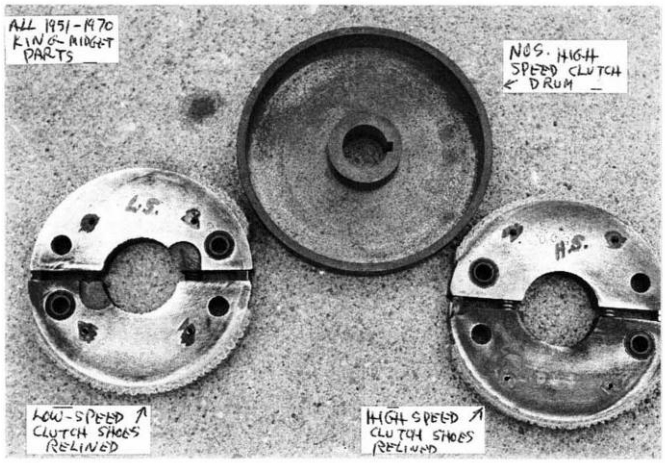
Maintenance and service of the original King Midget drive and driven clutches.

TECHNICAL NOTE #13

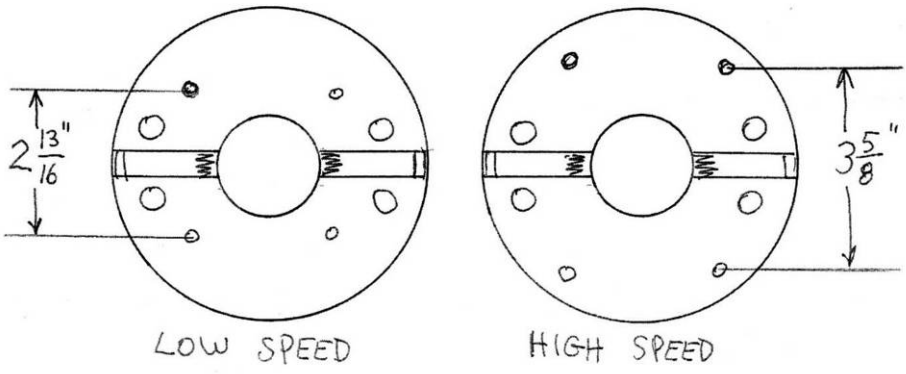
E-1 Low-Speed & High Speed Clutch Shoes Differences

by John Weitlauf



The low-speed and high-speed clutch shoes look almost the same to the untrained eye. The main way to tell the difference is in the distance between the pins that hold the inner springs.

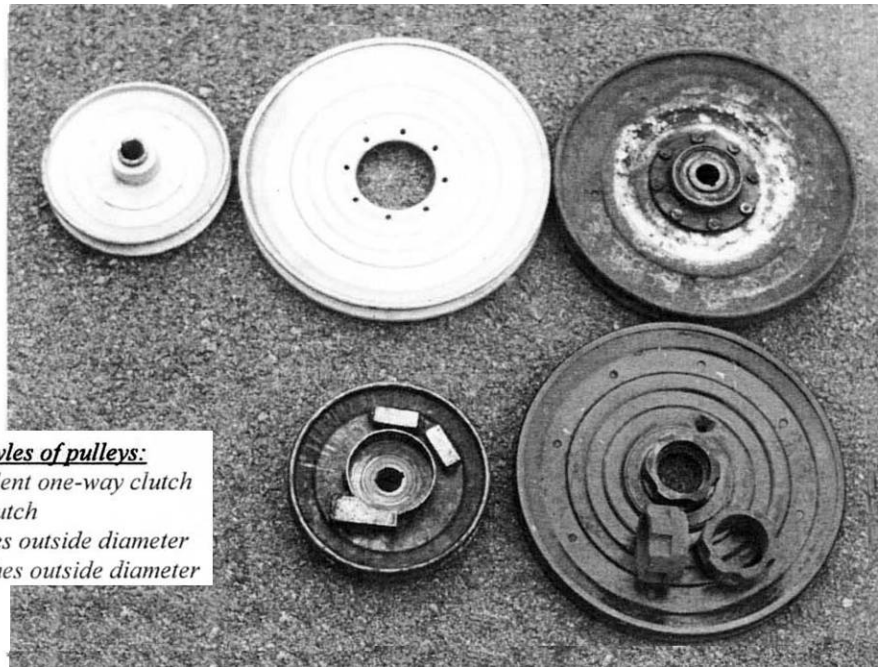
The high-speed clutch shoe pins are separated by about 3-5/8".
The low-speed clutch shoe pins are separated by about 2-13/16".
See sketches.



TECHNICAL NOTE #6 *John Weitlauf*

E-2 Driven Pulleys

Two different styles of pulleys used on input shaft of transmission. The mechanism in the pulleys is an "over-ride" feature when downshifting.



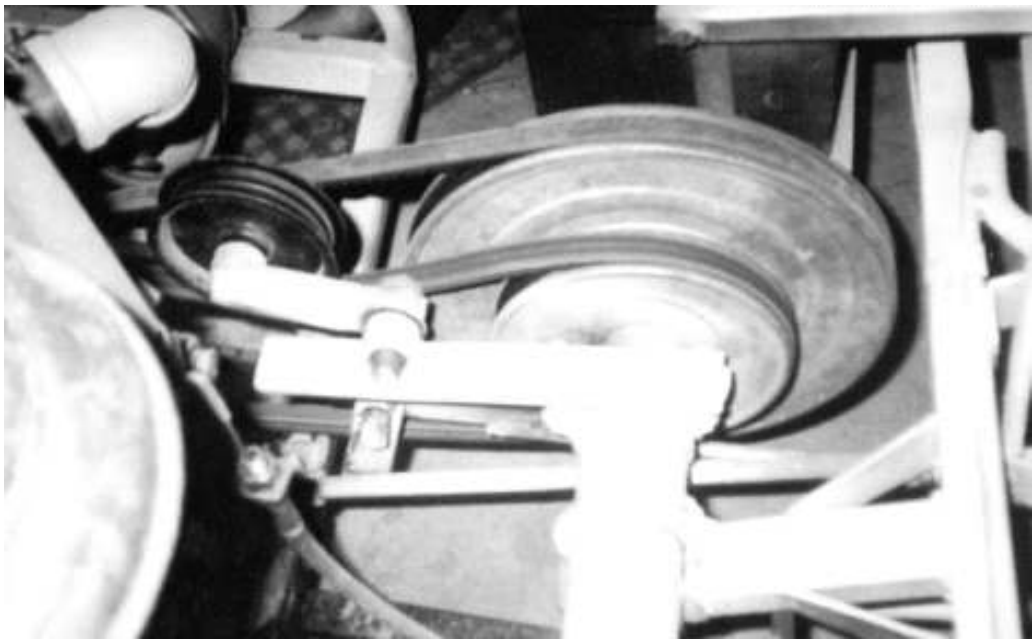
two different styles of pulleys:
top row: Borg-Warner silent one-way clutch
bottom row: "clicker" clutch
small pulley = 6 inches outside diameter
large pulley = 10 inches outside diameter

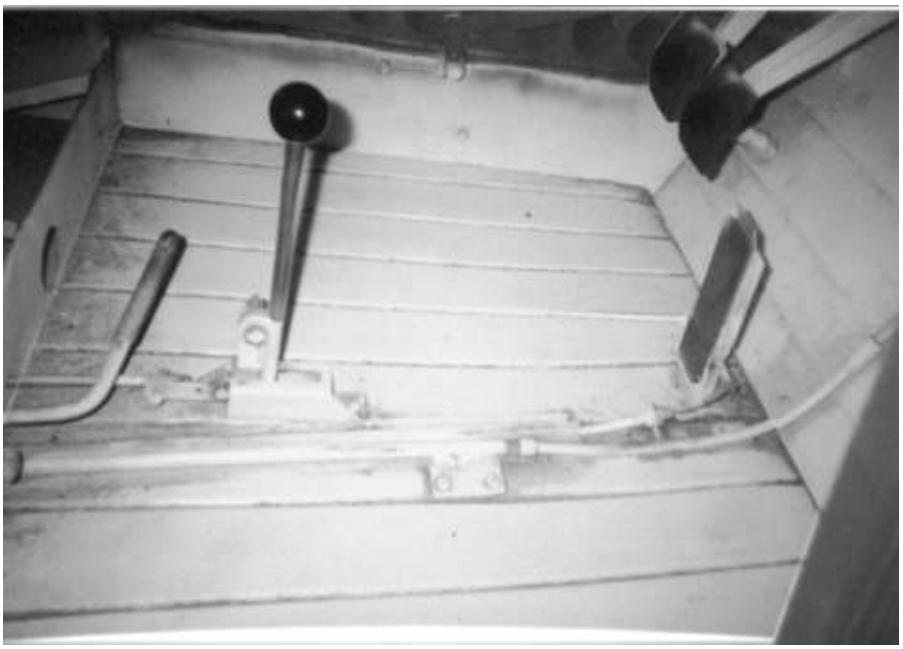
E-3 Making Do *by Jim Berg*

I guess you would expect me to be a KM nut since small cars have been a big part of my life. My first car was a Crosley, followed by an Austin, a couple of Morris Minors, a BMW Isetta and various VWs. When I spotted a 1958 Type III KM in 1969, it would be my next venture in small wheels. I'd been impressed by the advertisements in the "Mechanics" magazines, especially one showing a KM that had made a trip to Alaska.

After a few years, I sold my KM and regretted it many times. The guy I'd bought my first KM from had another Type III so in the summer of 2004, I got to wondering if he still had it. I called him, and he did. After a few more calls, I convinced him to sell me the second one.

On my current KM, parts of the clutches were missing so I decided to try a simple system with a manual clutch. I mounted a clutch pedal and cable to pull the motor frame forward to de-tension the low speed belt, using the regular spring tensioning bar as the clutch spring for low gear. I mounted a belt tensioner pulley on the high-speed drive belt to tighten it. After engaging the low-speed clutch pedal and accelerating to 15-20 mph, without disengaging the clutch, I pull the shift lever back and the high gear drive overrides the low speed drive and the car accelerates briskly. When you slow down, release the high-speed lever. When the car slows enough, it will continue in low speed until you press on the clutch pedal and brake to bring the KM to a stop.





I have considered putting together a kit to allow KM owners to make the modification by drilling about a half-dozen holes and mounting the assemblies. At any time, a person could revert back to the stock clutch system and only have a few holes to show where the modification had been installed. I try to confine changes to things that allow one to put it back to original at a later date.

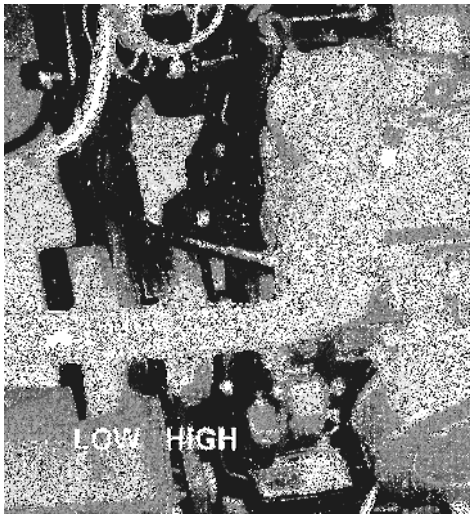
The clutch re-lining procedure has always been a problem for the do-it-yourselfer, but with this modification, you can just run down to the automotive supply and pick up a couple of new belts.

I am working on a brake on the low speed pulley to stop the input shaft spinning to get into gear. I usually start in gear to avoid gear grinding and believe such a brake will help.

I have thought of restoring my original clutches. The guy I bought the car from couldn't find the clutch parts. He had taken them off the engine, I think to reline them, and when my son picked up the car they couldn't find the parts (sounds like my shop!).

I was wondering if there are drawings of the clutch parts that go on the engine, that would be helpful in replacing those parts. I have a small lathe and access to a larger one, so I could duplicate missing pieces. Or perhaps someone has a set of clutches they'd sell me.

I enjoy giving my grandkids KM rides, so my KM is not showroom perfect, and to keep it "grandkid" friendly, it isn't too important to make it too nice to touch. □



E-4 Clutch Slippage *John White*

Sometimes we forget to release the emergency brake when attempting to move the car. This may result in glazing the clutch lining causing the clutch to slip.

To solve the problem, first remove the nut securing the low speed clutch (counter-clockwise direction). Next, use a 1/4 inch rod, punch or drift in one of the two indentations on the side of the low speed clutch face (also counter-clockwise direction). Use the tool in one hole, then the other to apply equal pressure.

Unscrew the inner unit. Check the amount of lining remaining. If there is less than 1/8 inch, the lining needs replacement. If there is 1/8 or more, you may "power brush" it *lightly* to remove the "glazing material."

The "power brush" may be an electric hand drill with a wire brush attachment, a wire wheel on a portable or stationary grinder, or if necessary, just a hand wire brush. Don't forget to wear eye and breathing protection.

Clean the inner contact face of the outer clutch housing with alcohol to remove any oils or foreign materials. Do this at least twice with a clean cloth, rag or paper towel, using a clean area of the rag on each stroke.

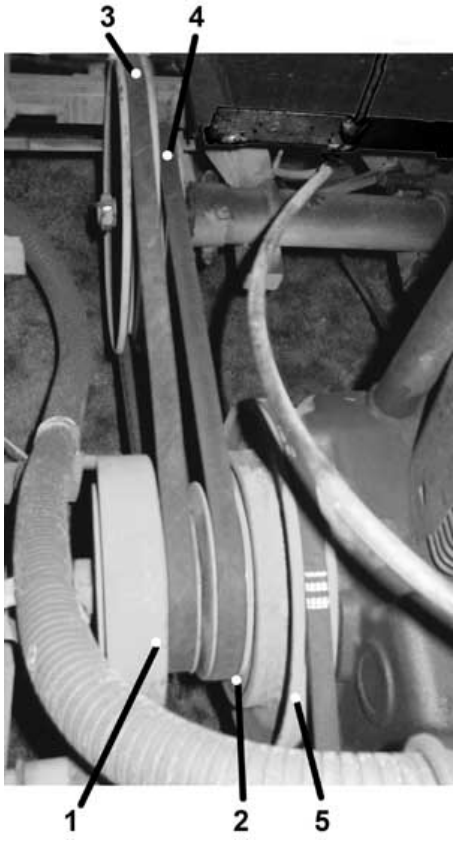
Re-assemble the parts, being extra careful not to touch the cleaned lining or inner drum face.

Of course, this is not a 100% fix, but it will cause the clutch to work more efficiently. I don't guarantee how much more efficiently. The best cure for a slipping clutch, of course, is a new or rebuilt one; Alan Conley has them. □

E-5 Overhauling KM Clutches *by John White*

Tools Needed:

- Strap Wrench (sized to fit high speed drum)
- Punch
- Ball Peen Hammer
- Two Large Flat Bladed Screwdrivers or Bars
- Set of Allen Wrenches
- Adjustable Wrench or Box End Wrench(to fit nut)
- Large two or three jaw Puller (may or may not be needed)

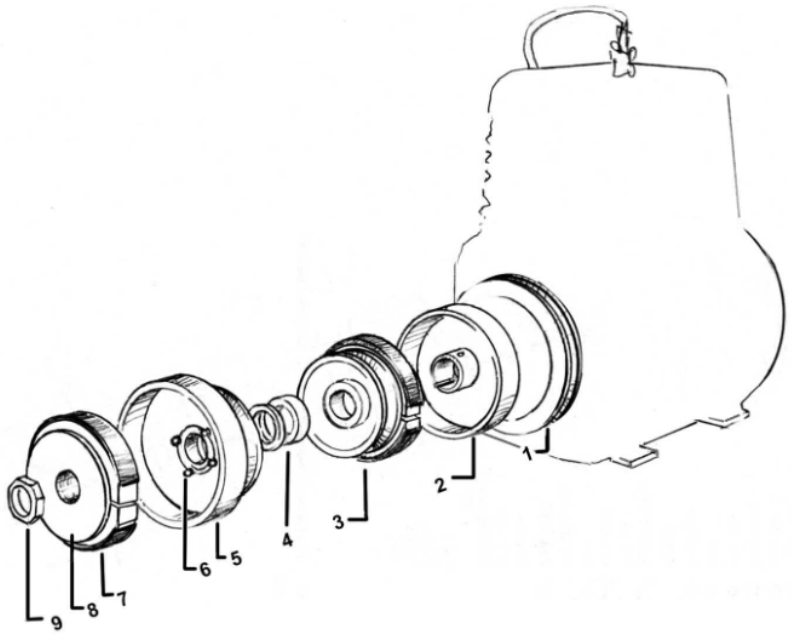


Let's start with an explanation of the workings of these clutches. The outer clutch (1) is the low speed and the inner clutch (2) is the high speed. As rpm's increase, centrifugal force spins the shoes of the low speed clutch apart until they come into contact with the low speed drum driving the belt to the large pulley (3) on the transmission shaft. That 10-inch pulley has what would be called a one-way clutch. In other words it drives the transmission shaft unless that shaft wants to turn faster, in which case, it gives up the task to the smaller high speed pulley (4) and free wheels. This neat trick is accomplished with a patented Midget Motors ball and spring arrangement in earlier models (the clicker) or a Borg Warner clutch in cars built starting in 1966. Your car may or many not have another pulley (5) to drive a starter/generator.

The shifting point is determined by springs in the clutches. As engine rpm increases, the six inch pulley (4), which is also keyed to the input shaft of the transmission, drives the high speed clutch (2) through the belt. Because of the difference in size between pulleys (3) and (4), the high speed clutch spins up faster than the low speed clutch. When its rpm's are high enough to stretch the stronger springs in the high speed shoes, they engage the high speed drum, which is keyed to the engine's output shaft. Since both clutches are now engaged, both are trying to propel the car. Since the high speed clutch wants to propel it faster than the low, the engine starts driving the transmission through the high speed clutch. The 10-inch pulley (3) on the transmission now free wheels because the transmission shaft is turning faster than it is being driven from the low speed clutch. That is the shift from low to high. When all is working properly, the shift is smooth as silk.

Okay, now to the disassembly of the clutches from the engine. Avoid using solvents or heat if at all possible. Solvents on the clutch linings can cause problems and heat can take the temper out of the springs or ruin the engine's seal.

The following drawing shows the clutch assemblies as they come off the engine.
1. This generator pulley may be on the other end or may not be present at all.
2. The high speed drum.
3. The high speed clutch assembly and pulley.
4. Spacers.
5. The low speed clutch and pulley.
6. Cap screws hold the bearing in place.
7. The low speed clutch assembly.
8. The drive plate.
9. The retaining nut (which may be replaced by a generator pulley).



First you will need to remove both low and high speed belts, along with the generator belt if your car has one. If you have the engine out of car (like I did), you use the weight of the engine resting on a block of wood to help hold it. If the engine is in the car, you

will need a strap wrench to hold the high speed drum next to the engine and keep it from turning. Either way the next step is to remove the nut or the generator drive pulley (unless it's on the right end of the assembly) from the left end of the crankshaft. If it's a pulley, there will be two indentations in the face of it. Position a punch in one of these indentations and hit it with a hammer to spin it in a counter-clockwise direction. If your car has the nut, place a wrench on the nut and strike its handle with a hammer in a counter-clockwise direction to loosen the nut as shown below.

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Once the nut or pulley is removed, the low speed drive plate and shoes are next. The drive plate also has indentations in its face. Using a punch, remove it the same way as the pulley above.

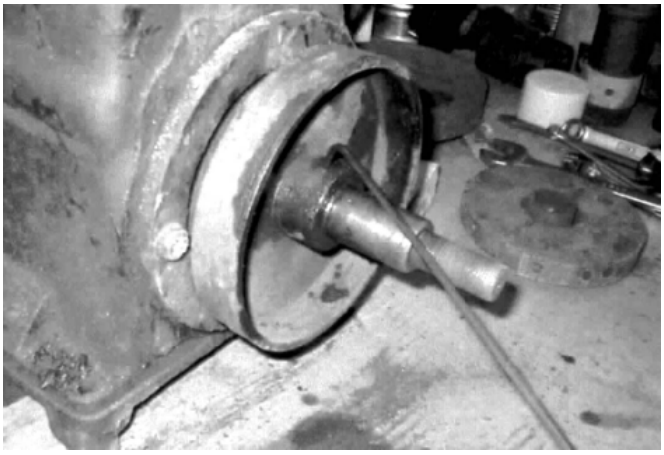
Once the drive plate is unscrewed off the shaft, remove the low speed drum.

This can usually be done by using a couple of large flat bladed screwdrivers or pry bars between the low speed pulley and the high speed pulley. Position them at opposite sides and pry. Remove and make sure to keep track of any spacers and their locations as you take them off. The number may vary and it is important to replace all you remove.

Next remove the high speed pulley and shoe assembly from the shaft. Do not pry behind the high speed drum! You're taking off just the pulley and shoe parts first and the drum can't come off until those have been removed because there are set screws that keep it in place. The high speed clutch and pulley assembly can usually be pried off the shaft and if not, you'll have to use a puller. (See photo below.) If the shaft is dirty or slightly rusted a piece of steel wool or fine emery cloth can be used to shine it up to make removal easier.

E. Clutches

Unless the engine is to be overhauled or needs a new seal, the high speed drum can stay in place. If you do remove it, you'll find there are two Allen head set screws set into the hub of the drum holding it in place. (See photo below).

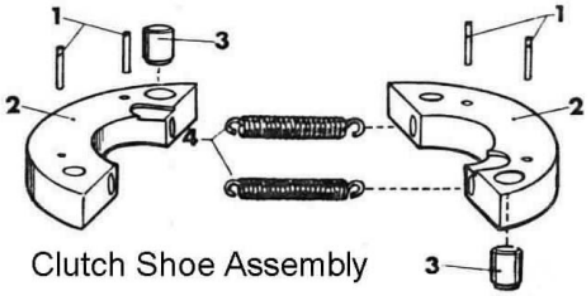


Reassemble in the reverse order. It is important to install the clutches in the direction they faced originally; opposite from each other. That's because the low speed clutch engages from a stopped position, while the high speed clutch engages its drum on the fly. You'll probably find the low speed shoes are milled out on one side to clear the bolt heads, indicating which way to install that set. When reinstalling the high speed clutch be sure the Allen set screws are tight. Lowell Tonding says if one works loose and backs out, it can lock your car in high gear.

There are two bearings used in these clutches. One is located in the low speed drum the other in the high speed pulley. By spinning these bearings you can feel them for roughness. You may have to drive the low speed bearing out, which may ruin it. Test it while it's in place and leave it there if it's good. If either bearing is at all rough, it should be replaced.

In the low speed clutch, remove the four Allen head cap screws and drive out the old bearing. Tap the new bearing in by striking its outer diameter, not in the center. The bearing in the high speed pulley can be removed by prying the shoe off the pins and removing two ¼ inch bolts. Make sure and use sealed bearings for replacements. Most of

these bearings are Part # R18 ZZ. If you need new bearings, best take the old ones along to the parts store. There are two rubber and steel bushings used in each set of shoes. The rubber ones presumably absorb shock from shifting and if they are weather cracked or misshapen, replace them. They are available from Midget Motors. Drive in new ones by their outer steel sleeve; not the inner one.



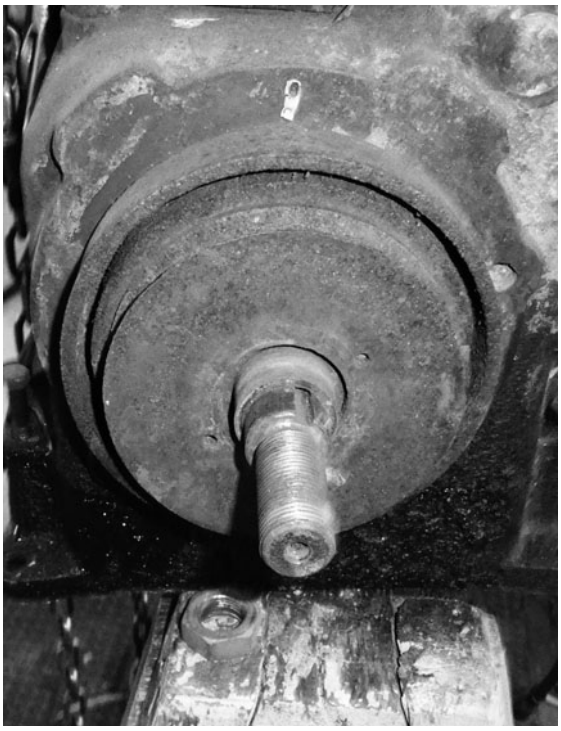
Clutch Shoe Assembly

Examine the shoe linings. If you intend to continue using them be sure they're glued on tight at all points. If they need to be relined, make sure to remove the springs and rubber bushings before sending them out. They can't stand the heat from baking the bonding cement. The low speed shoe uses longer springs and the high speed shoes use shorter ones. The springs can be removed by driving out the pins which retain them. The spring can be reinstalled by inserting it in one end and using a small punch or nail to catch the other end of the spring and pull it over. Then drive the pin in from the other end, thus pushing the nail or punch out.

When you get it all back together, do a road test and be sure your car shifts nice and smooth. This clutch overhaul process isn't easy, but it's not that difficult either. Don't install a Comet just because your original clutches are not working well! □

Note: I remove two of the ¼" 20 bolts holding the bearing in and replace them with thread-all rods and nuts, running through a

harmonic balancer puller. This allows you to pull the clutch without straining the cast iron or pulley.



I try to use these threaded holes ¼" 28 with the puller, same as low speed sometimes I can't get enough hold because threads are rusted away or bolts from other side are too lond. I then drill and tap new holes with ¼" 28 threads because I already have thread- all long enough. Then I use the puller to remove with no strain on the pulley. Then do the same for high speed drum. Paul Gerhardt

E-6 Want to Bond your Own Linings? *John White*

Paul Gerhardt gave it a spin. He used regular brake lining material and glue from S & E Adhesives ($87 per gallon—don't waste it!). If you have a congenial wife, maybe you can borrow her oven. First, spread the glue on both the lining and the shoe, let it dry and then clamp it in place. Crank up the temperature of the good wife's oven to 400 degrees. While the oven is heating up, take a torch and preheat the clamped clutch assembly to around 400 degrees in five minutes. Keep direct heat off the lining material. With the clutch and the oven hot, chuck the clamped assembly into the oven and leave it in there for an hour. Instructions are on the glue container.

Paul had to buy Ginger a new range when she came home and found him baking a Cushman gas tank he'd just painted. He now has the old oven in the garage. Let us know how you solve your problem.

As you can see though, even with a cooperative spouse this could be a somewhat daunting (and expensive) task. You may want to just send your clutches to a brake shop

for relining. I am going to try using Regular JB Weld, an epoxy that is good for 600 degrees. We'll keep you posted. □

Note: Apply glue heavy to both the clutch shoe and the lining material. Leave the linings in the over for 30 minutes at 400 degrees. Paul Gerhardt

Note: Somebody told me recently he'd tried the JB Weld and it worked fine. If you want to be sure though, Paul's method is best. Bob V.

Mechanic's Corner *by Alan Conley*

E-7 Driven Clutches

Bearings in the 10" low speed pulley should be checked on all King Midgets, because, even if they don't have very many miles on them to wear out the bearings, the grease dries out, gets hard and will not lubricate properly. Then, when we get our car out and start driving it, the bearings will not last long, can lock up and spin on the transmission input shaft and can damage the shaft quickly.

On cars with the Borg-Warner clutch, the clutch has a replaceable bearing inside that should be checked. While the clutch is apart, a small amount of grease should be put inside the clutch sprag unit to lubricate it. The sprag unit is not sealed and is usually dry. This is what generally causes a B-W clutch to explode. Since these clutches are not available, this small amount of preventive maintenance will save it from destruction.

Continuing to look at the drive train, the drive sprocket on the transmission output shaft should be checked to make sure it's tight. I've seen a lot of them loose on cars that I've worked on. If it remains loose, the keyway in both the sprocket and output shaft will get worn and hogged out. Remember, each set screw hole probably has two set screws in it, one to lock the other. So the outside set screw will have to be removed to permit tightening the bottom one first. □

E-8 The Clicker Clutch *By John White II*

In our ongoing Tech Tips on the power train in your King Midget, we'll be talking about the clicker clutch. This patented one-way clutch was used from the early 50's thru mid 1966. It consists of two components; the 10" pulley which has six lobes on the backside and the 6" pulley which has a passage with a tapered ball and spring.

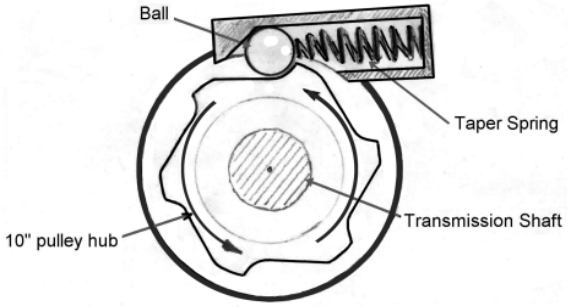
10" pulley (above) shows lobes, 6" pulley (below) shows spring/ball channel and balance weights.

To understand how this one way clutch works, it's helpful to review the centrifugal clutch operation illustrated last issue.

All drawings are shown as viewed from the 10" pulley looking toward the transmission. The 10" pulley runs on the transmission input shaft on two radial ball bearings (ND R12). These bearings allow it to turn freely on the input shaft, while the 6" pulley is keyed to

the input shaft. The ball and spring engage or disengage and allow the one way clutch to work.

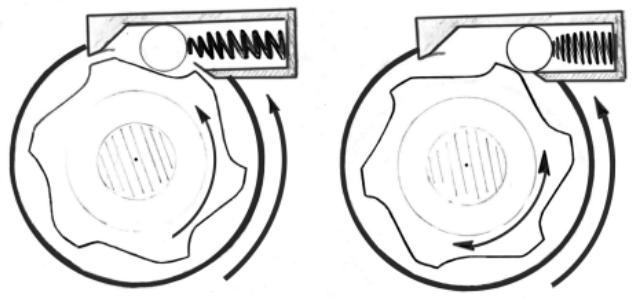
As the low speed clutch on your engine takes hold, its belt drives the 10” pulley. One of the lobes of the 10” pulley traps the ball of the 6” pulley against the bottom of its travel. See the illustration below.



10" pulley driving 6" pulley

With the ball trapped, the 10” pulley is locked to the 6” pulley and thus drives the input shaft of the transmission, while the smaller pulley is driving the high speed clutch on the engine thru the belt running back. As the rpm’s increase, that high speed clutch will engage. When the high speed clutch kicks in, it drives the 6" pulley faster than the low speed clutch is driving the 10" pulley; roughly twice as many rpm's. So, with the high speed clutch engaged, engine power goes direct to the 6” pulley and takes over propulsion.

The low speed clutch though, is still engaged and driving the 10” pulley, but about half as fast as the input shaft and the 6” pulley. In effect, the 10” pulley is turning backwards relative to the 6” pulley. This allows the ball in the 6” pulley to roll up the ramp and make its familiar “click” over to the next ramp repeatedly as long as the high speed clutch is engaged. As rpm and centrifugal force increase, the spring tension is overcome and the ball moves further up into its passageway. At high speeds, the ball no longer clicks at all. See the two illustrations below.



As the high speed clutch on the engine begins driving the 6" pulley the rpm of the 6" pulley becomes faster than the 10" pulley. The ball travels up the ramp of the 10" pulley and compresses the spring. As it goes over the high point of the ramp and drops into the low part once again it makes its familiar "Click".

As you slow down, the above events will be reversed. When the high speed clutch (being driven by the 6” pulley) drops below its engagement rpm, the 10” pulley will once again trap the ball in the 6” pulley and drive the input shaft as it did when you were starting out.

E. Clutches

Now for a bit on servicing the clicker clutch. The 10" pulley can be removed from the input shaft by removing the cotter pin and castle nut from the transmission's input shaft and sliding it off. Check the bearings in the 10" pulley for roughness. This can be done by putting your finger thru the hole of the bearing and spinning the pulley. If they feel rough they should be replaced. They are a common R12 bearing and should be available locally. Early 10" pulleys have a grease fitting on the pulley while later cars have sealed bearings. The newer style bearing can be used in the older pulleys, eliminating the need for greasing. If the bearings are bad you will need to use a small metal punch to drive the bearings out. You can't drive both bearings out of one side of the pulley! Each bearing must be driven out from the opposite end by using a punch on the center portion of the bearing. There is a spacer used between the bearings inside, but it can be moved enough to allow you to drive out the bearing. With the old bearings out, wash any old grease out of the housing. Make sure the passage on those with grease fittings is open.

Examine the lobes on the 10" pulley for wear. After years of service, these lobes have a tendency to get a groove worn into them. A little wear doesn't necessarily hurt, but if yours are worn a lot, they can be built up with weld and reshaped with a Dremel tool using a couple of sanding drums of medium grit.

The 6" pulley does not need to be removed from the input shaft unless it is damaged. It is retained to the shaft by a taper lock and a set screw. To remove it you will need to remove the set screw. It is best to spray some rust penetrant in the hole and allow it to work in for a while.

On the Model 2 transmissions there was enough room to allow the pulley to be knocked loose with a metal punch at its center. Don't hammer on the pulley its self. It can be bent easily. On very stubborn pulleys, heat can be used to try and free its grip. The risk of too much heat is, you may need to replace the input shaft seal of the transmission.

Check the 6" pulley to make sure that its special tapered spring has not been lost or replaced with an incorrect spring over the years. New springs are available from Midget Motors.

I've noticed that most 6" pulleys seem to wobble a bit. I believe this may have been caused by the piece of key stock and balancing weights Midget Motors welded to the pulley.

As a final thing I have replaced damaged key stock and balancing weights with a machined solid center piece. The idea for this came from Alan Conley and the original King Midget patent drawing of the two-speed drive from the early 50's. By drilling on the opposite side from the ball and spring hole, the piece can be balanced. It is held to the 6" pulley with four 5/16" socket head cap screws from the other side. See below.

I have not tried this yet, but wonder how the use of a dry film lubricant might be. If used on the lobes of the 10" pulley and the ball of the 6" pulley, it would seem to attract much less dirt than grease would.

Next issue, we'll hope to wrap the drive-train series up with an article on the transmission. □

Note: I tried squirting WD-40 into the Clicker innards without taking anything apart, using the little red tube to focus the spray. Noticeably better shifting, but not perfect. Bob V.

E-9 LETTERS: The Belts Slip

Both drive belts seem to slip.

Some indicators are that the engine races, but you don't go very fast and both sides of the belts are real shiny or small pieces of rubber seem to be coming off the belt.

Tighten the belt tensioner rod adjustment to make the belts as tight as possible. Typical belt adjustment rules of thumb would dictate leaving a half-inch or so of slack in the belt. But King Midget drive belts seem to need to be as tight as possible to avoid slippage. Taut doesn't seem to be too tight.

One of the drive belts seems to slip.

There may be a bracket for an idler pulley bolted to the engine, but, there's no pulley on the bracket. Did the last owner of your car take the pulley off and lose it?

Very few King Midgets need an idler pulley on either belt. Some things which might cause one belt to slip are: belts of different age, like an old belt and a new belt: belts made by different manufacturers; belts of incorrect size: or, misalignment between engine and transmission.

Sets of matched belts are not available. However, Duality controls in manufacture, coupled with strong, non-stretching cord, result in consistent lengths from belt to belt throughout their lifetime. Sizes between manufacturers are quite close, too, but aren't always exactly the same. So sets of matched belts aren't necessary anymore. It's best, though, to replace both belts at the same time, with both from the same manufacturer.

The other potential problem is that the engine or transmission. at some time, has been loosened or removed from the car. There is enough slop in the mounting bolt holes and U-bolts to permit either to become misaligned. The best way to ensure that the engine and transmission shafts are parallel is to take old the drive belts to remove that force. Loosen the bolts and move each of them, one at a time, until they are centered in their cradle. A long straight edge along-side the transmission pulley or the clutch drum will confirm their alignment.

Bolt them back down and re-check their alignment. Put the drive belts back on and tighten them until they are very taut. Slippage should be gone.

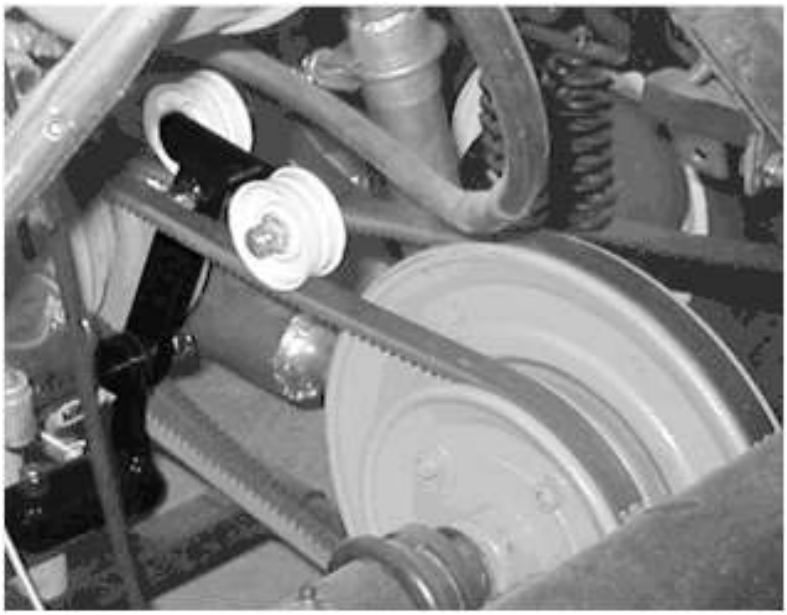
If slippage continues, an idler may be helpful. Any idler used should be a flat idler pulley adjusted to ride on the back of the slipping belt, and it should be as large in diameter as can be accommodated. □

E-10 LETTERS: Belt Tension

Bob: I got a copy of the new KMN yesterday. I noted you were talking about the belts wanting to slip on the museum car. You said Paul said what he thought were matched belts weren't?

I've never yet seen "matched belts" in different sizes. Not sure how you would be able to do that. They do sell matched belts in *same size* belts at many places. Supposedly they are matched because they come off of same production run sequences.

I have a solution that I used on Kenn [Beach's]'s M2. It works on it, and probably would also work on M3 Wisconsin engines than the mounting for the spring, and requires very little modification to the car itself. Not sure if it could work on Wisconsin's with the 12 volt start/generator or not—the 9" pulley inboard on the engine might be in the way. It is a self equalizing belt tensioner that works on both belts.



Many things go into getting belts to run tight. Even "matched" belts. Especially on the M2 cars which didn't have the saddles for the transmission to mount in.

Sometimes it is necessary to tighten one side of the U-bolt more than the other to have the transmission shaft parallel with the engine shaft. One way to check this is to use a straight edge along the pulleys to see if there is more of a gap between it and the front edge of the pulley or back edge. You want the gap even.

Another idea I had thought would solve the problem to use a ½" longer belt for the high speed than normal. This would allow the low speed belt to be properly tightened and a spring loaded idler to tighten the high-speed. But I don't think ½ size increment belts are made in regular V belts—though auto belts are. **John White II** □

Note: The term "Matched Belts" does not refer to size, but to manufacturing processes. Midget Motors recommended always buying belts in pairs, from the same manufacturer and replacing both

at the same time. Bob V.