Lilac V-Twin Rotary Shift Feature Removal
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The pages are 8.25 x 11 inches and are meant to be readily printable on either US Letter or A4 paper.

Back in the late '50s and into the mid-'60s, some Japanese motorcycle manufacturers thought that allowing a gearbox to have a rotary action, *i.e.*, change from top to neutral then first, was a good idea. The problem with this arrangement, as many riders found to their dismay, is that during spirited riding, one could think that one was not in top gear. A prod at the pedal, and we're in neutral. "Damn, missed a gear" thinks one as the opponent draws away, Another prod, and one is greeted by painful gnashing of gears. If the prod was hard enough, first gear could be selected, resulting in dire consequences when the clutch was released. Many a Yamaha broke a crank in this way.

Marusho installed a '3rd gear indicator', showing the rider that it was safe to change up, however the basic problem was still there. By the time they built the 500cc flat twins, all the manufacturers had realised what a silly thing rotary gearboxes were, and had abandoned them. Colin Horn was kind enough to send me an impression he took of the non-rotary shift drum from a Lilac R92 (see figure 2). Note that this is a mirror image of the drum.
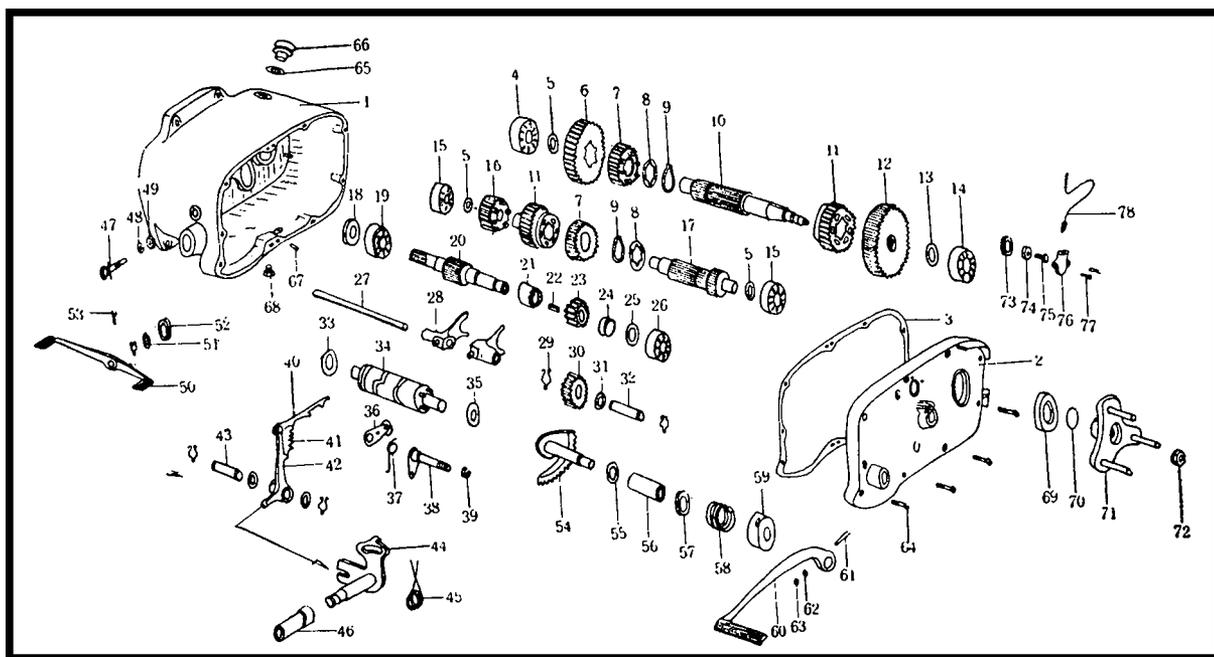

Figure 1: Lilac V-twin Gearbox. Note that this figure's resolution is 300dpi, while the remaining four figures are 72dpi.
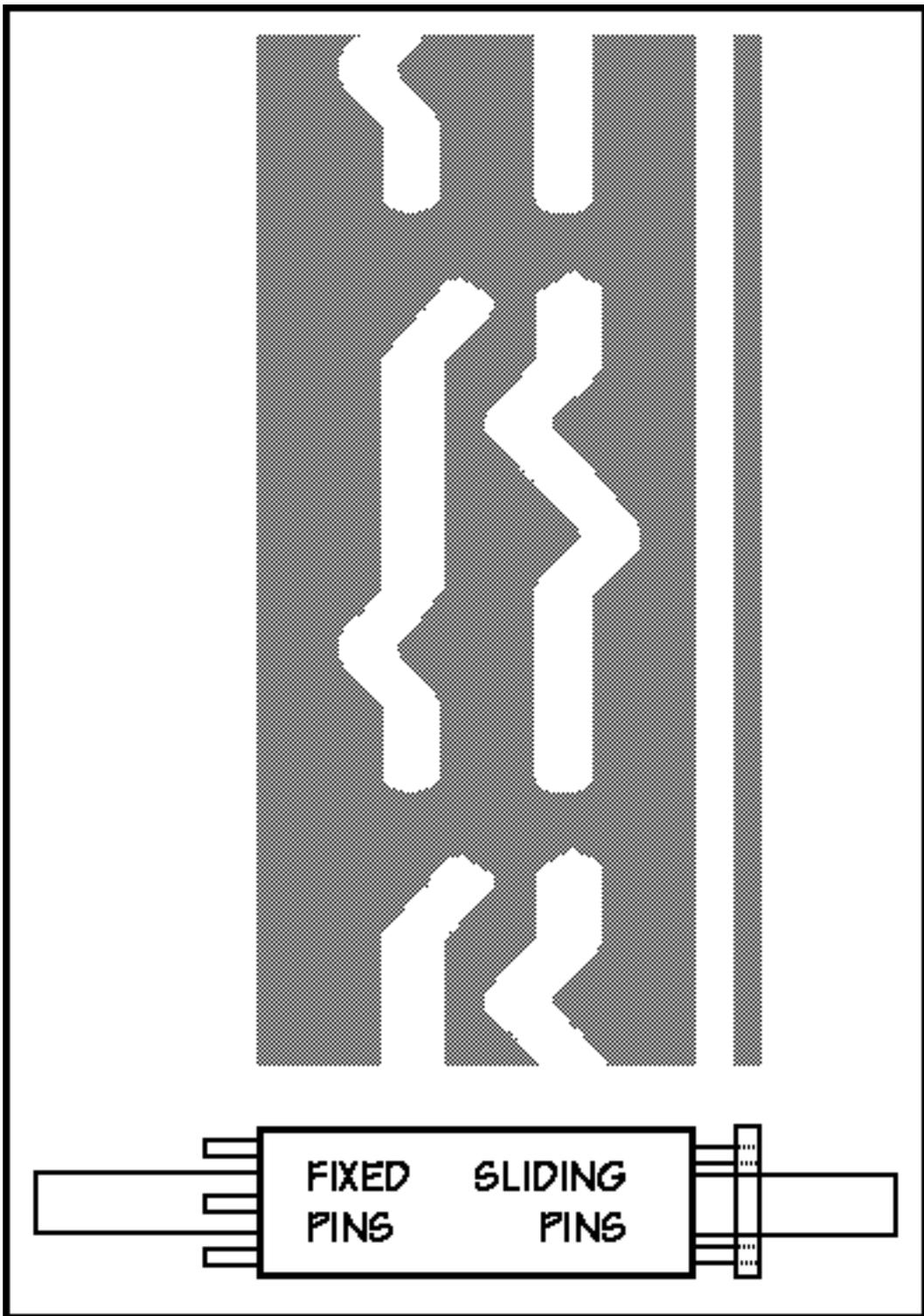
Figure 2: *Lilac R92 / Marusho 500cc non-rotary shift drum*

The solution to the problem for the other models is to remove the rotary action, which I have done in a method detailed below. This is not the only way, perhaps not even the best way, but it works and is relatively easy.

Step 1: Remove the pawl pin which allows the shift drum to be shifted from 4th to neutral (and neutral to 4th). Figure 3 shows the shift drum with this pin removed. This pin should be a sliding fit in the drum, and be quite easily removable.

Figure 3: *Lilac LS-18 shift drum with pin removed*

This operation is enough to remove the rotary action. However, if by some means the drum should rotate to in-between the neutral and 4th gear position, it may not be possible to return it with the gear lever. We need to stop the drum from rotating by blanking off the tracks (as per the 500cc model shown in figure 2.

Step 2: Machine up a drill bush to be a tight fit in the tracks. Note that the drum is quite hard, and I needed a carbide drill to break through the case hardening. We will be drilling and tapping an M5 x 0.75 thread in the track, so you will need a 4.25mm diameter drill.

Step 3: Position the bush in the correct spot. I found the spot by looking for the faint mark left by the shift fork pin when in top gear. A 7mm diameter pin gave me the size of the fork pin, and I placed the drill bush next to it with 0.5 to 1mm clearance. Figure 4 shows the bush in position.

Figure 4: Drill bush in position

Step 4: Drill and tap an M5 thread into the shift drum. Careful, as the drum is really hard, and you don't want to break off any drills or taps in there!

Step 5: On the other track, do the same thing, except with the neutral position as the guide. The holes will not be in line axially.

Step 6: Machine the heads of (2) M5 unbrako cap head screws down until they are about 7mm diameter, a neat fit in the tracks. Screw them in with some Loctite and *voila!* – no more rotary action. Figure 5 shows the completed assembly. The gear lever will now free-wheel because the pin has been removed, and the drum cannot turn past the 4th gear position, or back from neutral.

Figure 5: *The completed assembly*