# Auxiliary

# Transmissions for 'T' Fords,

## A Guide to Overhaul and Installation —

### By Louis P. Baudoin

Auxiliary transmissions were developed primarily for use in the Model T truck to augment the pulling power with less wear and tear on the low band and to allow higher speeds on the highway when conditions permitted, thru use of an overdrive.

These transmissions, of sliding gear design, offered three ratios: underdrive, direct 1:1 ratio and overdrive, resulting in six forward speeds for the Model T.

Almost immediately, some enterprising folks saw the value of these transmissions installed in the passenger car, especially those who lived in hill or mountain country. The passenger car rear end ratio was 11:40 and with the transmission in overdrive, the little engine suffered. Those same folks soon discovered that the Ford Motor Company also built a 10 tooth pinion gear under part no. 2597C that gave a ratio of 10:40 or 4 to 1. Now they had a Ford that could climb anything and could handle itself respectfully at a cruise speed of 43 mph., without lugging the engine seriously and almost forget low band problems. Stopping the "beast" became a problem, but that was solved by purchasing a set of "Rocky Mountain Brakes" for the rear wheels.

Included here are data on three of the popular makes of auxiliaries with some hints on repair and installation. If you are a real "T" type and like a little challenge, try building your own as I did, shown last but not least.

The various types of troubles encountered with auxiliary transmissions may be divided into three general classifications: noises, hard gear shifting and failure of the gears to stay in mesh. In addition, oil leakage may occur.

It must be remembered also that the transmission bought under conditions of un-sight-un-seen may have been abused terribly and will require a little tender loving care to re-construct into a reliable device. It is the intent here to offer as much information as is available to ease the restoration to the utmost.

These transmissions are inherently noisy because of the large tooth, spur gear design and the fact that overdrive drives power thru the counter-shaft, a position normally occupied by 2nd gear. Over and above the whine built into the beast, determination should be made as to which shift position is the culprit, then look at the drawings furnished and diagnose which gears are involved.

Hard shifting is due to the large teeth and lack of any form of synchronizer plus the fact that the Model T clutch is a multiple-disc type that runs in oil and always has a drag from the film of oil between the discs. Another in-born problem lies in the natural tendency of the driver's left foot to press the clutch pedal a little too far, causing the low band to engage slightly which will alter the speed of rotation away from smooth mesh. Aside from those built-in problems, look for improper spring pressure on the detent ball that controls the movement of the shifter rail and lubrication of same. Check for bent shifter fork and badly chipped teeth on the edge where meshing occurs. A little dressing with a small hand-held grinder will aid here.

A transmission that will not stay in gear is most often caused by wear in the bearings that support the mainshaft or counter-shaft, allowing the shafts to get out of alignment, which in turn causes a slope-like wear on the teeth of the gears, especially so of the 1:1 ratio position where one gear slides within the internal teeth of the other. That engagement is not a great amount and any slope worn here will cause the problem. It cannot be more important that the mainshaft bearings be in good condition and support it in good alignment. The same is true for the counter-shaft and reverse idler if there is one.

Oil leakage can be caused by a cracked case and careful inspection is a must. The most common cause of leakage is the counter-shaft or reverse idler shaft by virtue of their locations, being below the oil level line. On the "Jumbo" and "Muncie", the shafts protrude thru the case with no other means of seal than the good fit of the shaft in the hole. Care in the removal of these shafts is of utmost importance. Clean off all rust and any burrs on the portion of the shaft that is outside the case and try to determine if damage to the internal section of the shaft might damage the hole in the case upon removal. Use a brass bar to place against the shaft when driving it out to keep from causing a future burr problem. On the "Warford" where the counter-shaft is supported by Timken bearings, and the adjustment is accomplished by thin steel shims with no gasket paper or goo, some seepage of oil is to be expected, especially if STP is involved as it is so "creepy".

Servicing these transmissions requires few special tools. The brass bar or brass hammer and a pair of snap-ring spreader pliers along with a little common sense will go a long way toward sucess. Cleanliness is next to Godliness when working on a transmission, though you wonder when you start dis-assembly.

All transmission parts should be washed in cleaning solvent and thoroughly inspected. Bearings should be handled carefully to avoid damaging them. Do not spin them with compressed air, it can ruin them. Wash them clean; rotate them slowly and check for any roughness or excessive looseness. With Timken cones, after cleaning, hold them up to a light in such a way that will enable you to see the inner race; rotate and look for pitting. Inspect the cup for pitting and replace where necessary.

Inspect the counter-shaft for wear and straightness. Any sign of either is basis for replacement. Because these shafts are heat-treated or case-hardened, it is necessary to replace with a shaft that is so treated. If you will take your shaft to a shop that repairs truck transmissions, chances are very good that you will find a satisfactory replacement. If you find one that is a little too long, it can be cut to length with a cutting blade similar to one used for cutting cement or bricks and can be done on a table saw if you are careful and clamp it securely to the cross-cut fence and proceed with patience. Clean out all sawdust first as the sparks will set it on fire! O-Boy.

There are thrust washers to set the end-play of the cluster gear on the counter shaft. These are heat treated for long life and any replacement made must be of similar material. The counter-shaft cluster should have no less than .003" end play and no greater than .020". Check the case at the area where the thrust washers bear. If the new thrust washer will not have a good flat surface to bear against, correct it.

With the shaft and bearings in the cluster free of any oil, the shaft would have a radial clearance of .0005 to .0015" when it was new; that is if it has Hyatt or needle bearings. If it is found that new bearings will not bring the assembly into a reasonable state of radial clearance, it may be necessary to make an over-size counter-shaft and carefully ream the case to accept it. The bearings will normally accept this small change of diameter and still perform acceptably.

When adjusting the cluster on a "Warford", Timken bearings are involved. These bearings in this application must not be pre-loaded, that is they must have a running clearance of .0005" to .001" to give room for lubrication. The correct method of adjusting is to count the shims and place 1/2 of them at each end to basically center the cluster. With a film of light oil on the bearings, place enough shims in the assembly to have the shaft loose. Remove a shim from alternate ends, re-tightening the assembly each time until the shaft shows a resistance to rotation. Strike each cap with a rawhide mallet to seat the cups of the bearings. If the resistance to rotation is there, add one thin shim and the assembly should be free to rotate and the job should be correct. Apply a good squirt of 90 Wt. oil to protect them and proceed with assembly. Do not use any paper or gasket goo on the shims of the cluster gear. They must seat cleanly, metal to metal.

It is not intended to stir arguments from those who have fixed ideas about lubricants for these antique gear boxes. There are several good lubricants or combination of same that will do a good job. The early lubricants that were recommended when these these autos and gear boxes were first designed were the very best available, but face facts, realize that advancements have been made in lubricating oils and greases and it will extend the service of the vehicle to utilize these advancements, One that has proven to be good for rear ends and Transmissions is a mixture of 85% quality brand 90 Wt and 15% film strength additive. Do not use a film strength additive in the Model T engine.

# MODEL T DRIVE SHAFT SHORTENING

First, decide the condition of the drive shaft. It is a shame to shorten a perfectly good stock drive shaft when there are so many shafts available not fit for stock use, but by cutting either end or both, a good shaft can be produced from an otherwise useless one.

Dimensions of each end and the actual length of a stock T drive shaft are given in the figures. To determine the amount to be shortened, measure the transmission from the aft end where the universal ball cap will fasten to the forward end where it will bolt to the engine.

The Warford with fwd U-joint is 16"
The Warford without fwd U-joint is 12"
The Muncie without fwd U-joint is 13 1/4"
The Jumbo Giant for Fords without fwd U-joint is 9 1/2"
The above are the amounts to be removed from the drive shaft for each installation.

When cutting the drive shaft tube, scribe a straight line on top of the tube from front to back on the section of the tube that is of constant diameter, that is, not in the tapered section. Use the scribed line to correctly align the tube when the weld is made later.

After the shaft has been machined to size and the drive shaft tube cut, but not yet welded, assemble the drive shaft, bearing housing, bearings and pinion gear and bolt that to the rear axle housing. Assemble the cut front section of the drive shaft tube. Temporarily put the U-joint and rivet in place. The cut in the tube must be positioned so there is no slack in the thrust of the drive shaft fore and aft. If it is necessary to grind a little bit more off the end of the tube to get a good fit, do so, keeping in mind that this is a good opportunity to correct for previous wear in the thrust bearing by positioning anew. Set it up with no fore-aft slack as the weld will shrink the tube to about the correct end play. Tack weld at about 4 places around the tube and check for straightness. when straight, add a short length of weld at each tack, moving to the opposite tack each time to aid in keeping the thing reasonably straight. Grind the weld smooth and check for straight; use a straight-edge. If some straightening is in order, heat the high side, a spot about the size of a quarter and immediately quench with water. A couple or three of these will shrink the high place to a degree, but it helps to have been reasonably careful with placing the welds so as to have kept warp to a minimum.

The rear radius rods should be shortened after the tube and drive line are completed. It is best to cut and weld them near the forward end where the factory weld was made. In fact, this is a good opportunity to make use of an old set where the threads have seen better days by welding on a new Grade 5 machine screw, 9/16-18. Alittle imagination with a torch can shape the old rods to look very professional at the forward end. See the figures for further aid.

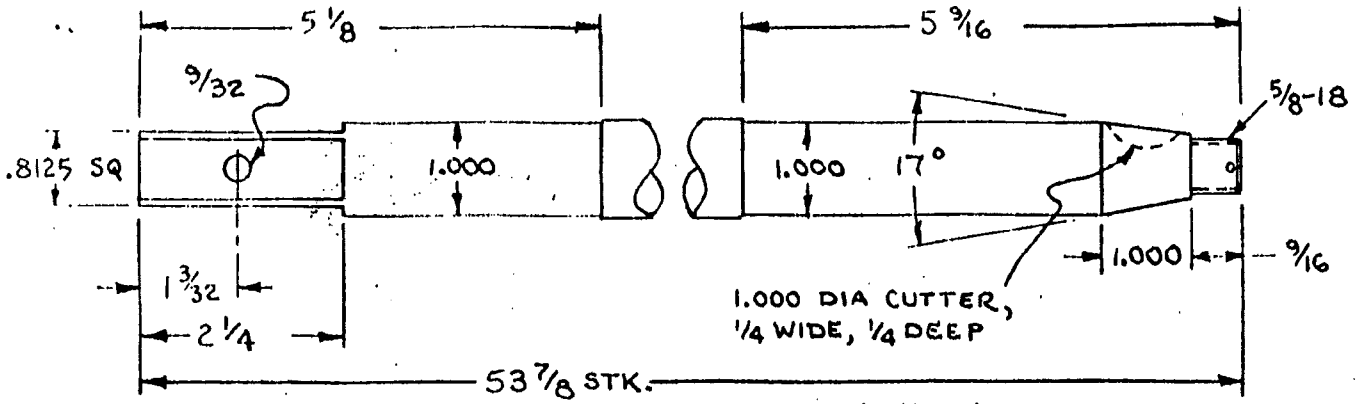



FIGURE 1

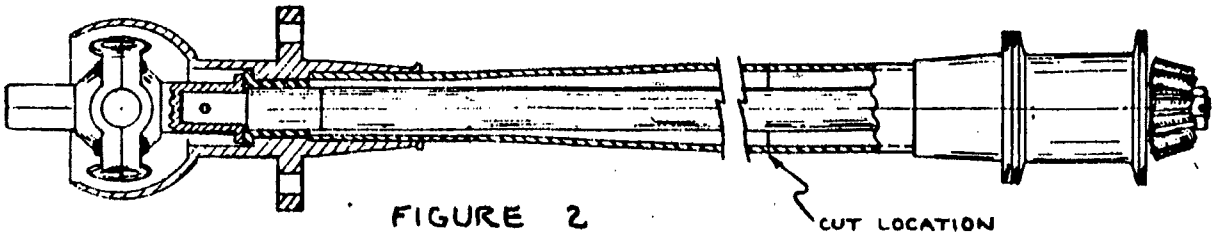
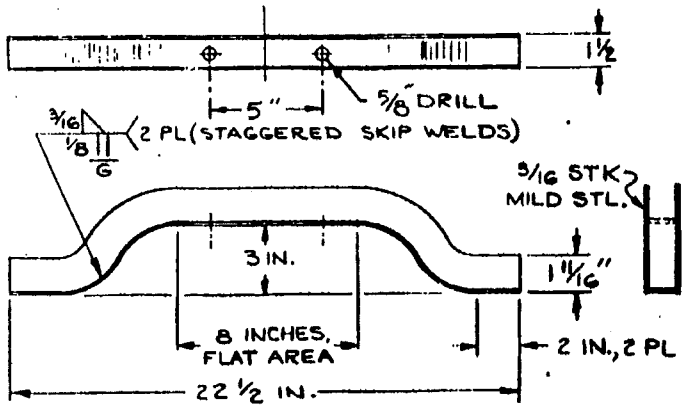
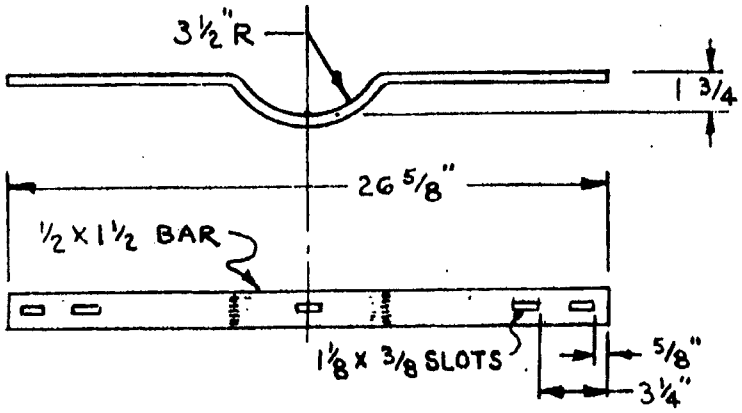



FIGURE 2




WARFORD CROSSMEMBER
FIGURE 3




MUNCIE CROSSMEMBER
FIGURE 4

2597 B

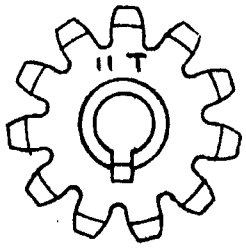



FIGURE 5

2597C

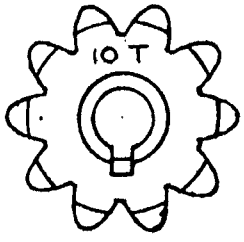



FIGURE 6

The MUNCIE Gear shift Transmission
for Ford Trucks and Cars

Manufactured by the Muncie Gear Works, Muncie, Indiana

1. Main drive input shaft and gear. 19 Teeth.
2. Input shaft bearing. New Departure #3208
3. Main shaft pilot bearing. Bronze bushing.
4. 2nd and 3rd gear, 16 T.(2nd is 1:1 ratio, 3rd is 1:1.397 overdrive)
5. Main drive output shaft, 1 1/2", 6 spline.
6. 1st and reverse gear. (1st is 1.792:1 underdrive, reverse the same.
7. Output shaft bearing, New Departure # 1306.
8. Square drive adapter
9. Countershaft, 7/8" O.D., 6 1/2-7" long.
10. Countershaft Cluster gear, 17 T, 20 T, and 12 T.
11. Countershaft Cluster gear bronze bushings.
12. Reverse gear, 18 T and 18 T.
13. Reverse gear bronze bushings.
14. Reverse gear shaft, 7/8" O.D.

All gear teeth are 20 degree stub,(6/8) 6 diametral pitch.

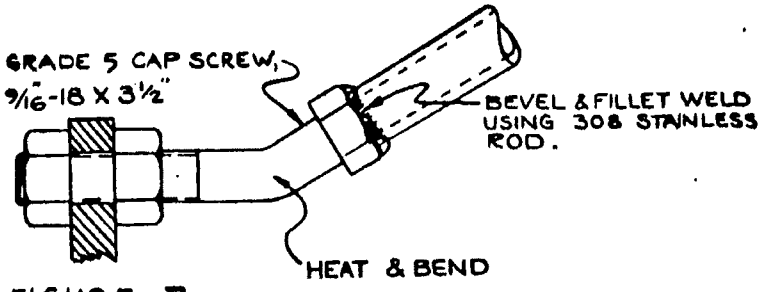


FIGURE 7

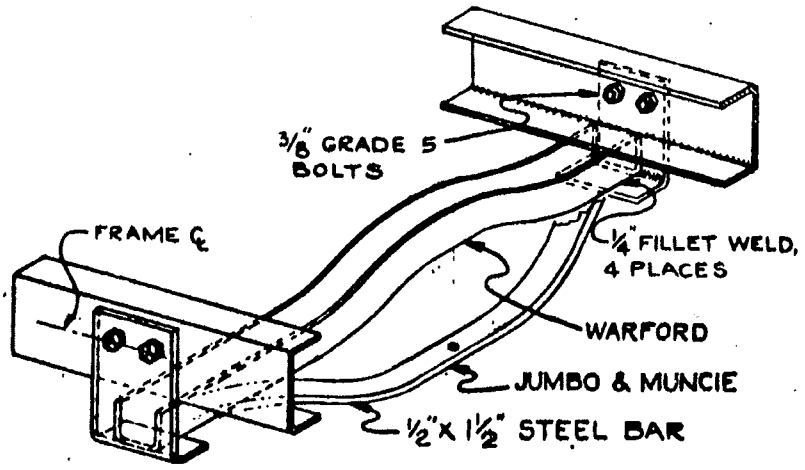


FIGURE 9

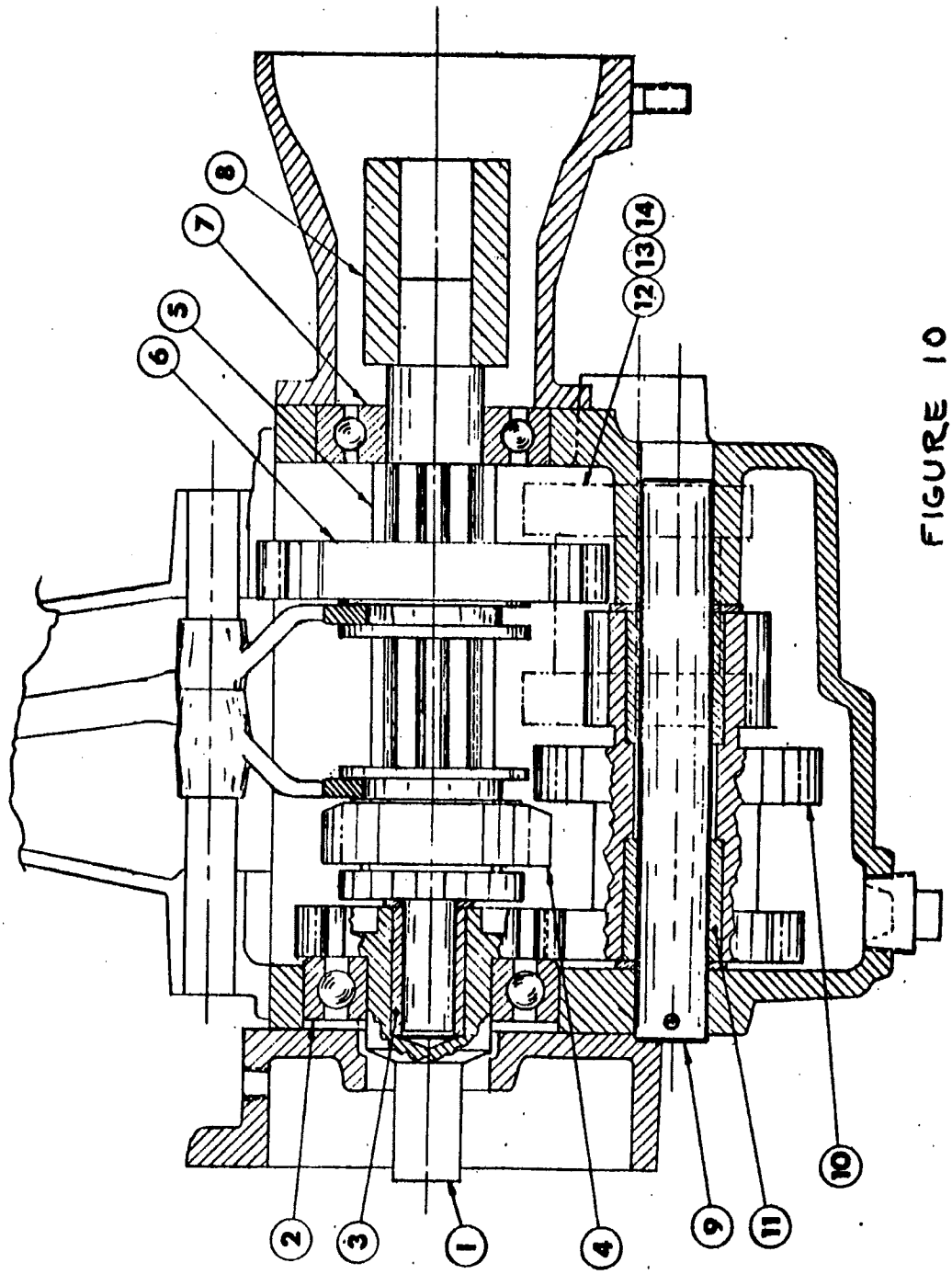



FIGURE 10

MUNCIE

JUMBO GIANT for FORDS Transmission - Mechanics Machine Co., Rockford, Illinois

1. Main drive input shaft and gear, 19 T
2. Main shaft
3. Bearing retainer washer, 2 3/8 I.D.,3 1/2 O.D.,1/8 thk.
4. Snap ring
5. Screw, 7/16-24
6. Belleville washer, 7/16 I.D.,7/8 O.D.
7. Input shaft bearing race, Hyatt OR210
8. Input shaft bearing, Hyatt 7147. New Hyatt number is RA99210.
9. Input shaft linear adjustment washer. (hardened)
10. Main shaft pilot bearing, Hyatt 95416
11. Main shaft pilot bearing spacer
12. 2nd & 3rd gear. 16 T. (2nd is 1:1 ratio, 3rd is 1:1.357)
13. 1st & reverse gear, 25 T. (1st gear is 1.66:1 ratio, underdrive)
14. 2nd & 3rd shifter
15. 1st & reverse shifter
16. Detent ball & spring
17. Shifter bar
18. Main shaft oil-control slinger washer
19. Main shaft aft bearing, New Departure 20208
20. Aft bearing snap ring
21. Countershaft, 7/8 O.D., 8.1/4 long. (hardened)
22. Countershaft cluster gear, 21 T, 24 T, 15 T, & 12 T.
23. Countershaft Bearing,Hyatt 1/4" roller, 7/8 I.D., 1 3/8 O.D. See below.
24. Cotter-pin, 1/4 X 1 3/4.
25. Reverse gear, 18 T.
26. Reverse gear shaft, 7/8 O.D.
27. Reverse gear shaft retainer screw

All gear teeth are 20 degree stub,(6/8) 6 diametral pitch.

Dana Corp., Chelsea Div. offers a gear # 43-P-96 P.T.O. Adapter gear that is a replacement for the reverse gear as far as number of teeth and pitch is concerned; slight work on bore and positioning washers is required.

Reverse gear takes a beating when a Power Take-Off is used as it must drive the P.T.O.

Hyatt no longer lists the 1 3/4"long bearing shown as item 23, but they do list the same I.D. & O.D. in bearing No. 94412 which is 3/4 long. By using 6 of these with appropriate spacer washers between them to maintain proper location, a perfectly satisafactory substitution will be accomplished.

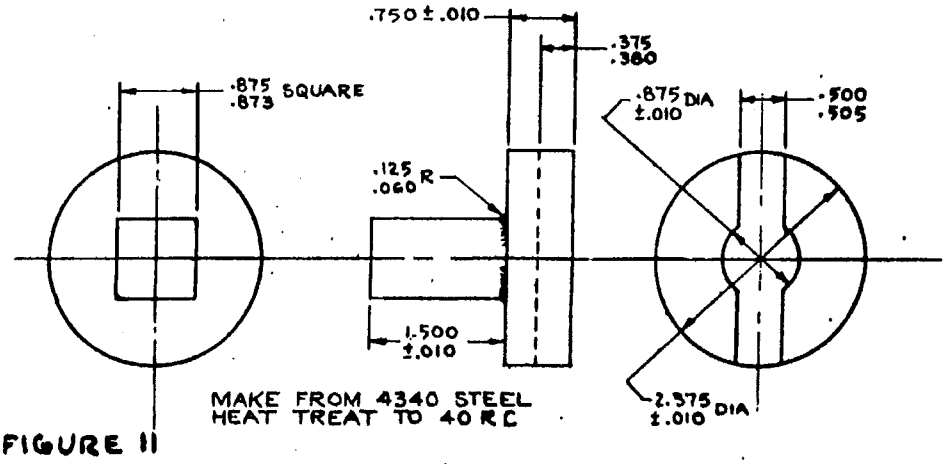



FIGURE 11

ADAPTER FOR "JUMBO GIANT"

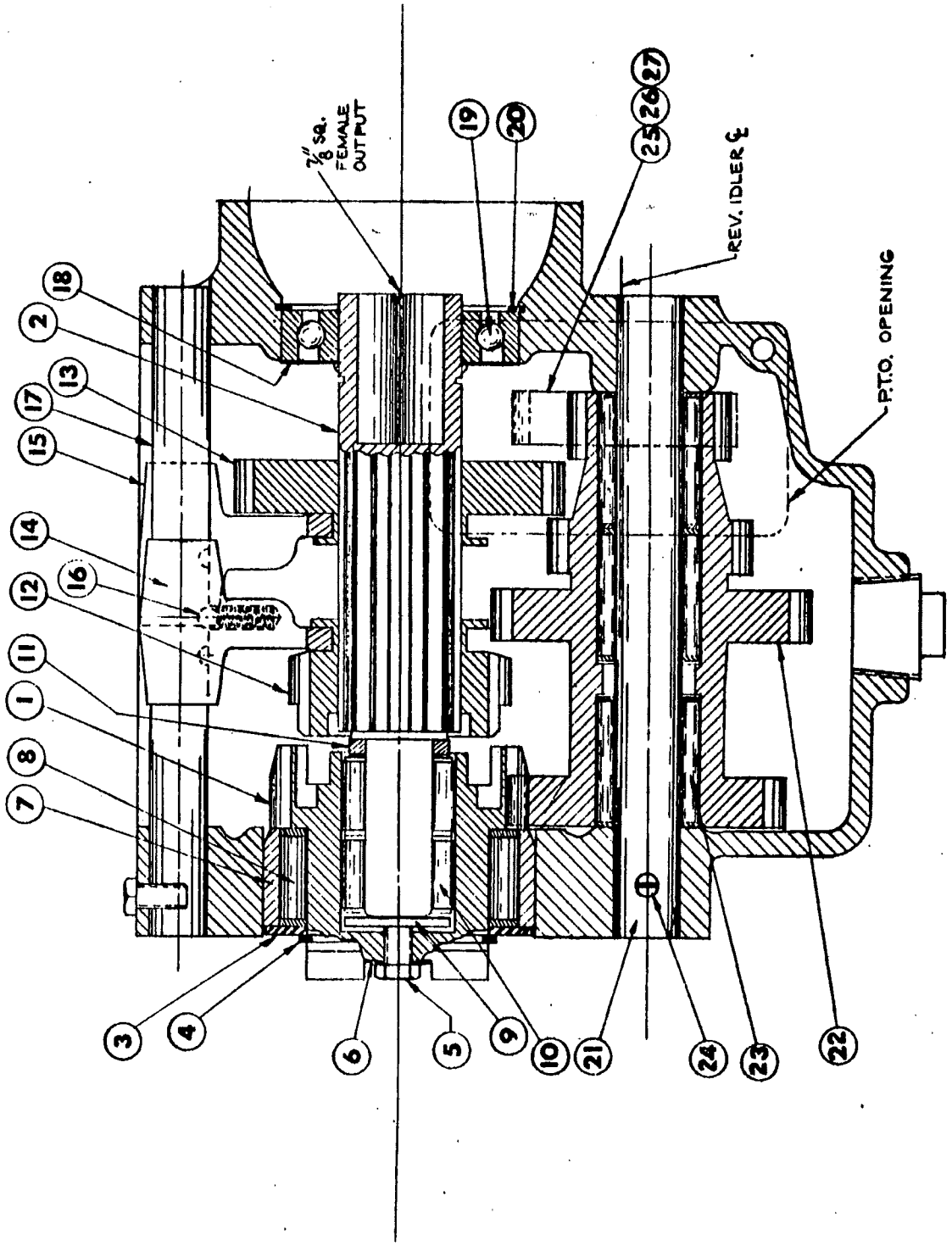



FIGURE 12

MECHANICS JUMBO GIANT

## WARFORD TRANSMISSION

Manufactured by WARFORD Corporation, New York, N.Y.

1. Main drive input shaft and gear. 18 Teeth.
2. Lock nut.
3. Lock washer, bend over type.
4. Input shaft bearing adjusting nut.
5. Input shaft fwd bearing cone. Timken # F19138.
6. Input shaft fwd bearing cup, Timken # 19268.
7. Input shaft aft bearing cone. Timken # F2789M
8. Input shaft aft bearing cup. One of these: Timken #2735X - 2.875" O.D. / Timken #2736 - 2.9375" O.D. / Timken #2729 - 3.000" O.D.
9. Pilot bearing. Timken # R20072M
10. 1st and 2nd gear, 25 T. 1st is 1.37:1 ratio, 2nd is 1:1 ratio.
11. Main drive output shaft.
12. 3rd gear, 15 T. 3rd is 1:1.363 overdrive.
13. Main drive output shaft aft bearing cone. Timken # F285M.
14. Main drive output shaft aft bearing cup. Timken # 283M.
15. Countershaft gear cluster, 22 T, 15 T, and 25 T.
16. Countershaft bearing cones, front and rear, Timken # 07098.
17. Countershaft bearing cups, front and rear, Timken # 07204.
18. Aft bearing adjusting nut and retainer screw.

All gear teeth are 20 degree stub, (6/8) 6 diametral pitch.

The Warford Transmission is mounted thru use of a bell housing on the forward end which accepts a stock "T" universal joint as the coupling to transmit power between engine and transmission. It has been mounted without the bell housing, bolting directly to the aft of the engine without a u-joint, but the latter method is not as common nor does it allow the flexibility of frame twist etc. The aft end of the transmission is supported with a "U" channel as shown in Fig. 3. The Channel has a hole drilled in its forward flange, allowing the shifter bar to shift into low gear. Its' shape with the 3" drop locates its ends below the passenger car frame flange, whereas it sits on the flange of the truck frame due to the deeper channel of the truck. Do not drill the flange as it will propagate a crack in flexure. Do necessary drilling in the web of the channel as shown in Fig. .

The centerline of the mainshaft of the transmission should be in line with the centerline of the engine crankshaft, both up and down and right and left. Position the crossmember to meet this requirement or undue vibration will occur. The exhaust pipe will fit above the crossmember with a little shaping, but nothing serious. The forward running board brace must be modified to allow the installation in the passenger car. The section between the frame members must be cut and removed or the shape altered to clear the transmission should you desire to maintain the support that it gives.

Fig.13 shows the crossmember in section with the required hole for the shifter bar. Fig. 3 describes the crossmember design for aid in fabrication. Mark and drill the shifter clearance hole from your transmission.

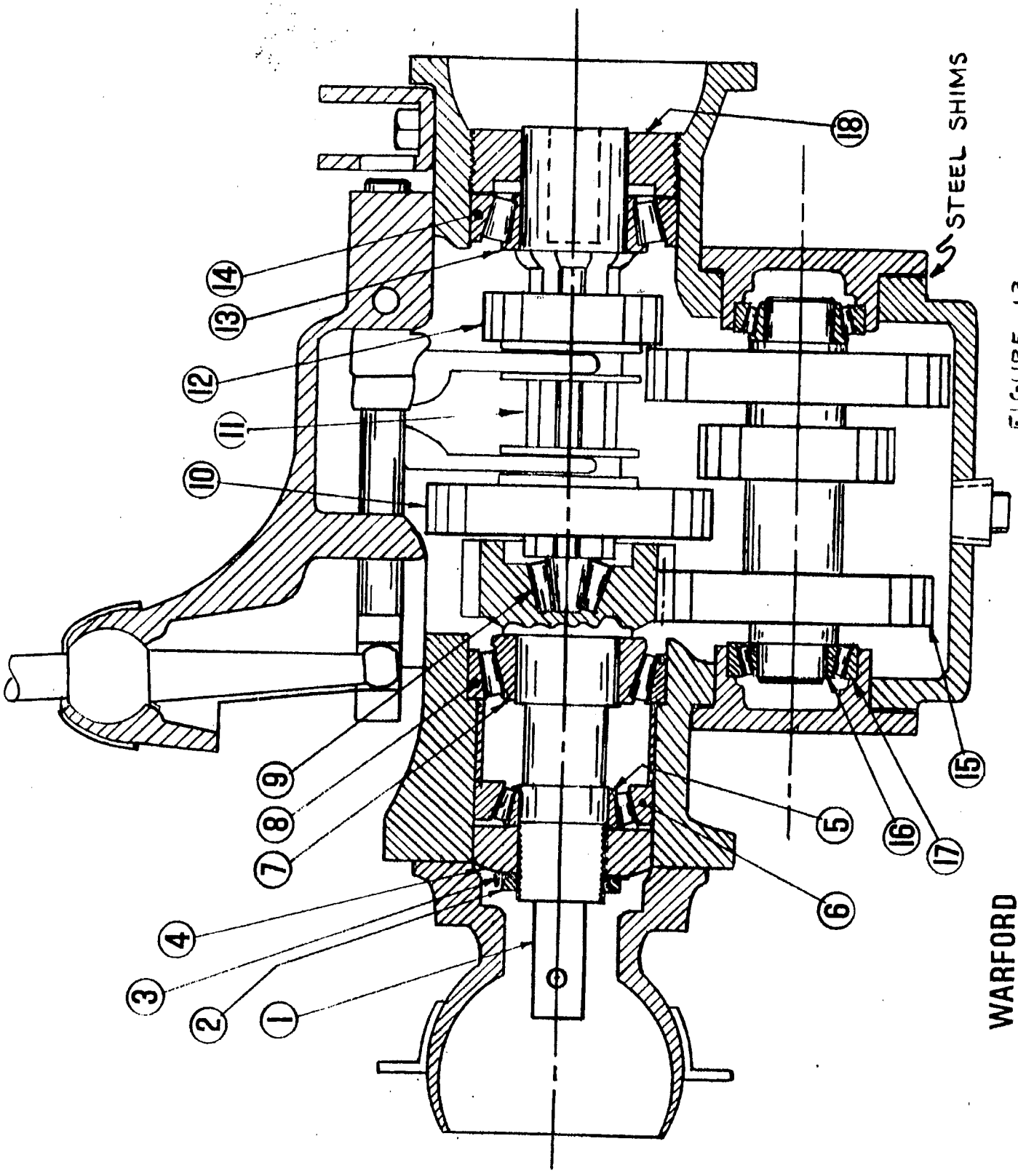



FIGURE 13

WARFORD

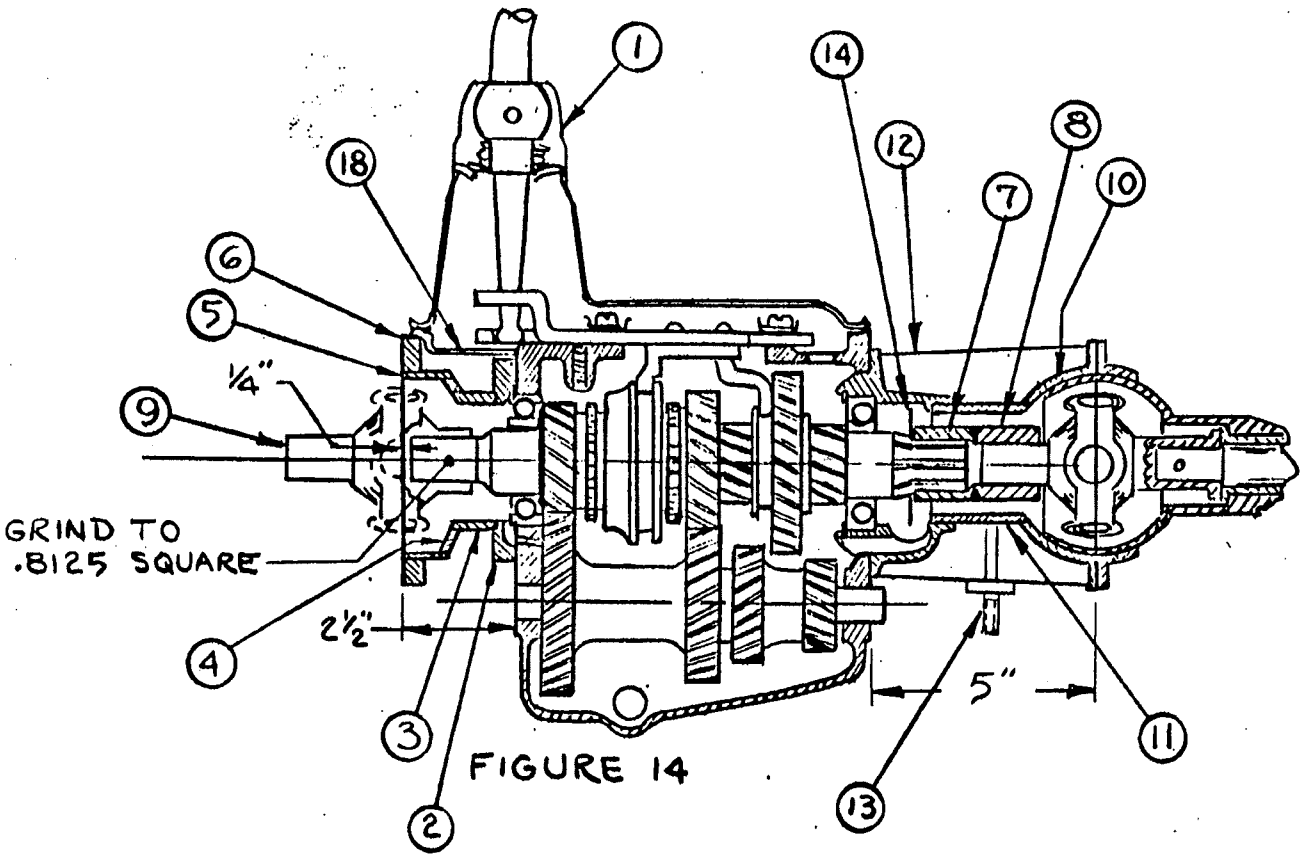



FIGURE 14

USING 3:1 REAR END RATIO, MAKES IDEAL SETUP FOR TOURING.

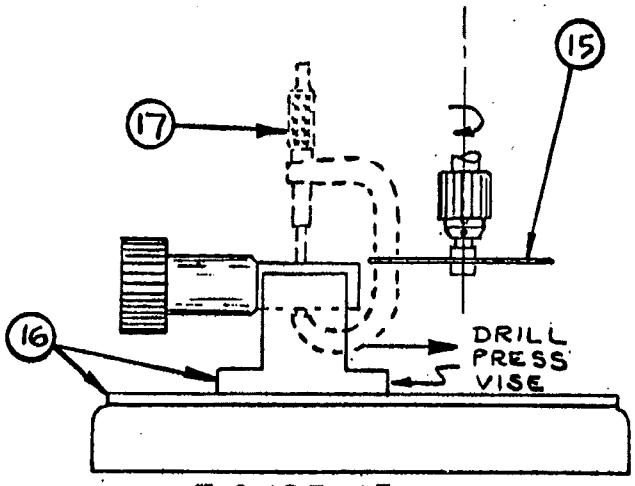



FIGURE 15

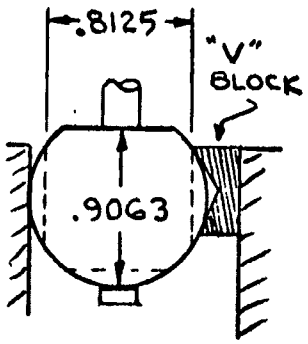



FIGURE 16

## HOME-BUILT AUXILIARY TRANSMISSION for A "T"

1. Restorable 3 speed stick shift transmission shown is a '35 to '38 Dodge, Plymouth or DeSoto. Most any about this size is O.K.

2. 4.75" dia X 3/8" Steel plate machined identical to original casting mating surface.

3. 1" long piece of 2 1/2" black pipe.

4. Cone shaped from 3/16" plate.

5. 3/4" long piece of 3 1/2" black pipe.

6. 3/8" steel plate, cut to pattern of the "T" universal ball cap #3369.

7. Splined portion, Approx 1 3/8" long of yoke or flange that came with transmission

8. Square hole part, approx 1 3/8" long from "T" driving plate, #3321.

9. "T" U-joint #2571, cut to about 1" engagement on female end.

10. One old "T" universal ball cap, #3369, cut to fit pipe section.

11. Appropriate length, approx 2" on this transmission, of black pipe to fit the grease seal O.D. when it is removed.

12. 1/4" plate gussets, 4 each. Make paper pattern; cut from plate; arrange top-bottom- both sides. Note that the original aft bearing-brake support is used but cut off the arms that supported the brake and remove the speedometer gear; plug hole.

13. Weld a 3/8 or 7/16" grade 5 cap screw here; gusset head. Crossmember, similar to Fig. 9, Muncie will do fine.

14. .020 to .060" thick steel plate washer as oil slinger; you make.

15. A 6" or 7" dia X 1/8" or so Cement Cutting Blade made for skill saws

16. Drill press and a good drill press vise.

17. Micrometer, hereafter called a "mike".

18. The Dodge transmission will require a piece of sheet metal shaped to make a closure here to keep dirt out.

FRONT END OF TRANSMISSION MODIFICATION:

A. Remove the casting that contained the front bearing and supported the throw-out bearing. Duplicate its mating face in item 2. Grind or file the trough for oil return. If your transmission has only 3 screws holding the casting, drill and tap for 3 more.

B. Prepare item 3 for welding to item 2; center it true and weld it.

C. Center the cone, item 4, and weld it to item 3. This assembly must allow free rotation of the shortened U-joint, so check as you proceed.

D. True up and weld on item 5. Check again for U-joint clearance and its fore-aft position. Its centerline of the swivels should align with front face of item 6. The hole pattern that mates the "T" engine must be oriented to position the transmission vertical. Weld item 6 onto item 5. True up the front face to be parallel with item 2.

E. Before removing the forward main shaft from the transmission, mark it for cutting 2 1/4" forward of the front face of the transmission case. Be careful of the pilot needle bearings in the mainshaft when dis-assembling.

F. Cut the mainshaft by wheel or torch; don't over-heat it.

G. Set up as in Fig. 15 if you want to do it yourself. Care and arithmetic will aid.

H. Determine the diameter of the shaft where the square is to be ground. Let's say it miked 1.000". The square is to be .8125" across the flats. The difference is .1875", half of which must be removed from each location. Placing the mike as in Fig. 16, you grind the face until the reading of .9063" is found over the entire length of the flat.

I. The grinding operation is as follows: Set and lock the up-down of the drill press for a light cut. Move the vise toward the grinding disc as the arrow shows in fig. 15 to the depth of 1 3/8". Alight cut will show if your piece is truly parallel to the blade by the cut getting wider or narrower and of course the mike will show a difference.

Get that first cut right or all will be wrong. Feed slowly; wear leather gloves and use face protection. Move blade down for next cut, make a start cut and check with mike.

J. When you have reached the right dimension, rotate the shaft 1/4 turn so the flat is against a vise jaw and grind another flat, using .9063". Rotate another quarter and use .8125", then one more quarter at .8125" and you are thru.

If the shaft is large on your transmission so that the square comes out with sharp corners, grind the corners so they look like the stock "T" U-joint square.

Remember that the figures above apply only if the original was 1.000" diameter.

REAR END OF TRANSMISSION MODIFICATION:

A. Because transmissions vary somewhat from make to make, use the detail in Fig. 14 as a guide. The 5" length is not sacred, but is close to most.

B. Cut off rear mainshaft for approx 1 1/4" engagement of spline, see Page 3.

C. True up and machine a groove for welding item 7 to item 8. Use 308 Stainless arc rod. Clamp end to end very firmly, complete weld and let cool before removing clamp. The spline and square must be on same centerline.

D. Machine item 11 for a light press fit into the bore that held the grease seal and for a centered fit onto cut-off item 10.

E. Weld item 11 to the aft bearing support casting using 308 Stainless rod.

F. Weld item 10 to item 11 and the gussets, item 12.

G. Use your ingenuity and secure item 13 with some gusseting to get a good attachment as the crossmember is needed to help the rear engine hangers.