Chapter 7

Drive Line

Power is transmitted in strange and devious ways in a moped. There are two power sources—human and mechanical. Human power is used to start the engine, help it when it falters, and, if necessary, can become the sole means of propulsion. The engine is the primary power source, connected to the rear wheel by means of an automatic clutch. In addition, some mopeds have automatic torque-multiplying transmissions, so the engine can operate at its most efficient rpm regardless of the forward speed of the vehicle.

CENTRIFUGAL CLUTCHES

The basic clutch mechanism is centrifugal, engaging in response to engine or pedal crank speed. The details vary enormously between makes, but all have these features in common:

- A central hub or yoke that turns at engine speed.
- A drum which is connected to the load.
- Friction shoes or plates that connect the hub with the drum.
- An override mechanism to transfer power from rider to the engine to start it. The override may be at the clutch or at some remote spot on the drive line.

Now we'll take a look at several popular clutches.

Batavus M 48

The M 48 clutch has been very influential in moped technology; one manufacturer has gone so far as to produce an almost identical copy.

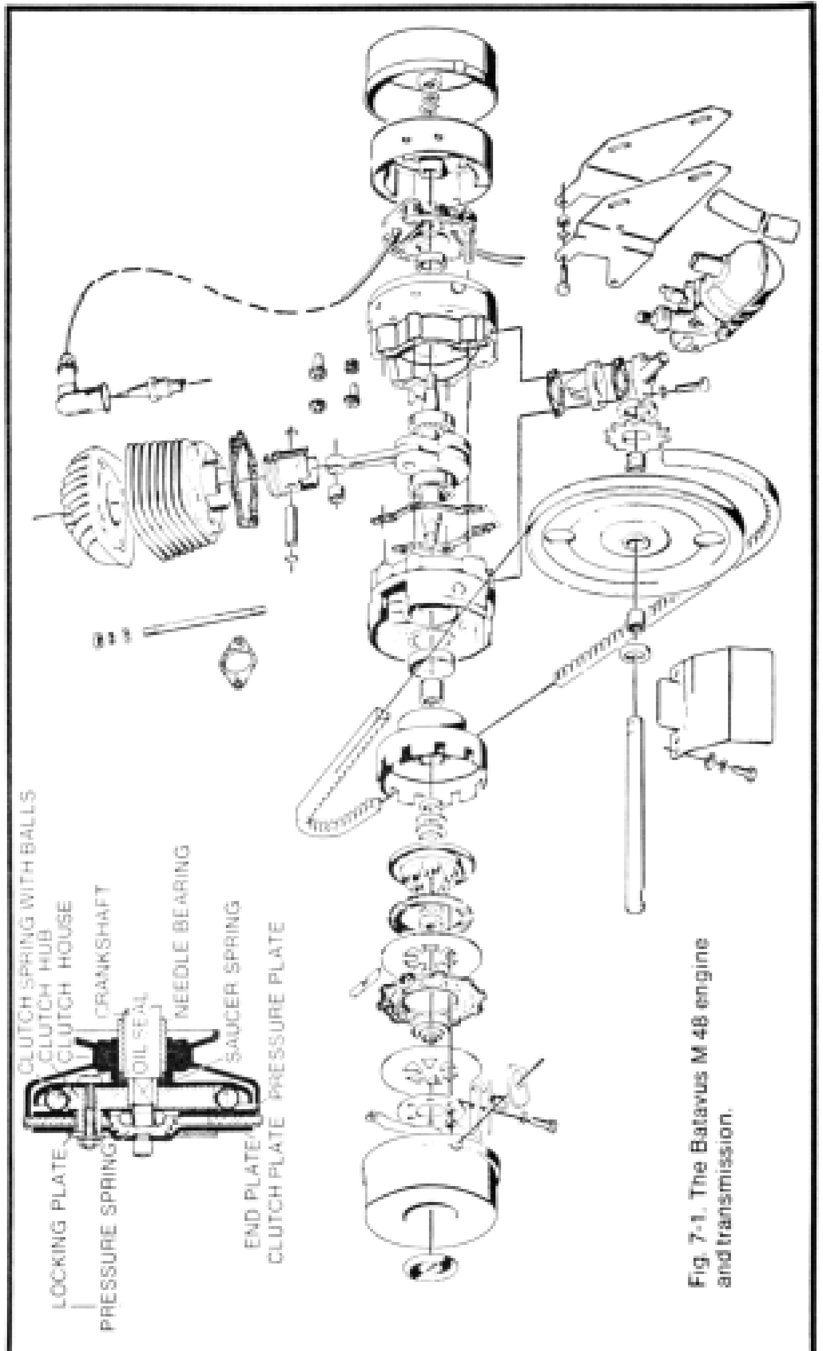


Fig. 7-1. The Batavus M 48 engine and transmission.

Operation. The clutch hub, spring, pressure plate, and end plate turn with the crankshaft (Fig. 7-1). The "house," or drum and clutch plate, are connected to the rear wheel by a belt and chain. At low engine speeds the drum floats on the crankshaft, insulated from motion by the needle bearing. As speed increases, ball bearings packed into the clutch spring feel the tug of centrifugal force and move outward, stretching the spring in the process. Ramps on the outer edge of the clutch hub divert this outward motion; the balls push to the left against the pressure plate. While the plate turns at engine speed with the hub, its splines allow some axial movement, and the plate contacts the right-hand friction surface on the clutch plate. The drum begins to receive power. Continued motion of the balls forces the clutch plate to the right where it contacts the end plate. Since the end plate is bolted to the crankshaft, no further axial movement is possible; the clutch plate is sandwiched between the pressure and end plates. Full torque goes to the drum and, hence, to the back wheel.

The starting lever displaces the end, clutch, and pressure plates to the right. Once the pressure plate butts against the spring and ball assembly, no further axial movement is possible: the clutch plate is trapped between the two hub-mounted plates. Power enters at the hub, passes through the clutch plate, and then to the crankshaft.

Service. The only internal adjustment is the clearance between the override lever and the thrust button. Bend the lever to obtain 2.0 mm (0.80 in.) clearance in the disengaged position (Fig. 7-2).

Upon disassembly, clean the parts in solvent—except the clutch disc which should not be wetted. Clutch slippage problems can usually be corrected by replacing the disc. Refusal to disengage completely or harsh, abrupt engagement most often involves the end and side plates. Replace if the plates are warped, scored, or streaked with blue temper marks. Small imperfections can be polished out with crocus cloth. Check the needle bearing for excessive play and, if necessary, replace with a new bearing, driven in from the marked side. Fill the bearing with high temperature grease or heavy transmission oil. Oil the hub, ball and spring assembly, and bronze thrust piece, but do not get any oil on the disc or the pressure sides of the plates.

Fig. 7-2. The override lever should be within 0.80 in. of the thrust button in the disengaged position. Bend the lever as required.

Note: Use the seal protector shown in Fig. 7-3 when mounting the hub. Otherwise the seal may be damaged, a condition that leads to bearing failure from loss of lubricant.

Jawa

The Jawa clutch employs shoes rather than a friction disc.

Operation. There are two sets of shoes: the outboard assembly connects the engine with the drive train; the inboard

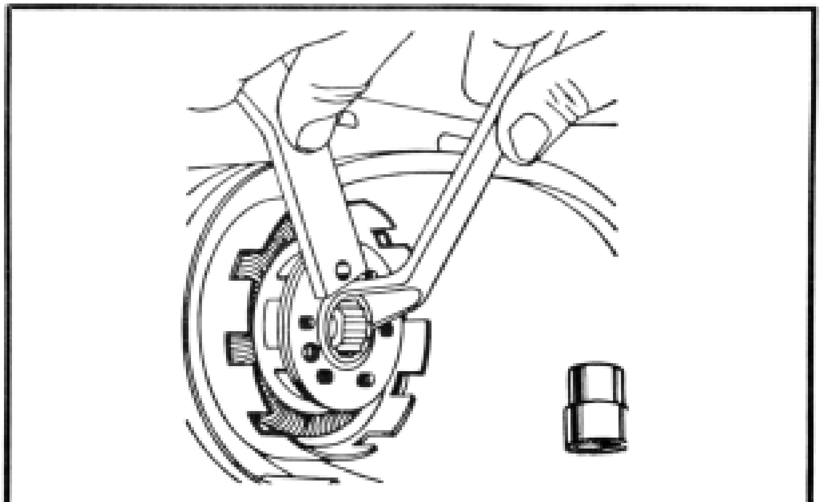


Fig. 7-3. The M 48 clutch wrench and seal protector.

set transfers power from the pedals, via the drive chain. Figure 7-4 shows the arrangement of parts. The flywheel (1), drive clutch shoes (3), segment carrier (4), and sleeve (5) are fixed to the crankshaft and turn with it. The starting shoes (6) and the clutch drum (7) are geared to the drive system and can turn independently of the crankshaft.

During starting, power enters the clutch drum, spinning it and the starting shoes which are pivoted on the drum. At approximately 600 rpm the starting shoes engage the inner lip of the segment carrier, turning it and the flywheel. Once the engine catches, power enters through the segment carrier. The drive clutch shoes pivot out against the garter spring and meet the clutch drum.

Service. Remove the flywheel bolt and the three clutch holddown bolts (Fig. 7-5A). Lift the flywheel off and, using special tool No. 975 1000 1.2, withdraw the segment carrier (Fig. 7-5B). (A substitute for this tool is a steel plate drilled for the segment carrier bolts with a large nut welded over the center.) Remove the sleeve with a small gear puller (Fig. 7-5C); if the shoes are to be separated, assemble them on their springs before installation. Pick out the oil seal and withdraw the drum (Fig. 7-5E).

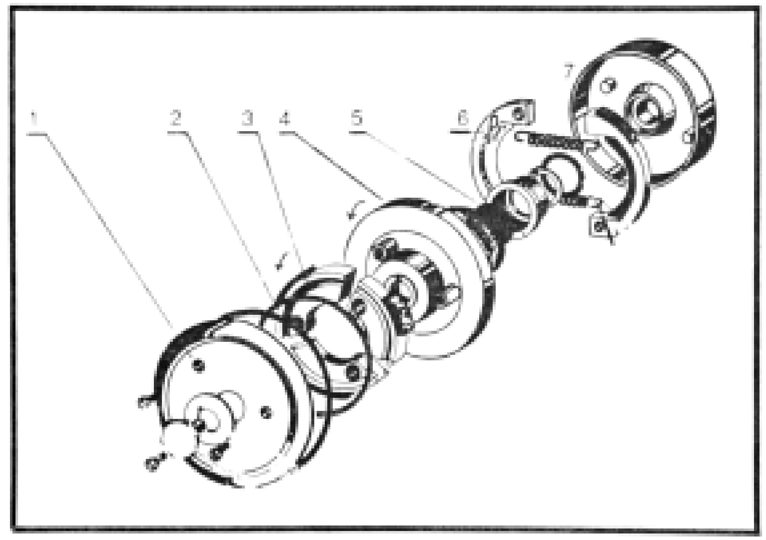


Fig. 7-4. The Jawa clutch is tucked neatly under the flywheel. 1-flywheel; 2-garter (shoe-return) spring; 3-drive clutch shoes; 4-segment carrier; 5-sleeve; 6-starting shoes; 7-clutch drum.

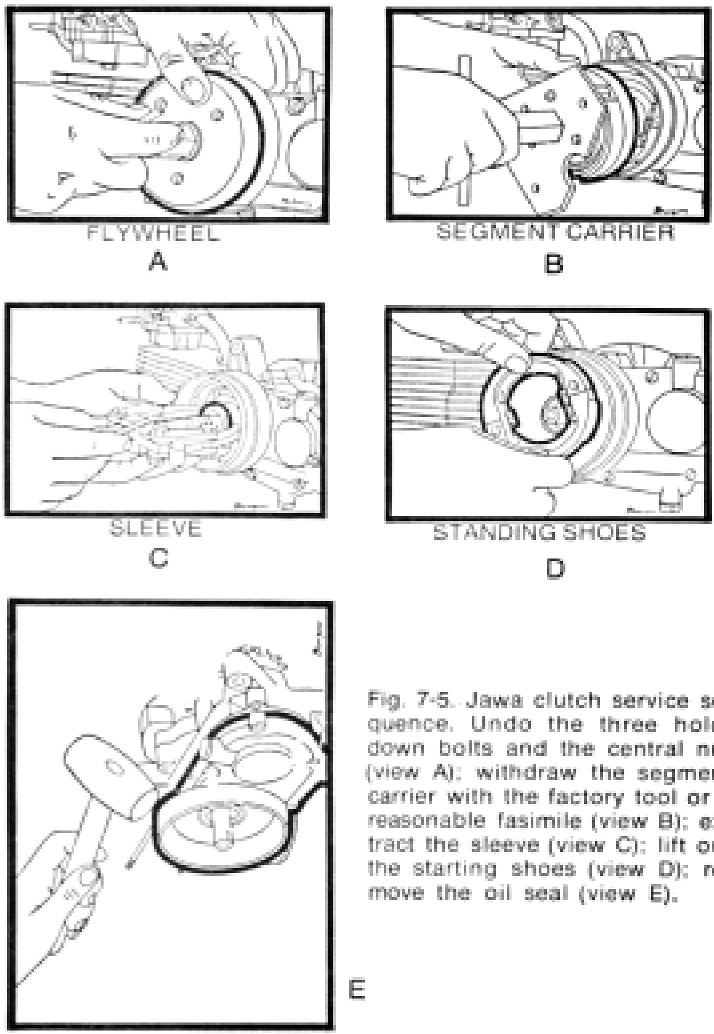


Fig. 7-5. Jawa clutch service sequence. Undo the three hold-down bolts and the central nut (view A); withdraw the segment carrier with the factory tool or a reasonable fasimile (view B); extract the sleeve (view C); lift out the starting shoes (view D); remove the oil seal (view E).

Although some oil seeps past the seal, it should not get on the friction surfaces. If the seal should fail, the clutch will drip oil. Engagment will be sudden and harsh, and the drive shoes may smoke under load. The seal and both sets of shoes should be replaced; in a pinch you can replace the seal and dry the linings with repeated applications of Berkebile 2 + 2 Gum Cutter.

Unless there is an oil problem, the starting shoes can be ignored: they get little wear. The drive shoes should be replaced long before the lining has worn down to metal, for once this happens, the drum will be ruined. Early signs of wear are late engagement and clutch slip on hills.

A stretched garter spring allows the drive shoes to engage early, before the engine is up to speed. Replace the spring and examine the shoes and drum for signs of overheating.

Peugeot

The Peugeot clutch is uniquely Peugeot with features that are shared by none other, yet it is a very practical device, having proved itself over millions of miles.

Operation. Figure 7-6 illustrates the mechanism in cutaway and exploded views. It must be remembered that the clutch drum C and ball drum D bolt to the crankshaft and turn

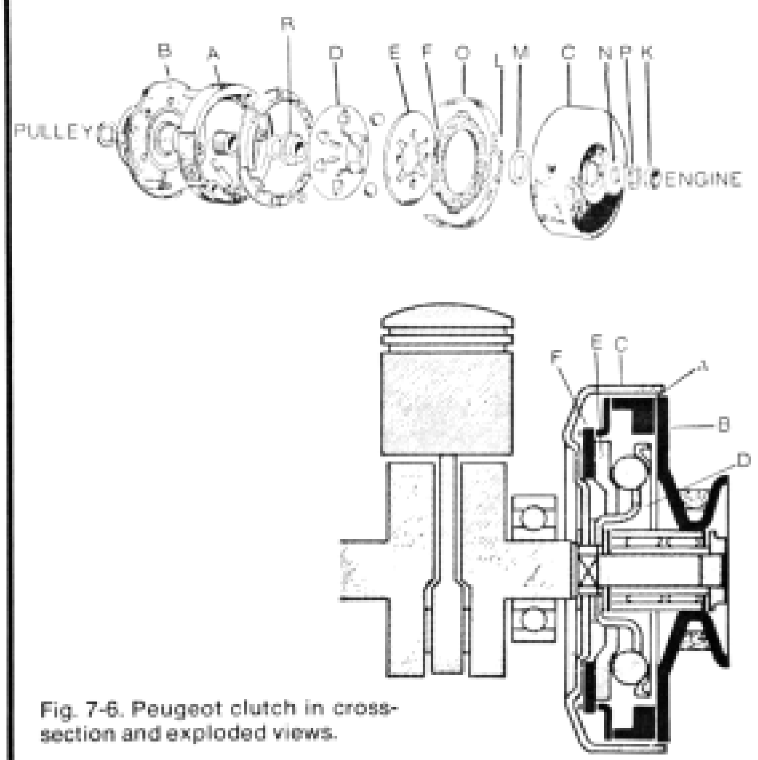


Fig. 7-6. Peugeot clutch in cross-section and exploded views.

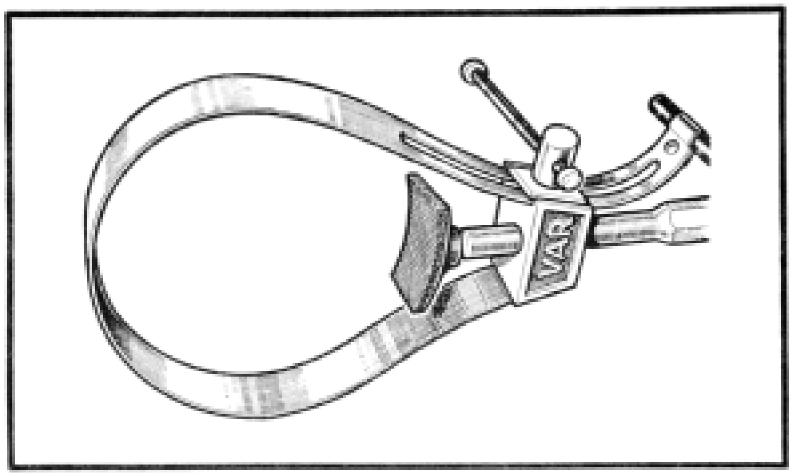


Fig. 7-7. A flywheel holder supplied by Motobecane.

with it. Starting shoes A and clutch disc F turn with the drive pulley B.

During starting, power flows from the pedals to the drive pulley. At about 5 mph the starting shoes A cam out against the drum C, locking the pulley and crankshaft. Once the engine starts, the six ball bearings move out toward the edge of the spinning ball drum D. The bearings are confined to teardrop shaped holes; as they move outward, they cam out of the holes and press against the plate E. The plate moves the clutch disc F against a lip on the inner edge of the drum. Power flows from the drum, to the disc, and through splines on the rim of the disc to the drive pulley. The star spring keeps the plate away from the disc at low rpm.

Service. The clutch mechanism is essentially the same for single- and variable-ratio machines. Hold the clutch drum with a strap wrench (Fig. 7-7) and remove the 17-mm nut (right-hand thread, overhand and left to loosen). Remove the washers and replace the nut with special tool No. 69142. This tool keeps things together when the pulley is removed and takes the guess work out of clutch adjustments. Remove the pulley.

Holding the ball drum D and plate E with one hand, unthread the special tool and pull the clutch drum off. Mark the outboard side of the clutch disc if it is to be reused. Remove parts in this order:

1. disc F
2. spring L
3. adjusting washer M
4. drum C
5. washer N

Place the pulley assembly on a bench, pulley down. Remove the nuts holding the locking ring O and lockwashers, and remove the locking ring. Unhook the springs from the studs in the shoes, noting which of the two studs was used (the first is for direct-drive machines; the second for variable-ratio models).

The shoes are a little tricky. Lightly lubricate the shoe pivot anchors. Assemble the springs on the shoes, with the large hooked ends secured by the slots in the shoes. Mount the shoes on their anchors and hook the small ends of the springs over the appropriate pins. Correctly installed, the open sides of the hooks face toward the center of pulley plate B. Secure the shoes to the plate with two 5-mm nuts and lockwashers. The nuts must be turned so their sides are clear of the clutch disc.

Assemble the rest of the mechanism, reversing the disassembly sequence. Torque the outboard nut 4.0 ts kgm (28.9 ft-lb) and test. If the clutch behaves abnormally—engaging harshly or slipping under load—it will be necessary to check the clearance between pressure plate E and disc F. There are at least three ways to do this.

1. The clutch can be partially assembled with the help of special tools Nos. 69140 and 69141. This is the currently accepted shop practice.
2. The clutch can be assembled in reverse of normal order on the crankshaft. One special tool, formerly available as No. 42018, is needed. This tool can be fabricated from a discarded clutch drum.
3. Assemble the clutch with modeling clay between the pressure plate and the clutch lining. Disassemble and measure the thickness of the clay.

The specification is 0.5-0.7 mm (0.020-0.028 in.). Correct by substituting a different-thickness adjusting washer.

Thickness	*Washer Part Number*
0.40 mm	45818
0.60 mm	45819
0.80 mm	45820
1.00 mm	45821

If you use method 1, place the assembling shaft 69141 vertically in a vise and assemble these parts on it:

- Washer N
- Adjusting plate No. 69140
- Adjusting washer M
- Spring L
- Disc F
- Pressure plate E
- Balls
- Ball drum D
- Nut

If you choose method 2, turn the engine on its side and assemble the parts in this inverted order:

- Hub ring R
- Ball drum D
- Balls
- Pressure plate E
- Clutch plate F
- Spring L
- Adjusting washer M
- Special tool No. 42018
- Washer N
- Washer P
- Nut K

Method 3 is, as you could expect, the most laborious. The clutch must be disassembled, assembled with modeling clay between disc F and the inboard side of drum C, disassembled again to remove the clay, and assembled one more time.

TRANSMISSIONS

One of the characteristics of mopeds is the high reduction ratio between the engine and the back wheel. The engine may scream at 5000 rpm-plus, but the road speed of the vehicle must be kept under 30 mph. The reduction is accomplished by gears or a pulley-and-belt arrangement. Some machines combine a belt with gears. Most transmissions give a single ratio between the engine and the driving wheel; a few have variable speeds, selected automatically in response to engine rpm.

Belt Drives

The traditional moped (on the French model) uses a V-belt to transmit engine power to the drive sprocket. While this system may look primitive, it has some real advantages. Belt drive is silent, vibration-free, and tends to isolate the crankshaft and main bearings from drive shocks.

Service. The belt must be replaced at intervals. It is a good idea to carry a second belt, wrapped in aluminum foil, on the machine. The aluminum foil will keep the belt dry and free of oil, and will help to protect if from ozone attack.

V-belts transmit power by wedging their angled sides against the edges of the pulley grooves. In time the belt wears and sinks deeper into the grooves, changing the ratio slightly. A machine with a worn belt will have a marginally higher speed than one that has just been fitted with a new belt; conversely, the bike with the new belt should have slightly better acceleration. Wear becomes serious when it is localized; when the flanks of the belt show dips and depressions, or when wear has progressed until the belt rides on the base of the pulley groove. Should this happen, the belt becomes a flat belt, with very little capacity to transmit power.

Belt dressing is one of those shade-tree fixes that help in the short run and cause additional problems down the road. This product, available from auto supply houses in aerosol cans, contains a powerful solvent that makes the belt stickier and better able to transmit power. In the process the belt is softened and wears more rapidly. But it works and will get you home.

Pulley grooves also wear and contribute to the early demise of the belt. The groove flanks should be flat and narrow enough so the belt is supported well above the base of the groove. Wear is more pronounced on the engine pulley, the smaller of the two.

Adjustment. Too much belt tension defeats the wedging action of the belt and loads the crankshaft and pulley bearings; too little tension allows the belt to hump and slip. Some machines do not have provision for belt adjustment, either because of the maker's confidence in steel-cored belts or because adjustment is maintained automatically by means of a spring. Peugeot and Motobecane are examples of the latter method: the engines are pivoted against springs.

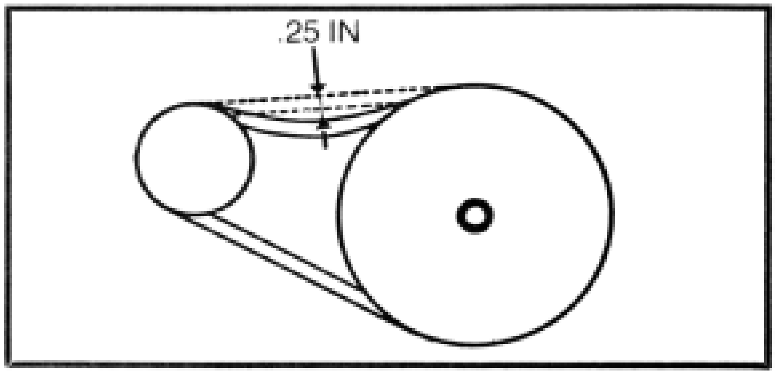


Fig. 7-8. Correct belt tension is important. (Courtesy Batavus Bikeways, Inc.)

In any event, the belt should have approximately one-quarter-inch play under light thumb pressure (Fig. 7-8). The engine is the movable element; the large pulley remains fixed to the frame. Figure 7-9 shows a very elegant tool used to pivot the engine away from the large pulley. The next drawing (Fig. 7-10) illustrates the Batavus procedure. Once the engine holddown bolts are slacked off, a 5-mm rod is inserted into hole A. Lever B rests against this rod and, moved as shown, pivots the engine forward.

Belt-Driven Variable-Speed Transmission

A belt running on fixed pulleys has some built-in ability to multiply torque. Figure 7-11 shows two pulleys with identical

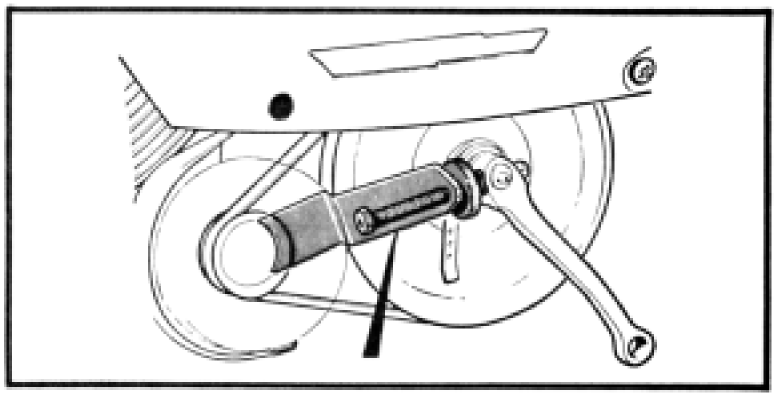


Fig. 7-9. A tool like this is convenient when adjusting belts against spring tension.

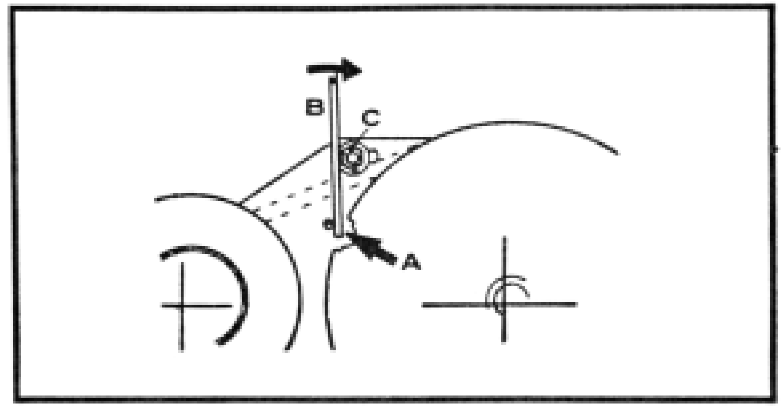


Fig. 7-10. Batavus belts are adjusted with the help of a rod A and lever B.

diameters. Under load, the lower side of the belt tenses and the upper side relaxes. The belt burrows more deeply into the driven pulley and flings outward on the drive pulley. The effective diameters of the pulleys change: the drive pulley becomes larger and the driven pulley shrinks. Torque, or turning force, is multiplied.

While this feature is useful and gives a tractability to belt-driven machines that is absent with gear or friction drives, real torque multiplication requires some mechanical

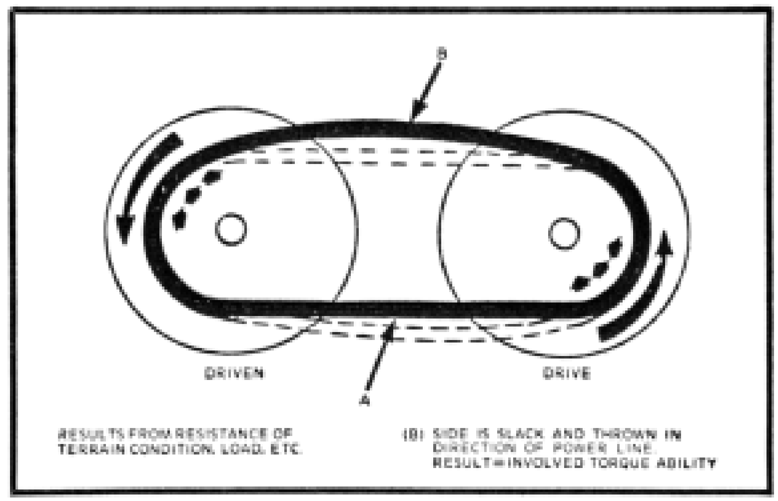


Fig. 7-11. Fixed pulleys benefit from some self-induced torque multiplication. (Courtesy Bombardier Ltd.)

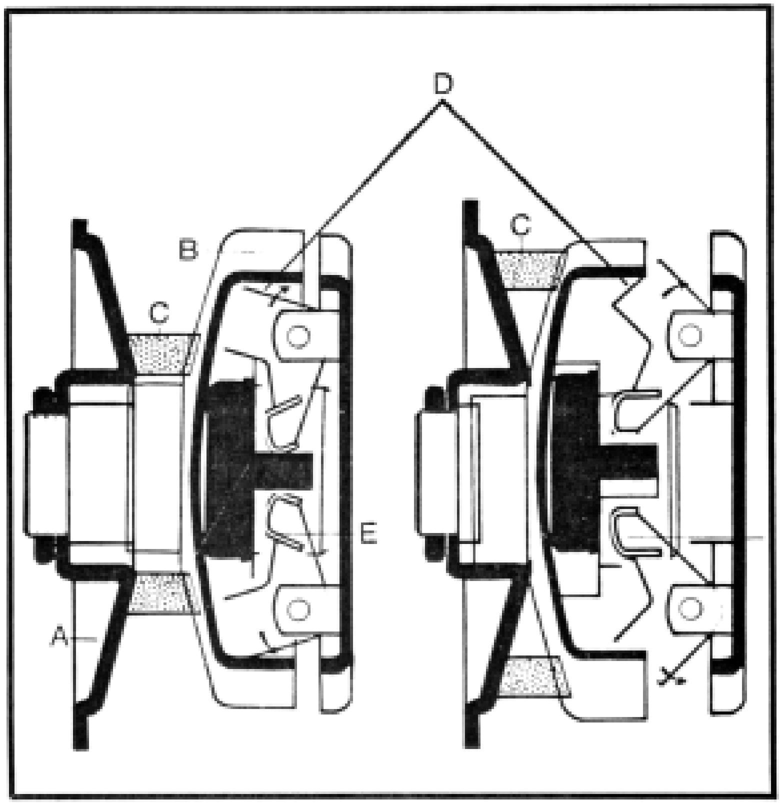


Fig. 7-12. Peugeot speed-sensitive pulley. A-fixed pulley flange; B-movable flange; C-drive belt; D-flyweights

means of changing pulley diameter. Variable-speed transmissions, sometimes called variators, are used on snowmibiles, a few motorcycles, and on at least two light automobiles. These transmissions offer a fairly wide range of ratios and are entirely "stepless." That is, one ratio blends into another without plateaus or steps.

Figure 7-12 illustrates an example from Peugeot. The inboard pulley flange (A) is fixed; the outboard flange (B) moves in and out. At low engine speeds, belt C rides low in the pulley groove, giving a low ratio for starting. As engine rpm increases, centrifugal force pivots the flyweights D out radially, camming the outboard flange inward. The belt is spring-loaded, and thus can respond by climbing higher in the groove. As it does, the ratio is raised for less torque

multiplication and more speed. Should the engine bog, rpm falls off, the flyweights relax their pressure on the flange, and the belt burrows deeper into the pulley groove. This device enables the Peugoet 103 LVS-U3 to climb an 18% grade, yet reach 30 mph on level stretches.

Very little maintenance is required of this and similar transmissions. The main concern is the belt, which must be replaced if it shows excessive wear or becomes oil-soaked. The flyweight assembly should be coated with high-pressure grease at the pivots and cam ramps.

Gear Drives

Gear drives may be single-stage or multistage. Single-stage transmissions have one gear pair between the crankshaft and engine sprocket; multistage units have two or more gear pairs in tandem. Figure 7-13 shows power flow through the Jawa Babetta in schematic form. Power leaves the crankshaft by way of a 20-tooth gear meshed with a 34-tooth for a ratio of 1.7 to 1. From there power passes through a second set of gears giving an additional reduction of 3 to 1. The overall reduction is 5.1 to 1. Puch gets a similar ratio from a single stage—a tiny engine gear turns a monstrous wheel on the drive side.

Service. Inspect the gear teeth for wear, giving particular attention to evidence of flaking. Sometimes it appears as if the surface metal has peeled, as indeed it has. One problem with moped (and motorcycle) technology is the unwillingness of

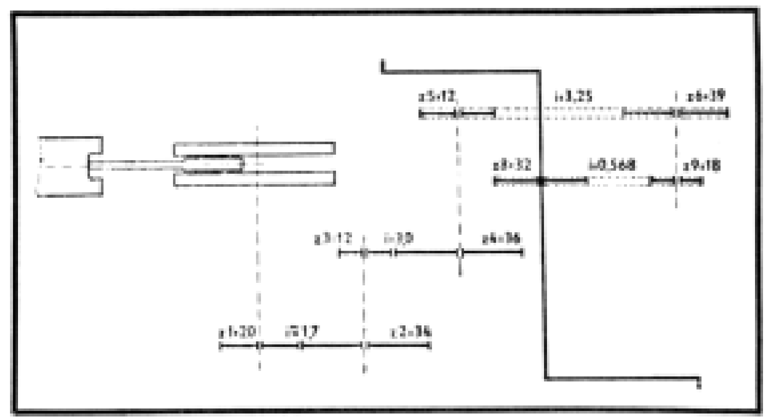


Fig. 7-13. Power flow through the Jawa transmission and rear wheel hub. The numbers represent ratios at each stage.

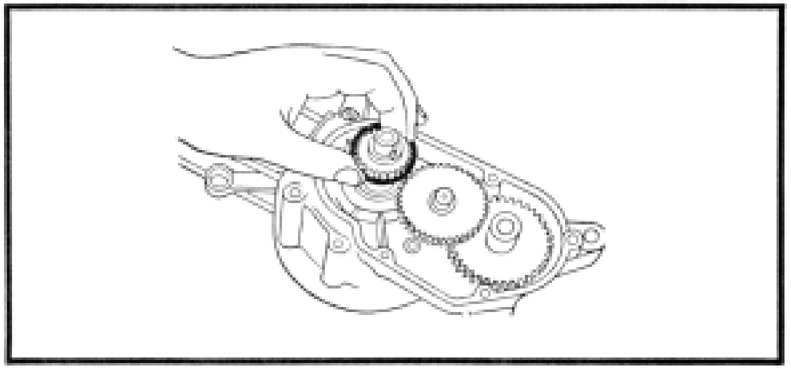


Fig. 7-14. Floating gears can be lifted from their shafts, as is being done here on a Jawa, but watch out for loose needle bearings.

many manufacturers to use the proper alloys. A very soft gear steel is surface-hardened for a few thousandths of an inch. Once this "skin" is broken, the gear rapidly fails. Normally, the damage is limited to the smaller gear of a pair; however, when one meshed gear gives way, the other must be replaced as well, for used gears do not survive long in the company of new ones.

Floating gears—gears that are free to idle—can be removed from their shafts once the bolt or spring clip is undone (Fig. 7-14). However, these gears may float on uncaged needle bearings and some care must be exercised not to lose any of the needles. Installation is easier if the needles are held with heavy grease or beeswax. Gears that turn with their shafts are held by through-bolts and keys. The shaft/gear fit is deliberately tight and a gear extractor will be needed (Fig. 7-15).

Excessive gear wear is often the fault of the shaft bearings. Bushings should be replaced each time the gear set is disturbed. In many cases, the bushings can be reached from outside the castings and driven inwards with a punch. If the bearing boss is blind, that is, if the shaft does not pass through the case, the bushing can be extracted by either of two methods. One way is to split the bushing with a small chisel, being scrupulously careful not to damage the boss in the process. Another technique is to fill the bushing cavity with grease, then drive a rod the same diameter as the shaft into the grease-packed bushing cavity. The grease will displace the bushing, lifting it up onto the rod.

Caged needle or ball bearings should not be disturbed unless the wear pattern on the gears shows they have wobbled. These bearings can be driven out of blind bosses by the same hydraulic technique described above, except that the medium is oil-soaked newspaper confetti. It helps if the casting is heated slightly. When installing needle and ball bearings, the numbered side is out, toward the installation tool. Drive the new bearing home with a hardwood block, seating it to its original depth.

Two-Speed Gear Drives

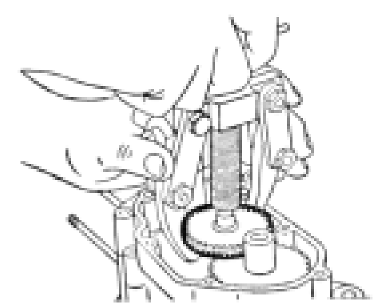
While three- and four-speed manually shifted mopeds are not unknown in Europe, American laws require that any moped transmission be automatic. The rider cannot be expected to do more than open the throttle. A gear-driven automatic transmission is a fairly complex piece of work, but can give smooth, effortless shifts and is not handicapped by the power losses inherent in belt drive, which can amount to 10% of the input.

Operation. Several mopeds use these transmissions, but all operate on the same theory to give two speeds. At a preset engine speed, one set of drive gears engages and the other simultaneously disengages. The second, or high-speed, set of gears forms a path for power from the pedals to the engine for starting purposes.

These transmissions have the following parts:

- Two sets of centrifugally engaged clutch shoes
- Two sprag clutches
- Two sets of gears that are constantly in mesh

Fig. 7-15. Captive gears must be removed with a puller.



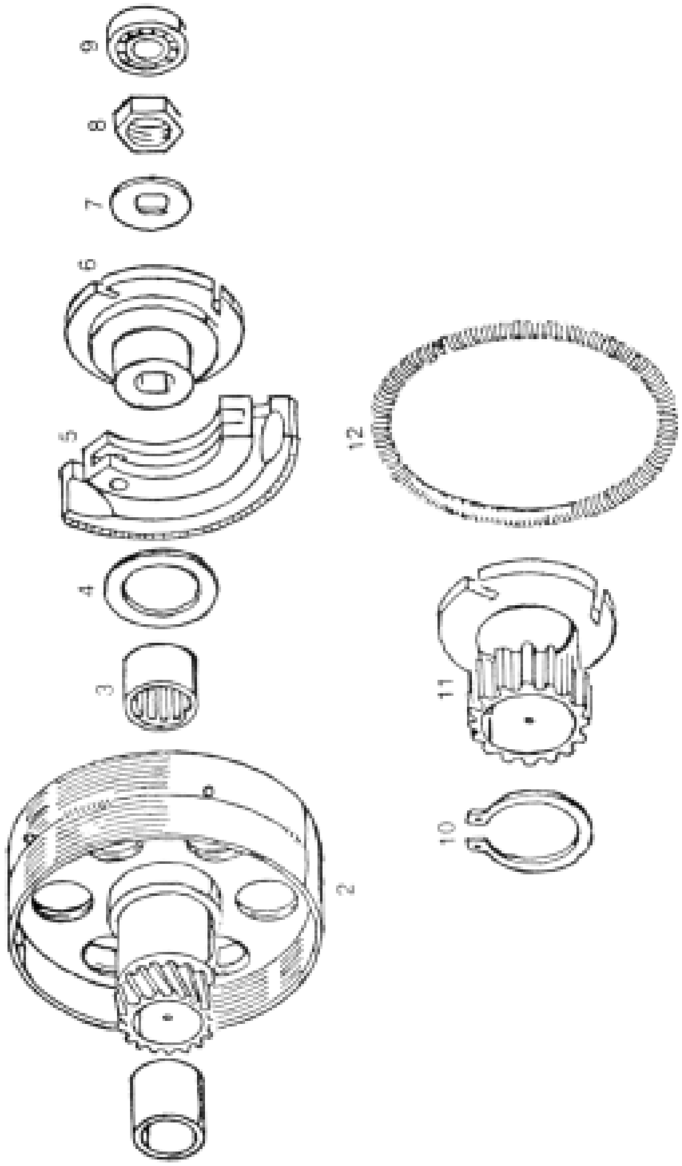


Fig. 7-16. Drive section of the Tomas two-speed, automatically shifted transmission. 1—bushing; 2—clutch drum (double-sided); 3—sprag clutch; 4—spacer; 5—shoe (three on each side of the drum); 6—first-speed hub; 7—lockwasher; 8—nut; 9—bearing; 10—spring clip; 11—second-speed hub and gear; 12—garter spring (one on each shoe set).

Figure 7-16 illustrates the driving parts in a Tomas transmission. The bushing (1) supports the two-sided clutch drum (2) on the engine crankshaft. Note that the clutch drum has an integral gear which turns with it: this is the first speed gear. Both sides of the drum house clutch shoes (5), three shoes on each side for a total of six. Two garter springs (12) restrain the shoes. The first-speed shoes pivot on hub 6, which turns with the crankshaft. The second-speed shoes ride on the hub and gear 11. This second-speed assembly floats inside the drum, on the left-hand side as shown in the drawing.

The drum can be engaged with the crankshaft by either set of shoes or by the sprag clutch (3). Sprag clutches work by means of a wedging action. In the case of clutch 3, the working elements are rectangular in cross-section and held at an angle to the shaft (Fig. 7-7). As this particular example is set up, power can be transmitted from the drum to the crankshaft, but not in the other direction. Once the engine starts, the sprag clutch slips and drum engagement is a function of the shoes.

Figure 7-18 illustrates the driven half of the transmission. The second-speed gear (8) is captive and turns with the countershaft; the first speed gear (6) is mated to the shaft by means of another sprag clutch. While this clutch is somewhat more complex than the one shown in the previous drawing, it operates on the same principle, allowing power to pass in one direction but not in the other. The first-speed wheel can drive the countershat, but the countershaft cannot drive the wheel.

Starting. The engine is started by back-pedaling. Power is transmitted by a small starting chain to the clutch drum and, via the sprag clutch under the drum, to the crankshaft. The chain bypasses one set of transmission gears, and so compensates for the reversed pedal rotation.

Fig. 7-17. Whatever the form, and there are several, a sprag clutch is biased to pass power in one direction and to slip in the other.

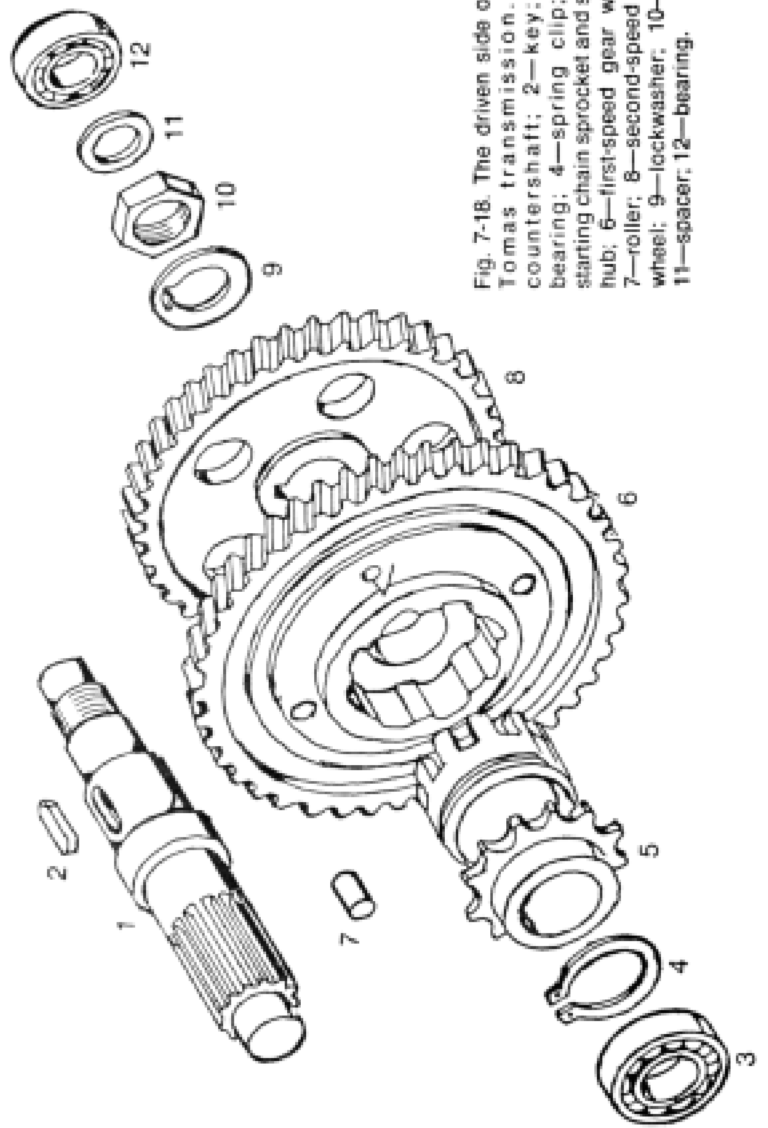


Fig. 7-18. The driven side of the Tomas transmission. 1—countershaft; 2—key; 3—bearing; 4—spring clip; 5—starting chain sprocket and sprag hub; 6—first-speed gear wheel; 7—roller; 8—second-speed gear wheel; 9—lockwasher; 10—nut; 11—spacer; 12—bearing.

Idle. The transmission is in neutral, with no power going to the drum (Fig. 7-19A). The sprag clutch slips, since it is biased to disengage when the crankshaft drives the drum and neither shoe assembly turns rapidly enough to engage by centrifugal force.

First Speed. The first-speed shoes turn with the crankshaft. At approximately 1500 rpm the shoes move out against the drum, mating it with the crankshaft (Fig. 7-19B). Power flows through the low-speed gear set where the flow splits. Almost all power leaves the shaft and goes to the back wheel; a small complement returns to the clutch assembly by way of the second-speed gear set. This power dead-ends at the clutch drum, since second gear is not turning fast enough to engage.

Second Speed. As engine rpm climb, the second-speed shoes reach engagement (Fig. 7-19C). At first glance it would appear that power flows through both gear sets simultaneously, but that interpretation overlooks the sprag clutch under the first-speed countershaft gear. Since the second speed gears drive the countershaft faster than the low speed set, the sprag clutch disengages, releasing the first speed set from the drive train.

Beautiful.

The sprag between the drum and crankshaft engages only during starting, and is rather fragile in comparison with the low-speed sprag clutch. The starting sprag is pressed into the drum and acts directly upon the crankshaft. After a great many starts, the crank may develop waves that interfere with clutch release. Small imperfections can be polished out with emery cloth; deep, fingernail-hanging indentations mean that the crankshaft should be replaced.

The starting sprag should remain undisturbed unless it has failed. In that event, the assembly is driven out of the clutch hub and a new one pressed into place. The numbered end of the sprag assembly is up, toward the arbor.

Test the transmission before final assembly. Hold the second-speed driven gear—the gear pinned to the countershaft—with your left hand and turn the clutch drum with your right. Both sprag clutches should slip when the drum is turned counterclockwise; turning the drum to the right should rotate the crankshaft and the first-speed gear set. If the transmission does not behave in this fashion, check:

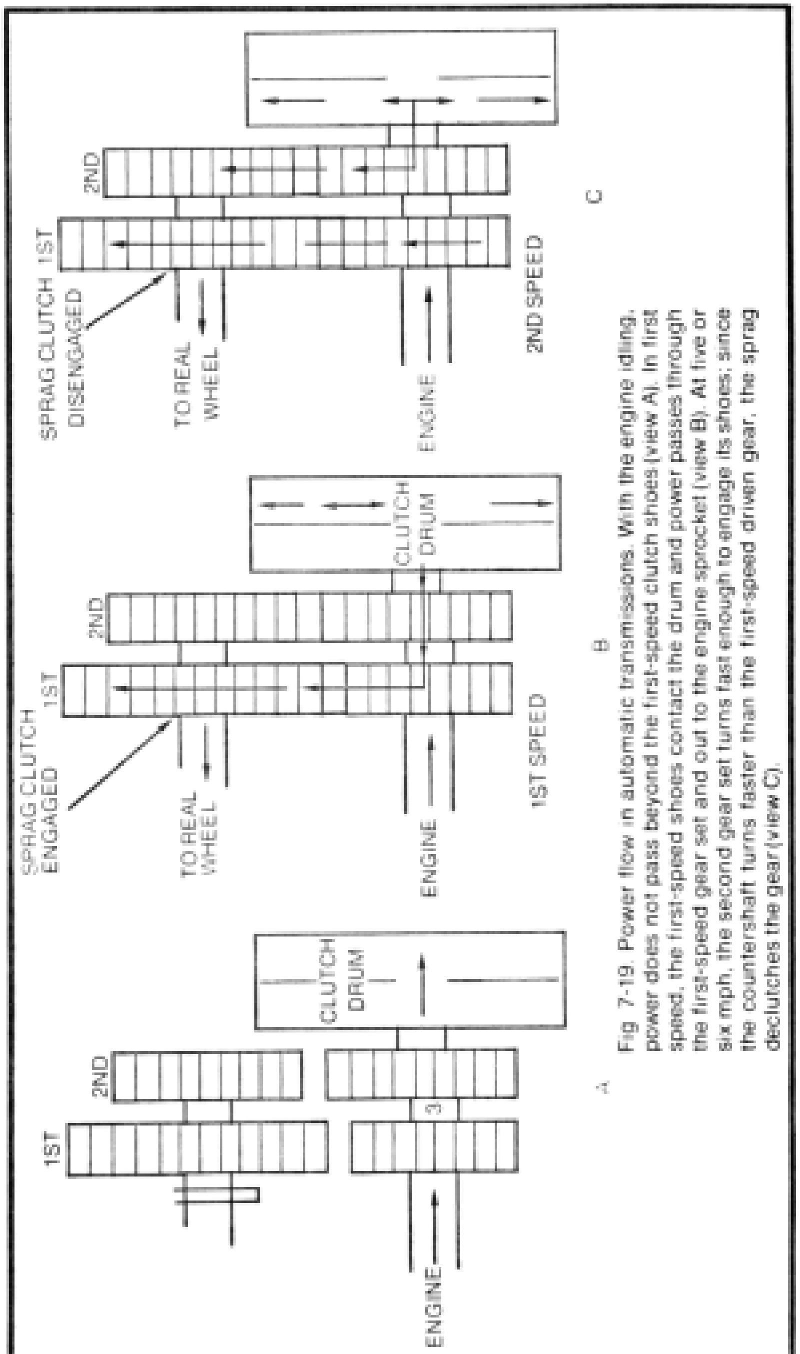


Fig. 7-19. Power flow in automatic transmissions. With the engine idling, power does not pass beyond the first-speed clutch shoes (view A). In first speed, the first-speed shoes contact the drum and power passes through the first-speed gear set and out to the engine sprocket (view B). At five or six mph, the second gear set turns fast enough to engage its shoes; since the countershaft turns faster than the first-speed driven gear, the sprag declutches the gear (view C).

- **Clutch shoe/drum clearance.** The specification for both shoe sets is 0.4 mm (0.08 in.)
- **Interference between the crankshaft nut and the drum.** With the nut torqued to 2.5 kgm (18.0 ft-lb) there should be 0.1 mm (0.03 in.) axial play between the drum and shaft. Adjusting washers in various thicknesses are available.

Friction Drive

Velosolex bikes drive through the front wheel by means of a roller that bears against the tire. The engine is mounted in a spring-loaded cradle and lowered into the drive position by a lever (Fig. 7-20). While there are objections to friction

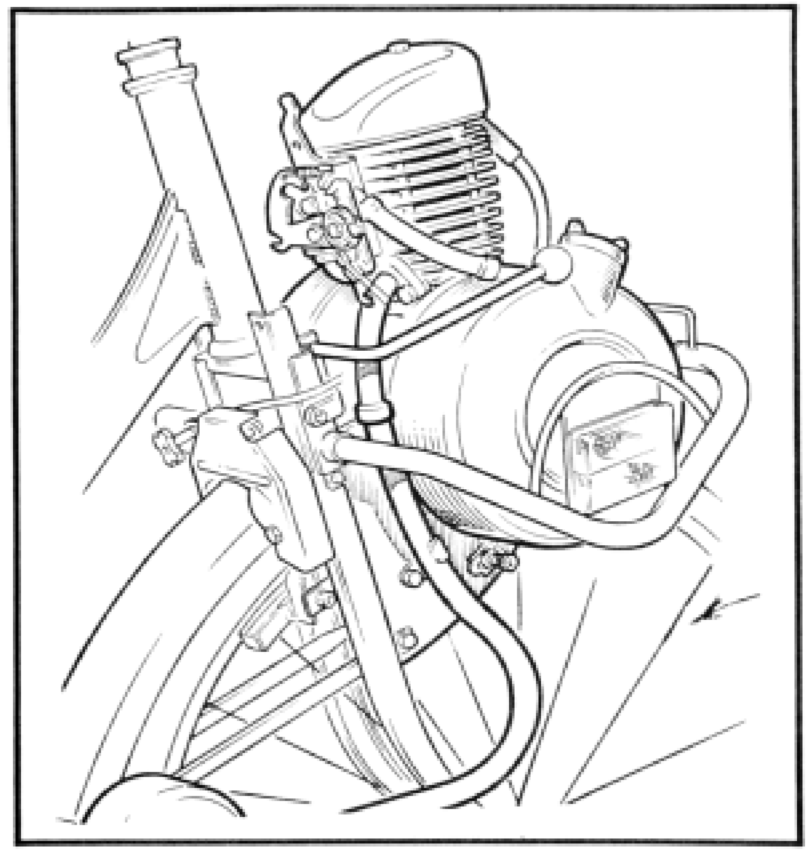


Fig. 7-20. The Velosolex drive mechanism with torque specifications in inch-pounds.

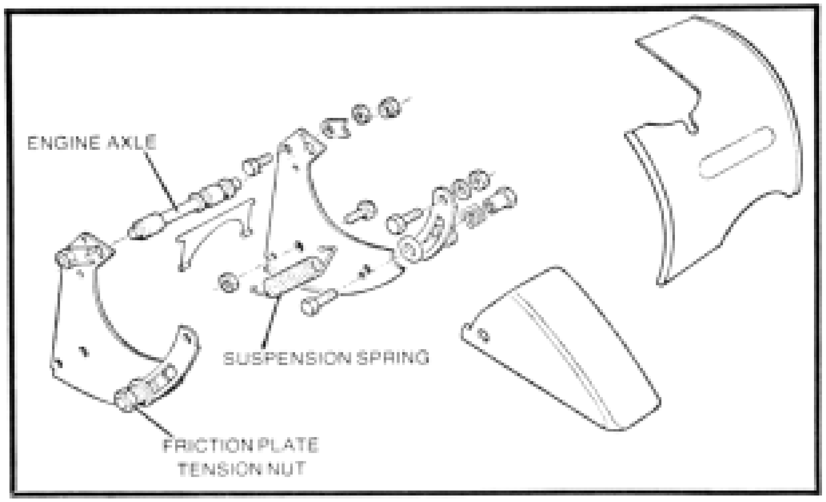


Fig. 7-21. Engine axle, cradle, and spring assembly. Radical simplicity has always been the Velosolex hallmark.

drive—accelerated tire wear, slip in rain and mud, the pendulum effect of the engine over the front wheel—the concept is elegantly simple. There is no need for elaborate clutch mechanisms or the complexity associated with single chain drives.

Figure 7-21 illustrates the cradle assembly. Spring tension is regulated by the friction plate and tension nut. The next drawing, Fig. 7-22, shows the centrifugal clutch, drive roller, and their torque specifications.

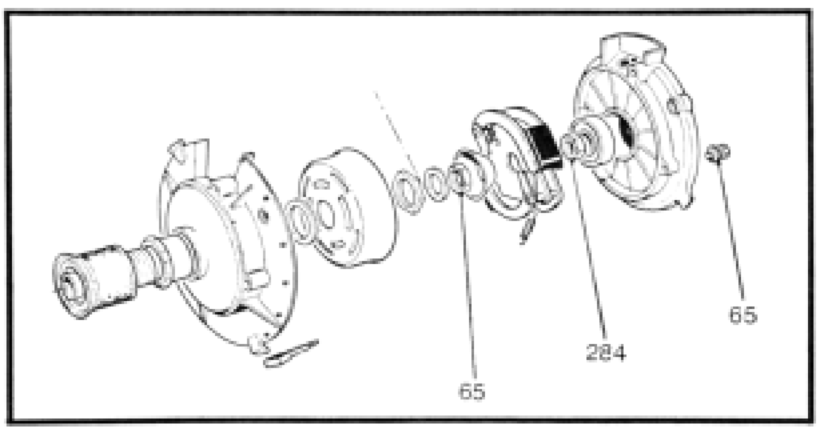


Fig. 7-22. Velosolex drive mechanism with torque specifications in inch-pounds.

To remove the centrifugal clutch, undo the nut securing the shoe assembly to the crankshaft. Squeeze the shoes together and withdraw from the drive roller housing. Inspect the linings for wear and replace if necessary. Assemble with the "X" marks on the shoes toward the drive roller. Run up the nut on the crankshaft and mount the wrench shown in Fig. 7-23 over the nut. The arm extending out of the side of the tool should point toward the front of the engine, where you will find an index hole. Bolt the tool down and torque to 65 inch-pounds (about 5.5 foot-pounds).

To service the drive roller assembly, gently disengage the seal, deforming it with your fingers. Once it has loosened, work the seal over the crankshaft threads (Fig. 7-24). Install the stroke limiter—the threaded rod shown at the left of the drawing—and undo the drive-roller nut and washer. Remove the drive roller.

Lightly grease the roller, confining the grease to the inboard edge where the roller makes rubbing contact with the crankcase flange. Do not get any grease on the friction surface. Align the roller flange with the engine engagement lever bolt hole, and insert a stop bolt. Fit the washer and drive-roller nut and tighten moderately. Replace the oil seal.

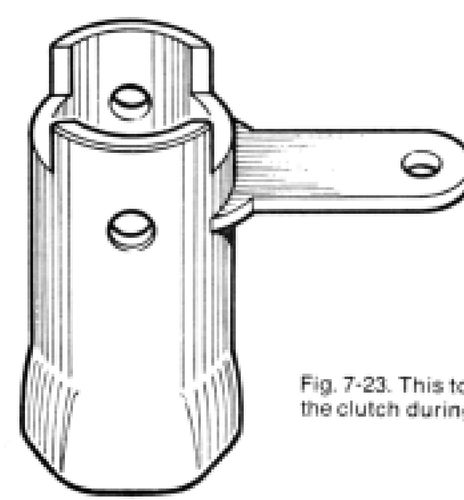


Fig. 7-23. This tool is used to hold the clutch during assembly.

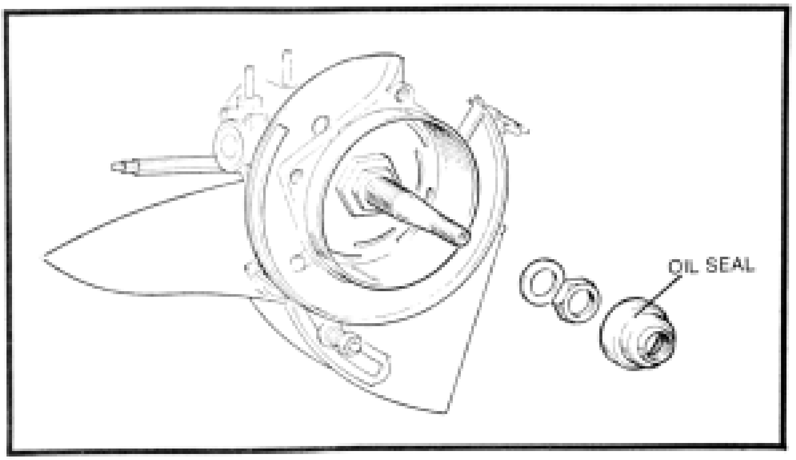


Fig. 7-24. Work the oil seal off with your fingers, being careful not to tear it on the crankshaft threads.

PEDAL CRANKS

The pedal crank is arranged to give three options:

- In *neutral* it is disengaged from the engine and rear wheel.
- In *start* it powers the rear wheel and engine.* Should the engine bog under load, the pedal crank can provide additional energy.
- In *drive* the crank diverts all energy to the rear wheel.

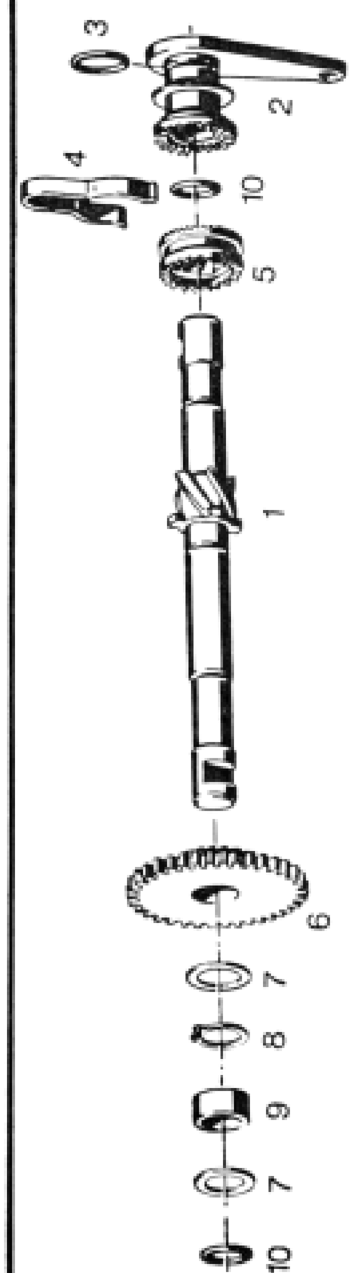
How these options are realized depends upon the type of drive mechanism and, to a lesser extent, upon the manufacturer.

Neutral

In the neutral position, the pedal crank is isolated from the rear wheel and engine. On machines with separate drive chains for pedals and engine, a rachet is placed between the rear-wheel pedal sprocket and the drive hub. The rachet, or freewheel, transmits power in one direction—from the sprocket to the wheel hub—and slips when the wheel hub turns faster than the sprocket.

Machines with a single chain to the rear wheel are fitted with a clutch on the pedal shaft. Figure 7-25 illustrates a

*Tomos is an exception; the crank must be reversed to start the engine.



PARTS LIST FOR SACHS ENGINE MODEL NO. 505/1A

REF. NO.	DESCRIPTION
1	Pedal Shaft
2	Driver Bushing Ass'y.
3	Round Sealing Ring 19 x 2
4	Brake Spring
5	Driver
6	Starting Wheel
7	Washer 16.2 x 22 x 1
8	Circlip
9	Bushing 16.3 x 20 x 9.2
10	Round Sealing Ring 13 x 1.5

Fig. 7-25. Sachs pedal clutch. (Courtesy Columbia Mfg. Co.)

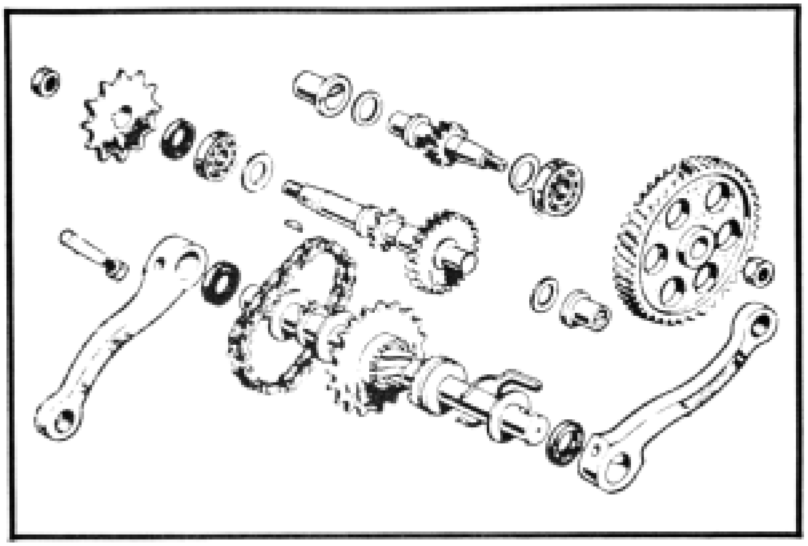


Fig. 7-26. Morini engines employ a short chain between the pedal crank and countershaft.

typical example from Sachs: the driver (5) moves over a thread cast on the pedal shaft in response to friction generated by the brake spring (4). Those of you who are knowledgeable about coaster brakes will be on familiar ground here. In neutral the pedals back off against the driver bushing assembly (2). This example has an external arm whose position can be adjusted to suit the rider, thus locating the pedals positively. (On free wheel designs the pedals can be backed off in a full circle and so offer little support for the rider's feet.)

Start

Pedal torque may be sent directly to the engine or it may enter indirectly, by way of the back wheel and engine chain. The indirect approach is limited to bikes with dual drive chains, and is shown in schematic in Fig. 7-13. Single-chain designs route torque from the pedals directly to the engine clutch. Returning to Fig. 7-25 for a moment, note that driver 5 is toothed on both ends. The right-hand end is for positive neutral stop; the left-hand teeth mate with teeth on the inboard side of the gear wheel (6). Torque from this gear splits in two directions: some goes to the rear wheel and some goes to spin the engine clutch drum. The Sachs engine clutch is engaged

manually by the same handlebar control that trips the compression release. Other clutches have starting shoes for automatic, speed-sensitive engagement.

While most manufacturers use gears between the engine clutch and the pedal shaft, a few use a chain. Figure 7-26 illustrates the Morini setup.

Drive

Drive, the condition when forward motion depends solely upon the pedals, means that the engine must be taken out of the circuit. On single-chain machines with manual override on the engine clutch, one merely does not engage the override. With automatic clutches that turn the engine once a preset speed is reached, the uncoupling mechanism is between the clutch and pedal shaft or rear wheel. Figure 7-27 illustrates one form of lockout.

Another lockout one that is typical of belt-drive practice, is shown in Fig. 7-28. The pulley floats on a pair of caged needle bearings (13) on the pedal shaft. It turns with the engine. The pedal crank has its own sprocket, not illustrated here; engine power goes to the back wheel by means of the sprocket assembly 2. The sprocket assembly consists of two toothed wheels; the outboard wheel drives the chain, the inboard wheel can mesh with the lock lever (9 and 15). The lever turns

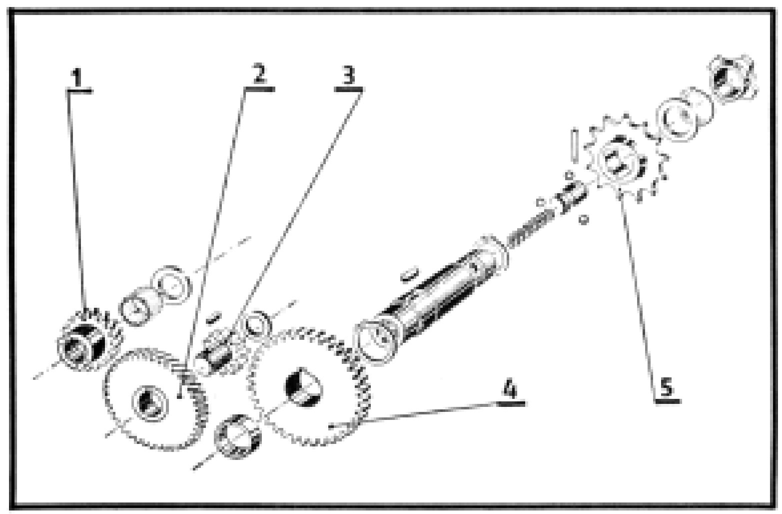
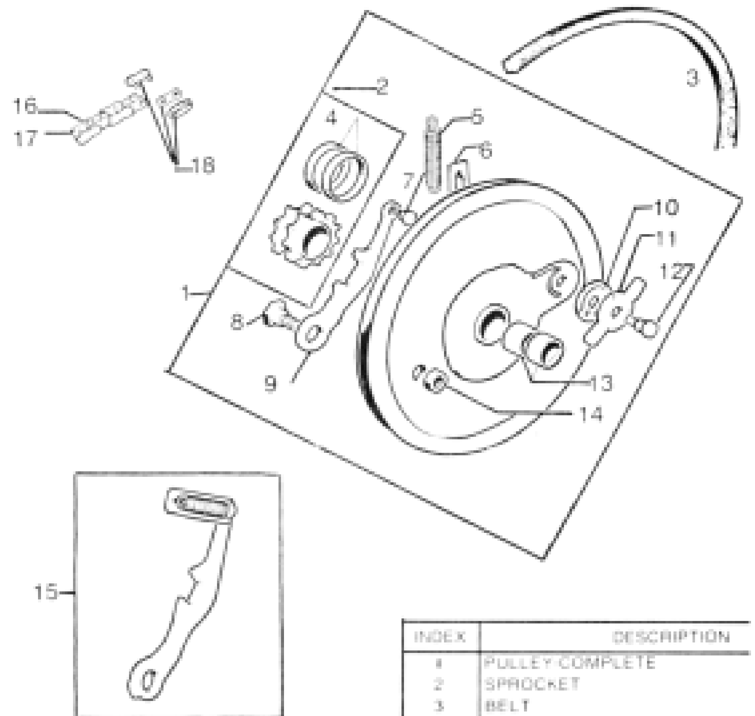


Fig. 7-27. Jawa uses a rather complex collection of parts to lock the engine out of the drive train.



INDEX	DESCRIPTION
1	PULLEY COMPLETE
2	SPROCKET
3	BELT
4	OIL SEALS
5	SPRING
6	PULLEY SPRING LIMITER
7	PIN
8	LOCK LEVER-SHOULDER BOLT
9	LEVER
10	WASHER
11	ENGINE ENGAGEMENT LEVER
12	SWIVEL PIN
13	NEEDLE BEARING
14	NUT
15	LOCK LEVER-COMPLETE
16	ENGINE CHAIN
17	ENGINE CHAIN
18	LINK-ENGINE CHAIN

Fig. 7-28. The Motobecane engine lockout is similar to the mechanism used on other belt-driven machines.

with the pulley, and is spring-loaded to hold the pulley in engagement with the sprocket. Turning the engagement lever to the right forces the lock lever out of mesh and breaks the connection between pulley and sprocket. Thus the pedals can turn without sending power through the rear wheel and back through the engine sprocket and pulley.

Service

The pedals thread into the crank arms. With reference to the rider's seated position, the inboard ends of the pedal axles are stamped "R" and "L". The right pedal has a standard thread, overhand and counterclockwise to loosen; the left one has a left-hand thread. While the pedals are clearly marked, it is possible to confuse the right and left crank arms if they are detached from the pedal shaft. Mark them.

As shown back in Fig. 7-26, the pedal arms cross-bolt to the shaft. Undo the nuts, remove the lockwashers, and—supporting the shaft with a wooden block—drive the tapered crossbolts out. The shaft must be supported to protect the bushings.

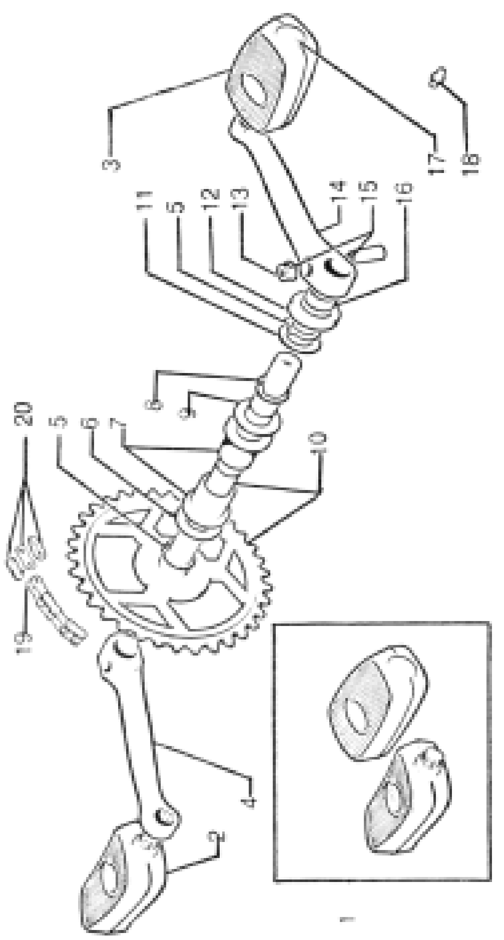
Relax tension on the chain and work it off the more accessible of the two sprockets. On belt-drive machines, disengage the belt and uncouple the pulley from the drive sprocket. Remove the spring clip (reference No. 5 in Fig. 7-29) and lift off the pulley. Removing the second spring clip (8) frees the shaft and sprocket assembly from the frame hanger.

Most other bikes employ integral pedal shafts extending through the crankcase castings. Further disassembly means that the crankcases must be opened, an operation described in Chapter 6. Polish the exposed portion of the shaft with a strip of emery cloth to remove any rust, then gently tap the shaft out of the casting.

Sliding starter engagement clutches, illustrated earlier in this chapter, are subject to brutal loads. The engagement teeth may round off or the thread may split and splinter. Occasionally you will find that the friction spring has lost tension. The clue to this condition is erratic clutching—the engine may engage with a few degrees of pedal crank movement, or it may take several revolutions to move the driver.

Pedal-shaft bushings are normally good for the life of the machine, for no one pedals more than he has to. If there is excessive up-and-down play between the bushings and the shaft, suspect that the shaft or, as the case may be, the frame has bent. Misaligned engine castings are a thought not to be entertained; if this were to happen, the transmission bearings would go first.

Pedal shaft bushings are available for most bikes and, if necessary, can be ordered through a bearing supply house by



INDEX	DESCRIPTION
1	PEDALS-PAIR
2	PEDAL-RIGHT-HAND
3	PEDAL-LEFT-HAND
4	CRANK-RIGHT-HAND
5	CIRCLIP
6	WASHER
7	PEDAL AXLE BUSHING
8	CIRCLIP
9	FLANGE
10	PEDAL AXLE
11	FLANGE-OUTSIDE 2 mm
12	COVER
13	NUT
14	CRANK-LEFT-HAND
15	PEDAL ARM PIN
16	SPACER
17	PEDAL CAP
18	GREASE FITTING
19	CHAIN
20	MASTER LINK-CHAIN

Fig. 7-29. Motobecane pedal crank assembly. The driven pulley floats between spring clips 5 and 8.

dimension (inside and outside diameters and length). Drive the old bushings out with a suitable punch and press the new ones into place. Some distortion is inevitable during installation: correct with an adjustable reamer of the type auto mechanics use. But the importance or relative lack of importance of these bushings is underscored by remarks in one manufacturer's service literature. This manufacturer suggests that new bushings be sized with a rat-tail file.

Axial play is critical for some sliding clutches. The standard specification is 0.1 mm (0.025 inch). Adjust with dealer-supplied or bearing-house shims. Lubricate the internals with light grease and assemble.

The Jawa lockout mechanism deserves special attention. The star-shaped part at the extreme left of Fig. 7-27 is known as the control gear, although it is not a gear in the usual sense of the word. It is secured to the shaft by means of the pin. The pin and control gear ride in a slot on the end of the shaft, milled in the form of the letter L. The plunger is grooved around its circumference and slips inside the shaft where it faces a spring. Engagement occurs between the inside of the sprocket and the three ball bearings. Each bearing is located over a hole in the shaft, one of which is shown.

Turning the control gear counterclockwise allows the plunger to retract so that its groove is under the balls. There is no contact between the balls and sprocket and no power goes to the engine. Moving the control gear in and to the right sends the plunger deeper into the shaft. The groove no longer indexes with the holes and the balls are forced up into engagement with the sprocket. Power can be transfered from the rear wheel to the engine.

To disassemble, drive out the control-gear pin with a small punch (Fig. 7-30A), extract the plunger (Fig. 7-30B), remove the spring clip and spacer (7-30C), lift off the sprocket and, using a copper or aluminum buffer, drive out the countershaft (7-30D). Upon assembly, be certain that the balls index with the holes in the shaft and with the groove on the plunger. Once together, the balls cannot escape and the lockout can be shifted to the "engine on" position.

Engine Chains

Nearly all mopeds use a 1/2 inch by 3/16 inch roller chain for both the engine and the pedals. The first fraction

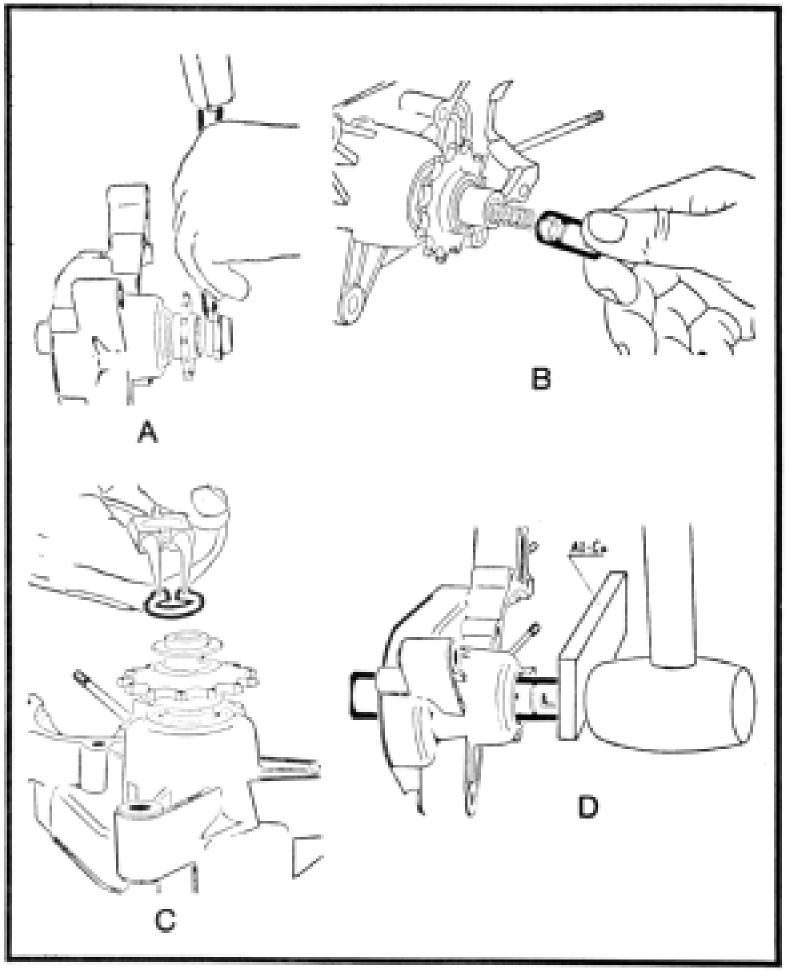


Fig. 7-30. Jawa lockout service. Drive out the control gear pin (view A); extract the plunger (view B); remove the spring clip and sprocket (view C); and tap the countershaft out of the casting (view D). It may be necessary to heat the casting with a propane torch to release the bearing. This technique was described in the previous chapter.

represents the pitch, or the distance between the roller centers; the second represents the width of the inner links. While there is little that can be done about chain pitch, the width of the chain can sometimes be increased for additional durability. The only factor limiting width is the clearance on either side of the sprocket. Wider-than-original chains may foul the spokes or engine case.

Adjustment

Too much chain tension can lead to expensive repairs since the chain, sprockets, and bearings suffer. Too little tension allows the chain to whip and snatch during acceleration and encourages it to jump the sprockets. Adjusted correctly, the chain should have 0.5 inch free upward movement between the sprocket centers. If the bike is equipped with rear spring-shocks, make the measurement with a rider aboard. (The swing arms are never on the same axis as the engine sprocket; weight on the suspension increases chain travel.)

The rear-wheel axle slides in the frame lugs, its position controlled by eye-bolts or cams (Fig. 7-31). Loosen the axle nuts and make the required adjustment. Cams are usually stamped with index marks so that both cams can be adjusted equally. But do not trust these marks to keep the wheel parallel; their value depends upon the trueness of the axle, the precision of the swing-arm bushings, and the integrity of the frame. It is possible to align the cams and have the rear wheel crabbed in the swing arm, a situation that costs power, handling, and tire tread.

A careful owner checks the cam marks against wheel alignment. One way to do this is with parallel boards on either side of the rear wheel (Fig. 7-32). Another, perhaps more accurate, way is to use taut strings. Once the alignment is

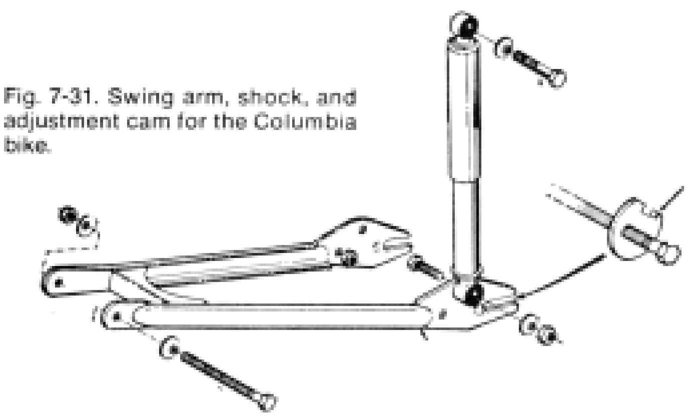


Fig. 7-31. Swing arm, shock, and adjustment cam for the Columbia bike.

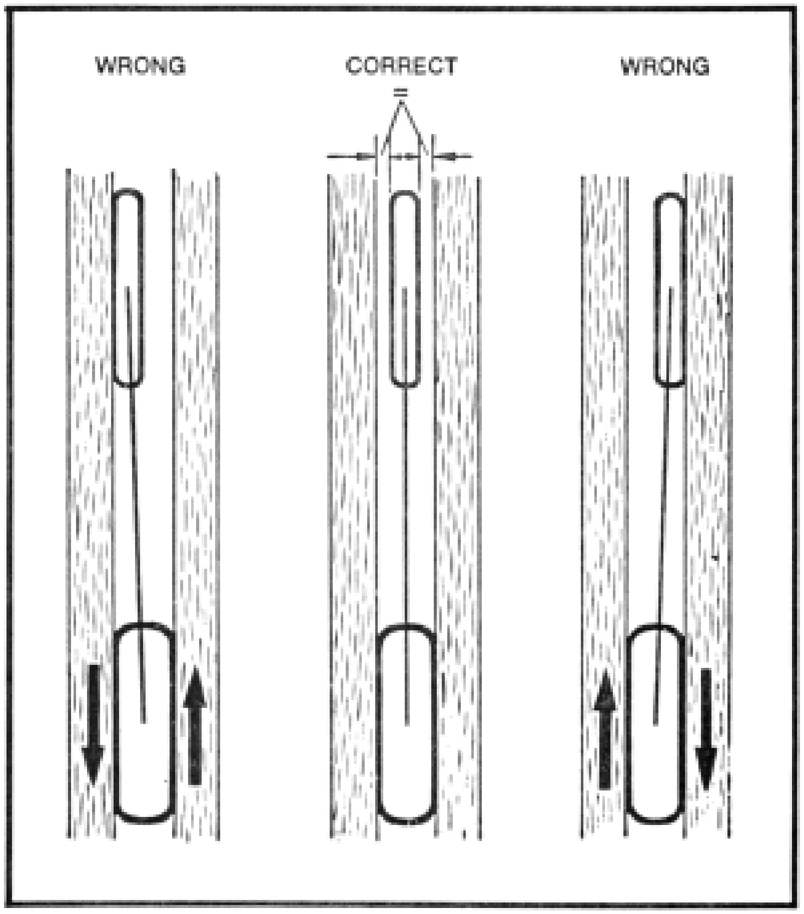


Fig. 7-32. Triumph suggests wooden battens be used to check wheel alignment.

verified, the cam marks can be corrected and future wheel alignments become almost automatic.

Lubrication

Roller chains are complex, with pins, bushings, and the inside diameter of the rollers masked by other parts (Fig. 7-33). The lubricant must be thin enough to work its way into these parts and, at the same time, tenacious enough to stay on the chain at speed. There are various chain lubes on the market, most of them packaged in aerosol cans and relatively expensive. A more economical alternative is a 50-50 mix of

Varsol and 60-weight motor oil, applied with a small paint brush.

The chain should be removed occasionally and soaked in solvent. Moped chains use three-piece master links easily identified by the spring clip. With a small screwdriver, pry the split ends of the clip apart and push the clip out of engagement with pins. Flex the chain to free the side plate. Once the chain is clean, dip it into a container of lubricant. Allow an hour or so for the excess oil to drain off; then thread the chain over both sprockets. Install the master link from behind, as shown in Fig. 7-34—otherwise the spring clip will not be readily visible. Flex the chain and snap the side plate over the pins. Mount the clip so its closed end is in the direction of travel.

Chain wear is measured by the amount of "stretch," or play between the rollers and bushings. For moderate-duty applications, the allowable stretch is 2%. Since moped chains have an average length of 100 half-inch links, moving the rear wheel back one inch is the absolute limit. If greater movement is required, the chain should be replaced.

SPROCKETS

The engine sprocket is about one-quarter the diameter of the wheel sprocket and therefore wears about four times

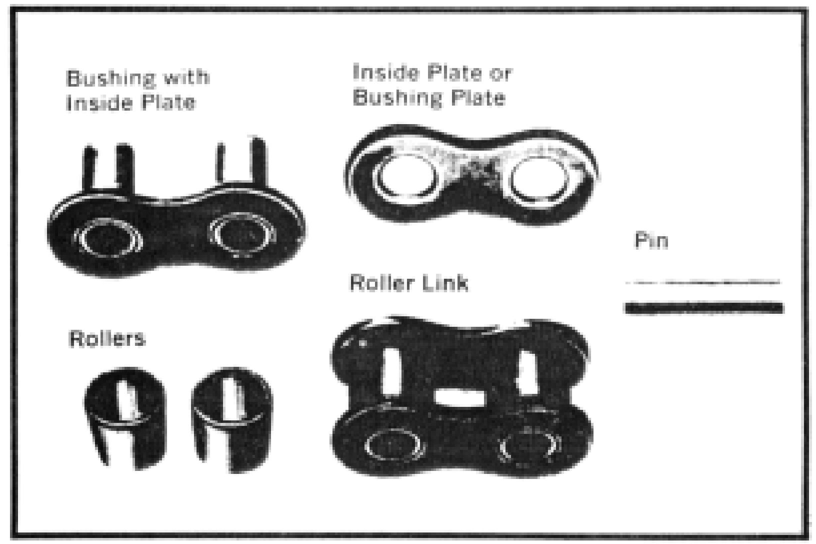


Fig. 7-33. Inner-link components. The outer link consists of two side plates, riveted on the pins. (Courtesy Daido Corp.)

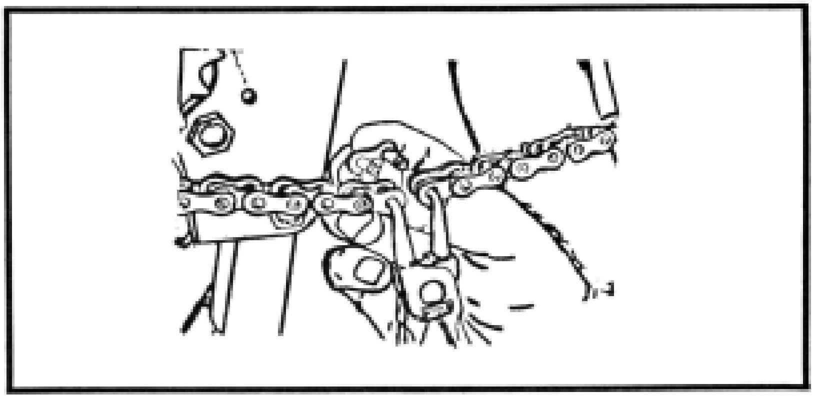


Fig. 7-34. Installing the master link on a Tomos bike.

faster. Moped engine sprockets are quite small, a tooth or so larger than the 9-tooth minimum that most engineers accept. Even discounting the difference in revolutions per mile, a small sprocket wears more than a large one because of the way it exercises the chain.

The best way to detect sprocket wear is to wrap a new chain over it. There should be some clearance between the teeth and the chain rollers, but not enough to be felt when the chain is tugged. As sprocket wear progresses, the symptoms become more obvious: the teeth appear hooked and eventually wear away.

As a rule, the engine sprocket should be changed as often as the chain. Wheel and pedal sprocket should last the life of the machine.

Chapter 8 Frame, Suspension, and Wheels

The frame, suspension, and wheels are, in terms of the rider's safety, the most important components on the bike.

FRAMES

Nearly all mopeds employ pressed steel frames on the pattern of the Motobecane shown in Fig. 8-1. This type of frame is heavier than other types of equal load-bearing ability, but is economical to manufacture and can double as the fuel tank. Batavus follows motorcycle practice and uses mild steel tubing. The HS 50 frame in Fig. 8-2 with its wide-diameter tubing and top tube is probably the strongest in the industry.

Fractures

Frame breakage is rare; when it does occur the fracture is at the steering head—the part that supports the front fork—or the juncture of the seat post with the bottom tube. Have a professional make the repair, using one of the new high-strength brass alloys. Electric arc welding, the process used by the factory, is generally not successful in the field, and tends to weaken the steel adjacent to the weld. Once the damage is corrected, the repair can be disguised with factory paint, available from most importers in aerosol cans.

Engine Mounts

Some manufacturers isolate engine vibration with hard rubber grommets. In time these grommets wear and must be

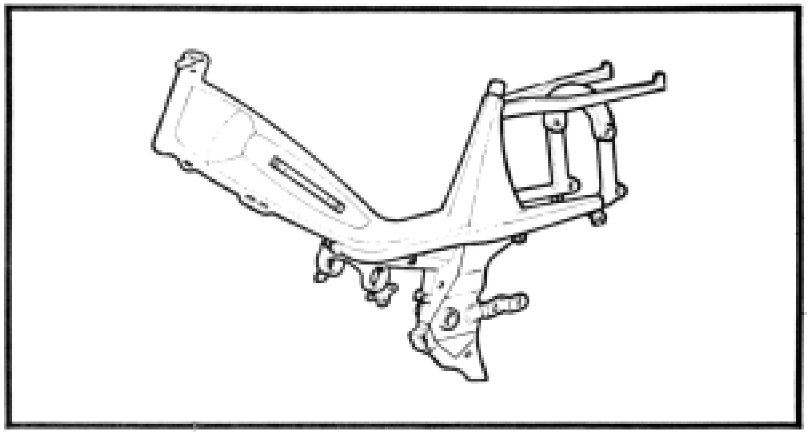


Fig. 8-1. The Motobecane frame is typical in that it's made of steel stampings.

replaced. Figure 8-3 shows an extractor-installer tool which can be purchased from Motobecane dealers or fabricated in the shop. In case parts are not available, grommets can be cut from the rubber blocks used in automobile motor mounts.

SUSPENSION

Suspension components include the swing arms, steering head, front forks, shocks and, to some extent, the wheels.

Swing Arms

Swing-arm distortion is a fairly common aliment which, unless corrected, results in wasted power, excessive tire wear, and rear-wheel steering. The first clue is a misaligned rear wheel, tilted off the vertical or canted to one side. The wheel

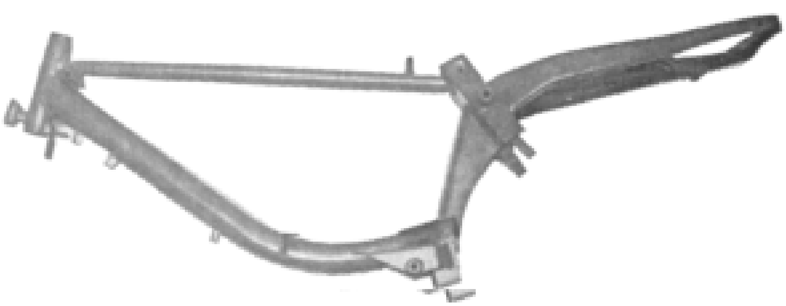


Fig. 8-2. This super-strong Batavus frame, made of steel tubing, is triangulated for additional strength and a motorcycle-like appearance.

can be adjusted in one plane by means of the chain tension cams as describe in the previous chapter. But severe horizontal misalignment or any degree of vertical misalignment means that the swing arm should be dismantled for inspection.

The rear of the arm is secured by the spring/shock units on each side; the front of the arm pivots on the frame. Most bikes use the arrangement shown in Fig. 8-4: the swing arm hinges on a central bolt. Puch arms are flanged to fit against the bearing housing and are secured by four capscrews (Fig. 8-5). Because the pivot flange is flat, it is a fairly simple matter to check the swing arm with a plumb bob: distances AA and BB should be equal. The same check can be made on other swing arms by mounting them vertically in a vise. If either measurement is off, the arm should be replaced or turned over to a first-class frame man for straightening.

Regardless of their construction, swing arms pivot on rubber bushings. Rubber is a mixed blessing. It soaks up minor road irregularities and quiets wheel rumble, but the bushings wear rapidly and tend to collapse with age. The rear wheel develops steering inputs, particularly on hard, fast curves. The bike is slow to enter a curve and remains in it after the rider has shifted weight for the straightaway.

The bushings can be replaced without disassembling the swing arm or removing the rear wheel. Place the bike on its centerstand and undo the pivot nut. Drive the pivot bolt out with a punch, an operation that releases the swing arm and causes its forward end to drop. Drive the bushings out and install new ones to the depth of the originals. Raise the swing arm and wheel and insert the bolt. Coat the bolt threads with Loctite or an equivalent adhesive and torque the nut snugly against the bushings. Snug is enough—do not overtighten and reload the rubber.

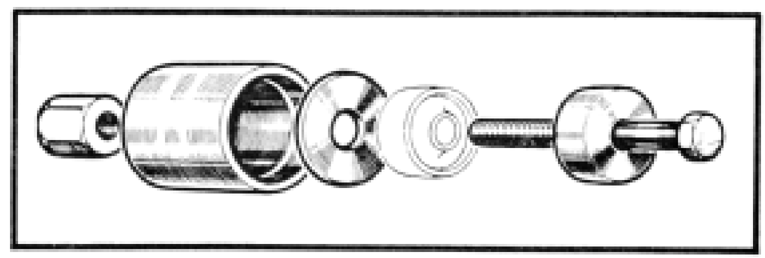


Fig. 8-3. A bushing tool available from Motobecane.

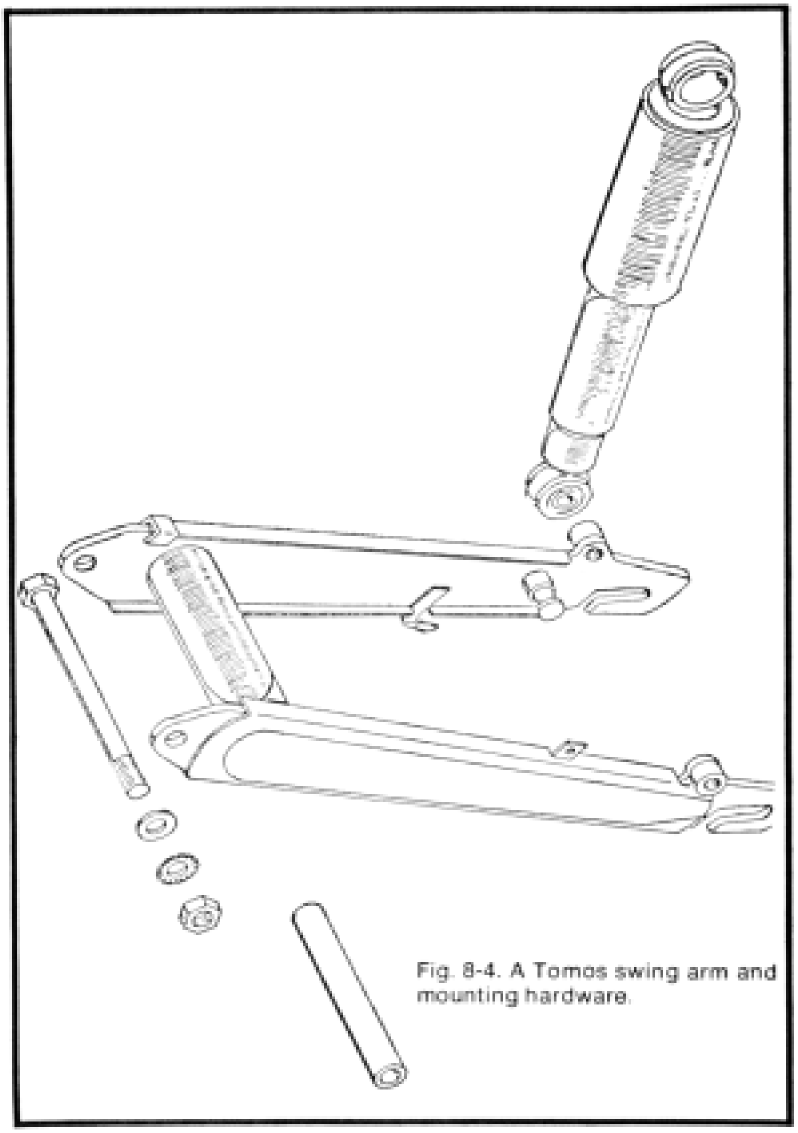


Fig. 8-4. A Tomos swing arm and mounting hardware.

Steering Head

The front fork rides in the steering head on two sets of ball bearings. As the bike rolls forward it tends to wobble from left to right. The rider learns to make corrections, but he is helped by the automatic self-righting tendency generated by the fork and steering head. As the bike falls off to the left, the fork pivots on the steering head bearings to the right, transferring weight away from the direction of fall. A bike with fixed steering is inherently unstable and impossible to ride.

The fork should have little or no up-and-down clearance on the bearings and, at the same time, must not bind at the extremes of pivot. Place the bike on its centerstand and sit on it, raising the front wheel clear of the pavement. Pull up on the forks, as if you were trying to lift them out of the steering head. There should be no free movement. Slowly turn the handlebars from lock to lock to detect binds or rough spots. Excess axial (up and down) clearance can be corrected by loosening the locknut in Fig. 8-6 and tightening the copper cone. Tighten gingerly—too much torque will imprint the balls into their respective cones ruining the steering response. Leave a tiny amount of play and tighten the locknut. Test as before. If the fork binds at the extremes of travel, loosen the adjustment nut a hair. Should the assembly be impossible to adjust—remain loose at the straight-ahead position and tight when the fork is turned—suspect that the fork is bent.

Rough action can mean that the bearings are dry or that they are damaged. The latter is more likely. Fork removal is

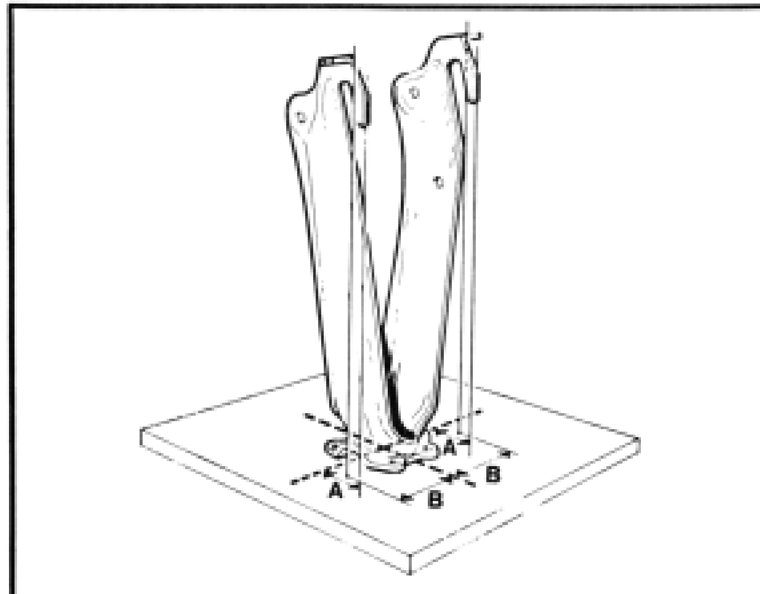


Fig. 8-5. Making an alignment check on a Puch swing arm. The same technique can be used with other makes.

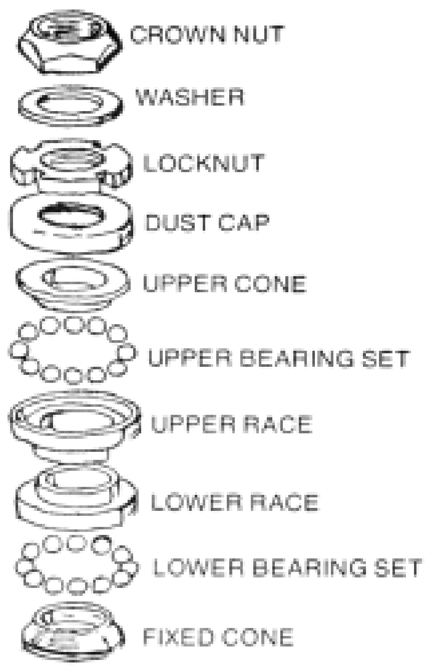


Fig. 8-6. Some bearing sets vary from this pattern by omitting the locknut.

discussed further on in this chapter; here we will be concerned with replacing the bearings, cones, and races.

Inspect the cones and the races. If the bearing surfaces are pitted or if the bearings have worn deep grooves into the metal, it is best to replace the complete bearing assembly—balls, cones, and races. Sometimes you can get by with a new lower cone or race, but this is not recommended because of the safety aspects involved. At any rate, do not replace a broken or lost bearing with a new one. The whole set must be purchased, since a new bearing would be slightly larger than the others and the assembly might crumple under the strain. The dealer where you purchased the machine is, of course, the best source of parts. But you should know that bearings are a standard item available from houses that cater to this trade. In addition, cones and races can sometimes be purchased at bicycle shops.

The upper cone unthreads to release the fork; the lower cone can be pried off with a knife blade. The races, or bearing cups, are pressed into the fork tube from which they can be driven with a punch. New races are usually driven home with the help of a wood block; professionals use the VAR tool shown in Fig. 8-7.

Front Forks

The solid, springless fork on the Velosolex is a heritage of friction drive; the wheel must not be allowed to move relative to the drive roller (Fig. 8-8). Intramotor's Blanco is one of the few mopeds to employ a leading-link suspension (Fig. 8-9). The links, supported by springs and pivoting on bushings, allow a few degrees of wheel movement. This type of suspension saves money since the forks can be inexpensive stampings, jig-welded together. On the other hand, the forks are susceptible to bending from side forces—the kind of forces that can be generated by skidding into a curb—and the bushings are not up to the job of keeping the wheel parallel. Another disadvantage is that the wheel base, or the distance between the front and rear axles, changes with suspension movement. Handling is always a triffle sloppy.

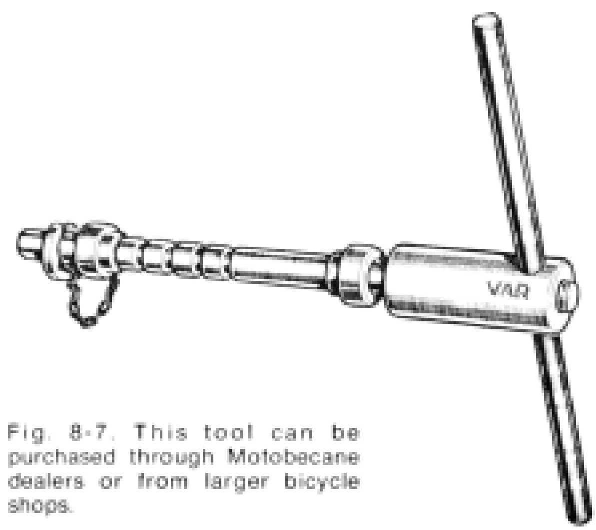


Fig. 8-7. This tool can be purchased through Motobecane dealers or from larger bicycle shops.

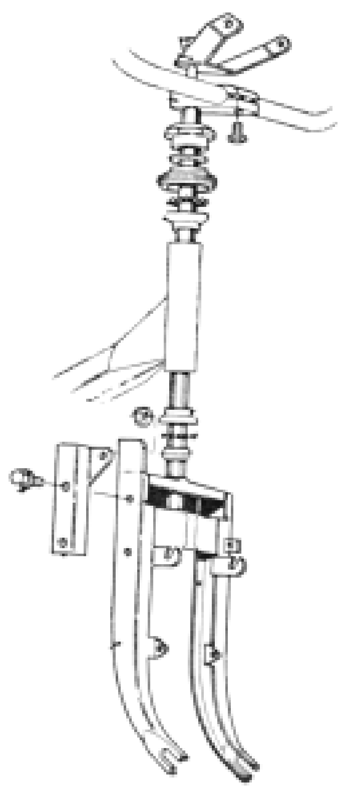


Fig. 8-8. Velosolex uses a rigid fork.

Telescopic forks are the standard of the motorcycle world and are used on the better mopeds. These forks are inherently strong and locate the wheel through large bushings (Fig. 8-10). The more sophisticated designs are oil-dampened on joust and rebound to give a smoother, safer ride.

To remove the forks from the frame, first detach the front wheel and the handlebars. Loosen the handlebar stem bolt, unthreading it so it extends a half-inch above the stem. Rap the bolt head down with a soft mallet to disengage the expansion plug. The handlebars should be free to turn from side to side without moving the wheel. As you turn the bars, pull up, working the assembly out of the fork tube. It may be necessary to use the mallet on the underside of the stem. Lay the handlebars carefully alongside the bike with the wiring and control cables still connected.

Remove the nut securing the forks to the tube and carefully back out the cone. As you do, the fork will drop away from the frame, releasing the lower set of ball bearings. With one or two exceptions, these bearings are uncaged. Given the chance, they will run away and hide, so cup your hand at the fork-steering-head joint and catch them as they fall. Count the bearings. Completely unthread the upper cone and retrieve the upper bearings with a magnet. Count them; the number should be the same as in the lower set. If not, one or more is missing. As mentioned earlier, do not make up the discrepency by adding new bearings to the used sets—replace each set as an entity. Wash the cones, bearings, and races in solvent and grease lightly in preparation for assembly.

The fork is now detached. Normally, a visual examination from several angles will detect distortion, but you can get an accurate picture of the fork condition by mounting it in a vise and taking measurements with a plumb bob.

Further disassembly means removal of the triple crown, the triangular plate at the top of the assembly. The bolts may be exposed as in the Puch design, or they may be hidden under plastic covers. Pry the covers off. Motobecane and a few other bikes secure the tubes with slotted screws that require a specially ground screwdriver.

Fig. 8-9. Leading link forks are a compromise between cost and comfort. (Courtesy F.G.S. Enterprises, Inc.)

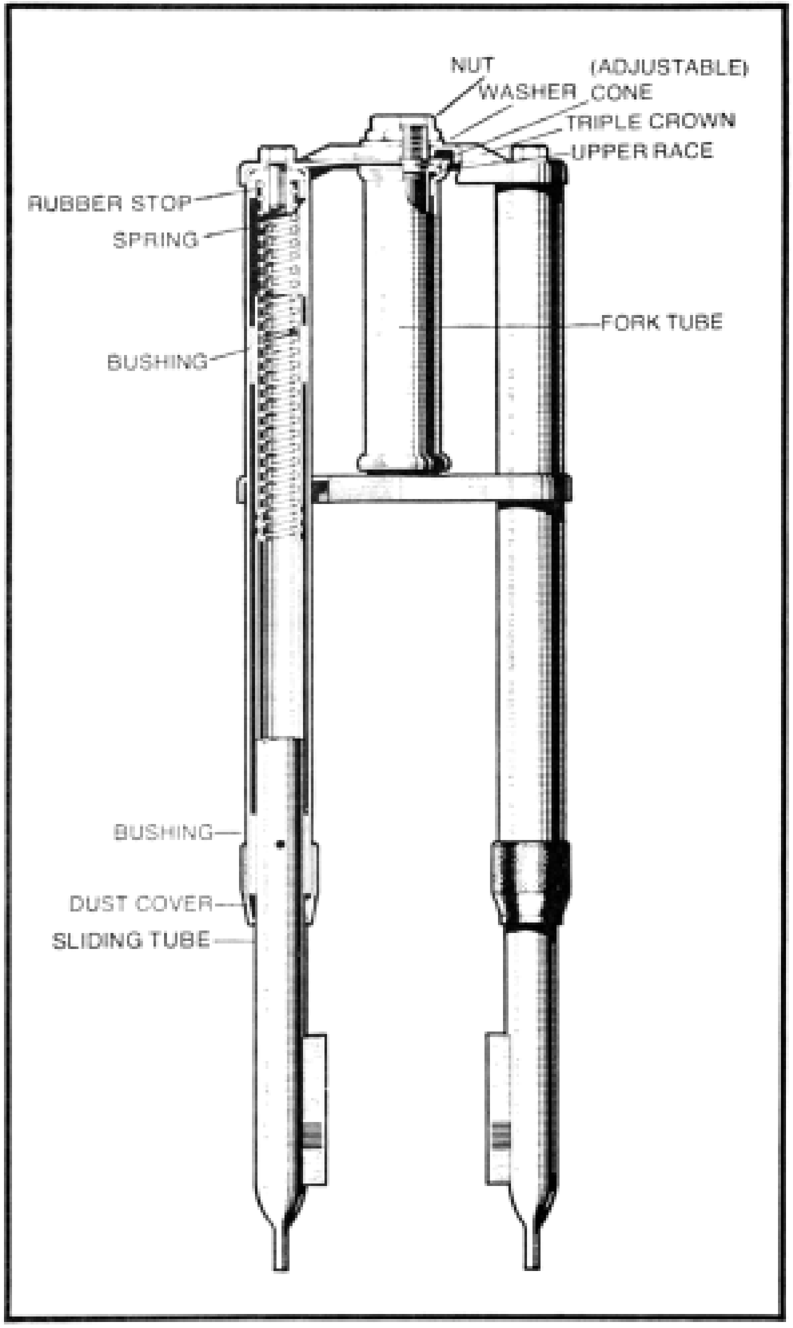


Fig. 8-10. Puch employs a telescopic fork.

Removing the triple-crown bolts releases the springs and allows the lower, or sliding, fork tubes to drop free of the fixed tubes. Jawa is an exception—the sliding tubes are held by the triple-crown bolts and by large knurled nuts (Fig. 8-11).

Clean the parts in solvent and replace the bushings—often made of plastic—and rubber stops. If the unit is oil-dampened, drain the old oil and replace with the correct amount of oil or, more fashionably, automatic transmission fluid. The dealer will be able to tell you how much oil should be used. Lubricate the bushings and assemble in reverse order of disassembly.

Rear Shocks

Rear shocks can be dismantled for cleaning and lubrication, but serious repair is out of the question (Fig. 8-12). Most manufacturers list part numbers for the rubber bushings at the shock mounts; a few can supply internal bushings. Guide rods, springs, and tube assemblies are not obtainable. If the shocks sag or have suffered impact damage, replace them with bona fide, oil-dampened shocks intended for small motorcycles. The best of these are made by aftermarket suppliers such as Koni and Bolger. But even the cheapest Japanese shock is better than original moped quality.

WHEELS

The spoked wheel is a remarkable invention, just now being replaced by cast aluminum wheels. The integrity of the spoked wheel depends upon the strength of steel wire in tension. Only a few spokes are in play at any time: no more than a dozen bear the weight of the rider and the machine, with those near the top of the wheel carrying most of the load (Fig.

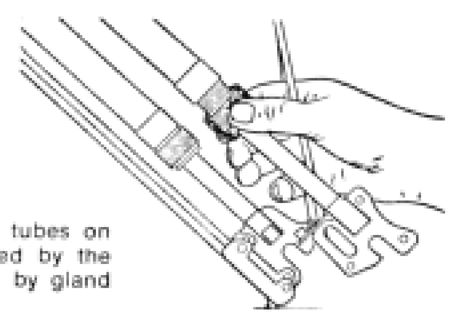


Fig. 8-11. The sliding tubes on Jawa forks are secured by the triple-crown bolts and by gland nuts.

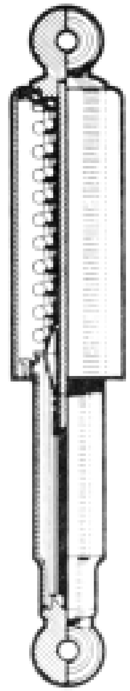


Fig. 8-12. Some internal parts are available for Puch shocks, a thoughtful gesture which is not shared by other manufacturers.

8-13A). Even fewer spokes contain braking and accelerating forces (Fig. 8-13B and C). It is not surprising that spokes "sing" when they break.

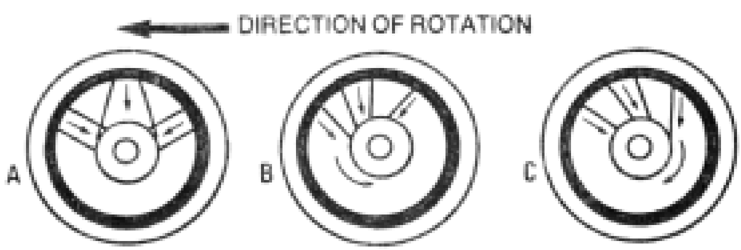


Fig. 8-13. Only a few spokes are important at any given moment. The drawings show the normal load distribution (view A), forces generated during acceleration (view B), and during braking (view C).

Tension Adjustments

Restraint is a key work in adjusting spoke tension. Most amateurs overtighten spokes, causing distorted rims, and, occasionally, broken spokes or stripped threads.

An extremely loose spoke will rattle when wobbled with your finger, or you may hear it as you ride. Less severe tension imbalance can be detected by tapping the spokes with a small wrench. The tighter the spoke, the higher and cleaner its resonance; loose spokes will sound flat and sloppy in comparison.

Figure 8-14 shows a VAR spoke-nipple wrench, available from bicycle shops and Motobecane dealers. The nipples are made of brass, but the spokes corrode and penetrating oil is frequently needed. Another stratagem is to loosen the nipple a fraction of a turn before attempting to tighten it. At any rate, work slowly, tightening each loose spoke no more than a quarter-turn at a time; otherwise you may distort the wheel. Under no condition should any spoke be tightened more than two turns without removing the tire to see if the spoke protrudes through the back of the nipple. If it does, the end must be filed off to protect the tube.

Truing

Truing wheels is a minor art form, like orgami or potato carving. The perfect wheel has all spokes torqued to the same tension, retains the original hub offset (or "dish") and is perfectly round, without trace of eccentricity or wobble.

Real success requires a truing stand. Fig. 8-15 illustrates a professional model, equipped with an adjustable pointer. Perfectionists substitute a dial indicator for the pointer at the final stage of the work. But truing stands, with or without the dial indicator, are hardly worth the investment for a moped owner. You can get fair results if you turn the machine over

Fig. 8-14. VAR spoke wrench.

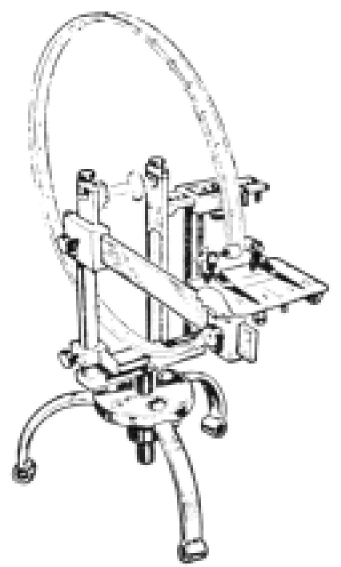


Fig. 8-15. A truing stand encourages accurate work.

and use the front fork as a stand. An Allen wrench secured to the fork leg by an automotive hose clamp serves as a pointer.

Remove the tire, tube and tube protector. Check the rim for local creases or dents that are too defined for the spokes to correct. Unless the rim is folded, these dents can usually be pounded out with a mallet. Mount the wheel in the fork and set the pointer so that it just brushes the rim at the point of greatest runout. Loosen the spokes near the runout and tighten those across from it to pull the rim back into line. Move the pointer to the other fork leg and repeat the operation. You may have to check the other side again, but with patience the wheel will spin with only the shadow of a wobble. Now place the pointer under the flange of the rim, that part that is on the inside and near the bead. This is to determine if the rim is eccentric, or egg-shaped. Loosen the spokes near the bulge and tighten those on the far side of it. These procedures should not shift the hub relative to the center of the rim. The offset will remain as the manufacturer intended.

Once you are satisfied that the rim is true, grind or file off the ends of the spokes flush with the nipples, since protruding

spokes will work through the rim protector and gnaw away at the tube.

Spoke Patterns

While respoking wheels is a job for the professional and out of the scope of this book, you should be aware that there are several possible spoke patterns. Most mopeds use the "cross-3" pattern on both wheels (Fig. 8-16): each spoke crosses over three other spokes on the same side of the trim. Cross-3 lacing makes a moderately strong wheel, adequate for most service. Velosolex uses a cross-1 pattern at the front and cross-2 at the rear. In other words, Velosolex wheels are deliberately spindly, a design that makes little sense until you reflect that this bike has no suspension. The only way it can absorb roadshock is to allow the wheels to flex.

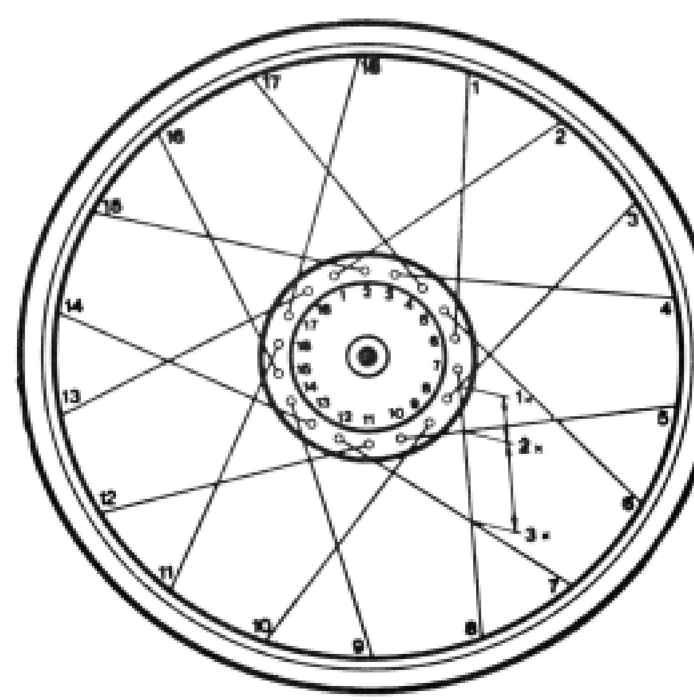


Fig 8-16. The cross-3, 36-hole spoke pattern used on Puch wheels.

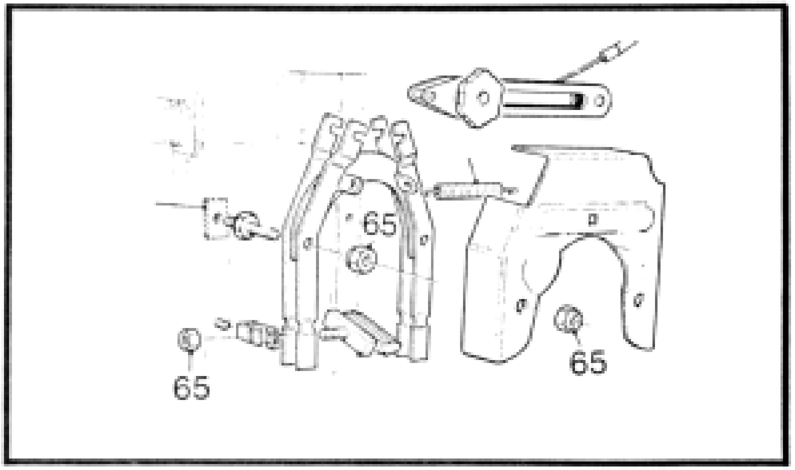


Fig. 8-17. The Velosolex caliper brake with torque limits given in inch-pounds.

Heavy riders can benefit from a stronger rear wheel. Heavy-gauge spokes can be substituted for the originals or the wheel can be relaced in the cross-4 pattern.

Brakes

Mopeds use drum or caliper brakes. The former are lightweight versions of those used on motorcycles; the latter have evolved from the familiar bicycle rim brake.

Caliper Brakes

Figure 8-17 is breakdown of the Velocette front-wheel caliper. When engaged, a pair of rubbing blocks, or shoes, moves into contact with the sides of the rim.

There are two adjustments. Small changes in the shoe position are made at the handlebar end of the control cable. Loosen the locknut and turn the barrel counterclockwise to bring the shoes closer to the rim. There should be approximately one-half inch of play at the end of the handlebar lever.

To make larger adjustments, remove the U-shaped cover over the caliper mechanism. Turn the handlebars to the right for easy access and pull the right brake shoe into contact with the rim. Turn the star wheel to the left (Velocette has a special wrench for this, although you can wrap a shop towel around the wheel and use pliers), which tightens the cable by moving

its anchor point. Stop when there is a quarter-inch clearance between the rim and left brake shoe.

To disassemble, attach the brake cable at the caliper and remove the cover plate. The caliper is bolted to the fork and fender. Replace worn brake shoes with factory parts; if you must use bicycle shoes, be certain that the crimped ends of the shoe holders are forward, to lock the shoes against wheel rotation. Position the holders so the shoes contact the rim and not the tire sidewalls. When installing the cover plate, be sure that it engages the brake return spring.

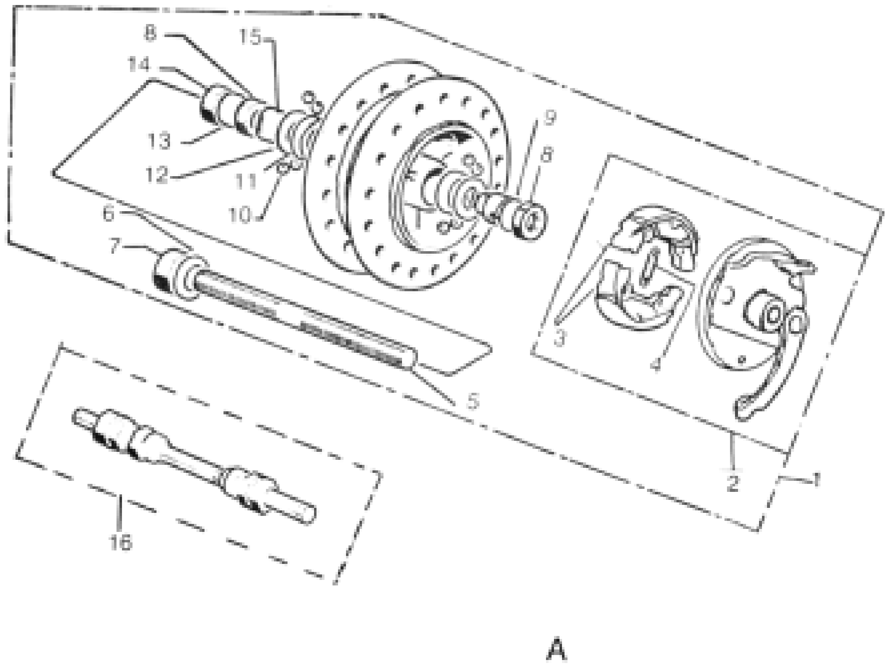
Drum Brakes

Drum brakes are located within the wheel hubs where they are fairly immune to rain and water splash (Fig. 8-18A and B). A cast-iron liner pressed into the aluminum hub is the friction surface; shoes mount on a backing plate that is locked into the fork or swing arm. The actuating lever pivots on the backing plate and terminates in a cam which nestles between the shoes. Moving the lever prys the shoes apart and into contact with the drum. Return springs, sometimes with the addition of a helper spring at the lever, assure that the shoes pull out of engagement when pressure on the lever is relaxed.

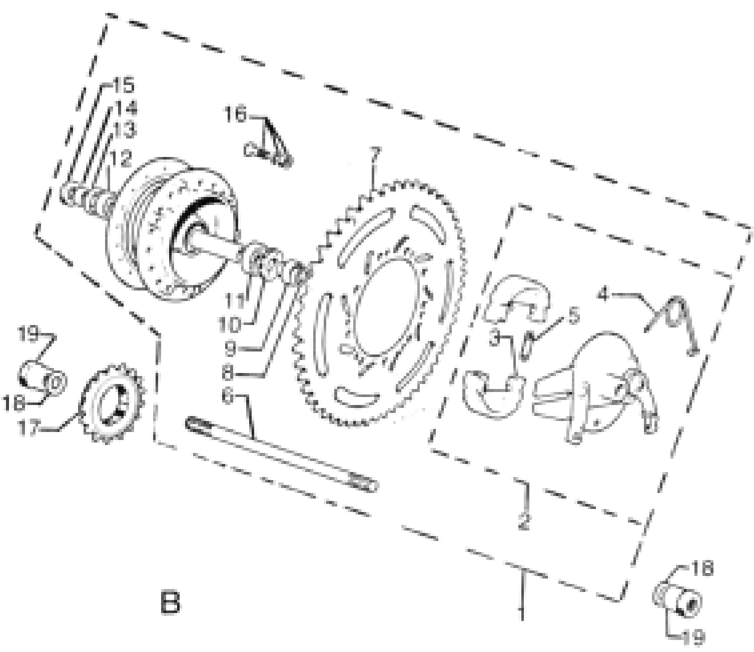
Adjustment. The brake cable must be shortened to compensate for lining wear. Depending upon the manufacturer, the cable adjustment may be at the handlebar, the backing plate, or at both locations. In any event, loosen the locknut and thread the adjuster barrel out, toward the center of the machine. Sachs hubs have an additional refinement—the lever and cam are in two parts, geared together. The purpose of this is to restore leverage to worn linings, for as the linings wear, the lever works at a progressively more unfavorable angle (Fig. 8-19). It can be repositioned at right angles to the cable by disassembling the backing plate and meshing the gears for earlier engagement.

Service. The backing plate floats on the axle and drops off once the wheel is out of the frame. Note the position of the shoes for assembly; in most cases the shoes appear identical, but the wear patterns will not be.

Disengage the return springs with the point of a screwdriver, freeing the shoes. Replace the shoes if either lining has worn to half of its original thickness or if either has become grease-soaked. For most bikes, replacement shoes are



1—FRONT HUB
2—FRONT BRAKE DRUM-COMPLETE
3—BRAKE SHOE
4—BRAKE SHOE SPRING
5—FRONT HUB AXLE
6—WASHER
7—NUT
8—CONE-COUNTER NUT
9—SPACER
10—BALL
11—HUB CUP
12—WASHER
13—BUSHING
14—NUT
15—CONE
16—HUB AXLE-FRONT COMPELTE



1—Rear Hub
2—Rear Brake Backing Plate and Shoes
3—Brake Shoe
4—Spring
5—Brake Shoe Spring
6—Rear Hub Axle
7—Sprocket
8—Washer
9—Spacer
10—Locknut
11—Bearing
12—Bearing
13—Dust Cap
14—Spacer
15—Nut
16—Bolt, Nut and Washer—Complete
17—Freewheel
18—Flat Washer—10 mm
19—Nut

Fig. 8-18. Hub assemblies for current Motobecane bikes. The front hub (view A) uses uncaged bearings; the rear hub (view B) features caged balls with a provision for adjustment.

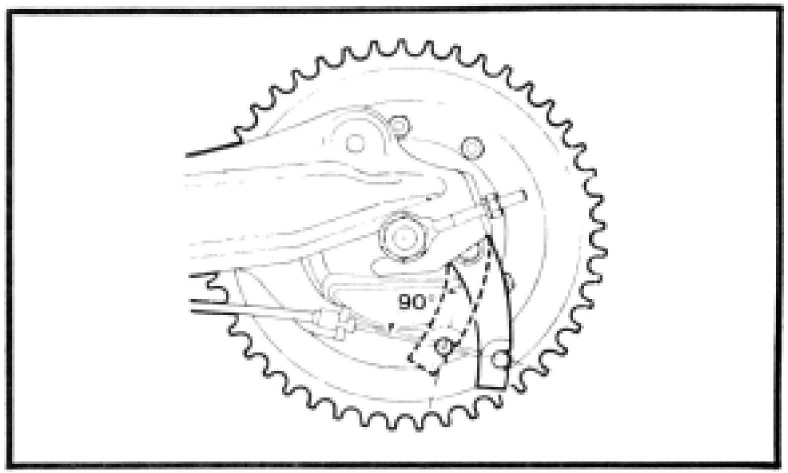


Fig. 8-19. Sachs brake levers can be adjusted for best leverage.

easy to come by; obsolete bikes and orphans, whose distributors have gone on to greener pastures, can be put back into service with the help of the local brake-and-clutch shop. They will cut new linings and glue them to the shoes.

Clean the metal parts in solvent and lubricate the cam and anchor pin with high-temperature grease. Hook the springs over the shoes and place the assembly over the cam, pulling the shoes apart as you install them. Install the spacer and backing plate. When mounting the wheel, be sure that the slot on the backing plate arm engages a pin on the fork or frame. Otherwise the plate will turn when the brakes are applied.

HUBS

Hub maintenance is often overlooked, perhaps because a missed lubrication period has no immediate symptoms. The wheels roll as before. But the factories are not kidding when they insist on frequent maintenance. The specification for most bikes is 6000 miles between hub disassemblies; Motobecane suggests 3600 miles and Velosolex would have you take the hubs down at 3000-mile intervals.Unlike the sealed bearings used in an automobile, moped bearings are vulnerable to dust and water damage.

Front Hubs

Figure 8-18A illustrates a typical front hub assembly using adjustable cones (15) and uncaged balls (10). To

disassemble, dismount the wheel at the fork and remove the backing plate. Carefully back off the cone with the jam nut ahead of it. In the drawing the cone is on the left side of the wheel. Retrieve the bearings as they become accessible and count them. Slip the axle and cone out the other side of the wheel.Compare the number of bearings on this side with those on the first. If a bearing is lost, replace all bearings on that side; otherwise the new, unworn bearing will be loaded more than the others and may fail. Wash the parts in solvent without disturbing the mounted one. As long as this cone is in its original position, the axle will be centered on reassembly.

Assemble the hub and adjust the bearing clearance, tightening the cone that was unthreaded. Adjust for the tiniest amount of side clearance between the axle and hub. Holding the cone with a thin wrench, tighten the jam nut hard against it. Even though the cone has not moved, the jam nut will take up some of the slack. If you have allowed correctly, the bearings will have zero sideplay, yet be loose enough to allow the wheel to turn from the weight of the valve stem.

Rear Hub

Figure 8-18B shows one hub variety with a sprocket on either side, using caged ball bearings. Other dual- or single-chain hubs may use loose bearings and cones, slightly more hefty versions of the bearings shown in Fig. 8-18A. Caged bearings are normally left in the hub where they are cleaned and packed with grease as well as conditions allow. Wheel wobble or bearing noises—not to be confused with the racheta-racheta of the freewheel—mean that the bearings should be replaced. Drive out the old ones and, using a tube sized to the bearing, drive in the replacements. Where one side of the bearing is closed, that side is outboard. This hub has an endplay adjustment at locknut 10; others are fixed during manufacture.

The freewheel/sprocket assembly can be removed from the hub with a wrench like the one shown in Fig. 8-20. Moped dealers service freewheels as complete assemblies; but springs, pawls, and freewheel wrenches can be purchased at bicycle shops. Lubricate the pawls with light grease.

The Sachs hub, one of the most complex, is shown in Fig. 8-21. In this country, the rear-wheel brake is lever-operated to meet DOT's penchant for standardized controls. In Europe the

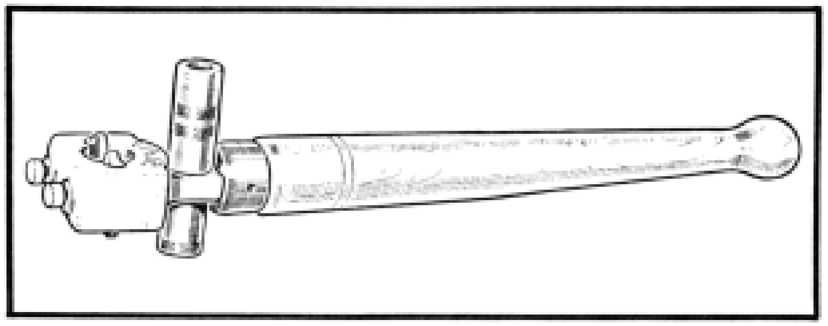


Fig. 8-20. A high-quality freewheel tool

lever is often omitted and the brake is engaged by reversing the pedals. The Sachs hub can be operated both ways.

With power on the pedals, the driver threads the driving cone to the right where it contacts the tapered end of the hub. Although the clutch depends upon metal-to-metal contact, tremendous force is exerted by the driver and there is no slip. In neutral the pedals are stationary and the driving cone is disengaged from the hub: no power passes to the pedals. For braking the pedal direction is reversed, moving the driving cone to the left, toward the end of the driver. The cone engages the coupling which mates with the gear. The gear turns and rotates the brake cam, opening the brake shoes against their spring. In short, the Sachs hub and its imitators amount to a coaster brake with drum and shoes.

The mechanism is disassembled from the brake-drum side. Using a screwdriver, pry off the dust covers for access to the bearings. Wash all metal parts in solvent and lubricate with multipurpose grease, being careful not to touch the brake drum with your somewhat, inevitably, sticky fingers. When assembling, note that the open side of the bearings is inboard, toward the center of the hubs. Replace the dust caps using a wooden block as a driver; once the caps are squarely installed, check that they do not rub against the bearings.

Adjustment is by way of the small cone to the left of the driver. Using finger pressure only, tighten the cone until the axle binds, then back off 1/4-1/2 turn. Check driver action before remounting the shoes: the pedal sprocket should engage the hub during normal rotation, release when sprocket tension is relaxed, and turn the gear when sprocket rotation is reversed.

TIRES AND TUBES

The most popular tire sizes are 2.00 or 2.25 by 16. That is, the tread width is two or two and a quarter inches and the inside diameter is 16 inches. In either case the rim is two inches wide. Some owners may wish to fit a larger tire on the rear for marginally better handling. The rim will tolerate a maximum tread with of 2.50 inches, although the frame may not. The outer diameter of the tire increases with the width; a quarter-inch of tread section adds a half-inch to the rolling diameter and the tire may rub against the fender or frame. The overall gear ratio will be "taller," giving fewer engine revolutions per mile and less acceleration.

Changing a tire is not difficult. You will need a valve-stem wrench or one of the almost obsolete slotted valve caps and a pair of motorcycle tire irons. Remove the wheel and follow this procedure:

1. Unthread the valve core to release all pressure in the tube.

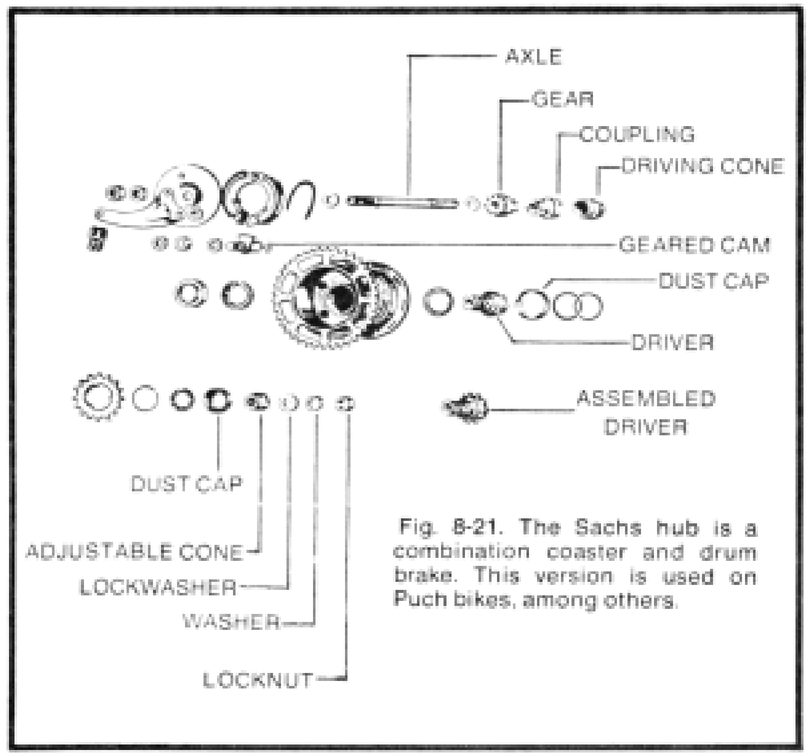


Fig. 8-21. The Sachs hub is a combination coaster and drum brake. This version is used on Puch bikes, among others.

2. Walk around one sidewall to free the bead from the rim. Do the same for the other sidewall.
3. Insert a tire iron at some point near the valve and pry up, levering the sidewall over the rim.
4. Keeping tension on the first iron, insert the second a few inches away from the first. Hold and lever until you can work the rest of the bead off with your hands.
5. Push the valve stem through the hole in the rim and gently pull the tube out.
6. Hold the wheel upright between your knees and work one iron between the mounted bead and the far side of the rim. Pry up, shoe-horning the bead clear off the rim.
7. Keeping the first lever in position, take a bite with the other. The tire should pop off.

To mount the tire, reverse the process. Center the tube protector—the rubber band on the inside of the rim—over the valve stem hole. Mount one side of the tire and install the tube, inflated with just enough pressure to take the wrinkles out of it. Work the valve stem through the hole and tuck the tube well clear of the edge of the rim where it could be pinched by the tire tools. Carefully lever on the bead and inflate the tire.

Moped dealers do not bother with patching tubes. Labor costs mitigate against the practice and European tubes should be replaced by smog-proof American rubber anyhow. But an owner can save money by patching his own tubes if the damage is local and not concentrated at the valve stem. Ozone rot or abrasion from protruding spokes mean that the tube should be replaced, since new leaks will develop.

Small leaks can be found by dipping the tube under water. Once you have located the site, mark it and check the tire. The cords may be damaged or the offending object may still be in the thread where, unremoved, it will promptly give you another flat. The tube can be repaired with either hot (vulcanizing) or cold patches, available at bicycle shops.

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