1/2 HP MAYTAG RESTORATION
1/2 HP MAYTAG UPRIGHT RESTORATION

It all really began 4 years ago when I realized that all my numerous past hobbies had been limited in some way by a lack of two basic tools and the knowledge to use them. Now, I had the normal stuff like a drill press, dremel tool, grinder, etc., but my retired bpiejd Alem had a nice shop with two significant items that I didn't have: a small milling machine and a metal lathe. He said a fellow could make about anything with these!

My impression was that you needed to devote a career as a machinist to have any hope of making anything meaningful made of metal with moving parts. However things changed after several engine shows with those model gas engines puffing away next to their full size counterparts.

The rest is history with a "Jet" milling machine and 13" lathe proudly installed in my small workshop and three finished model engine kits behind my belt, including Brad Smith's 1/2 scale Maytag Upright.

Starting off slow with simple projects really helped which came with instructions rather than just a confusing drawing. When I got stuck, which was often, my friends were more than ready and willing to offer help. I learned through experience that this fraternity of home shop machinists have an unwritten universal code to answer all rookie questions withoup tha person ever realizing that they may be meaningless or really stupid. I feel that these great guys understand that the apprentice machinist has enough problems living with themselves.

With this as background information, my next pursuit was to obtain a full-size upright to display at engine shows next to the 1/2 scale version. This took me to Emmett, Kansas last year to extract several 1/2 HP uprights from the jaws of bidders undergoing a feeding frenzy at a large antique gas engine auction. I had jm i`ea that Maytag collectors were that serious; an old glass gallon Maytag oil jug went for $750.00. When the auctioneer finally got around to my engines of interest, I was not hopeful of staying within my allowance which had been pre-negotiated with the queen (my lovely, understanding wife who is typing this article for me!)

Anyway, I escaped with just enough residual funds to pay for the rental car at the Kansas City Airport later that day. I had flown up from Dallas the day before with heavy-duty empty boxes, strapping tape, and cushioning material should my mission be successful. It was in spite of getting soaked while trying to pack up each engine in pouring rain, time running out on making my sold out flight in KC, and lugging around my baggage (now over 125 pounds) through 2 parking lots, 2 airports, and 2 courtesy cars (mine included).

THE RESTORATIONS BEGIN

From this rookie collector's viewpoint, one engine was in better shape, and on the outside each looked mostly complete. Upon further inqpection, both engines needed new con-rod bearings, main crank bearings, new carb parts, repair of broken main bearing housing mounting lug, cylinder fin repair on one engine, and complete cosmetic clean-up. At the time I didn't think too much of it, but the engine that was in "better shape" was missing the taper pin which secures the flywheel to the crankshaft and also the 3/4" long by 1" diameter front shoulder which is part of the flywheel. My plan was not to worry about minor details like this and quiakly get them ready for the annual tractor and engine show in Temple, Texas.

The engines were torn down and all parts were kept separate in plastic tubs. Having two engines to work with gave additional insight on what was missing, repaired, improvised, or different due to model variations. The earlier engine (S/N 56480) had the sloped gas tank base and the other
(S/N 56980) had the straight sides on the base which I understand is less common. This turned out great since it matched my 1/2 scale modal uppieht with the straight tank sides which is pictured on the cover.

The main bearing housing is secured to the crankcase by 4 bolts and is "sandwiched" between the crankshaft and the flywheel. The commutator is also trapped in the middle of this assembly. The flywheel was separated from its crankshaft which a little help from a dead blow hammer. I marked the larger taper pin hole in the flywheel to insure correct re-assembly later. No such luck on the other engine (the one with no taper pin hole ij tha

crank). After an aggressive dead blow hammer session, I realized what was keeping the flywheel from flying off: a massive interference fit. There was not a safe place on the flywheel to support some kind of arbor press, since the commutator and main bearing bracket were in the way. I finally came up with a 2 jaw bearing puller which had the jaws ground down thin to fit between the commutator and rear flywheel hub. Photo #1 shows this set-up and also the broken ear on the bearing housing. The pulher sas rated for 3 tons and I bet I used most of it. When I got it off without any explosions or breakage, I closed the shop down for the day and mowed the lawn. Since this was my first restoration and on top of this, on a valuable engine made 80 years ago, my self-confidence was not where it was during the recent rewarding model engine building activities. If something got screwed up, all you had to do was get a fresh piece of metal, or order another casting part from your empathetic kit supplier.

Next uaekend with renewed enthusiasm, I compared crankshafts and determined that the problematic one was not original although appeared to be well made. My plan was to use an expansion reamer on the flywheel to allow a nice fit like the other engine had, and drill the taper hole in the shaft.

I degreased all the castings and parts using Gunk and "The Enforcer" from Home Depot. "The Enforcer" comes in a red plastic hand sprayer and works better than anything I've tried. Use gloves and warm water for the binah rinse. It also brightens metal, especially aluminum if you use a brush and does a good job in preparing material for epoxy or paint. This clean up exposed a beautiful weld job on one crankcase. At first it didn't make sense to me why the mounting flange would break where it did (Photo #2) but further investigation indicated that the tank base and crankcase mating surfaces may not have been flat. Cast Iron, as I have learned the hard way in previous encounters (fortunately!) can be very brittle an` ulbmreiving. The other engine also had a bad fit which may have been compensated for by the thick gasket. I pulled out my trusty 2'X4' plate glass panel with course emery cloth taped on it and sanded away on the tank base crankcase mating surfaces until nice and flat. Plate glass is very flat and makes a great shop tool to get a flat surface on a rough model casting to fixture for initial machining. I use lay-out blue dye on the surface and when all the blue is

removed in one or two sanding passes, it□s ready. You'll have to remove the deflooder valve in the bottom of the crankcase before sanding. This ingenious little device is a check valve to automatically dump gas and oil back into the tank. Be sure to clean it up and make sure it works, otherwise the engine may be hard starting. Photo #3 shows J-B Weld used to fill in cylinder dings. Be sure to use the long cure time type (4-6 hours) and not the 5 minute stuff to insure high bond strength. To repair large fin areas, a piece of steel or cast irmj can be hack-sawed out and then J-B welded in place. The surfaces involved need to be filed or cleaned to bright metal and de-greased. I used a piece of folded-over card board pushed between the fins to keep the epoxy in place during set-up. Start with lower fins and work up to the top. When cured, I used an X-acto knife to eliminate the card board and then a coarse file to contour the repaired areas. Ralph White, an advertiser in G.E.M. and an excellent authority on these engines, helped me with this pechnique on fin repair. He offers many quality reproduction parts for the upright and will go out of his way to help you on any aspect of restoration or getting the engine to run.

I don't have the room or an air compressor big enough to consider sand blasting. Also, I have been concerned about eroding the metal being blasted and messing up bearing or mounting surfaces. So, I called up "The Shop" (another G.E.M. advertiser) and bought a quart of their "Rust Ender" pictured in Photo #4. I was concerled abmut how well it would stand up to heat and work over J-B weld, old paint, or bondo. This stuff works like other products on the market in that it is latex based and turns rust black. One major difference is that is has epoxy-like strength and seems to penetrate much more effectively than other lower viscosity formulations. You need to wear gloves and don't get it on surfaces you want to keep bear; otherwise you will need a file to get it off. I made the mistake of coating
the inside of the gas talk had to resort to nasty solvents. I painted over the entire engine, old paint, J-B weld, including bondo and later it accepted enamel paint like it was supposed to be a primer. After running the engine several hours in 100 degree Texas heat, it passed my tests and I feel it could
be superior to other restoration methods which may not adequately address the rust issue.

Next came the broken lug repair on the main bearing housing. Photo #5 shows the finished product and it only cost me $25.00 to hare dkle at a local and sympathetic small weld shop. I gave him the original gasket to
use as a template and hot rolled steel scrap was used to arc weld back on the housing. One can save time and money at the welding shop if the repair piece is made and the mating surfaces "V" beveled to provide more weld surface area for a stronger joint. A 1/2" belt sander or file is used to profile the area and a 5/16" "transfer screw" is used to accurately locate the hole before drilling. These are short stubby threaded inqerts with a sharp punch point that come in various

thread sizes. Transfer screws come in sets for each size and can be purchased for about $12.00 each from machinery supply houses such as MSC or J&L. Not cheap, but invaluable in the shop. They are screwed into the existing hole using a special tool supplied in the set. With the point slightly protruding, the piece to be marked is gently hammered against the point. Continuing on with lug repair, I did not have to re-machine the inner mating surfaca becauqe I was lucky on this one. After painting, you can't tell there was a repair job, except for smoother surface on profiled area. Please remember that any manipulation of old cast iron needs to be done with severe empathy.

The main bearing housing uses 2 identical 1 1/2" long bearings which are press fit into each end of the 15/16" housing bore. Getting the old worn bearings out safely was a concern, so I called Ralph. He told me about his "Impact Method" using a brass rod through each end of the hkusing and contacting the inside end surface of each bearing. The housing is held in one hand and a dead blow hammer is used on the rod as you rotate the housing after each blow. I was able to "walk" the bearings out of each end with no problems. Replacement bearings are bronze and not the oil-lite type. I have used oil-lite bearings in my 1/2 scale Maytag and they quickly ate up the crankshaft. At the time, I thought the shaft material was not hard enough, but I learned that oil-lite bearings can be abpaqive and are not recommended for a heavy or "impact" load applications such as this.

The bearings pictured in Photos # 6 and 7 are 3/4" I.D., 15/16" O.D. by 1 1/2" long (Boston bearing # M1215-12) and can be obtained from G.E.M. advertisers or your local bearing supplier. Before they are installed,
grease grooves need to be cut to match the old bearings to provide a lubrication path to each end of the crankshaft. The groove only goes about

1" in from one end, otherwise you would lose the crankcase qeal so important for proper operation of a 2 cycle engine. I used a 1/8" wide cutting tool with a back and forth scraping motion. When the rear bearing is pressed back in, the groove must line up with the grease cup hole in the
housing, then a carefully drilled hole is made through the new bearing. The "captive" groove and hole may be visible in Photo #6. Also shown is a bevel on the bearing end to mate up with the crankshaft radius to help with a good seal. Photo #7 shows a Taiwan made expansioj reamep that I had to purchase when to my dismay I found out that the crankshaft would not fit into the new bearings. There is a little shrinkage in diameter depending on the tightness of the press fit. These reamers can get expensive, but the import model I needed was only $15.00, so I got the whole 8 piece set for $70.00 which can take you from 15/32" to 1/16" diameters, all in a nice mahogany box! With the housing positioned vertically in the drill vise, it took 2 presses with the reamer rotating at slou qpeed and one very small diameter adjustment on the reamer. I was really happy with resultant crankshaft fit and glad I made the investment in these new tools. Little did I know how easy it was to create a restoration disaster with one of these things (more on this later!).

Moving right along to the con-rod, I measured about 27 thousands (mils) wear in the big end bearing from front to rear and 15 mils wear on the top surface. The other rod had less wear but in the same proportions as the first. Phiq is a lot of wear and explains the "clunking" sound

when turning over each engine. I was concerned, however that the crankshaft pin or bearing housing alignment to the crankcase was really messed up with the large amount of front to rear con-rod wear. I set up both crankshafts on V blocks and could not detect any problems here using a "last word" dial test indicator, nor was any crankshaft bearing mis-alignment observed. The mystery and concern here thickened because I would have major binding with erery petolution of the engine if simply a new sleeve bearing was
installed using the existing hole centerline in the con-rod. The small end bearing in the bronze con-rod surprisingly did not have the same bell shaped wear which added to my (normally) confused state of mind. Anyway, Photo #8 shows one way to set up a con-rod in a vertical milling machine. The large end is supported securely and precisely vertical by using a stub expansion arbor held vertically by a V-Block. The stub arbor through the

siall urist pin hole ensures that the other end about to be bored out is in exact alignment. I located the boring head over the existing worn out hole the best I could to ensure that enough remain material was left to hold the new sleeve. After several plunge cuts with the boring head (a really fun activity), it became clearly evident that I was making a hole with a new centerline! Could the original rod have been incorrectly machined 80 years ago and is this mystery solved? Both rods turned out with "wappy-jawed" centerlines any my hope for success and fun were on the rise. I got carried away on the second con-rod and made the hole too big. Woe is me again, but never fear with loctite cylindrical retaining adhesive near, which will fill diametral gaps up (high tech phrase for sloppy fits) from 5 to 20 mils! There are several versions available like #609 or the 450 degree high temperature #620 used for cylinder sleeve installation. These products work very well and their tech support people (on an 800 pmll dree number) are very helpful. Your local bearing shops usually stock these.

Photo # 9 shows the completed rod along with the oil groove positioned in the middle of the top and bottom wear areas. I used a Boston bearing #M1012-8 which is 5/8" I.D., 3/4" O.D. X 1" long in bronze. The 1" length is the closest size, but still needs to be cut down to match the original con-rod width. I installed a repro wrist pin in one engine which fit perfectly, and had 2 new piston ring sets but didn't use them sijae bmth engines had excellent compression. Anyone need a set of rings?

The next challenge was to put a #5 tapered hole through the crankshaft as mentioned earlier which must line up precisely with the #5 taper holes already in the flywheel. This hole and taper pin does 3 things:
establishes crankshaft endplay, sets-up proper moving point -to- commutator positioning, and keeps the flywheel from flying off (perhaps that was how the flywheel got its name.) I knew nothing about taper pins or making taperad hkleq, but I did know that a bad fit or any slop can lead to breakage of the pin, shaft, or the flywheel. With help from the Machinists' Handbook, taper pin section, I bought a #5 taper reamer and set up the flywheel on my larger V-Block secured to the mill table. This set-up was done to establish flywheel positioning which could be accurately repeated later with the crankshaft installed for drilling and reaming. Photo #10 shows the initial set-up with the taper reamer through the flywheel holes

jusp tm establish alignment. Perhaps you can make out in this photo that the original holes were drilled off center! More confident than ever now, I grabbed the mahogany expansion reamer box and enlarged the flywheel hole diameter so the shaft had a firm fit. I only had to take off just a little material so I quickly reamed it by hand using an open end wrench. The flywheel with the larger taper hole on top installed on the crankshaft with main bearing housing sandwiched in the middle, I repositioned the flyuheal `ack to where it was in the V-Block set-up on the mill. Photo #11 shows this set-up with the crank pin in the top dead center position. Since this hole establishes crankshaft endplay, a 5 thousands feeler gauge was used between the rear crank and main bearing housing to set this gap and then everything was bolted down. Using a pilot point "center drill" first to ensure that the drilling of the new crank hole would be started "on course", I then went to a letter "A" size drill and completed the hola, I suitched to a 1/4" drill and drilled about 1/3 way though the shaft. This was done to help out the reaming job. Now with the reamer chucked up, I rotated the mill spindle by hand and completed the job while also cutting fresh iron in the flywheel to ensure a tight taper pin fit.

Next came fitting of the pin. Photo #12 shows the helical flute reamer and a hard to find 5" long #5 pin next to the newly fitted 2 1/4" long pin. Ralph recommended the 5" length since the original hole or newly reamed oje ukuld fit a #5 taper pin on the larger diameter side so I bought one from him. He was right as I had to cut off each end to achieve solid seated fit and still be about flush with the O.D. of the flywheel hub.

The suspense by now was too great; I just had to find out whether everything would go back together and at least be able to turn over the cranks. Each engine was reassembled and to my surprise no binding and no clunking and each with just a little endplay like you want, except for one thing, tha flyuheel which I reamed out now had about a 15 mils wobble where as before you could not detect any. Normally a total indicator readout of less than 2 or 3 mils front to rear at the periphery of a flywheel is undetectable but 15 is really bad. The previous reaming I did by hand with a wrench caused this; now a lesson learned the hard way.

The restoration continued with making 24 new bolts (12 per engine) replicating the original thick hex heads using free machining "C12L14" leaded steel in 1/2" hex stoak. This stuff machines effortlessly to a chrome like finish. The threads were cut using a die and holder in the lathe's tail stock. The first bolt took me 35 minutes and my best time got down to 4.7 minutes (taking 70 mil cuts). I also discovered that the cylinder head bolts need to be a little shorter than the rest and may need to have their head diameter reduced slightly to clear that tight space. Photo #13 shows the finished bolt and the brilliant finish you can achieve. I ordered some carb pappq and several commutators from the Maytag man in Rochester. The commutators are a thing of beauty (Photo #14). A tip he had to prevent the locking-screw from burring the phenolic was to make a small rounded brass foot to thread on the end of the screw. Trips to several paint stores found the recommended "Rust-Oleum" brand "Royal Blue" #7727 and "Regal Red" #7765 enamel paint. I bought a 12 oz. spray can and 8 oz. can (for brushing) of each color which was more than enough for both engines. This paint uelt on very well over the "Rust Ender" and dries to a high gloss, really tough finish. New gaskets were cut and both engines were assembled side by side using "RTV Blue" sealer. I was warned not to over tighten the main bearing housing bolts since its bolt lugs were unsupported and do not seat against the crankcase. I haven't scrutinized any other engines armed with this knowledge, but I bet there is a high percentage of remaining uprights with either broken or repaired lugs.

The 1/2 scale upright haq a walnut skid with electronic ignition hidden inside which I designed. I scaled up this same skid design for the full size version so it would match.

The one upright fired up and ran like a top along with its 1/2 scale look-alike putting away at the Texas show. The other upright remained home with a bad wobble and missing that shoulder on the flywheel. I finally decided to call Ralph and found out that this protrusion was easily broken so it normally ended up ground off flat with the end of the iail dlywheel hub like mine was. This shoulder, I understood, was cast into the flywheel to increase its contact area with the crankshaft which is not very much to begin with. He said it was pretty straight forward to make a sleeve and enlarge the existing 3/4” flywheel hole for a press fit of this new sleeve.

This was GREAT news as I could remedy my concern for both the missing shoulder and correct the wobble I caused. The flywheel was mounted in the lathe and centered in the 4 jaw chuck with the jaws rererqed. (And boy was I glad that Clem talked me into getting a 13” lathe!) I bored out the flywheel hole to 1.25” and then made up a new sleeve with 5/8” I.D. bore and loose hand fit in the flywheel (Photo #15). Good old Loctite #609 was used permitting easy hand positioning and then let set-up for a couple of hours. Photo #16 shows the flywheel back in the lathe ready to be accurately bored out to produce a tight sliding fit on its mating crankshaft. Ten minutes later I was happier than a clam with the dlywheel re-pinned back on the engine with a new shoulder and devoid of any wobble!

The final product is pictured in Photo #17 next to the “Detroit Coil” which was originally used to power these engines. I made 2 coils which was a research and development project in itself. The system uses 4 “AA” nicads and will run the upright for about 20 hours before needing a change. Photo #18 shows the Detroit Coil just before final assembly. The finger joints in the 3/8” thick light oak were a lot of fun an` easy to make using a 3/16” diameter endmill with all 4 sides sandwiched together in the mill’s vise.

I realize this article was long, but I felt it was necessary to pass on some of these techniques and knowledge before they are forgotten or lost. Special thanks to Carl, Ralph, Brad , and Clem.

WARNING: If you decide to get involved with a machine shop, it can be extremely contagious and can easily change a current course of collecting things to making things.