UH003

Ultra-Half Modified VW Engine

Disclaimer: These plans were gathered and are being disseminated for their educational and historical value only. Anyone actually constructing aircraft or engines from these plans does so at their own risk. No warranty expressed or implied.

The 2 cyl. VW engine. How to start?
Read the plans thoughly. Decide which configuration will be right for you. After polling many homebuilders that started building their 2-cyl. VW engine I found that only about 1 out of every 10 actually complete the motor. And those that do complete it spend an average of 10 to 12 months completing it. I have spent more than 2 years building one and have been unsatisified with every configration except for the one that I call the Ultra-Half.
This is not to say that all other configrations are bad, not at all. There are many hundrends flying around the country. That's why I give you all the information that I know about so that you can decide for yourself.
Now let me sell you on the Ultra-Half.
The Ultra-Half uses a full case, side draft carbs, and plug in magneto. The benifits are as follows.

1. The full case uses its oun engine mounts bolted directly to the firewall. (No engine mount to weld up or fabricate.)

2. There is no welding to the case itself. (easier than welding)

3. A Full case means more oil capacity and no need to construct an oil cooler.

4. A Full case means more crankcase area to handle crandcase pressures. (No need to build a Oil Separator.)

5. The full case can use a stock VW fuel pump which means that you can locate the tank anywhere in the plane. (cut case cannot)

6. Side draft carbs use a very short intake tube which makes them easier to fabricate and very unlikely to pick up icing.

7. A plug in Vertex magneto uses the original Distributor hole and eliminates the need for a battery. Also keeps you from machining end of crank to accept a rear mounted magneto.

8. The only welding required will be the heads unless you choose to purchase heads prewelded from a supplier such as Great Plains Acft., or purchase SCAT, Mosler style heads which are built to be single piece units originally.

Suggestion- Go to your local junk yard and purchase a $50 to $100 used VW 1600 from 1970 or later with dual port heads. Serial mumbers should start with AE or AK. Dissasembling the engine will help you decide if you want to continue and which method

is going to be right for you. The only parts that you will use from your dissambled motor will be the case, crankshaft, connecting rods, heads, and oil pump. If building a aero motor everything else will be new. If building an engine just for the enjoyment then used parts are fine.
Building an engine can be very enjoyable and rewarding much like building an aircraft. The pride of knowing that you built it yourself goes a long way.

Tools Required
Book- How to build a reliable VW aero engine. "HAPI"
6 inch Dial Calipers, dial guage, Ohmmeter
Set of metric tools, snapring plyers, hammer and drifts. Gear Puller, Feeler guages, Torque wrench.

Services Required
Alum. and Steel welding
Metal lathe work
Bead Blaster
Crankshaft balancing
All above services can be attained at just about any local VW repair shop, or engine repair shop. Go to a VW shop whenever possible.

CrankCase- When case is completely disassembled you will want to have it bead blasted. This will make it look like new. While at the VW shop have them inspect the #2 bearing saddle. If more than .001 high have the case line-bored. If you don't the new bearings will not be held in place which will allow too much clearance between the bearing and the saddle. (even with new bearings!, trust me and don't ask me how I know.)
Further inspect the bearing saddle's to be sure that the case will not have to be scraped. It should meet the tollerinces below.

Stanard-	2.565" -brgs 1,2,3,	1.965" -brg. 4
1st Line Bore-	2.585" -brgs 1,2,3,	1.985" -brg. 4

Once you know you have a good case you will have to decide whether or not to use the full case or cut case.
If it is cut then bolt the halves together and mark the cut line. Drill for the new dowel pin. Cut the case off at the 4 3/8 mark. The surface at the cut off must be machined flat to accept the 1/4 rear cover plate. I have found at that this is best done by a VW machine shop on a milling machine or lathe. Some people have been able to get theirs flat enough with a large rasp and doing it by hand, not me!
Now the cut case must be plugged according to one of the 2 drawings. Either welding or drilling and tapping for plugs. Magnesium welders are sometimes hard to locate. VW shops seem to be the best source. When using the D & T method use silicon RTV to seal the plugs before installing. The cut case that I completed and had welded cost me $80.00. The case worked fine and I was satisified with it but ran into problems when it was run,of blowing the oil overboard out of the breather. The problem

was never completly fixed but it was held to a minium by an oil return line returning the vented oil back into the engine by way of the oil separator. See drawings.

By using the full case none of the above steps will have to be done. You will move right into having the cylinder holes opened up to accept the larger 92 mm size. Of course the smaller ones can be used but the 92 mm are recommended. I have also used 94 mm clyinders but couldn't tell much of a difference. To allow as much wall thickness for the cylinder hold down bolts the cyl should first be cut at 3.700" to a depth of 1.125" then the second cut is 3.787" to a depth of .75"

If your case is cut then you will have to drill a 3/16 hole aprox. 1 7/8 directly above the existing hole in the bypass adjacent to the oil pump. Full cases 1970 and later contains 2 springs and pistons to control engine oil pressure. One located just to the left of the oil pump and one at the flywheel end. The extra hole drilled in the cut case resplaces the one cut away in the cut case conversion. Buy an adjustable oil relief valve assembly and set it for 60 psi.

On the cut case the oil pickup will have to be removed and the tube cut per the drawings, then welded.

Now the rear cover plate will have to be made. (cut case again). Make it per the full size drawings. Tape the 2 sheets together and match at the marks given. Note the bottom of the plate and make sure that enough material is left so that it can be filled to accept the oil sump cover plate. Be sure to locate holes so that no oil gallery's will be restricted. There are slight manufacturing differences in VW engine cases and a correct hole in one may be inaccurate for another.
Locate the center of the magneto on the rear cover and use a 2 1/2 inch hole saw to make the initial hole. Then screw the cover to the case, mount everything in a lathe, and apen up the hole to 3 1/4 inches for the magneto mounting flange. It is necessary to ensure tht the magneto will be on center with the crankshaft.

Crankshaft

Both the cut and full case conversions the crankshaft will have to be cut. On the full case it is easier because there is less to be machined. For the cut case using the magneto a slot will have to be machined to accept connection to the magneto. See drawings on both conversions.
Dissassemble by removing the snap ring at the pulley end and removing the cam drive and distributor drive gears. (Gear Puller) Insert a bolt in the pulley end of the shaft and suspend teh crank by a piece of wire. Holding the crank vertically strike it with a piece of wook and listen for a ring. If no ring then the crank is defective. If you are not sure you may want to have it magnafluxed.
Inspect the brg journals for grooves or defects. Measure them for size and out-of-round.

Standard:	2.165"	(brgs 1,2,3 & rod journals)
	1.575"	(brg #4)
First Regrind:	2.155"	
	1.565"	
Second Regrind:	2.145"	
	1.555"	

Cut the crank as shown in the prints according to which configration you are using. This is down with a hack saw and then trued up on a lathe or milling machine.
Cut out and install the counterweights as shown and grind the crank as necessary for a gook fit. Counterweights are Tig welded on. If the VW mechanic knows what he is doing he will warn you about welding on the crank. The correct method of welding is to preheat the crank to 450 F, then after welding place back into an oven at 450F and slowly reduce the temp. over a eight hour period. This will minimize the possibility of cracks forming and relieve the internal heat stresses built up from welding.

Now procure a prop hub. Building your own is not recommended mainly because you will have more invested in it than it takes to buy one already made. The end of the crank is taper cut to match the hub which is usually 3°. The assembly with the hub installed is taken to the VW shop for balancing. Since we are not balancing "pro's" it is best to seek the help of the guy's who get paid to do it. This is what kept me from pulling all my hair out while trying to get the crank balanced. If you arn't sure about this area, and I do believe that this is the toughest part, I would recommend purchasing a crank already completed.

The dual flanged brg is used at the #3 brg position next to the small brg at the prop hub end. Both flanges are used as thrust brgs. This is to controlend play of the crank. (aprox. .008) Machine the thrust surface of the crankshaft so that it is true. One original thrust washer with the inside dia. inlarged to fit over the #3 brg journal will be fitted so that it fits flat against the thrust surface. Measure the distance from the thrust surface to the forward edge of #3 journal. Substract the flange to flange distance of the brg from it. This is the amount plus allowance for three thrust washers and the required endplay of .008 that must be removed from the face of the gear that drives the camshaft.
Example: Thickness of all thrust washers- .010 each. Width of flanged brg between flange surfaces- 1.060". Width of #3 brg journal- 1.030". Amount to be removed from width of camdrive gear = (1.060 - 1.030) + 3X .010 + .008= <u>.068"</u>

Remove the amount required from the gear in a lathe starting at the outside dia. down to d dia. of 2.115". Cut a groove in the center of the teeth about 1/8" deep to allow gear to be removed if ever the need arise.
Place camshaft in a lathe and remove a similar amount from the rearward facing side of its mating gear plus .010 to allow for end play of the camshaft.

Camshaft
Cut the camshaft on the rearward side fust after the middle brg journal. It can be trued up on a lathe but is not required.

Heads
Completely dissassemble the used head, including the original valves. They will be replaced with single piece stainless steel units. Inspect the head for cracks particularly on the inside from the spark plug hole to one of the valves. One side may be okay to use while the other is scrape.
When ordering valves measure the face and stem diameters of the old ones and include this with your order. The intake valve is the larger one, smaller one is exhaust. Check the valve guides for excessive wear. If they are out of limits you will need new valve guides so you'll be better out scrapping the head.
If you lap in new valves use a fine valve grinding compound.
Replace the valve springs and keepers.
Cut the heads in half as shown. Open up the 1 1/4" hole in teh side for the Alum intake tube. Cut the valve cover seat from a discarded head and make plugs from alum. to cover the original intake holes. This will now be welded per drawings.
Single port heads may be used but will take much more work to cover the exposed intake passage.
It 92mm cylinders are to be used the opening in the head must be enlarged to 3.865".
Make new valve covers and hold down springs per drawings. They will be welded or brazed. New gaskets will be made from 1/8 cork material. Use silicon sealer on both sides when assembling.
The original rocker arm shaft will be cut down per drgs. Drill a new mounting hole 5/16 in dia. at the cut end and make sure that it is parallel with the existing one. Mount assembly on the head securing it with the existing stud. Using the 5/16 hole as a guide drill through the bottom of teh head to locate the hole for the other rocker arm shaft support. Make spacers from alum. to fit between and use AN5 bolt and locking nut to secure the other end of the shaft. Make spacers from steel tubing to maintain rocker arm position then drill and tap end of shaft for a AN4 bolt and large washer.

Crankshaft assembly
Oil brg journals and fit the first thrust washer and brg over the #3 journal. Note the position of the sowel pin that the brg mates with when it is positioned in teh saddle. (This keeps the brg from turning) Heat the cam drive gear, spacer and distributor drive gear to 450°F. Slide these parts into position on the crankshaft making sure that the other two thrust washers are in place on the cam drive gear. Secure with tape to keep them from sliding off sholder as the gear is tapped into place. Install snap ring, check the clearance for end play with a set of feeler gauges. Limits are .006 to.013.
Put each half of the #2 brg in the #2 saddle of both crandcase halves and note the position of the dowel pin. Install the #4 brg on the crankshaft and note the dowel pin. Install the modified oil slinger. Slide the prop hub seal on the hub and make sure that the open end of teh seal faces rearward. Install

the prop hub and but no not tighten the bolt. Insert the entire assembly into the right half of the crankcase. Each brg must be properly seated in its dowel pin. Check to see if the crank turns freely. If the counterweights touch use a grinder to remove enough material to allow to turn freely. Do the same to the left side.
With the crank in position in the right half balance the pistons and connecting rods per HAPI's manual and install rods on the crankshaft. Torgue per manual.
Before closing the crankcase, make sure that inside is clean and free of any metal chips, etc.
Install valve lifters and teh camshaft brgs then place the camshaft in position being sure the timing marks on both gears line up. When installing the camshaft brgs the narrow set is not used. The wide set with the flanged half is installed next to the cam gear. The flanged half is installed in teh right half of the crankcase. Install valve lifters in the left half and hold them in with string. Oil the lifter faces and camshaft lobes. Coat the splitline of the case halfs with RTV silicon sealer then assemble the halfs together.
Torque the four large bolts first per the manual. Torque up the smaller bolts around the outside next per manual. Check rotation of the crankshaft. It should turn freely. If it won't open ut up and check for proper seating of the bearings or rub marks. Correct and re seal.
If using the cut case install 1/4-28 nutplates on the inside of the rear cover plate to secure the magneto. Install the rear cover plate using silicon sealer. Install, tighten bolts and lockwire the heads per drgs.
Install the oil pump using silicon and torque to 14 ft. lbs.

Magneto
Make fibre block coupling and measure to make sure that when fitted it has .010 loose fit. Mount the magneto on the rear cover plate with the fibre coupling in postition. Push crankshaft from end to end and measure the end play with a dial gauge. Micarta is available from electrical motor repair shops.
The magneto must be set to fire the sparkplugs at 22° before top dead center. Use a dial guageset up in the spark plug hole to determine the spot where the piston reaches it's upper most travel as the crankshaft is rotated. When it is determined scribe a line on the top of the prop hub matched with the splitline. Turn the crank backwards 22° by using a protractor taped to the prop hub. Scribe another mark and mark it as 22°.
Place the magneto in position on the rear cover making sure that the coupling is in place. Make sure that the crankshaft is at the 22° position. Remove the black phenolic cover from the rear of the mag. to expose the points and use an ohmmeter across the points to determine when they are opened or closed. Rotate the mag body CCW until the points just open. Secure the mag. in place by tightening the clamps on the rear cover. Recheck to make sure it is set corectly.

Cylinder Deck Heitht
This is the distance between the top of the cylinder and the surface of the piston when the piston is at Top Dead Center.

The Compression ratio is set be adding shims at the base of the cylinder. The recommended compression ratio is 8.5 to 1. Install the piston on one connecting rod and set the cyl. in place without shims. Turn the crankshaft to Top dead center. Measure the distance from the top of the piston to the top of the cyl. (surface that mates with the head). Substract your measurement from .08" and this is the thickness of the required shim. Repeat for the other cyl.

Head and Valve Assembly

Install the cyl. hold down studs using two nuts jammed together. Place both cylinders in place with corredt shims installed. Use silicone on the shims. Coat the pushrod tube seals with silicon and position them in the head and the crankcase. Hold pushrod tubes in position and install the heads and tighten down lightly with the nuts on the hold down studs. Make sure that heads sit squarely on top of the cyl. and that hold down studs are perpendicular to the crankcase. Rotate the head in necessary. Torque down per manual.

Slide rocker arms and spacers into place on the shaft and mount the assembly into place after sliding the pushrods down the tubes and into position. Torque per manual.

Set valve backlash. Rotate the crank to bring the piston to top dead center on the compression stroke. Use feeler gauge and set the gap between the rocker arm and valve stem to .005" on intake and .007" on exhaust.

Make the gasket for the valve cover from 1/8 cork and coat both sides with silicon before installing.

Carburetor

Several carbs can be used. I'll try and list all that I have tried. For the cut case and updraft system you can use a POSA super carb with a throat size of 26 to 29mm. It has cockpit adjustable mixture control. The Bendix-Zenith is being flown on alot of engines. It is in JC Whitney as a Model "A" replacement carb. #12566. For the twin carb side draft I use Mikuni 32 mm. Spigot mount. If you would rather have a flange mount they are available also. Order a catalog from Central Snowmobile Salvage 1-800-558-6778. (about $50 each.) They also sell Tillotson flange mounts. Some people have used a stock VW carb, top mounted. A Carb heat system is recommended on all aircraft engines. You will have to have it to get it registered.

Intake manifolds, exhaust pipes, oil coolers and crankcase breathers are built to suit and per drgs. If you have gotten this far then these items will be a piece of cake.

A remote oil filter can be mounted to the firewall. Great Plains Acft. has adapters.

Torque the prop hub to 85 ft. lbs. Push the seal up against the front of the crankcase. Clean the area and use epoxy (Plastic steel) to install the seal in position. See drgs.

Engine mounting is shown in the drgs. and will vary from one installation to the next.

Recommended Operating Specs.

Oil pressure, hot, 2800 RPM's-	35-45 psi-1/2 case,	25 psi (Full. Case)
Oil Temp	200F Max.	
Max RPM	3500	
Idle RPM	900-1200	
HorsePower standard crank	28 single carb, 30 Twin	
HorsePower Scat 78mm	35 aprox.	

B.O.M.

1/2 set (2), 92mm pistons and clyinders
1-C-20 Camshaft (Scat or Great Plains)
2-Ehaust valves and 2-Intake valves
4-Valve pushrods and pushrod tubes
1/2 set (4) lifters
1-Main brg set
1-Rod brg set
1-Cam brg set
1-Tapered prop hub and faceplate (Great Plains Acft.)
1-Prop hub seal. Garlock #63x1114 21128, or CR Indust. #19852
1 or 2 carbs, depending on configration (see carb section)
1-Ignition system. (see Magneto section)
2-NGK #B6HS sparkplugs with gap set to .016"

Suppliers

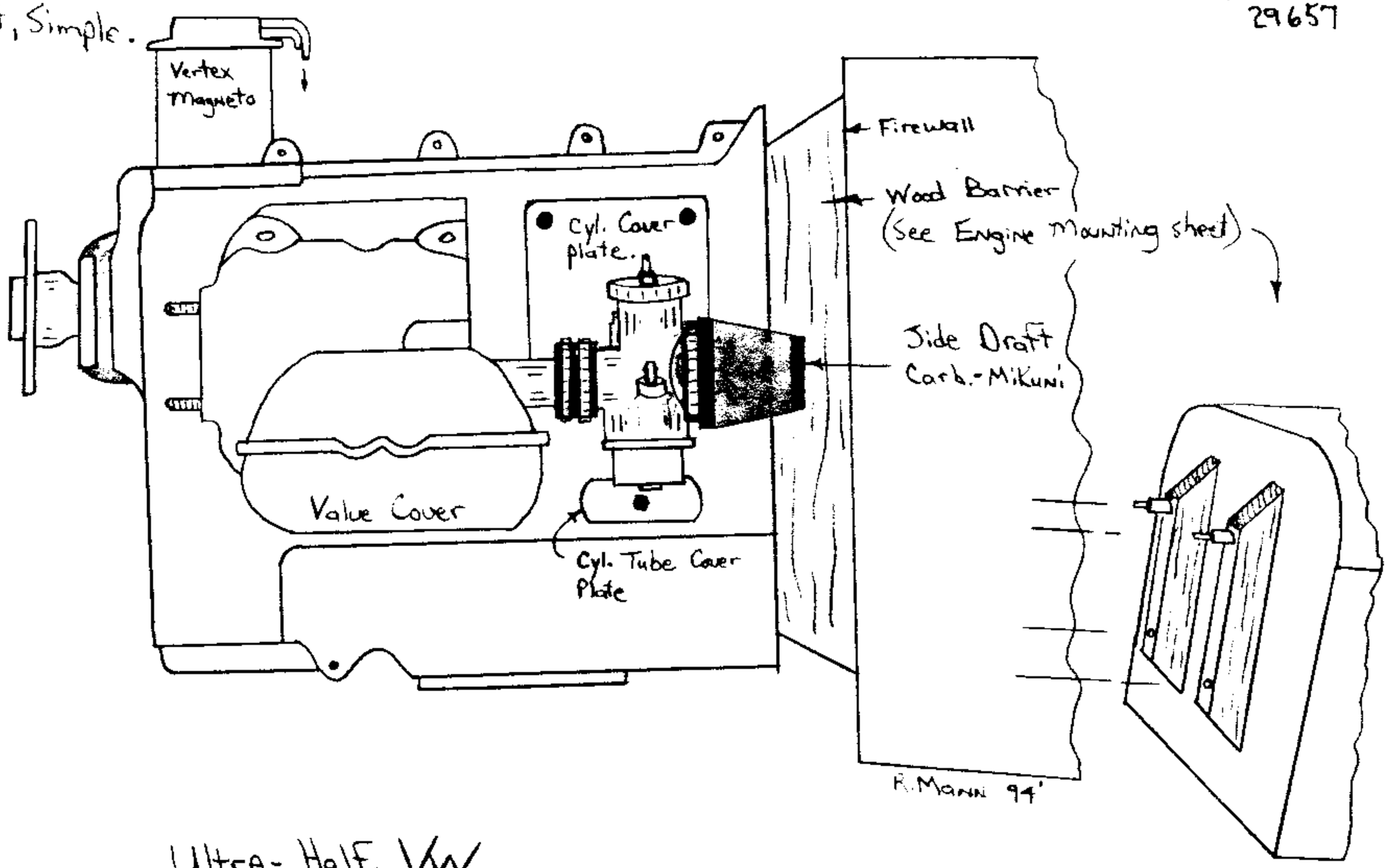
Great Plains Acft.
PO Box 304
St Charles, IL. 60174
(708) 464-4178

SCAT Enterprises, Inc.
1400Kingsdale Ave.
Redondo Beach, CA. 90278
(213) 370-5501

2 - Cyl., 4 Cycle
26 - 40 H.P.
85 lbs. Aprox.
1 gal. per hr. at Cruize.
Low Cost, Simple.

Plans - $25.00

RagWing
312 Gilstrap Dr.
Liberty, S.C.
29657



Ultra- Half. VW

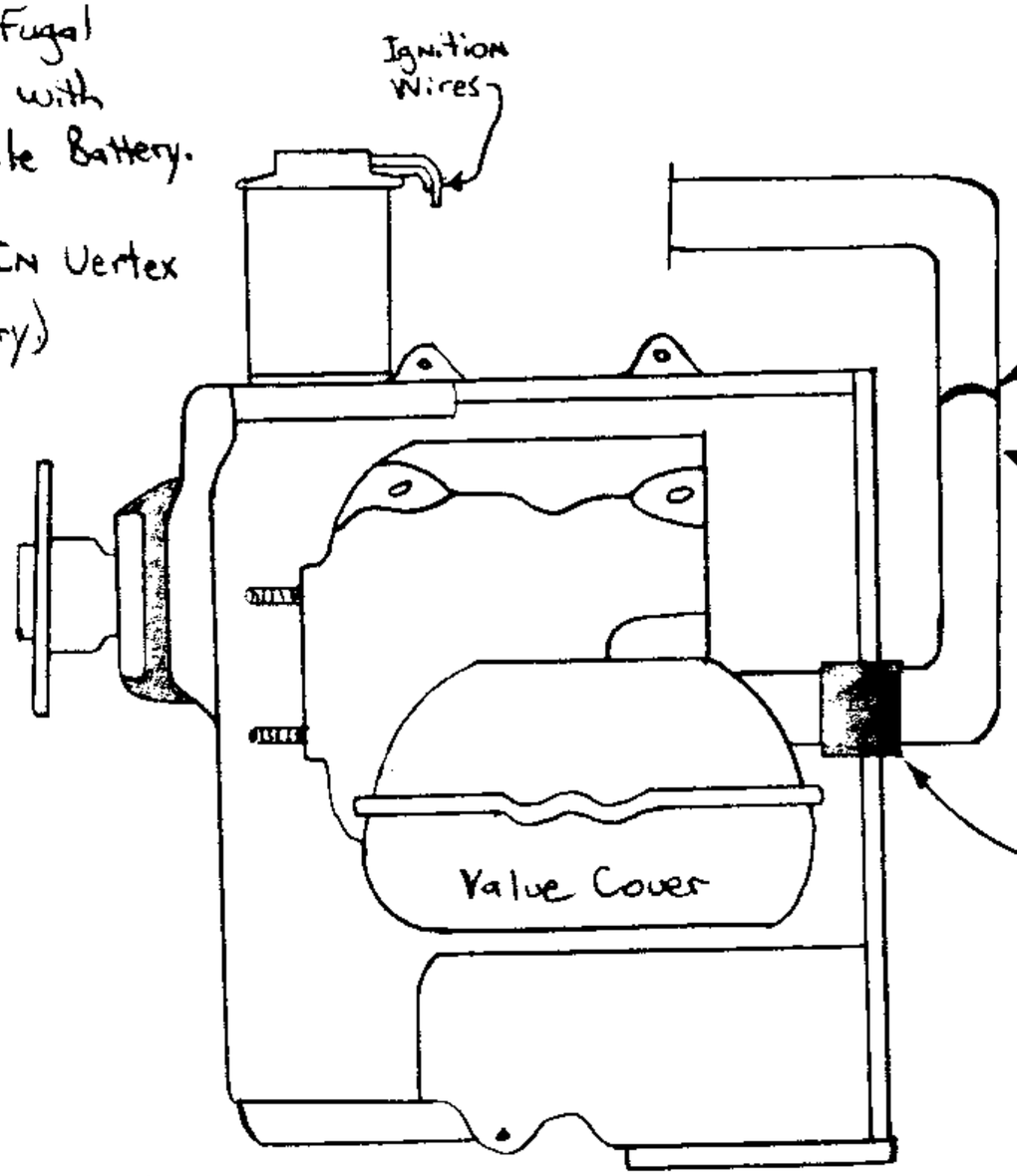
This configration is considered the easiest to build. Drawings also shows Cut case, Rear mount Magneto, Updraft Carb., down draft carb., etc. Over 60 drawings.

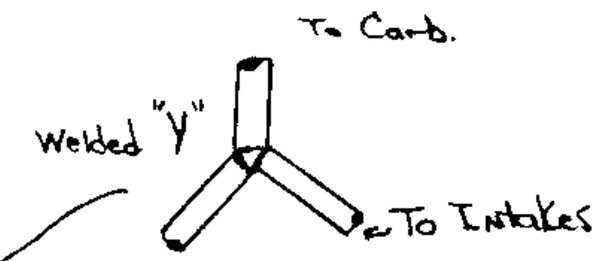
Full Case
Side Mount Carbs

Options

May use Stock Centrifugal Advance Distributor with a 6-volt motorcycle Battery.

Shown is a Plug-In Vertex Magneto. (No battery)



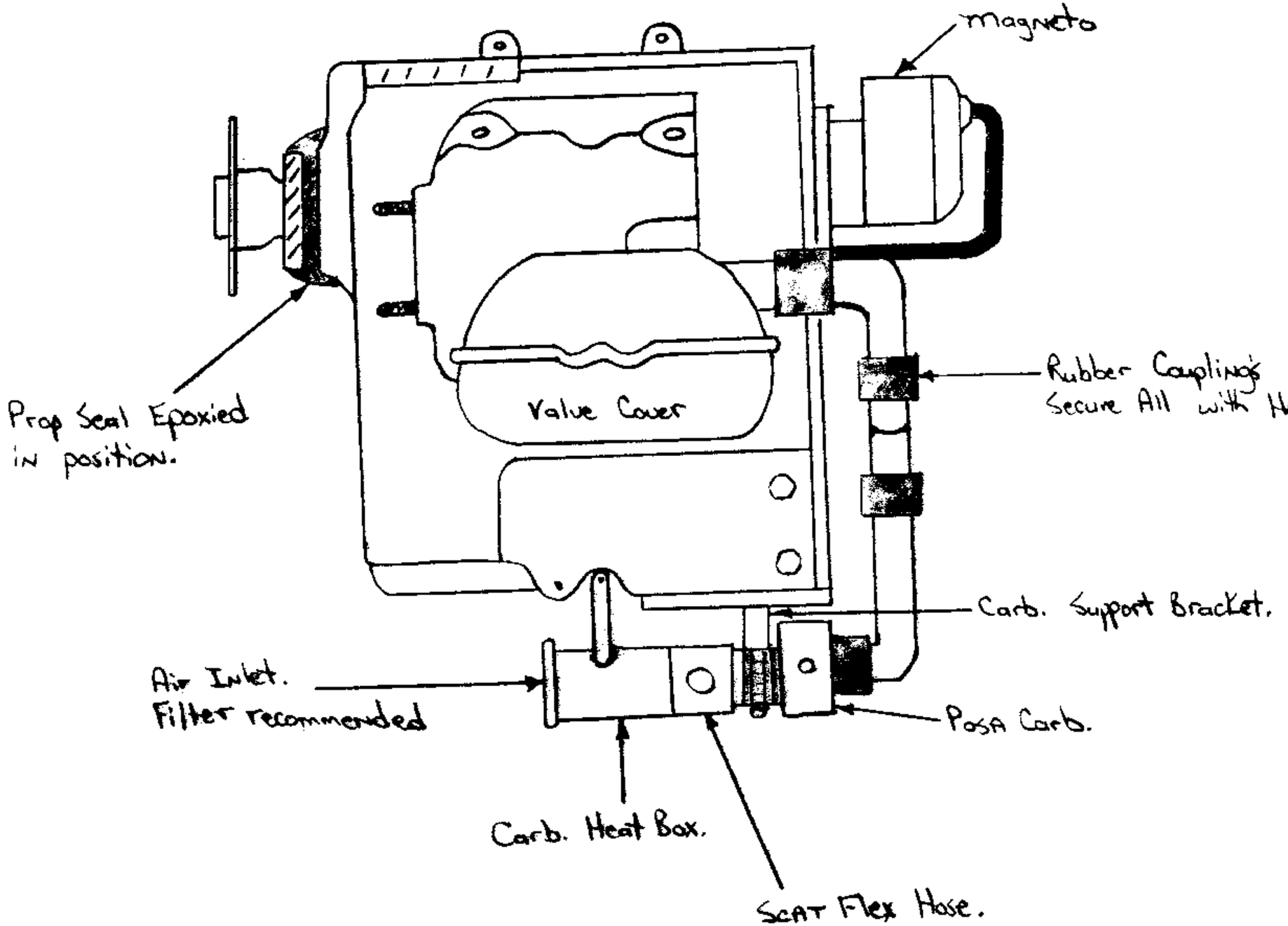


Options

Route Intake Tubes to Top and use a stock Downdraft Carb.

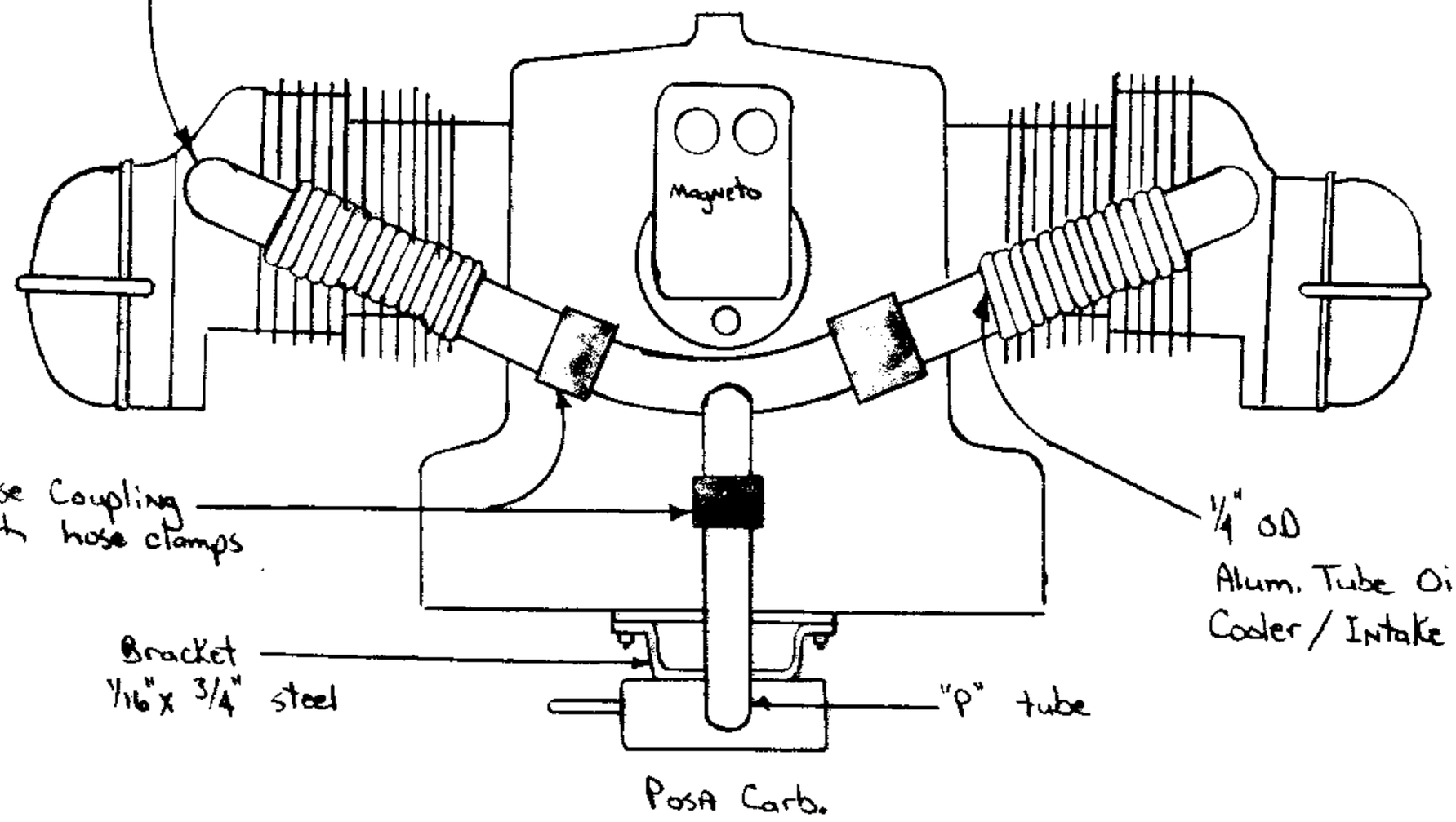
Connect Motorcycle Carbs. directly to this Intake Pipe. One Carb on each side.

Downdraft Carb.



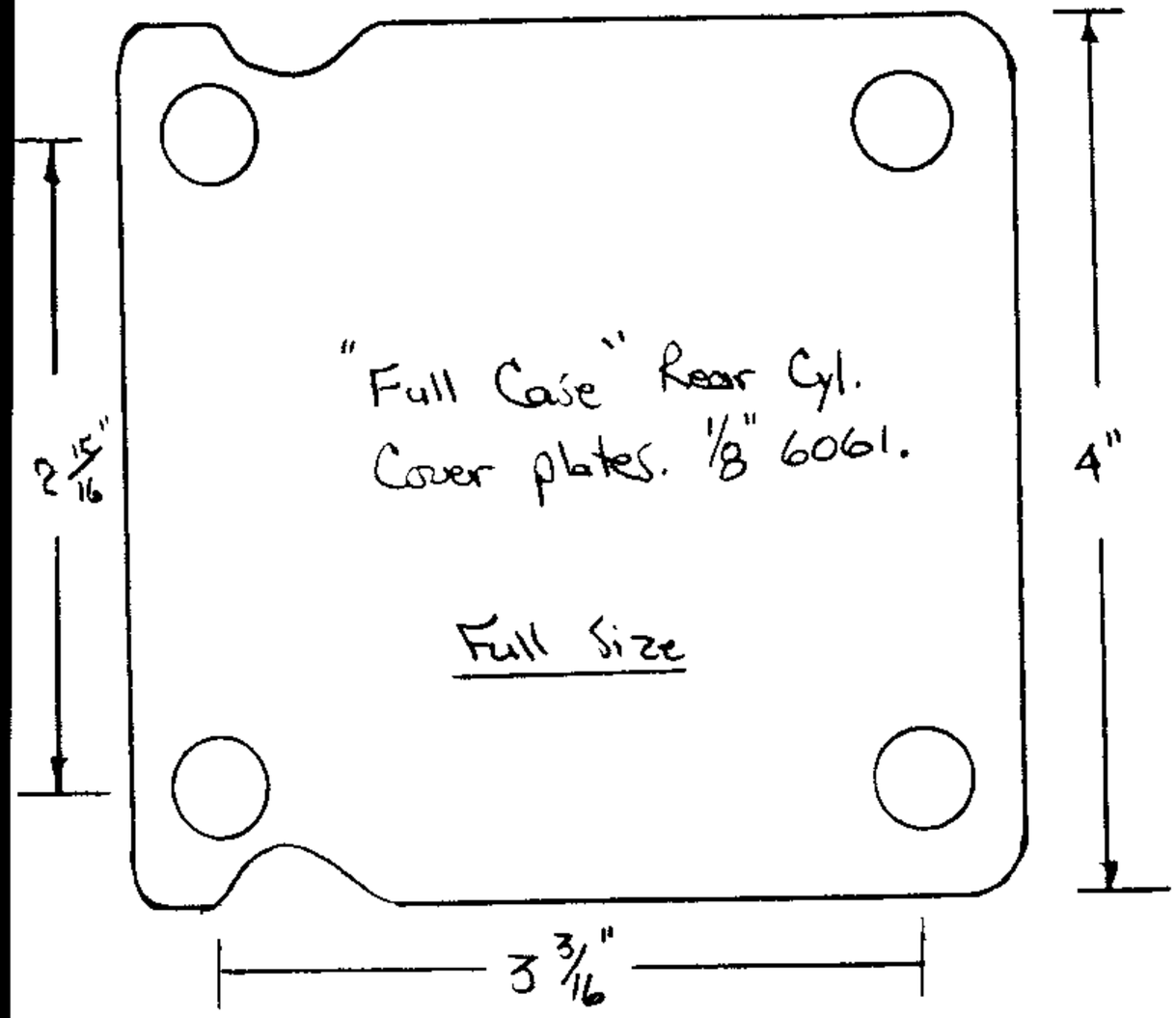
Updraft Carb.

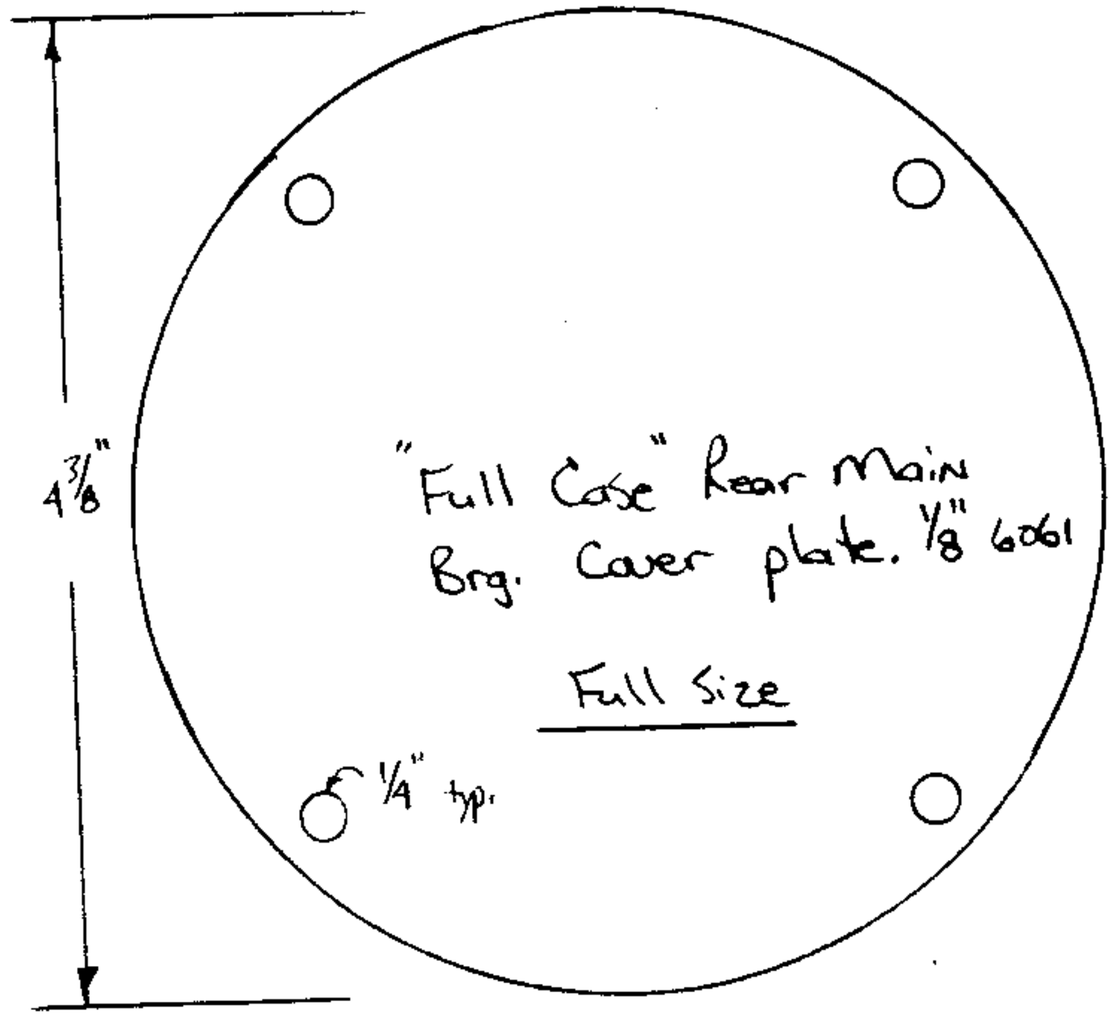
Intake Tubes may also be routed to Top of Engine, using same method as shown below, when a down draft Carb. is to be used.



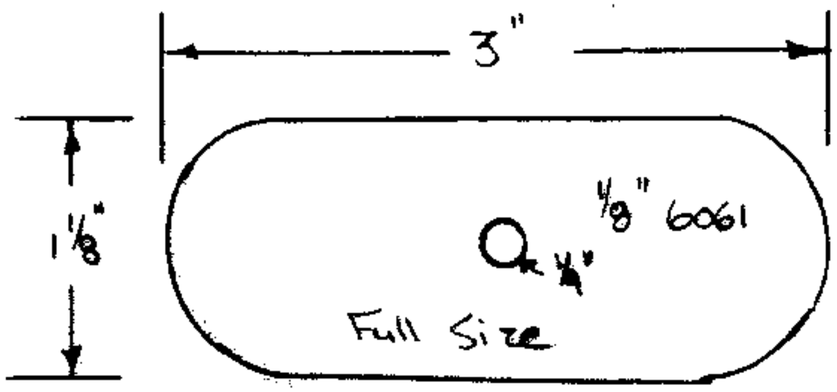
PosA Carb.

Up Draft Carb.





use plate as a guide to mark case with center punch. Drill + Tap case to 1/4"



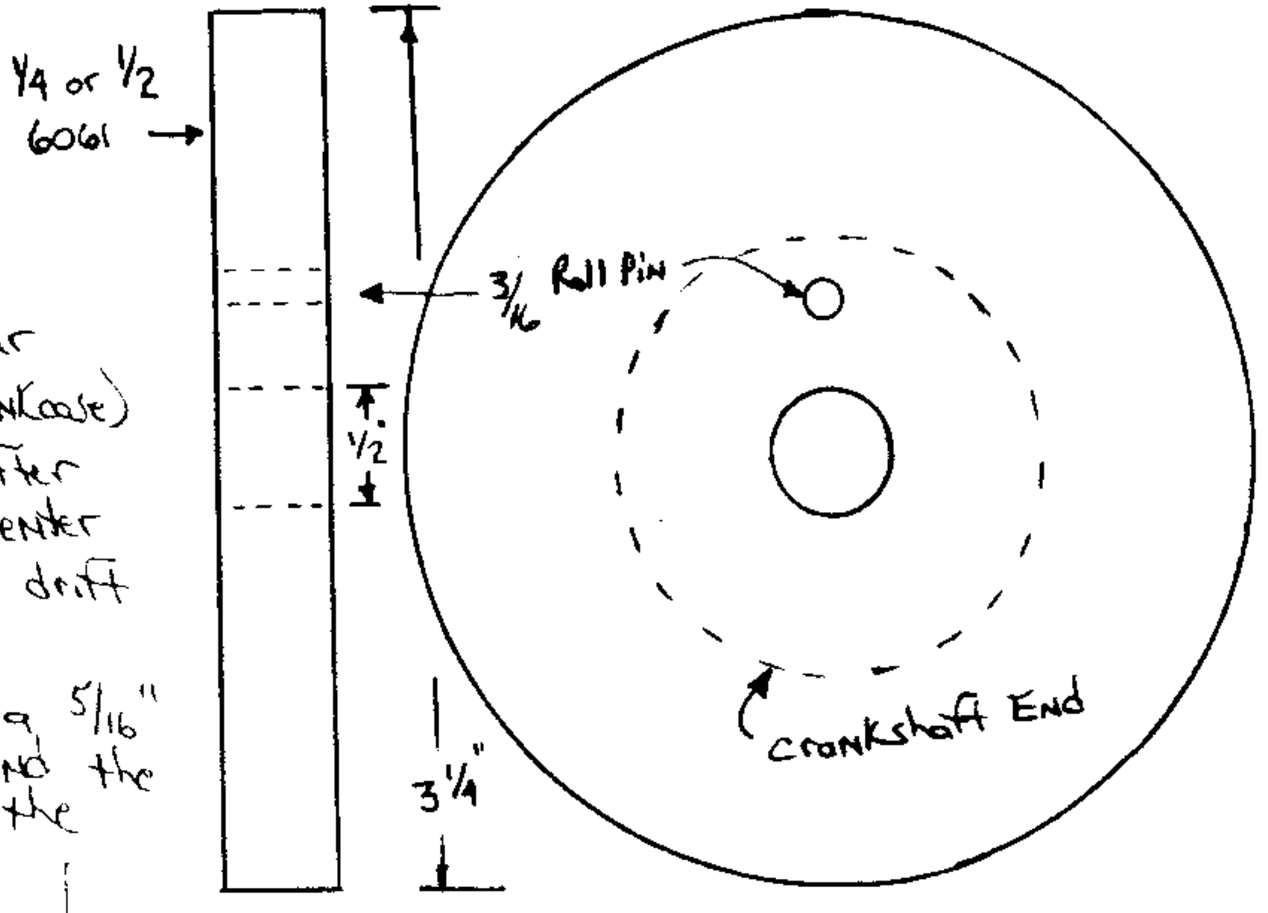
Gaskets used under all Covers.

② Cut Tube Cover "Full Case"

"Full Case"

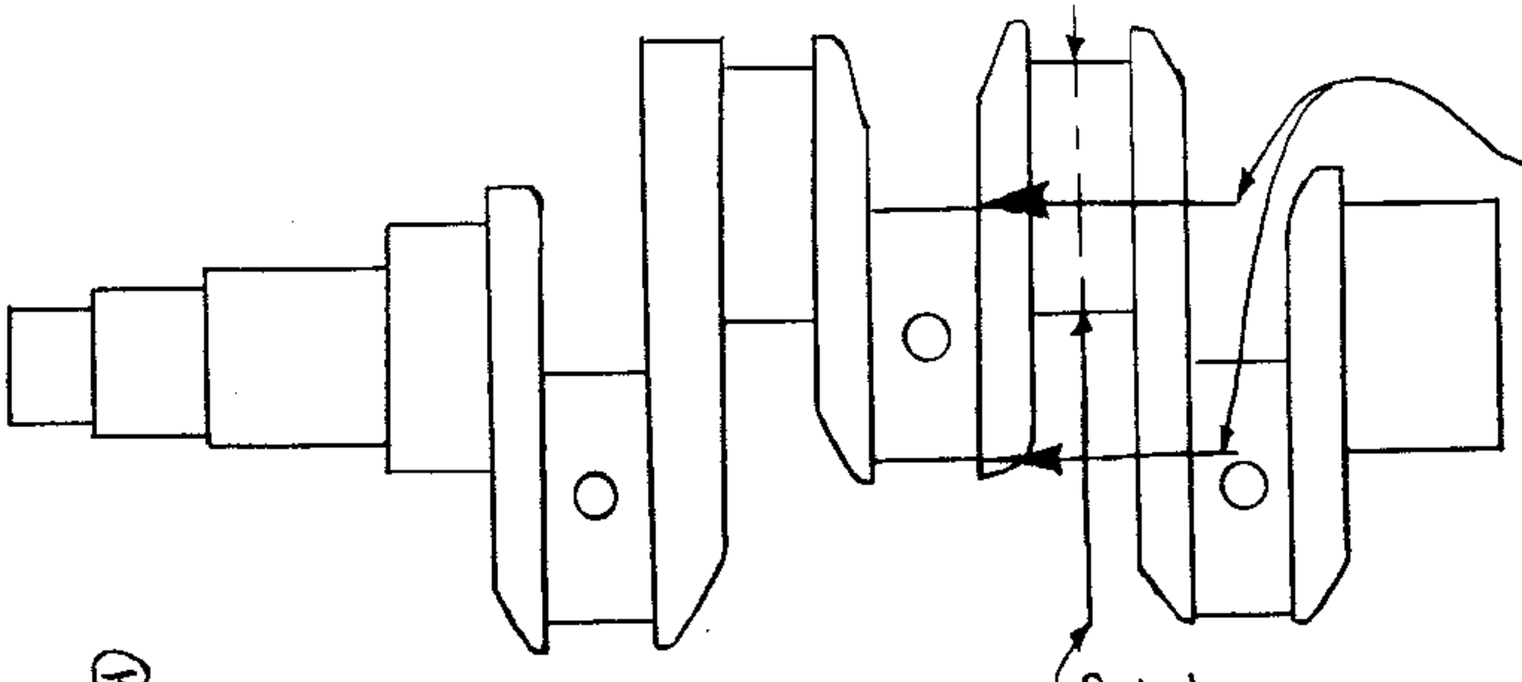
Notes: Move Rear Brg. to center of Case.

The Oil passages that lead to the rear of the engine must be plugged. (Crankcase) Drive a plug through the rear lifter passage, then move it to the center lifter bore passage using a long drift to drive it in tightly.
Plug the rear of the case with a 5/16" allen set screw. Use silicon around the threads. Plug the oil passages to the rear main brg the same way.



Use VW shims for .004 End Play.

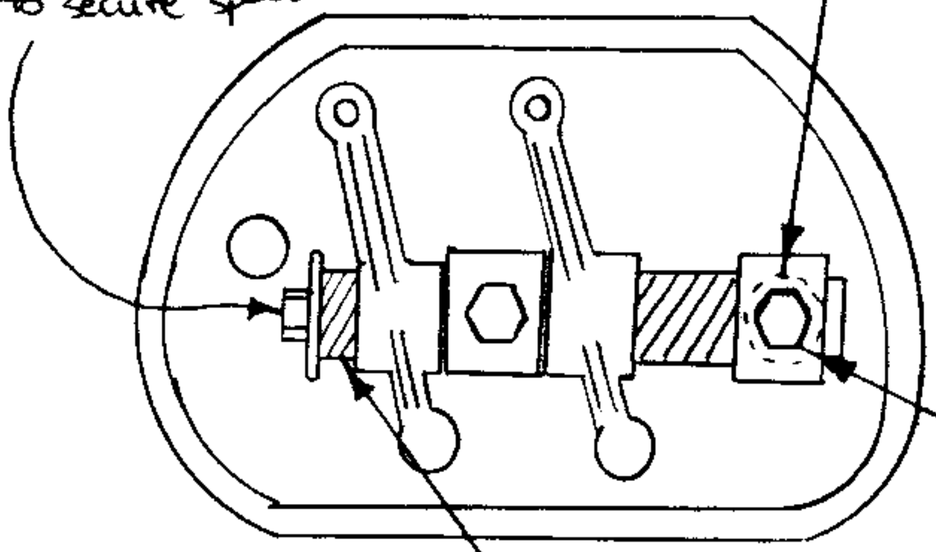
Machine here for end plate.



Full Case Crankshaft Conversion.

Drill and tap 1/4"-28
Use AN 970-4 washer
to secure spacer.

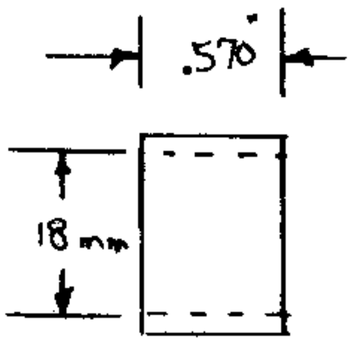
make spacer for
Rocker stand under bolt.

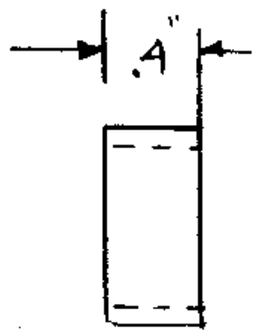


AN5 Bolt
and Locknut

Front spacer. 2 required

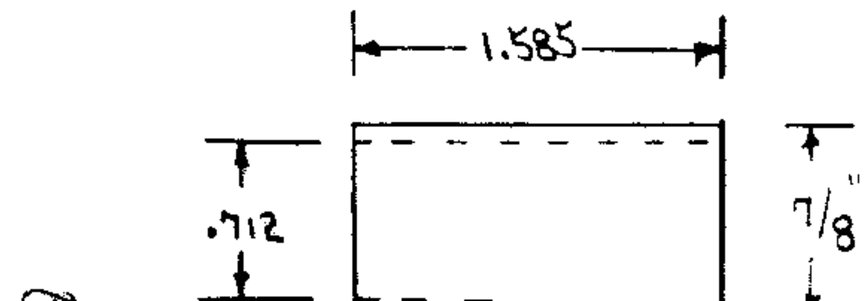
Left side 1ea.



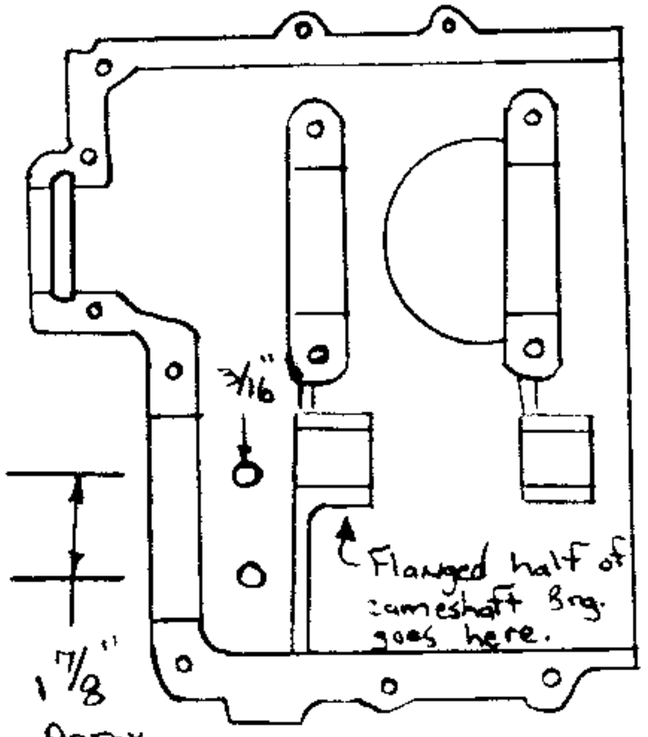


Rocker Arm
Shaft Spacers
7/8" x .049 4130 Tube.

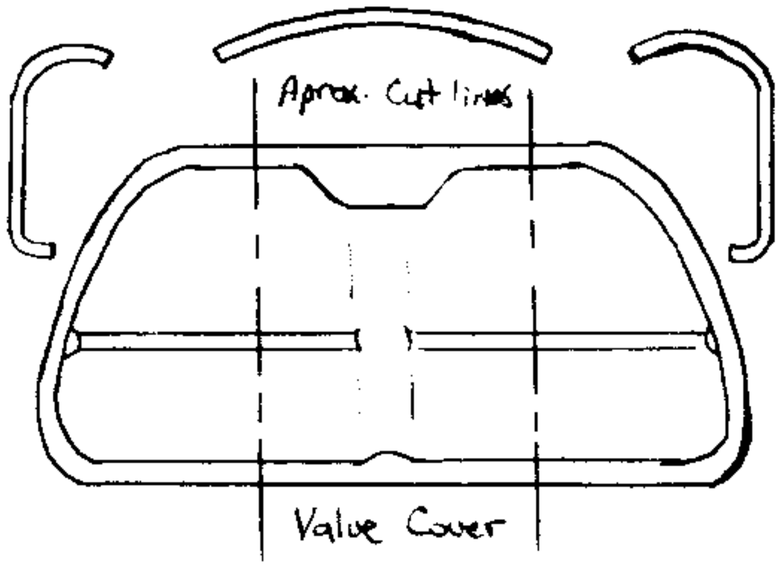
Rt. side 1ea.



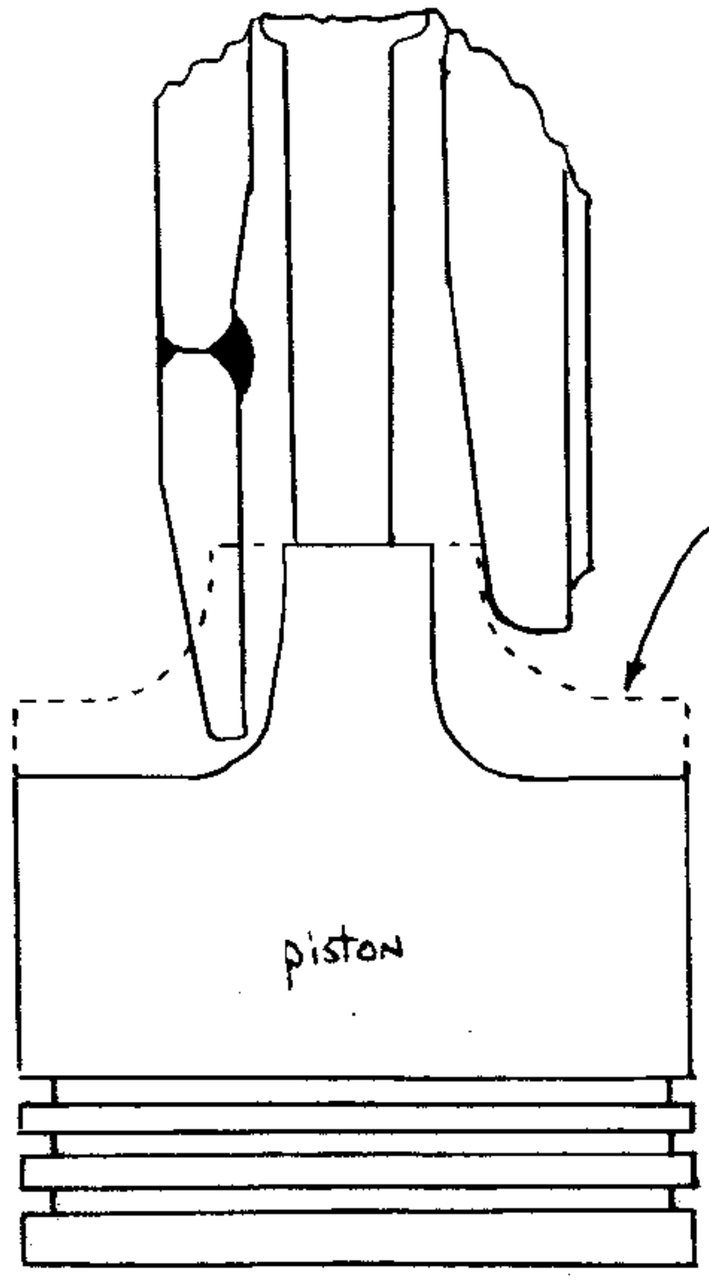
View- Looking Inside
of Rt. Crankcase half.



Oil Pressure Relief hole to be
drilled above existing hole.



Use Finished Head as a guide through

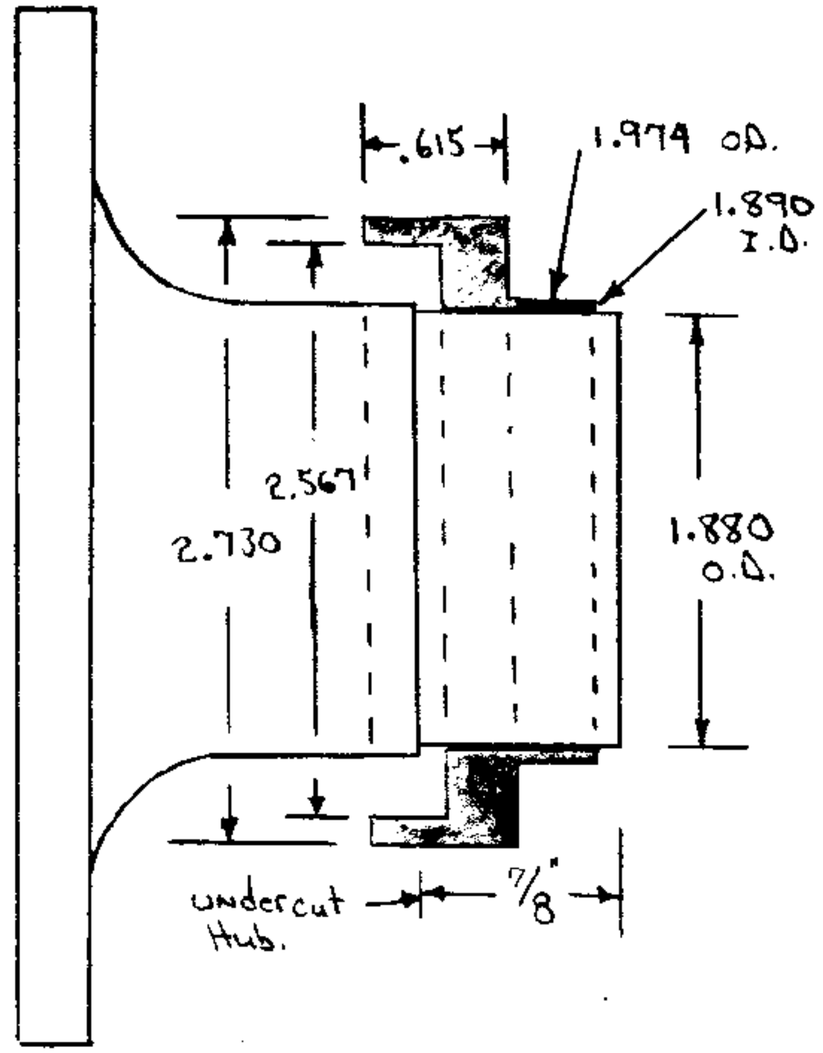


Use 8.5 to 1 Compression Ratio and .060 Deck height for 92 mm cylinders. (917 cc.)

Piston Skirt material must be removed to clear Counter weight. Balance Pistons, crank and Rods.

Be sure arrow on top of pistons point Aft.

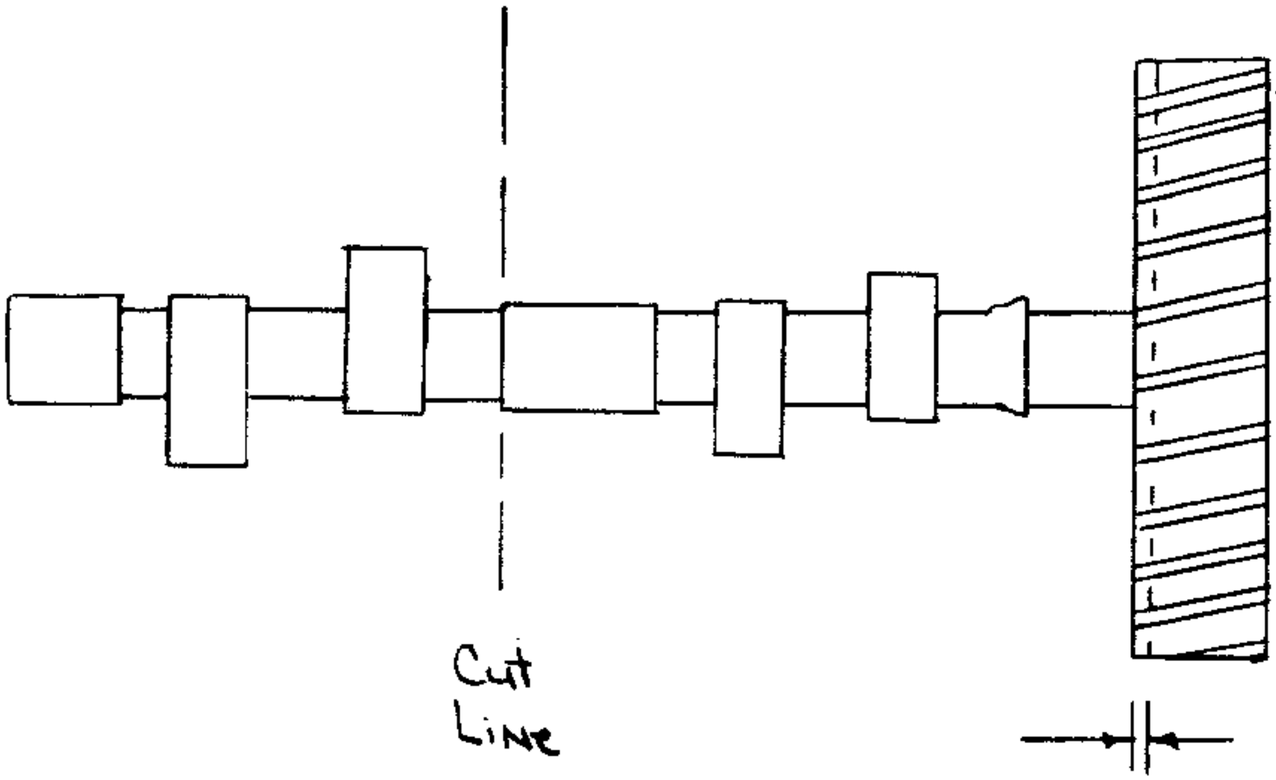
Forge marks on Rods should be up.



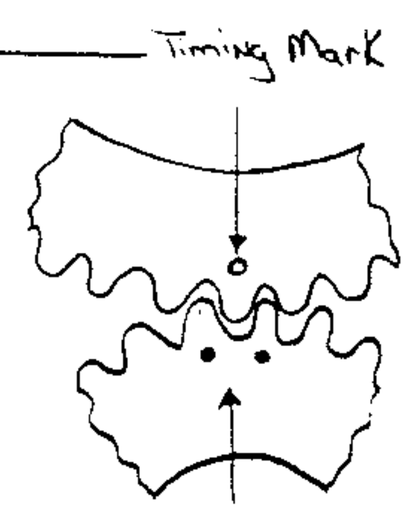
Monnett Prop Hub.

Form YW Type II Bus Seal with Front Disc Brakes.
P/N 211-405-6410

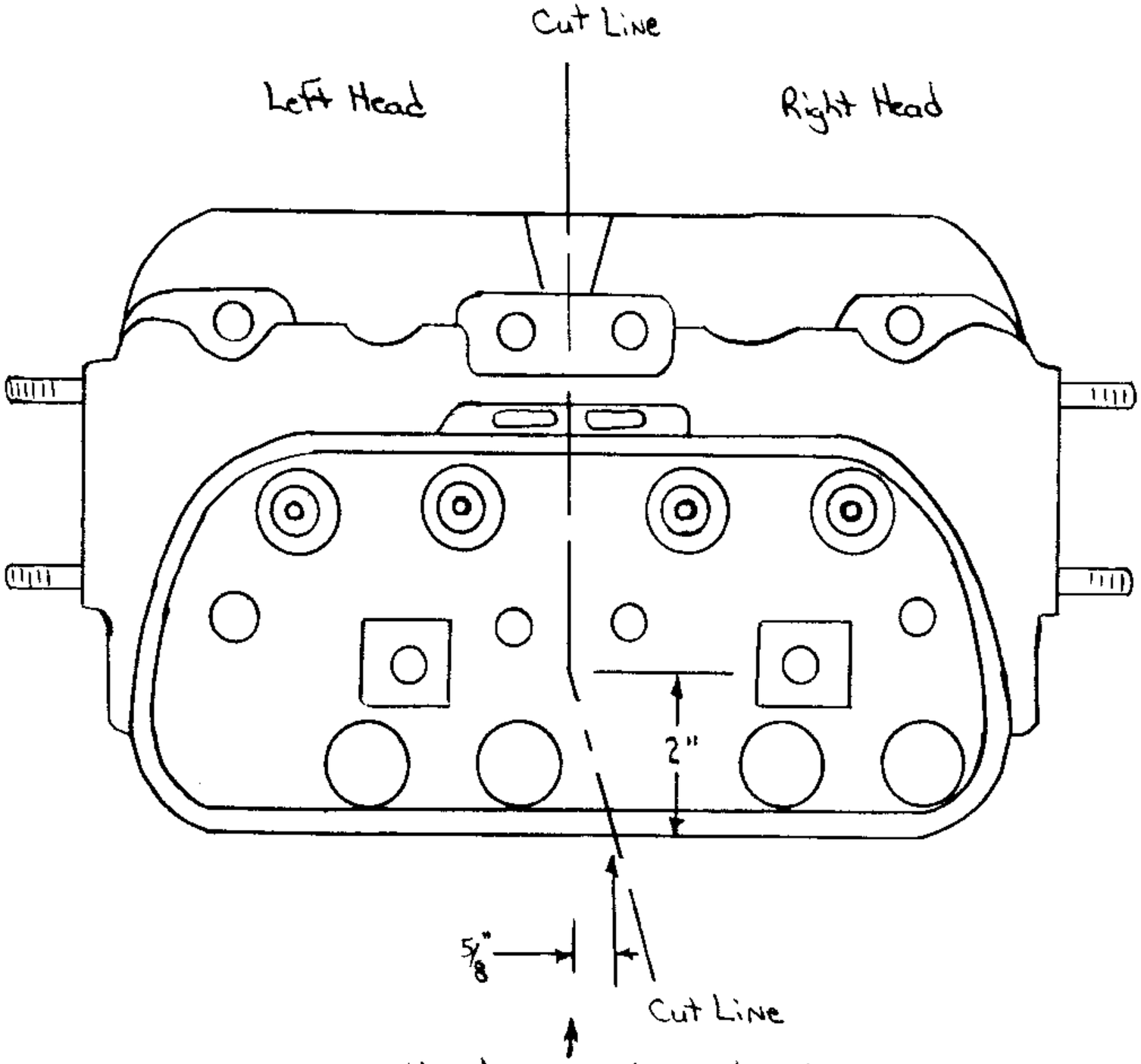
IF HAPI Tapered Hub is used they will also supply Seal.



"Z" + .010
To be removed.

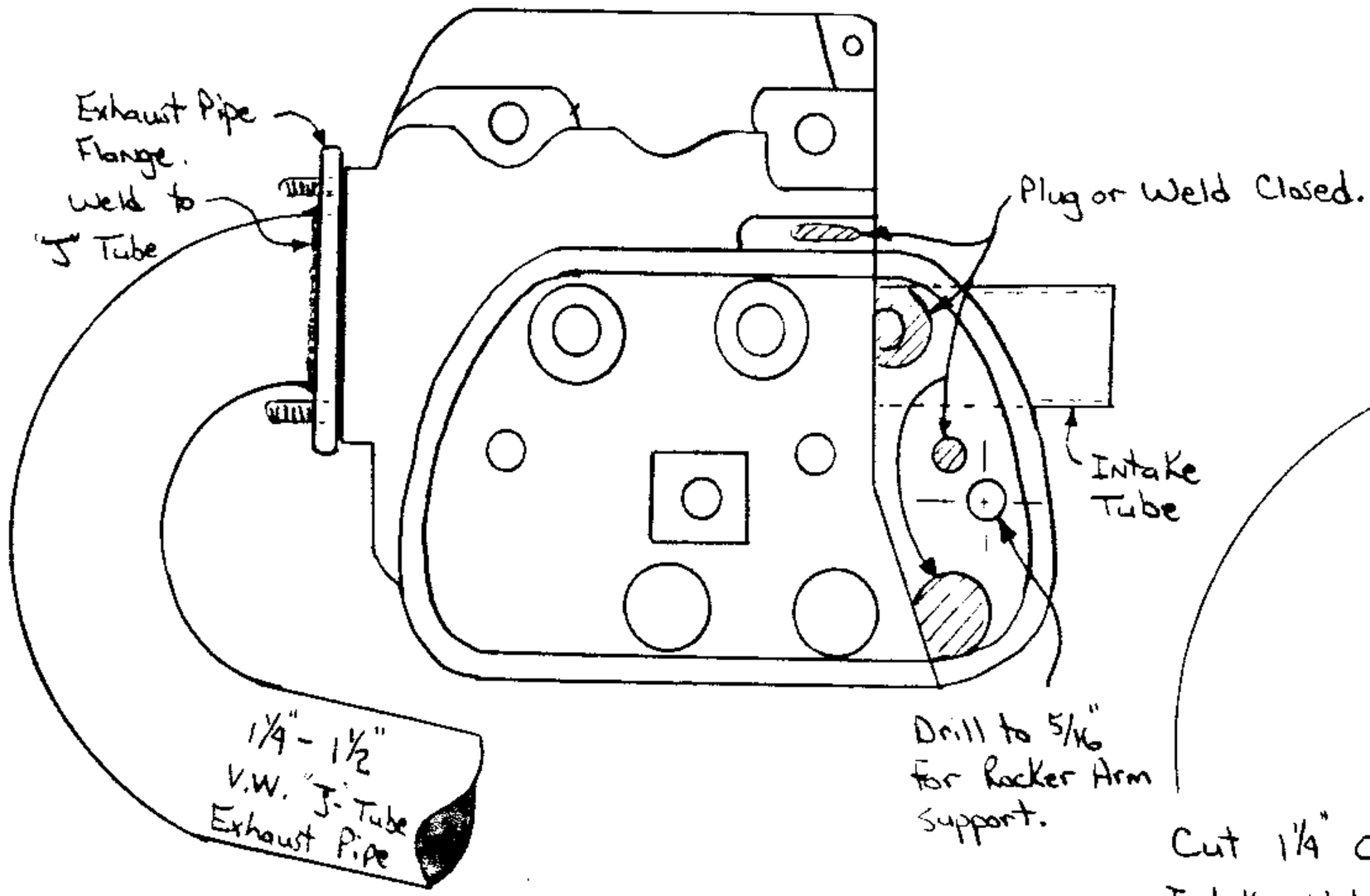


Camshaft

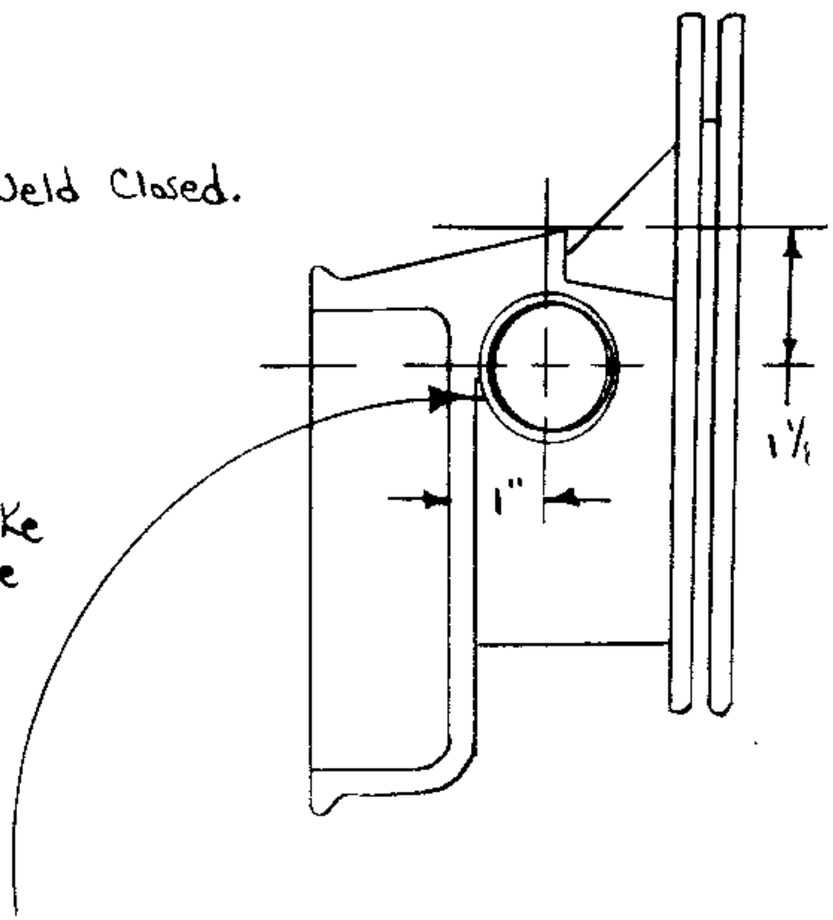


Heads may be cut straight

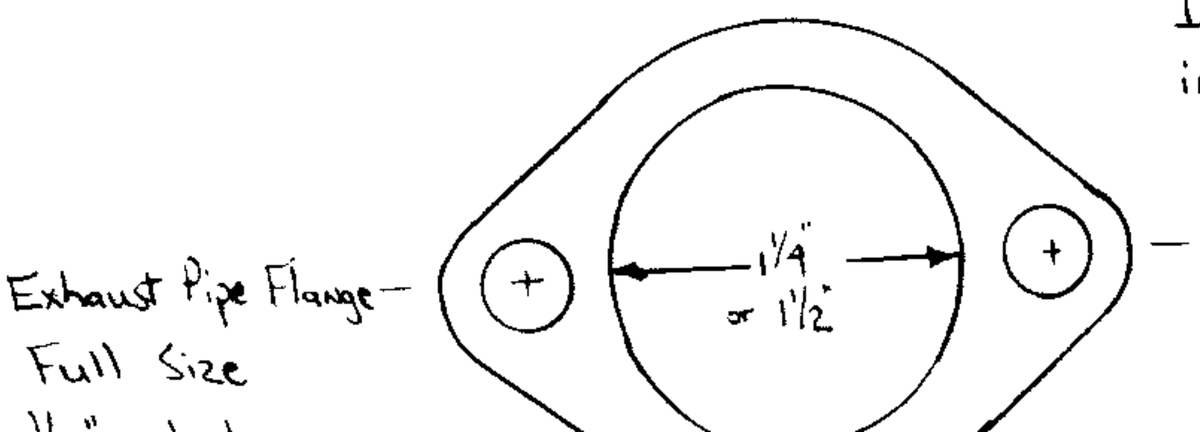
Side View



Rear View



Cut 1¼" O.D. hole in side of Intake Valve. Weld Intake Tube in place. 1¼ O.D. x .058 - 2 5/8 Long.
6061 - T6



Carb. Heat Muff
Optional Cabin Heat

Left exhaust Pipe shown
For Carb. Heat.

8"

Air Intake

2½ Hose clamps

Sect.
AA

A

2¼

Braze

1½"

.032 Steel Disc
Front with holes
Rear without.

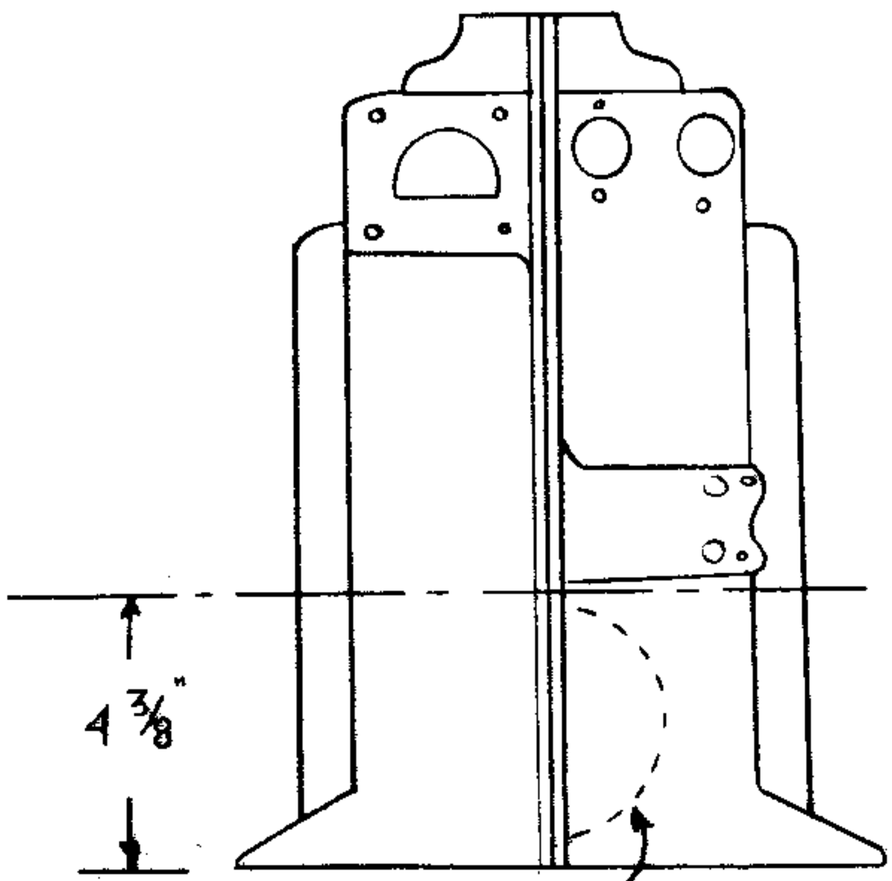
.016 2024
Alum. sheet

Exhaust
Pipe

Heated Air
to Carb.
Heat Box

1" OD x 1½ long
Collar

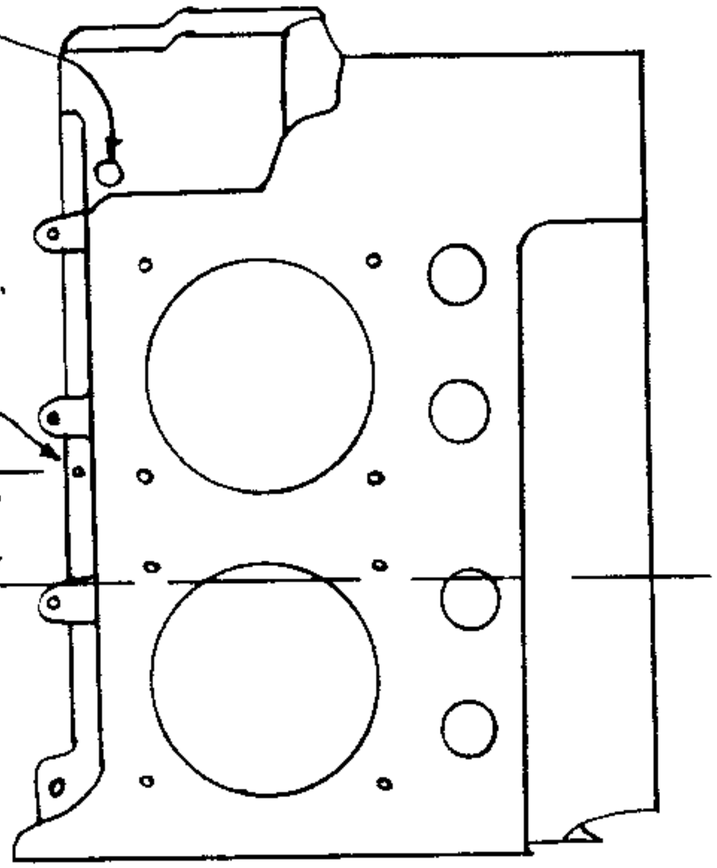
Full Size



Drill optional 1/8" NPT For Oil pressure Guage Line.

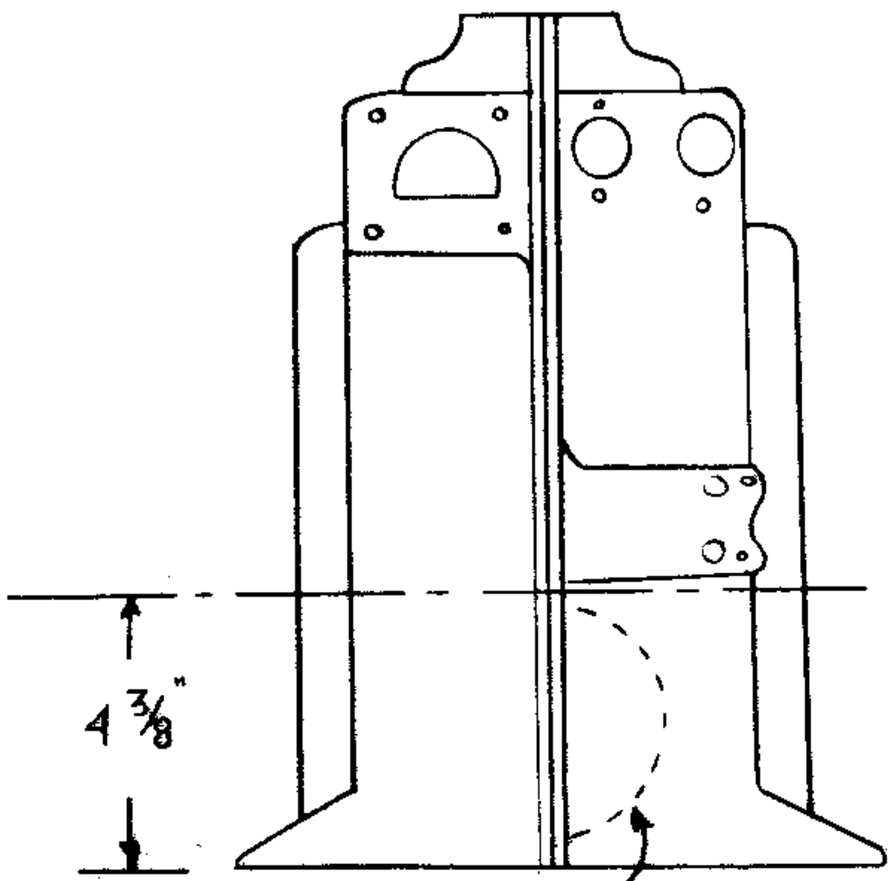
location of 1/4" hole for new dowel pin.

1 3/4"



1/2 moon shape to be used to Fill in cyl. opening when welding.
See Crankcase Connection - Welding.
Also see Full Size pattern.

IF using Full case these holes will be covered. See Cover plates.



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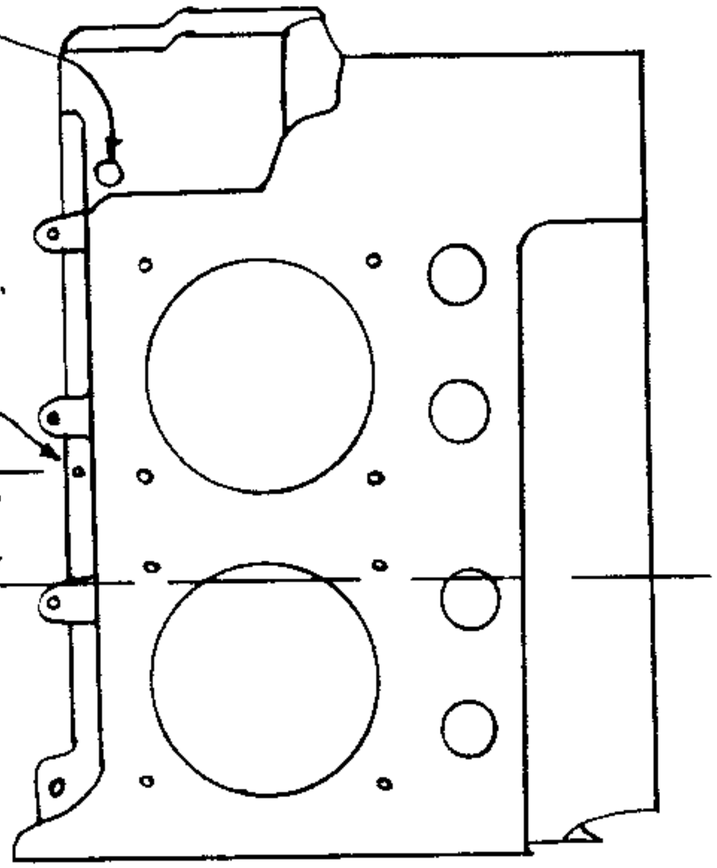

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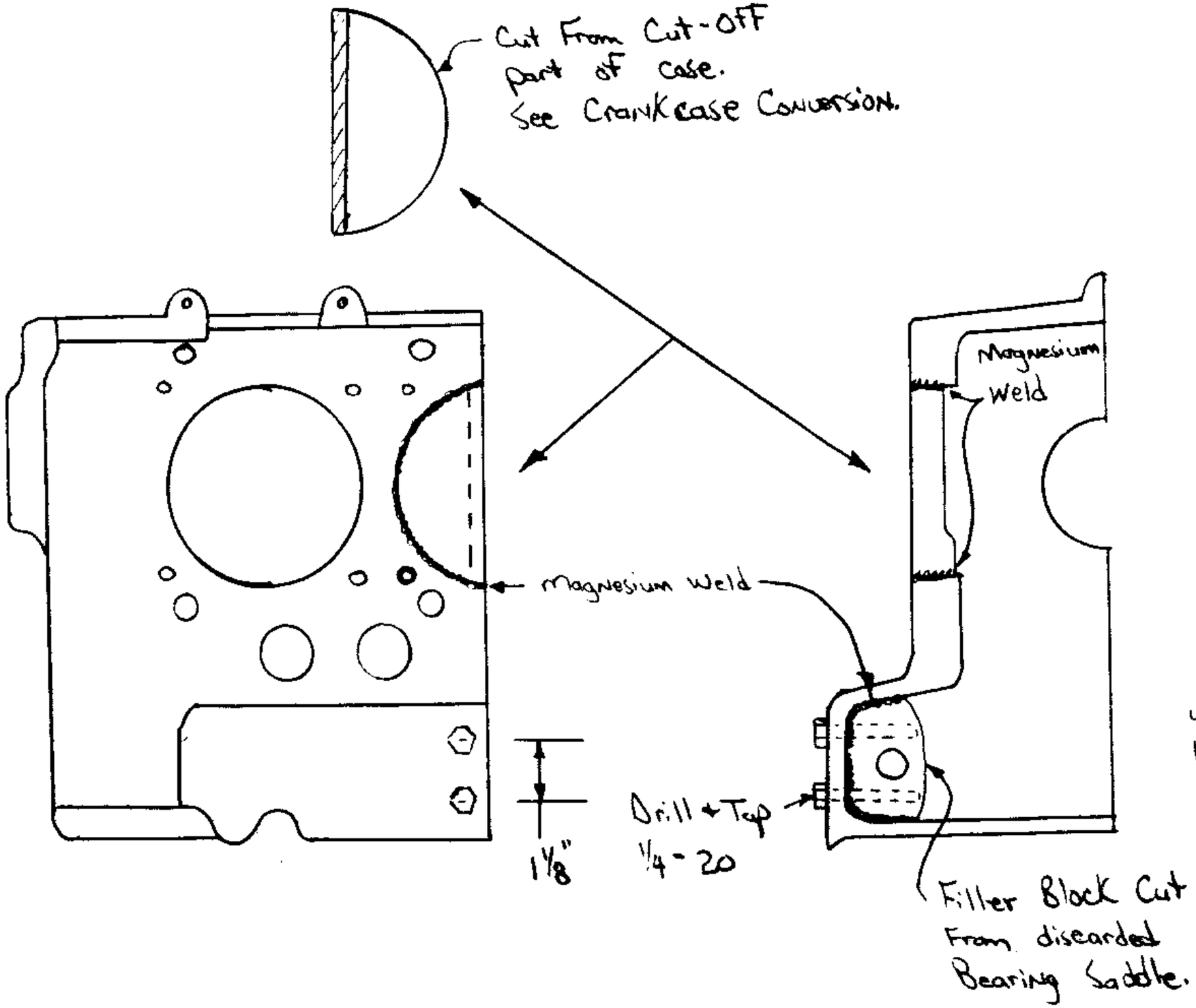
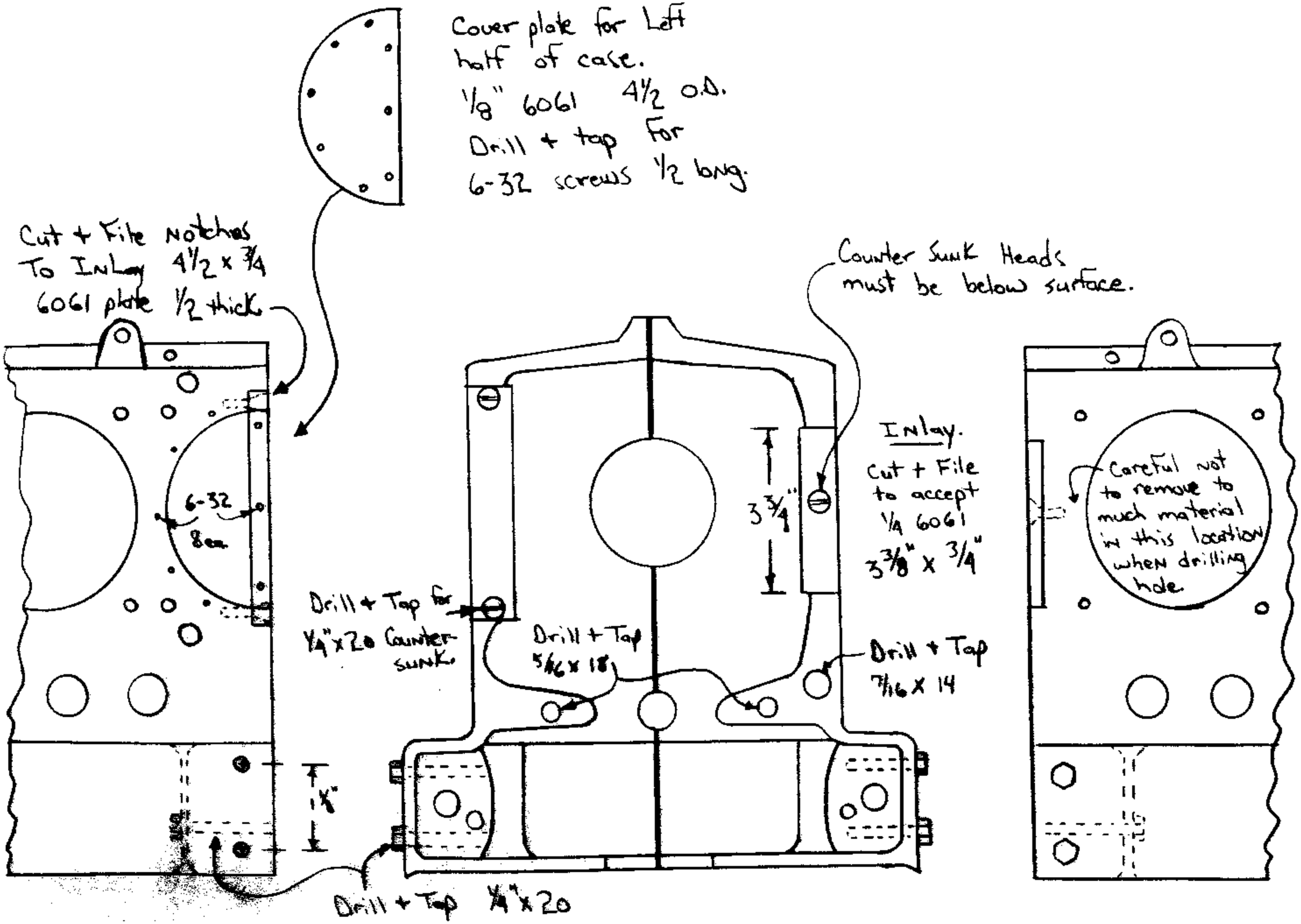
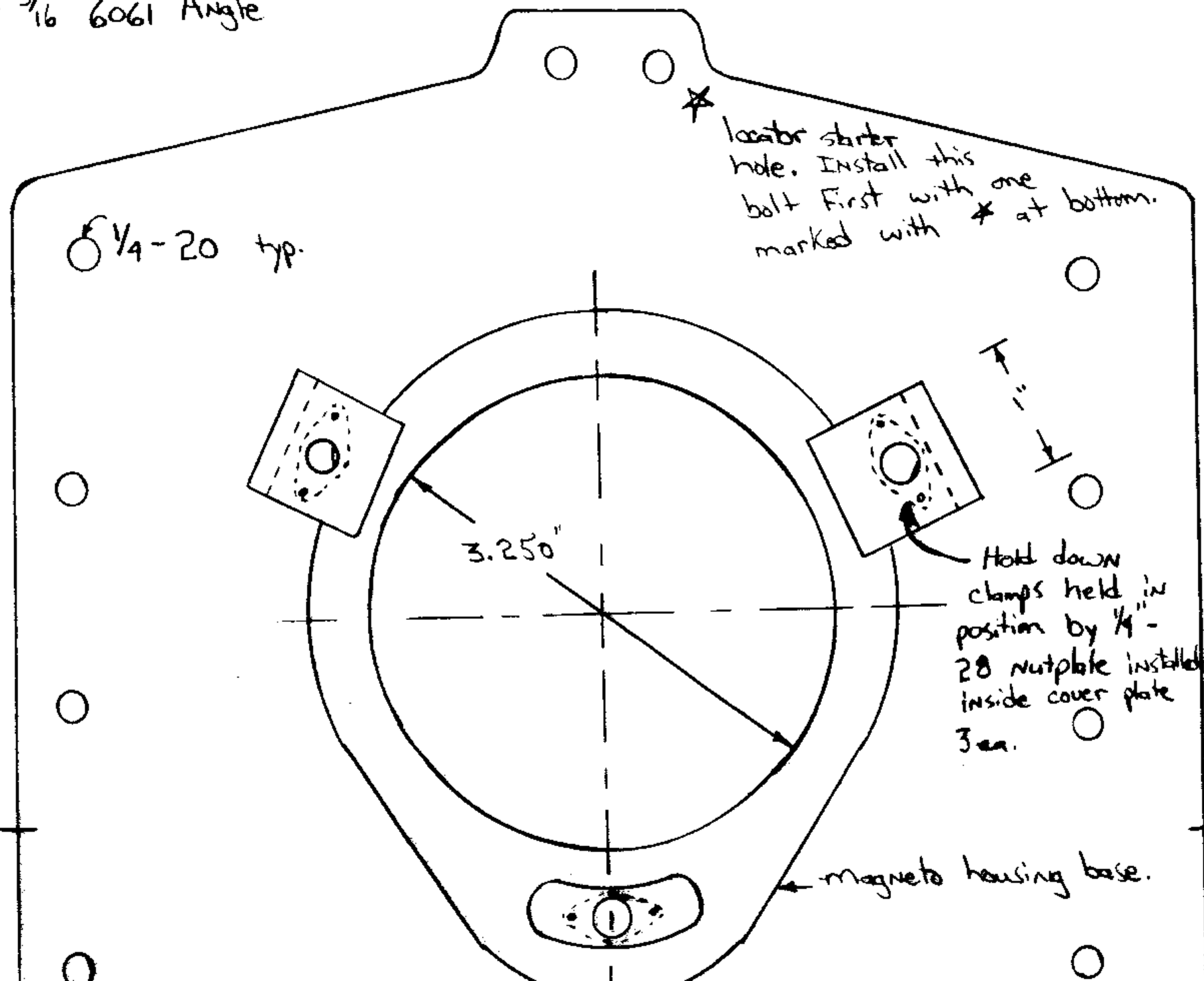

Cut From Cut-OFF
part of case.
See Crankcase Conversion.
Magnesium
Weld
Magnesium Weld
Fill depressions
with Weld in Rt.
Half of Crankcase.
Drill + Tap
1/4 - 20
1 1/8"
Filler Block Cut
From discarded
Bearing Saddle.


Cover plate for Left half of case.
1/8" 6061 4½ O.D.
Drill + tap For 6-32 screws ½ long.
Cut + File Notches To InLay 4½ x ¾ 6061 plate ½ thick
Counter Sunk Heads must be below surface.
6-32 8ea.
Drill + Tap for ¼"x20 Counter sunk.
Drill + Tap 5/16 x 18
3¾"
Inlay.
Cut + File to accept ¼ 6061 3⅜" x ¾"
Drill + Tap 7/16 x 14
1"
Drill + Tap ¼"x20
Careful not to remove to much material in this location when drilling hole

Engine Rear Cover Plate. Sheet 2 of 2.

← Mag. Hold down clamps.

1 x 1 - 3/16" 6061 Angle



Sheet 1 of 2

Correct at Reference marks.

3/16 dowel

1/4"-20

3/16 dowel

1/4"-20

3/8-16
Drill + Tap
Through Cover. 2 ea.

#10-24
4 ea.

Use 2 hole locations to aline plate then drill and tap remainder, see above.

Washer from 1/4" 6061. For Oil Temp Sensor.

Rivets 3 ea.

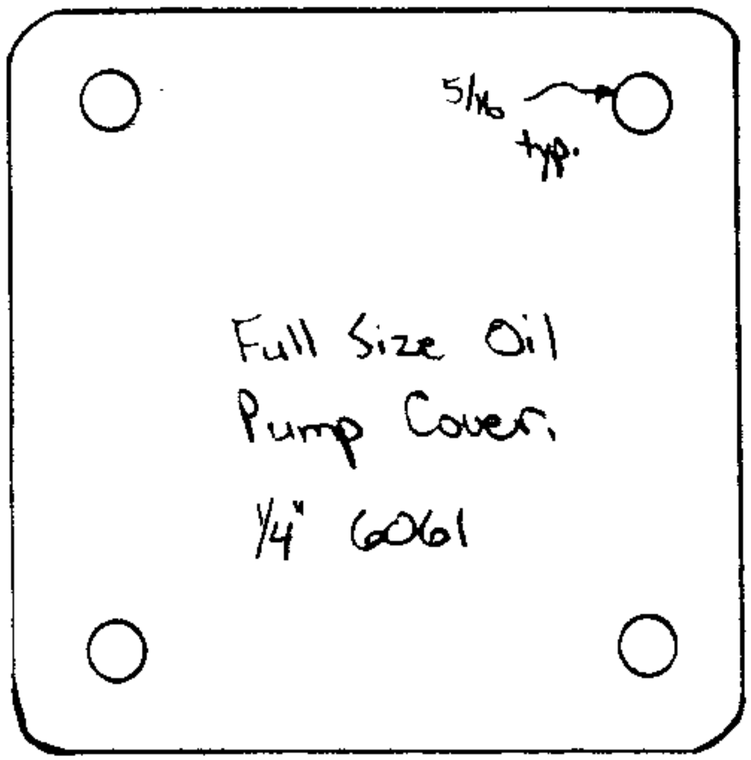
Drill & Tap as required

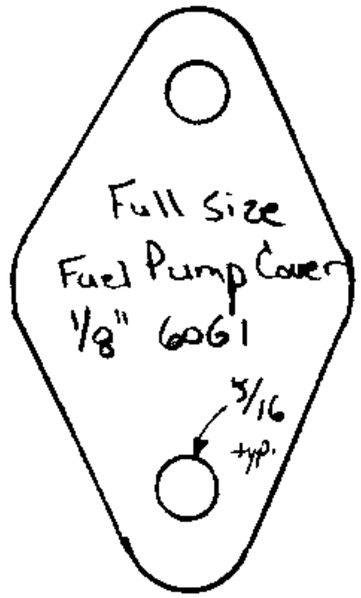
This surface must be flat so that oil sump cover plate will seal.

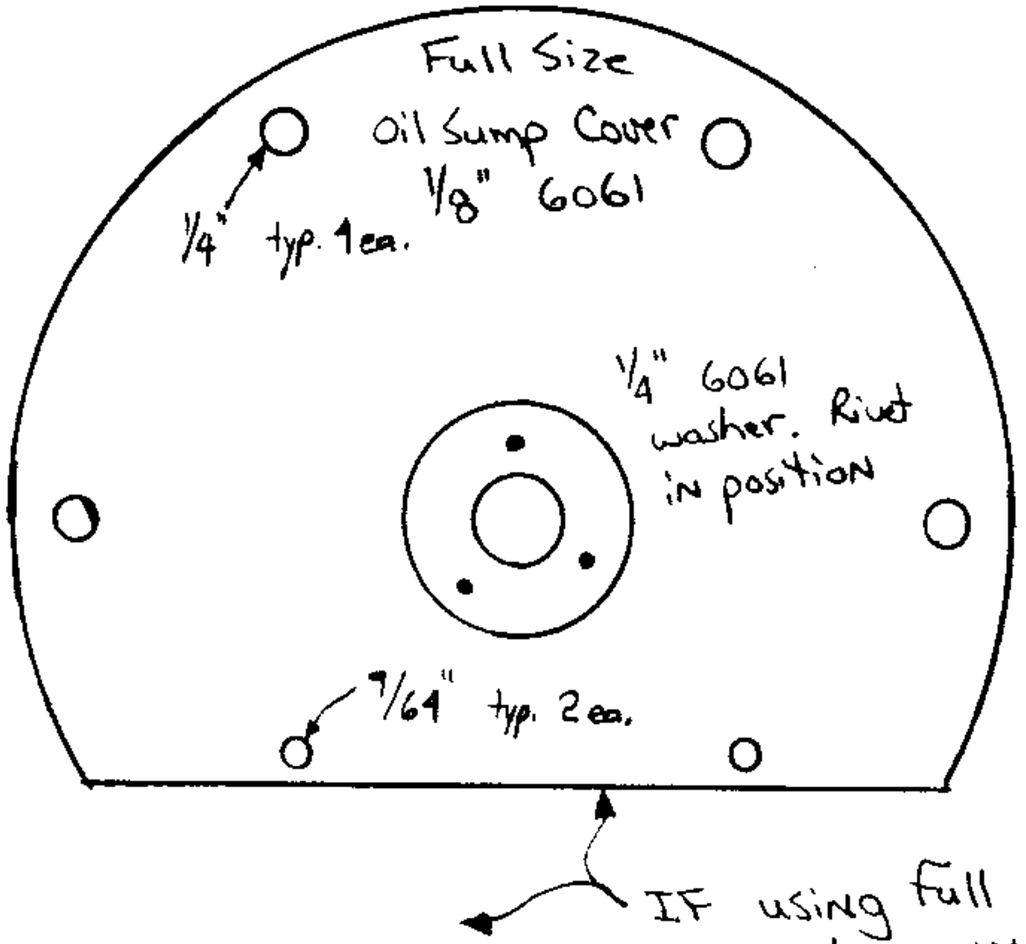
These 2 screws for securing Rear of Oil Sump Cover plate.

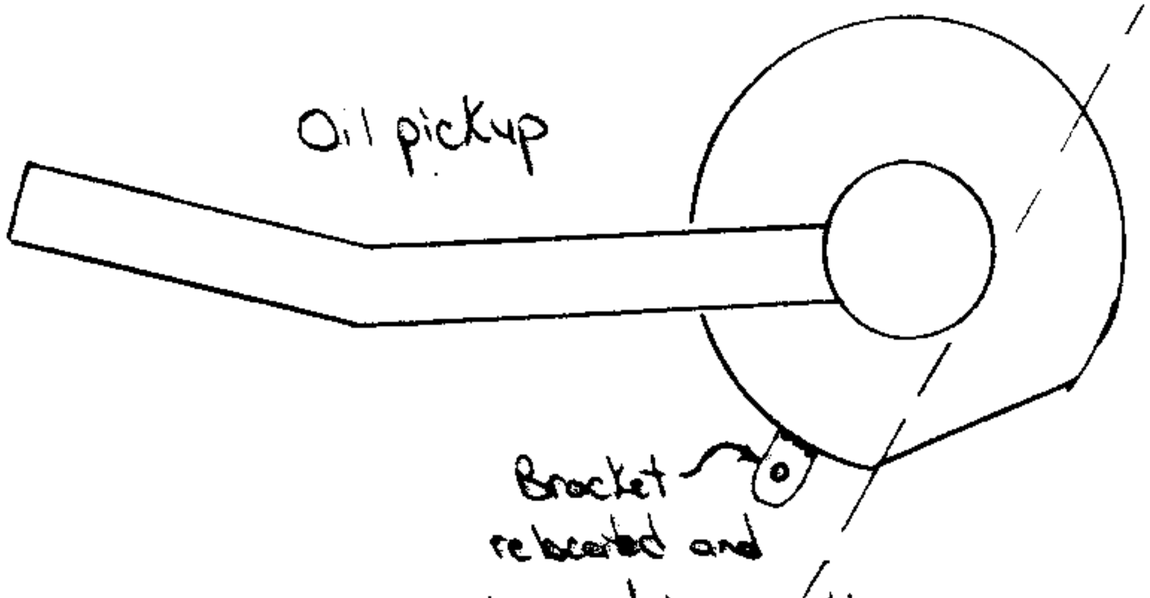
Cut plate from 1/4" 6061

Engine Rear Cover

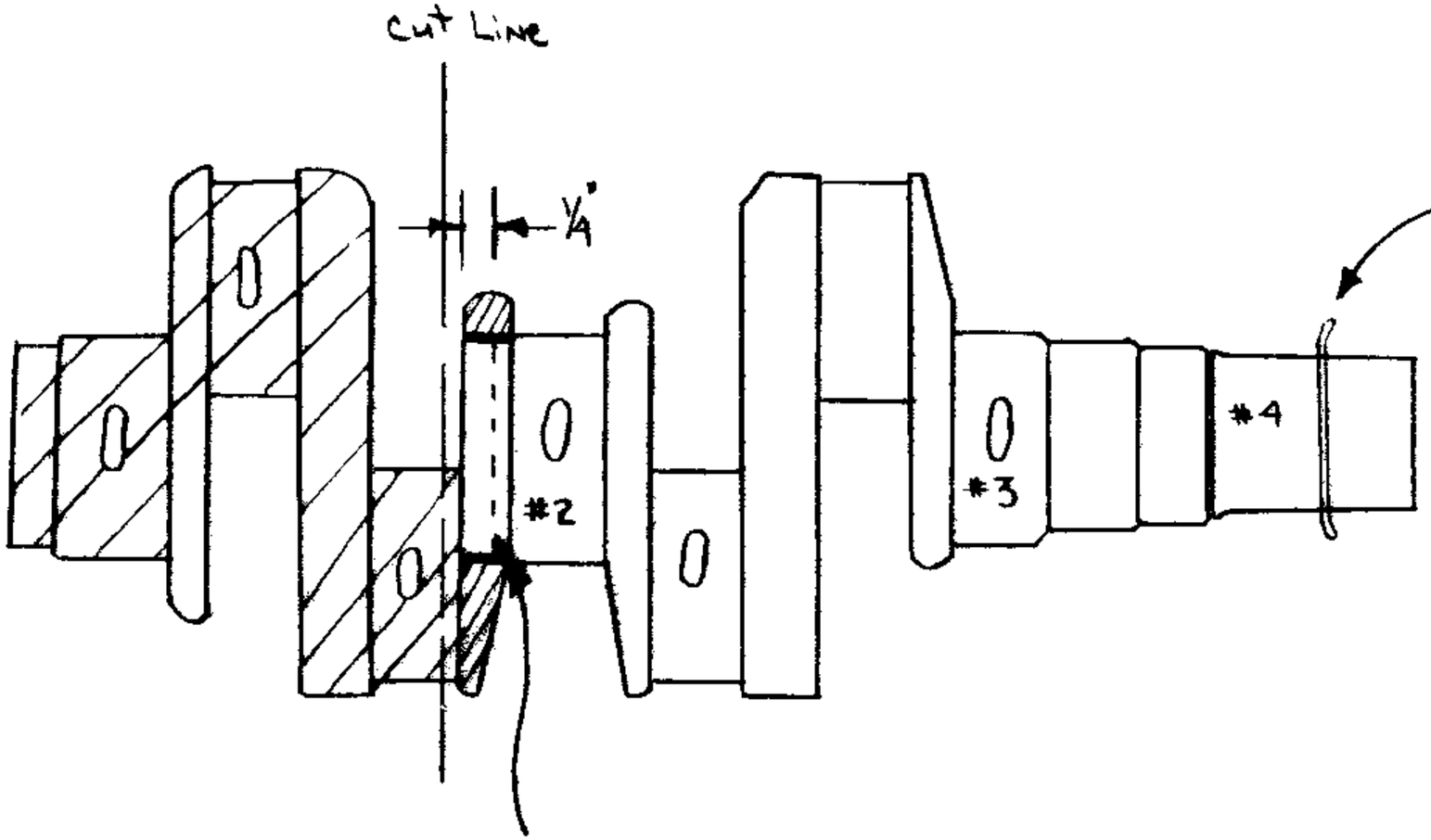




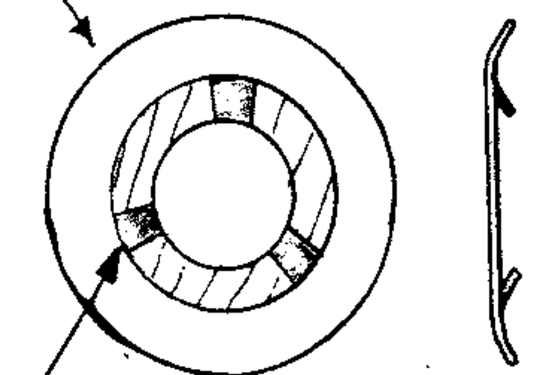




Cut Oil pickup as shown. Cover cut end with .028 plate and braze in place.



Machine #2
1/4" From End.
See Additional
Crankshaft Drgs.



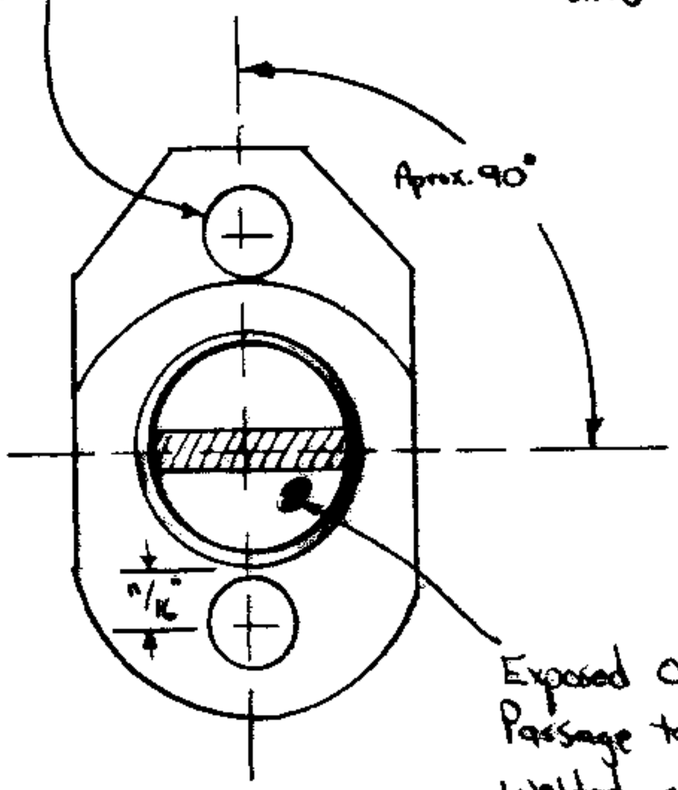
Oil Slingler

Modify by making
6 ea. saw cuts then
Bend tabs out.

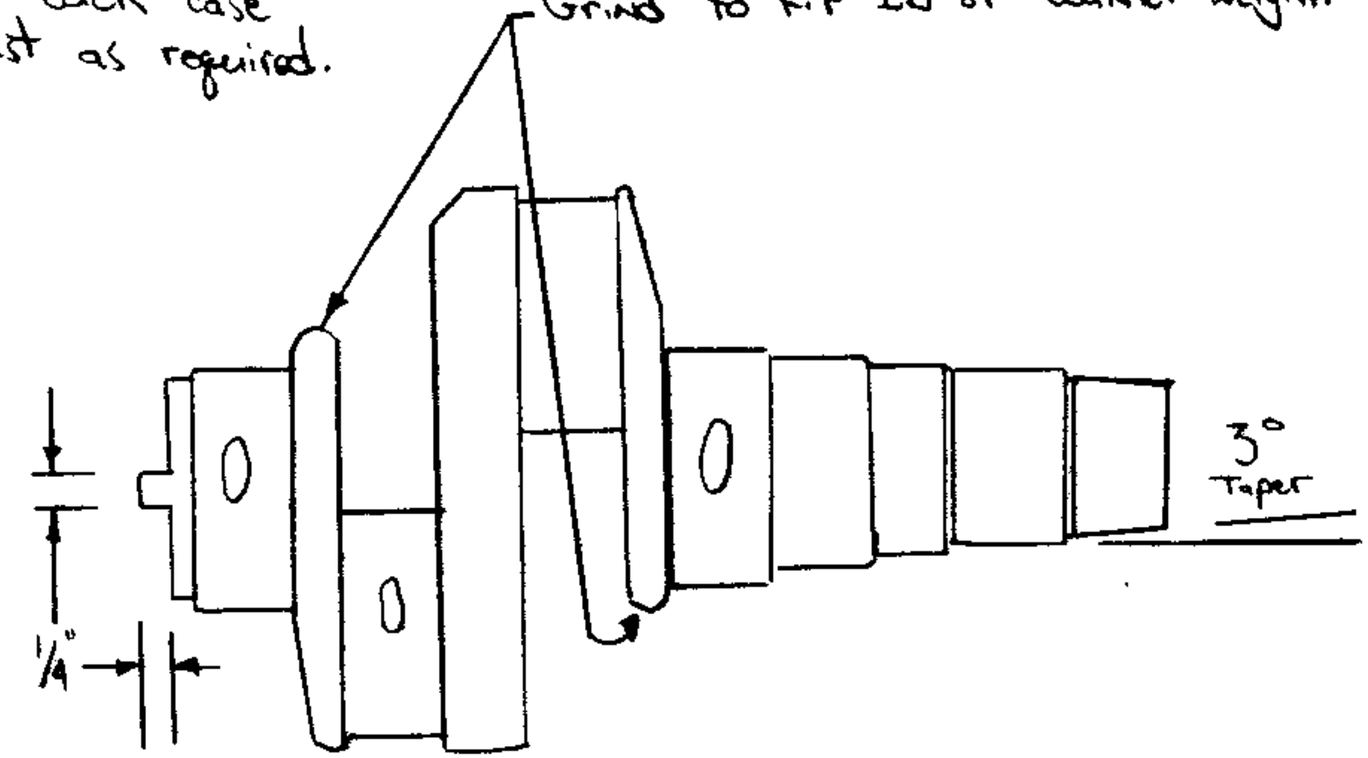
Magneto
Crank Shaft

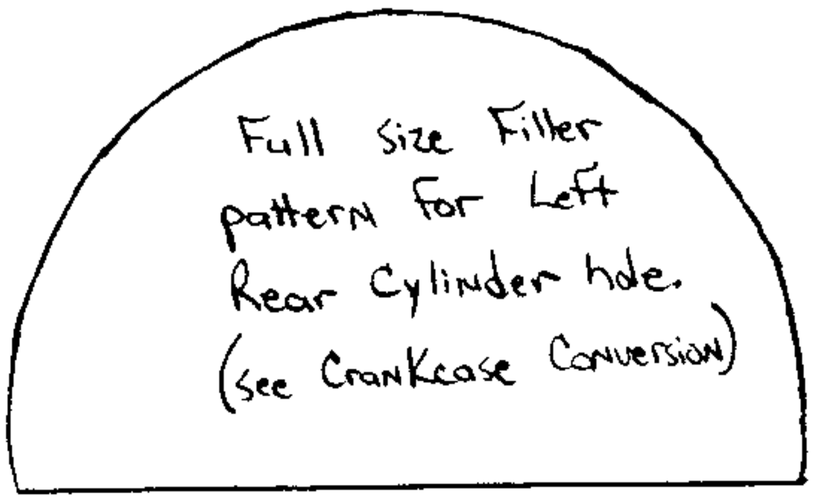
Drill 3/4 - 7/8 holes through Rod Journals Only If Extra Balancing Method is used for the crank 2 places.

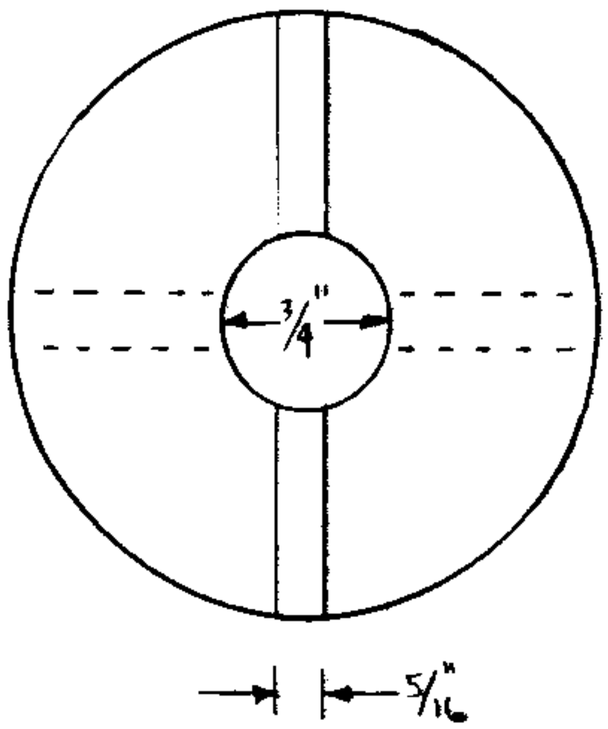
Magneto Baby should be vertical at 22° BTC Timing with Projection cut at 90°. Verify for each case and adjust as required.



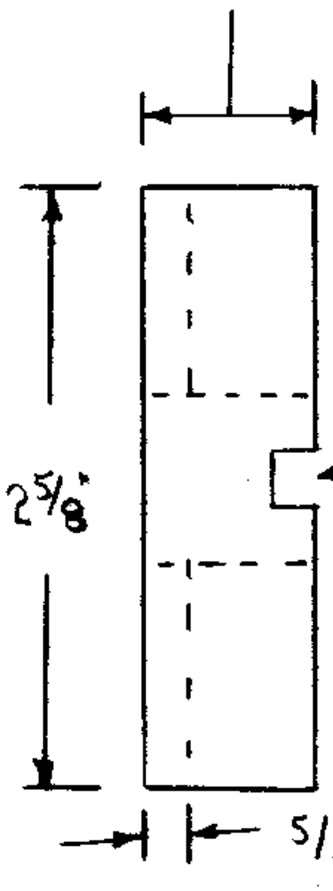
Magneto







Adjust to suit Magneto End Thrust Clearance. Aprox. 5/8" to 3/4"

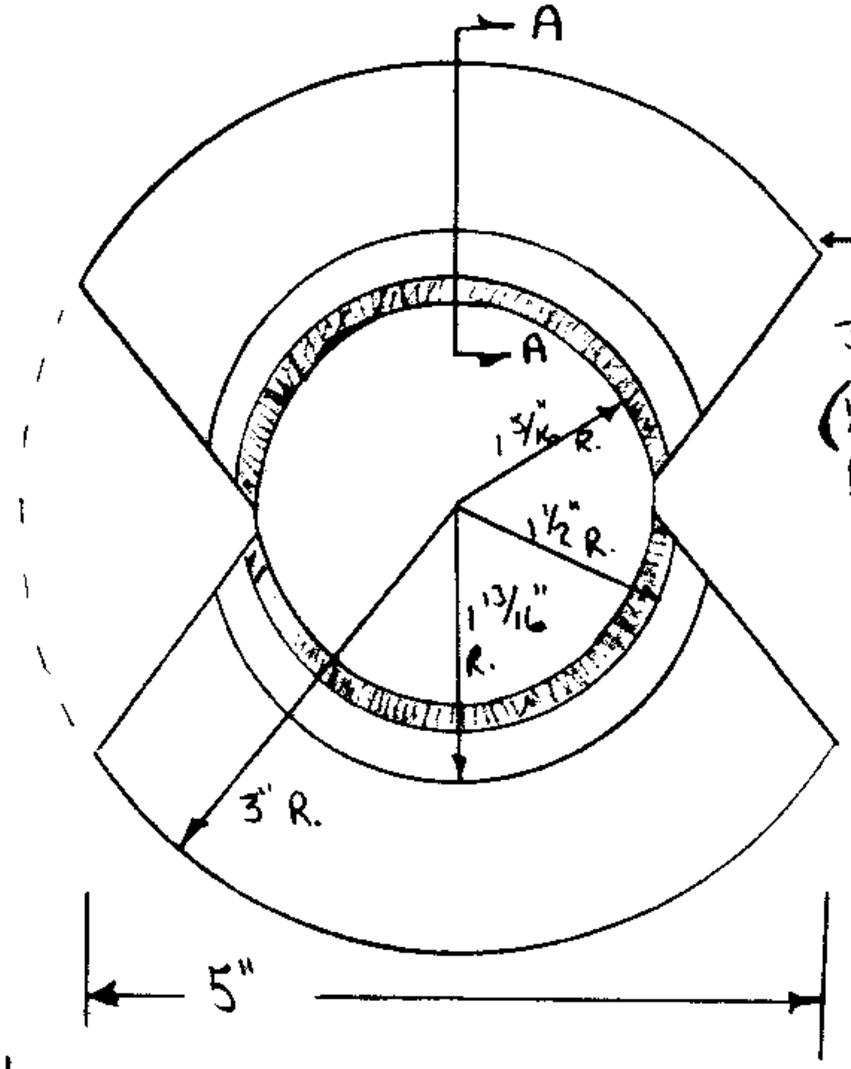


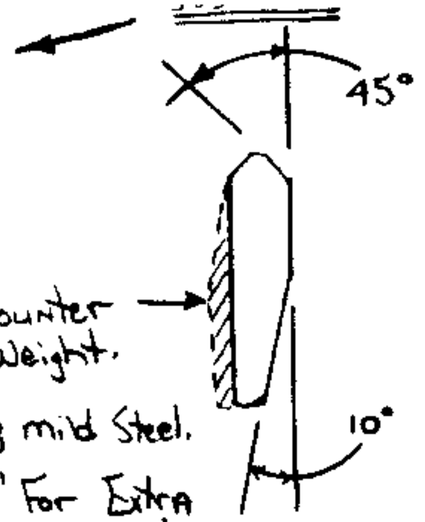
Mates to Projection on End of Crank.

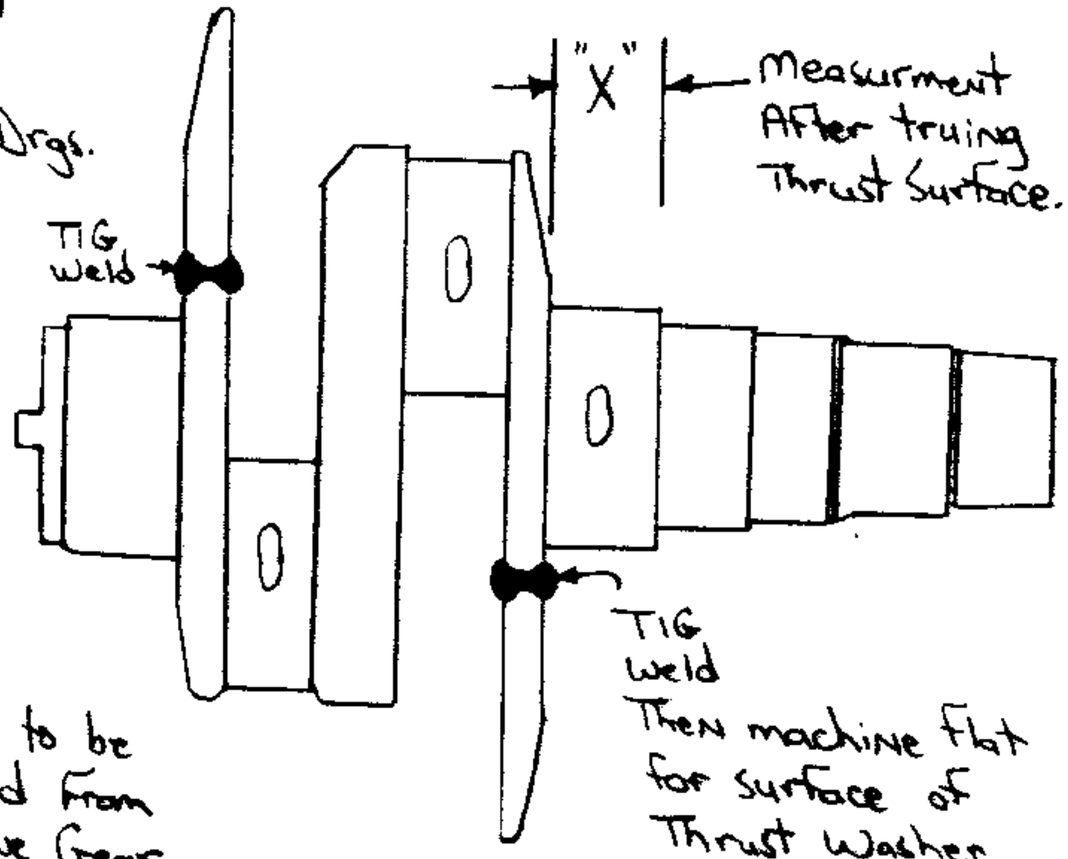
Mates with Projection on Magneto.

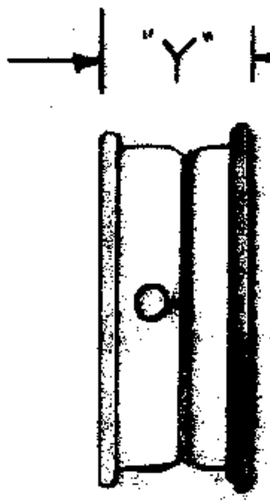
Full Size

"Micarta" Magneto Coupling.

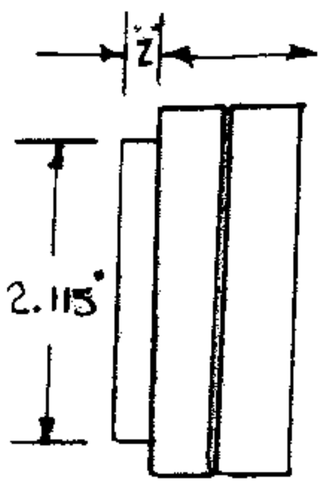








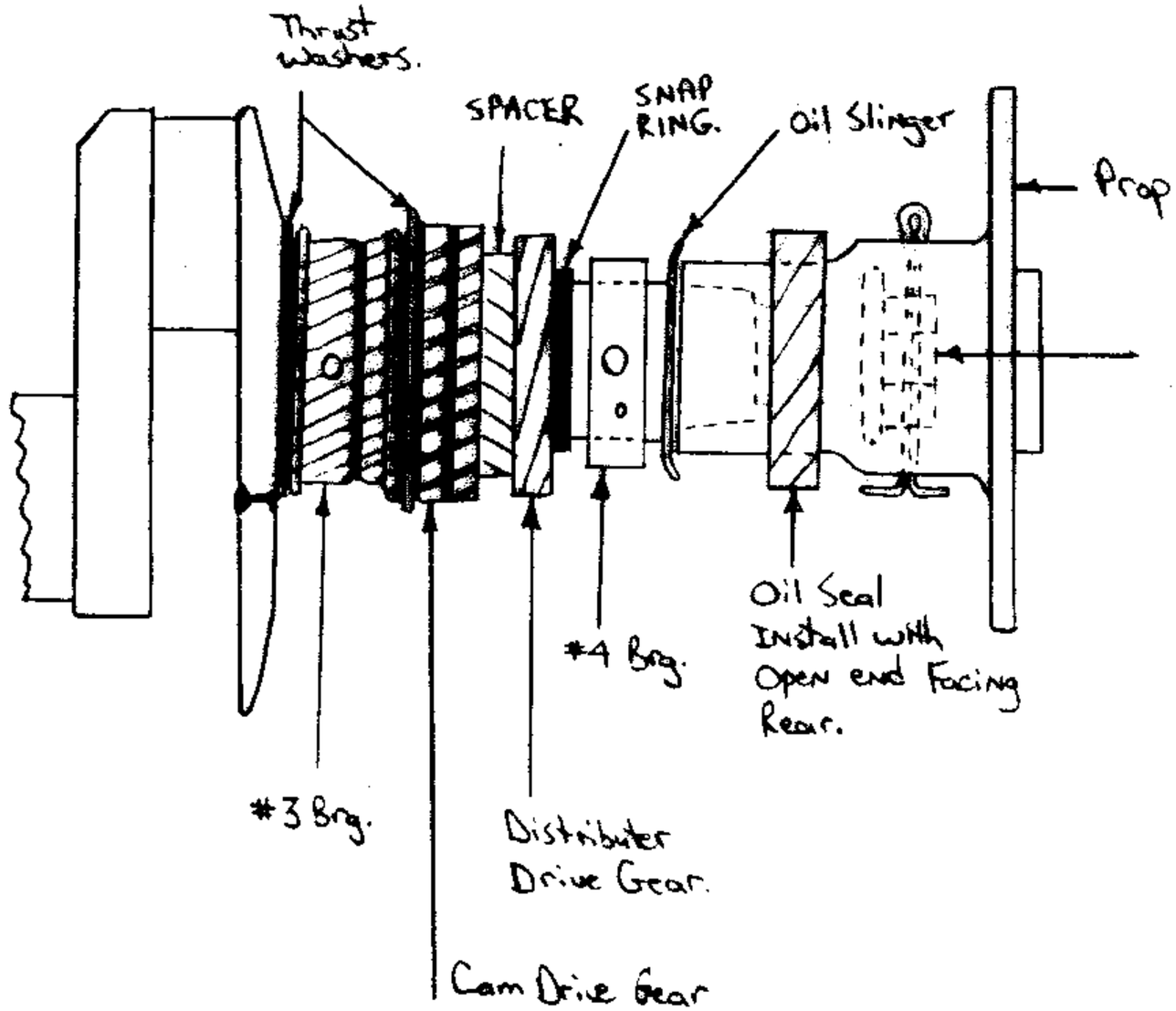
This measurment + thickness of the #3 Thrust shims T1, T2 + T3.



Amount to be machined from Cam Drive Gear.

Machine 1/8" x 1/8" Groove (For Gear Removal)

Extra Crank

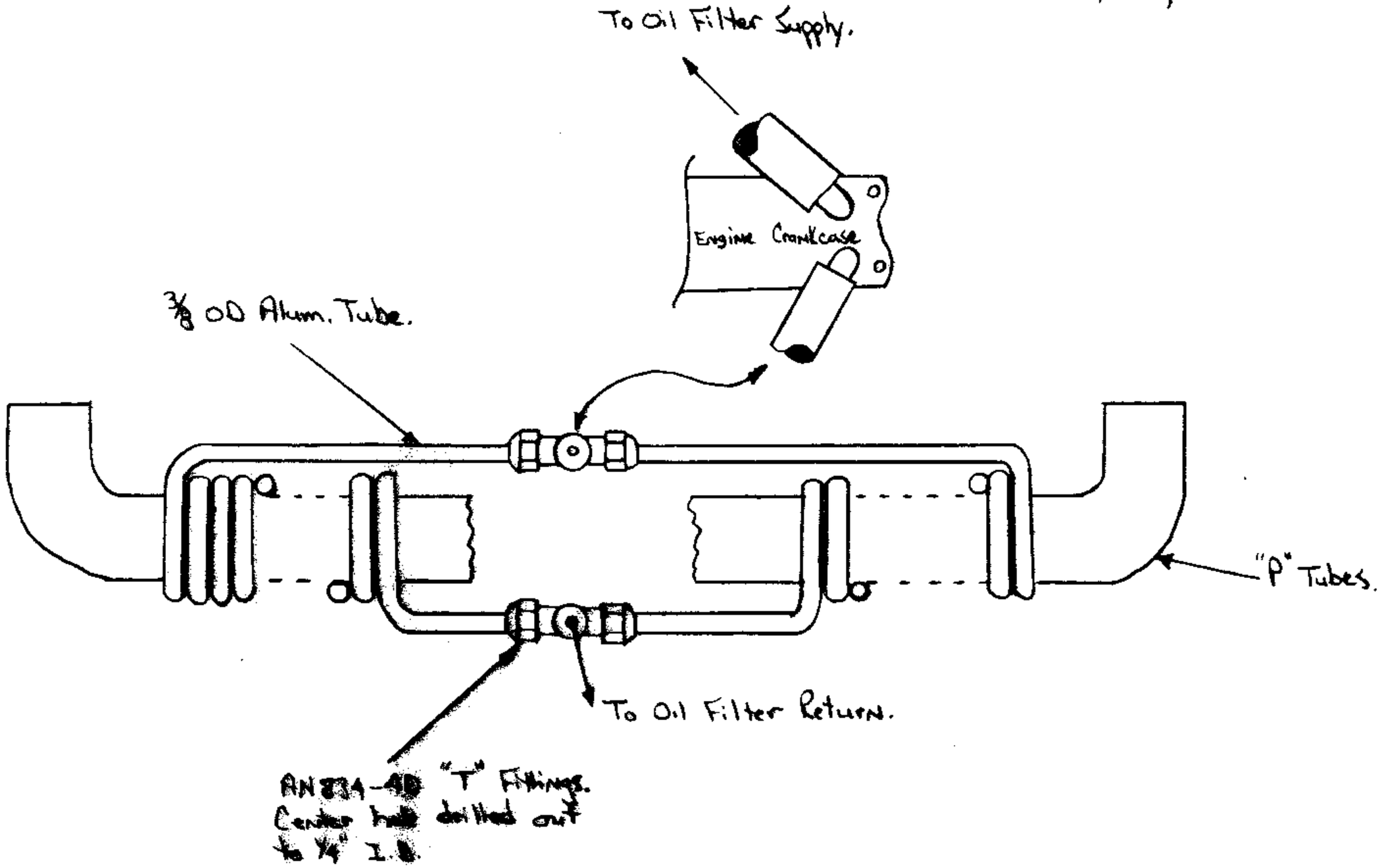


Prop Hub purchased From Great Plains AcFt.

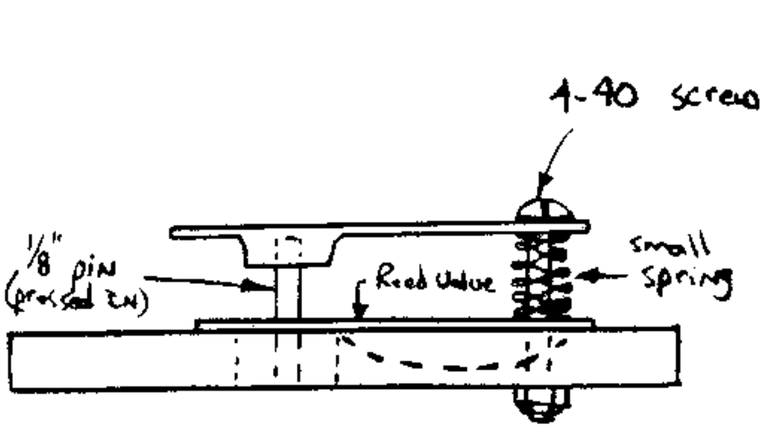
(2)

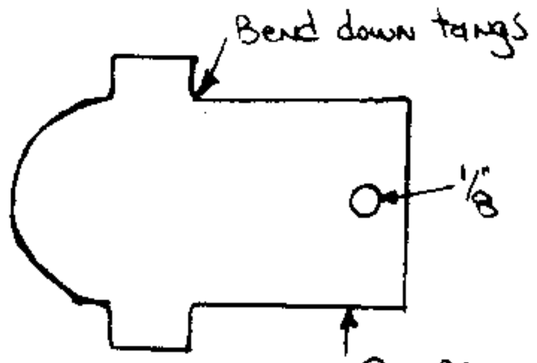
Prop Hub Installion

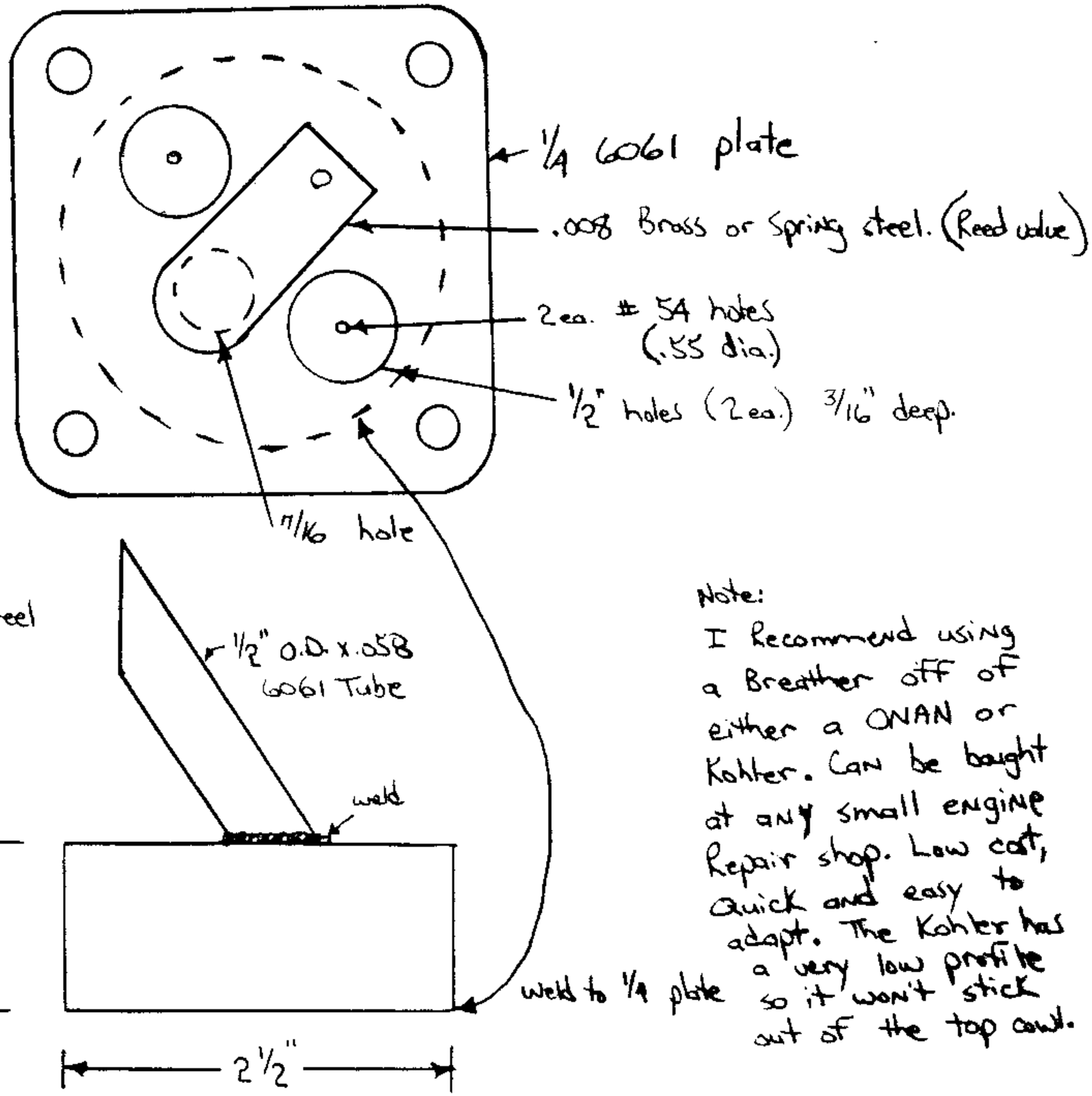
Note: Regular Oil Cooler on Engine. When equiped with one, may be used.



Oil Cooler / Intake Heater.



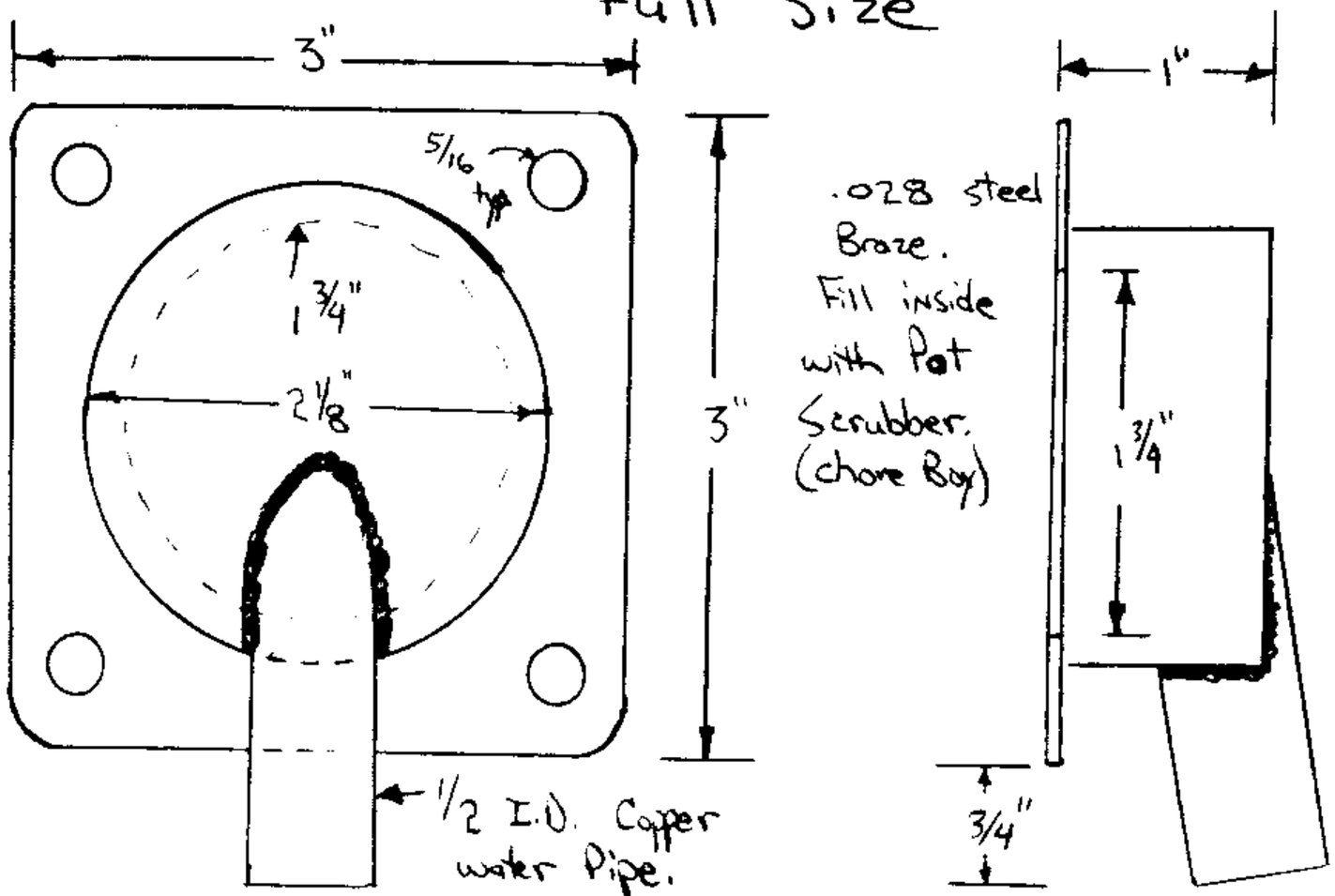


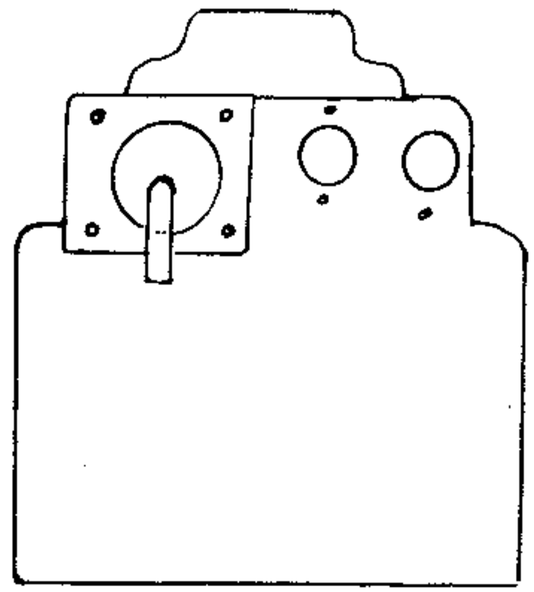


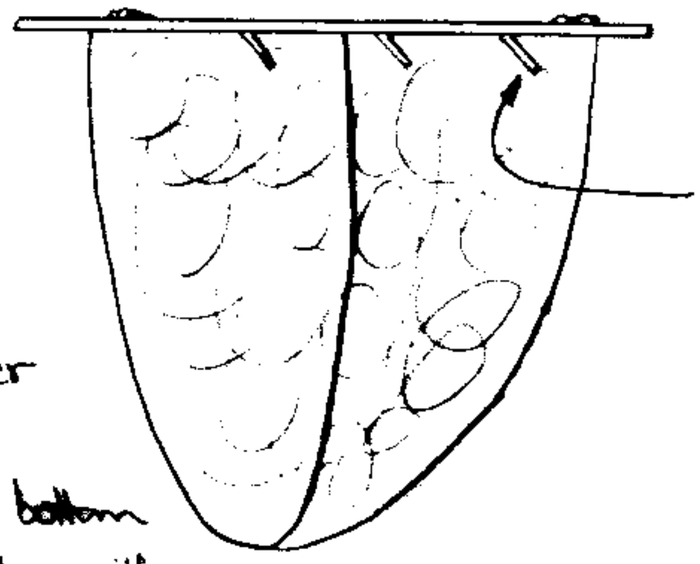
Note:
I Recommend using a Breather off of either a ONAN or Kohler. Can be bought at any small engine Repair shop. Low cost, Quick and easy to adapt. The Kohler has a very low profile so it won't stick out of the top cowl.

Optional U.L.

full Size



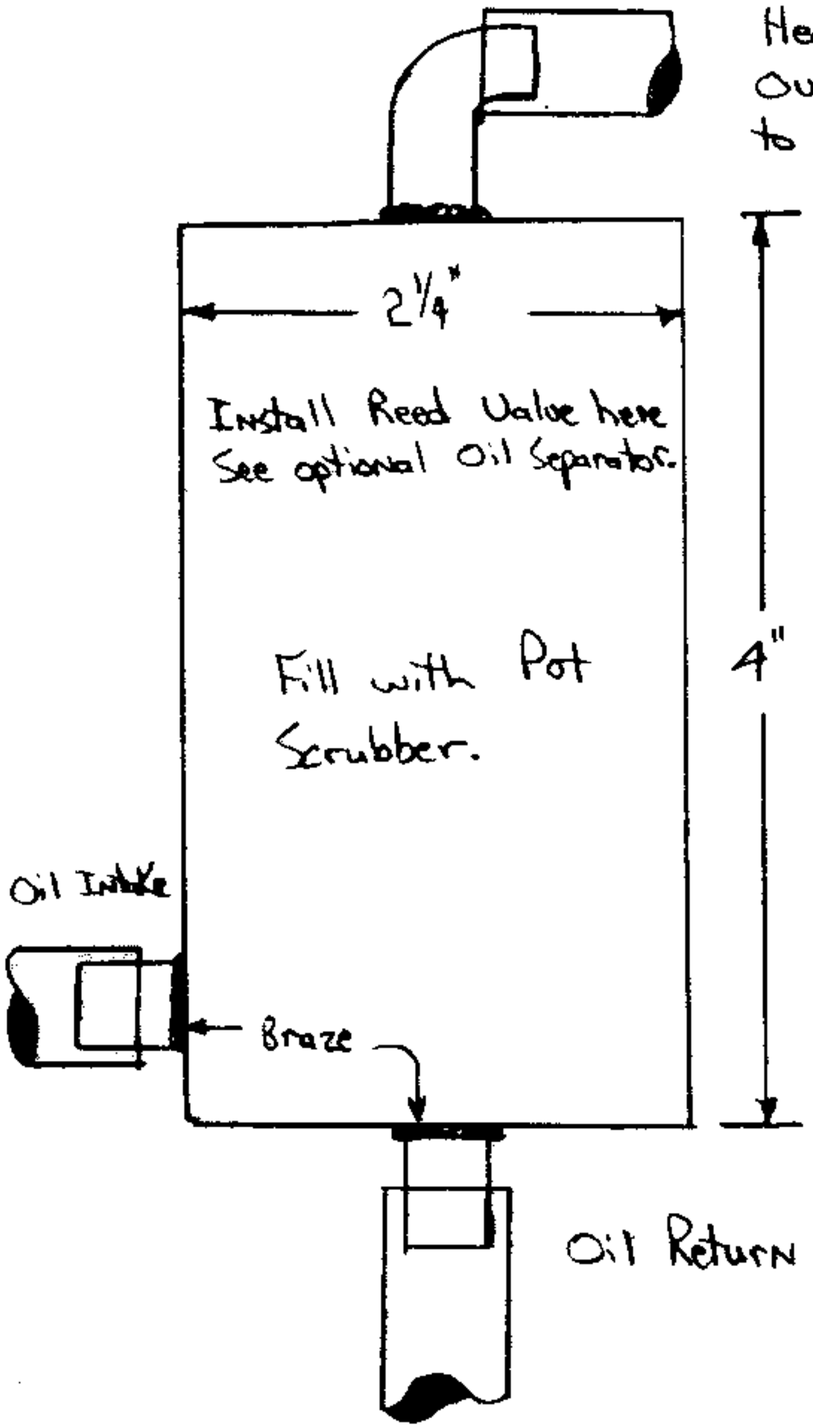




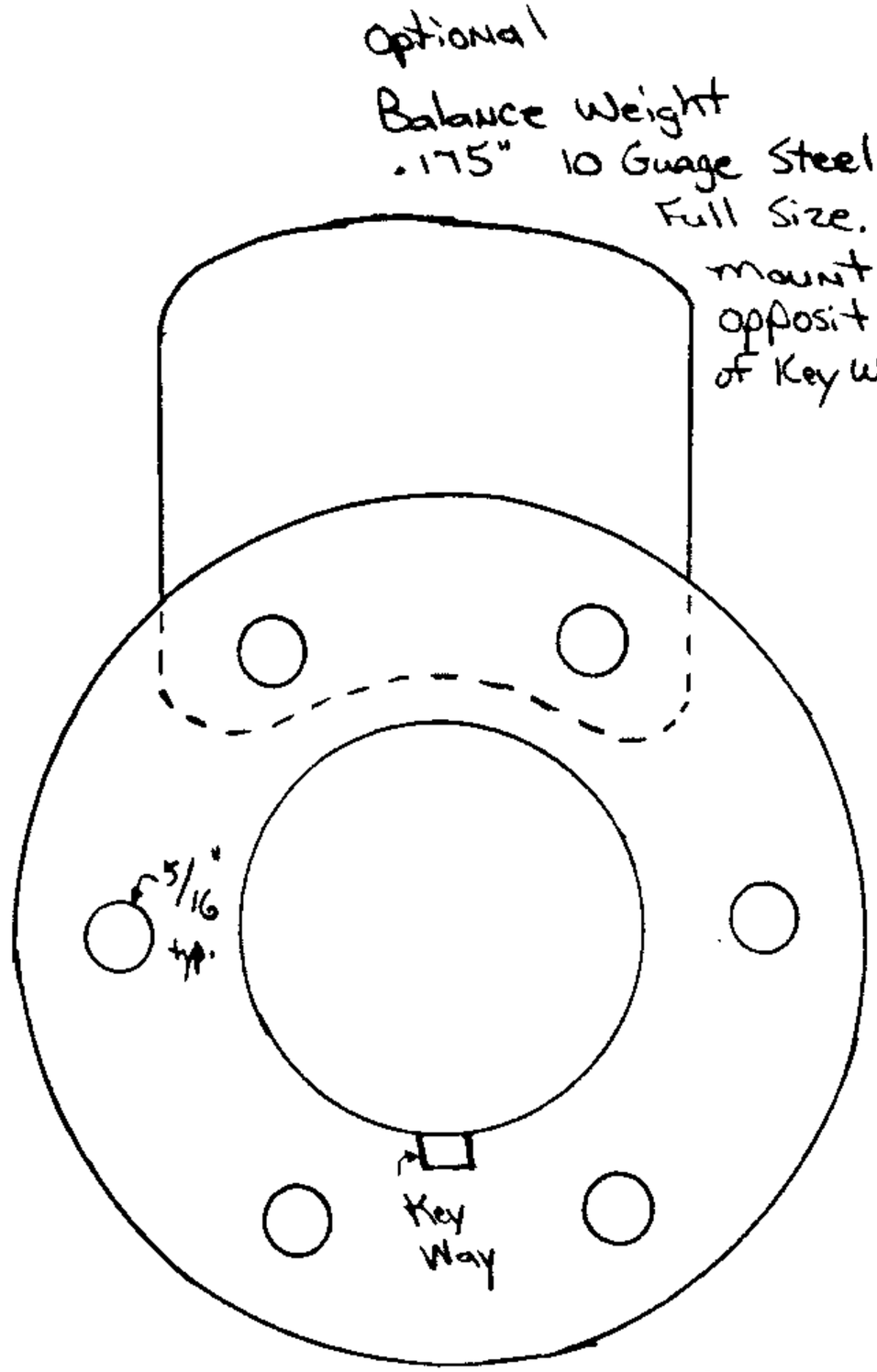
Vent Plate

Pot Scrubber
(chore Boy)
Secured to bottom

Install before Crankcase Breather. Be sure that scoops of the vent plate Face down and to outside of the Engine.

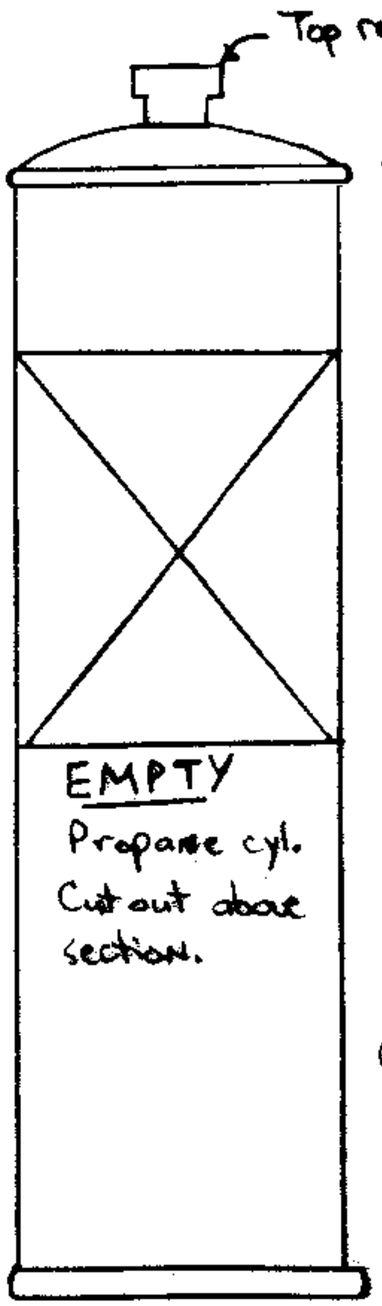


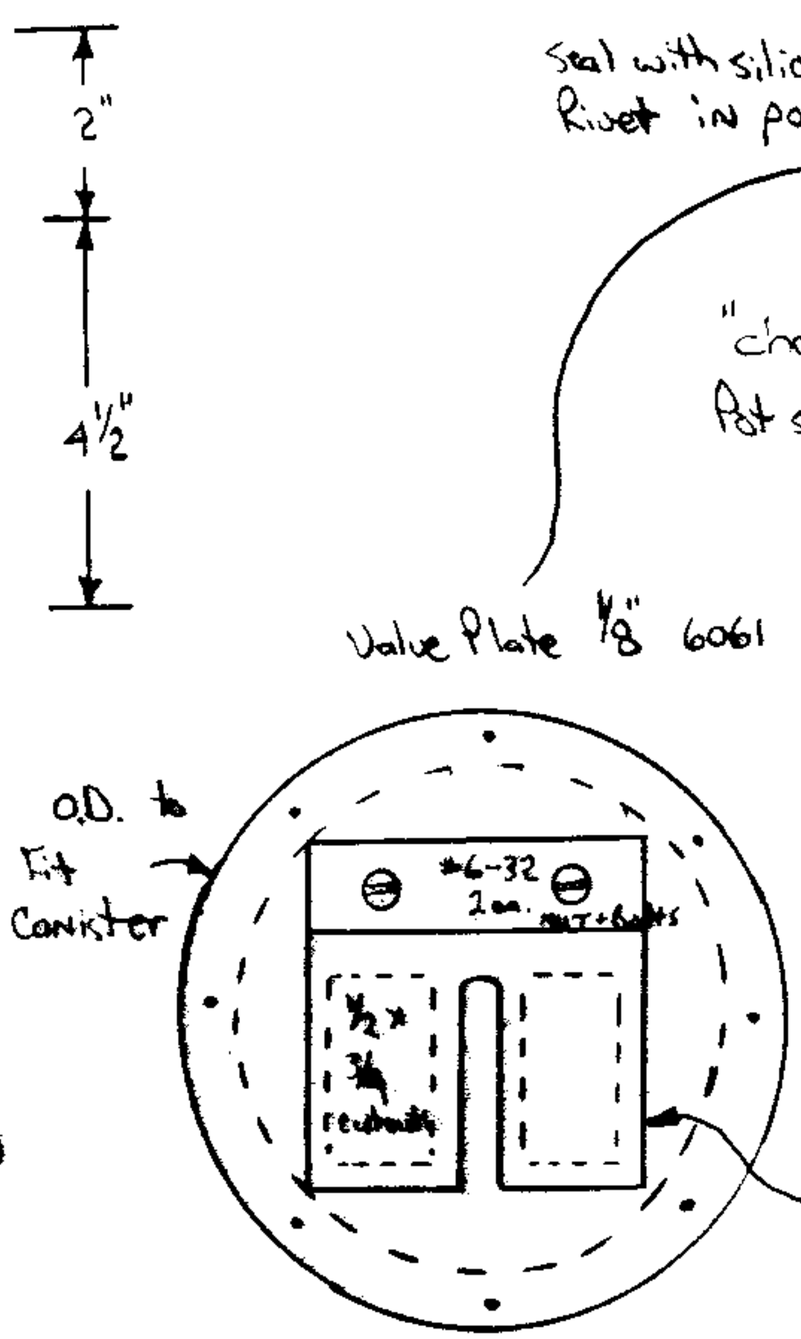
Note: when using Full Case
- Oil Separator will not
needed.

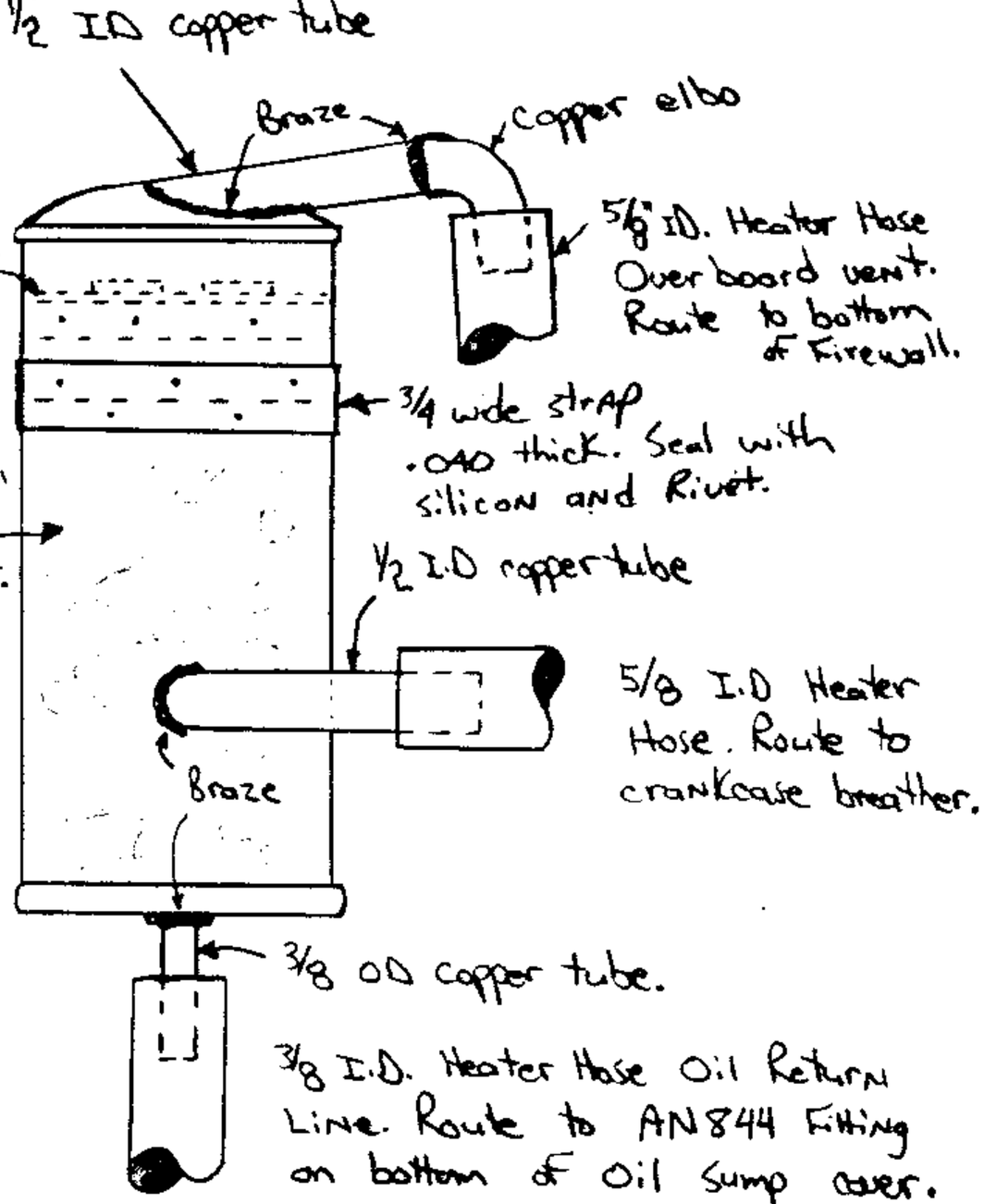


master Prop Hub

Note: When using full Case a Oil Separator will not be needed.







Canister Oil Separator

Also See optional Separators.

.090 steel Gusset.

2" .090 steel plate.

3/8"

2"

1"

5/16" typ

2 5/8" approx.

3" approx.

6"

1 1/2"

Cut down from
1 1/2 x 1 1/2 x .090
Steel Tube.

Line holes up with holes in top of crankcase.

Engine Mount Holes. 3ea.

Engine

1 1/16"

Heavy washers

5/8" washer

1 3/8 O.D x .049

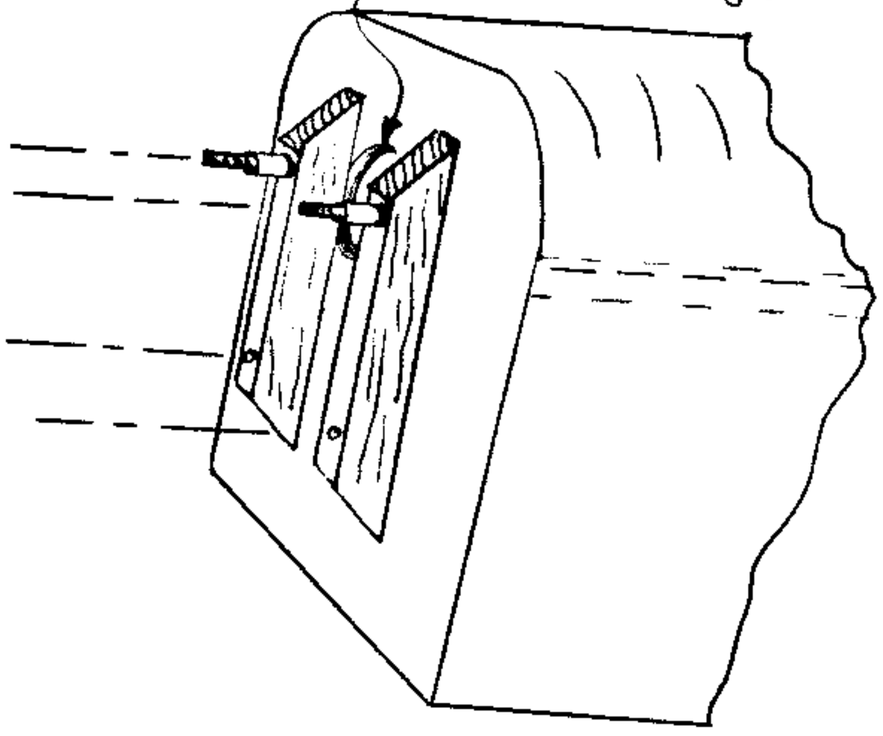
1 1/16 long. Weld to Engine mount.

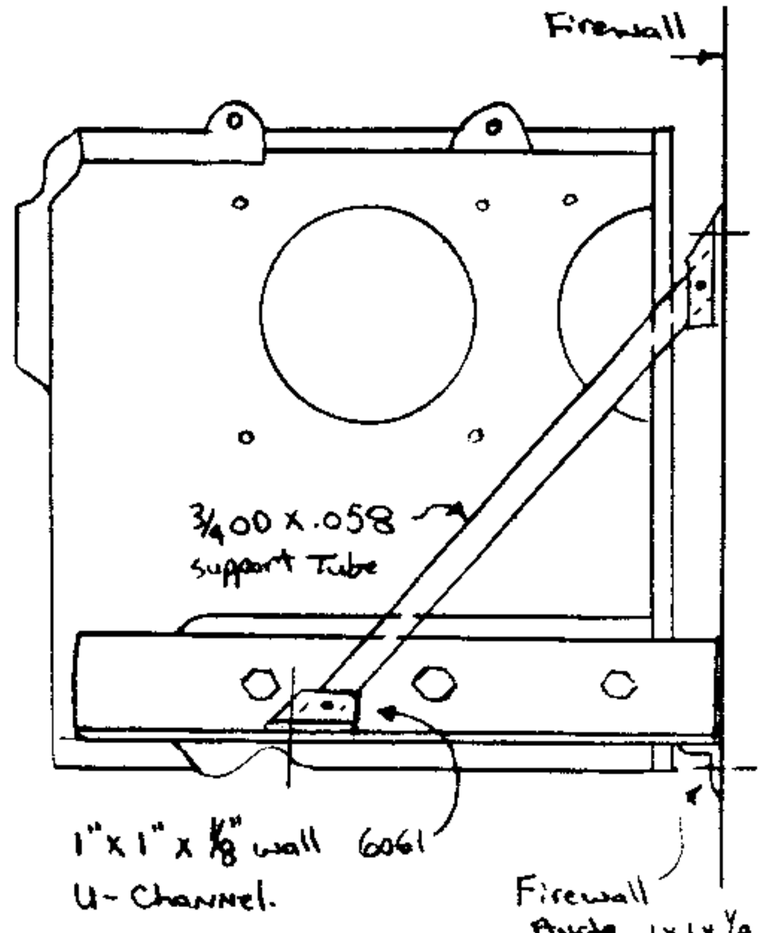
BalKamp Shock Rubbers # 650-1157.

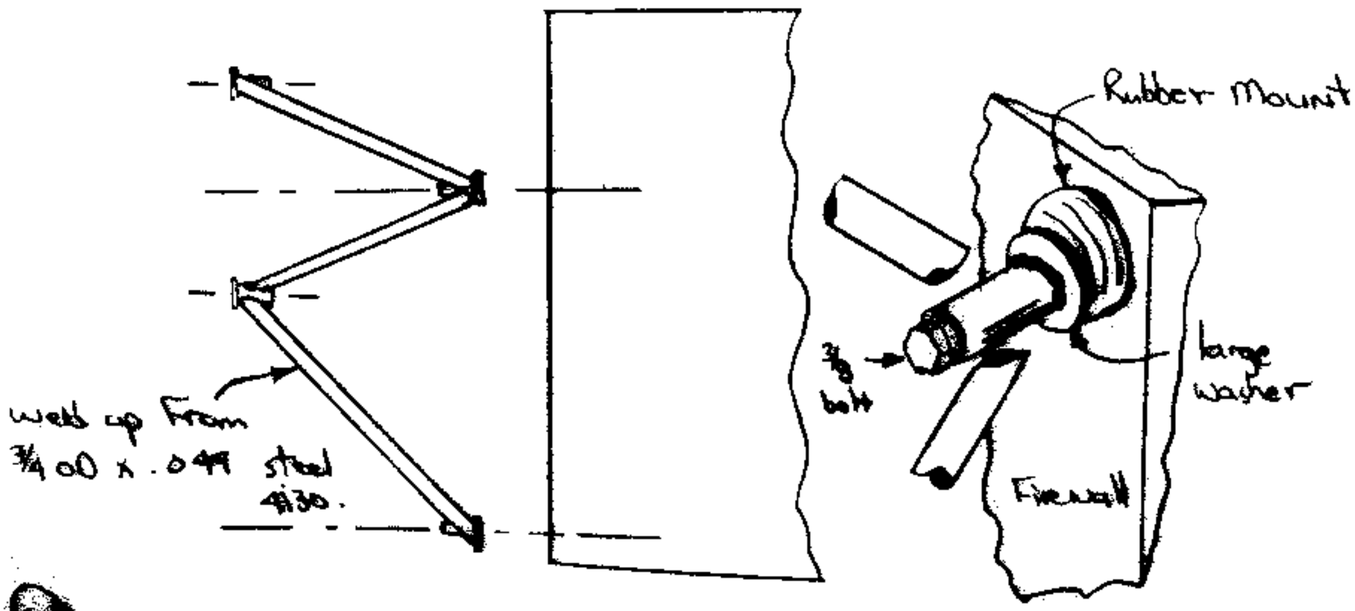
7/16" Bushing.

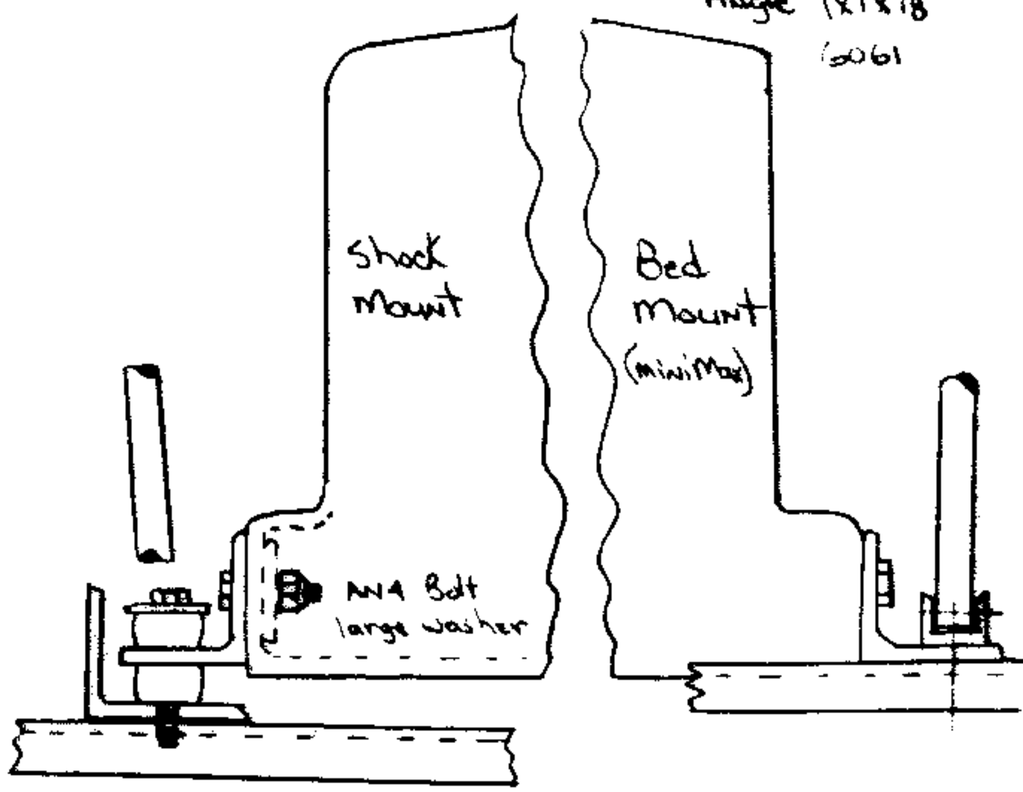
(4) If using Full Case the Regular Engine

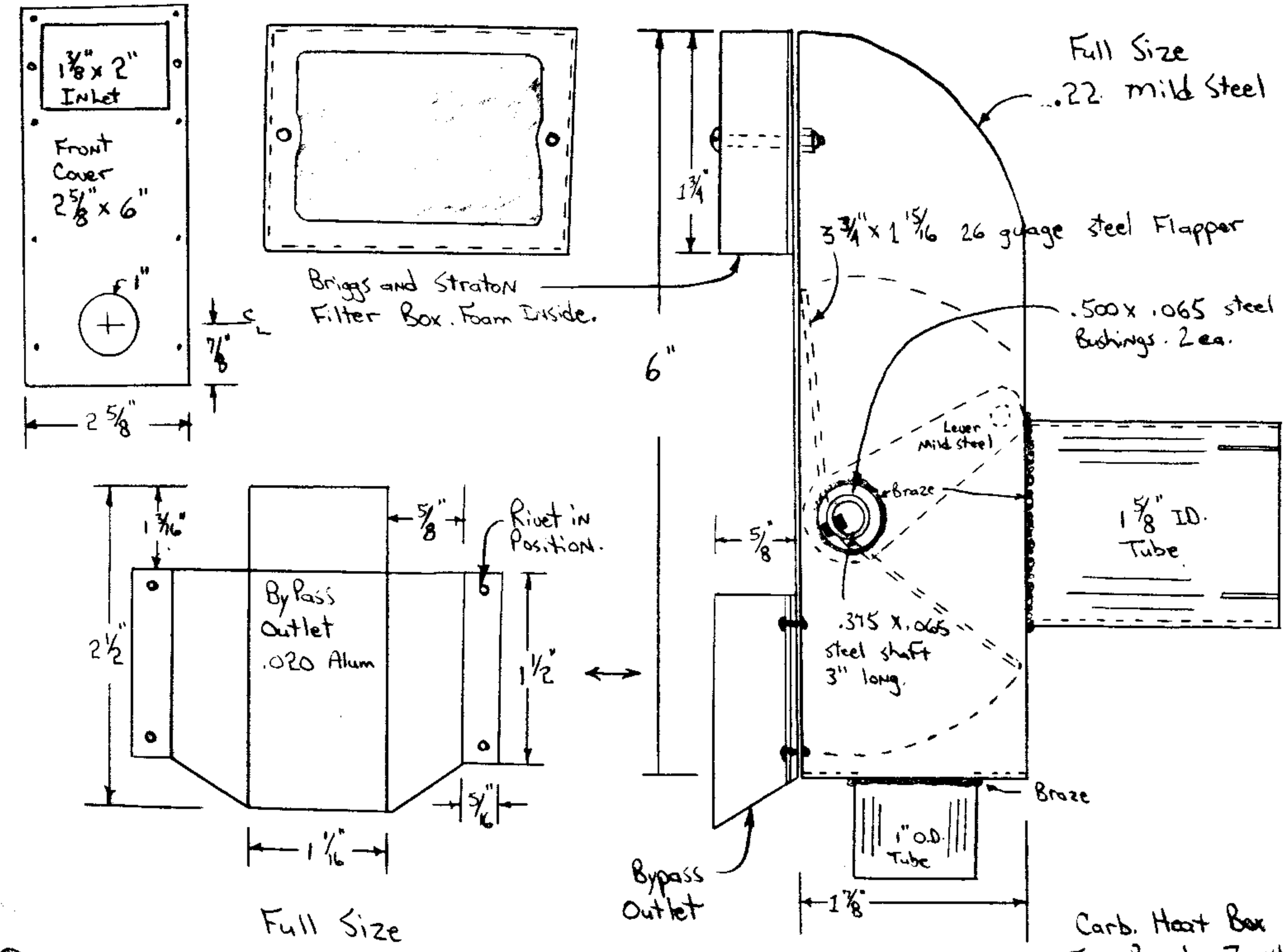
Mount For Full Case. ½ or Full 4-cyl.

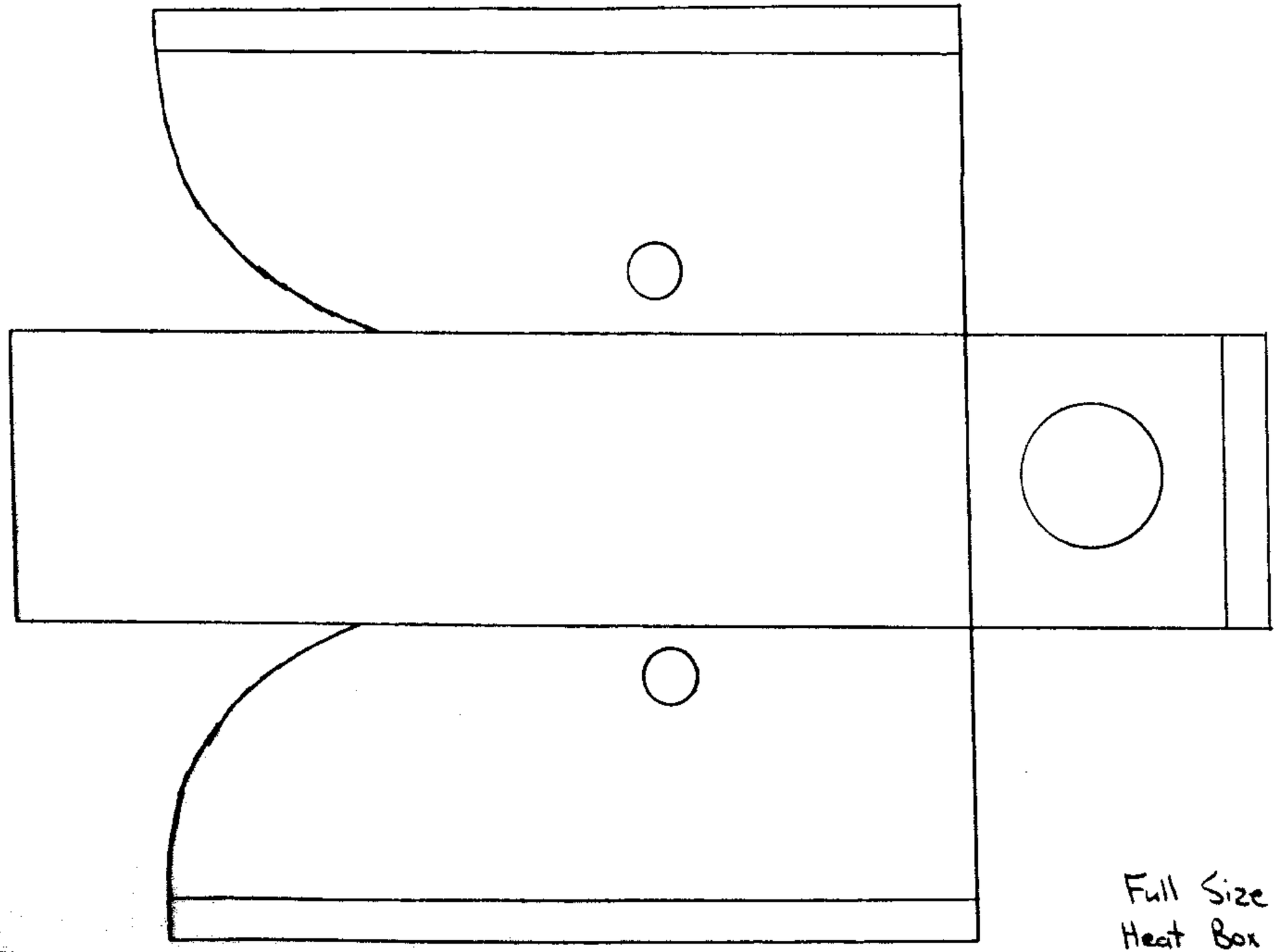




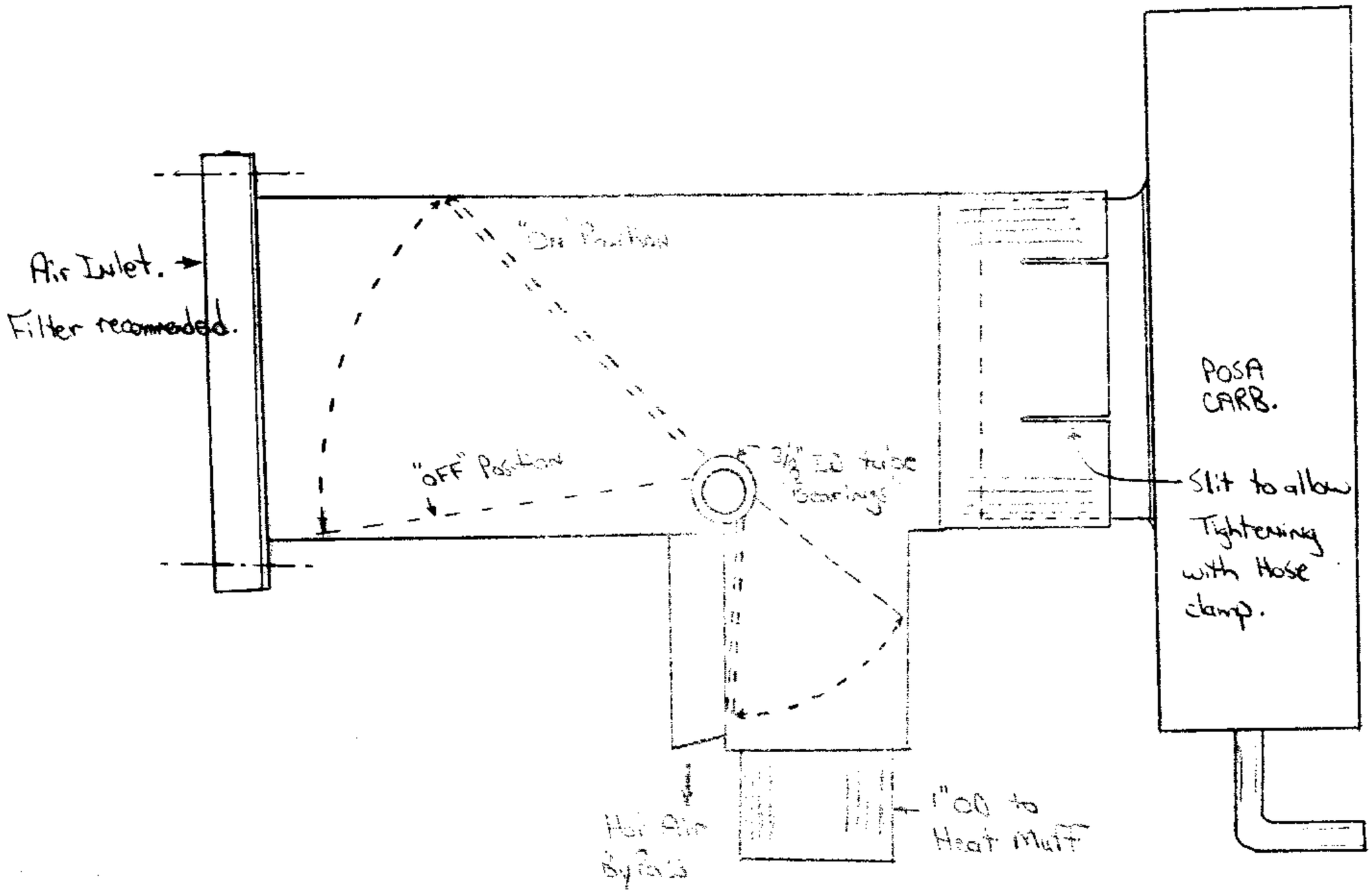




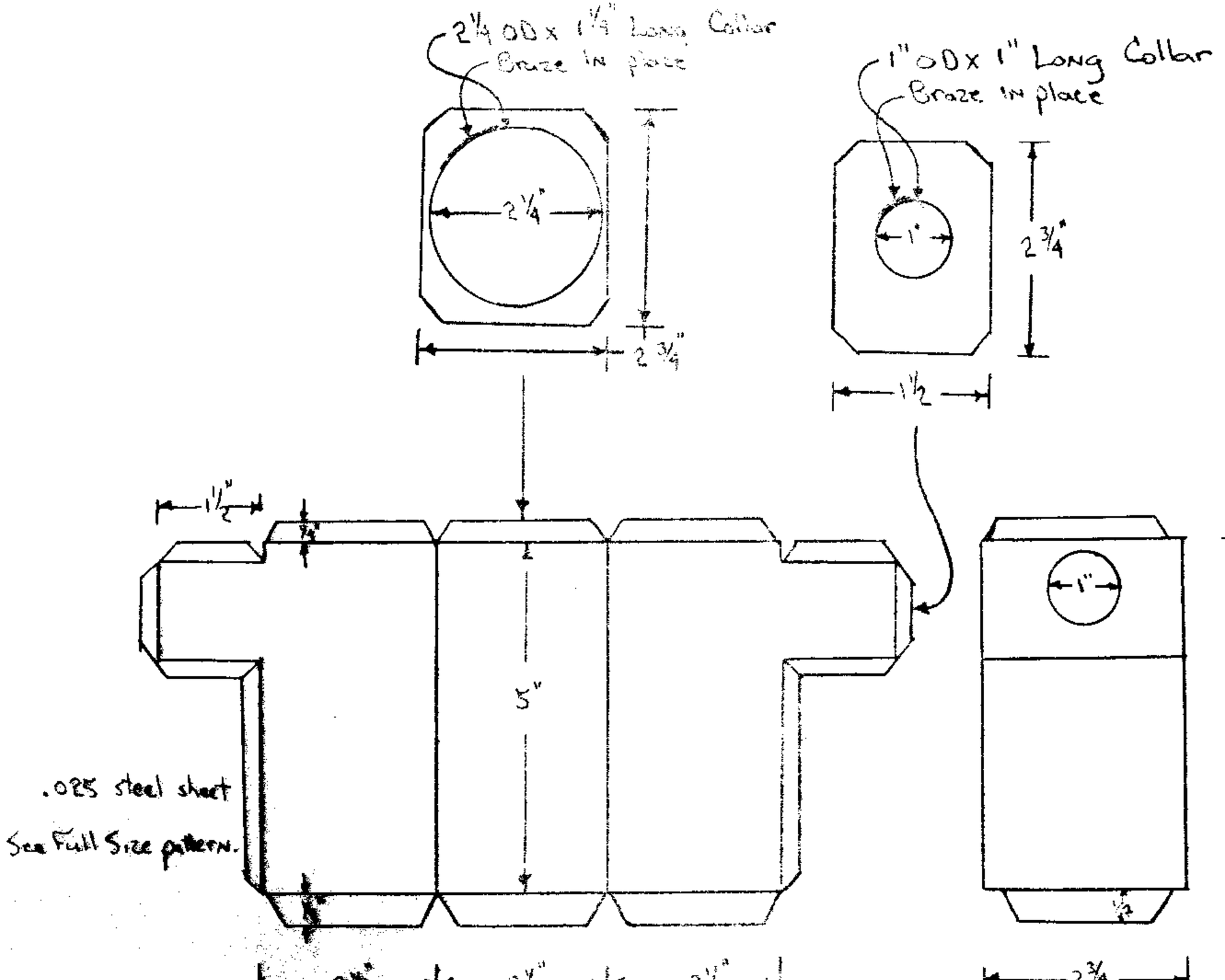

1⅜" x 2" Inlet
Front Cover 2⅝" x 6"
1"
℄
7/8"
2 5/8"
Briggs and Straton Filter Box. Foam Inside.
1¾"
6"
Full Size .22 mild Steel
3¾" x 1 5/16 26 gauge steel Flapper
.500 x .065 steel Bushings. 2 ea.
Lever Mild steel
Braze
1 5/8" ID. Tube
5/8"
.375 x .065 steel shaft 3" long.
Braze
1" O.D. Tube
1 7/8"
Bypass Outlet
1 3/16"
5/8"
Rivet in Position.
2½"
By Pass Outlet .020 Alum
1½"
5/16"
1 1/16"
Full Size
Carb. Heat Box For Bendix Zenith

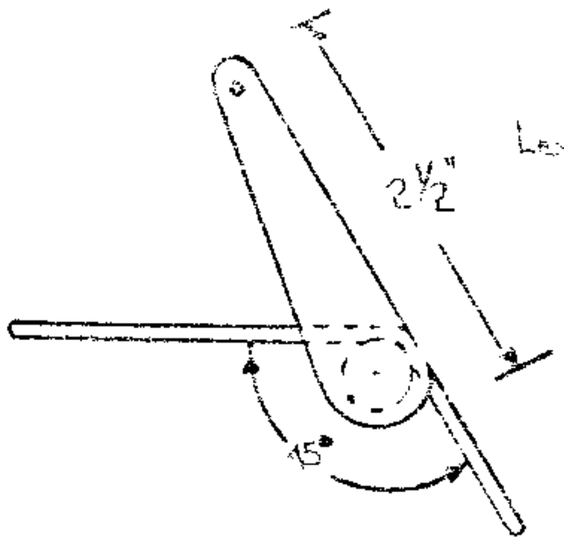


Full Size Carb.
Heat Box for

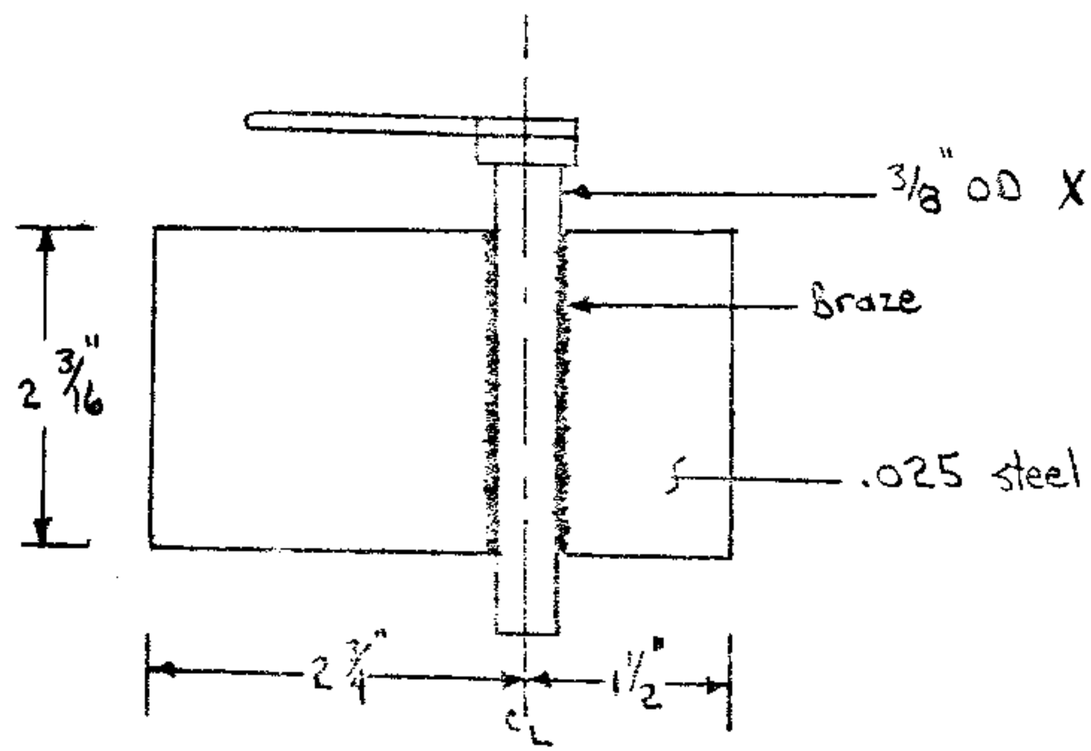


Carb. Heat Box


2¼ OD x 1¼" Long Collar
Braze in place
2¼"
2 3/4"
1" OD x 1" Long Collar
Braze in place
1"
2 3/4"
1½
1½"
5"
.025 steel sheet
See Full Size pattern.
1"
1½"
3 3/4"
2¾
2¼"
2¼"
2¼"
Carb Heat



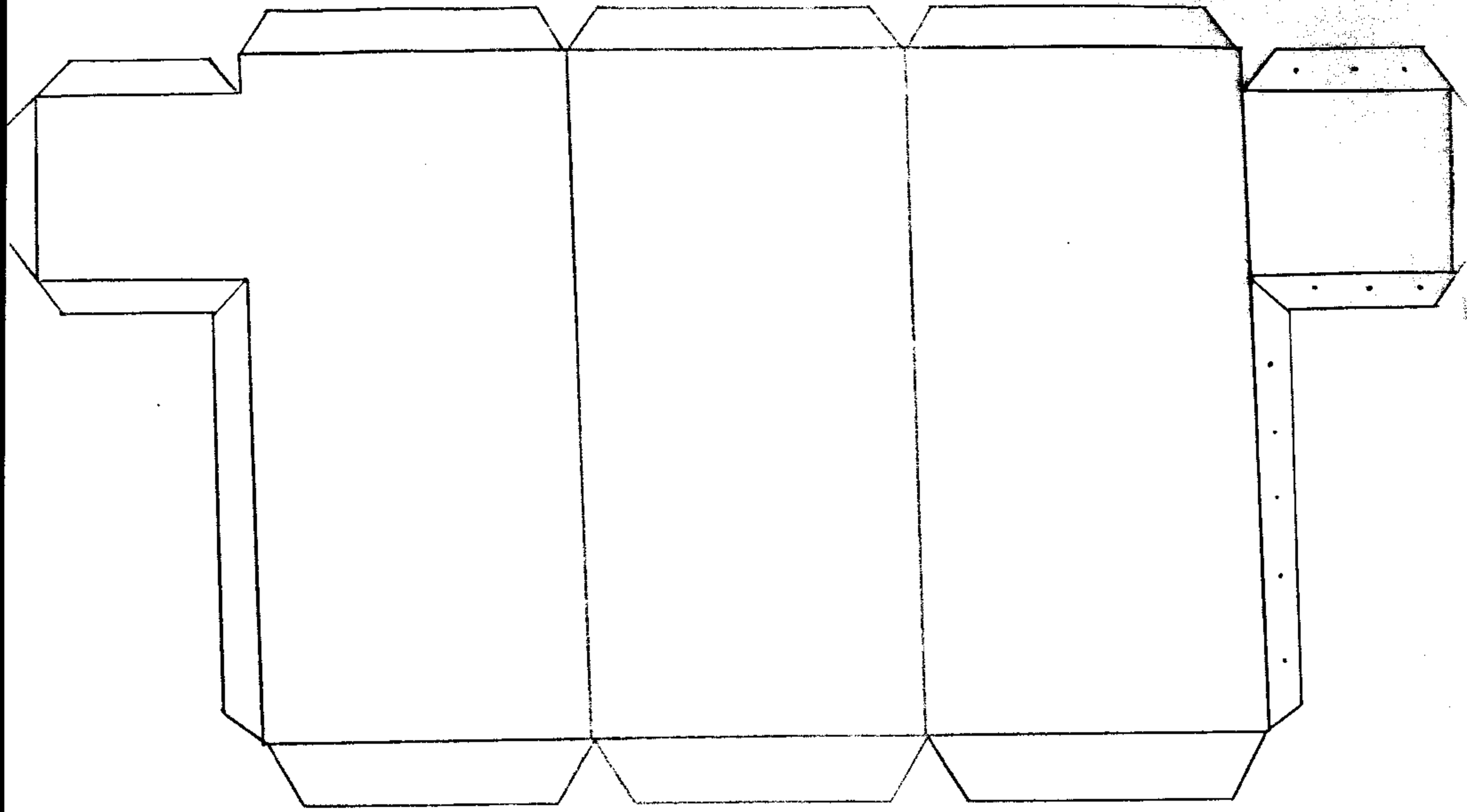
Lever Arm .040 steel



3/8" OD X .065 steel tube.

Braze

.025 steel



Carb. Heat Box
Full Size Pattern.