

PLEASE NOTE THAT THE FOLLOWING PLANS AND INSTRUCTIONS WERE FIRST PUBLISHED IN THE EARLY 1970'S. OVER 600 ENGINES WERE MADE USING THESE PLANS AS A REFERENCE AND PROBABLY EVERY SINGLE ONE WAS SLIGHTLY DIFFERENT FROM THE OTHERS. THESE PLANS ARE PROVIDED FOR REFERENCE ONLY AND NO IMPLICATION IS MADE THAT YOU WILL HAVE A DEPENDABLE OR SAFE AIRCRAFT POWER PLANT IF BASED ON THIS INFORMATION.

1. THE ROTAX PROPELLER PATTERN IS NOW A STANDARD AND MANY LIGHT WEIGHT PROPS WITH HIGHLY REDUCED TORSIONAL RESONANCE ARE AVAILABLE. THE BUILDER IS ENCOURAGED TO USE THE LIGHTEST GROUND ADJUSTABLE PROP AVAILABLE. THE OLD RAND-ROBINSON PROP IS NOT CURRENT TECHNOLOGY.

2. IT HAS BEEN FOUND THROUGH USE THAT THE INTAKE MANIFOLD SYSTEM WILL DISTRIBUTE FUEL MUCH MORE EVENLY TO THE CYLINDERS IF THE LEFT AND RIGHT MANIFOLDS ARE CONNECTED TOGETHER WITH A LENGTH OF 1 1/2" ID 90 DEGREE ELBOW MOLDED RADIATOR HOSES THAT ARE BAND CLAMPED TO THE STRAIGHT ENDS OF EACH MANIFOLD AND CROSSING OVER THE ENGINE.

3. THE 135HP CHRYSLER OUTBOARD MOTOR STARTER IS OLD TECHNOLOGY AND THE PROSPECTIVE BUILDER WOULD BE BETTER SERVED BY USING A GEARED STARTER SUCH AS USED ON HONDA CARS. THE GEARED STARTER HAS MORE TORQUE, LESS WEIGHT AND DRAWS FEWER AMPS.

4. PROP HUB IS A DIFFICULT PART TO MACHINE PROPERLY. THE PROSPECTIVE BUILDER WOULD BE WELL SERVED TO PURCHASE A PROP HUB FROM A WELL ESTABLISHED SOURCE (SUCH AS GREAT PLANES AIRCRAFT).

5. THE PROTOTYPE ENGINE WAS ONLY 1800 CC DISPLACE. PARTS ARE READILY AVAILABLE TO INCREASE THE DISPLACE UP TO 2600 CC WITH THE CORRESPONDING INCREASE IN POWER TO WEIGHT.

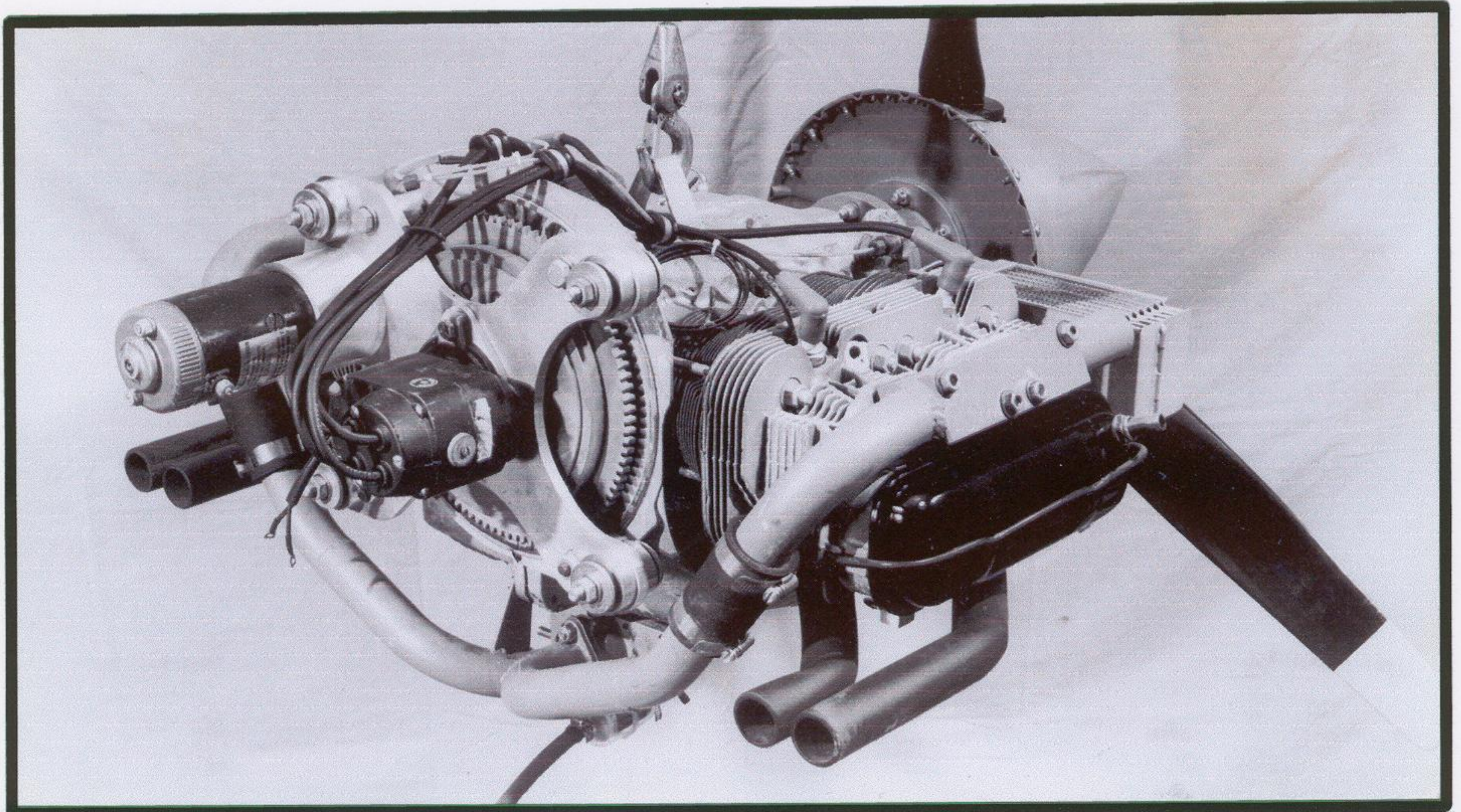
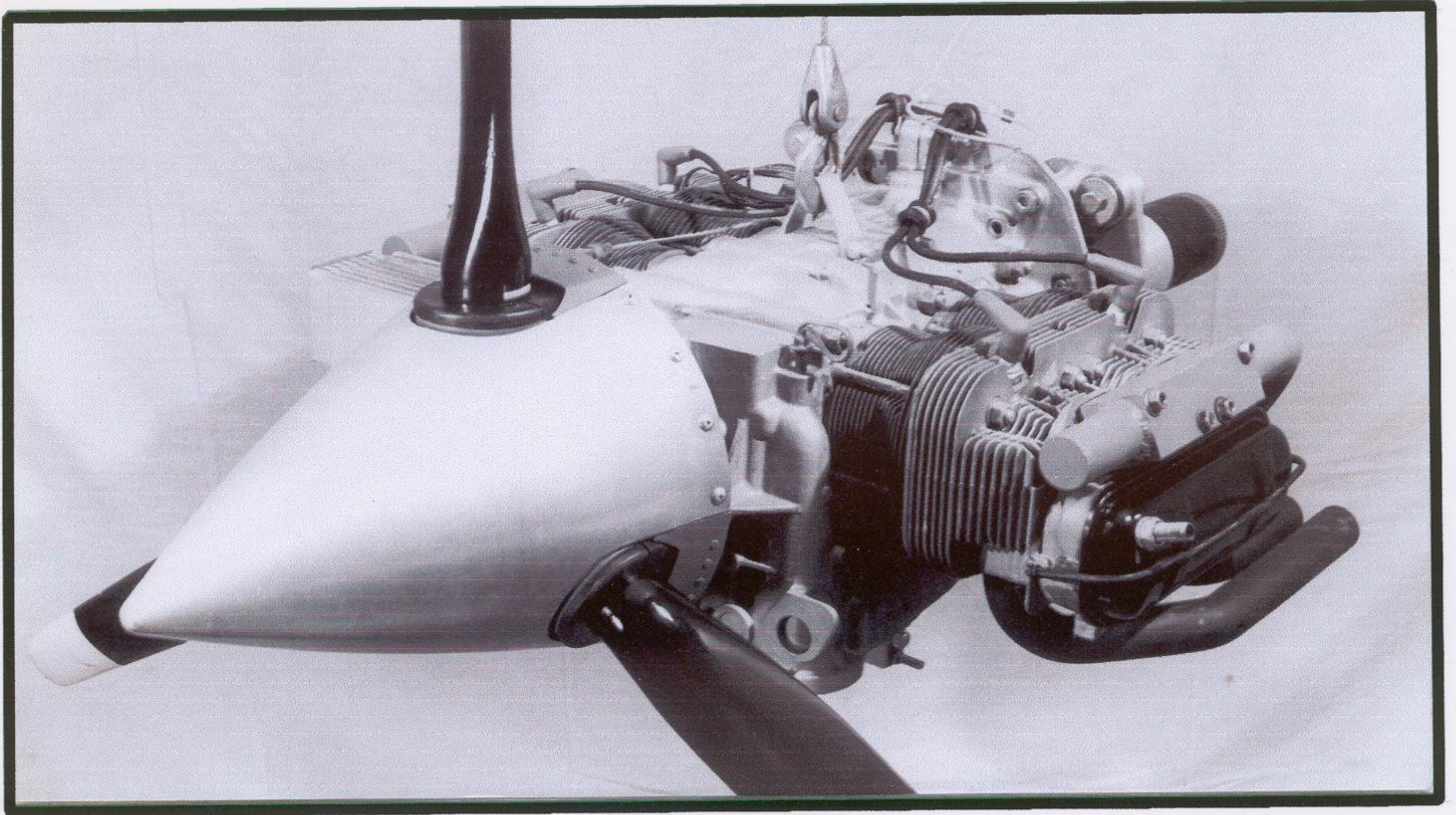
6. THE ORIGINAL CARBURETOR WAS A POSA FUEL INJECTOR WHICH IS NO LONGER AVAILABLE. THERE ARE MANY POSSIBLE SUBSTITUTIONS INCLUDING ELLISON FUEL INJECTORS AND MANY OTHER SIDE DRAFT TYPE CARBURETORS.

7. THE ORIGINAL SLICK MAGNETO IS OLD TECHNOLOGY. A MODERN ELECTRONIC IGNITION SYSTEM OR BETTER YET A COMPLETE FUEL INJECTION AND IGNITION SYSTEM WOULD PROVIDE BETTER PERFORMANCE AND LONGER LIFE..

8. THE EXISTING MOTOR MOUNTING IS EFFECTIVE, BUT IT MAY BE CHANGED TO BETTER COMPLIMENT DIFFERENT AIRCRAFT.

					ADDENDUM						
					SCALE: NONE						
					No. 00						

VW TYPE IV, PORSCHE 914 CONVERSION



VW TYPE IV, PORSCHE 914 ENGINE CONVERSION

GENERAL

This engine conversion is based on the VW Type IV engine. This engine is used in the VW 411, VW 412, late model VW Buses and the Porsche 914. Some features that this conversion include are an oil filter, oil cooler, starter, alternator and vibration type mounts.

The prototype engine is a standard displacement 1800cc VW 412 engine. Parts are available to increase the displacement of this engine. If you do decide to build a larger displacement engine than the prototype, the only changes needed are to use a 32mm Posa fuel injector rather than the 29mm injector and to layout the intake manifold slightly differently.

SPECIFICATIONS (1800cc Engine)

Bore	93mm	Fuel Consumption	4 GPH
Stroke	66mm	Alternator Output	7 Amps
Displacement	1793cc	SAE HP @ RPM	75@ 3800
Compression	8.2:1	Torque Ft./lbs. @ RPM	108@3800
Firing Order	1-4-3-2	Ignition System	1 Magneto
Min. Fuel Octane	90	Fuel Induction	1 Injector
Dry Weight	195 lbs.		

FABRICATION OF THE CONVERSION PARTS

THE PROPELLER FACE PLATE is band sawed out of the same 3/8" 6061-T6 plate that the accessory mounting plate is out from. The center hole and outer edge are machined on a lathe, and the 6 5/16" holes are indexed in the plate at the same time the propeller spacer is indexed. The hole edges are chamfered slightly with a countersink bit.

THE PROPELLER used on the prototype engine is a 3 blade 48" dia. "ground adjustable pitch" prop, with wooden blades and an injection molded fiberglass hub. It is made by Rand Robinson Eng. Inc., and designed for clockwise rotation engines such as the VW. Although this propeller is more expensive than other VW props, it is worth it, in that it can be adjusted for various conditions, and its small diameter lets the engine "turn up" to a high enough RPM to deliver power efficiently.

THE PROPELLER SPACER is machined from 5" dia., 6061-T6 bar stock. All inside corners not otherwise marked have a 1/32" rad. to alleviate stress. The holes are indexed, drilled and chamfered in the same way that the propeller face plate is done. Although the spacer is not necessary for propeller clearance; it makes for a cleaner cowling profile and allows more room inside the cowling for baffles, dipstick, and etc.

THE HUB RETAINING WASHER is machined in accordance with the drawing from 1 3/4" 4130 bar stock. The part is then tempered to prevent bending and to raise the surface hardness.

THE PROPELLER HUB on the prototype engine is a weldment made by heli-arc welding by full penetration weld a plate to the VW fan hub and machining this while on the crankshaft between lathe centers. After machining, the hub was magnafluxed and X-Rayed. If you fabricate the hub from bar stock, the taper must be lapped with compound to fit the crankshaft taper exactly. In addition the key way must be carefully machined with radiused inside corners. Failure to do either of the previous steps can result in failure of the hub. This is a highly stressed part, BE SURE IT'S RIGHT.

THE ACCESSORY MOUNTING PLATE SPACERS are machined from 1" dia. 2024-T3 bar stock in accordance with the drawing. Do not substitute tubing spacers, for they have too narrow a footing.

THE FLYWHEEL is from a 135HP Crysler outboard motor. A used flywheel is completely satisfactory, and much less expensive than a new one. Cut the center out of the flywheel and face off the top side down to a total flywheel thickness of 1 1/8". Due to the mass of the flywheel, it must be accurately indexed to prevent balancing problems. Be sure to use a dial indicator to center the flywheel on the indexing table before drilling. A 7/16" Allen wrench can be ground into a tool to swage the counter-sunk holes to accept the attachment nuts.

THE STATOR SPACERS can be machined from aluminum or cut from steel tubing; either way is satisfactory.

THE SHOCK MOUNT BUSHINGS are machined in accordance with the drawing from 1 3/4" 6061-T6 bar stock, and must be a tight fit into the 1" holes in the accessory mounting plate. They may be tack welded to the plate; however a full circumference weld is not recommended.

THE THRUST BEARING is machined from the VW flywheel or torque converter drive plate. You can probably pick up a scored flywheel or a warped drive plate free of charge from your local VW dealers junk pile. Remember; all you need is the center of the flywheel; so why pay big bucks for a new one?

THE FLYWHEEL ADAPTER PLATE is cut from .090" 4130 plate. The thrust bearing may be used for setting up the indexing table for drilling the 5 center holes. The 12 outer holes are indexed at the same time the flywheel is drilled, without changing settings. As with the flywheel, accuracy is mandatory in fabricating this part.

THE ACCESSORY MOUNTING PLATE is cut from 3/8" 6061-T6 plate. Layout all holes on the sheet stock; double check it; and then drill. Note that the six 1/4" holes around the center are tapped. Cut out the 2 3/4" center hole last, because it is a reference for all the other holes. Band saw out the outside edge of the part and dress it down with a drum sander. Be sure to sand away all saw marks on the edges, as these are potential stress points.

THE STARTER MOUNTING BASE is machined from 3 1/2" bar stock in accordance with the drawing. It may be tack welded to the accessory mounting plate AFTER the ring gear to starter pinion engagement is adjusted.

THE MAGNETO MOUNTING BASE is machined in accordance with the drawing from 1/4" 6061-T6 plate. The center hole in the part should be a slip fit over the Slick 4016 magneto. This part may be welded to the accessory mounting plate.

THE IMPULSE COUPLING DRIVE is machined from nylon bar stock in accordance with the drawing. Don't be concerned if the fit of this part seems tight on the flywheel bolts or on the magneto end. The nylon expands considerably as the engine reaches operating temperature thus increasing operating clearances.

THE INTAKE MANIFOLD PLENUM is machined from 1 7/8" square 6061-T6 bar stock. The bar is fly cut or milled to the outside dimensions first. Secondly, the four 11/32" holes are drilled. Next, the 35mm length-wise hole is bored. And finally, the two 35mm side holes are bored. If you do this out of order, boring straight holes will be very difficult.

THE UPPER INTAKE MANIFOLDS are made of 4 pieces each. The buffer tube plug is pressed into the buffer tube until flush and then heli-arc welded with aluminum filler rod around its circumference. The buffer tube is pressed into the plenum block until it stops and then weld in the same manner. The aluminum manifold tubes have to be filled with lead to prevent them from collapsing while bending. Your local muffler shop should be able to handle the bending. When heating the bent tubes to remove the lead; keep in mind that this much molten lead can be deadly if it spills on you. DO NOT weld the bent tubes to the plenum blocks until after the manifold is assembled and positioned on the engine.

THE LOWER INTAKE MANIFOLD should be cut and welded in a jig to assure proper alignment. DO NOT use brass type filler rod to weld this part; it just isn't strong enough. The dimensions marked with an * are approximate, and will vary slightly from engine to engine. Go to the trouble to varify these dimensions before starting on this part. Paint the finished part with zinc chromate paint to prevent it from rusting; or better yet; build the entire part out of stainless tubing and sheet.

THE EXHAUST STACKS are fabricated from the VW exhaust pipes. Since the cylinder heads are semetrical, the exhaust pipes can be turned 180° and directly bolted on. The sheet metal heat boxes may be left on or removed. On the prototype engine, the heat boxes are removed and the pipes separated by cutting off the muffler attachment flanges. By using rearward faced exhaust stacks, usable thrust can be gained for free.

THE DISTRIBUTOR HOLE PLUG is an expansion type rubber plug. I hate to put in a plug for someone elses engine conversion, but; Monnett Experimental Aircraft, Inc. distributes an excellent plug advertised in their catalog as an "oil filter plug" which this is also used as in the Type IV conversion.

THE ROCKER ARM COVERS are stock with the exception of having crankcase vents added. The vents are made by drilling a 3/4" hole in the upper front corners of the covers, and inserting an AN848-8 bulkhead 90° hose elbow with the bulkhead side nipple cut off just past the threads. The hose elbow is held in place with an AN364-12 elastic stop nut inserted from the inside of the cover.

THE POSA FUEL INJECTOR is a gravity feed device and thus does not need or operate well with a fuel pump. Due to the injector not having a venturi or butterfly; it does not tend to ice up; thus carburator heat is not needed in this conversion.

ENGINE COMPONENT PREPARATION

THE ENGINE CASE can be new or low mileage. If you want a mechanical fuel pump on the engine, DO NOT choose the automatic transmission engine case. It has no provision for mounting the pump. If a used engine case is chosen, dismantle the engine completely using a VW maintenance manual as a reference. Deburr the inside of the case by scraping the sharp corners, then have the case "hot tanked" and checked by an expert for warpage, cracks or any other damage. If you decide to use oversize cylinders, now is the time to have the case bored to accept them. The left side of the case must have a 1 1/2" hole cut with a hole saw drill, 5 3/8" from the case seam, directly behind and in line with cylinder #1. This hole is for the starter bendix clearance. The oil dipstick tube and the dipstick are shortened so that only about 1/2" of the dipstick tube protrudes from the case.

THE CRANKSHAFT whether new or used should be magnafluxed and checked for straightness and journal concentricity. Unfortunately, just because an engine component is new, does not mean that it is serviceable. The only modifications made to the crank are the machining of an additional key slot 180° opposed to the existing one; and drilling and tapping a 1/2"-20 hole 3" deep in place of the fan hub retention bolt hole.

THE CYLINDER HEADS may be new or used. If they are used, "glass bead", and hot tank the heads to remove the carbon deposits. Check for cracks around the sparkplug hole and valve seats, and check for worn valve guides. The valve seats may be ground if necessary.

THE VALVES should be inspected for burning, warpage and edge thinness caused by previous valve grinds, then magnafluxed. If the valves don't check out; it is best to buy new valves. The VW engines are notorious for "dropping" the exhaust valve in the #3 cylinder.

THE VALVE SPRINGS should be checked for proper length and compression strength. Replace them with new springs if they are not up to specifications.

THE CAMSHAFT should be checked for wear on the cam lobes, bearing journals and drive gear and then magnafluxed. "High performance" camshafts are not recommended.

THE CONNECTING RODS must be checked for straightness, piston pin bushing wear, bearing concentricity and then magnafluxed. In addition, you may want to remove the forging marks, and shot peen the surface of the rod to remove stress points.

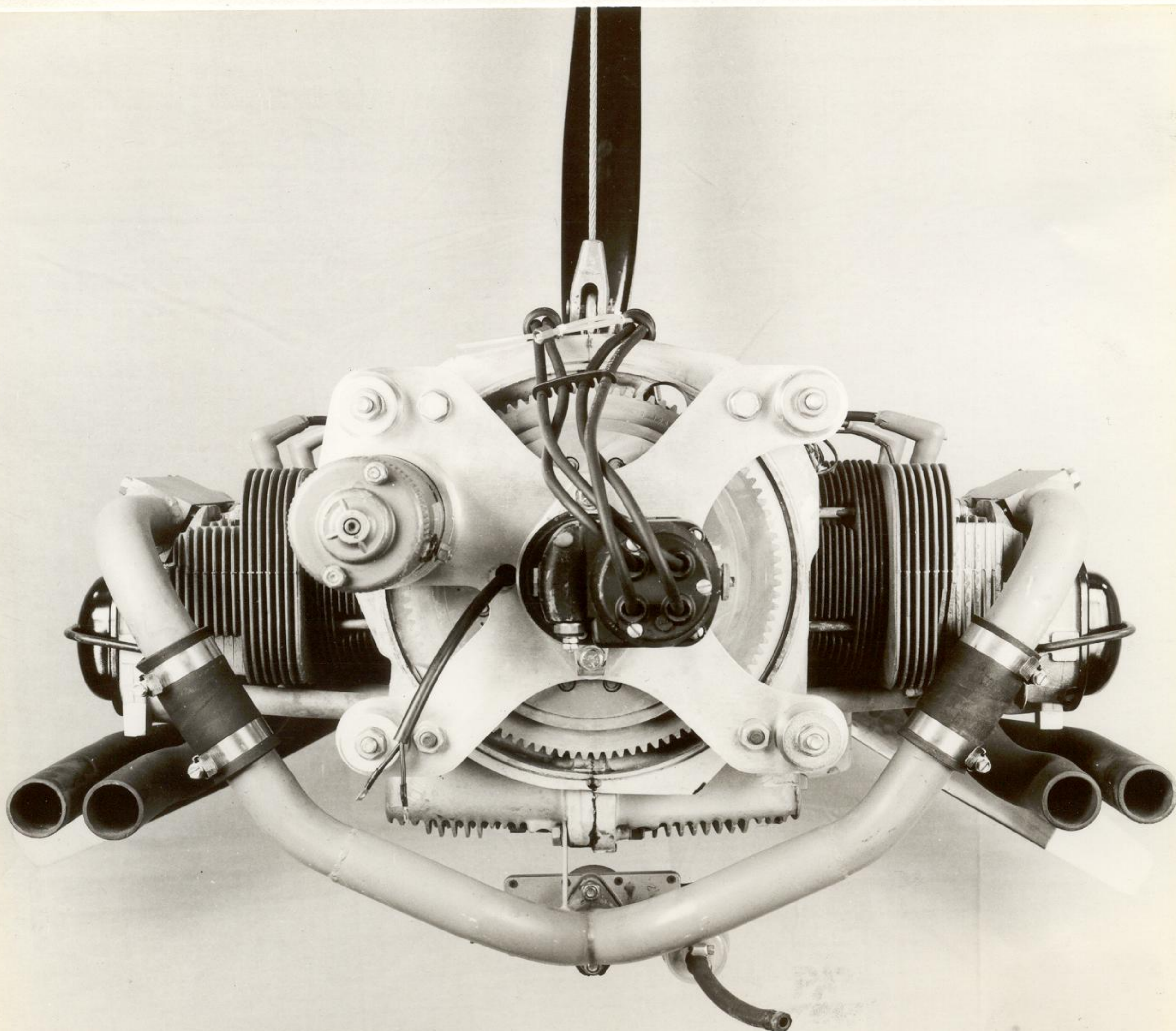
THE PISTONS if used, must be carefully cleaned of carbon, and checked for cracks, ring groove wear, pin bore wear and matched weights. If new cylinders are installed, new pistons should be also.

THE CYLINDERS if used, should at least be honed to facilitate the seating of new piston rings. Overboring the cylinders IS NOT recommended.

THE OIL PUMP on the stock Type IV engine is totally satisfactory. After market "high volume" oil pumps have the bad habit of causing oil leaks, and they actually rob power in a low RPM engine application. A new oil pump is recommended.

THE OIL COOLER is used in its stock configuration. It should be checked for leakage and bulging which is often caused by stuck pressure relief valves. If a non-detergent oil has been used in the engine, it will have to have the oil cooler cleaned with solvent or replaced.

THE OPTIONAL CASE MODIFICATION depicted in Dwg. 23 is done prior to engine assembly. 6061-T6 aluminum filler plate is heli-arc'd into the designated areas and carefully filed flush with the case seam. Care should be used while welding so as to prevent excessive heat build up and subsequent case warpage.



ENGINE ASSEMBLY

The engine should be assembled in accordance with the VW service manual. All bolt torques and assembly specifications should be carefully followed. After the basic engine is assembled, the following supplementary instructions should be used to install the conversion parts.

THE PROPELLER HUB is installed clean, dry and unlubricated onto the end of the crankshaft after first inserting the two keys. The hub retention bolt is coated with "lock tight" and inserted through the retention washer and into the crankshaft end. The bolt is then torqued to 80 ft. lbs. and safetied with .041" stainless wire to the propeller spacer.

THE PROPELLER SPACER is bolted to the hub after twisting it clockwise to tension the safety wire connecting it to the hub retention bolt. The six 5/16" bolts connecting the spacer to the hub are inserted with the heads forward and torqued to 38 ft. lbs. After torqueing, the bolts are safetied with .041" stainless wire through the castle nuts and to each other in a circular pattern.

THE PROPELLER should be installed after the engine is mounted to prevent damaging it. The prop manufactures instructions should be followed in mounting, setting up, and torqueing the propeller bolts. The prop bolts should be safetied in the same manner as the prop spacer bolts are safetied. Note, if a spinner is used on the propeller, the spinner support plate(s) will be mounted on either side of the prop before inserting and safetying the bolts.

THE FLYWHEEL is bolted with twelve 1/4" bolts to the adapter plate and torqued to 17 ft. lbs each. The assembly is then bolted to the thrust bearing and the rear of the crankshaft with 5 socket head flywheel bolts torqued to 80 ft. lbs. each.

THE STATOR is bolted to the accessory mounting plate using six 1/4" bolts and the strator spacers. The bolts should be coated with "lock tight" and be torqued to 5 ft. lbs. each. The staters lead is routed through the 1/2" hole in the left side of the accessory mounting plate. Note, the 1/4" bolts MUST NOT protrude all the way through the accessory mounting plate.

THE ACCESSORY MOUNTING PLATE with the stater bolted onto it, is mounted to the engine case using the accessory mounting plate spacers and 10mm studs, bolts, and elastic stop nuts. These are torqued to 22 ft. lbs. each.

THE STARTER is inserted into the starter base and the two 1/4" studs are used to secure them to the accessory mounting plate. The starter bendix gear is set up to have a .005" lash clearance with the flywheel ring gear. After the lash is adjusted, the starter base may be welded to the accessory mounting plate if so desired. Note, DO NOT use threaded rod as a substitute for the 1/4" studs. Torque the stud nuts to 17 ft. lbs. each.

SPECIAL NOTES

DYNAMIC BALANCING of the engine components, while not essential is highly beneficial. This procedure increases the engine horse power and life span. If you decide to have the engine balanced, be sure to include the propeller. Note, this procedure is done before the engine is assembled.

HEAD "CCING" or making the combustion chambers equally matched in volume, can be done by the builder at home. Like the balancing, "CCing" also contributes to higher horse powers and increased engine life. For detailed instructions on head "CCing", consult a "hot red" book on engine building. Note, this is also done prior to engine assembly.

THE FUEL INJECTOR tuning is best and most easily done with an exhaust gas analyzer. The engine should be tuned to run at approximately 75% of the maximum engine RPM. If an exhaust analyzer is not available, consult the posa instructions for tuning.

MAXIMUM ENGINE RPM is determined by taking into account the propeller diameter and or the propeller speed limitations. Propeller efficiency drastically decreases as the prop tips approach the speed of sound. For the 48" Rand propeller, the RPM limit is about 3800 RPM.

THE ENGINE TIMING is set on the prototype at 25° BTDC. To set the timing prior to the first run; set up the engine so that the magneto impulse coupling releases as the TDC point. This is done because the Slick 4016 magneto has a 25° timing lag when rotated by hand. After the engine is started, set the timing with a strobe light to assure that your static setting is correct. Note, maximum engine timing is limited by fuel octane; never use fuel under 90 octane with the 25° BTDC timing setting.

THE OIL PRESSURE SENDING UNIT or oil pressure guage capillary is serewed into the stock location on the oil cooler boss.

THE OIL TEMPERATURE SENSOR is inserted into the oil drain plug after it is drilled and tapped accordingly.

THE CYLINDER HEAD TEMPERATURE THERMOCOUPLE is inserted under the #3 cylinder spark plug. If a compatable guage unit is available, the stock VW thermocouple in the right cylinder head may be used.

THE TACHOMETER CONNECTION is an electrical connection, and attached to the magneto "P" lead terminal. A fuse MUST BE used in this circuit to prevent engine failure in the event of a tachometer short to the ground.

SAFETYING should be done to all nuts, bolts and studs. This can be accomplished by using "lock tight", elastic stop nuts, safety wire or combinations of the three depending on how critical the attachment is.

SPARK PLUGS used on the prototype are Champion N-6 with an unshielded ingnition harness. If a shielded ignition harness is desired the Champion REL 37B is a good choice.

THE VOLTAGE REGULATOR is the hermetically sealed solid state unit that is on the 135HP Crysler outboard motor. Although this unit is expensive, it is guaranteed to work with the Crysler alternator.

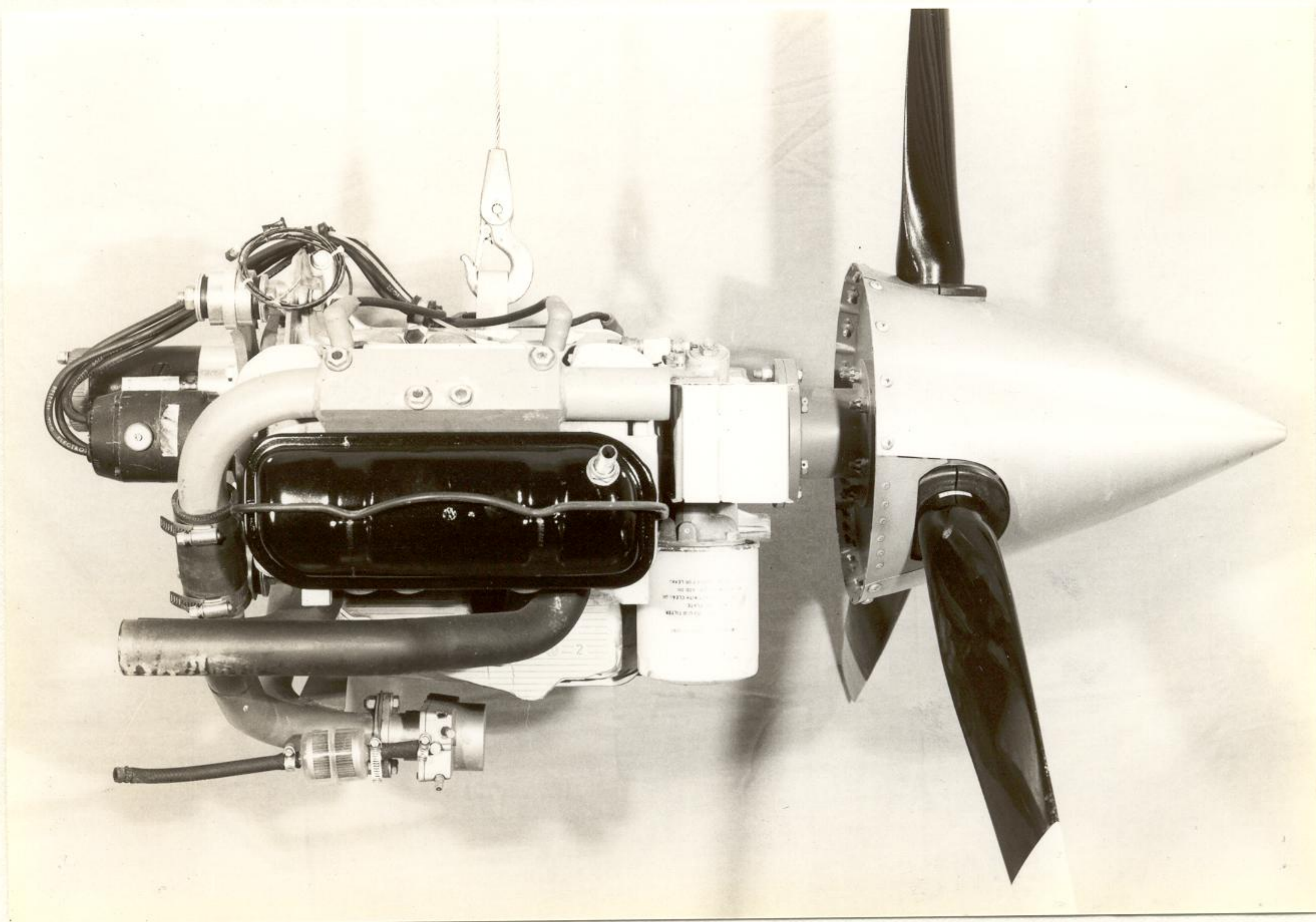
DISCLAIMER STATEMENT (Please Read) The proceeding instructions and drawings are supplied to aid in the building of a non-certified aircraft engine as described and under the restrictions of the Federal Air Regulations.

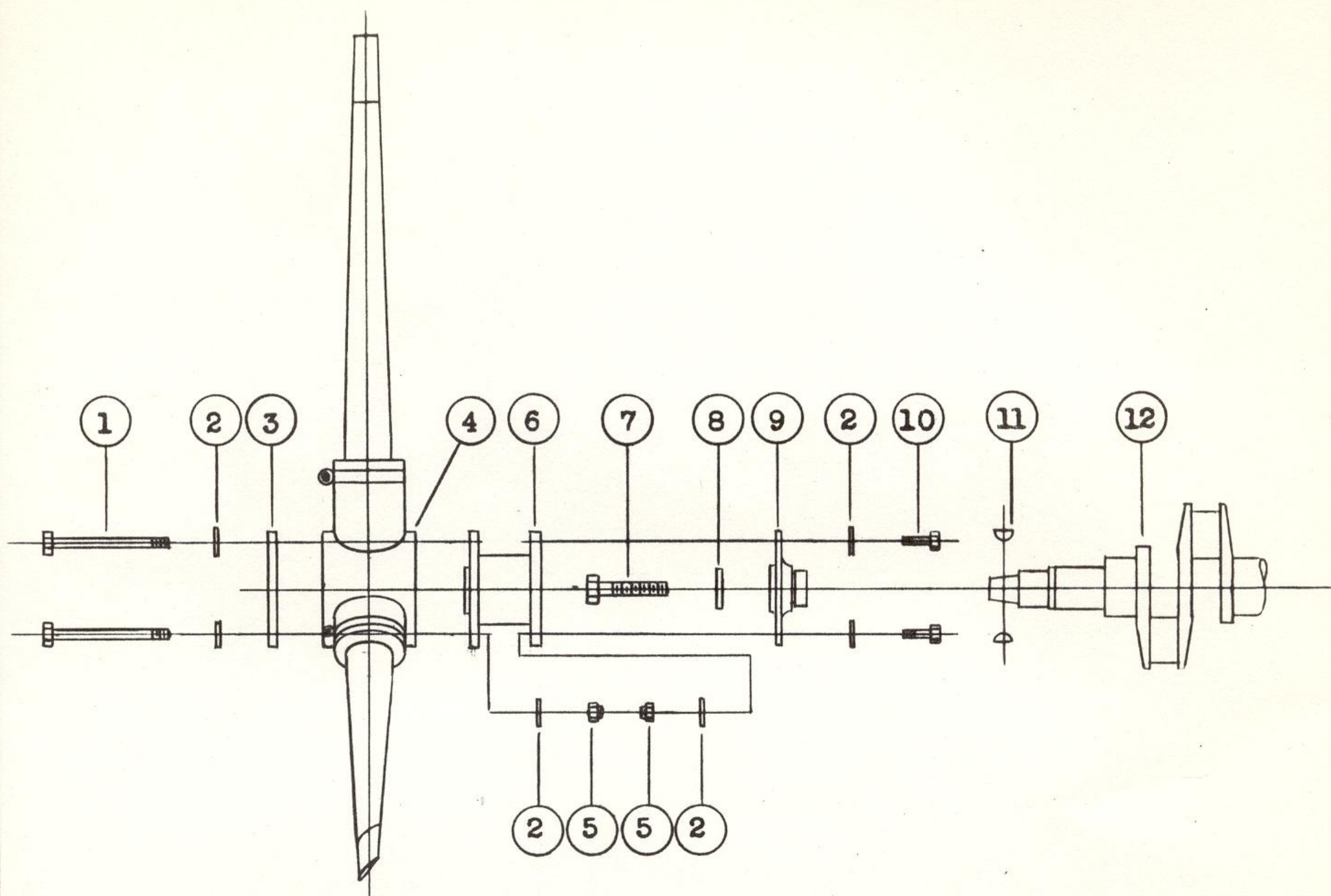
Although reasonable care has been used in the designing and testing of the described engine, no guarantee of reliability or safety will be made or implied; nor will the designer accept responsibility for any damages or injuries resulting from the subsequent use of an engine built from these plans, as he has no control over the materials and workmanship there in, or control over the ultimate use and or abuse of such an engine.

PARTS AND MATERIAL KITS are not available at this time. When and if they do become available, plans holders will be notified by mail.

QUESTIONS AND OTHER CORRESPONDANCE will be replied to if you will PLEASE send a self-addressed, stamped envelope. Any good suggestions for improvement on these plans will be gratefully acknowledged.

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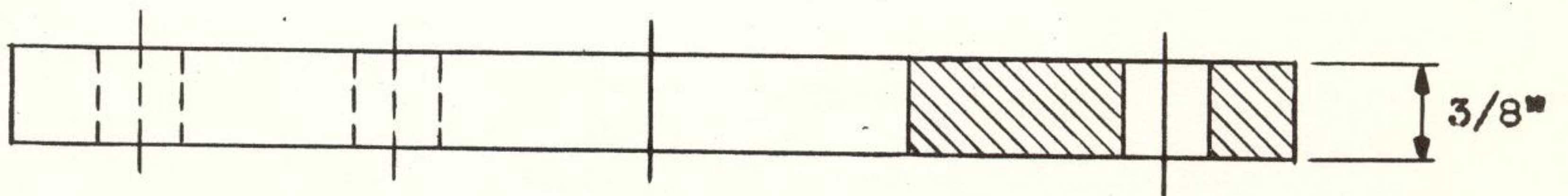
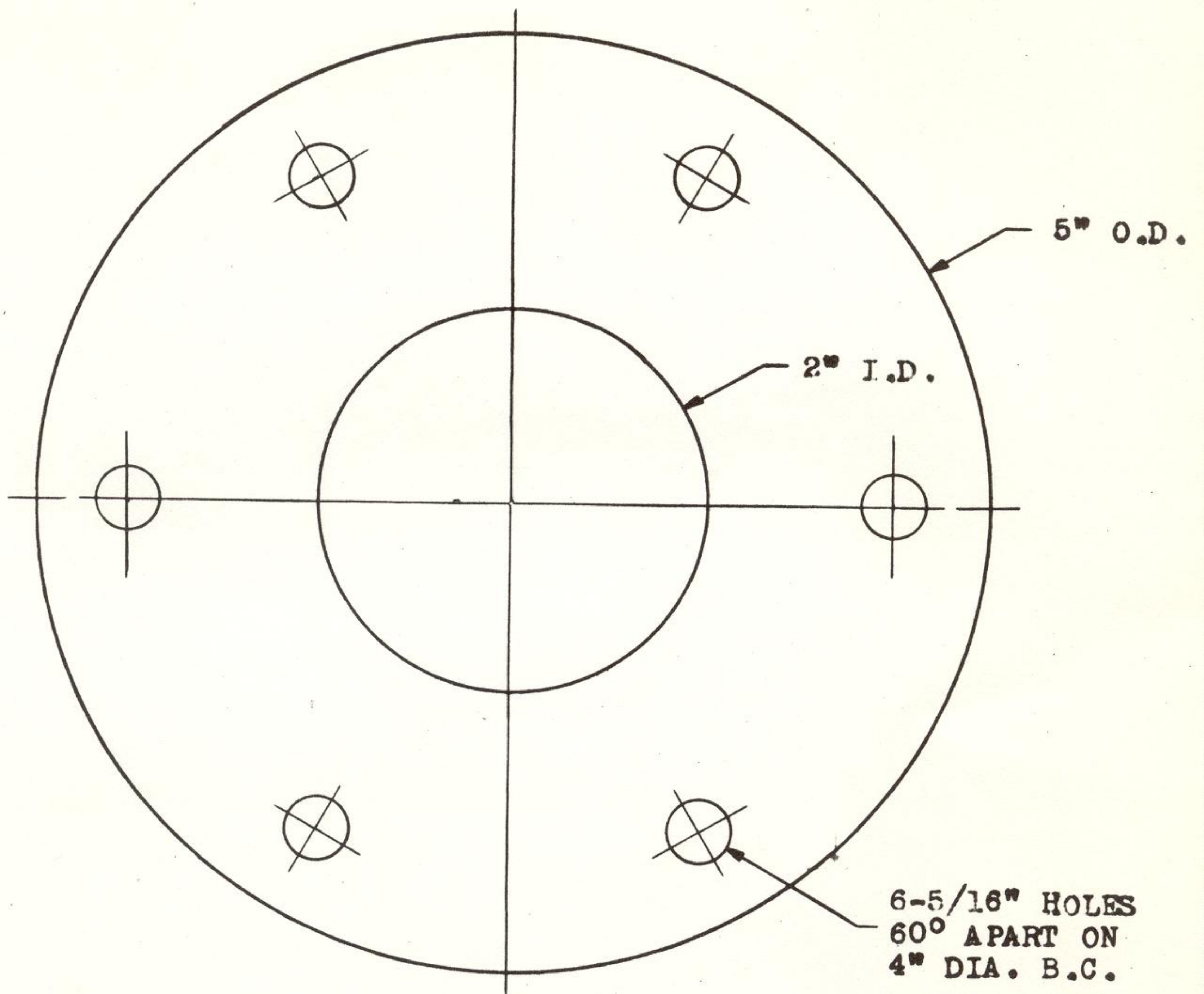


1. 6 PROP BOLTS AN5H-57 (IF RAND PROP IS USED)
2. 24 WASHERS AN960-516
3. PROP FACE PLATE (DWG. 02)
4. 48" DIA. RAND ROBINSON PROP
5. 12 CASTLE NUTS AN310-5
6. 3" PROP SPACER (DWG. 03)
7. HUB RETAINING BOLT 1/2" X 3" GRADE 8
8. HUB RETAINING WASHER (DWG. 04)
9. PROP HUB (DWG. 05)
10. 6 HUB BOLTS AN5H-11
11. 2 4mm VW FAN HUB KEYS
12. CRANKSHAFT

PATENT PENDING

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					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE	NONE	No. 01			

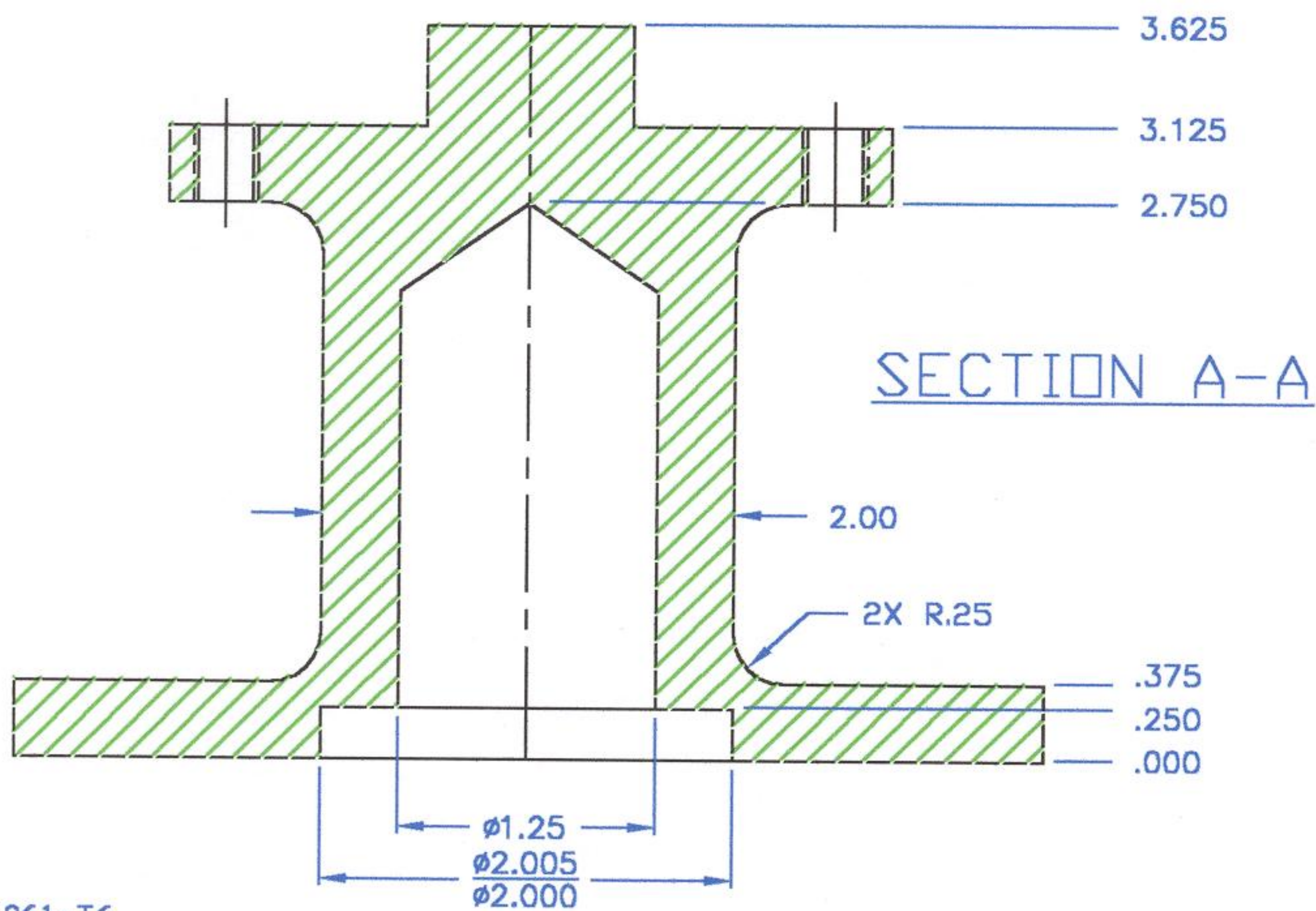
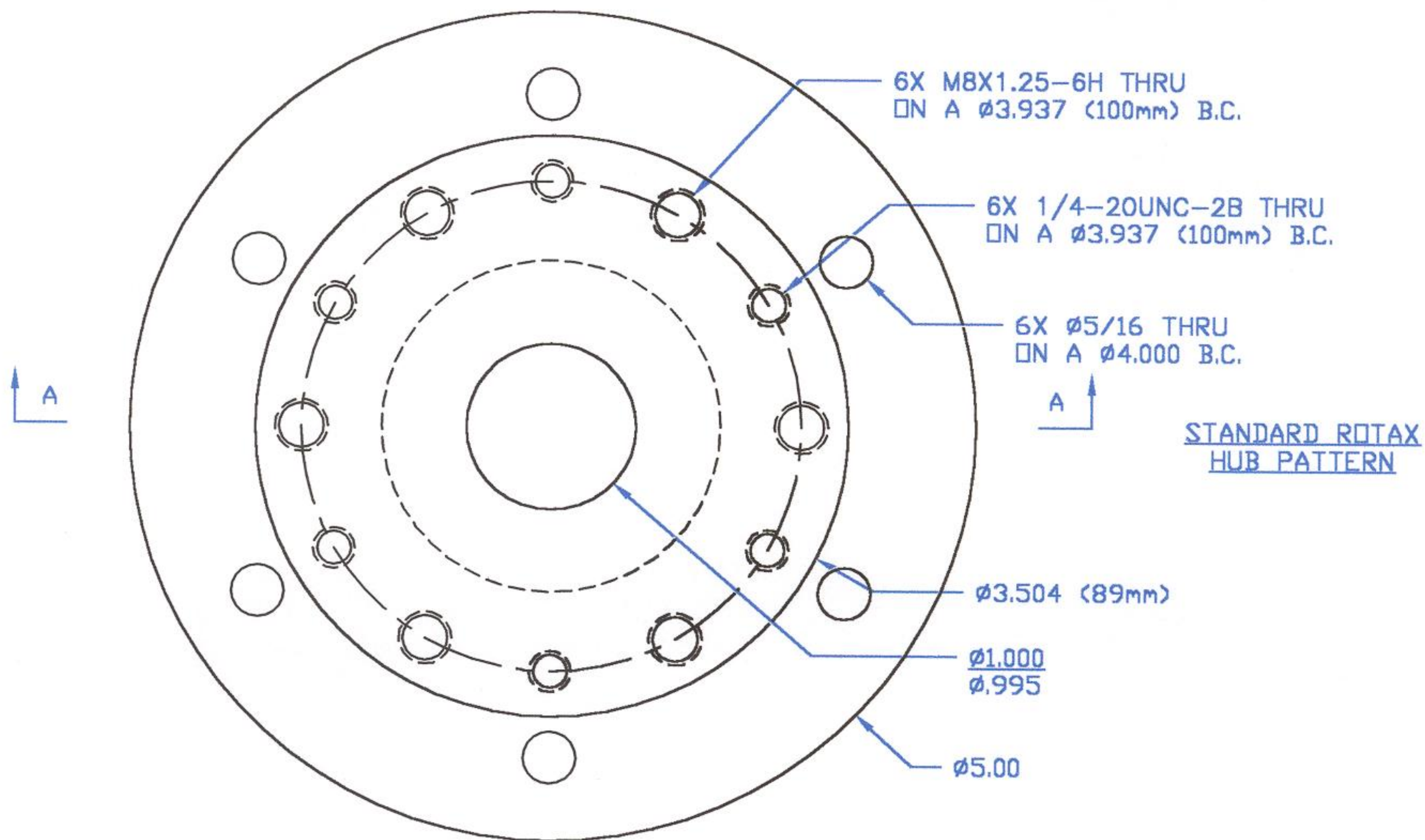
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MATERIAL: 3/8" 6061-T6 ALUMINUM PLATE

PATENT PENDING

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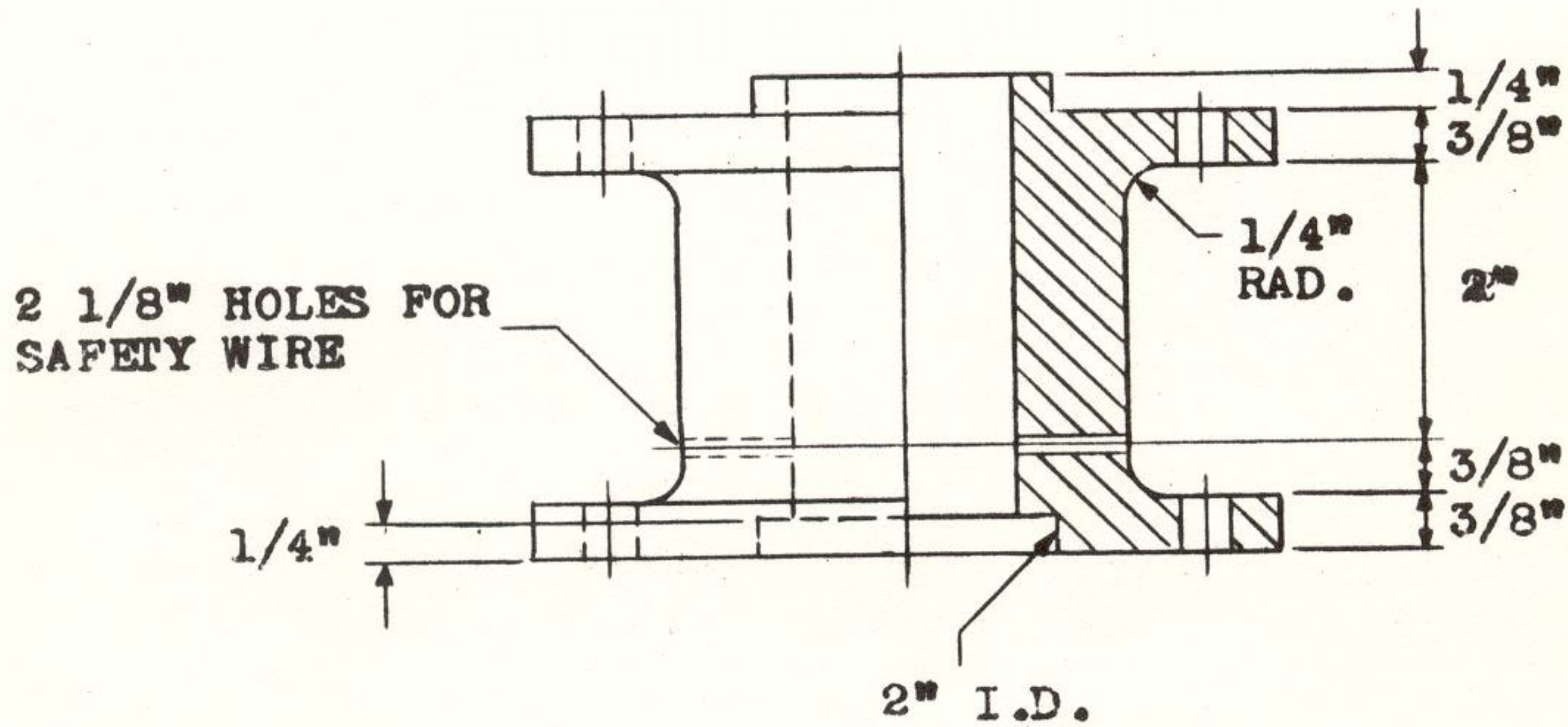
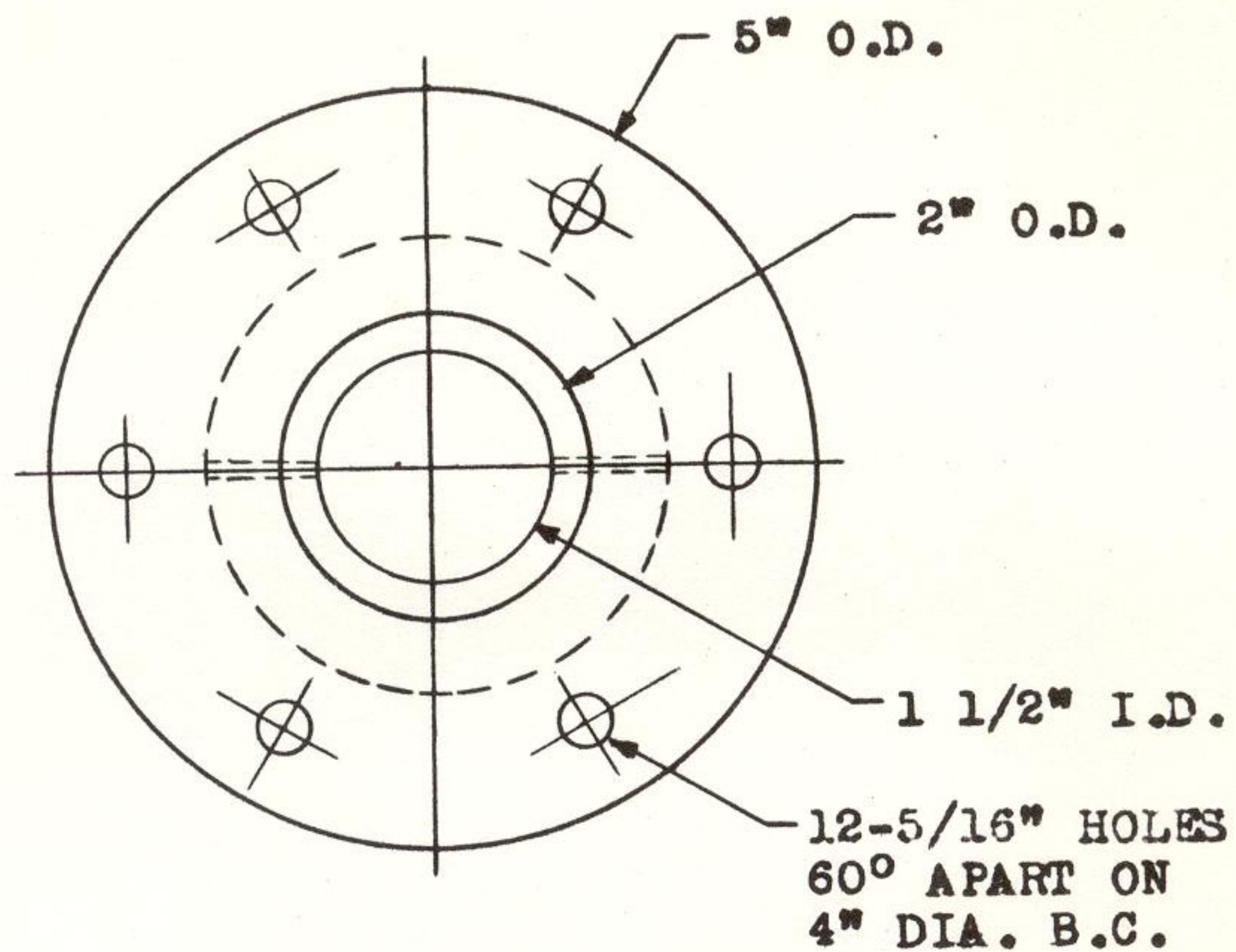


MATERIAL: 6061-T6

ROTAX PATTERN PROP SPACER

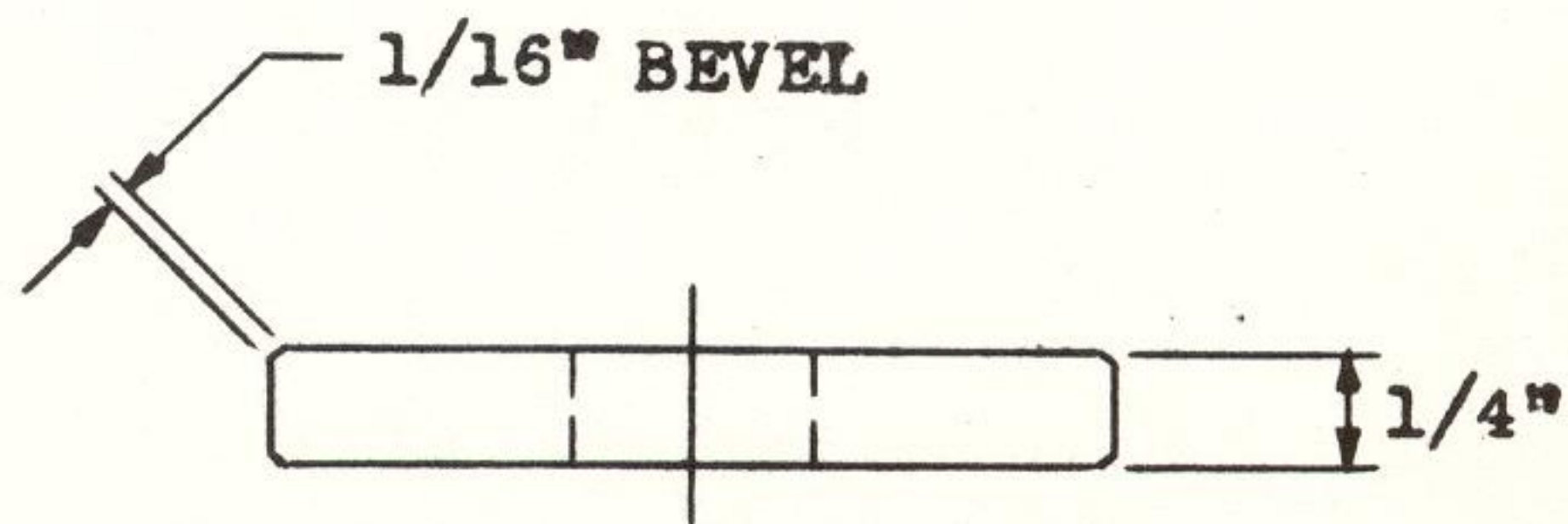
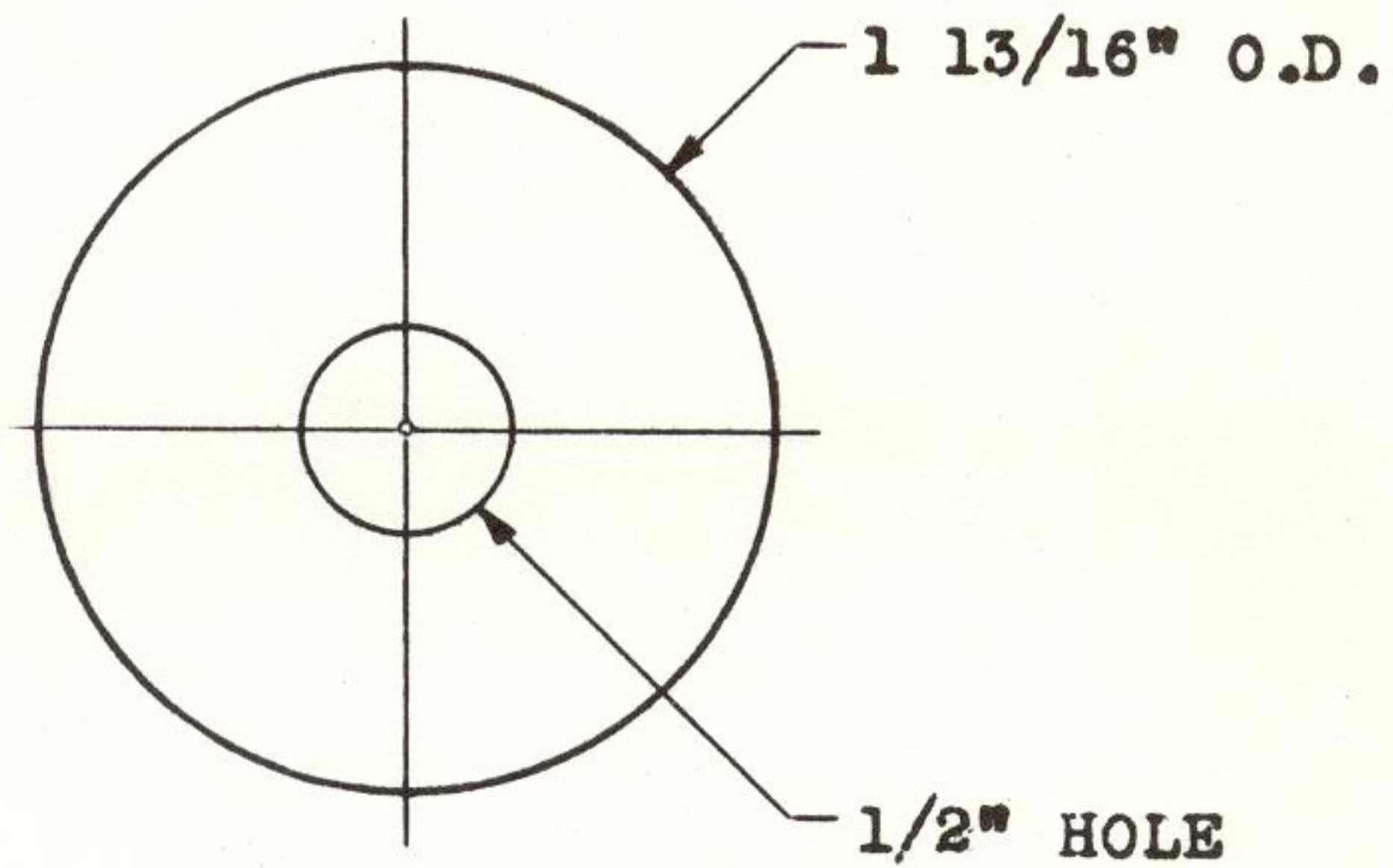
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PATENT PENDING

MATERIAL: 6061-T6 BAR STOCK

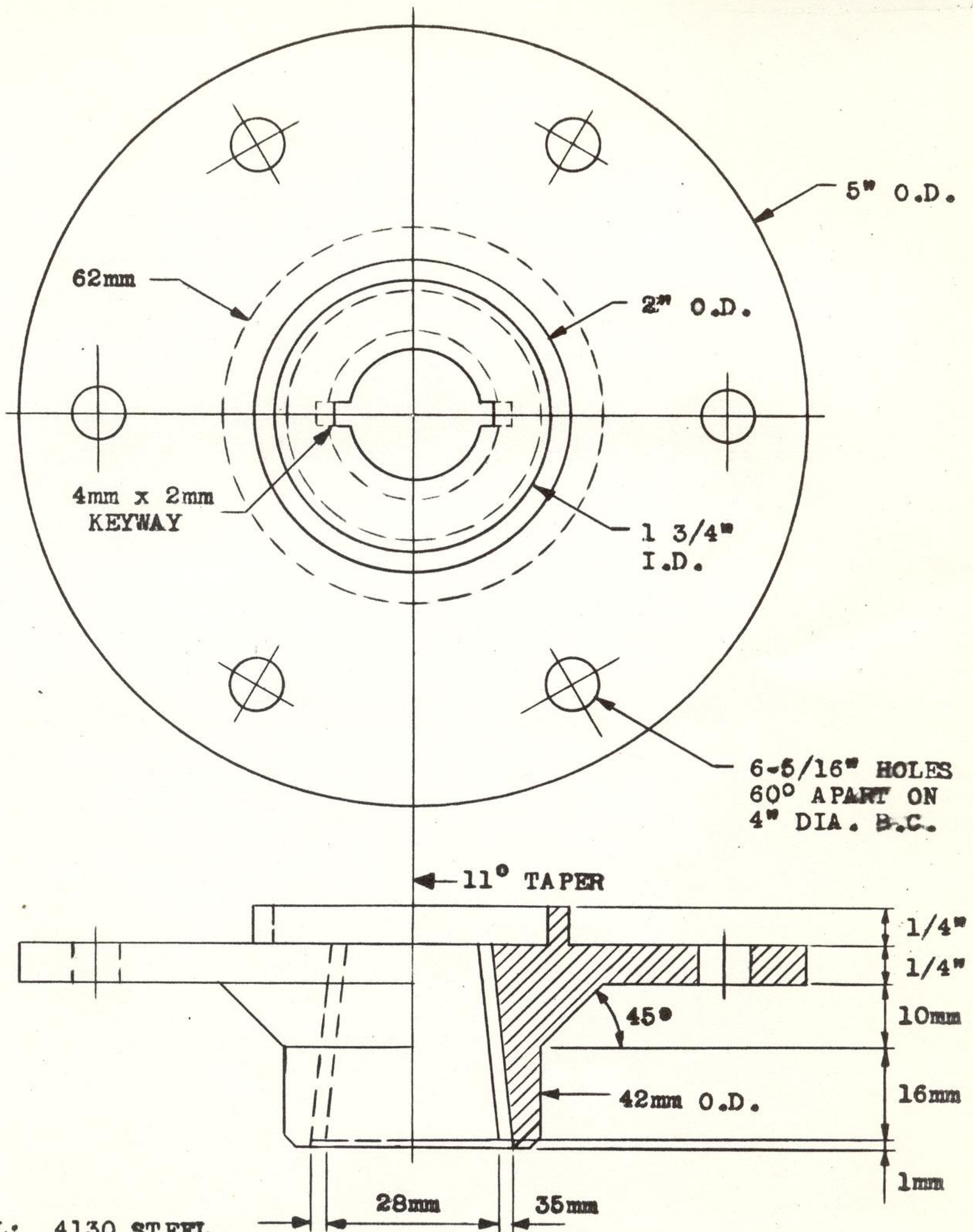


PATENT PENDING

MATERIAL: 4130 STEEL (HEAT TO CHERRY RED COLOR AND QUENCH IN WATER)

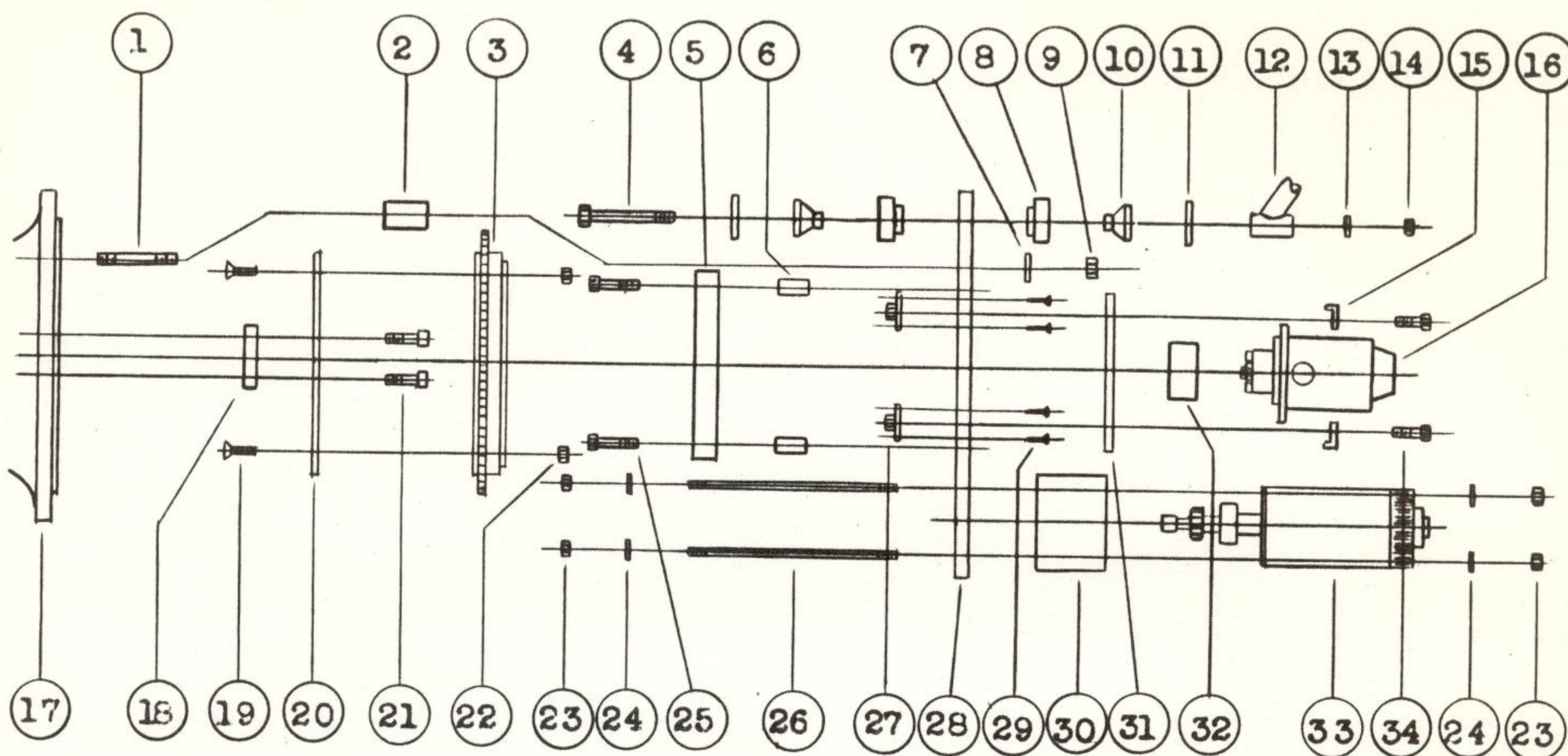
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PATENT PENDING



MATERIAL: 4130 STEEL

					PROPELLER HUB					
					DRN.					
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- | | | | |
|-----|-------------------------------|-----|-----------------------------|
| 1. | 2 10mm x 75mm BOLTS (TOP) | 18. | THRUST BEARING (DWG. 11) |
| | 2 10mm x 75mm STUDS (BTM) | 19. | 12 MS24694-S105 FH SCREWS |
| 2. | ACCESSORY MOUNTING PLATE | 20. | FLYWHEEL ADAPTER PLATE |
| | SPACERS (DWG. 07) | | (DWG. 12) |
| 3. | FLYWHEEL, 135HP CRYSLER | 21. | VW FLYWHEEL MOUNTING BOLTS |
| | OUTBOARD MOTOR (DWG. 08) | 22. | 12 AN363-428 NUTS |
| 4. | 4 AN6 BOLTS (LENGTH TO SUIT | 23. | 4 AN365-428 NUTS |
| | MOTOR MOUNT) | 24. | 4 AN960-416 WASHERS |
| 5. | STATOR UNIT, 135HP CRYSLER | 25. | 7 AN4-16A BOLTS |
| 6. | 7 STATOR SPACERS (DWG. 09) | 26. | 2 1/4"-28 x 8 1/2" STUDS |
| 7. | 4 10mm WASHERS | 27. | 2 AN366F-524 PLATE NUTS |
| 8. | 8 SHOCK MT BUSHINGS (DWG. 10) | 28. | ACCESSORY MOUNTING PLATE |
| 9. | 4 10mm CASTLE NUTS | | (DWG. 13) |
| 10. | 8 CONTINENTAL BUSHINGS | 29. | 4 AN426-4-16 FLUSH RIVETS |
| | PART NO. 22387 | 30. | STARTER MT BASE (DWG. 14) |
| 11. | 8 CONTINENTAL WASHERS | 31. | MAGNETO MT BASE (DWG. 15) |
| | PART NO. 21530 | 32. | IMPULSE CPL DRIVE (DWG. 16) |
| 12. | MOTOR MOUNT | 33. | STARTER, 135HP CRYSLER |
| 13. | 4 AN960-616 WASHERS | 34. | 2 AN5-17A BOLTS |
| 14. | 4 AN310-6 CASTLE NUTS | | |
| 15. | 2 SLICK MAG HOLD DOWN CLAMPS | | |
| 16. | SLICK 4016 RH MAGNETO | | |
| 17. | REAR OF ENGINE CASE | | |

PATENT PENDING

ACCESSORY ASSEMBLY

DRN.

NO.

REVISION

CHKD

APPR

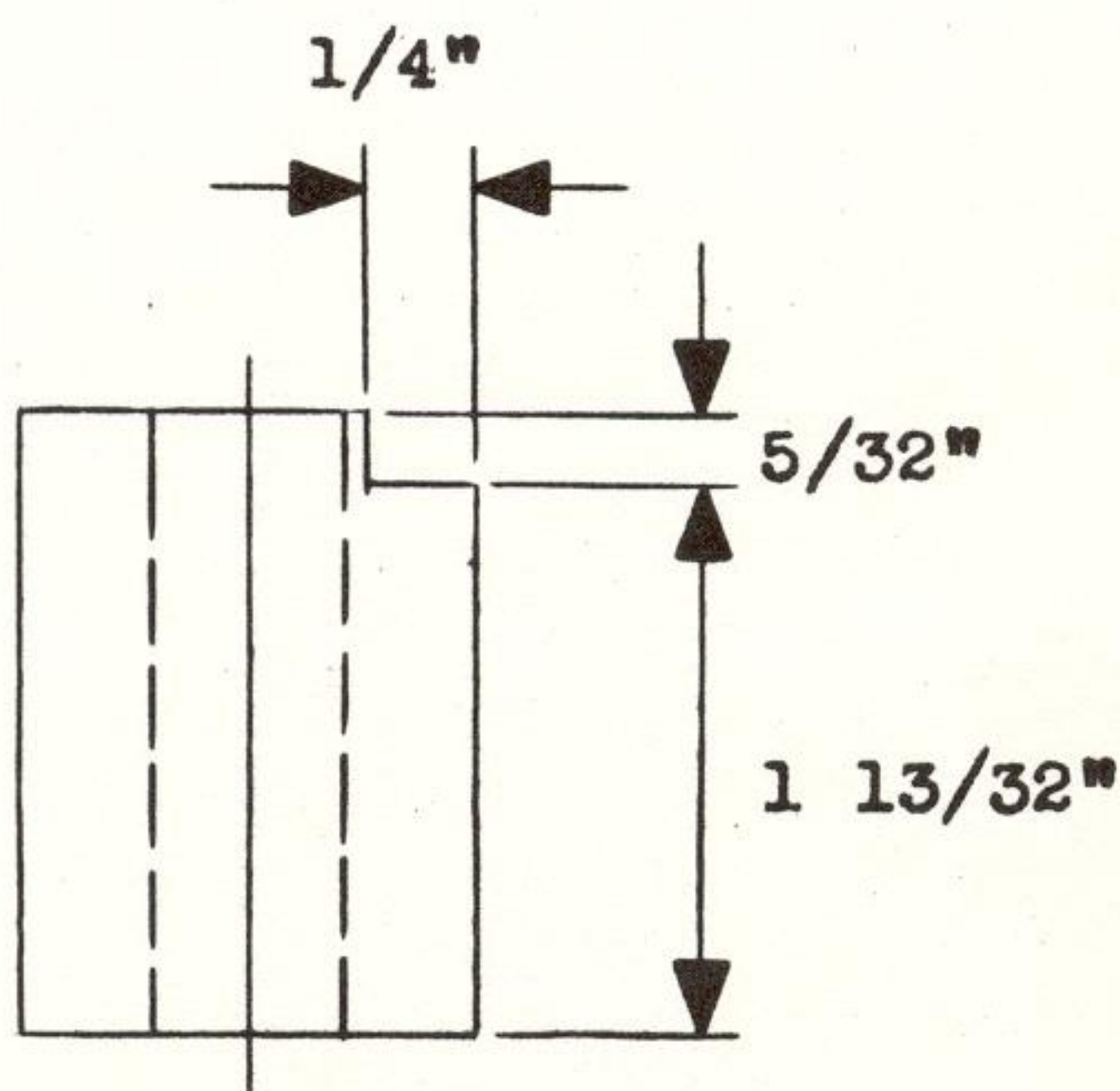
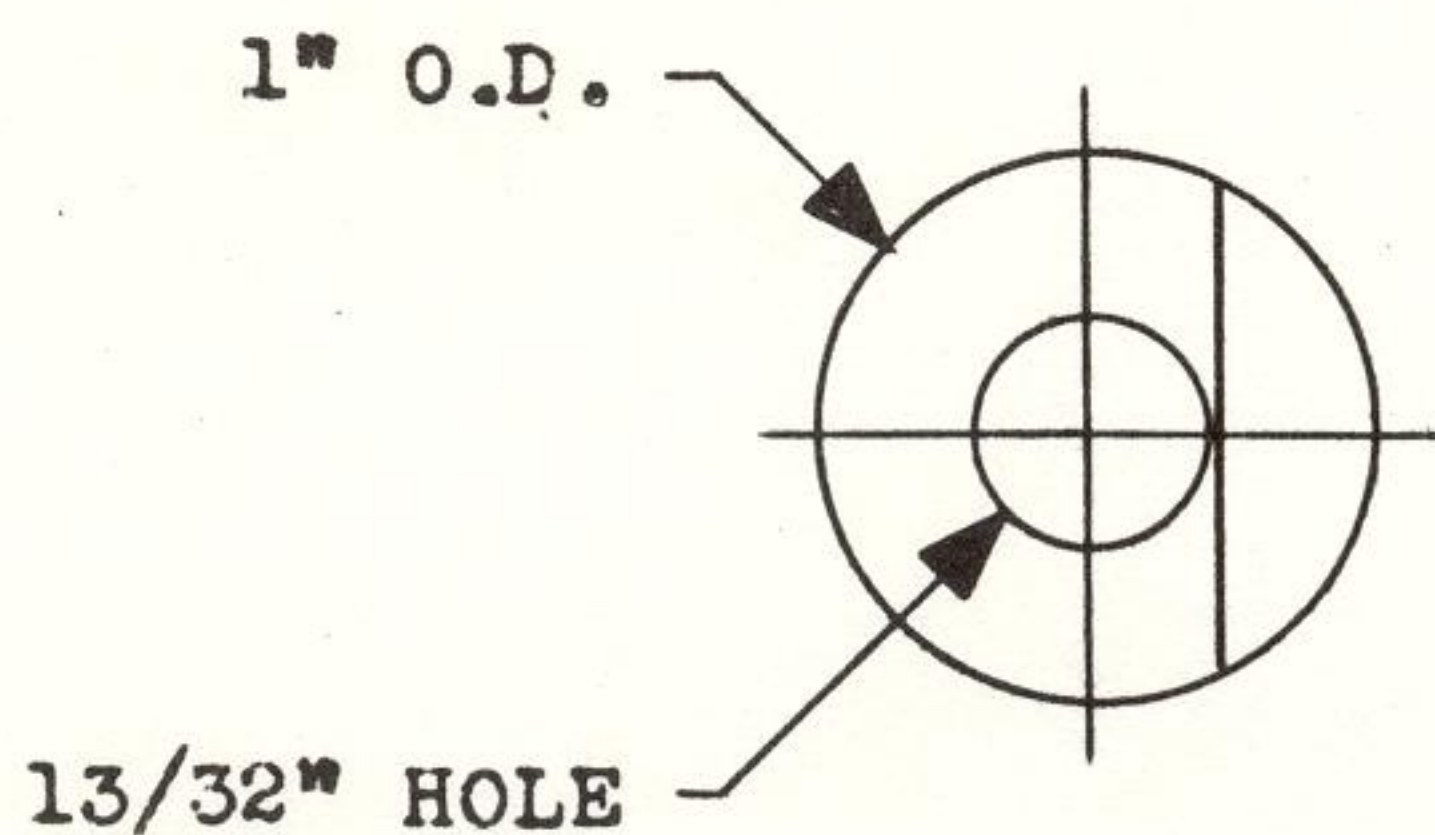
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TYPICAL OF 4 SPACERS



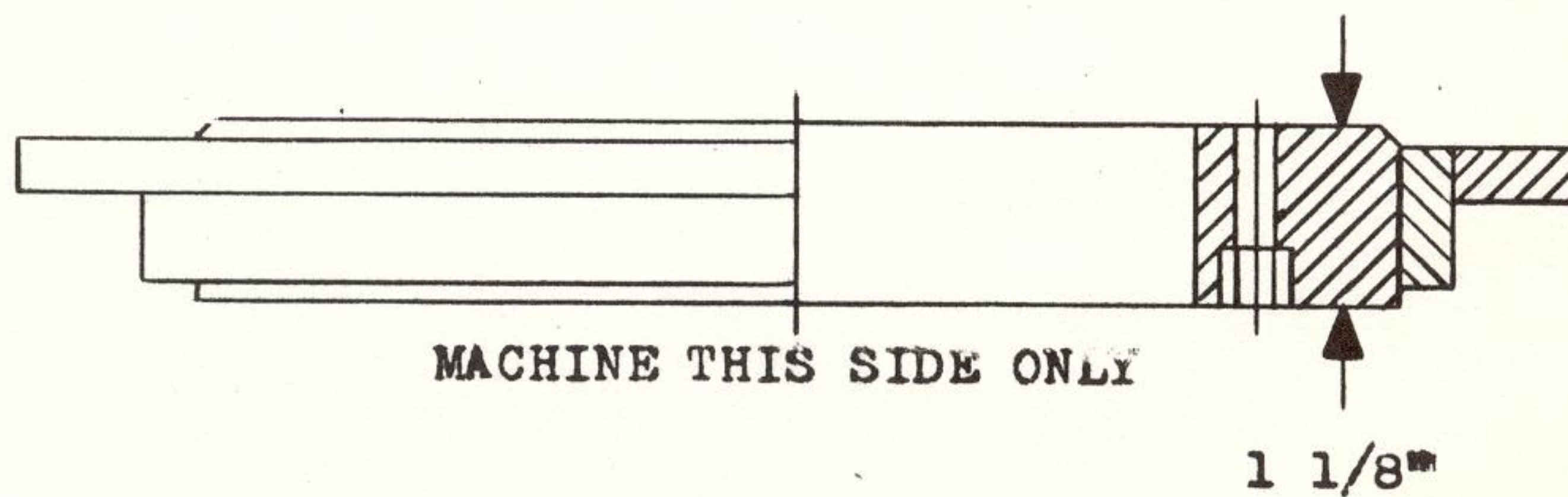
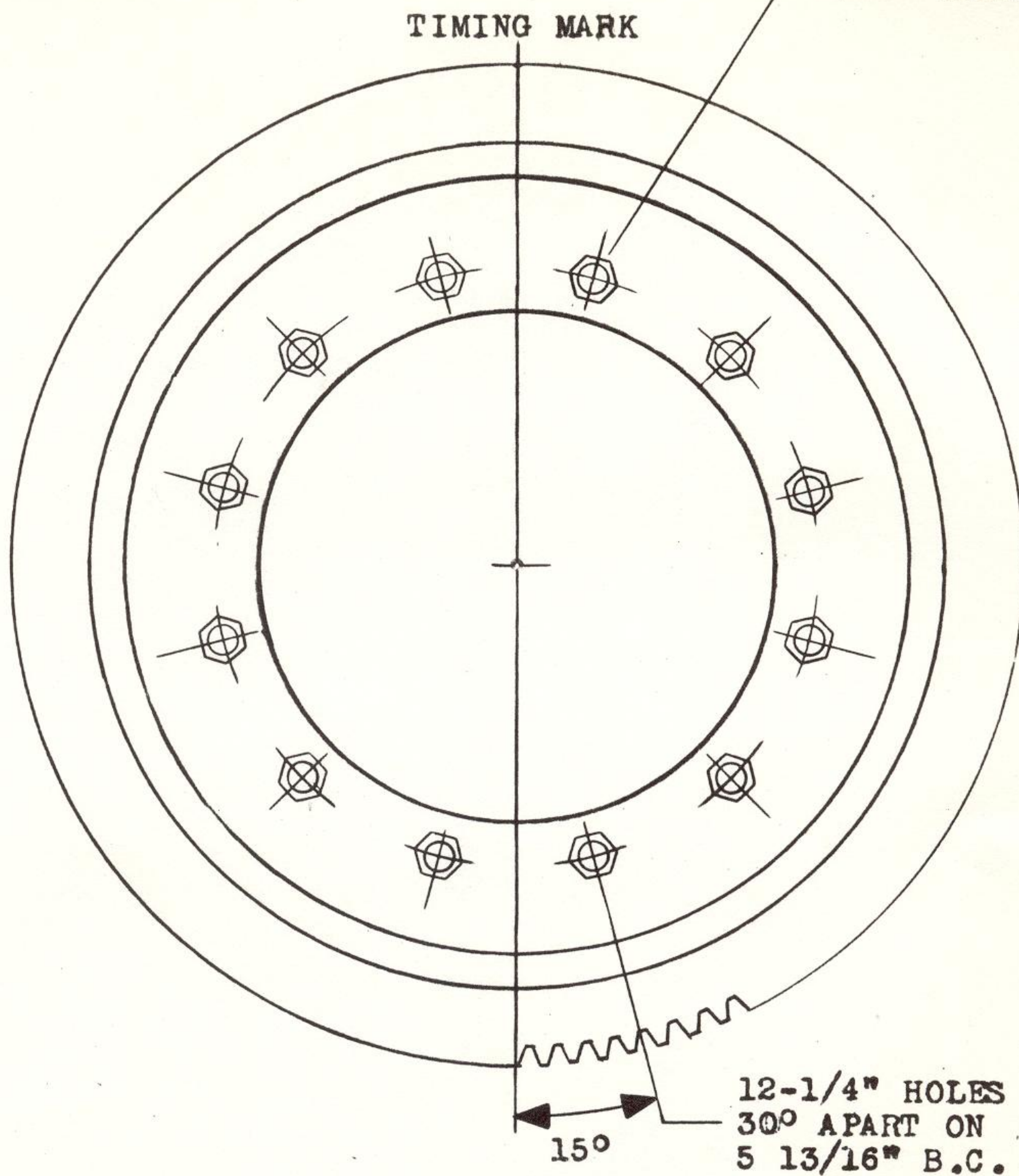
MATERIAL: 2024-T3 BAR STOCK

PATENT PENDING

					ACCESSORY MOUNTING PLATE SPACERS					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE FULL				No. 07	

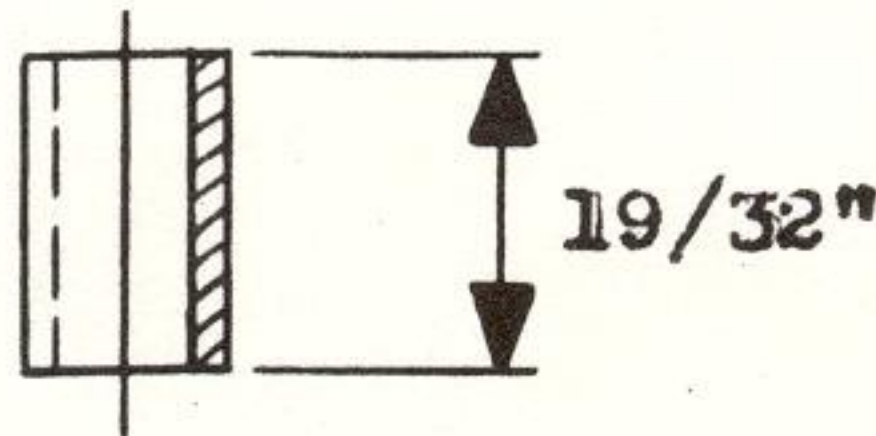
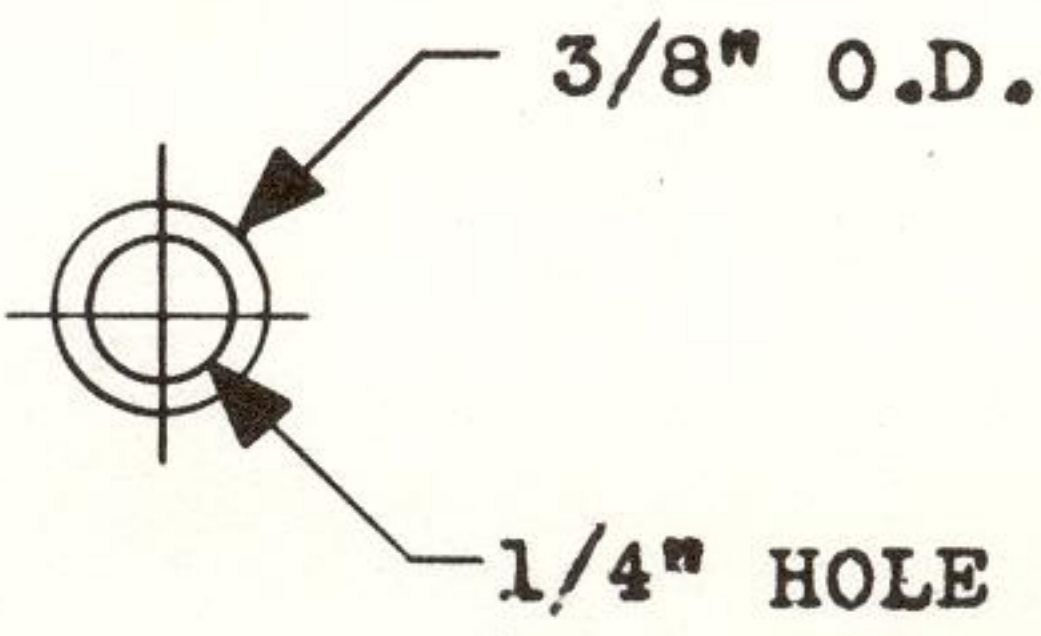
PATENT PENDING

12-7/16" COUNTERSUNK
HOLES 1/2" DEEP
SWAGED TO SHAPE USING
7/16" HEXAGONAL ROD



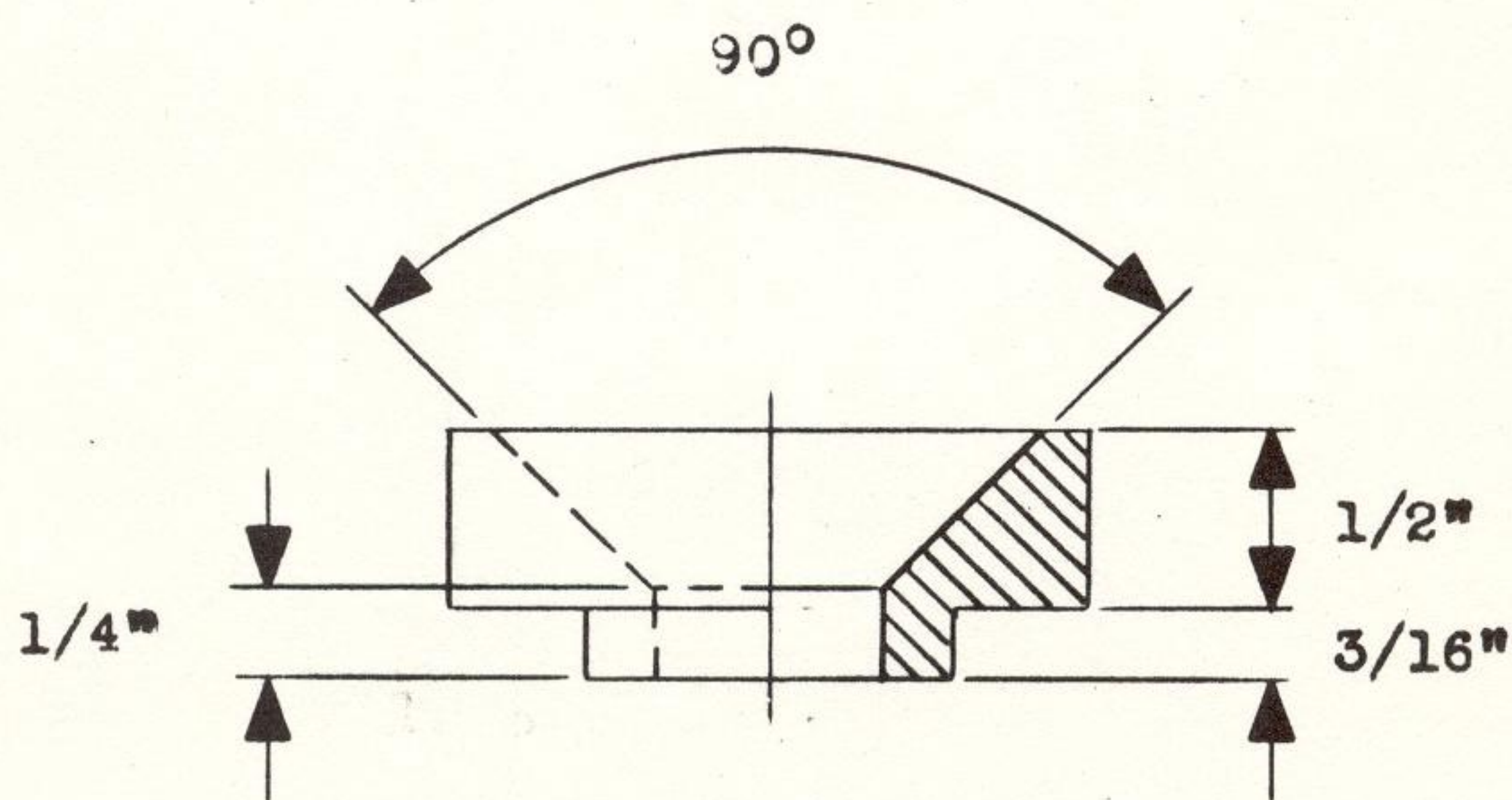
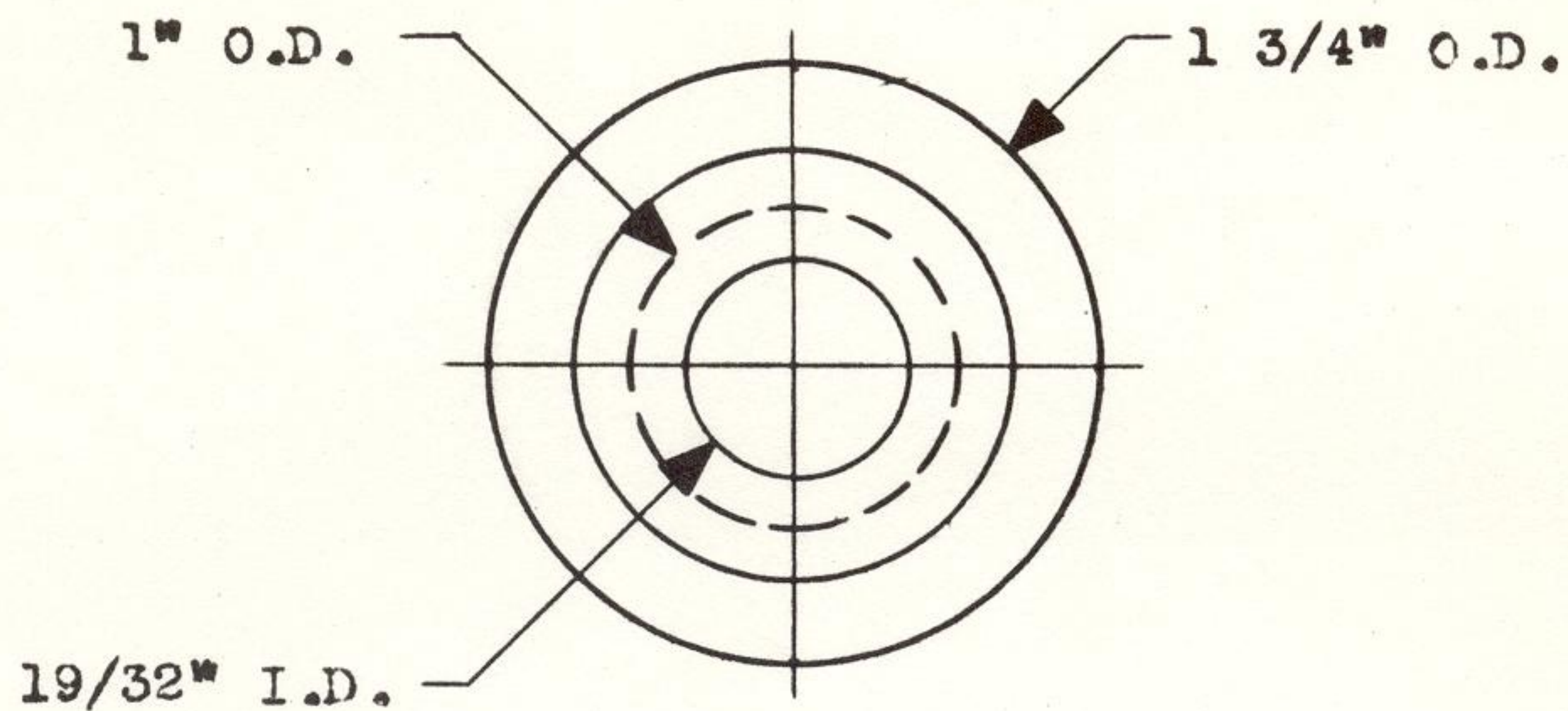
135 HP CRYSLER OUTBOARD MOTOR FLYWHEEL

					FLYWHEEL					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE 1/2		No. 08			



MATERIALS: 2024-T3 ALUMINUM ROD OR 3/8" x .058 4130 TUBE

					STATOR SPACERS					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE FULL			No. 09		

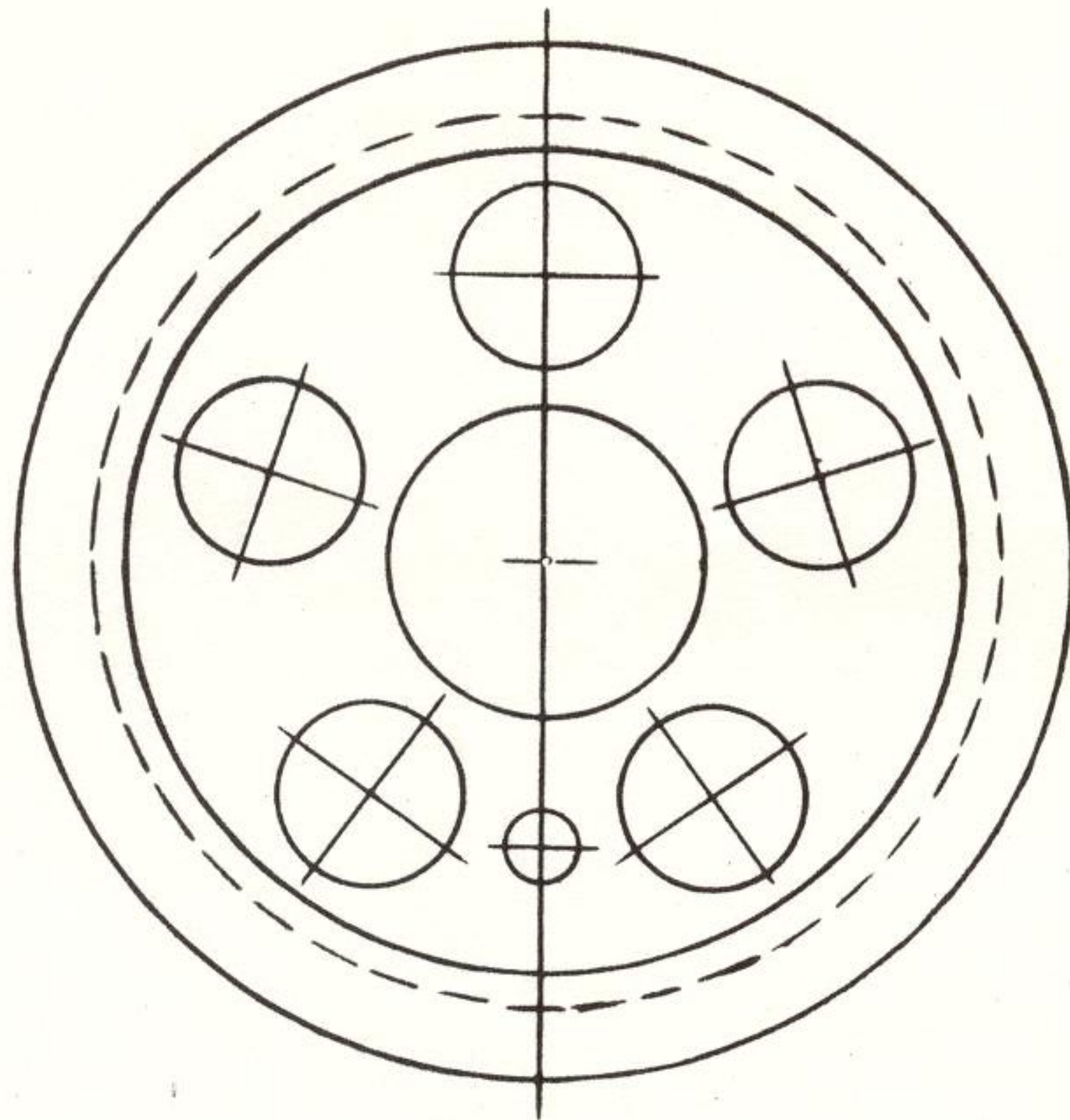


MATERIAL: 6061-T6 BAR STOCK

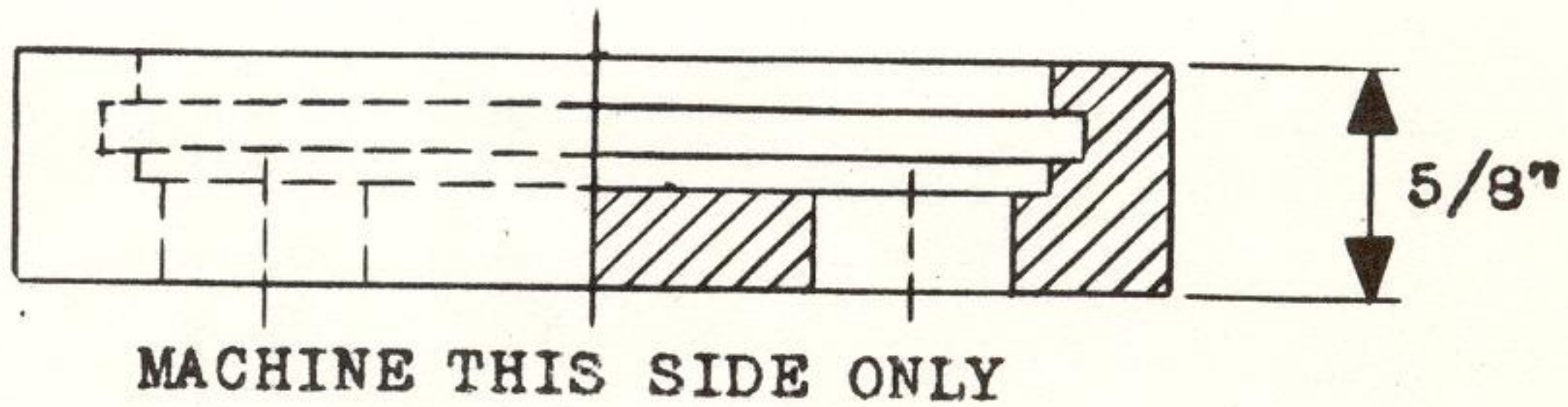
PATENT PENDING

					SHOCK MOUNT BUSHING					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE	FULL No. 10				

PATENT PENDING

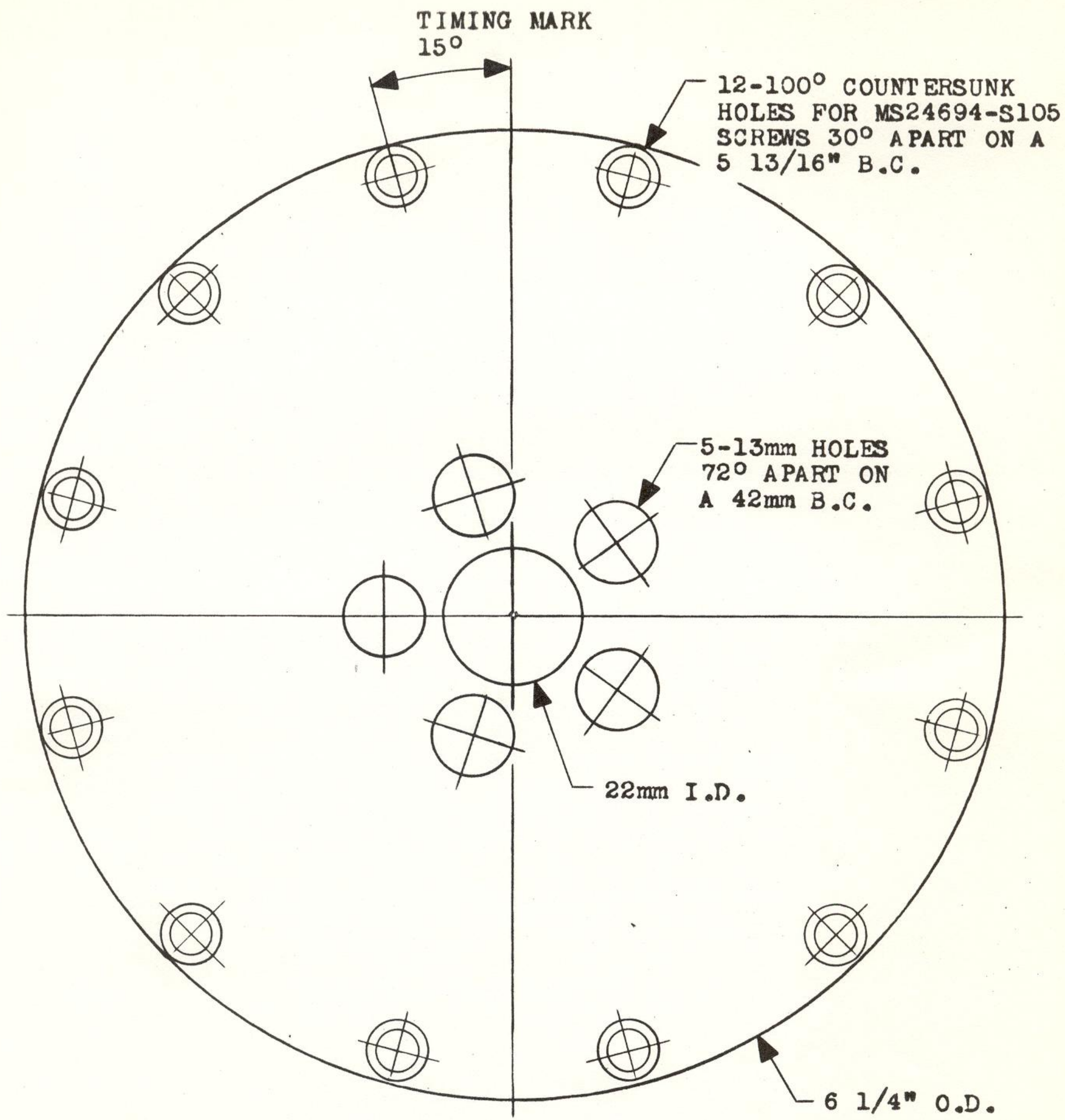


HOLES ROTATED
INTO VIEW



MATERIAL: CUT AND MACHINE FROM THE CENTER OF VW FLYWHEEL

					THRUST BEARING					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE FULL			No. 11		



MATERIAL: .090" THICK 4130 STEEL PLATE

PATENT PENDING

FLYWHEEL ADAPTER PLATE

DRN.

NO.

REVISION

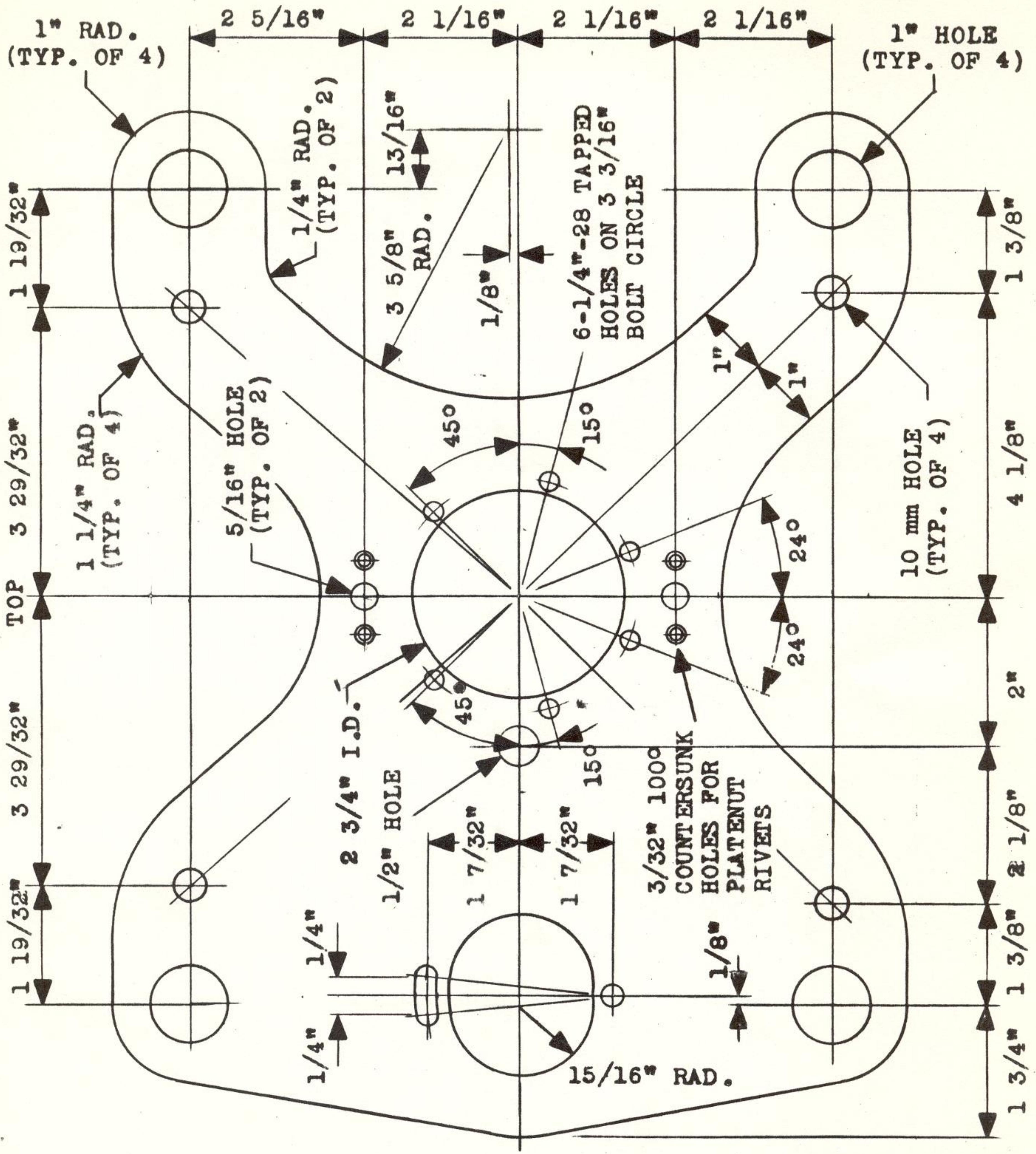
CHKD

APPR

DATE

SCALE FULL

No. 12

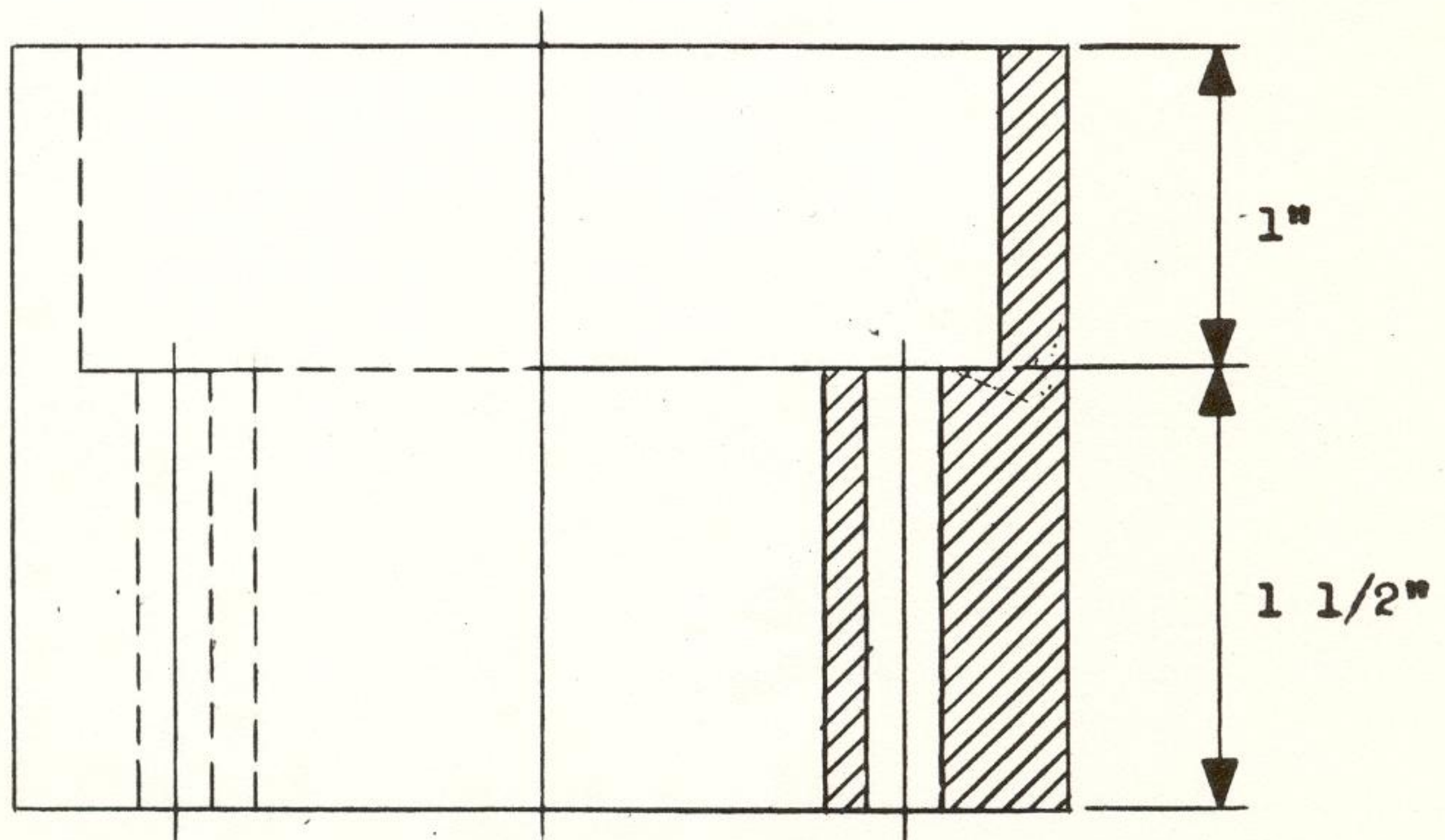
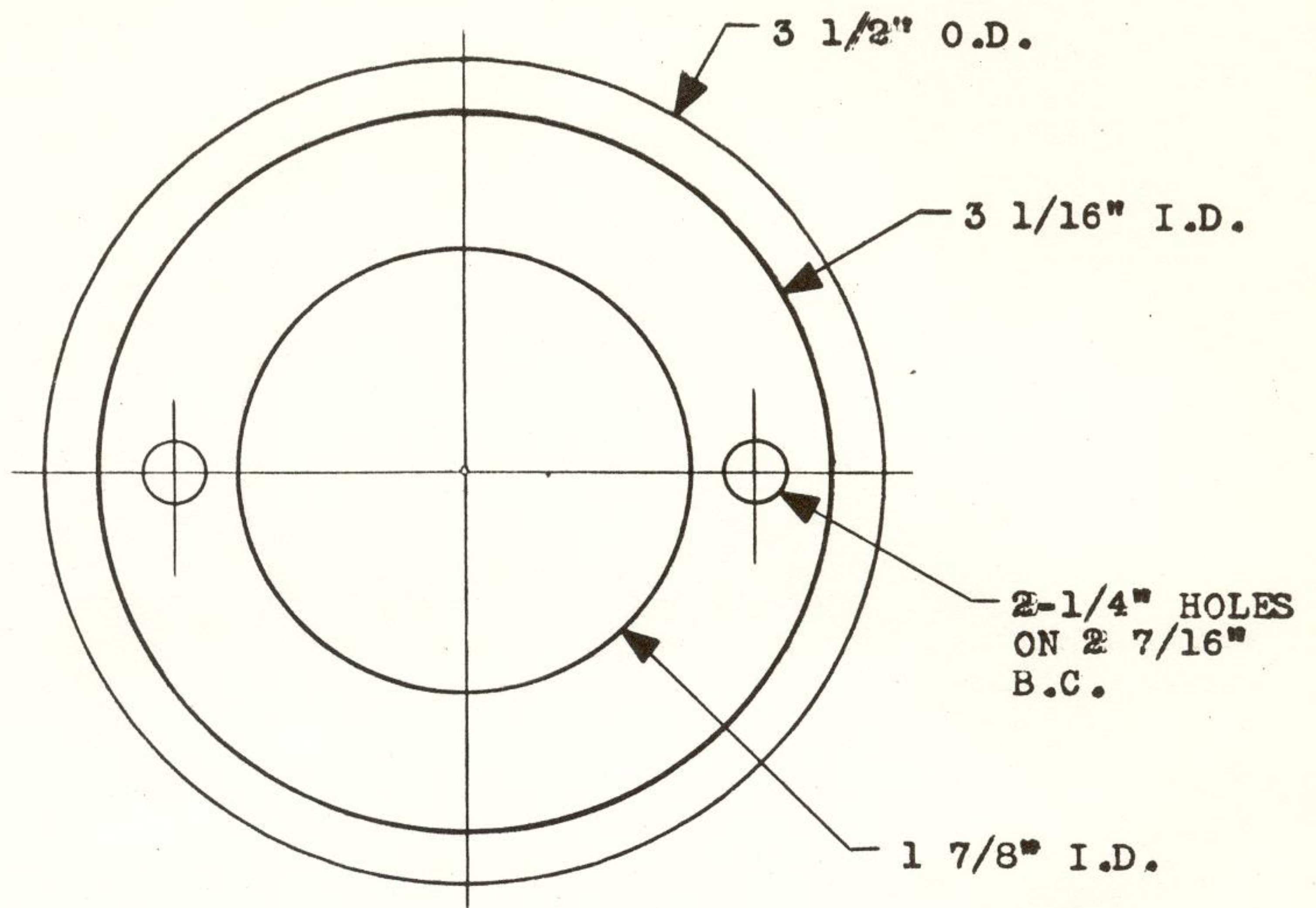


MATERIAL: 3/8" THICK 6061-T6 ALUMINUM PLATE

PATENT PENDING

NO.	REVISION	CHKD	APPR	DATE

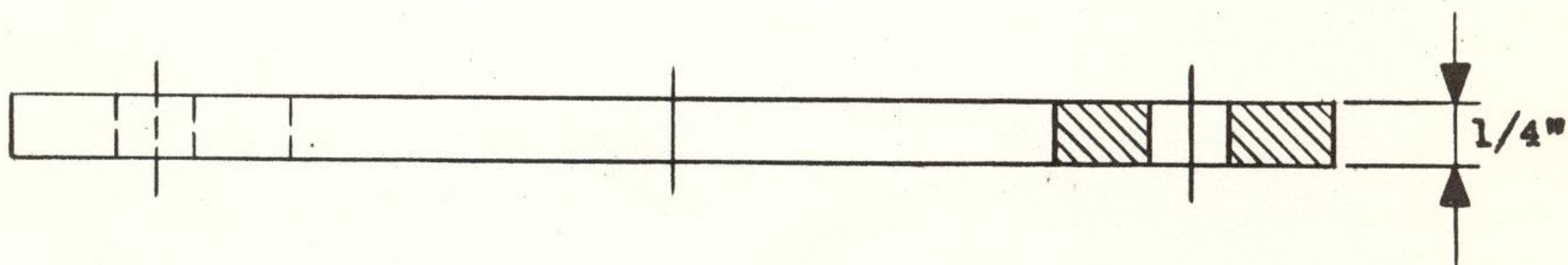
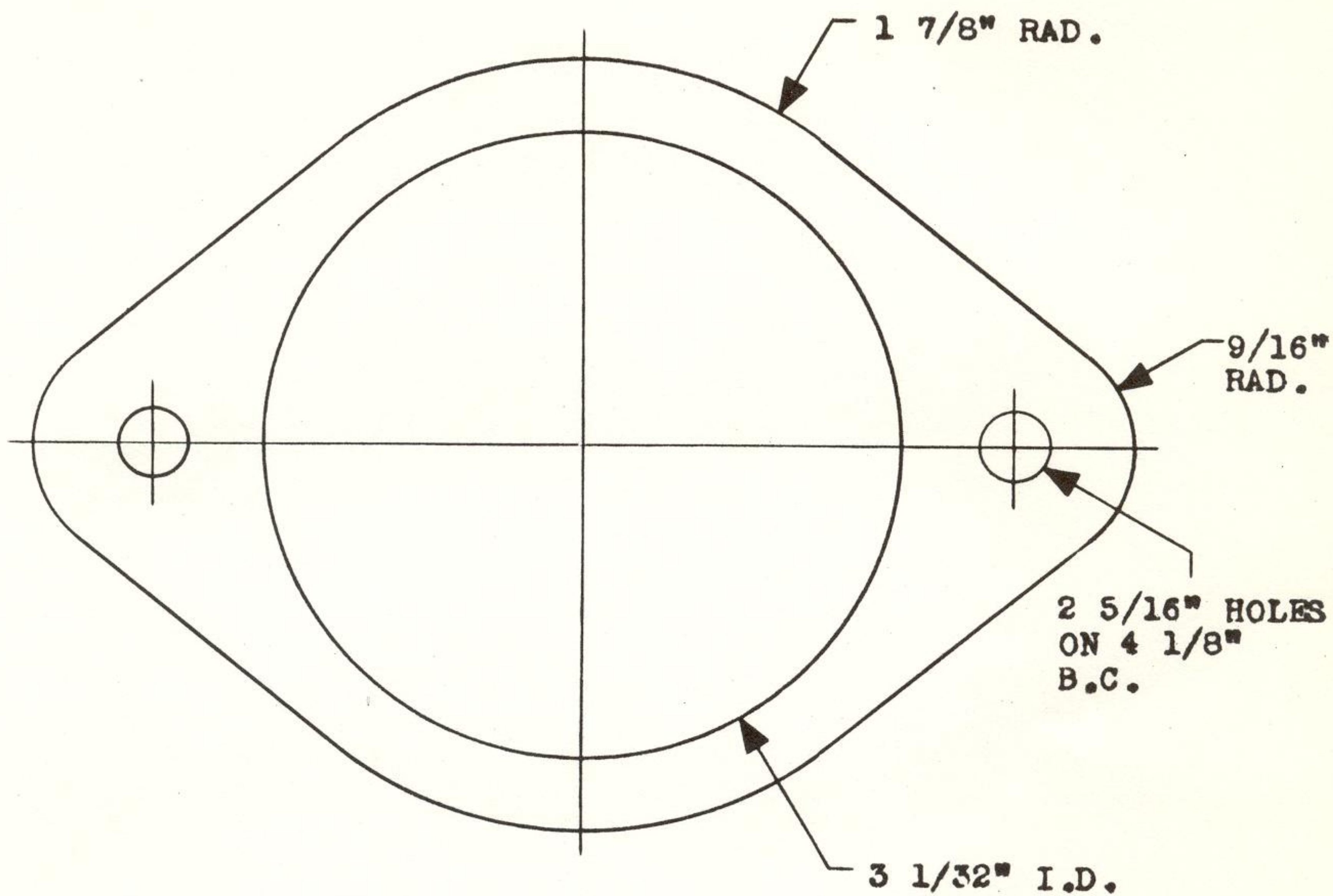
ACCESSORY MOUNTING PLATE				
DRN.				
SCALE	1/2	NO. 13		



MATERIAL: 6061-T6 BAR STOCK

PATENT PENDING

					STARTER MOUNTING BASE				
					DRN.				
NO.	REVISION	CHKD	APPR	DATE	SCALE FULL		No. 14		



MATERIAL: 1/4" 6061-T6 ALUMINUM PLATE

PATENT PENDING

MAGNETO MOUNTING BASE

DRN.

NO.

REVISION

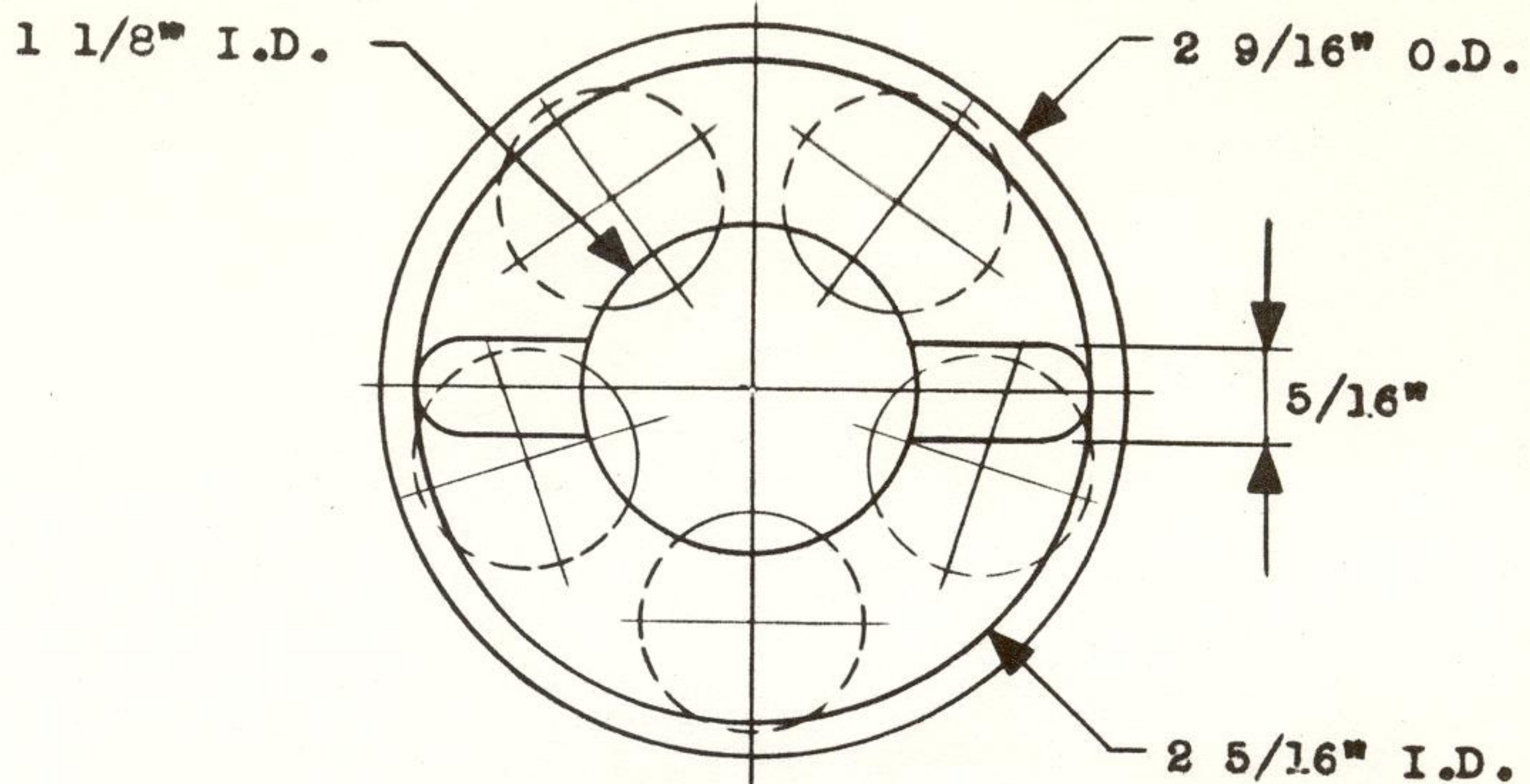
CHKD

APPR

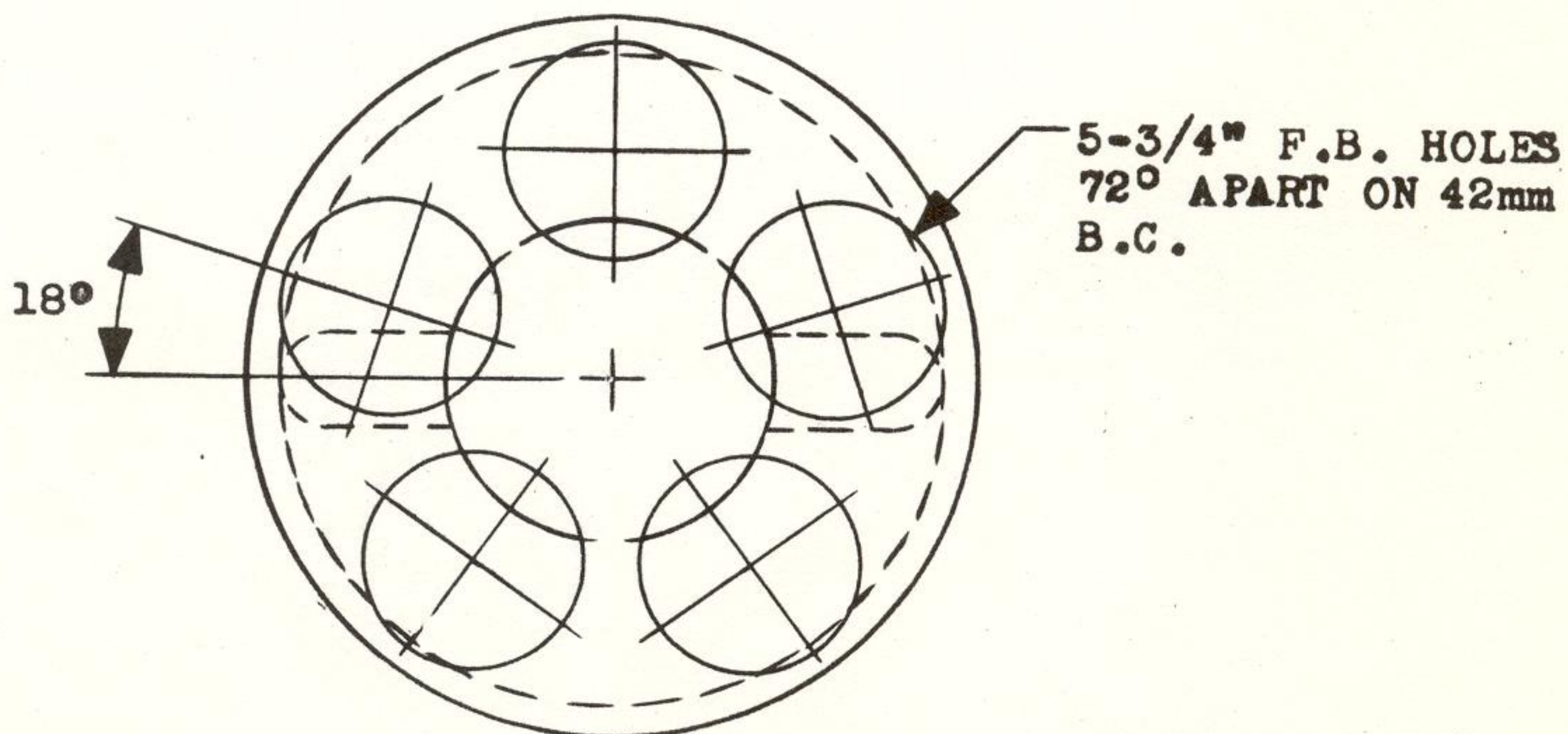
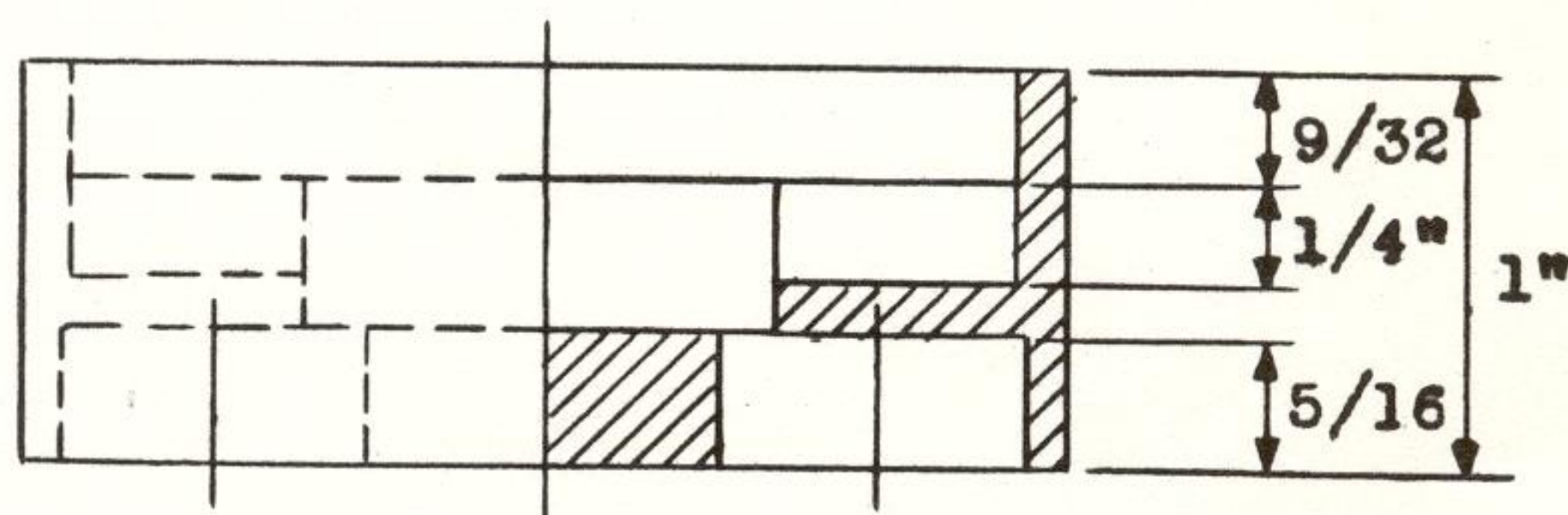
DATE

SCALE FULL

No. 15



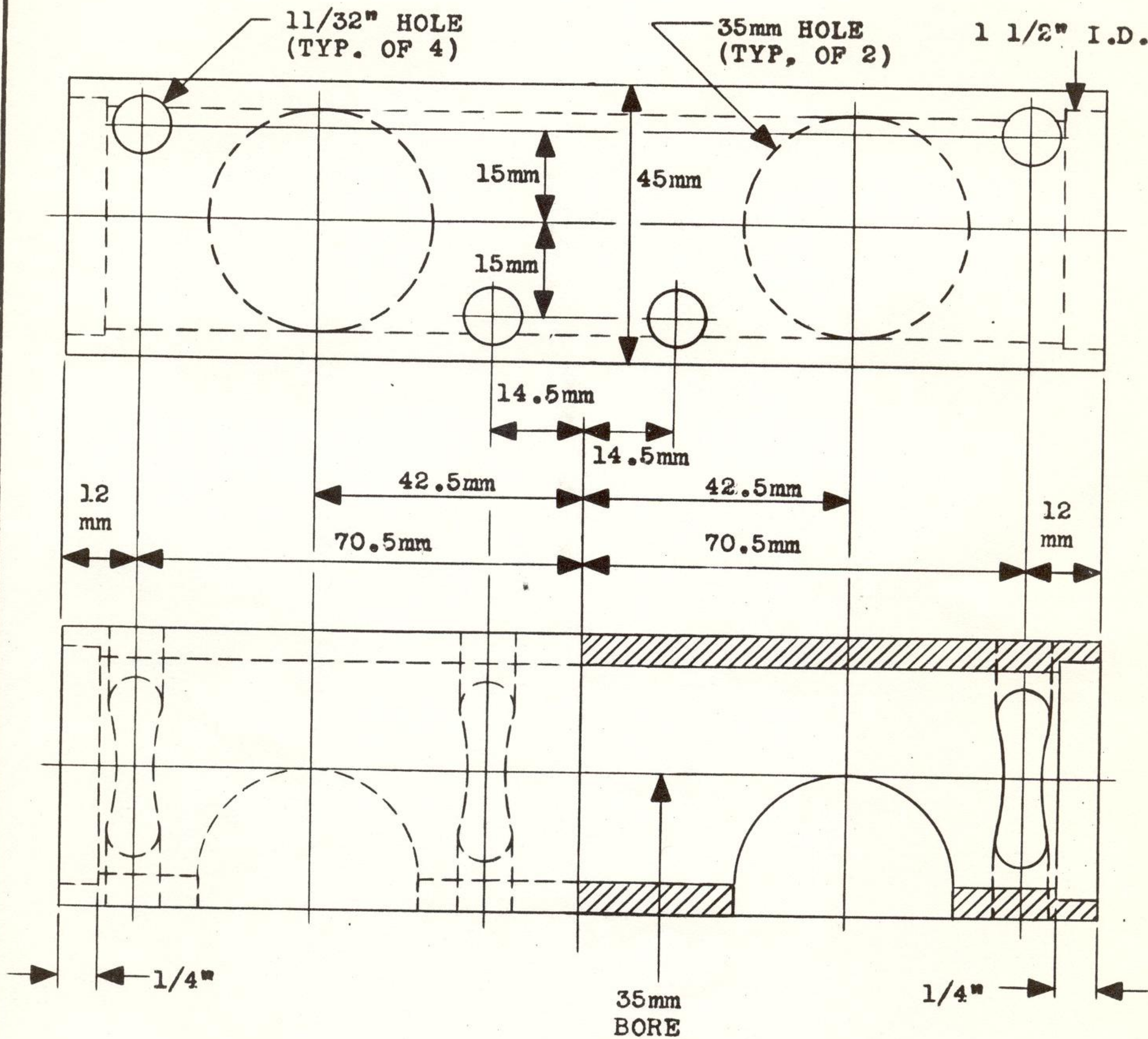
HOLES ROTATED
INTO VIEW



MATERIAL: NYLON BAR STOCK

PATENT PENDING

					IMPULSE COUPLING DRIVE				
					DRN.				
NO.	REVISION	CHKD	APPR	DATE	SCALE	FULL	No. 16		



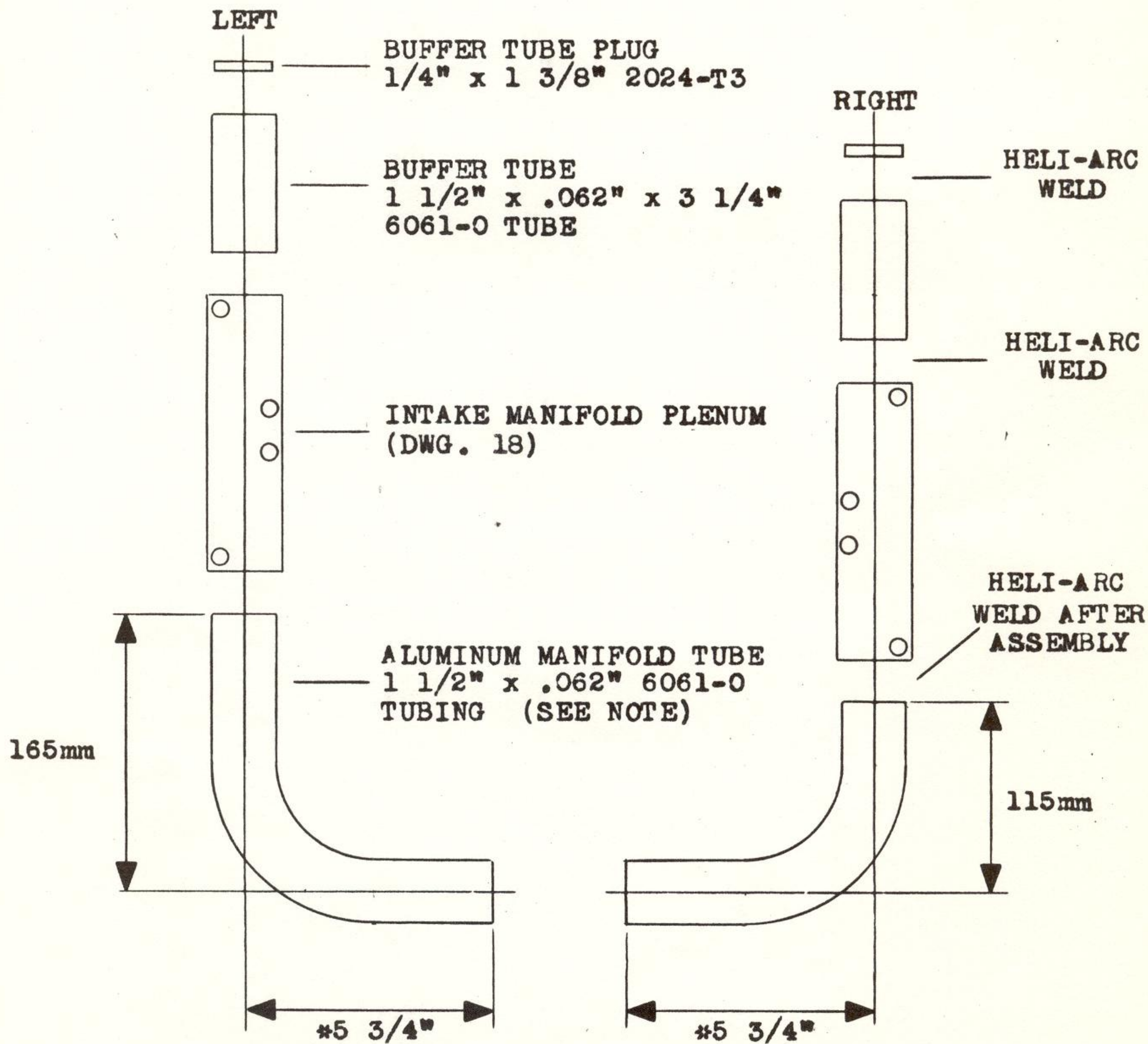
MATERIAL: 6061-T6 1 3/4" SQ. BAR STOCK

PATENT PENDING

					</					

NOTE: FILL TUBING WITH MOLTEN LEAD AND BEND ON A TUBE MACHINE USING 3" RAD. DIES. AFTER BENDING, HEAT TUBES TO 690°F TO REMOVE LEAD

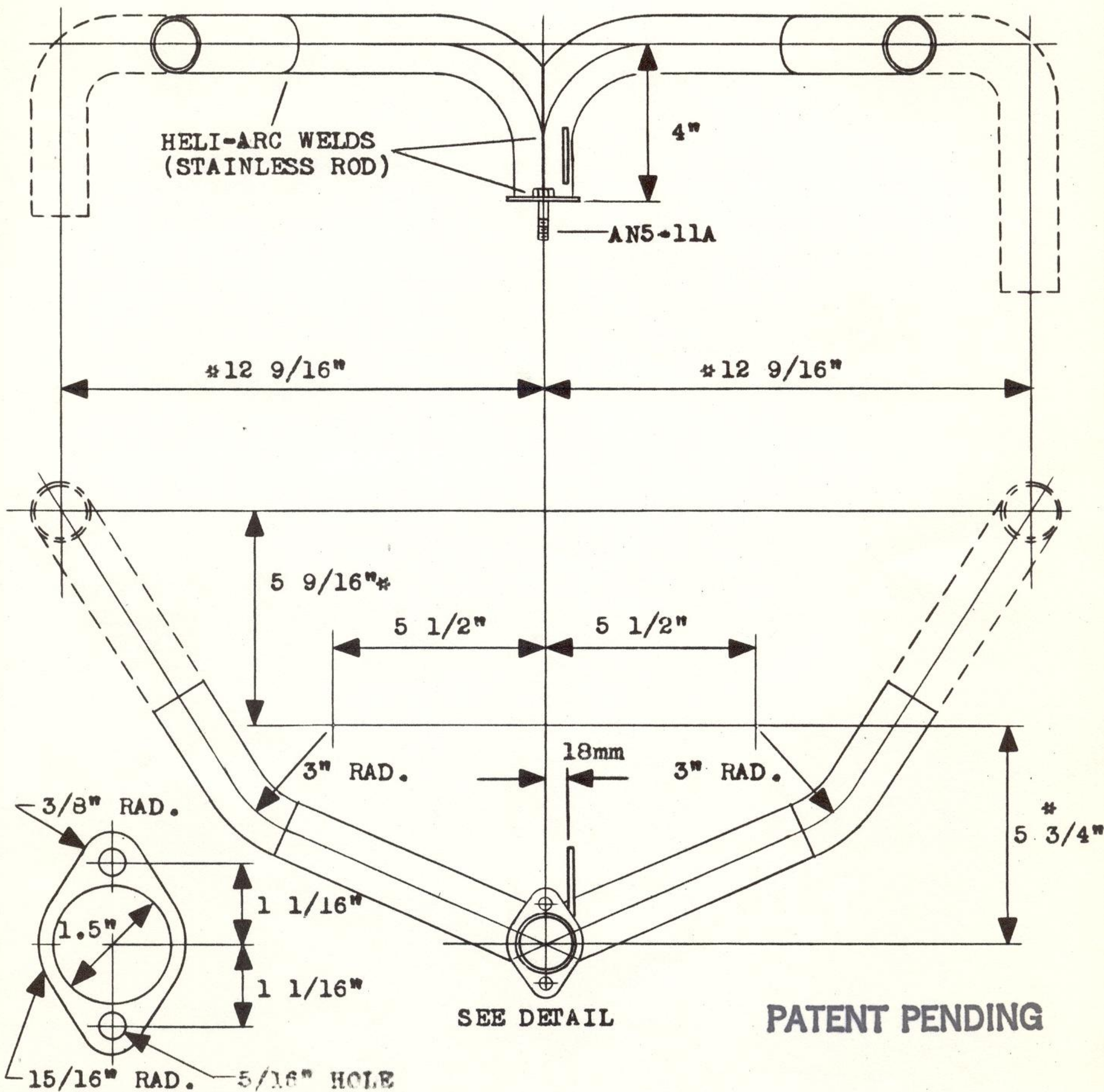
PATENT PENDING



* DENOTES APPROXIMATE DIMENSIONS (CUT LONG AND TRIM DURING ASSEMBLY)

					UPPER INTAKE MANIFOLD					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE 1/4			No. 19		

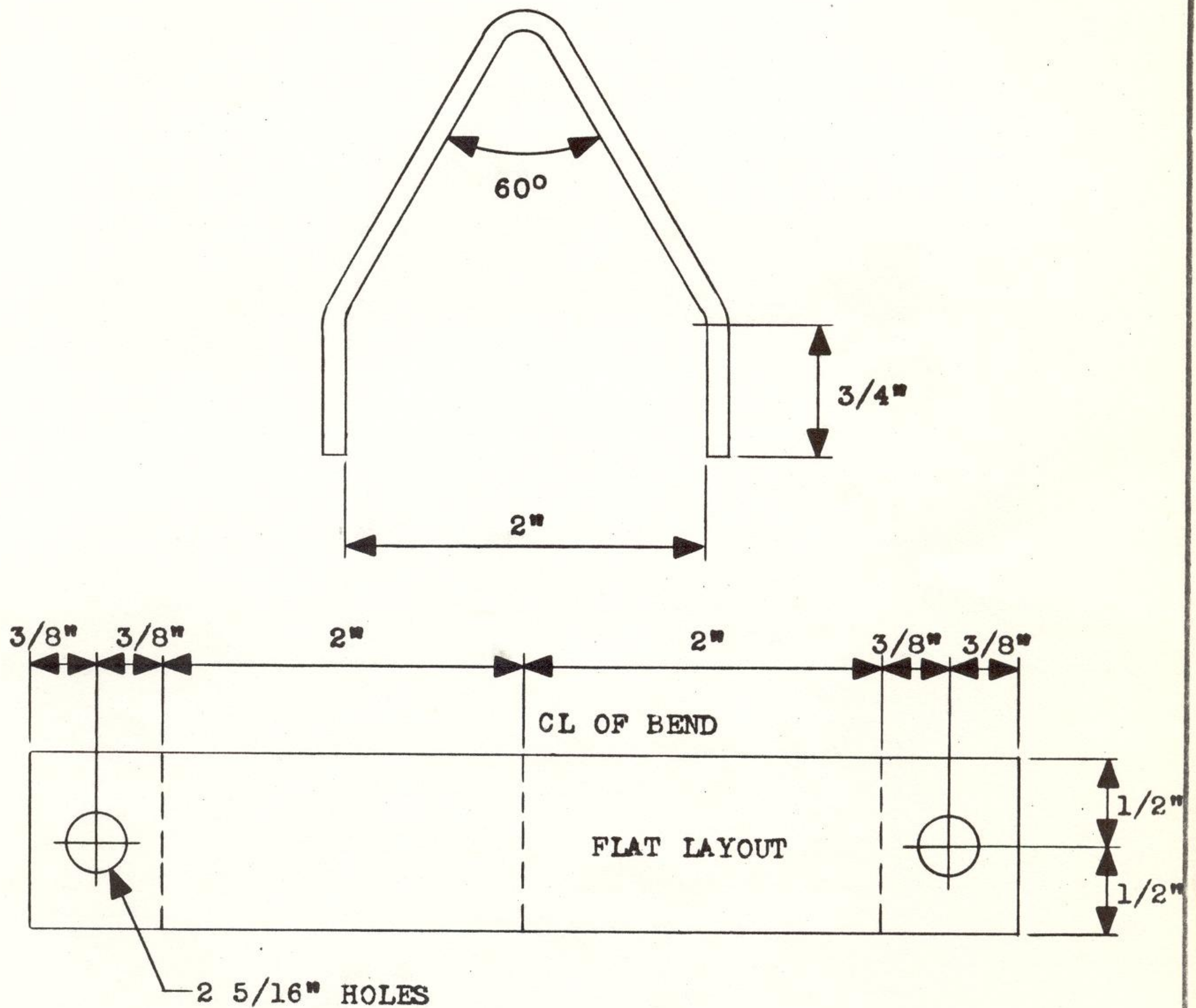
* DENOTES APPROXIMATE DIMENSIONS (VARIES FROM ENGINE TO ENGINE)



MATERIALS: 1 1/2" x .062", 3" RAD. STEEL ELBOWS AND .090" 4130 PLATE

					LOWER INTAKE MANIFOLD				
					DRN.				
NO.	REVISION	CHKD	APPR	DATE	SCALE 1/4		No. 20		

NOTE: BOLT TO TOP CENTER CASE BOLT FOR HOIST LIFTING ENGINE.

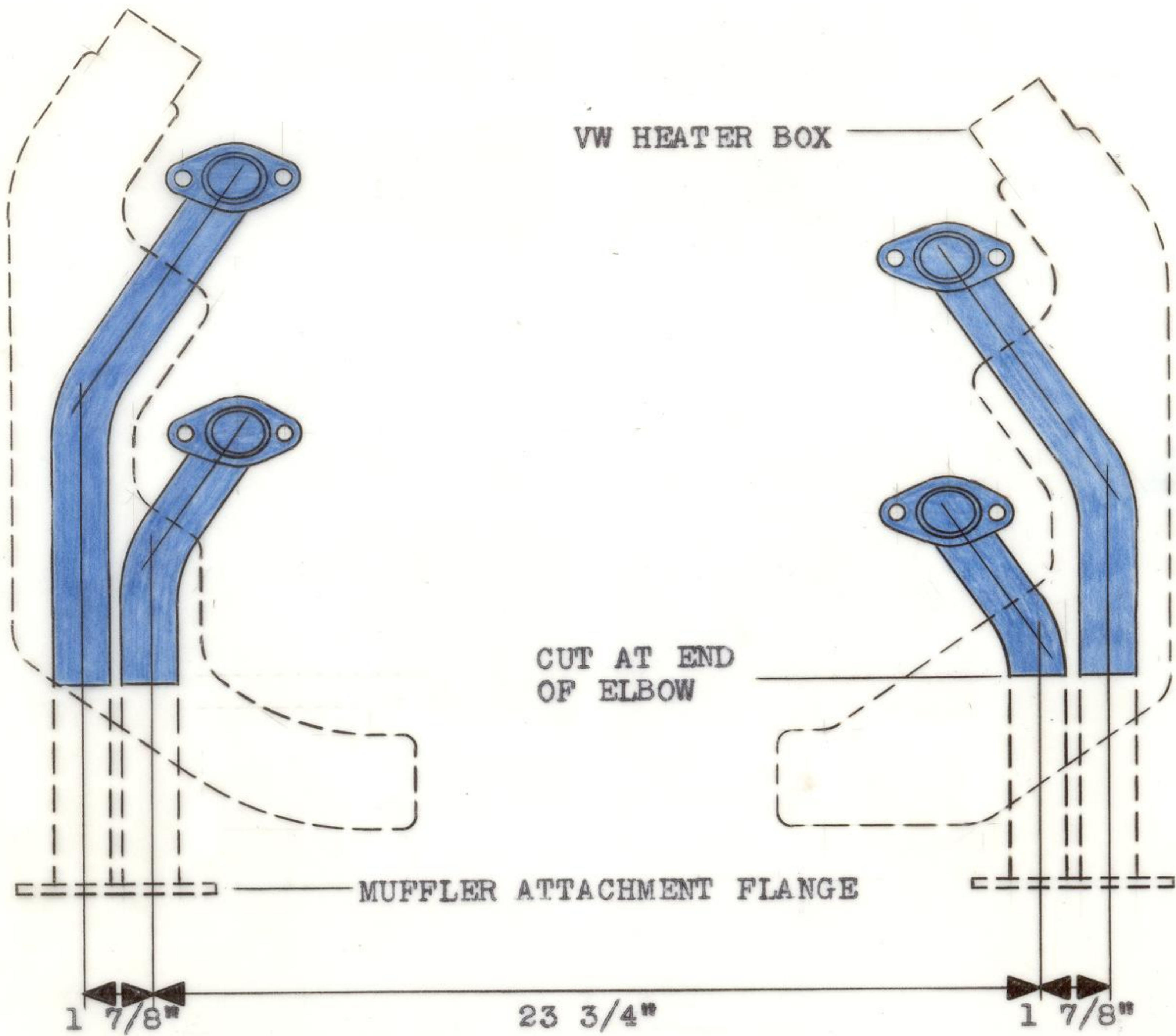


PATENT PENDING

MATERIAL: 1" x 1/8" 4130 STEEL STRAP

					ENGINE LIFTING STRAP					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE	FULL	NO. 21			

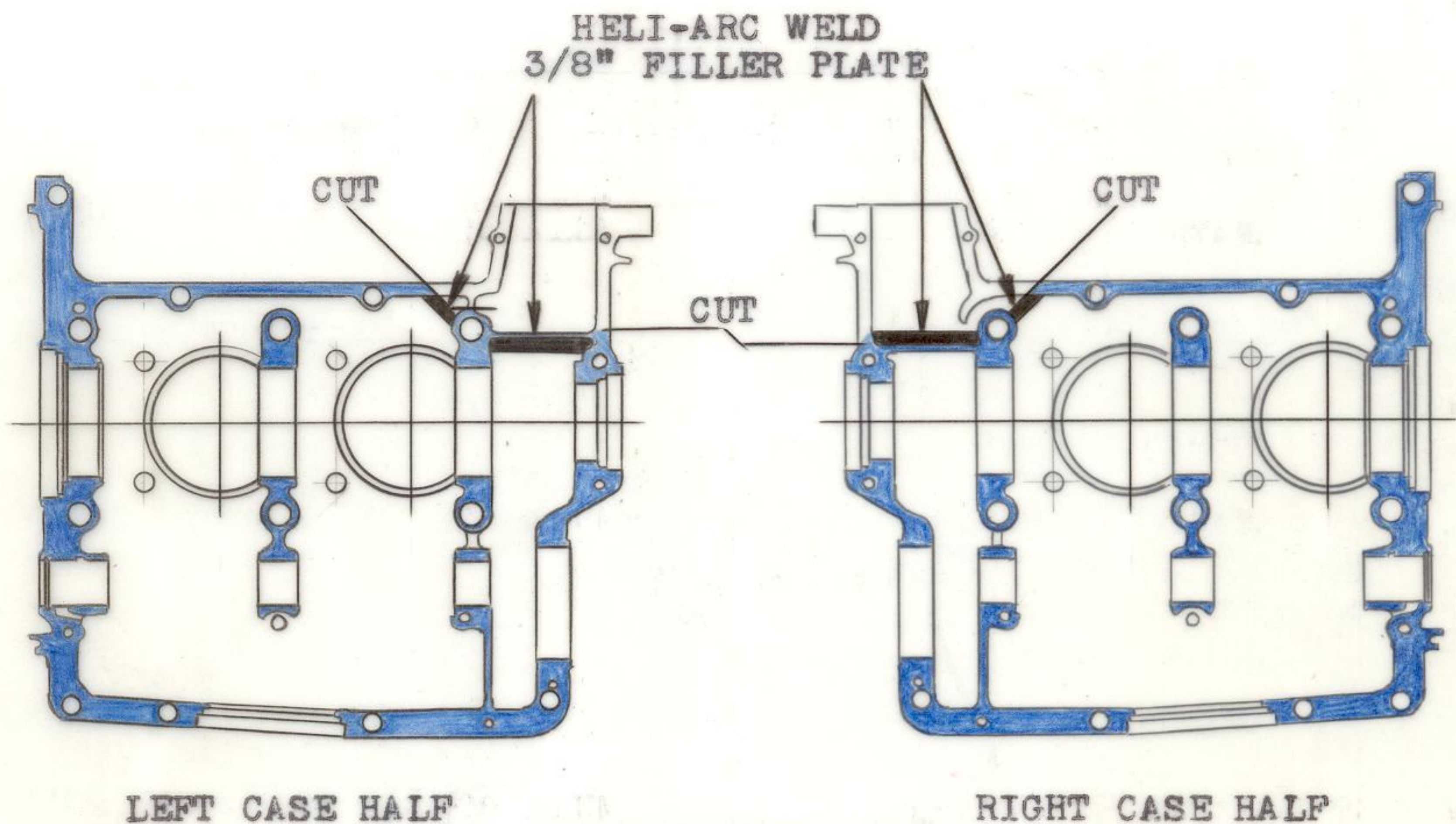
NOTE: ALL DIMENSIONS SHOWN ON THIS DWG. ARE APPROXIMATE AND ARE INTENDED TO HELP DETERMINE FIREWALL CLEARANCE USING STOCK EXHAUST.



MATERIAL: VW412 STOCK EXHAUST

					EXHAUST STACKS					
					DRN.					
					SCALE NONE No. 22					
NO.	REVISION	CHKD	APPR	DATE						

NOTE: THIS MODIFICATION IS NOT NECESSARY IF A 12" OR LARGER SPIN-ER IS USED, OR IF A "BUMP" IS MADE IN THE COWLING TO CLEAR THE BREATHER. IF THIS MODIFICATION IS USED, CRANKCASE VENTS MUST BE INSTALLED ON EACH ROCKER ARM COVER.



MATERIALS: 3/8" 6061-T6 ALUMINUM PLATE (FILLER MATERIAL)

					OPTIONAL CASE MODIFICATION					
					DRN.					
NO.	REVISION	CHKD	APPR	DATE	SCALE	NONE		No.	23	

