Flexible flywheel modification

by Nick Beck

The method that I used to make a flexible flywheel that I wrote about in the 2006C magazine is described here. It will probably be helpful to read the magazine article and these notes together. These notes together with the drawings of parts should enable the modification to be replicated. The only claims that I can make for the success of the modification is my own experience of using it on two cars during a period of over 14 years. If you use these notes to replicate this modification I accept no responsibility for the success or failure that you achieve. These notes are also intended for a reasonably competent machinist.

When I first experimented with a flexible flywheel it did fall apart so I have developed it and it seems to be fairly reliable now. The version described in these notes is approximately Mk 6. When it did fail the results were not catastrophic and I was able to carry out repairs fairly easily. The drawings that I have prepared are the result of my experiments and represent how I would now build a flexible flywheel. The flywheel shown is the type as fitted to a two bearing engine with a forward starter motor mounted into the crankcase. I think that the modification could be applied to any of the two bearing engine flywheels, but it could be worth checking to see if the differences on the earlier engines would affect the operation. I have not considered modifying a flywheel with a Borg and Beck or Newton-Bennet clutch as fitted to a three bearing engine. I am not sure that there would be any benefit making the modification to a three main bearing engine anyway.

The developments to the original design are worth explaining so that the features in the current evolution described here are understood. Initially the six spring straps as illustrated were fitted as three double strap sets. This version tended to fail by the spring strap anchorages becoming loose. I reasoned that the load on the fastenings was too great so I then fitted the spring straps as six individual straps and so doubled the number of fastenings. This second version of the flexible flywheel lasted much longer but was eventually prone to the spring straps cracking.   I examined the broken straps and found that the cause of the cracking was caused by the forces exerted on the flywheel when the clutch was disengaged. The fastenings were changed to have a larger diameter head which prevents excessive travel flexing of the spring straps and has prevented any further failures. The photograph in 2006C was of flywheel in which the larger headed fasteners were first used. It was only necessary to use them on the outer fasteners to prevent the damage caused by operating the clutch. So in the illustration the inner fastenings have not been changed. In any further examples that I make the larger fastenings will be used all round, and that is what is shown in the drawings.

The objective of this modification is to eliminate the vibrations that I believe can cause the two bearing crankshaft to crack and break near to the rear main bearing or number four big end. To start with it is important to have a crankshaft and flywheel that are in good order. The crankshaft should not be cracked and the flywheel needs to fit and run true with negligible (less than .003 inch) runout. Ideally the crankshaft and flywheel should be balanced as an assembly. The principal tools and equipment that are needed are a lathe big enough to turn the flywheel and a pillar drill or preferably a vertical milling machine and a rotary table. The drawings do not show any tolerances, but the twelve headed fasteners need to be a close fit in the spring straps and in the recesses to be made in the flywheel. Ideally the 0.375" location diameter of the holes wants to be made to the same tolerance as would be produced using a machine reamer. The mating diameter on the fasteners needs to be a snug fit and should not have any play. The headed fasteners need to made of a medium carbon steel such as En8 or stronger such as would be used to make high strength fasteners.

With reference to the drawing of the assembled flywheel and detail B you can see that there are shim washers placed each side of the spring strap. The shim washers are an important component and, to some extent, they determine the amount of flexing that can take place. The thickness of the shim washers seems to be satisfactory in the region of 0.0152 to 0.020", but I do not think that it is very critical. The shim washers are 0.375 inch I/D and 0.625 inch O/D. Of course, all the shim washers in one flywheel assembly must be the same thickness. The countersunk screws used with the fasteners can be slotted or hexagon socket type. The hexagon socket type are probably best, but I have used both. The screws should be long enough to just protrude through the headed fasteners then they are trimmed off flush after they have been fastened tight. The spring straps, taken from an A series Mini clutch assembly, can be cut and drilled without altering the heat treated state that they are in.

The basic sequence that I have used is to machine the cut to separate the inner and outer parts of the flywheel half way though from the inside of the flywheel. The holes to accept the fasteners for the spring straps are then machined so that the spring straps are in tension when the engine is driving. It is important to make sure that the holes are equi-spaced to maintain the engine balance. The spring straps are then fitted whilst the flywheel is still in one piece. The final operation is to complete the separating cut from the outside of the flywheel. This ensures that the flywheel does not generate any eccentricity during the build. It is necessary to make a lathe tool to make the trepanning type cut that separates the two halves of the flywheel. The spring straps taken from a Mini clutch need to be shortened. Cut the required amount off one end and drill a new hole. Only one end of the strap needs to be radiused as shown in the drawings so that it clears the clutch lining. It is important that the centres of the holes on the spring straps and the centres of their fixing locations in the flywheel match. To achieve this I made a simple drill jig with drill guides the required distance apart. I used this jig to drill all the spring strap holes together and also to space the pairs of holes on the flywheel the same distance apart. More recently I have obtained a vertical milling machine with a rotary table and I will use that to machine the spring strap fixings in a flywheel in future.

The joining of all the spring strap parts and the flywheel must be done so that there is no possibility of free movement. I have found that it is best to use a small amount of filled adhesive in the spring strap fixing joints so that any clearance gaps are filled. I have used J-B Weld which is a steel filled epoxy resin. (See www.jbweld.co.uk) It also locks the fixings so that they do not come apart. Do not forget to put the shim washers each side of the spring straps as you assemble them to the flywheel. Once that the spring straps are all fixed the flywheel can be put back in the lathe and the trepanning cut completed from the outside of the flywheel to make it flexible. The amount of flexing is quite small but it is sufficient to completely alter the natural vibration frequency and protect the crankshaft from excessive flexing stress. Finally I use an angle grinder to carefully grind off the small amount of the screws that protrudes through the headed fasteners flush with the surface of the fastener. This needs to be done as there is only about 0.040" clearance between the fastener heads and the clutch plate. Assuming that all the components holding the two parts of the flywheel together are matching weights, the balance of the flywheel and crankshaft should not be affected.

Nick Beck , Jan 2007