Now Press the START icon

10. Run the Vehicle and gradually shift the gear to the top gear

13. Accelerate the engine to the Maximum speed

14. Now press the clutch and leave the acceleration lever

15. Wait till roller stops

16. Close the pop up menu

17. The test results will be stored.

18. Press the printer icon to take the printout

Result

Note the

1. Maximum Power

2. Maximum Torque

TWO WHEELER CHAIN TENSION TEST AND ADJUSTMENT.

Ex.No. 10
Date :

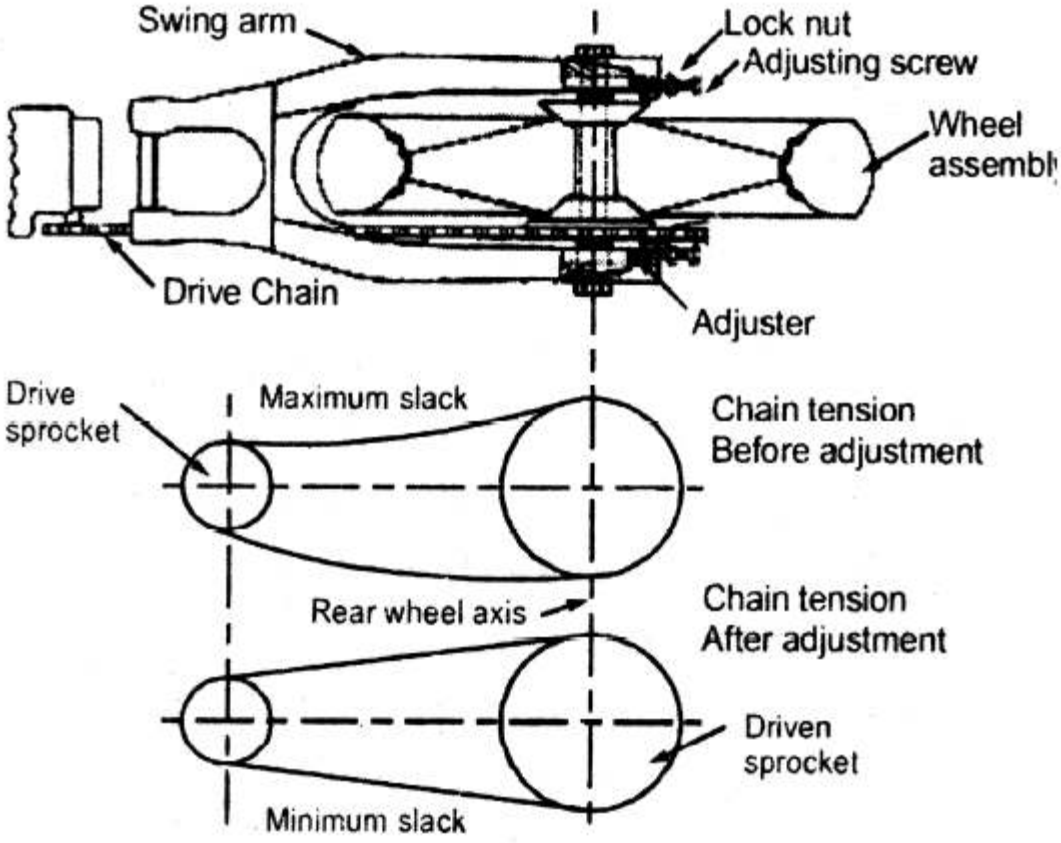
AIM : To adjust the drive chain of the given two wheeler.

APPARATUS REQUIRED : Tool set, Two wheeler

PROCEDURE :

Drive chain adjustment: The service life of the drive chain is dependent upon proper lubrication and adjustment. Poor maintenance can cause premature wear or damage to the drive chain and sprockets. Under severe usuage, or when the motorcycle is runned in dusty areas, more frequent maintenance will be necessary.

Inspection:
i) Turn the engine off, place the motorcycle on its main stand and shift the transmission into neutral remove hole cap.
ii) Drive chain slack should be adjusted to allow approximately 20-30 mm vertical movement by hand. Roll the motor cycle and check drive chain slack as the wheel rotates. Drive chain slack should remain constant as the wheel rotates. If the chain slack in one section and in another, some links are kicked and binding. Building can be eliminated by frequent lubrication.
iii) Inspect the sprocket teeth for wear or damage.
iv) If the drive chain and sprockets are excessively worn or damaged, they should be replaced. Never use a chain with worn out sprockets since this will result in rapid chain wear.



ADJUSTMENT OF DRIVE CHAIN

Adjustment

i) Remove the split pin and loosen the rear axle nut.

ii) Loosen the sleeve nut, turn the adjusting nut on both the right and left chain adjusters to increase or decrease chain slack. Align the chain adjuster index marks with corresponding scale graduations on both sides of the swing arm.

Note: If drive chain slack is excessive when the rear axle is moved to the farthest limit of adjustment, the drive chain is worn out and must be replaced.

iii) Tighten the rear axle and sleeve nut.

iv) Recheck drive chain slack.

v) If rear brake pedal free play is affected when repositioning the rear wheel to adjust drive chain slack. Check rear brake pedal free play and adjust as required.

Observation Table

Full Tight position Chain Tension :

S.No	Motor Voltage	Motor AMPS	Dynamometer RPM	Load in Kg

Slackness position Chain Tension :

S.No	Motor Voltage	Motor AMPS	Dynamometer RPM	Load in Kg

FORMULA

Motor HP = HP

Motor RPM = rpm

Motor Amps: Amps

Power of the Motor = Volts x Amps x CosΦ / 800 Watts

Where CosΦ = 1

Calculation of Power at Eddy current Dynamometer

Torque = W x R , Nm

W – Load in Kg = W x 9.81 N

R – Arm Length in Metres

Power at Eddy current dynamometer = 2 π N T / 60 Watts

Loss in power in the Chain at the Chain in Full tight condition = Input power – Output power

Similarly find the loss in Power when the chain is at slack condition

INFERENCE :

RESULT :