Girder fork

NOTHING labels a motorcycle as 'vintage' more immediately than the girder fork. The most mundane mount thus equipped and parked in a 1981 street will attract crowds as readily as a powerful and spectacular superbike. The interested parties may well include a one-time motorcyclist who, given the chance, will make eloquent and nostalgic remarks about the forks' vices and virtues, both of which have been either condemned or eulogised since the widespread use of the girder fork ceased.

The traditional girder, being triangulated, is considerably less likely to flex than the telescopic fork. However, the damping is unsophisticated and unsprung weight tends to exacerbate any malfunction in the forks. These features, and particularly neglected bush wear, are probably responsible for the ancient and hair-raising tales of tank-slappers, which have persisted about even the most refined development; the Vincent Girdraulic. Nevertheless a girder fork in good condition will handle almost as well, if not feel quite as comfortable over rough surfaces, as many modern forks.

There are several firms now prepared to undertake girder fork rebuilds, but the impecunious enthusiast can feel confident in tackling repair work himself for, despite the fiddly look of the unit, dismantling and assembly is straightforward. The 'average' girder fork, certainly the one most frequently used on production motorcycles, was the Webb pattern, and it is on this type that attention is concentrated in this feature.

The exposed nature of most of the working parts of a girder fork facilitate examination for wear, which can be assessed without preliminary dismantling. A girder fork used regularly will wear more rapidly than a telescopic fork because of this 'exposed' quality and partly because of the proliferation of bushes used in its construction. Wear ignored will repeatedly remind the rider of its presence through inconsistent and rapidly deteriorating handling culminating, in extreme conditions, in the aforementioned tank-slapper. Happily, various clonks on low speed turns, 'bunching up' under braking, and gentle handlebar flutter are usually early and less dramatic indications that something is amiss.

A simple list of checks is as follows:

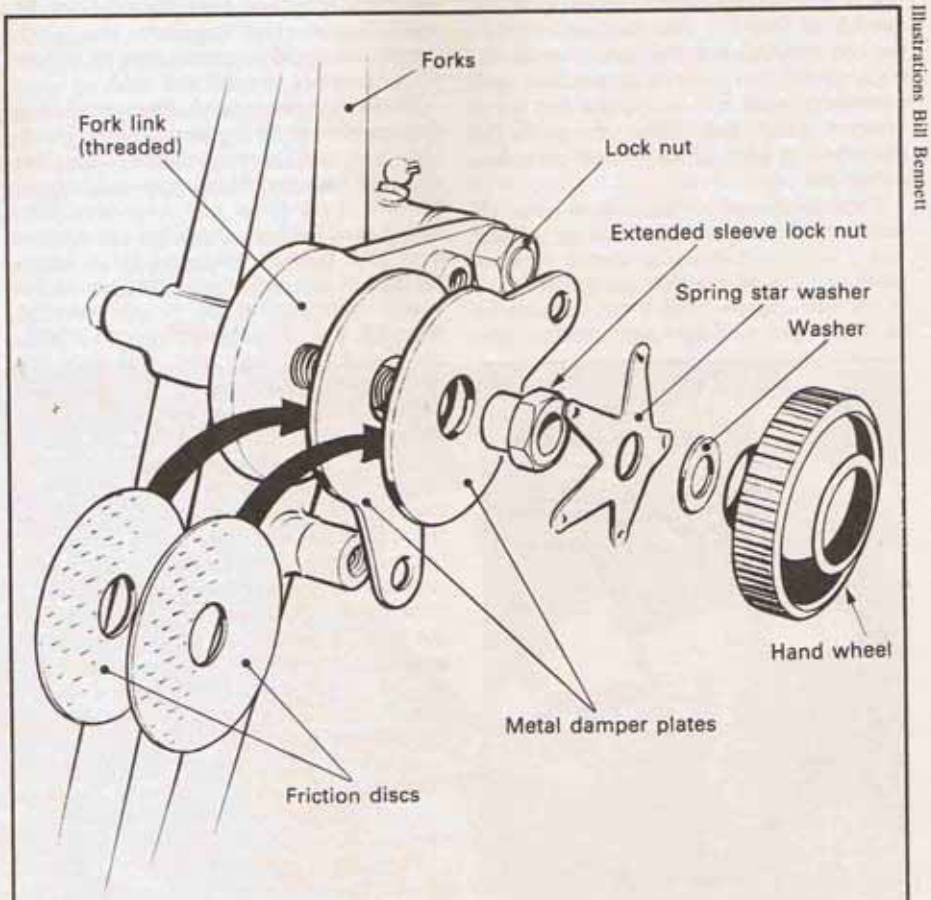
1 Seated normally on a stationary motorcycle, movement in the forks, other than suspension depression, can be felt through the handlebars if the front brake is applied and the machine rocked back and forth. Don't confuse play in the brake plate anchor peg or looseness in the steering head with bush wear. If these are first eliminated, an assistant can then help by placing fingers against the edge of the bushed links of the fork and feeling for and pinpointing the worn area.

2 Sideplay in the bushes can be ascertained in the same way, but this will often manifest itself in an audible knock as the handlebars are swung from lock to lock. Once again it is necessary to ensure that the noise does not come from a wheel bearing or the retaining bolt of the friction damper bottom plate. A simple adjustment may be all that is required, and this is considered in a later section of the article.

3 The main spring may well be weak on an old motorcycle, and the position of the fork top link should be inspected, again with the rider seated. The top link should not rise above the horizontal. Conversely, a top link well below horizontal suggests a stronger than standard, perhaps even a sidecar-rate, spring. This in itself should not adversely affect handling — it might even improve it! A sidecar rate spring has sometimes been fitted to machines used for competition work to give additional ground clearance to prevent overloading the mediocre damping by restricting movement and where comfort is not important.

4 Assessment of damping is less straightforward. Side-mounted friction dampers, a feature of the girder fork, are often grease-contaminated from the bushes, but will still provide considerable initial stiction if well tightened. Once the fork is moving rapidly on the road and stiction is overcome, the damping may well vanish. Bouncing the forks against the front brake will give some indication, particularly if the damper seems to require really vigorous tightening to make any noticeable difference. Dismantling is the only way to be sure of friction disc condition.

The foregoing summarises checks for wear, but misalignment must also be considered. The simplest test for lateral misalignment is to examine wheel alignment. First ensure that the rear wheel has been correctly adjusted



Illustrations Bill Bennett

Side friction damper arrangement on a 1939 high-camshaft Sunbeam.

renovation

by Roger Woods

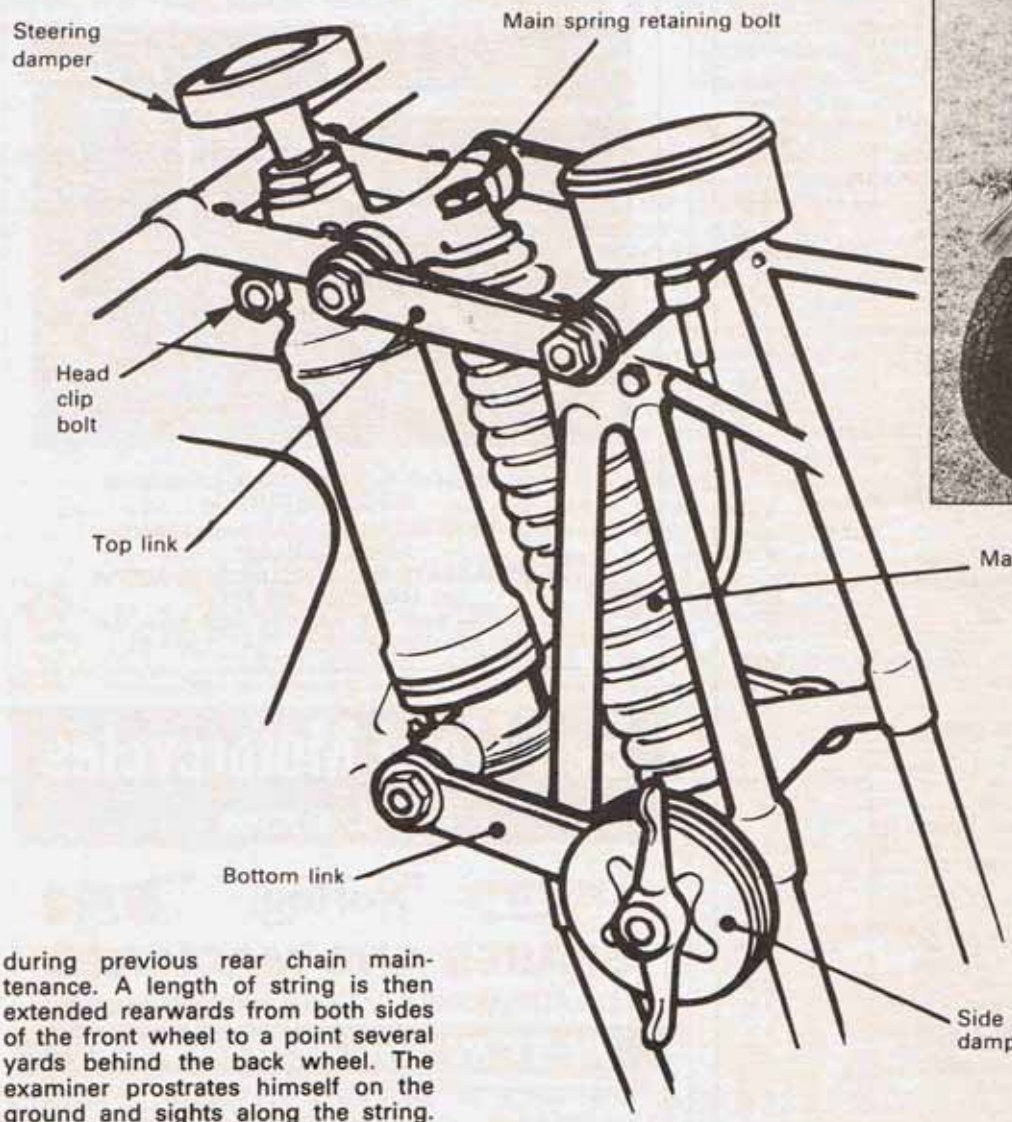


Diagram of a typical Webb-type girder fork.

during previous rear chain maintenance. A length of string is then extended rearwards from both sides of the front wheel to a point several yards behind the back wheel. The examiner prostrates himself on the ground and sights along the string. Allowing for different tyre widths front and rear, it should be possible to hold the string parallel along each tyre sidewall. It is important not to be confused by obstructions such as the prop, rear and centre stands and it is equally important to ensure that the steering is centralised. A bulge on one side of the string suggests fork (or frame) misalignment. Planks can also be used to effect the same check.

Consideration of vertical alignment demands the use of a straight edge held along the girder fork tubes. However lying under the fork with the front wheel removed, it is possible to make a quick check by sighting along the fork. This reveals vertical as well as lateral faults, as when sighting along a gun barrel.

Most fork repairs will require only partial dismantling, as individual pairs of bushes can be replaced without disturbing the remainder. The main girder section can be removed for realignment without touching the headbearings or the headstock end of top and bottom links, and mainspring removal can be effected with only the top link removed.

However, an entire stripdown and repair will be plotted here, and readers can omit sections at their discretion.

FORK DISMANTLING:

1 The front end of the motorcycle must be supported in such a way that the front wheel is well clear of the ground.

2 The front wheel must be removed together with all ancillary components such as brake cable, mudguard, headlamp and any wiring that is threaded through sections of the fork. Some old headlamps have a central screw-on console with ammeter and switch. This may not be quite small enough to be wriggled through the forks, but before embarking on the tedious procedure of removing and labelling each wire it is wise to check if an early stage of fork dismantling will give sufficient extra clearance. If so, note which stage is the valuable one to facilitate reassembly.

3 Either completely remove the handlebars, or wrap them in thick rag and place them on the petrol tank. An

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aerolastic will prevent accidents.

4 Remove the central steering damper knob. Unbolt the bottom damper bracket and remove it together with the steel washer and friction pads. Note the order for re-assembly. Do not attempt to remove the central rod as this is probably located by the rear lower link spindle.

5 Remove the central spring top retaining bolt.

6 Support the fork ends and, as a preliminary, thoroughly lubricate all bushes via the grease nipples to ease later extraction.

7 It is now possible to remove the top link spindles, and these should come out as a pair. Squared-end spindles with threads and locknuts on each end are the usual method of tying links through the fork bridge-piece, but occasionally a simple long bolt is used with a thread adjacent to the bolt head as well as on the opposite end. Top link nuts and spring washers should be removed from the side opposite the squared end (or bolthead); the top link on the same side will now lift off together with the large-diameter washers. Tapping the exposed spindle ends very gently will move them back through the bushes. Grasping the remaining top link, a good pull should suffice to withdraw both spindles simultaneously unless the bushes and spindles are badly seized. Ensure the large diameter washers remain on the spindles for safe keeping.

8 The head-clip pinchbolt, locknut, adjuster nut and washer can now be removed to dismantle the steering head. (Note that this operation will be superfluous for many repair jobs).

9 Remove the fork support and, holding the forks with one hand, bump the steering column down through the head clip with a rubber mallet. An assistant will prevent the untimely departure of the steering head balls and will also attempt to prevent the loosened girder assembly from folding like a deckchair, trapping the operator's fingers or removing enamel with a wayward central spring. It is also necessary to catch the head clip as it is released.

10 Steering cups and cones can now be inspected for wear which usually manifests itself in a considerable depression to the front and rear of these parts, or minor indentations all round. A sidecar machine will be more prone to the former. Severe wear will have been noticed already while the motorcycle is ridden, as the steering will try to self-centre. The method for removing cups and cones varies on different marques. Cones are usually a light interference fit. Some cups are conveniently stepped to permit the use of a drift. Others are internally threaded with a very fine thread, demanding the purchase or construction of a special tool normally in the shape of a 'blind' threaded tube which is screwed into the cup. A drift can then be used against the blind end.

11 The main portion of the fork assembly can now be carried into the workshop and placed, forward side down, on the bench.

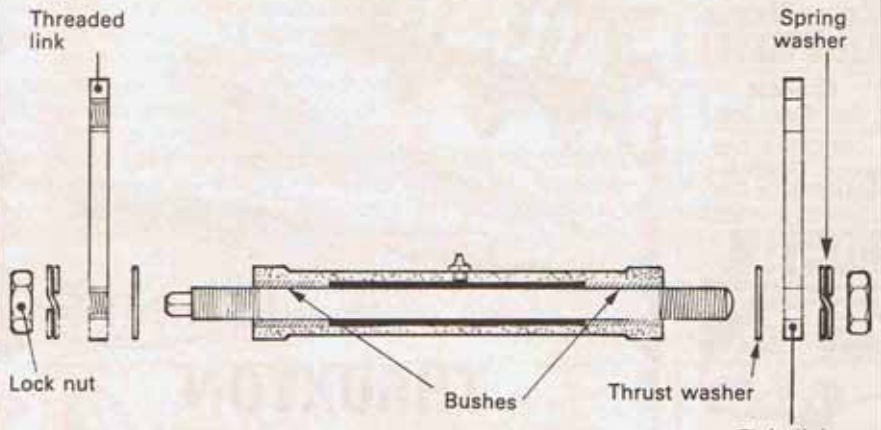
12 Dismantling the side friction dampers is a preliminary to removal of the bottom link spindle. The wing-nut or knob, sometimes retained by a split pin, should be unscrewed and the underlying steel washer can be lifted off.

13 The bottom links and spindles are now removed by repeating the procedure adopted for the top link. Additional care is required to locate and retain the friction discs and dummy star washer on the forward bottom link. Note that the central damper rod is now released. Mainspring removal is effected by jarring free the end. It will then unscrew by hand.

14 Both pairs of spindles remain assembled to their respective links. The spindles are screwed into the links and are provided with a locknut. The spindles are often dissimilar lengths, thus it is worth taking notes before separating the links from the spindles.

15 At this stage it is opportune to assess for wear the spindles and bushes. Obviously they should first be thoroughly cleaned. Replace each spindle in its original tunnel, but do not push right home. It is important that the bush should bear on an unused and therefore unworn area of the spindle. There should be no side play. Spindle wear is usually visible to the naked eye, manifesting itself in a step where it bears against the bushes, or pitting from inadequate lubrication. A micrometer is useful in marginal cases, but a thumb nail is a fairly sensitive measuring instrument! Evidence of wear on spindles indicates almost inevitable wear in the bushes.

16 New bushes should not be fitted until the forks are checked on the bench for misalignment. Some fairly elementary equipment will be required to do this. Rods or tubes of spindle diameter, but long enough to project considerably on each side of the fork, should be inserted through the fork bridge pieces. A rod of wheel spindle diameter should pass through the fork ends. All rods should lie parallel. In the absence of more sophisticated metalware, offcuts of domestic



Details of spindle, bush and link arrangements can be seen in this diagram.

Use of a threaded rod assists in replacing bushes.

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plumbing copper pipe of appropriate diameters might suffice.

A secondary check is the string test. Reinsert the rods in the fork ends and bottom bridge piece, and tie the string down the outside of the fork located by the rods. A measurement can be taken at various points across the fork from string to string, and the distance should be the same in each case. Check the exact location of misalignment with a third piece of string from the midpoint of the bottom bridge piece to the midpoint of the fork end rod. This shows which side of the fork is misaligned. These checks are intended for the average workshop and assume the absence of jigs and gauges. Of necessity they are rough and ready tests, but in conjunction with keen eyesight they are perfectly adequate.

Misalignment must be remedied before bush replacement. Minor realignment can be attempted cold. Tube joints are generally brazed, thus welding is precluded. A severely misaligned girder should be heated to red heat and straightened by clamping in a vice. The clamping should come after heating to prevent too much heat loss through the vice. This possibility provokes impatience. Better to be forced to reheat than to misalign the girder in another direction due to a hasty tug. The girders themselves are the best lever for this operation.

Once the forks are in perfect alignment, attention can be returned to the bushes and spindles. Spindles can be made up from a good quality steel of around 50 tons per inch approximate strength, such as EN/16, or even of good stainless steel like 18/8, but it is worth bearing in mind that it will be difficult to machine fine threads in stainless steel. Supply your engineer with the original spindles as patterns and ask him not to lose them!

Bush removal is straightforward as they are usually of light interference fit. Use a tube or drift to drive them out. The bush on one side will have to be driven right through the fork. It will act as a drift to push out its counterpart. Ensure that any centrally located grease nipples are removed, in case they project far enough internally to impede the progress of the bushes.

Retain the old bushes as patterns, and supply spindles and bushes to your engineer even if bushes only are required. Bushes can be made from phosphor-bronze or oil-impregnated nylon. The wear on bushes may have been caused by under-lubrication due to blocked nipples, thus it is wise to check their efficiency. If a non-original material is used for the new bushes ensure that the correct nipples are fitted; that is — for grease or oil as necessary.

Bushes will not stand brutal treatment and should not be bumped into place with a rubber mallet! Use a long threaded rod fitted on each end with nuts and washers to ease the bushes gently into place. If this is carried out carefully they will not swell or bell-out, and with luck the spindles will simply slide into place. Failing this, check for high spots on the bushes — which is easier said than done because this test has to be carried out 'blind'. Use a scraper to remove high spots. Imperfect machining of bushes may result in the internal diameters not running parallel, in which case a long line-reamer is required.

FORK REASSEMBLY

All bearing surfaces should be thoroughly lubricated. Reassembly is, in general, the reverse of dismantling but a number of points require emphasis as they are easily overlooked:

1 It is important not to omit the large-diameter flat (sometimes knurled) washers situated between top and bottom links and girder bridge pieces.

2 The central steering-damper rod must be relocated by the bottom link spindle as it is pushed home.

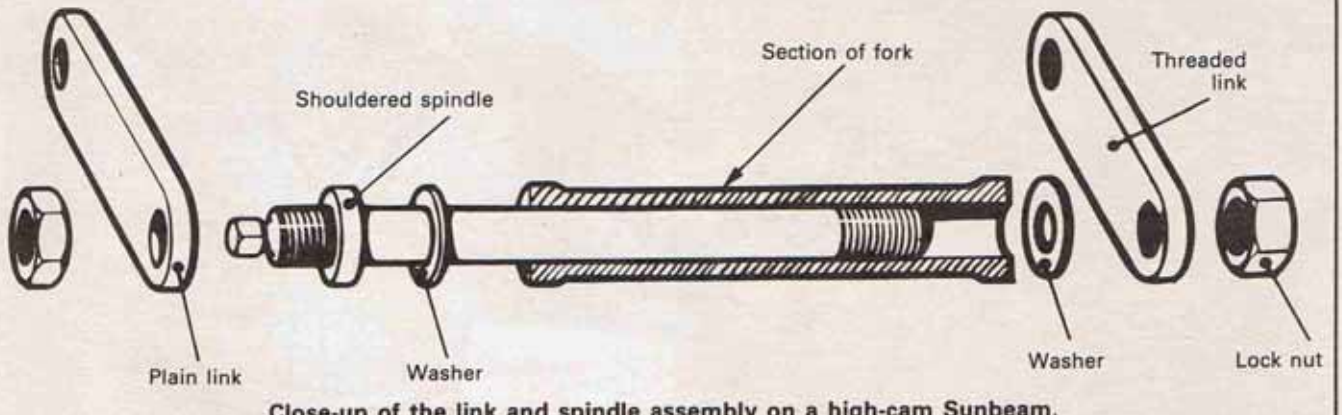
3 Any bulky wiring component which was removed after partial dismantling will have to be threaded back into place at the appropriate time.

4 Surplus grease will be scraped off spindles and bushes as the former are inserted. This must not come into contact with the side friction plates. Do not forget to position these friction plates as the spindle is inserted.

5 Having screwed the spindles into the side links, place unthreaded side links on the opposite end after insertion. Do *not* tighten locknuts. Rotation of the spindles will push apart or draw together the top links — draw them together so that both flat large-diameter intermediate washers can be easily rotated with the fingers without sideplay. Tightening the locknuts will affect the setting. It is necessary for *one* flat washer on each spindle to remain sufficiently free to be rotated with finger pressure. An overtight assembly must be readjusted until the correct setting is obtained. The spindle which locates the side friction dampers is, of course, an exception to the above. Adjustment is provided by the wingnut/knob, which should always be just biting to eliminate sideplay. It can be tightened to the rider's taste when the machine is in use.

6 Steering-head bearings should be adjusted before the central friction damper is fully assembled and tightened. A grease gun should now be applied to all nipples, but do not overlubricate the side friction-damper spindle as this will lead to early contaminaton of the friction surfaces.

Readjustment of the spindles will almost certainly be required once the assembly has bedded down in use, and the rebuilding procedure will have highlighted the need for frequent, careful lubrication of the entire fork unit to ensure longevity of the new components.



Close-up of the link and spindle assembly on a high-cam Sunbeam.