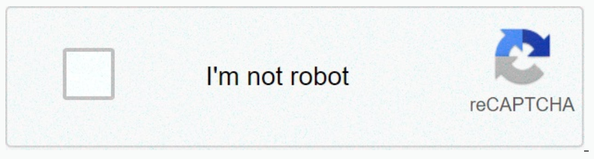

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Tecumseh Engine Rebuild for Mini Bikes and Conversion from Snow Blower Engine to Mini Bike Engine format. I buy and collect minibikes. 01/01/21. E-mail: cfh@provide.net chapters of the table of contents. 1. A Tecumseh Flat Head for your 1970s Minibike - Introduction. Suppose you have a vintage 70s mini bike and you want a good flat head motorcycle for it. How would anyone do that? First, let's talk about the history of the minibike engine... At the end of 1969 Briggs and Stratton decided that they would no longer sell their flat main bikes to mini-bike makers. They just didn't want to be associated with minibikes (probably more legal reasons than anything.) But anyway, this really opened the door for Tecumseh to deliver engines. And just about all mini-bike makers took Tecumseh on this, and used their bikes for minibikes during the 1970s. But the problem with 1970s motorcycles is time, and kids, and mini-bikes. After all, who rode mini-bikes during the 1970s... Crazy kids! And they probably didn't treat these engines very well. That's why when you see a 1970s vintage minibike for sale today, it often misses the engine. The Tecumseh minibike engines of 1968-1970: H25, H30, H35, HS40, H50. The best minibike engine, the HS50, was only introduced in 1972. The HS40, introduced in 1968, was also a very popular minibike engine. Noticed the balloon blower housing Tecumseh logo, which was replaced around 1971 with the double flags Tecumseh logo. The double flag was used until 1978 when a rectangle (boring) logo was used. Yes, there are modern engine replacements. The Harbor Freight $100 Predator 212 engine has a large number of old minibikes back on the road. But the look of the 212 engine is completely different from the old school Tecumseh flathead. For example, the cylinder is not vertical, it is more horizontal. In fact, there's really nothing that even on a Predator 212 looks like a classic Tecumseh engine. And if you're going for that vintage look, the modern Predator 212 style overhead value engine is just not going to cut it. This is what we want to get to... a minibike ready Tecumseh engine in white (or black.) This particular Tecumseh HS50 engine came from a 1970s Ford snow blower. Or if you prefer to be in black... a minibike ready Tecumseh HS50. This particular engine came from a 1970s Arien snow blower. If your 1970s Tecumseh minibike engine, which is now 40+ years old and abused by every 10 years child in the neighborhood, is dead... How do you get a decent bike to restore your vintage minibike? Well the short answer is, Snowblowers! I guess it depends where you live, but here in the midwest, old snow blowers are pretty common (and cheap.) And in general, at least here in the Midwest, a 20 or so or 40 year old snowblower engine tends to use fairly low. Why is that? Well they were only used during snow times (no dirt or high temperatures). And And the midwest (I'm in Michigan), we don't tend to get much snow (maybe 30 inches a year.) So these old snow blower flathead Tecumseh HS50 engines are big donors for a vintage minibike. That said, snowblower flathead Tecumseh engines need some work to get them minibike ready. And that's what we're going to discuss in this document. Obviously you need some tools to do this, and some general mechanical knowledge. I assume you have these things! You also need some parts. Most is available from Ebay or some of the online small engine warehouses. Also note some abbreviations such as SBH (short block horizontal), BB (ball bearing), GS (horizontal small frame), BCR (bump compression release), MCR (mechanical compression release). The Famous Tecumseh HS40 Engine. We need to talk about the Tecumseh HS40 engine. It was the mainstay of minibike engines during the 1970s. The Tecumseh 4hp HS40 was introduced in 1968, but really didn't gain traction with minibike manufacturers until about 1970. At that point, the large frame H50 engine was out of favor (due to its extremely wide body size), and the much narrower HS40 simply fit better into the wave of mini-cycle style bikes made in the 1970s (such as the Rupp Roadster, etc.) Since there was no small size 5hp engine (until 1972 when the HS50 was introduced), the HS40 was really the go-to engine for a host of minibike/minicycle makers. A 1970 Tecumseh HS40 restored and ready for use on a 1970 Rupp Roadster. Note the engine color (silver), which Rupp specified for their engines HS40 from 1970. Also note the balloon logo, as used before 1971 on most Tecumseh engines. The black HS40 engine in the background is a restored HS40 engine for a 1971 or 1972 style Rupp minibike. The early 1968-1970 Tecumseh HS40 engines had some minor differences, such as a mechanical compression release (MCR) cam shaft (as the engine begins, the compression release swings out of the way). The cam had a huge intake lobe on it and they compensated with a shorter lifter so they had to clear the crankshaft for it to fit. They then turned into a bump compression release (BCR) that was a permanent bump on the cam shaft for the exhaust. Frankly the BCR style can suck power out of an engine. Sure it helps with starting, but it doesn't go away as MCR after the engine starts. The bump can be easily ground out of the cam though. An unrestored 1983 Tecumseh HS40 engine. The logo on the blower enclosure began around 1978. With all that said, you'll see many references to the HS40 engine in this document. Not because I recommend getting an HS40 engine from a snow blower... If you do that you're better off with an HS50 snow blower engine. But many people want original HS40 minibike 1969-1975 for their originality. Even if you have a minibike that has lighting (such as a Rupp Roadster), a HS40 engine with a dynamo is really the way to use lights (I have yet to see a snow blower with an HS50 engine and a dynamo!) This will see many HS40 references in this document. (Although MTD made minibikes from 1972 to 1975 with original HS50 engines and lighting facilities.) But again, if you need a motorcycle (you have nothing), and you want a Tecumseh flathead for your vintage 1970s minibike, converting a snowblower HS50 motorcycle to minibike size is really the way to go! 2. Finding a good snowblower donor. Finding a good used (old) snow blower (if you're in a snow field), should be pretty easy. Craigslist (especially in summer) should net a good donor snowblower. Ideally you want a Tecumseh HS50 (5hp) engine (introduced in 1972) on a scruffy looking snow blower, but a Tecumseh HS40 (4hp) engines also work great (they were introduced in 1968.) This is usually fairly easy to identify the snowblower model number. For example, a Toro 521 is a 21 wide snow blower with a 5hp engine. Make sure it's a Tecumseh flat head (HS50 or HSSK50 or LH195), and you're probably gold. Even if you find a 4hp Tecumseh, the same model designations apply. That is, an Arien 420 will be a 4hp engine on a 20 wide snow blower. The Tecumseh H50 (left) and HS50 (right). There is a pretty dramatic difference in size in the two! The H50 is very wide, too wide for most minibike frames that are not specifically designed for an H50. Watch out, because I'm no longer 10 years old and 100 pounds, I'm trying to get 5hp flathead engines. But honestly the Tecumseh HS40 engine (4hp) works pretty darn well too. One thing I would say, not a Tecumseh H50 engine. The H50, which before Tecumseh introduced HS50 in 1972, is too wide of a format for many minibike applications (although some minibikes originally used H50 in the 1968-1971 time frame.) The HS frame size is just so much nicer of an engine to use in almost any minibike wanting a flathead. The Tecumseh HSSK50 engine specifications for snow blowers. Note the cast iron cylinder cover. Tecumseh's HSSK designation means Horizontal Small Snow King. Also no discount on the newer HSSK50 or LH195 Tecumseh snowblower engines. Although the pull start looks slightly different, theses winter application engines are very good. So good actually, some have a cast iron cylinder (as opposed to aluminum.) These are damn good engines. In the 2000s Tecumseh came out with the LH195 engine. Basically it is a replacement for the HS50 with some minor modifications. They advertise this engine as 5.5hp (instead of the HSSK50's 5hp rating.) This happened because they opted in the porting, manifold, and cam a bit, making for a little more horsepower. This because they dialed in the porting, manifold, and cam a bit, allowing for a bit more horsepower. In particular, the LH195sa and the LH198sp both came out around 2006. The P means power-up, and thus the increase in statistics from 5hp to 5.5hp. The LH195 cam is part #37040. Late production models production models the LH195 will have a *plastic* cam. Of course you don't want to! The plastic cam needs lighter valve springs. So if you're good at watching valve springs through a removed breather assembly, you'll see if it's a metal or plastic cam. If you have an LH195 with a metal camera, that's a great engine. It uses the same parts as an HSSK50 (or late model HS50) engine (apart from the cams and lifters, be it metal or plastic.) Generally I avoid 3hp and 3.5hp (Tecumseh H30 and H35) engines. Often they have a 5/8 PTO axis. And they are usually side poppers (exhaust on the PTO side of the engine). Side exhaust will really limit your exhaust options, as the common Taylor minibike exhausts don't exist for side poppers. Also personally I don't like to blow exhaust on my left leg! And 3hp and 3.5hp are just too bad. If you make all this effort to do an engine again, it is better to have a 4hp or (better yet) 5hp engine as a starting point. Note they used side popper engines on a few minibikes in the 1970s, but for 98% of all mini bikes, rear exhaust engines were the norm. It is the same amount of work to repair an H30 engine as it is an HS50 engine. So why not the best starting point with the more power. A Yardman 521 snow blower from the 70s with a beautiful Tecumseh HS50 engine. Please note that you don't want the combo snowblozer plastic models. Generally, these will be a tapered PTO output shaft, which will not work on a minibike. Avoid these models unless they are dirt cheap (or you'll see the PTO shaft and make sure it's not tapered.) You convert a tapered axle engine to a fixed width, but it's more work and cost. Hence you're better off not getting a plastic snow blower (unless it's dirt cheap or free!) A 1980s Craftsman plastic snow blower with a Tecumseh HS50 engine. Generally avoid this type of snow blower, as the PTO shaft will almost certainly be tapered. Do we care if the engine is running? Heck no! In fact, I'd say a non-running snow blower is probably an advantage, as the snow blower will be cheaper. We're going to rebuild the engine anyway. I mean, when it goes, that's great. But it's not necessary. A 1970s snow blower with a Tecumseh HS50 engine. Looks like junk, but this is the perfect motorcycle donor candidate for a vintage 1970s minibike. Tecumseh made flathead engines until 2006 (Tecumseh went out of business in the fall of 2008.) The newer 1998 five HP and later style flathead engines are not labeled as HS50, but are HSSK50. Moments later, the HSSK50 became the LH195 models. The 1988 and later models all have a newer style cyclone or pull pull starter (introduced in early 1988). They are great flathead engines too, although they don't quite look the same as the old style four leg pull start engines. If you're a snow blower that's an HSSK50 engine (or LH195 that was called 5.5hp), don't run it. They're great flathead motorcycles, motorcycles, all info here also applies to them. Also, some HSSK50 engines have a cast iron cylinder cover (instead of aluminum) for a longer life. The newer flathead cyclone engines do have some advantages. For the most part, they are really an older HS50, but with some changes to make them emit less hydrocarbons. That doesn't affect their power. In fact, because they are newer, the chances are pretty good that they have less time (use). Also, they will not have a points and condenser engine, but will have electronic (solid state CDI) ignition ... which frankly is a really nice feature (one less thing you have to worry about, and buy fewer parts/customize/maintain.) Here's a cyclone trek start HSSK50 snowblower flathead engine. It has a slightly different look than the old school 4-leg pull start HS50 engines. But it's still a great bike and works wonderfully on a minibike. Please note that the pull handle is replaced by the correct style. Here are two converted snow blower Tecumseh 5hp engines. The one on the left is an old school 4-leg pull start 1982 model HS50. The one on the right is a 2001 Tecumseh HSSK50 engine with the cyclone pull start. Note after the conversion to minibike size they do not tend to look so much different. And both work great on a mini bike. And if you really want, the old style 4-leg pull start blower enclosure/starter for the HS50 will fit right on the newer HSSK50 engines. This gives the 'old look', but on a newer engine. If you don't find a number that indicates which model an engine might be, you always remove the head and measure the bore. The following numbers are the bore, line, and then displacement. HS50 (pre 1998) = 2,812 x 1,938 (or 2 13/16 x 1 15/16) 198cc. These are HS50 models G and earlier and HSSK50 models M and earlier. HS50/HSSK50/LH195 (1998 and later)* = 2,795 x 1,938 (or 2 51/64 x 1 15/16) 195cc. These are HS50 models H and later and HSSK50 models N and later. HS40 (1968-1997) = 2,625 x 1,938 (or 2 5/8 x 1 15/16) 172cc H40 (released in 1998) = 2,500 x 1,938 (or 2 1/2 x 1 27//2 32) 156cc H35 (pre 1987) = 2,500 x 1,844 (or 2 1/2 x 1 27/32) 148cc H35 (1987 and later) = 2,500 x 1,938 (or 2 1/2 x 1 15/16) 156cc H30 (pre 1987) = 2.3125 x 1,844 (or 2 5/16 x 1 27/32) 127cc H30 (1987 and later) = 2,500 x 1,844 (or 2 1//1/1/1/1/1/1/1/1/1/10000). 2 x 1 27/32) 148cc AH817mb two cycle = 2,437 x 1.75 (or 2 7/16 x 1 3/4) 8.17ci or about 133cc or about 5.70rpm (and yes the MB in the model is for mini bike). * The smaller HS50/HSSK50 bore also came about with a smaller outlet. The smaller outlet reduces knocking (pre-detonation) by reducing heat in the combustion chamber. Because the outlet glows cherry red, it can ignite the fuel in the combustion chamber before the spark plug does. In (cam and carburettor) configuration, a smaller outlet is a good thing, hence hence change in the mid-1990s (before the reduction of drilling). Don't forget sears (Craftsmen) snow blowers either! Although Sears uses their own 143 number (instead of a Tecumseh number), most Sears/Craftsmen snowblower engines were made by Tecumseh. You refer to the 143 craftsmen number to find out what the Tecumseh number can be (and the size/horsepower of the engine.) A link to that cross-reference is located at the top of this document. HS50 Model Letter. The watcher who follows the model number on the HS50 can tell you quite a bit about the engine. A,B,C = 1972 to 1979 models. These all have a points and condenser magneto, and the little nut for the flywheel. D = 1980/1981 models. This was the change in the bigger note for the flywheel. But these models still have points/condenser magneto. E,F = 1982 to 1986 models. These will be the larger flywheel nut and CDI ignition. They will also still start the 4 leg pull (although the flywheel blower casing on some E and all F models is often flat around the pull start, not raised as on previous A-D model HS50 engines.) G = 1986-1990ish models. These will have the cyclone style pull-lite pull start. H and later = 1990 and later models (also N and later HSK50.) Will be the smaller cylinder bore size with the thin rings. Probably smaller outlet too. After you find your donor snow blower, remove the engine. It should be quite clear what needs to be done for this task. The hardest task will be to pull the out of the PTO exit shaft. Personally, I often use a 3-leg flywheel puller for this task. Not necessary, but it helps a lot. What about the 2-cycle Tecumseh engines? Tecumseh made some decent 2 bike bikes for snow blowers that can work on a mini bike. Fitting them can take a little work, and also make sure the engine has a 3/4 diameter PTO axle. And use a good quality synthetic oil that is mixed with fuel stabilizer/gas at 50:1 and it will run clean. They can work decently in a mini bike, at least the 5hp models (don't use the smaller versions, not enough power.) Here is the breakdown: AH520 = 5.2ci or 85cc HSK600 (or AH600) = 6ci or 98cc AH817mb = 8.17ci (134cc) 5hp, designed for a mini-bike. HSK845 = 4.5hp HSK850 = 5hp (139cc) HSK870 = 7hp But these engines are outside the scope of this document... 3. Dating a Tecumseh Engine. Tecumseh used a fairly consistent method of dating their engines. The only problem with their method is the lack of a decade in the serial /annual number. But based on other information, you generally tell what decade the engine was made. Some things to think about are: Style blower housing sticker: pre-1971 Flags style blower housing sticker: 1970-1978 Tecumseh Decal Retangle style: 1978 and newer Small metal tag with numbers, bolted to fins on the side of the cylinder: pre-1975. But sometimes this can be seen with short/long block block in the 1990s. Blower Housing numbers on the side of the casing, on a two rivet tag: pre-1974. Blower Housing numbers stamped in metal on top near spark plug, 1973 and later. Sticker with model/serial number on side of blower housing (barcode): 1995 and later. Blower Housing Shape: a rounded blower casing part #30655 (rounded as the metal bends to the spark plug): pre-1974. Blower Housing Shape: from about 1972-1974 most horizontal axle engines changed into a square top blower enclosure. (HS50 from 1972 and HS40 in 1973.) Blower Enclosures consistent between models H30,H35, HS40,HS50 (part# 33663 square top style): November 1974 and later. Blower Housing bump removed at the 4 leg recoil (to accommodate the CDI coil): late 1984 (round E or F series on HS50). Four leg tracing starts: until 1987. Cyclone pull lite style pull start: early 1988 and later. Giant mitten pull starting handle (used on both starter styles): 1984 and later on many Snow King engine models. Plastic gas tank: 1970 transformed from metal to plastic (some exceptions.) Spark plug wire around cylinder on side PTO: pre-1977 Spark plug wire led on top of head (main fins modified): 1977 Points/Condenser ignition: before July 1984. CDI solidstate inflammation: summer 1983 and newer. 5/8 flywheel nut (old style taper): 1980 and earlier (models A,B,C on HS50). 3/4 flywheel nut (new style stepr): late 1980 and later (models D and later). 1995: HS50 changes outlet to be smaller. Engine block painted: pre-1995. Nude (no paint) engine: 1995 and newer. Alloy flywheel: until 1974. Cast iron flywheel: 1974 and later. HS50 designation discontinued: 1998 HS40 model production halted: 1997 H40 and LH195 models started: 1998 Note in 1997 the HS40 engine goes out of production, and is replaced in 1998 with the H40 engine. The H40 is really an H35 engine in disguise, as the H40 bore/stroke is the H35 size of 2.5 x 1,938 (not the HS40 bore/stroke of 2,625 x 1,938). This means the H40 is only 156cc, compared to the HS40 which is 172cc. Why did they call it four horsepower? If it's like the LH195, it gets more horsepower because it has a higher lift cam. The piston on the H40 uses the same top two rings as an H35 (oil ring not interchangeable.) My suggestion is to avoid this engine. That is, get an HS40 or HS50 instead. Also in 1998 the LH195 is created, which is a replacement for the discontinued HS50. The LH195 has a bore/stroke of 2,795 x 1,938 (identical to the 90s HS50.) This engine also had its horsepower advertised higher (5.5hp at 3750rpm versus 5hp), even though the bore/stroke of 2,795 x 1,938 is the same as the HS50. The cam on the LH195 gives about 20% more lift than an HS50, hence the added half horsepower. The numbers on the blower is what identifies the engine type and it is date. The first set of numbers are the engine type such as HS50, HS50, Example. The second set of numbers are the actual motor spec number. This is important information when ordering parts. The third set of numbers is the serial number. But it's really the production date. The first number is the last digit of the year. The next three numbers are the day (from 001 to 365). Sometimes there is a letter after this number, which gives further info, such as shift/plant, etc. The problem with the Tecumseh date scheme is that no decade has been provided for in the date code. Hence, the above bullet points help figure out exactly when a particular engine was made. Dating a Tecumseh engine: On the side of the blower casing is a two rivet tag with the model/spec/serial number. This style and location of the songs was done on pre-1973 engines. This engine is an H35 spec# 452716, made on the 118th day of 1970. Dating a Tecumseh engine: On top of the mid-1970s Tecumseh engines should have impressed numbers, as shown here. This is an HS50 spec# 67175d. Newer engines (such as the 1990s to 2008) used a sticker with a bar code that identifies the engine number. On the picture below you can see on the left HS50, which is the model/size of the engine. If you want to know the year, look at the number after SER (the third set of numbers). In the example above, the numbers are 0183b. The 0 is the last figure of the year, and the 183 is the day of the year (from 001 to 365) that the engine was made, and the B is the factory the engine was made. So the above engine was made on July 2, 1980. How did we know it was 1980 and not 1990? Well the decade can be a little tricky, but for the most part you can identify the decade of the snowblower it was removed, or the style of the engine (this engine was points/condenser.) So this engine couldn't be 1990, and it couldn't be 1970 (the HS50 model didn't exist in 1970), so it had to be 1980. Serial number mounted on a tag. This happened on a motorcycle from before 1975. First number is the base model (HS50). The number '67023' indicates the specifications of the engine. And the number '2270b' tells us that the engine was made on the 270th day of 1972. Serial number mounted on a tag. This happened on a motorcycle from before 1975. First number is the base model (HS50). The '67011' number indicates the engine's specifications. The song '2175b' tells us that the engine was made on the 175th day of 1972. The second tag shows that this engine was sold as a short block. The engine may have been damaged, and a new short block was used to replace the original block. Craftsmen Tecumseh engines used their own system of numbers. You refer to the Craftsmen 143 number to a standard Tecumseh model/spec number using this reference chart to find out what exact Tecumseh engine you have. Craftsmen serial number on top of the engine. Using the Tecumseh/Craftsmen cross reference document, the 143 number translates to a Tecumseh H35 spec #45592R, made on the 133rd 133rd 1986. The new style Tecumseh date tag. This HSSK50 engine was made on the 162nd day of 2001. 4. Is your Snowblower Engine a good Minibike Engine? With the flathead Tecumseh engine off the snow blower and on a table, you evaluate what needs to be done to get the minibike ready. A 1980 Tecumseh HS50 snowblower engine. One thing you see on a lot of snow blowers is weird colors. Minibike engine colors are generally white or black (or possibly silver, as on MTD or 1970 model Rupps.) Orange (a common snowblower engine color) was never used on a minibike. Not that this is a big deal, but it's something to think about. If that bothers you, get another snow blower! In general, Toro and Ariens will have orange engines. Please note that you can see the serial number of the engine in this photo. Also pay attention to the snow protectors on the gas tank and the pull start. These will be removed for our minibike use. Here is a picture of the throttle mount and the snow blower carburettor. Both of these will be changed to minibike style, and an air purifier assembly added. This style damper can be used on a minibike, but traditionally, it's not really a minibike exhaust. Here's a Tecumseh HS40 from a Toro snow blower. The orange color is not a deal breaker. We can fix that color... 5. The PTO Output Shaft and Extended Cam Shaft and Side Cover. One of the main features of a donor engine is the PTO (power take off) exit shaft. That's the axle you ultimately mount the clutch on, and powers the minibike. The PTO must be the right size. The most common PTO size is 2.25 long and 3/4 diameter. This is the standard mini bike axle size. Longer is OK (heck you always cut the shaft, and if using a Torque Converter, longer is an advantage.) But you never want to be shorter than 2.25 in length. Note some Rupp HS40 engines have 2.75 in length. And some snow blowers use that length, too. If you are running a torque converter, the longer length PTO is a plus (although not required.) A 1978 Tecumseh HS40 snowblower engine with 1 wide and 2.75 long PTO axle. Tecumseh 4 and 5hp engines generally have either a 3/4 or 1 diameter PTO axle. Some Tecumseh 3 and 3.5hp engines can have a 5/8 diameter PTO. I would say to avoid engines with a 5/8 PTO. Not because you don't use them, but it just limited the number of clutch/torque converter options you have. The 3/4 size is most desirable, but no discount on a 1 PTO axis. It will limit your clutch options a bit as well, but it's still workable (and if you have a metal lathe, you need to switch a 1 axis down to 3/4.) But for the most part, having a 3/4 PTO without taper is the ideal size for a minibike. A 1970 Tecumseh H35 snow blower with 3/4 PTO and a secondary cam shaft PTO. Note some Tecumseh snowblower engines will have a secondary cam shaft extended PTO (used on snow blowers and roto-tillers for What Tecumseh did is extend the cam shaft so that he leaves the side cabinet and puts another outer gear bulkhead/pully on this smaller axle. While not ideal, this is not a show stop. The simple reason is that the extended cam shaft can be cut (externally), and the engine used as a single PTO axle engine. The downside is that this is another seal and another place for the engine to potentially leak oil. But for the most part, it's fine to just cut it clean externally. Cutting the secondary extended cam shaft PTO using a hacksaw blade. The easiest way to get rid of the secondary small cam shaft PTO is to start the engine, and use a hacksaw blade to cut the shaft! This works amazingly well and is quick and easy. A more time consuming way to remove the secondary PTO shaft is to split the case. That is, remove the side case, and remove the cam (easier than it sounds.) Then the cam shaft can be cut to 0.6 from the large cam gear to the end of the ridge (to get rid of the extensive secondary PTO.) Unfortunately you will get another side valve, one with only the one main PTO hole. Or you can use a 7/8 freezer plug to fill the hole. Another side carter cover is easy to get as most Tecumseh HS40 and HS50 engine from virtually any era will work (they are generally interchangeable.) Note that H30 and H35 side caps are generally different - the PTO bushing is only 7/8 diameter, where on HS40/HS50 Tecumseh engines have a PTO bushing that is 1 diameter. Also in later HS40/HS50 side covers the casting of the sidecover cams before the mount bolts became wider. Which means it may require one or two light longer side cover bolts than say 1970 versions. Another variable is the location of the oil filling (single or double-layer or high). Generically the best minibike single axle side flap is Tecumseh #32700, but as I said, others will also work (with the oil fill position being the main variable.) Don't discount high oil filling PTO covers - although not a minibike thing, they are definitely convenient to use! Here is a Tecumseh H35 engine that had a second cam shaft PTO. I cut it off externally (using the running engine and hacksaw blade to do this), and repaired the engine as usual. Don't even tell you that the second little PTO was there! Note this engine has a bushing style side case (as most engines, but not all, will have.) Beware if you remove the side case and retain the small PTO (say when you remove the governor), you will have problems with the seal around the small PTO cam shaft. That seal doesn't like to have the cam removed, which means you end up with a leak. I call this because you share the internal governor (which requires splitting the case), you have problems with this seal. Here's a camera that's being measured. It shows 0.580 to 0.600 length at the end going into the side valve. If you have the side case (for whatever reason), my suggestion is to cut it End the cam shaft length to 0.580 to .600, and get another side cabinet without the small PTO cam shaft hole. Alternatively you use a 7/8 .885 freeze plug PC29 (aka steel cup expansion plug) and some sealer, and seal the side case cam shaft hole (after you cut the cam shaft end to .580 to .600 in length.) These plugs are available from Dorman Products or Advance Auto Parts. Note the exact length of the end of the cam is approximate ... this was originally cut on a bandaw in the factory, and the measurement varies. So keep the measurement at .580 to 0.600 and it should work fine. Pry out the old cam shaft PTO seal with a screwdriver. Before installing the new PC29 7/8 freeze plug, remove the old seal. I use a screwdriver and pry it out. Just gone by the seal, you don't need it anymore. Also check the size of the hole. I generally get .871 or close to that. Then check the size of the new PC29 freeze plug. It will be bigger than that, usually about 0.020 larger. You can't just punch that in the hole. Using a bank grinder, I take some meat from the sides of the PC29 plug, to get it to about 0.005 larger than the hole of the sump cover.I. Then you hammer into the side valve without damaging anything. A freeze plug (PC29) installed on an HS50 side sump cover, where an extended cam shaft once came through. Make sure to compare the plug size with the size of the hole. There will be a difference of .010 to .020. Use a sofa grinder and lightly take some meat from the freezer edge to get it within 0.005 to the hole size. Best to install the plug concave, as seen below. To install the freezer plug, I put the cover on a hard workbench or vice. Then use a nylon hammer to get the freezer plug into the side case cam hole. Then I used a little Permatec Ultra Gray gasket compound around the freezer plug, just to make sure it doesn't leak. Some people use JB Weld for this... but either will work. Also don't you mount the freeze plug in either direction (concave or convex.) I think if you really want to be accurate, concave is the right mountain. This Tecumseh HS50 engine from 1974 has a metal tag with the identification number and serial number. The number of this engine of 4 079b indicates that it was made on the 79th day of 1974. Note also this HS50 engine has a ball bearing side case (as opposed to an aluminum canister.) Tell you this because the connection has indented into the side case about a 1/8 of an inch. On bushing style side cabinet, the seal is similar to the outside of the side case. Note that some HS40 and HS50 engines may have a ball bearing side case (as opposed to aluminium canisters.) These are easy to identify because the side case seal is indented about a 1/4 of an inch, as opposed to a bushing side case seal that is similar to the side case.. The ball bearing side case is less prone to wear and is generally considered a good thing for a mini mini Engine. Some makers, such as Rupp, use ball bearing side cases on their HS40 engines as well, for better wear properties. All early (pre-1975) HS50 engines seem to use a ball bearing side case. The only downside to a ball bearing side case is if you need to remove the side case. Removing a ball bearing side case is more eloborate - the seal should be pred out, and a C clip exposed and removed to get the side fall out. Hence, you should #28540 a spare side case seal, if you are going to remove a ball bearing side case. On ball bearings, the external seal must be removed before the side covering is removed. I use a flat-headed screwdriver to get the seal out. This will almost certainly ruin the seal (the bottom seal was the one pried out, the top seal is new.) Because of this, a new seal #28540 have handy to replace it when reassembling the case. Note in the image below the blue arrow shows the C clip. This *must* be removed to get a ball bearing side lid out! After the C-clip is removed, the side valve comes off immediately. If you look at the inside of the side flap, you can see why the C clip had to be removed - the ball bearing is held in place with two screws/rings. If you try and pry the side lid off without removing the outside C clip, you will destroy the ball bearing mount screws/rings. Here's the ball bearing side case removed. Please note that the ball bearing is held in place with two screws and oversized rings. This is why you can't remove the side valve without taking out the C clip (exposed to removing the seal, as seen in the image above.) Note that the crankshaft used in engines with side case ball bearings is different. The area that makes contact with the ball bearing is smaller than a crankshaft used in a bushing side case engine. Bushing engines had a .9985 surface contact with the bushing. On ball bearing side trunk engines the crankshaft had .785 surface contact with the ball bearing. I think you could theoretically turn a bushing crank down and a C clip groove width of 0.0745, making it a ball bearing crank. A ball bearing crankshaft (installed) versus a canister side crankshaft. Note the difference is diameter in the part of the crankshaft that goes through the side case. Diameter is .785 on the ball bearing side case, version .998 on the bushing side case crankshaft. Specifications of Tecumseh on the Ball Bearing HS50 crankshaft. 6. Ignition - Points/condenser or electronic, and flywheel material. Before approximately July 1984 all Tecumseh engines used points and condenser for the ignition. Tecumseh officially switched to (solid state CDI) ignition on August 1, 1984 (although on some models it took until 1985 to fully implement the change.) This new system does not require a points/condenser. This change is a good thing for the most part... Fewer parts to wear and maintain. But the classic minibike engine used A 1974 Tecumseh HS50 engine with a stock aluminum flywheel. Before 1975 Tecumseh used aluminium for their flywheel material (as opposed to steel.) Also flywheel options are different between the two systems. With the electronic ignition, all flywheels will be made of steel. With points and condenser, most flywheels are also steel, but original minibike engines uses aluminum flywheels. The advantage of aluminum is faster RPM gains when you hit the gas. The advantage of steel is once you get to the desired RPM the momentum keeps you looking better. The year Tecumseh went to steel for all flywheels seems to be 1975. Prior to 1975 and you will notice that their engines (whether it be HS40 or HS50) will be aluminum. In the end, I'm not sure if the flywheel material really matters all that much. All snow blowers have a steel flywheel (often with teeth to accommodate electric start.) So honestly, that choice was made for you. And you'll, get what you get, when it comes to electronic versus points/condenser. You don't change the system, so you'll have to deal with what you have. Also, changing a steel flywheel to an alloy flywheel is harder than you might think. I mean, you do it, but it's tricky. So I don't suggest that avenue, if you think about that... electronic ignition on the left, points/condenser on the right. Blue arrow shows external coil on electronic ignition engines. It's easy to keep the two systems apart. The coil (blue arrow in the image above) is external on electronic ignitions. At points/condeser engines the coil is internal (behind the flywheel). That means that maintaining the points/condenser requires removing the flywheel. We'll talk about that later, but if you have a points/capacitor engine, you need to remove that flywheel to maintain those parts. Note flywheels are not necessarily interchangeable. The flywheel side of the crankshaft changed about 1981. The 'point condenser' for 1981 had a .541 diameter end for the flywheel. The 1981 and later cranks had a .644 diameter end for the flywheel. This change happened almost at the same time as CDI (electronic) ignition occurred (in 1985). But there were some points/capacitor motros made with the larger crankshaft ending in the 1981-1984 era. These flywheels are not interchangeable between the two sizes. And they are certainly not interchangeable between points/condenser and CDI model engines. 7. Removing the snow parts. At this point, it is a good idea to remove unnecessary parts from the engine. Here's a list of what to remove: Remove the snow shields from around the carburettor, (keep screws). Remove the carburettor, discard (hold screws) Remove the housing of the blower (with pullstart attached), hold. Remove the pull starter, hold. If it's a snow sheild around the top, throw it. Remove PTO shaft pully, throw away. Usually a pully remover needs to do this. Remove the Tank. If there is a snow shield, remove, throw. Remove the fuel line, throw it away. Remove the damper, save. The Tecumseh 'snow bowl' seen on snow blowers, and keeps snow out of the carb. With these parts removed, you basically have a long block engine. Now we can handle building the engine back with minibike usable parts. Parts are removed from the engine, making it a long block. Ready for serious work! 8. Tecumseh subnumbers. Depending on your skills and what your engine have or need, there are a number of other components that can be useful to have. Unfotunately things are necessarily easy, as Tecumseh made some changes along the way. First a word about point/capacitor versus CDI engines... When it mentions points, this generally means 1984 and before. And likewise no points (CDI) is late 1984 and later. This is a general rule to keep in mind. On cranks and flywheels a change in 1982 brought a larger flywheel nut and less taper on the flywheel side of the crankshaft. This kind corresponded with the change of points/condenser to electronic ignition, not perfectly, but roughly (technically although the change of points was to electronic ignition on 1 August 1984.) In 1981/1982 there were some engine with both the new style less taper crankshaft (3/4 flywheel connection needed, instead of 5/8 socket) and points - This only happened for a short time. Note the early pre-1981 cranks with more taper used a 7/16-20 nut (5/8 socket), and the later cranks with less taper used a larger 1/2-20 nut (3/4 socket). On HS50 engines, the A/B/C series (letter after the five numbers after HS50) used the smaller taper flywheel. Starting around series D or E on the HS50, the flywheel stepr changed. And E-series HS50 engines generally had CDI ignition. Also on HS50 engines they changed the cylinder bore at some point (2,795 newer HS50, 2,812 older bore), I believe in the 1990s. This change occurred when they slightly reduced the size of the exhaust value to meet EPA emission regulations (HS50 models H and later and HSSK50 models N and later.) Another comment... HS40 and HS50 use *not* the same crankshaft. The counterweights are different (although virtually every other dimension is the same.) Note the change during the 1990s from the old style thick rings to thinner rings. The thinner rings used less oil and therefore less emmisions. Sometimes these are known as the British version, I think because the change was carried out abroad first. The thin ring piston is also different, with less side shirt and of course thinner openings for the rings. But the newer thin ring style piston/rings for HS40 works fine in the old 1970s and 1980s HS40 engines. And in some ways is more desirable, because there is less cylinder wall contact with the piston and rings. On the HS50 engines, the newer thin ring piston are slightly different in size (as they are his HSSK50/HSSK55/LH195 piston/rings), and will *not* work in 1972-1990 HS50 engines. Why? Because the piston size is different. With the newer thin ring piston they changed the piston size from 2,812 (old thick ring piston) to 2,795 (thin ring piston.) So these, unlike the HS40, are not interchangeable. Tecumseh engine bores: HS50 = 2,812 thick ring piston (1972 to 1980). HS50 models G and earlier and HSSK50 models M and earlier. HS50/HSSK50 = 2,795 thin ring piston (1990s and later). HS50 models H and later and HSSK50 models N and later. HS40 = 2,625 (note the fat body H50 also used this size, but had a longer bore.) H35 = 2,500 (pre-1990s) H25/H30 = 2.3125 (pre-1990s, with H25 discontinued around 1975) On the left is the old style thick ring piston. On the right is the newer British style thin ring piston. Note the wrist pin is set in, for reduced piston sidewall area. This and the thinner rings give less wear properties. It is important to note the difference in the thick and thin rings as used on HS40 and HS50 engines. Because on the Internet, these part numbers get cross referenced. You need to know what is what, so you get the right rings/piston. Especially if you buy pistons or rings on ebay. The part numbers just crossed, and you may not order what you really want. I suggest you look closely at the pictures because it is easy to identify a thin or thick ring piston and thin or thick rings. Thin and thick rings are a big problem on the HS50 especially: Thick Rings: two upper compression rings are .092 thick. Soil oil ring is 0.153 thick. Thin rings: Two upper compression rings are 0.060 thick. Soil oil ring is 0.121 thick. HS40 minibike short block (1970-1972): #754186 HS40 mini bike replacement engine (1970-1972): #904415 HS40 minibike short block (1972 speedway): #754153b H SSS 50 minibike short block (1972-1974): #754192 HS50 mini bike replacement engine (1972-1974): #905420 HS50/HSSK50 crankshaft 3/4 PTO new style (no points): #34740 HS50 crankshaft 3/4 PTO old style (points): #33677 or #34728 HS50 crankshaft 3/4 PTO old style (points) ball bearing case: #33676 (1972 to 1 9980) HS40 crankshaft 3/4 PTO new style CDI (no points): #34734 HS40 crankshaft 3/4 PTO old style (points): #32877 HS40 crankshaft 3/4 PTO, long, old style (points), ball bearing: #33080 (Rupp style) HS40/HS50 driver: #32875 or 32875a OHH driver: #32875b (more meaty) HS40/HS50/HSSK50 valve lifter (intake/exhaust the same length): #27241 LH195sp valve lifter (intake/same exhaust exhaust , both longer than hs50 lifters): #37670 HS40/HS50 valve spring (intake/exhaust of the same length): #31672 HS40/HS50 valve spring cap lower holder (intake/exhaust the same): #31673 d.m.v. hs40 valve springs on higher retainer (small hole version): #27883 HS50 valves on higher retainer (large hole version): #27882 inlaatklep en lagere retainer: retainer: HS40/HS50/HSSK50 intake valve and lower holder: #32645 (oversized 1/32) HS40/HS50 outlet and lower holder (large valve): #29313 HS40/HS50 outlet and lower holder (large valve, oversized 1/32): #29315 HS50/HSSK50 outlet and lower holder (small valve): #36472 H S40/HS50/HSSK50 cam bump compression release (BCR): #33158 HS40 cam mechanical compression release (MCR): #32701 H30/H35 cam (no compression release): #31317 30/H35 cam (bump compression release): #33149 H30/H35 cam (mechanical compression release): #32197 LH195sp cam mechanical compression release (MCR): #37040. Note this cam is available in metal or plastic! If you are looking on ebay and it comes with valve springs, don't buy it! The lighter valve springs are for the plastic cam (also there are splines behind the exhaust lobe of the plastic cam.) The metal version of the 37040 uses standard HS50 valve springs. This #37040 part number replaces the original #33158 cam (BCR) HS50 cam on many websites. I'm not leaving this camera behind. HS40 head gasket: #33015 HS50 head gasket: #33554 or #36443 HS40/HS50 head: #33016 HS40 gasket set: #33240 HS50 gas set #33683 (or #36444 with two gaskets) HS40/HS50 side cover: #27677 Note that by the end of 1969 and later HS40 and all HS50 heads are identical. But the head gaskets are not the same (due to differences in combustion chambers). --- HS50 piston/pin/ring assembly (thick rings): #34535 HS50 piston/pin/ring assembly (thick rings): #34536 (.010 over) HS50 piston/pin/ring assembly (thick ed rings): #34537 (.02 0 over) HS50 piston/pin (thick rings): #33562 HS50 piston/pin (thick rings): #33563 (.010 over) Piston/pin HS50 (thick ly rings): #33564 (.020 over) HS50 piston rings (thick): #33567 HS50 piston rings (thick): #33568 (.010 over) HS50 piston rings (thick): #33569 (.020 over) --- HS50 piston/pin/ring assembly (thin rings): #40004 --- <3> (replaces #36073) HS50 piston/pin/ring assembly (thin rings): #40005 (.010 over, replaces #36074) HS50 piston/pin/ring assembly (thin rings): #40045 (.010 over, replaces #40005) HS50 piston/pin/ring assembly (thin rings): #36075 (.020 over) HS50 piston/pin (thin rings): #36070 HS50 piston/pin (thin rings) : #36071 (.010 over) HS50 piston/pin (thin rings): #36072 (.020 over) HS50 piston rings (thin): #40006 (replaces #36076) HS50 piston rings (thin): #40007 (.010 over, replaces #36077) HS50 piston rings (thin): #36078 (.020 over) --- HS40 piston/pin/ring assembly (thick rings): #34520 HS40 suction deer/pin/rings assembly (thick rings): #34521 (.010 over) HS40 piston/pin/ring assembly (thick rings): #34522 (.020 over) H S40 piston/pin (thick rings): #32603 HS40 piston/pin (thick rings): #32604 (.010 over) HS40 piston/pin (thick rings): #32605 <1> <1> (.010 over) HS40 piston/pin (thick rings): <1> <1> (.010 over) HS40 piston/pin (thick rings): <1> <1> <1> <8> (.020 over) HS40 piston rings (thick): #34854 (or #33315) HS40 piston rings (thick): #34855 (.010 over) HS40 (thick): #34856 (.020 left) HS40 piston/pin/ring assembly (thin rings): #35544 HS40 piston/pin/ring assembly (thin rings): #35545 (.010 over) HS40 piston/pin/ring assembly (thin rings): #35546 (.020 over) HS40 piston/piston/rings assembly (mounting thin rings): #35546 (.020 over) HS40 piston/piston/rings mounting pin (thin rings): #35541 HS40 piston/pin (thin rings): #35542 (.010 over) HS40 piston/pin (thin rings): #35543 (.020 over) HS40 piston rings (thin rings): #35547 HS40 piston rings (thin rings): #35548 (.010 over) HS40 piston rings (thin rings): #35549 (.020 over) HS40/HS50 side case oil seal PTO side (bushing style): #27897 (typical for a snow blower engine) HS40/HS50 side case oil sealing PTO side (ball bearing style ala Rupp): #28540 HS40/HS50 side case ball bearing (as used on Rupp Tecumseh engines): #28458 HS40/HS50 side case ball bearing clip : #28539 HS40/HS50 side case oil seal magneto side: #27876 H50 side case oil seal PTO side: #28427 H30/H35/HS40/HS50/HSSK50 side case (sump) gasket: #27677 Side case HS40/HS50 single PTO hole, bushing, low oil fill: #32700 Side case HS40/HS50 single PTO hole, bushing, high oil fill: #34674 Side case H35/HS40/HS50 single PTO hole, ball bearing, low oil fill: #30756 Oil fill plug no dip stick: #27625 Oil fill plug with dip stick, level motor mount: #34245 Oil fill plug with dip stick, 20 degree motor mount: #32969 Oil fill plug gasket: #36832 Oil fill plug and dipstick (for high fill location): #31297 (ideal) or #37884 (will work) HS40/HS50 steel flywheel lighted (CDI) : #611203 (or #611093 for 8/9/10hp engines) HS40/HS50 steel cast iron flywheel (CDI): #611081 HS40/HS50 steel cast iron flywheel (points): #611029 or #33701 Plastic fan for cast iron flywheel: #610933 H S50 (all then not illuminated) magneto timing cam breaker: #30992 HS40 alloy flywheel (points): #32517 or #610754 HS40 alloy flywheel (points) illuminated: #610769 HS40 alloy flywheel (points) for electric takeoff: #610845 HS50 alloy flywheel (points): #33659 (for 19 72-1974 HS50) H50 alloy flywheel (points) illuminated: #30755 LAV35 alloy flywheel (points): #31331 H35 alloy flywheel (points): #31332 H30 alloy flywheel (points): #1267 (aka #30542 and #29165 and #30367) H30 alloy flywheel (points): #610781 LAV35 (vertical) alloy flywheel (points): #610782 or #32159 CDI alternator lighting coil 350ma (exterior attachment): #34960 CDI alternator lighting coil 18watt (inner support requires flywheel #611203) : #611111 CDI alternator lighting coil 3amp (indoor fastening requires flywheel #611203): #611095 or #611104 Alloy flywheel tow head cup: #590416 Flywheel screen: #33668 Flywheel key: #610961 Flywheel gas line keeper clip (pre-1975 with front tank): #20443 Flywheels gasline keeper bracket (1975 and later with front mount # 34212 Breather assembly: #31337 (best version to get has a rubber breathing tube) Breathing belt gasket: #31619 Condenser: #30548b Points: #30547a Points coverage aluminum: #30550 (or #610947) Points coverage coverage (small hole with foam): #610948 Points cover gasket (small hole no foam): #610955 Points cover gasket (large hole with foam): #610957 Points lid wrap (large hole no foam): #32052 Points deck: #30511 Points magneto stator mount: only #30561B Points coil: #30560 CDI magneto stator: #34443 CDI magneto under the flywheel: #610893 Spark plug cover (also known as boat): #610118 Pull starter: #590387 Spark plug short circuit: #610893 Spark plug cover (also known as boat): #610118 Pull starter handle: #590387 Spark plug shortklef: #610893 Spark valve (also known as boot): #610118 Trek starting handle: #590387 Spark plug short clamp: #30747 #610893 Spark plug cover (also known as boat): #610118 Pull starter handle: #590387 Spark plug short clip: #610893 Spark plugcsc <2> <4> Air purifier mounting: #730127 or #730164 (both fasteners) Air purifier mounting plate: #31691 or #31914 (offset) Air purifier body: #31715 Air filter paper :

#30727 Air Filtration Foam: #31700 Air Purifier Packing: #27272A #31715 <2> <5> Inlet manifold HS40 oblique style: #33301 Exhaust L shape: #35771 Exhaust L pipe shape: #37684 HS40,H35,H30 Exhaust gasket: #33170 HS50 Exhaust gasket : #33670 H S40 Intake Packing: #32649 HS50 Intake Packing: #33673 HS40 Packing Kit: #33240 HS50/HSSK50 Packing Kit: #33683 or #36444 Aperture & Gasket carb rebuild kit 236B #630978 Aperture & Gasket carb rebuild kit complete #631893 Aperture Inlet Needle, Seat, Gasket, Spring carb rebuild kit 236A #630932a Carb float: #632019 (metal) or #632802 (plastic) Carb float repair kit: #31840 Lazy Susan engine display: #696348 The HS40 seems to be the most abused engine. You see a lot of '70s HS40 engines with worn cylinders. The bore was 2.6250 and the piston size is 2.6215 with a .0035 piston-to-wall clearance (Tecumseh specs are .004 to .006 on inspection.) If the cylinder is actually .008 large/tapered/scratching, a +.010 piston won't solve the problems, you just can't solve the problems with that little material to work with. The Tecumseh #35546 piston (.020 over) is therefore the best choice to change the HS40 cylinder. Tecumseh says to use a rigid grinding stone (such as Sunnen AN-112) to change the size and 390 grit stones. Well 400s are what is available and they need silicon carbide. The only lubricant used is Goodson Honey Oil or automatic transfluid. Head gaskets on the HS40 and HS50 engines are different! You don't mix them. Yes, they are the same outer shape, but the HS50 head gasket is cut wider on the inside. This houses the larger bore on the HS50. If you put an HS40 head gasket on an HS50 engine, it won't run properly! Here's an HS40 head gasket on top of an HS50 head gasket. See the difference? Don't get this one mixed up. The size of the combustion chamber is different. 9. - Delete or keep? (Connector Rod and Side cover replacement)< The governor's job is to keep the engine from sustained high RPMs. These Tecumseh engines are designed for a maximum RPM of 3600. And frankly, they don't like to stay at that RPM level for any length of time (say more than 5 seconds.) As a kid I was always asked on my minibike, did you remove the governor so that it would go faster??? I was never sure what the governor was, let alone how to remove it! Good thing too. Because a de-governor and a 10 year old are almost definitely going to throw the float, pretty much ruining the engine. The Tecumseh side case removed. Shown is the plastic gear and wings that push on the gas arm and lower the RPM as the engine revs too long. The way the governor works is when the user hits maximum RPM (3600), internally a small plastic wheel (coil) pushes wings, which push onto a rod connected to the gas arm. This supports the RPMs down by forcing the carb butterfly to be completely open. This happens automatically, without any user control. So you get the full 3600 RPMs at the first full throttle, but only for a second or two. Then the engine backs it up to about 3000 RPM (or so.) This prevents the engines from throwing the rod. The parts removed from the side trunk to remove the governor. The wings can be clearly seen in this photo. So how does the engine throw the rod. Well the stock drive rod is cast aluminum, and frankly not as robust. What probably happens is the bar diaries get starved for oil at high RPM and heats up. It can get so hot that it practically melts on the crankshaft diary. Then the rod grabs on the crankshaft diary, and the bar just breaks apart... Often the rod pieces throw through the side of the housing of the engine! Here's the internal lever that rides on the plastic governor gear and which is influenced by the governor's wings, to lower the RPM. This internal lever is connected to the external throttle clutch, and eventually the carb's throttle. Sometimes I remove these parts as well (blue arrows), and tap the case hole 10-32 and put a bolt in the hole. When using a slide carb these parts just get in the way. Do you want to remove the governor with this? Honestly, on my bikes, I always remove the governor. The internal plastic cam and its pieces can also break, ruining an engine. And frankly I'm smart enough to know not to leave an engine on full RPM for extended periods of time. Basically, as the horseman, I am the governor! Even if you use a torque converter on your mindbike, it also provides a certain amount of protection (if the torque converter automatically changes gears, this changes the engine load and rpm.) Note on newer Tecumseh HS, HSSK, LH195 engines the internal governor coil parts are printed on the side sleeve shaft. There is no E-clip to remove... The only way to get the governor to rinse off parts is to cut them off. I use a small Metabo to cut right through the coil and the metal shaft. Again, don't forget to remove the thin metal washing machine behind the coil! Connecting Rod Upgrade. To really make sure that you have no connecting bar problems with no governor, consider to Arc #6282 billet rod. Tt really does 'bulletproof' the Tecuseh engine. The aluminum billet rod from Arc #6282 is advertised for the Tecumseh OHV 5.5hp engine, but this rod works great in both vintage vintage HS40 and HS50 engines. This assumes that you remove the internal governor parts, as the Arc rod oil dipper is something different than the original HS rod oil dipper. The Arc oil dipper will hit the governor's parts, so they need to be removed to use this rod. With the Arc 6282 rod being only $65, it's a good certainty that you won't throw a rod into a non-governor HS40 or HS50 Tecumseh engine. On the picture below you can see the Arc 6282 rod (above) is a lot more robust than the (bottom) stock Tecumseh rod. Here is an HS50 engine with an Arc 6282 rod installed. Note the governor parts need to be removed, or the Arc rod oil dipper will hit! From what I've seen, the number one cause of rod failure is not enough oil to lower the rod around the crankshaft. The lack of oil at high revs causes the aluminum to heat up, to the point where it can grab bearing surface. If that happens, the rod breaks. Comparison of the Arc rod and hole feeds oil at the bearing surface, compared to a stock Tecumseh rod. Check out the picture above. Arc uses holes to feed oil at the bearing surface. Tecumseh uses a small gate to get oil to the bear surface. But what if we make a change to the stock Tecumseh bar? There's already a hole in the stock tecumseh rod that goes to one of the rod cap bolts. Why not drill a hole to connect the bearing surface to this hole? This gives another way for oil to get to the lower surface. Changing a stock Tecumseh bar with a new 3/32 hole drilled into the journal of the rod to connect to the stock cap bolt hole. An additional way to get oil to the bearing surface. What I have experiementing with is drilling a 3/32 hole, from the bar diary, to the hole that Tecumseh in the rod for the bar lobout. The hole only needs to be about 1/4 deep to connect. It doesn't seem to affect the strength of the rod (especially since you drill into the meatiest part of the rod.) And it gives a different path for oil to get to the lower surface. My idea is that this will keep oil on the bearing surface at higher RPM, when a stock rod fails to feed enough oil. After the new hole is drilled, do not forget to angle the sides of the hole. I used a Dremel with a small cone-shaped bit. This will actually help with oil feeders, and will relieve the tension on the sides of the new hole.. Does this change work? I did it on about ten bikes. Not blown up yet, but that's not really a good test. A better test would be two engines (one mod'ed, one stock), in the same condition, and running the same oil. Run them side by side on the same RPM's for the same time, and see where they But I don't ... Sorry. Remove the governor. If you want to remove the governor, you have to split the case. Honestly I didn't even remove the oil to do this. Simply put the engine on its side (flywheel down), and remove remove case screws. Then gently tap the side case with a rubber hammer, and the case should slide off (assuming the engine does not have a crank bearing on the side case, which snow blowers do not use.) The parts can then be removed from the side case (as shown in the image above.) It's only two E-clips to remove the parts. Also, remember to remove the thin ring after the gears have been removed! Note on newer Tecumseh engines (especially HSSK50 models), the governor parts should be cut off (they printed on the parts and do not use E clips.) Engine on its side, side cover removed. Now you can remove the governor's arm. When replacing the side valve, always use a new gasket #27677. Tear the old one off with a razor blade. One thing I really hate is leaking engines. So I make both the engine and side gasket area with Naptha, and apply a very thin layer of permatex Ultra Gray gasket maker. I use a thin layer of permatex Ultra Gray on both the engine and side deck walls. Then put the gasket on the engine, and replace the side valve. But don't make it down yet. Press the lid and let it dry for an hour. Then screw the side sump cover up to 115 inches/pound or 9.5 feet/pound. Permatex gasket maker. I use it with a new gasket #27677. I've seen some people use the Permatex gasket maker without gasket. Personally, I'm not comfortable doing that, but I've seen it. I perfer to use a new gasket #27677 and the Permatec. I've found that it works best. Here is an engine where I removed the governor internally, but also removed the external throttle control arm. The hole was tapped with a 10-32 faucet, and a 3/4 10-32 screw/ring installed to close the hole. If you've removed the governor's system and tap with a 3/4-long 10-32 bolt, you'll still use the original outer lever lever arm and minibike throttle mount #730136a, with an original Tecumseh carb. All I do is use the 10-32 bolt with a nut, and the original exterior governor lever, as seen below. In addition, I remove the internal governor L metal arm and external throttle arm. If I use a non-stock slide carb, I don't have the throttle arm. When removing the internal governor L arm, be aware on the inside of the case there is a small ring on the arm. Don't drop the washing machine in the suitcase and lose it! (Although using a magnet can often be found.) Removing the internal governor L arm and external throttle arm is ideal. In this case tap the hole where the governor's arm was located with a 10-32 crane, and put a 3/4 long 10-32 all bout washing machine in the hole (from the outside) to stop it. One less place for oil to leak! If you use the stock carburettor set, you still remove the governor's L arm. Just use the 10-32 bolt and a nut to a arm the pivot for the outside governor. Here's a snowblower engine that threw a rod. Nice hole in the side side I'm not quite sure why this happened, but it was probably because the snow blower didn't have enough oil. If you are really concerned about throwing a rod at your non-ruled Tecumseh, consider using a billet aluminum driving rod. For $65 for the Arc #6282 rod, it's a good piece of mind. The rod is 3,484 Tecumseh 5.5 OHV Stock Length with a solid dipper. Designed for the Tecumseh overhead value 5.5hp engine, it happens to work fine in vintage Tecumseh HS40 and HS50 engines. Yes, you need to remove the piston from the engine and do some work to install the rod. But if you've already split the case, it's not a huge job. Here is the same engine as the above piston and rod ... Notice where the rod on the crankshaft has melted! You can see where the aluminum rod attached to the steel crankshaft that melted aluminum from the rod and broke from lack of oil. This could have happened due to high RPM... but the most likely culprit was the oil level too low. Every now and then you need to replace many seals that go on the side case (or behind the magneto on the other side of the engine.) Also, you need a new side valve gasket #27677. The side valve should use a torque wrench and the bolts tightened to 115 inches/pound or 9.5 feet/pound. Here's some other part numbers that can be useful: Bushing side case seal: #27897 (typical for a snowblower engine) Ball bearing side case seal: #28540 (as used on Rupp Tecumseh engines) Side case ball bearing (as used on Rupp Tecumseh engines): #28458 Magneto side case seal: #32600 (or #27876 ?) Side case (sump) gasket: #27677 also remember whether you have a ball bearing side case engine (like say a Rupp HS40 or a pre-1975 HS50 engine), you'll definitely need a new side case seal #28540. That's because you have to pry out the original seal to expose a C clip, and remove the C clip, before the side case will come out of the engine. 10. Getting the Color Off and Back On. Let's say you're going to color the standard minibike (white or black.) But the engine you have is not that color. How do you deal with this? Well, the engine can be repainted. Because you tear the engine down to the long block, all metal pieces can be easily painted. But keep in mind that you need to use a gasoline-resistant paint! Otherwise just a gas leak, and the paoint comes out of your engine! To get around this problem, I prefer to use powder jacket. As part of the process, they will sandblast the parts. And the end product looks great, and is completely petrol resistant. On color, personally I do not use pure white or any shiny colors. Why? Because they're higher maintenance. Gloss colors are really hard to keep looking good, and show scratches and defects and dirt very clearly. For this reason I use an off-white matte color and medium black (not shiny black.) Many people use the 'bright white' or shiny colors. But I just don't like that look. Also, most paints are not petrol resistant. If you're using something unknown, the SEM 1k clearly works well in a can as a good gloss sealer. These are the removable parts that were powder coated. What about that Primer lamp on the blower housing (above the pull start)? For a minibike, the primer lamp goes away. It will pull off or unscrew. Throw it away, we won't use it. I think you have the primer lamp hole (s), but personally I try and close the hole (s). Using a TIG welder I can usually pull this off without deforming the blower casing metal (it can be a bit hard to do.) This is optional, of course, but is a nice touch. We won't need that primer lamp, so plugging the hole is ideal. After welding closes, use a flap mill and then sandpaper to smooth it. Of course do this for paint or powder coat! Rustoleum Appliance Epoxy spray paint. And SEM 1k clearly #40903. If you don't use the Epoxy paint device, the SEM 1k clearly works really well as protection against gasoline. So fine, you've decided to powder the removable metal. But what about the block? Of course, you can't powder coat that! For me, I put the engine on top dead center and block the exhaust and intake gates (and breather) with rags. Then sandy the long block! This gets the old color off (important if you bought an orange engine!) When you are ready, blow the engine with compressed air. Then I use a Home Depot available spray can product to paint the long block. This paint is Rust-Oleum Appliance Epoxy paint. It is available in white, almond, black and silver (although silver I had to order online.) I love the almond color for my white engines (the white color is too white for me). If you let this spray paint dry for 48 hours, it is really gas resistant. More resistant than other paints I've found (short of spraying 2-piece urethane.) A sandblasted Tecumseh 3.5hp side popper long block, ready for new paint. Using the device epoxy spray paint on an HS50 engine for an MTD minibike. The blower casing was also painted and then erased with the SEM 1k. After letting it dry the long block, do not reassemble the blower housing parts. Because the next thing we need to address is... 11. Replacement of points condenser, flywheel removal, Kill switch, Lighting. If you have an older engine, now is the time to deal with the points and condenser. If you have a newer engine with electronic ignition, save this step. Please note that we do this after we have blasted and painted the long block. This is a CDI electronic ignition engine (flywheel removed.) No points to replace! If you want an external kill switch, sell a wire to the lug shown with the blue arrow. Please note that this block may support a CDI ignition *or* a points/condenser magneto. This can be seen by the anchorages for the points/condenser magneto (not used.) Adjusting the CDI coil is Easily. Just loosen the two screws that hold it, put a business card between the bottom of the coil and the top of the flywheel magnets, and twist the coil mounting screws. This is known as the airgap. Officially, the airgap should be .0125, but most people don't have a feeler meter that exact thickness. Therefore, the visitecard trick is used. Now most business cards .0125 are thick? Probably not... but it seems to work fine doing it this way. Since you already have the blower casing out, you can see the flywheel. This must be removed to access the points/condenser. First, remove the middle nut. Some guys are lucky by using a rubber hammer and hitting the crankshaft end (where the nut was removing) to pop the flywheel. Personally, I've never been lucky enough to do that. And I've seen people screw up the crankshafts. Some people retreat from the nut and hit it. Again, don't do it... The nut is too small and too thin. Tecumseh sells a device (knock off tool) to do this, part #670103 (for small nut older flywheels) or #670169 (for CDI big nut flywheels). Basically it is a huge long nut that goes on the shaft to make this technique possible. Use a stiff plastic hammer and press the flywheel knock off tool #670103 or #670169 (where the flywheel nut was removed) while using a screwdriver to push behind the flywheel. Again, I haven't had much luck doing this, but others have. Tecumseh recommends this technique in their repair manual using a Tecumseh flywheel puller long nut (knockoff tool) #670103 or #670169 to remove the flywheel. For example, Tecumseh recommends removing a flywheel. Personally, I haven't had much luck with this technique. For this reason I bought a 3 leg flywheel tractor from ebay for $20. But be warned, a jaw type flywheel puller can crack the flywheel. This is not really a problem with a steel (cast iron) flywheel (as used on snow blowers and most Tecumseh engines after 1975). Especially if your cast iron flywheel has an electric starting gear, this works really well. But if you are working on a minibike Tecumseh or very early Tecumseh with an alloy flywheel, you will crack a flywheel using a jaw type trigger. So don't do it! Using a flywheel tractor to remove the flywheel. Don't use this on an alloy flywheel! Only for cast iron flywheels. Works great on cast iron flywheels with a starter ring gear (which you'll soon remove anyway!) If you have an alloy flywheel, you need the right flywheel trigger. That would be #670215 Tecumseh part (or some alternatives such as #670306, #670218, It screws into the alloy flywheel, close to the nut. This works really well and won't crack an alloy flywheel. I can't stress how important it is to get this right. If you use a 3-leg flywheel puller, it is pretty much guaranteed that you are deforming or cracking an alloy flywheel! Here's the recommended flywheel puller, Tecumseh #670215. There is also a one other versions that are similar to #670306, #670218, #25183. With the flywheel off, you can see the coil and (covered) points and condenser. First, just replace the consender #30548b. Don't mess around, it's a $5 part, just install a new one. I also take a Sharpie and write the date on top of the condenser. It's easy to replace this part, it's a screw to hold it in place, and then the nut where the wires all connect (at the points.) Don't replace that nut yet, we need it to maintain the points. The Tecumseh magneto (coil). The blue arrow shows the condenser #30548. Working on a minibike Tecumseh with lighting? Then the magneto is something else (to power the lighting of the bike.) Here's a Rupp style magneto (coil). It's really the same, but the condenser is in a slightly different location. The blue arrow shows the condenser #30548. Then remove the aluminum sheild that covers the points. It's just a spring clip that holds the cover in place, easy to remove with a small plyer. Then you can see the points. Turn the PTO axis from the engine to TDC (top dead center). That's with the shaft key straight up at 12 oclock. Also, there is usually an arrow or other brand about to riser colar with TDC. When the PTO is on TDC, the points should be gaped at 0.020. Don't worry about that right this second... Simply use a flat screwdriver and remove the screw that holds the points in place. Also pry the wire bolt out, and the points will be completely removed from the magneto. Top blue arrow shows colar arrow that indicates the points adjustment location. It's not TDC, but I'll often call it that! You want the points at the highest point on the colar. Please note if you have installed this colare backwards, with the flywheel key on 12 oclock, the points will not be open! So clearly don't do that. (Better yet, don't remove the colar points.) Bottom blue arrow shows 020 point gap on TDC. With the points removed, you examine the actual points. They are probably pitted (unless they are new.) That's why we're replacing them. Note the wells is exaggerated by a bad condenser. In fact, that is the only task of the condenser, to save the points from wells (the engine will work without the condenser, but the points will pit severely, and fail.) The condenser is essentially an electronic shock absorber, preventing arc over the points (causing the points to pit and lowers the voltage at the spark plug.) Therefore, you should always replace the condenser when the flywheel is removed. Either way, the items are part #30547a, and new ones can be purchased for about $10. Alternatively, you will face the original points again to remove the wells. It's your anyway works fine. Personally, I like to revisit the original points myself. Remember, when installing new points, you need to clean them before you install it. There will be a protective protective about the face of the points. I use about 600 grit sand paper to do this. Close the dots with the sand paper between them, and pull out the paper. Make sure you have both sides of the points. This will ensure that your new points work as they should. Tecumseh points #30547a, deleted. Watch the wells on the contact! That's a bad thing... Install the new (or re-faced) points now. Many companies (other than Tecumseh) made replacement points. My suggestion is to use 'real' Tecumseh brand points when you replace them. The off-brand (as say Sten) don't seem to be quite right. Since the engine is still at the high point on the colar, set the dot gap to 020, and turn the screw on. When you do this the wire nut should be tight - point gap can change if that nut is not tight. Also, if you twist the flat head screw to set the points, sometimes they are 'running'. So check again after you adjust flat head screw tightly, to make sure it's still at .020 gap. You now #30550 the aluminum cover (or #610947) and it's gasket #610948. Usually the cover and the gasket will be in good condition and can be reused. Now you have replaced the wires on the point screw. The nut should be tigthened when you adjusted the points, so remove it and install the wires (assuming not done before). I add a 3 foot length of wire (light blue thread in the photos) to this screw/nut as well. This is the kill switch thread! I love all my minibikes to have a handlebar mounted kill switch, and you need a wire to ground the points. I use #18 or #20 meter stranded wire for this. This is very important to do, because you have the whole engine already apart! You also use a spark plug short circuit clip #30747. But personally, I hate those things. Notice how the wires are running around the magneto (and below the points retention clip. Get this right, it's very important! Also note the flywheel key and the notched part is to the center of the engine (see blue arrow). How the wires run around the magneto is very important! If you get this wrong, the flywheel can rip or fray the wires, killing the engine. The wires run under the point cover the point cover retention clip. They also run under the condenser leg. Get this right! Finally if the flywheel key was removed #610961, note it's orientation - the notch goes to the center of the engine. With this finished, you replace the flywheel and turn the flywheel retention nut. This nut must be pretty tight! Otherwise, the flywheel may become loose and slide off the flywheel key. This will change the timing, and the engine will never run. If you have a torque key, turn the flywheel note to about 50 feet/pound. Not a good idea to make an impact to turn the flywheel, it can overload the flywheel and crack. When you are ready, you should work looking like the Below. Note the orientation of the wires! This is how the 1970s wiring is done. In the next picture though... The last years of the points/capacitor models Tecumseh began to wire their points and condenser a little differently. Below is the more modern version of how they ran the wiring from the condenser to the points' bolt. Anyway works, but I stick to how the engine was originally wired. NOTE the red arrows in the image below. DO NOT remove these bolts! They adjust the timing, and there's no reason to do this (assuming you don't remove those two bolts!) Setting the Timing is a trick on these engines. The CDI engines don't allow you to change the timing, so they're really easy! There is nothing to do, other than the distance between the magnet and the coil, aka the airgap. The official airgap distance is 0.0125, but most people just use a business card, as seen above a few screens. (Although it should be noted that a business card is generally not 0.0125 thick, but it does work as a long feeler meter that is .0125 thick, is pretty hard to find!) On HS40/HS50 points engines, the timing can be set to 0.035 BTDC (for top dead center). My suggestion is this.... Don't mess with it! There is no reason to remove the magneto in the first place (it is held in place with two 1/4-20 bolts.) I hope you didn't delete these. Because adjusting the timing requires a dial indicator and an ohm meter, and some work. To set the timing to a points/capacitor engine, you need to use a dial indicator to find 0.035 for top dead center. Once this is done, the magneto bolts so that the entire magneto frame can be rotated. Using an ohm meter at low ohm (or buzz tone), place the magneto so that the points open (buzz off) at .035 for TDC. Basically you set the points gap at .020, and then adjust the piston to .035 BTDC (for an HS40/HS50). Now set up the magnetoframe (stator plate) to open the dots there (using an ohm meter.) It's just not worth doing unless you removed the magneto - and even if you did, you usually return the magneto and adjust it to the old 'witness marks' of the bolts. That will get you almost perfectly correct. Note that smaller engines like the H30 have a different timing of 0.065 BTDC (except 1983 Tecumseh H30 engines, the last year with points, just to make it confusing!) Tecumseh also made their own dial indicator for adjusting the timing. It screws into the hole of the spark plug. The easiest way to set the timing is to use the Tecumseh dial indicator designed for this purpose. It installs in the spark plug hole. Make sure you use the finger to the piston. Also sometimes the finger has to be bent slightly downwards, so that it does not touch the cylinder wall. Note I really don't recommend tampering with the timing unless the magneto was removed. It takes a good hour of rumbling rumbling get the adjustment just right. That's because when you turn on the two magnetobouts, the value changes. So it's a constant test and re-test until you set it up. The Tecumseh dial indicator foot that hits the piston so that TDC can be measured. Since you have a kill switch wire installed at the points, I also suggest running a hard ground wire with the kill switch wire. Although technically the frame of the engine is grounded throughout the bike, if you have rubber mounted handlebars, that ground may not work. So have a discreet hard ground is recommended. I mount that wire directly to a motor bolt (see photo below.) Then I used a two wire kill switch like the one used on the modern-ish DB30 (these are available on ebay for $5.) Here is the (light blue) point wire and the green hard ground wire. I used this for a kill switch mounted on the handbars. Please also note the new 1/4 fuel line is installed here. An important note ... In the picture above you can see that I hold the bolt that keeps the engine sheild as the ground point. This bolt is a 1/4-20 style bolt, and it's not very long (1/2 long). Do NOT use a longer bolt than 1/2!! I can't stress this enough. If you use a bolt for too long, and can push a hole in the combustion chamber. That would be a bad thing... The DB30 style handlebar mounted kill switch. Although much more 'modern' than a traditional kill switch, it offers much more safety for both the rider and the engine. I don't like the push and hold style killing switches... Having a hard 'on' and 'off' handlebar mounted kill switch is a much better system. After the flywheel is installed, make sure you've done everything right! Don't forget to use a coupling key to turn the flywheel on. A steel flywheel gets 550 inches/pound (or 46 feet/pound), and an alloy flywheel gets 450 inches/pound (or 37 feet/pound). The best way to check your work and check for spark is to remove the spark plug. Leave it plugged in and up to the top of the head (as a ground joint), and quickly turn the flywheel (the flywheel should rotate easily with the spark plug removed.) You should see a little spark over the plug. Having the store lights out helps, but usually you can see the spark in an illuminated room as well. Testing the points/condenser installation with the spark plug removed. Another method is to use a spark testing gadget. This item is available online and connects to the spark plug wire and then to the ground. There is a 240 volt light bulb in the tester, and it will light up if there is indeed spark (obviously you need to turn the flywheel quickly.) Personally, I find using the spark plug method better, because it is more realistic. But this Also. Testing the points/condenser installation with the spark plug removed, using a spark testing gadget. Another easy way to test for spark is with the flywheel attached, but with the blower casing still Convenient to do before you reassemble the blower casing. This requires that the spark plug is also removed. Put an outlet on your drill, put your drill in forward, and twist the crankshaft using the flywheel nut and the drill. Because the plug has been removed, you can easily see if there is spark to the plug. Testing the points/condenser installation with the spark plug removed, using drill and socket on the flywheel nut. If you don't have a spark, you've obviously done something wrong. One thing I do too often is to move the colat that the points installed backwards. If you do the spark will never work (as the magnets on the flywheel will not line up with the points opening.) Remember with the flywheel key at 12 oclock, the points should be fully open. Lighting Coil or Charging Coil Wiring. If your Tecumseh engine originated on a Rupp, MTD, etc style minibike with a headlight, the magneto has what is known as a lighting coil or charging coil. The flywheel is also special, with many more magnets. When the engine is running, it delivers 12 volt AC at 3 amps to the lighting system (headlight, taillight, etc.) These engines are considered special, as putting a snowblower engine on a Rupp Roadster is not going to make the headlight work (if that's important to you, who can't.) It's easy to tell if your engine has a lighting coil. There is a 3 prong plug at the front of the engine that is used for the lights. The lighting coil plug used on Tecumseh engines with the ability to power light (headlight for example.) To use this style plug, it is available from Mouser.com subnumber 829-02973172-B (male pins) and 829-02962683 (female pins). Sorry don't have a part number for the plastic casing... If you're wondering what the wiring is for this plug, as we look at it in the image above, here's the layout (note that ground is just the engine casing): Top lug (green wire) = ignition grounding (kill switch) Left lug (black wire) = light power to headlight Right lug (red wire) = light power to light tail light that in the 1980s changed the wire color on the 3-ng pro plug. Green remained the same, but the two power lines changed to yellow. You check your lighting coil on a running engine. At lower RPM (say 2500) the voltage will be lower (about 8 volts.) But when the engine revs it goes up to a whopping 14 volts. You use a volt meter and check at the plug for ac voltage. Note on larger engines (say 10hp), where there is a battery (and the battery is charged), there will be a diode or bridge rectifier to convert the AC generated by the magneto into GELIJK voltage. But for smaller Tecumseh and 5hp engines this is not the case. As far as headlights go, Rupp for example in 1970-1975 used a sealed hi/lo lamp #4456 (hard to find and about $30). The 1969 Rupp headlight had no hi/lo beam, and used a #4411 sealed lamp (much cheaper, about about and easier to find even at your local car parts store.) Lighting coil that can be added to CDI solidstate ignition engines. But the flip side is that this only delivers 12volt at 350mA. In that plastic cap is a 47mfd capacitor and a 1n4004 diode. This causes a kind of half wave rectification from AC to TSPEN. On CDI (solidstate) engines lamps can also be added. The cheapest way is to get Tecumseh alternator coil #34960. It is a lighting coil that bolts to the side of the existing CDI coil. It's not really that expensive, and it doesn't require another flywheel either. That's the advantage. But the downside is that it only has 350mA of power (compared to 3amps for the points lighting coil version.) Why is that? Because there are no extra magnets on the flywheel. This device is really specially designed for charging a 12 volt battery. But to be honest, it works great (as long as you use an LED headlight.) Lighting coil added to CDI solidstate ignition displayed as a battery charger. The battery can then power a headlight. This would give consistent 12 volts to a headlight. But who wants to use a battery? Not me... Can you power a headlight with 350mA power? Yes, but just an LED headlight (and LED taillight) on your mini bike. Since there is only one magnet delivering this lighting coil, the power will not be as smooth in idling as the points 3amp lighting coil. They use a 47mfd capacitor and 1n4004 diode to try and smooth the power a bit, but the LED headlight will flicker in idling. Using an LED headlight is your only choice, as there is only 350mA power available. But as the engine RPMs increase the flicker disappears. It works really well with an LED headlight. But you need to add a 25 ohm streaming limiting resistance to the LED head light as well. Why is that? Because this device will power more than 12 volts when the RPM's are high, and this will kill an LED light. So using a 25 ohm resistance will prevent the LED headlight from getting over voltage and dying. Lighting coil #34960 and how it fits on an existing CDI coil. Have found the Krator 6 LED headlight to work very well with the Tecumseh #34960 lighting coil. I drill a hole in the top of the headlight dome and put a switch there. Then put the 25 ohm 5 watt resistance in line from a switch lead to the head light plug. I only use the high beam lug of the LED light (ignore dipped beam, really what's the point?) The other lead on the LED plug goes to the ground. Yes when stationary it will flicker a bit. But as soon as you throttle the engine, that problem disappears. This light is incredibly bright with this set-up, no battery is required. When using the lighting coil #34960 probably the best fit is a 6 Krator LED headlight. It works pretty well with this lighting coil. It flickers in idle. I tried a 12 volt voltage controller and it didn't help. But this headlight is. Is. $20 on ebay. A cheap solution if you want a light. But you have to use a 25 ohm resistance inline because more than 12 volts will kill the LED. When using the Krator 6 LED headlight, I want to drill the casing of light and mount a switch. In this way, all operation is right on the light (easier to mount, no steering switch required.) I also mount the 25 ohm resistance in the light. Installing a switch and 25 ohm resistance in the Krator 6 LED bulb. Please note that the blue thread is not used (it is dipped beam). Only the black and red wires are used. Other Lighting Alternator Options. If you have more power than the 350ma cheap #34960 alternator listed above, for about $100 you add a 3amp alternator. But this only works on engines with CDI ignitions (won't work on points/capacitor engines.) The Tecumseh #611104 alternator is available for this. With the flywheel removed, it bolts where a points/condenser magneto unit would go, but it provides power for lighting. The outer magnet for the CDI coil is not used for this purpose. The downside (besides the cost) is that you have to JB Weld three large magnets in the flywheel (or get flywheel Tecumseh #611203, which already has the interior magnets installed). Personally, I find it easier to install alternator #34960 (350ma). But with the 3amp #611104 unit, you use any style headlight. The Tecumseh 611104 alternator 3amps for CDI ignition engines. There is also the Tecumseh #611111 alternator (only CDI ignition engines), which is a shortened version of the 611104 version. It's about $5 and offers 18 watts of power. But you still need to install three large magnets in your flywheel. In this case I think the outside 350ma Tecumseh #34960 is a better choice. The Tecumseh 611111 dynamo 18 watts for CDI ignition engines, and the flywheel magnets needed. Note these magnets are also needed for the 611104 alternator as well. 12. Piston rings and valves (Honey/Bore). Sometimes you have to call an engine again. This is especially true when you're working on a vintage 1970s motorcycle that's original to your vintage 1970s minibike. That is, a high use motor. If your HS40 or HS50 engine needs new rings, this section should help with that installation. How do you know you need new rings? With the spark plug installed, how does the pull (with the pull starter)? Do you feel compression? You also use a compression controller. But if the engine has a compression release (some do), this test won't work. Most HS40 and HS50 engines have a BCR (bump compression release). But you still get an idea about compression by just pulling the starting cord.. However, the later HSSK50 engines have a more severe compression which helps start the engine. If that's the case, the slow pull start test won't tell you much. If the engine starts and oil burns, chances are you'll have a Problem. You also pull the head and just look at the cylinder bore. If it's slippery, that's good. If you see the cross-hatch pattern, that's even better! Many snow blower engines will be used very limited. If you see cross-hatches on the cylinder bore, you have a very light use engine. That's a big thing! You also test the piston wobble, as seen in the video below. Short film control of the cylinder of an HS50/HSSK50 engine for wear. If you have no history with the engine (i.e. you have never seen it run), and you remove the piston, and remove the upper most ring, you measure the height of the upper most piston ring in the cylinder. This will tell you if there is ring wear, and if you need a new set of rings. Of course, you need to remove the side valve, the cam and the two screws that hold the lower cap to the drive rod (1/4 socket needed.) Then you can push the piston out of the top of the cylinder. If for some reason you don't push the piston out of the top of the cylinder, you have a bigger problem. That engine is worn out, and you have a ridge ring around the top edge of the cylinder. Hopefully this is not the case, as this would indicate a really worn cylinder. And short of boring it to .020 over, this block will probably be out of use. Measuring the upper ring gap. This feeler meter only goes to 0.035, and there's probably still twice the gap! This engine really needs new rings. And probably should get bored to use a .010 or .020 about piston size. When your thick ring Tecumseh engine was new, the ring hole was 0.007 to 0.010. The working specs are 0.007 to 0.017 ring gap on thick ring pistons. With a thin ring piston (after 1992) this work gap is 0.010 to .020 (with it at .010 when it was new.) Basically if you're above .020 ring gap (both engine type), it's probably time for new rings (both engine type). In the photo above, the feeler meter only goes to 0.035, and the ring gap is clearly twice that (if not more.) I would say that this engine needs new rings (or maybe an oversized piston as well.) Because a cylinder wears more at the top and middle of the stroke than the bottom, it is better to use a ring gap of 0.010 on thick ring pistons. Trying to get it to 0.007 is not a good idea (unless you've just bored the cylinder again and tightened it.) Because if the ring goes down the cylinder, it will tighten the gap. If the gap crashes, you will be in a world of pain! And that can happen on a used cylinder. So better to mistake on the side of caution. Also when checking ring hole on a used cylinder, you really need to do this in the middle of the cylinder bore (I usually go down an inch so). Why? Because the center of the cylinder carries more than the bottom or top. You might have a .010 ring hole on the top/middle of the cylinder, but a .005 ring hole at the bottom. This will cause a problem! The engine will be cold, but if it warms up in a few minutes, it will grab soft and stop walking. So you need to check the ring hole at the bottom of the cylinder as well, to make sure it's not too tight. Same cylinder, but with a new .020-over ring installed. From this you can see that the cylinder is not big enough for an oversized piston. That's a good thing, which means we can carry the cylinder to fit an oversized piston, if desired. Same cylinder, after honing, but with a new .010-over ring installed. You can see that the gap is almost enough to bring the ring together. But not quite! Here's a brand new Tecumseh H35 short block (with thick rings.) This engine has never been performed before! Check the ring gap... it measures about 0.010. That's brand new, from the factory. This should give you some perspective on ring gap. This HS50 engine had a soft seize. This happened because the new rings were gapped to 0.007 at the top of the cylinder, but not checked on the *bottom* of the cylinder. The ring gap there was about 0.005... As the engine became hot, the extension of the rings tightened the ring gap, and grabbed the engine. Let the engine cool down, and it would start right back up (for 5 minutes.) Had to re-grind the cylinder and widen the ring gap, and now the engine works fine. Let's say you don't want to oversized the cyliner. It's understandable, you need a machine shop that does that job (it costs money.) There is another way to treat this, and that is to use oversized rings, and grind one end of the ring to get a .010 gap. While probably not the best approach, it solves a problem. It's the cheap way to re-ring an engine that should probably get bored. Use the standard piston, and modified oversized rings. This works! Egg-shaped cylinder and boring. The way these aluminum bores wear is egg-shaped. That is, the top and bottom of the cylinder remain free around. But the middle area is uneven. There's only one way to fix that, and it's to overcharge the cylinder. You don't tighten a round cylinder. You *will* make it worse, not better, trying to tighten it up to oversized. For example, I had a really worn HSSK50 engine (see video above.) I could almost drop an over-size .010 piston into the cylinder. For fun, I tightened the cylinder to accept the .010 over piston. This took a decent running engine (with lots of oil burning, but it ran!) to a completely non-running engine. If you decide to carry a cylinder, you need an oversized piston. A machine shop should be able to do this on a Bridgeport Mill for you. Costs are usually about $40 to $50. Make sure you give them the specs and the new piston. make cylinder boring. If a cylinder is really worn and egg-shaped, this is the only way to fix it. If the engine you're boring is a newer HSSK50 or a 1990s HS50 with the thin ring piston and smaller outlet, there's a way to make an over-sized piston easy (sometimes over-sized are hard to find.) When Tecumseh went to the small flap (about 1995) and thin-ring piston (formerly approximately 1992) on the HS50/HSSK50, they reduced the drilling size from 2,812 to 2,795. This means you can #33562 an old stock size HS50 thick ring piston, and get almost .020 over on the newer format HS50/HSSK50 engines. It's cheating, but this works if you don't find a good over-sized piston! Tighten the cylinder. Before installing new rings (or some kind), tighten the cylinder. It wants a cross-hatch pattern for the new rings to sit correctly. It will also remove slight wear or scratches in the cylinder. Honey is not boring though! This means that honing (at most) will remove 0.0005 to 0.0020 from material. It is not boring where a lot of material (.010 or .020) is removed. The goal is to get that cross hatch pattern, and possibly clean up some light cylinder wall scratches. It will not remove any serious problems. In fact, if your cylinder is out round, honey will make it worse (not better.) But honing helps the new rings chair work better and better. Boring will make your cylinder perfectly around again - honing doesn't do this. If a cylinder carries, it tends to be out-of-round (egg shape). Especially in the middle of the bore, that's where you wear the most. Only boring can return a cylinder to perfect around. Remember, the whole idea behind honing is to remove small scratches and to get that cross hatch pattern. In fact, after a cylinder is bored, it needs to be tightened before installing the new oversized piston. Honing the cylinder to get a cross-hatch pattern. This is highly recommended when installing new rings. There are actually two different styles of grinding: the 3-stone type, and the flexhone ball type. In the image above, the ball type is used. The flexhone type is a little easier to use (as it can be used in a hand drill, where the 3-stone type should be used in a drill press.) But either style is fine, just a 320 or 400 grit variety (with 400 grit being ideal). I've found the ball type grinding to be more aggressive than the 3-stone type. It also just seems to work better and is easier. For this reason I use the flexhone ball type. Remember grinding come in different diameters (and grits) as well. I use a 2 3/4 Flexhone because it works with an HS40 (2 5/8) and HS50 (2,812). Remember that you have to use some kind of oil when honing. Automatic transmission fluid works really well for this. After honing the cylinder you get a cross-hatch pattern. Now the new rings will be well in their new engine. You have some small scratches in the cylinder, which were too deep for the grinding stone to How many honings do you do? Don't spend a lot of time on this, that's not the issue. When using the bead style grinding, I usually up and down the cylinder wall for about 10 to 20 seconds. Then wipe the cylinder and and the crotch come out and the scratches. Don't go too wild! Remember that you're honing, not boring! After doing the honing, you need to clean the cylinder really well. The aluminum that's left behind is like sandpaper. It needs to be cleaned. The correct way is to put the cylinder in a soapy water (countertop). Then wipe the cylinder with a white cloth. Every gray on the canvas, and you have to keep cleaning that cylinder. No gray on the canvas, and you have it clean! Wipe the sharpened cylinder. Most people who do this work recommend washing the entire block in soapy water to remove the aluminum dust from the grinding stone. Wiping the cylinder with a white cloth will tell you if you have been successful. There should be no grey on the canvas if you've done a good job. In the photo below, there is still some work to do... Installing the new rings. Getting the old rings out of the existing piston is easy. Brute force works fine, you throw them away anyway. But getting the new one on is much harder. Because you can easily break a new ring! The best way to do this is to use a piston ring expander tool. You do it without this tool, but it is not recommended. Instead of using oil for assembly lubricant, you buy assembly grinder. It's designed for this, and probably a good idea, but definitely optional. You have to use something. Some people just use oil, some use fat. Assembly lubricant is kind of between the two. The lower ring is the oil ring. I'll do it first. Often it has a spring metal expander that goes for the ring. That's easy to put on. But I install the oil ring itself from the bottom of the piston. Slowly walk it up the piston skirt, until you hit the bottom most ringing set. Tecumseh forms #690770 which explains the positioning of the thick style rings on the piston. Another ring card. Style #1 is the most common, but sometimes you see Tecumseh rings made in Style #2, with an added spring steel expander ring behind the middle and lower ring. Yet another ring chart. This is basically the same as seen in the chart #2 above. The middle ring I put on from the top. Again it's slowly running. Then do the same with the top ring. Also note that there is a top and bottom to the new rings. Usually there is a form #690770 in the ringbox that explains position (it can vary from set to set.) For old school thick rings, the picture above shows the position of the corners on the upper and middle rings. Ring Gap Positions. The position of the ring gap is really important. Basically you want the ring holes to be spread 120 degrees away from each other. But there are some other things to consider. Put first a ring hole next to the values. Also, never put a ring hole over the wrist pin. So that kind of leaves you with a certain position that works! Also, many pistons have an arrow on the top of the piston. This must be done focused on the values. The blue circle in the photo shows the arrow on the piston, which should point to the valves. Here's where the ring gaps should go on these motors (positioning the ring gaps about 120 degrees apart.) Do not place the holes directly next to the values or place the holes directly over the wrist pin. Now to slide the piston and new rings into the cylinder, you need a ring compressor. You probably do it without it, but it's not worth the risk (of breaking a ring.) Just buy one. Place oil on the cylinder wall and on the wall of the ring compressor. Tighten the ring compressor as tightly as possible and place the piston in the cylinder (from the top.) Then using the wooden handle of a hammer, you beat the piston into the cylinder. Get the piston and new rings in the cylinder using a ring compressor. Using a hammer wooden handle as leverage. 13. Cams, Valve Lapping, Valve Springs. The cam used on HS40 and HS50 engines are the same. They're not high performance. However, you get high performance cams. But they usually effect higher RPM's. If you're going this route, you'll need an ARC billet #6282 drive bar, because all high performance cams add RPMs! Keep that in mind. If you don't use a better driving rod, you'll throw the rod and probably ruin your engine. Dynocams.com in Delco, North Carolina offers a 245, 255, and a 356 cam for the Tecumseh engines. They are specified for the HSSK50 engines, but work in an HS40 or HS50 engine. To get these cams you need to give them a core and some money, and they will grind the cam desired. Here's the specs on the cams: Stock Tecumseh HS40/HS50 cam lobe lift: 0.975 Dynocam 245 HS40/HS50 cam lobe lift: 1,050. Kicks in at 3000 rpm. Dynocam 255 HS40/HS50 cam lobe lift: 1,060. Kicks in at 3500 rpm. Dynocam 356 HS40/HS50 cam lobe lift: 1,150. Kicks in at 5000 rpm. The Dynocam 245 is a nice cam. It is almost identical to the 94-SS Briggs & Stratton flathead gravel which has been the most popular DynoCam flathead cam for years. The 245 doesn't seem really very different from the stock cam, except that it allows the engine to accelerate noticeably faster. Also, it will allow for higher RPMs (although probably not much more than 5000 RPMs, which is a bit more than the stock Tecumseh 3600 RPMs). You can also use the existing valve springs and holders with this ridge (they suggest not using stronger springs because this ridge is not welded or heat is treated.) Pull start doesn't seem any harder with this cam. It's a nice all around cam that gives a little more performance. The Dynocam 255 is just a little more aggressive than the 245, it's also a nice cam. The 255 is very close to the Predator/Honda clone mod2 cam with a little more lift. It's probably the sweet spot in the Dynocam More performance than the mild 245, 245, be crazy. Again you use the stock springs, although a slightly more aggressive spring would be better. Because this cam will provide higher RPMs (probably in the 6000 range.) Here's a stock cam versus the Dynocam 356. There is a lot of lift added on this cam! The Dynocam 356 is a beast. It has much higher lobes, and will probably suffer your low-end. But you get to 8000+ RPM with this cam! It is a welded and heat-treated ridge, which means that you need to use stiffer valve springs (or the valves will float at higher RPM.) You also need a ball bearing crank side cover as well. I don't recommend this cam unless you're a racer. (And if you're a racer, you probably won't read this document anyway.) Also the valve lift is so high I seriously doubt this cam would even work with a stock head (the valves would hit the head.) Here's the Dynocam 245 versus the Dynocam 356. When using a Dynocam 245 or 255, carb jetting should be maintained. That is, a higher performance cam generally doesn't change carb jetting. Keep that in mind. Dynocam spec sheets. There is another company that does cam grinding for small engines called Small Engine Cams (Gardena CA). You contact them for a higher performance cam as well. Here's the outlet on an HS40 engine with a stock cam. The elevator seems to be about .245. Note on LH195 engines, valve lift is about .275 (that's how they get 5.5hp off an HSSK50 engine). Here's the outlet on an LH195 engine with a stock cam. The elevator seems to be about 0.280. This is more lift than a stock HS40/HS50 cam, and probably how Tecumseh claims it's 5.5hp. Here's the outlet on an HS40 engine with a Dynocam 245. The elevator seems to be about 0.300. This is considerably more lift than a stock HS40/HS50 cam. All that aside, a stock cam needs to be checked. Usually the problems I've seen are on the newer HS40/HS50/HSSK50 engines. Tecumseh added a slight bump to the exhaust lobe on these cams, known as the bump compression release (BCR). The bump is almost against the exhaust cam lobe. This bump takes effect on the compression stroke, as a compression release, to make starting easier. Check your engine for this! It's easy to control. Just remove the head and turn the engine over by hand. Look at the compression stroke, from the bottom of the stroke to about 1/2 the way up. If you see the outlet bump just a little bit (probably about 0.010), you have one of these cams. My suggestion is to change this cam to remove the bump. Otherwise, your compression will be reduced quite a bit, compared to a non-release engine. It's actually pretty easy to do. With the cam removed, you can feel the bump (on the side of the lobe). I use a belt and gently grind the bump from the side of the exhaust lobe on these cams. Then install and check the outlet again (to make sure that there are compression bump on the outlet.) Cam of an HSSK50 that had a BCR compression release on the exhaust nob lobe. In this photo I sanded out the compression release bump. Here is a stock cam with the BCR compression release on the exhaust lobe (blue circle). Why did Tecumseh add this compression killer? Well it makes the engines start a lot easier (there's almost no compression kick when pulling start.) But unfortunately, there is no way to disable this compression release. Some early HS40 cams had a mechanical release. This is nice, because when the engine starts, the release shuts off, so you get full compression as soon as the engine starts. But with this new style BCR cam, the compression release is always present. It shows the performance of these engines. It's a nice thing for a snow blower, but it sucks for a minibike! Cam of an LH195 that had a mechanical compression release (MCR) on the inlet nob lobe. This compression release is fine... As soon as the engine is inactive, it swings out of the way. Cam of an early HS40 engines (approximately 1968-1971) with a mechanical compression version (MCR). Note the one lifter for the inlet is shorter than the exhaust lifter. That's because the intake cam lobe is huge, to adjust the mechanical compression release. Some LH195 engines have a plastic cam (left)! You obviously don't want to. On early HS40 engines there is sometimes a mechanical compression release. In this case, the lifter used for the intake valve is shorter than the exhaust lifter. The shorter lifter is 1,318 long, compared to 1,478 for the exhaust lifter. The longer 1,478 lifter is the standard lifter used on non-MCR liftcams on HS40 and HS50 engines. They use a shorter lifter because the intake lobe on the MCR cam is huge, to accommodate the MCR. If you install a Dynocam or even a regular HS40/HS50 cam, you should replace the short lifter with the 'normal' length (1,478) lifter. Note the LH195 engine the valve lifters are another length at 1,445 high. Valve Springs. If you have a larger ridge, stronger valve feathers would be helpful. Above say 5000 rpm, the stock feathers will 'float the valves' because they can't kick the valves back fast enough at the higher revs. Most people use a stronger valve spring to solve this problem. The downside of this is that it puts more wear on the cam lobes. Basically you don't want to go nuts with too strong of feathers! If you use a Dynocam 245 most racers recommend an 18 pound spring. This prevents valve raffle at 5000+ rpm. Dynocam also doesn't want you to go crazy with spring tension, because their 245 cam (they say) doesn't have the wear properties to handle large springs. Rummaging around the interweb, I've discovered that most kart racers use briggs cam feathers on the That's because no one makes a replacement spring specifically for the Tecumseh flat To solve the potential floating valve problem when using a larger ridge, the next thing is available. These can potentially work in a Tecumseh HS series of engines: Comp Cams GP971 spring (Briggs Animal). Estimated at 17 pounds. Dynocam DCS-AN feather (Briggs Animal). Estimated at 18 pounds. For use with their Briggs AN001 cam. Dynocam DCS1360 spring (Briggs flathead springs). Estimated at 16 pounds. Dynocam DCS1420 spring (Briggs flathead springs). Estimated at 18 pounds. Here's the Tecumseh HS40/HS50 valve springs specs we need to emulate: length uncompressed: 1,100 length compressed (using a vice): .48 00 outside diameter : .820 inner diameter: .625 wire thickness: .085 Here are the 18 lb brigg animal springs specs (DCS-AN or GP917), which is an OHV engine, and have the following specs: length uncompressed .910 length compressed (using a vice): .465 outer diameter: .835 inner diameter: .620 wire thickness: .100 And finally here are the Brigg flathead 18 pound feather specs (DCS1420). These are definitely too long. Here's the specs: length uncompressed 1,475 outside diameter: .810 inner diameter: .625 wire thickness: .085 I play around with the feathers. One answer may be to take the 18lb Briggs flathead spring and cut it to the right length. Not ideal, but it can be the simplest answer. Comparison of feathers. The leftmost is a Briggs 18 pound flat head feather. Tecumseh stock HS spring is next door. The two springs on the right are the Briggs Animal 18 pound spring, with and without the aluminum DCSH102 retainer. The above Briggs Animal sources appear to be about 0.200 shorter in length than the stock tecumseh feathers. But if you convert to Dynocam aluminum billet retainers (which are thicker), the spring length is slightly built up (the holder is about 0.100 thick). Here are the parts that are often used: With the above holders and keepers you still need to stock Tecumseh hs50 upper spring retainers #27882. The Dynocam DCSH102 lower retainer and DCSH103 keepers will need some editing to work on the Tecumseh valves. That's because those aluminum lower holders are actually for double feathers. The inner riser should be edited from the retainer so that the spring sits equal to the outer riser (lip). Left: Animal 18 pound spring DCS-AN or GP917 with the aluminum DCSH102 lower retainer. The step (blue arrow) must be removed on a lathe. Right: Animal 18 pound spring with the aluminum DCSH102 lower holder modified on a lathe to remove the step. The DCSH103 split retainers are also there. Also shown is an original Tecumseh stamped steel lower holder. Here is the modified DCSH102 lower retainer and the split keepers DCSH103 installed on a Tecumseh valve. Also shown is the original stamped steel lower veer retainer. Here's a stock Tecumseh valve feather (left) and a Briggs flathead £18 feather, which the same length as the Tecumseh spring. This setup would give a stiffer spring and can be used with Tecumseh's stock lower and upper retainers. The Valves are lapping. If you already have the engine apart, I would strongly suggest lapping the valves. Basically this requires some valve patching connection (cheap), and a wood rag stick. This pairs the valves to the valve seat, and will help increase compression. It only takes a little bit of time to do this, and costs almost nothing. It's a good idea to do. To patch the valves you need some valve folding compound and a patchwork extension (basically a wood rod with a suction cup.) I used the Permatex 80036 valve grinding compound. You buy a kit with the compound and tool for about $10 on ebay. To do this, you need to remove the valves. This is pretty simple. You do this with the side valve (and all parts like the cam/lifters) installed, or with the side valve off. Frankly, it's easier to round the valves with the side valve off and the valve lifters removed. But honestly, it's only a little harder with the side valve and all the parts installed. One advantage to do this with the side valve installed is that you measure the valve lash. With the side valve off, you don't get an accurate valve lash measurement. For this reason usually round the valves with the engine fully mounted, only removing the head and valve breather. Remove the side valve #31337 and it is gasket #31619. Two 5/16 machine screws hold it in place. With it removed, the valve feathers and retainer clips are visible. It is easiest to do this with the valve lifters removed (meaning the side sump lid is removed, and the cam removed.) But it is not quite necessary to have the hitchhiker removed (just easier.) The spring retainer clips are notched. Just the holder of their center, and this releases the valve spring. I use a flat head screwdriver to do this, lifting the holder if you push it sideways a bit. This should release the retainer - it's really pretty simple. Then the valve can be lifted out. With the valves removed, you clean the valves and the gates. The use of a Dremel wire brush works just fine for this. You also put the valves yourself on the wire wheel and get all the carbon and other clutter out. Clearing the valve area and the gates with a Dremel. Cleaning up the valves on a wire wheel. Next thing is optional. If the valve chair is still crispy, use some emery cloth and clean them further. Simply punch the valve through the emery cloth and use the valve to help clean the chair. Cleaning the valve chair with emery cloth. I do this when the chairs are really dirty. Now is the time to turn the valves. a thin layer of valve folding joint on the valve seat. Then insert the valve and attach the suction cup tool to the top of the valve. Then you use the tool between hands to patch the valve. Pull the valve after a few seconds, and repeat. This should give a nice round of the valve to their seat. Applying patches of connection to the valve. Lapping the valve on the chair using the rags suction tool. How to look at the valve and seat after a sucessful patch. With the valves flipped, now comes the time to reinstall them with the valve springs. This is also easier with the valve lifters removed. If you don't have a spring compression tool, use nylon bands to compress the valve springs. Once this is done, it is easy to put the top cap, the spring, and the lower holder on the valve. Once in position, simply cut the nylon straps and pull out the nylon straps with pliers. Alternatively, Briggs and Stratton sells a nice valve spring compression tool #19063 that works really well. Use nylon bands to compress the valve springs for easy installation. The Briggs and Stratton valve compression tool #19063, if you want to fancy it. The valve parts. Note some engines (HS50), the exhaust top spring holder is different from the inlet spring top retainer. This is important! Don't get them mixed up. The exhaust spring top retainer has a larger hole because the outlet seat extends into the valve spring area (see next photo.) Exhaust chair on some engines (HS50) extends downwards. Therefore, the upper spring holder has a larger hole for the extended exhaust seat of HS50 engines. After the valve spring and top and bottom retainers are installed, cut the nylon straps and pull them out with pliers. (This is an HS40 engine, and notice the exhaust seat does not extend in the spring.) With the valve springs and holders installed, the lifters and cam can be reinstalled (assuming you remove them to lap the valves.) I would add that on some HS50 and HSSK50 and LH195 engines (basically 1990s and newer Tecumseh flathead 5hp engines), there is *no* top spring retainer! For some reason, they removed these from these designs. I don't really like this, as the spring could carry over the top of the valve area (in the aluminum.) It also reduces the spring tension on the valves. This allows me to install HS50 top spring retainers. This helps the center of the valve spring, reduces wear, and increases valve spring tension slightly. It's a good idea to add them! Question: do you remove the valve springs and install the valves with the side case in place, and the cam shaft and lifters? Answer: Yes, you can, using the nylon tie technique. It might be a little harder th is way, but no big deal. And besides, with the side valve installed, you measure the valve lash. With the side valve off, you don't get an accurate valve lash measurement. I'm checking the valve lash. I appreciate people who want to do this, honestly, since there is no easy way to adjust the valve lash, it's a little pointless. The kleplash should be (use a feeler meter) with the piston on top dead center. And you only measure it when the side case is installed and bolted into place. Otherwise, the end of the cam dips and gives a false valve eyelash reading. Checking the valve lash with a sensor meter. With the piston at the top dead center, the hole should be 0.006 weeping the bottom of the valves and the top of the lifters. If you have more than 0.006 in gap between the end of the valves and the top of the lifters, the only thing to do is to buy new valves (and hope the cam is not the wear spot!) But before you go nuts with new valves or welding/grinding, try switching the two valve lifters. Although technically they are identical (most of the time, some engines with compression release cams they are different). This can sometimes solve a cam lash problem. You could weld TIG the end of the valve, and grind it down to get the right eyelash. That would be a different technique. I had a particularly worn HSSK50 engine where there was almost 0.015 valve lash. Yes, there were also other problems (such as slightly worn valve guides), but thought I could easily address the valve lash problem. Used a TIG welded and just welded a dab at the end of the valve. Then using a belt sander, turned the valve as the end of the welded ridge turned. While it doesn't necessarily give you a perfect perpendicular cut, it gets pretty close. The end of this valve was welded. After the welded valve end is roughly sanded, put it in the engine and check the eyelash. You don't need to install the spring to do this. Hopefully the whip is too little... get to about 0.004 or 0.005 of an inch, then install the spring and spring keeper. At this point take a small metal file. Lift the valve with a screwdriver and place the file between the valve end and the lifter. Then make some tax returns. You want to take that last .001 or .002 with the file. This will ensure that the end of the valve is nicely perpendicular to the hitchhiker. Using a file to take off the last bit on the welded valve. Port and Polishing the valves. Remember an engine is actually a mover of gases. So technically, the easier gases in and out of the cylinder, the better performance. For this reason some people port and polish the valve area. Personally, I don't do this because my belief is that there is minimal to no increase in performance from doing so on a Tecumseh HS40 or HS50 engine. Some may disagree, but I don't think the juice is worth it. And if done wrong you ruin an engine block. That said, because where I work on engines has a Dremel mill a foot away, I do number of very mild porting. On the intake and exhaust ports I round the sharp edges of the original block with a Dremel and a grinding wheel. It's only going to take a minute. But don't go crazy! Like I said, it's easy to go too far. The shiny parts can be seen in the photo below I used a dremel to take off the sharp edges of the inlet and exhaust ports on an HS50. Here is the top view of the ports. Again shiny parts are where I hit it with the Dremel. Some people even go further and shave the eyebrows. There is a video of someone doing this on a Brigg 5hp on youtube. I really don't recommend this, because it's just too easy to ruin a block. Also on a Tecumseh the valve area is very close to the cylinder, so the advantage of this action on a Tecumseh is minimal at best. What about polishing the valve area? On the intake side, you really don't want to polish the valve area. Only on the exhaust port can a smooth finish help. But again, on a Tecumseh, the end (minimal) result does not justify the work. 14. The crankshaft. The standard minibike crankshaft PTO diameter is 3/4 of an inch. With 3/4, you have the most versatility of clutch and torque converter option. But many HS50 snowblower engines have 1 diameter PTO axles. With a 1 PTO, the choice of couplings is not only more limited, but also more expensive. For this reason I always use a 3/4 PTO axle. But with this in mind, don't discount an otherwise good HS50 engine with a 1 PTO! There are a few ways to deal with this. Either just stay with the 1 PTO, or convert. If you're on Ebay, you'll find used crankshafts for sale. Make sure you get the right one, and that the bearing magazines are not worn (easy to see visually). Also between the horsepower the cranks are not inter-changeable. That is, you don't use HS40 crank in an HS50 engine. Finally, your existing flywheel taper should pair to the crankshaft taper. Just look at the flywheel nut size to make this determination. If it uses a 5/8 socket for the nut, that's the smaller and older style crank with points and condenser. They stopped using the smaller nut crankshaft at the end of 1980/early 1981. If it uses a 3/4 socket, that's the newer style crank with another flywheel taper. Some points engines made true with the newer crank taper and larger nut in 1981/1982. Certainly all CDI electronic ignition crankshaft have the larger flywheel nut and the larger flywheel/crank taper (since CDI was created in 1983). The point is that you don't mix the flywheel/crank taper - they have to match. HS50/HSSK50 crankshaft 3/4 PTO new style taper (CDI): #34740 HS50 crankshaft 3/4 PTO old style taper (points): #33677 or #34728 HS50 crankshaft 3/4 PTO old style taper (points) ball bearing case: #33837 (1972-1974, has 3 PTO) HS50 crankshaft 3/4 PTO old style taper (points) ball bearing case: #33676 (1972-1980, has 2.3 PTO, replaced #33837) HS40 crankshaft 3/4 PTO new style taper (CDI): #34734 HS40 crankshaft 3/4 PTO old style taper (points): #32877 HS40 crankshaft 3/4 long, old style taper (points), ball bearing: #33080 (Rupp style) A pair of 1 crank and a formerly 1 crank that was rotated 3/4 and the 3/16 keyway milled back into the PTO. There's another option too, and that's to put your existing 1 PTO crankshaft in a lathe, and put it down to 3/4. After you've done that, you'll also need to mill a 3/16 keyway in the crankshaft. Of course this is work for someone with a lathe and a mill. In general, it's just easier to buy a new crankshaft from ebay. But I do this lathe/mill work, and find it quite satisfying. Ready to cut a 1 PTO shaft to 3/4 on a lathe. The distance from the cam acceleration to the beginning of the 3/4 cut is usually about 1,250. But I've seen 1,200 to 1,300 as well. I write a line on the crankshaft to remove the side valve to give a reference line. One advantage of cutting a 1 PTO to 3/4 is that you end up with a longer PTO. The stock Tecumseh 3/4 PTO is usually 2.25 long. But most 1 PPOs are 3 (or close to it.) That's a nice thing to have when you're running a torque converter. A crankshaft that bar diary that was melted with aluminum from the rod. This aluminum can be removed with muriatic acid. If the crankshaft was used in an over-rev'ed engine, there may be some aluminum on one of the three crankshaft magazines. You don't want to sand the aluminum. Instead use muriatic acid, which will basically melt the aluminum, and leave the steel diary intact. Just use a small brush to apply the acid, wait a few minutes, and it should wipe. This may require a few attempts. After all the aluminum is removed, you size the diary with a dial calipher, to make sure it's still in-spec. Any scratches can be removed with very fine sandpaper (such as 1500 or 2000 grit.) Not about sand, because you formed the diary egg. Also, if the diary has aluminum on it, there is a good chance that it is just worn or scratched over use. There are a number of machine shops that will re-weld the diary (to reset the worn material), and then again cut the diary to the correct size. That's expensive, but some store can do this. Usually it's just easier to get a new crank. Note some motors will have a thin ring between the end of the crankshaft and the side lid. This was put there to reduce the amount of endgame on the crankshaft. Not all engines will have this washing machine installed. If it's there, make sure you reinstall it. Tecumseh put it there for a reason! The crankshaft washing machine, used on some Tecumseh engines. The factory installed that to reduce endgame on the crankshaft. 15. Flywheels and Blower Enclosures (Torque Wench Numbers too). Many guys want to recreate the Tecumseh look of thie 1970s minibikes, and really want to go extra mile to do this. One of the complaints of using a snow blower engine is the appearance of the blower casing. Tecumseh H30 and H35 and even 1968 to about 1972/1973 HS40 engines have a more rounded blower casing. Where all HS50 (introduced about about has a more square blower casing, just like 1973 and later HS40 engines. It's a subtle difference, but many hardcore minibike guys can spot the newer square style blower enclosure of 50 feet. (Heck some guys can even spot the 1968 HS40 blower enclosure with no line under the three head bolt attachments, and no starter mount pouring on the front of the case!) Left: HS40 pre-1973 rounded blower enclosure. Right: more square 1973 and later HS40 homes. I think the question is ... you need an H30 or H35 or HS40 old round blower housing and put it on an HS50 engine (that had the larger square casing)? You could do this, but it would require replacing the flywheel with a more compact alloy version (HS40 #32517). It works (that's the engine running), but honestly I'm still testing the concept – I don't know the long-term problems that can arise. Such as the durability of the flywheel on an HS50 and if the round blower housing can keep the HS50 cool enough. Also remember the starting cup will also need to be replaced by the thinner #590416. Another look at the rounded blower casing verses the more square HS50 enclosure. On the rounded

blower casing, note the starter mech nut is at 12 oclock, which means this casing is better for a flat engine assembly. The square blower casing is better for a 20 degree engine mount. Two round blower enclosures. The black (left) is earlier in 1968. The white (right) is a 1970 version. See the difference? The 1970 version has a pressed ridge at the top, where it bolts to the head. Also check the positions of the starter mech notes. These two blower enclosures are better for 20 degree mount motors. Two different square HS50 blower enclosures. The one on the left is a C series points and condenser blower casing. Note the elevated area around the 4 leg pull start. The one on the right is an F series CDI blower enclosure. Note the area around the 4 leg pull start is not raised. This better adapted the CDI coil. But the blower casing on the left looks a lot cooler. With some fiddling, the left blower will fit on a CDI engine without any modifications. The CDI coil is close to the blower casing metal, but it does fit. Cooling is probably not as good at the top of the cylinder however. Now to discuss flywheels. We hit the stats. Later, the Tecumseh HS50 flywheel was made from aluminum. Did they bring any extra performance? ... The aluminum flywheel (part #611080) for flat head engines and the later HS40 engines ... Flywheels work great to maintain momentum, but because they weigh a lot, they don't let an engine rev quickly. For minibikes, speeding is probably better than maintaining momentum. For this reason, stock HS40 minibike engines before 1975 always have an alloy flywheel (usually the #32517 alloy flywheel, as used by say Rupp.) On minibike H30 engines (they used a Alloy flywheel #31332 (does not fit on HS40 or HS50 engines because the crankshaft is taper is different)...

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