

TWO SPEED FORWARD AND REVERSE TRANSMISSION



WARNER GEAR DIVISION

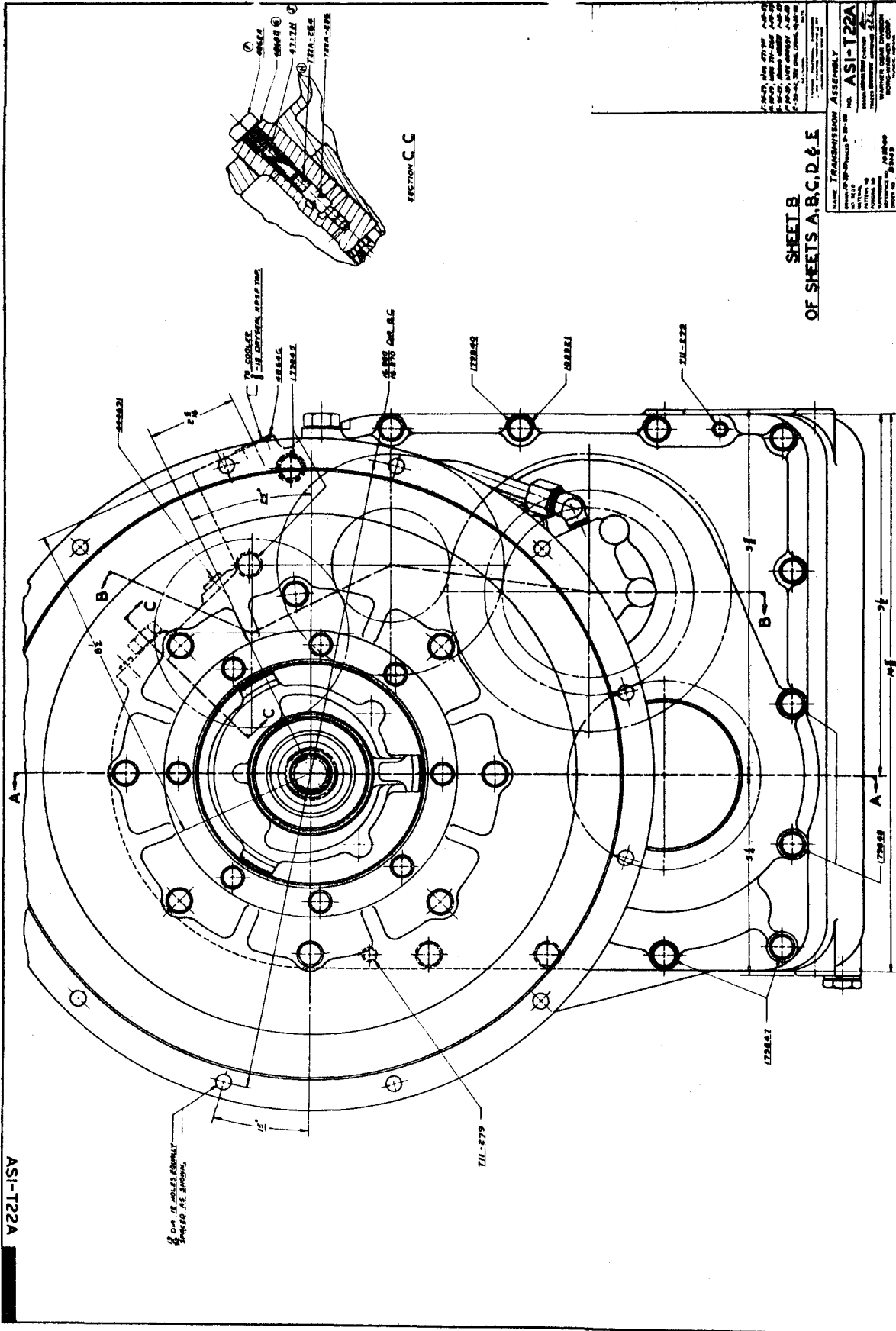
BORG-WARNER CORPORATION

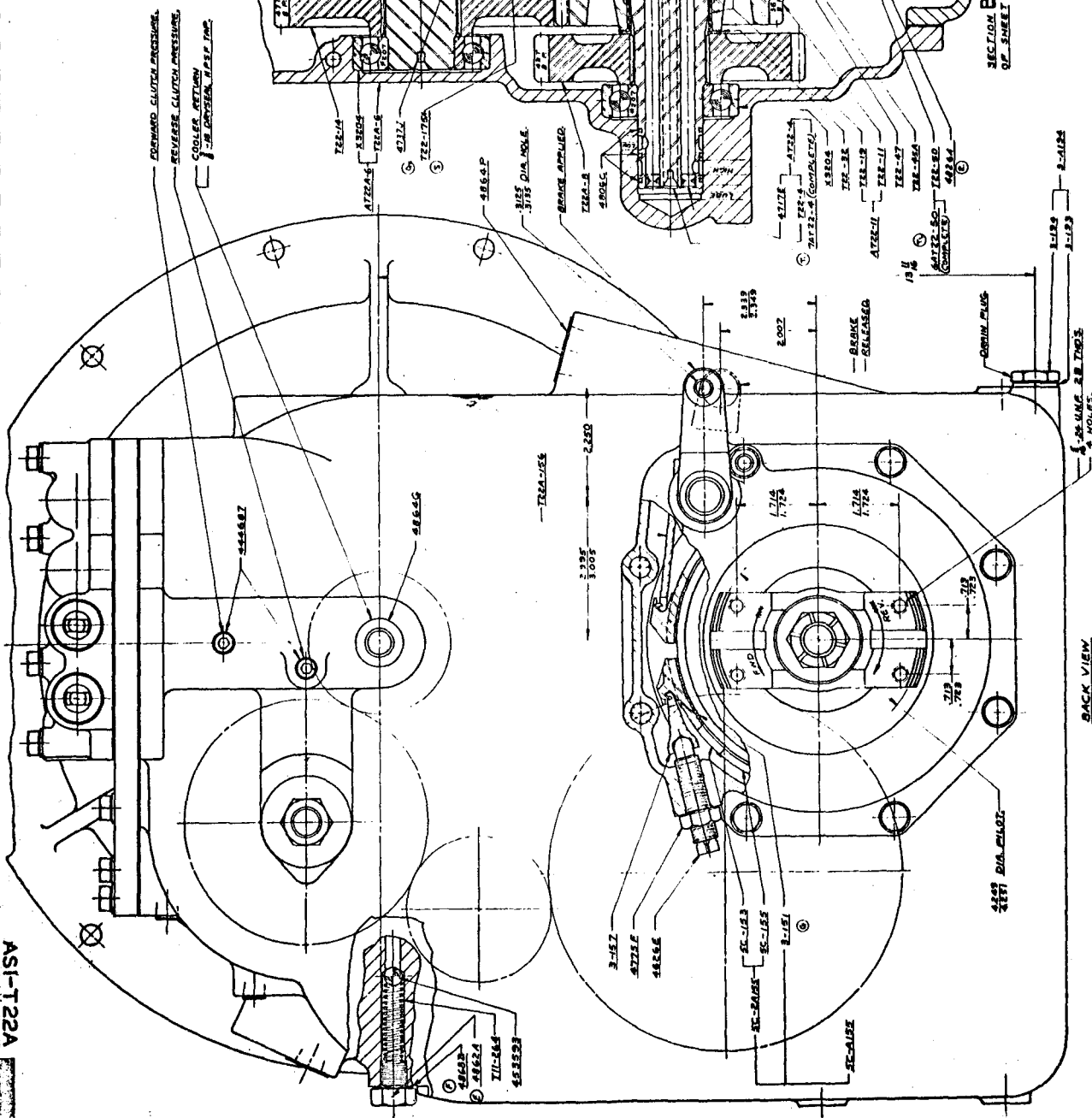
MUNCIE, INDIANA

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ASI-T22A

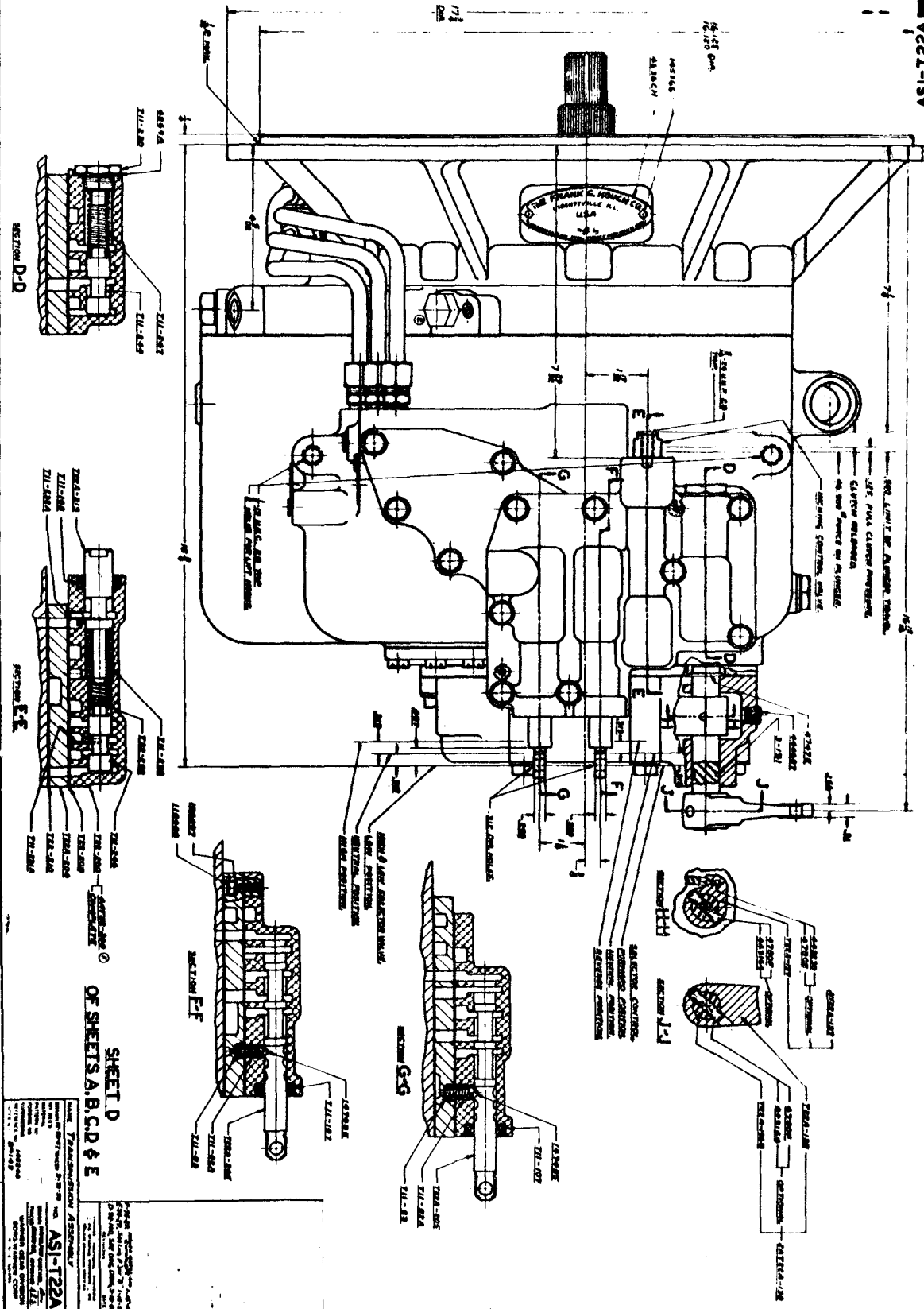






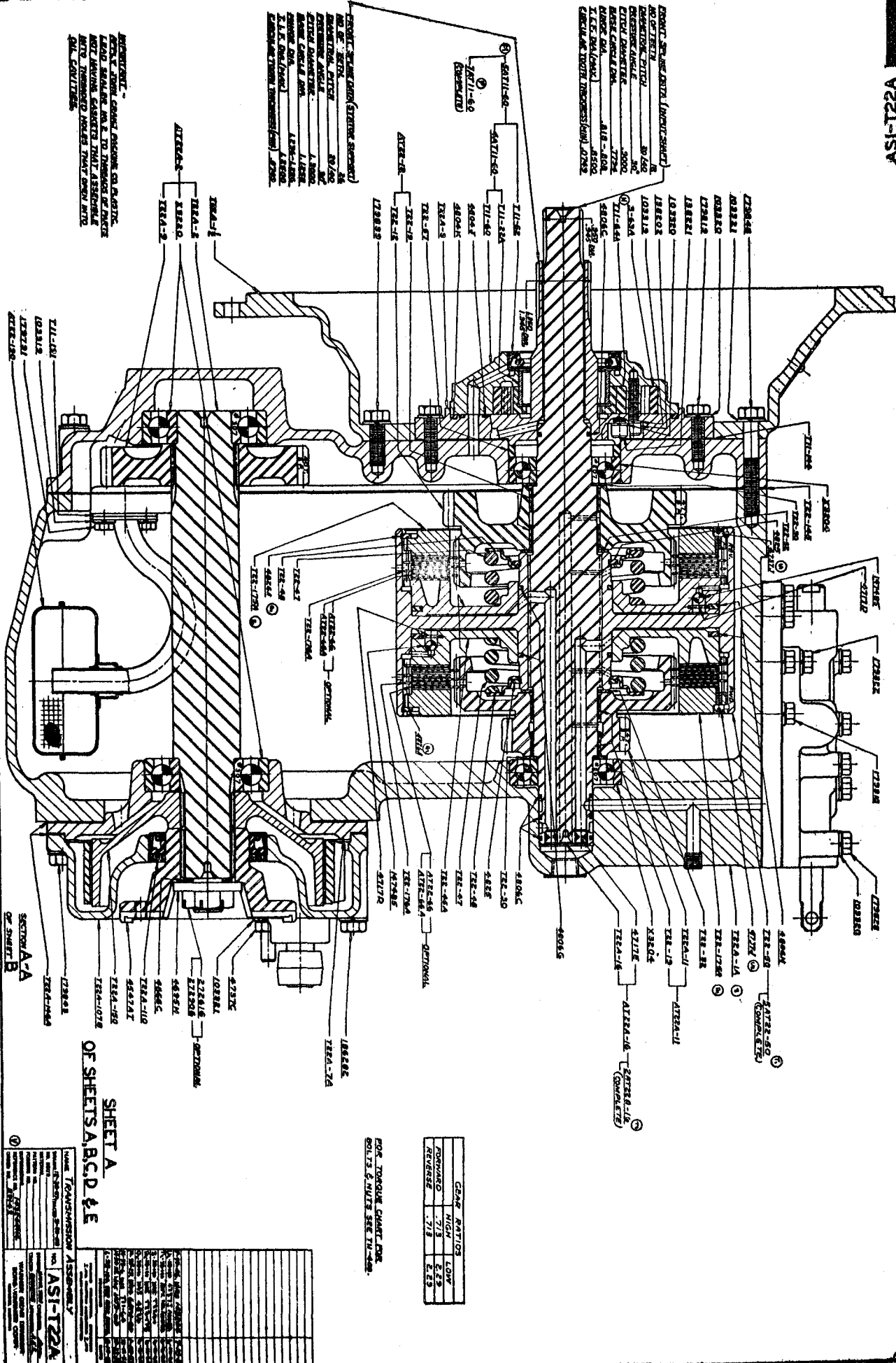
OF SHEETS A.B.C.D.E

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SHEET D
OF SHEETS A, B, C, D & E

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<p>DATE: 10/1/80 BY: J. L. HARRIS CHECKED: J. L. HARRIS APPROVED: J. L. HARRIS</p>	<p>DATE: 10/1/80 BY: J. L. HARRIS CHECKED: J. L. HARRIS APPROVED: J. L. HARRIS</p>



GEAR RATIOS	
	HIGH LOW
FORWARD	.713 2.29
REVERSE	.713 2.29

FOR TORQUE CHART FOR BOLTS & NUTS SEE TN-400

SHEET A
OF SHEETS A, B, C, D & E

NAME TRAVERSATION ASSAULT	
DATE 12-25-79 TIME 2-3-80	
NO. 1	ASI-T22A
MANUFACTURED BY: <i>ASI</i> MODEL: <i>ASI</i> SERIAL: <i>100</i> PART NO.: <i>100</i> DATE: <i>12-25-79</i> TIME: <i>2-3-80</i> LOCATION: <i>100</i> OPERATOR: <i>100</i> TESTER: <i>100</i> TEST NO.: <i>100</i>	
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TWO SPEED FORWARD AND REVERSE TRANSMISSION

ASSEMBLY PRECAUTIONS

1. When reassembling clutch shaft into clutch assembly, make sure that the oil feed passages in the shaft and clutch assembly are indexed properly.
2. The use of rags for a final wipe of parts before reassembly can lead to lint coated parts and the eventual plugging of the intake screen. After a final wash before reassembly, air dry parts or assemble parts wet.
3. Proper attention should be given to torque tightness of all bolts. Use chart below to determine this tightness specification according to the size bolts involved.

<u>Part No.</u>	<u>Size</u>	<u>Torque Tightness - Ft. Lbs.</u>
9409012	5/16-18 X 1	18-23
179840	3/8-16 X 1 1/8	20-25
179847	3/8-16 X 2	20-25
179845	3/8-16 X 1 3/4	20-25
179848	3/8-16 X 2 1/4	20-25
179819	5/16-18 X 1 1/8	10-15
179839	3/8-16 X 1	20-25
179843	3/8-16 X 1 1/2	20-25
186282	3/8-16 X 3 1/4	20-25
179828	5/16-18 X 2 1/2	15-20
179818	5/16-18 X 1	10-15

TWO SPEED FORWARD AND REVERSE TRANSMISSION

(Suggested Disassembly Procedure Continued)

17. Disassembly of High and Low Clutch Assembly:

Note: In the assembly, the high clutch has three (3) clutch friction plates and the low clutch has four (4) friction plates.

High Clutch: Remove outer snap ring retainer screw, outer snap ring, clutch retainer plate and clutch separator plates and the four (4) clutch friction plates.

Low Clutch: Turn assembly over and remove outer snap ring retainer screw, outer snap ring, clutch retainer plate and clutch separator plate and four (4) clutch friction plates.

18. Disassembly of Forward and Reverse Clutch Assembly:

Note: In this assembly both the forward and reverse clutches have three (3) clutch friction plates.

Disassembly procedure is the same as for the high and low clutch assembly except that both clutch retainer plates are the same.

19. Disassembly of Cylinder and Pistons Assembly:

Note: This assembly is the same in both the high and low clutch assembly and the forward and reverse clutch assembly. Place cylinder assembly in arbor press. Place a horseshoe collar of proper size on spring retainer, compress clutch retractor spring and remove snap ring. Release pressure on spring, remove assembly from arbor press and remove clutch spring retainer, clutch retractor spring and clutch piston. Unhook at ring opening the small piston ring and remove from clutch cylinder. Unhook at ring opening the large piston ring and remove from clutch piston. Repeat this procedure to remove the other three (3) clutch pistons.

20. Disassembly of Clutch Centrifugal Release Valve:

Removal of the large piston ring from the outside diameter of clutch piston allows the retaining pin to move out radially and free the ball for removal purposes.

TWO SPEED FORWARD AND REVERSE TRANSMISSION

(Suggested Disassembly Procedure Continued)

10. Removal of Countershaft and 24 Tooth Gear:

Remove countershaft and 24 tooth gear on rear of countershaft.

11. Place Transmission Case on Side Locating Dip Stick and Filler Tube on What is Now the Top Side of the Transmission Case.

12. Removal of Idler Gear:

Remove the large external nut on the retainer bolt holding the stub shaft for the idler gear. Also remove the retainer plate against which the large external nut seats and lightly tap out the retainer bolt, being careful to leave the idler gear and stub shaft in position. Start the stub shaft and idler gear out of the case, grasp the two thrust washers together, and pull the stub shaft, idler gear, thrust washers, and 28 needle rollers as a unit from the main case. This latter operation is important to avoid dropping the loose needle rollers. It may be necessary to lightly tap the rear end of the stub shaft in order to remove it and its locating Woodruff key from the bore and keyslot of the main case.

If desired, remove countershaft ball bearing from transmission case using a suitable puller.

13. Removal of Hand Brake Housing and Band Assembly:

Remove 3/4 - 16 hex lock nut, plain washer, cork washer and yoke from output shaft.

Remove eight (8) hex head cap screws holding hand brake housing and band assembly to transmission case and remove brake housing and band. Remove brake drum from output shaft. Remove one outer gasket, bearing retainer and inner gasket.

14. Removal of Output Shaft and Rear Bearing:

Using plastic hammer, tap rear end of output shaft, moving shaft and bearing forward and out of bearing retainer.

15. Removal of Output Shaft Rear Bearing Retainer:

Remove outer gasket, bearing retainer and inner gasket.

16. Removal of Oil Screen Assembly:

Remove two (2) hex head cap screws and remove oil screen assembly and oil screen assembly gasket.

TWO SPEED FORWARD AND REVERSE TRANSMISSION

(Suggested Disassembly Procedure Continued)

(Removal of Transmission Case Cover Continued)

C. With special care in keeping transmission cover level, remove cover from the transmission case, leaving the complete gear train in the transmission case.

D. Remove transmission case cover gasket.

6. Removal of Output Shaft Front Bearing:

Using suitable puller, remove ball bearing from front end of output shaft.

7. Removal of Gears:

Lift gears from front end of:

- A. Output Shaft (40 tooth)
- B. High-Low Clutch Pack (43 tooth)
- C. Countershaft (47 tooth)

8. Removal of Forward and Reverse Clutch Assembly and Input Shaft:

Remove forward and reverse clutch assembly and input shaft as follows:

- A. Remove ball bearing on front of input shaft.
- B. Lift off first thrust washer, 47 tooth gear and second thrust washer.
- C. Lift forward and reverse clutch assembly from input shaft.
- D. Pull input shaft out of rear bearing leaving 24 tooth gear, two thrust washers and rear ball bearing in case.
- E. Lift 24 tooth gear and two adjacent thrust washers from case.

9. Removal of High and Low Clutch Assembly:

- A. Lift front bronze thrust washer, 36 tooth gear and rear bronze thrust washer.
- B. Lift out the high-low clutch pack.
- C. Lift out the high-low shaft.
- D. Lift out the remaining 59 tooth gear and its two adjacent thrust washers.

TWO SPEED FORWARD AND REVERSE TRANSMISSION

Suggested Disassembly Procedure

With the transmission assembly removed from the vehicle and placed on its back on a clean, suitable working surface, proceed with the disassembly as follows:

1. Removal of Valve Block Assembly:

Remove twelve (12) hex head cap screws holding valve block and valve block plate to transmission case. Lift valve block, valve block gasket, valve block plate and valve block plate gasket off of transmission case.

2. Removal of Converter Housing:

Remove eight (8) hex head cap screws holding converter housing to transmission case and lift off converter housing.

3. Removal of Front Collector Ring and Pump Assembly:

Remove eight (8) hex head cap screws holding front collector ring to transmission case and pull off front collector ring and pump assembly. Remove gasket and bearing spacer.

4. Removal of Front Pump Body and Gears from Front Collector Ring:

- A. Remove one (1) flat head 10 - 24 screw and four (4) hex socket head 5/16 - 18 screws and separate collector ring and pump body.
- B. Remove the large seal ring from between pump and front collector.
- C. Before removing pump gears from pump body, mark gears for proper mating during reassembly.

5. Removal of Transmission Case Cover:

- A. Disconnect and remove lubrication feed tube, high clutch feed tube and low clutch feed tube, using a flare nut wrench of the proper size.
- B. Remove the thirteen (13) hex head cap screws holding transmission case cover to the transmission case.

PREVENTIVE MAINTENANCE CONT.

6. PRESSURE CHECKS: (1) Maximum rated pressures should be checked at proper points with oil at 180-200°F and high idle engine r.p.m.
7. STALL CHECK: (1) Oil temperature 180-200°F at beginning of check.
(2) Run engine at high idle to determine if it will operate at governed speed.
(3) Apply parking brake and service brakes.
(4) Shift transmission to forward and high range.
(5) Open throttle to wide open position.
(6) Read engine tachometer and check to see if reading corresponds to vehicle manufacturer's recommendation.
(7) Do not exceed 250°F oil temperature during stall check.
8. LINKAGE ADJUSTMENT: (1) Check periodically to determine if selector valves are operating in full detented positions.
(2) Check parking brake linkage to determine if parking brake lever travel is within proper "throw." Adjust takeup on parking brake by tightening adjusting screw completely (with lever in "off" position) and then backing off adjustment screw 1.5 turns.
9. EXTERNAL LINES: All external lines should be checked periodically for loose or damaged fittings and damaged or collapsed hose or tubing.

PREVENTIVE MAINTENANCE

1. OIL: Use Automotive Transmission Fluid Type A. This oil is recommended for 4 main reasons:
 - (a) Lack of foam tendency
 - (b) Relatively stable viscosity index with temperature change.
 - (c) Lack of tendency to "varnish out" at high temperatures
 - (d) Detergent quality for lasting over extended changes which also prevents gum deposits during periods of shutdown.
2. FILL CAPACITY: Approximately 11 quarts should fill the entire system allowing for small variations in piping arrangements.
3. CHANGE PERIODS:
 - (1) Oil change every 1000 hours of operation.
 - (2) Clean screen at overhaul periods (3000-5000 hours depending on usage) always clean screen after any failure occurs.
 - (3) Filter change every 500 hours of operation. Always clean filter and cooler after any failure occurs.
 - (4) Change oil and filter whenever traces of dirt, metal particles, or effects of high operating temperatures are present as evidenced by discoloration or strong odors.
4. OIL LEVEL CHECKS: Check daily when warm with engine preferably idling at 1000 r.p.m.
5. OPERATING TEMPERATURES:
 - (1) Working temperature should be 180-200°F.
 - (2) Extended operation at or above 250°F, should be avoided if at all possible.
 - (3) To cool oil, shift to neutral, apply parking brake and accelerate engine to 1200-1500 r.p.m.

TROUBLE DIAGNOSIS (CONT)

<u>Trouble</u>	<u>Cause</u>	<u>Remedy</u>
Low clutch pressures and slow engagement at idle.	1. Worn main pump 2. Low oil level 3. Leak on intake side of main pump	1. Inspect pump and replace if worn 2. Add oil 3. Check intake line
Loss of power	1. Cold oil 2. Parking brake on 3. Low converter pressure	1. Warm and recheck 2. Release parking brake 3. Same as "low clutch pressure" above.
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to opposite direction	1. Failed direction clutch in direction vehicle will move	1. Overhaul
Vehicle drives in one range but stalls when shifted to another range	1. Failed range clutch in range vehicle will move	1. Overhaul

TROUBLE DIAGNOSIS CONTINUED

<u>Trouble</u>	<u>Cause</u>	<u>Remedy</u>
Continuously high oil temperature	1. Low or high oil level	1. Add or drain oil
	2. Foamed oil	2. Check for proper oil and whether or not air leak exists on intake side of pump.
	3. Engine cooling system inoperative	3. (a) check radiator coolant level (b) Eliminate restricted water or oil flow through cooler.
	4. Improper vehicle operation	4. (a) Operate in lower gear range (b) Operate away from stall more frequently
	5. Low oil flow through converter	5. Converter pressure regulator valve stuck in near closed position.
Slow or erratic clutch engagement	1. Improper shift linkage arrangement or adjustment	1. Free linkage and adjust.
	2. Low main pressure	2. Main pressure regulator valve stuck, clean, check springs, free up in valve bore.
	3. Internal oil leaks	3. (a) Check other clutches (b) Check shaft sealrings (c) Overhaul

TROUBLE DIAGNOSIS

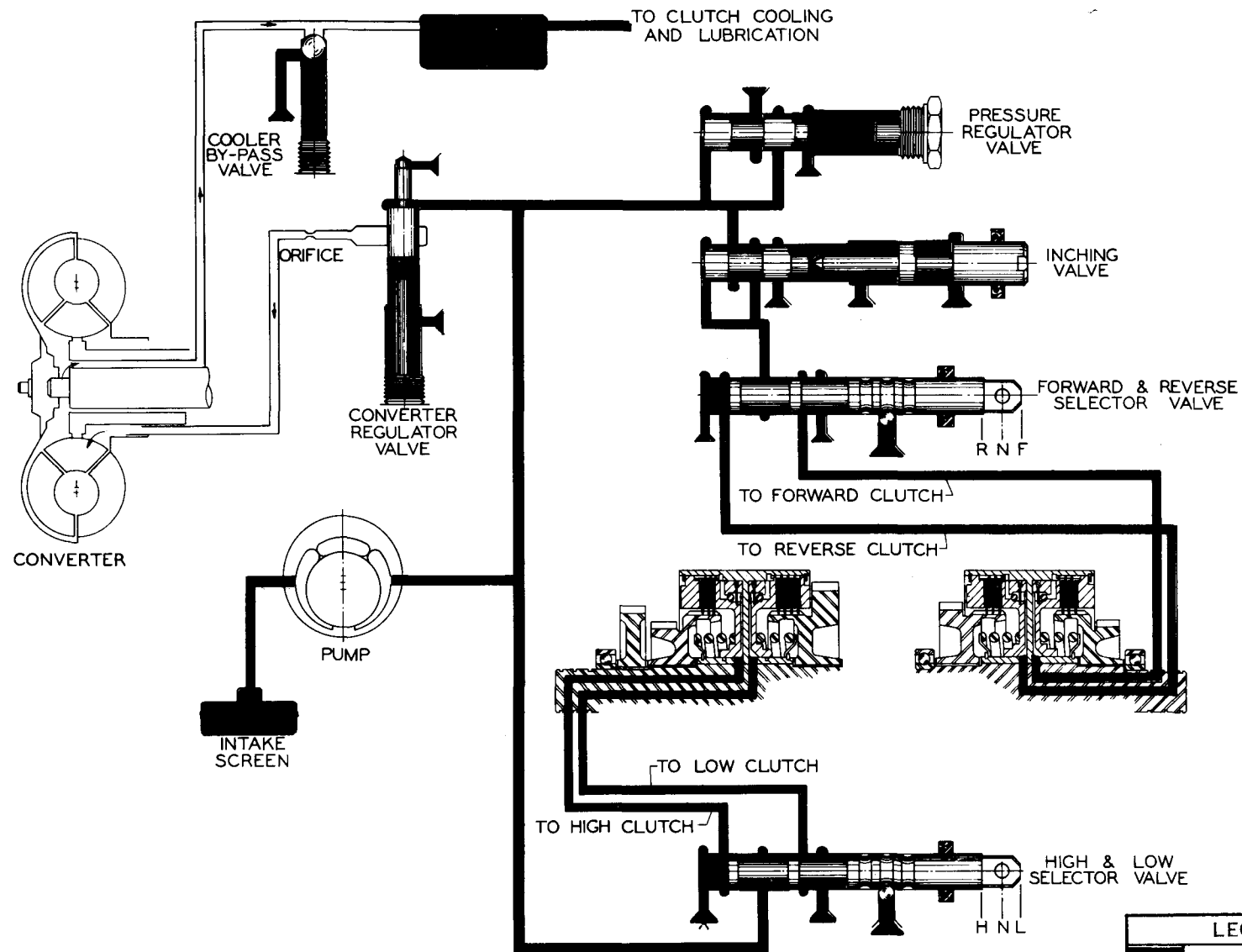
<u>Trouble</u>	<u>Cause</u>	<u>Remedy</u>
High stall speed	1. Low oil level	1. Add oil to proper level
	2. Low con- verter pressure	2. Check converter pressure and, if low, check main regulator valve, converter regulating valve, and cooler bypass valve to see if they are in "stuck open" position.
	3. Slipping Clutch	3. (a) Actuate other clutches to varify slipping of particular clutch being checked (b) Observe main pressure at clutch lines to determine if within limits. (c) Overhaul
	4. Foaming Oil	4. (a) Too low or too high oil level. (b) Water in oil (c) Air leak on intake side of pump. (d) Improper oil

TWO SPEED FORWARD AND REVERSE TRANSMISSION

TROUBLE DIAGNOSIS, GENERAL

When a transmission malfunction is encountered, the following general procedure will aid in isolating the failure:

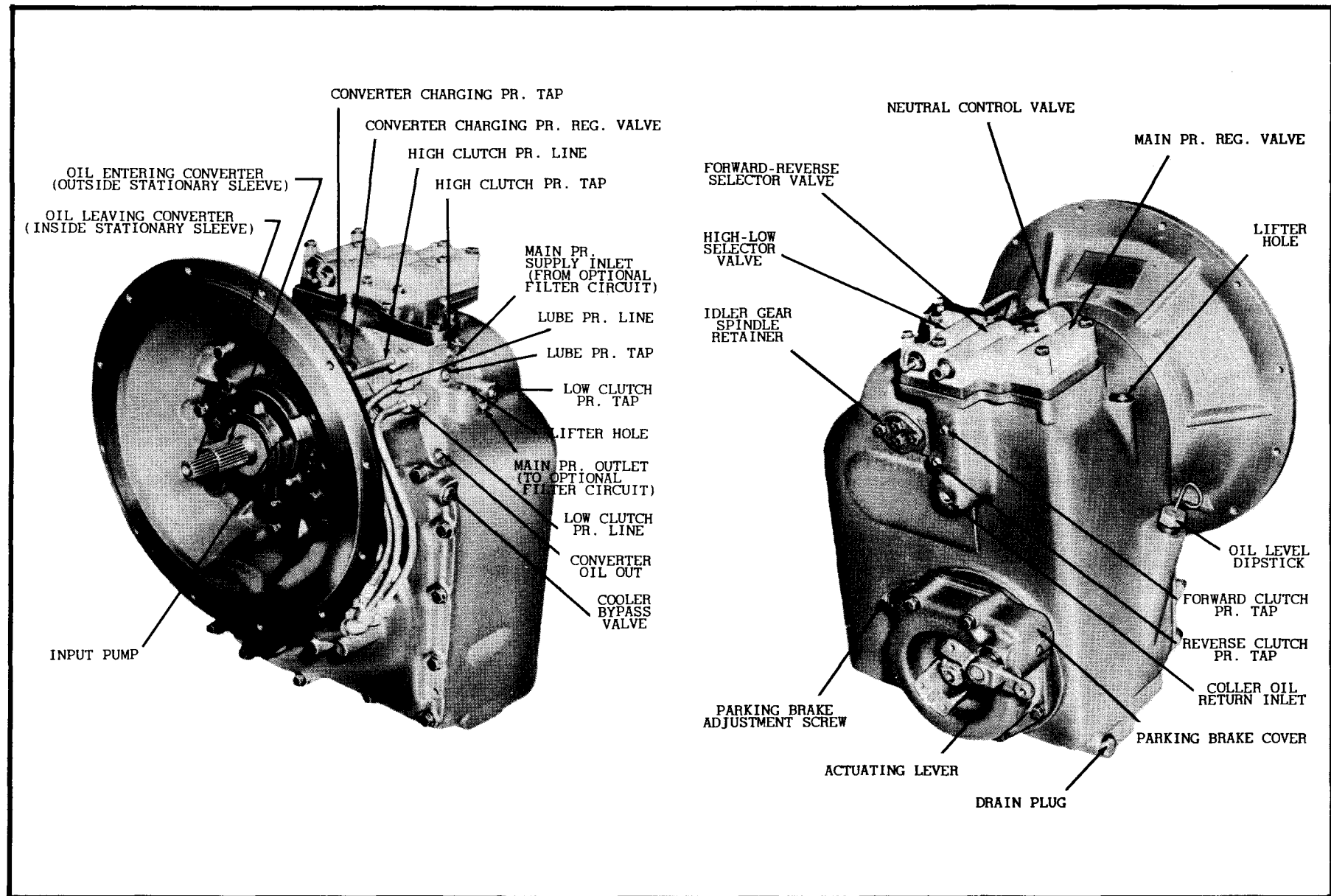
1. Be certain the transmission is at proper operating temperature (180-200°F.)
2. Check oil level; if low, bring level up to full mark and recheck operation of vehicle.
3. Check external linkage connections to both selector valves and to the clutch control valve.
4. Mount pressure gages on the transmission at appropriate locations and check for absence or presence of operating pressure.



LEGEND	
	MAIN PRESSURE
	CONVERTER PRESSURE
	LUBE PRESSURE
	VENT PRESSURE

SCHEMATIC HYDRAULIC CIRCUIT

WARNER GEAR MODEL T 22A TRANSMISSION



EXTERNAL NOMENCLATURE

TWO SPEED FORWARD AND REVERSE TRANSMISSION

GENERAL HYDRAULICS OPERATION

C. NEUTRAL CONTROL VALVE OPERATION: (Continued)

time the brakes are applied. This clutch release and apply action can be carried out while the engine is operating at a high enough speed to provide sufficient power for running the implement pump and this gives fast action to the vehicle hydraulic actuating cylinders.

TWO SPEED FORWARD AND REVERSE TRANSMISSION

GENERAL HYDRAULICS OPERATION

A. OIL FLOW:

Whenever the engine is operating normally and the transmission is properly filled, the following conditions are common to all gear combinations:

1. The transmission oil pump operated at engine r.p.m. supplies oil to the main pressure circuits where maximum main pressure is controlled by the pressure regulator valve.
2. Regulated main pressure is supplied to the neutral control valve, the high-low clutch selector valve, and the forward-reverse clutch selector valve.
3. Regulated main pressure is passed through the converter regulator valve to the converter supply orifice in the ground sleeve. After passing through this orifice, the oil under reduced pressure passes through the converter into the cooler and then into the clutch cooling and lubrication circuits before returning to the sump.

B. CLUTCH ACTUATION:

All gear combinations are obtained by positioning the selector valves in the desired positional locations thereby directing pressure regulated oil to flow through the proper channels to apply the desired clutches. This in turn locks the required gears to their mating shafts and produces the gear ratio desired. The clutches not in use are vented to sump.

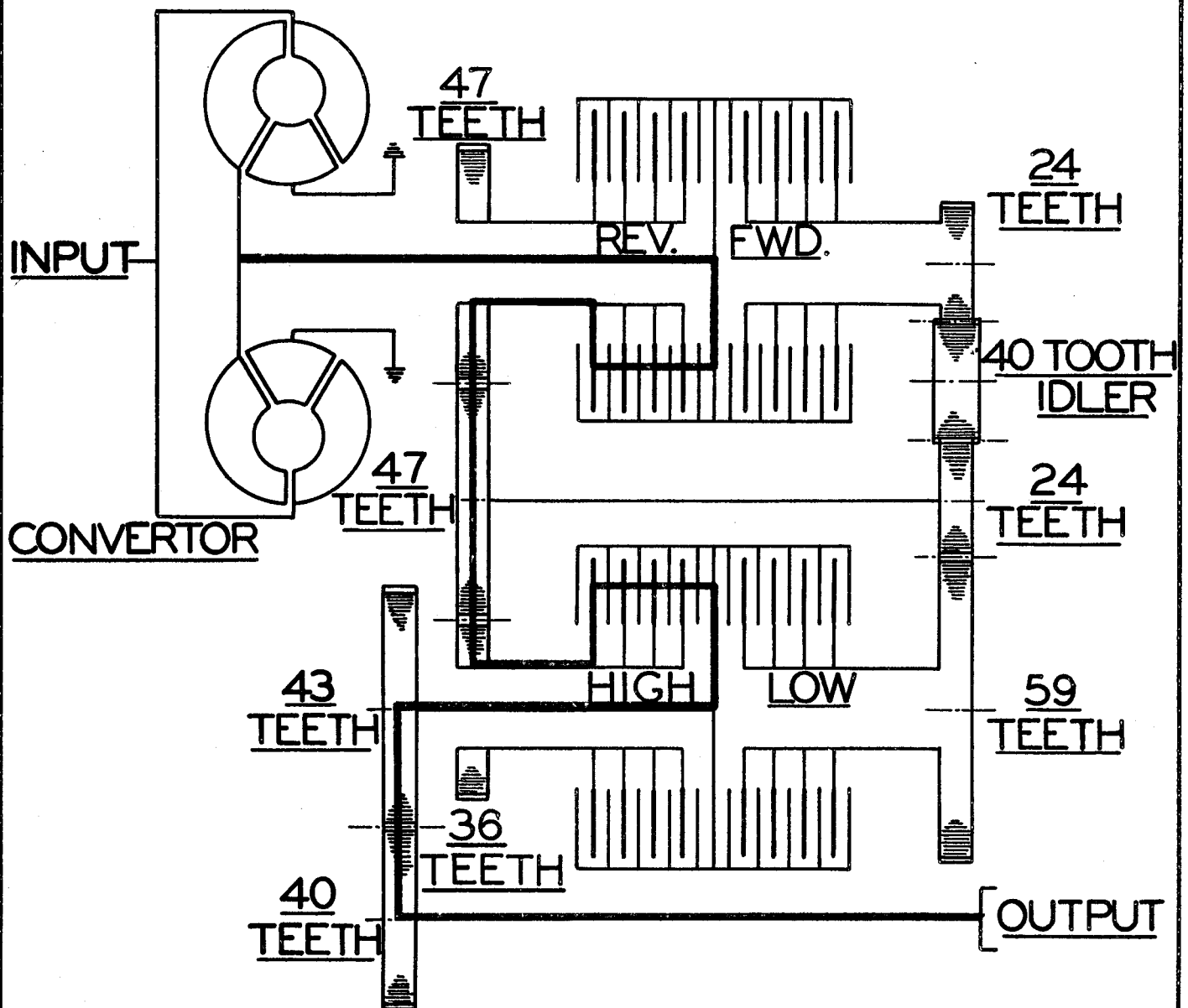
C. NEUTRAL CONTROL VALVE OPERATION:

When the vehicle is in operation, functioning of the neutral control valve is accomplished by positioning of the neutral control valve actuating plunger which is connected by mechanical linkage to the vehicle brake pedal. When the brake pedal is in the fully released position, the forward or reverse clutch is applied by full regulated main pressure. When the brake pedal is gradually depressed, the apply pressure to the forward or reverse clutch drops gradually to zero, at which

TWO SPEED FORWARD & REVERSE TRANSMISSION

GEAR REVERSE-HIGH

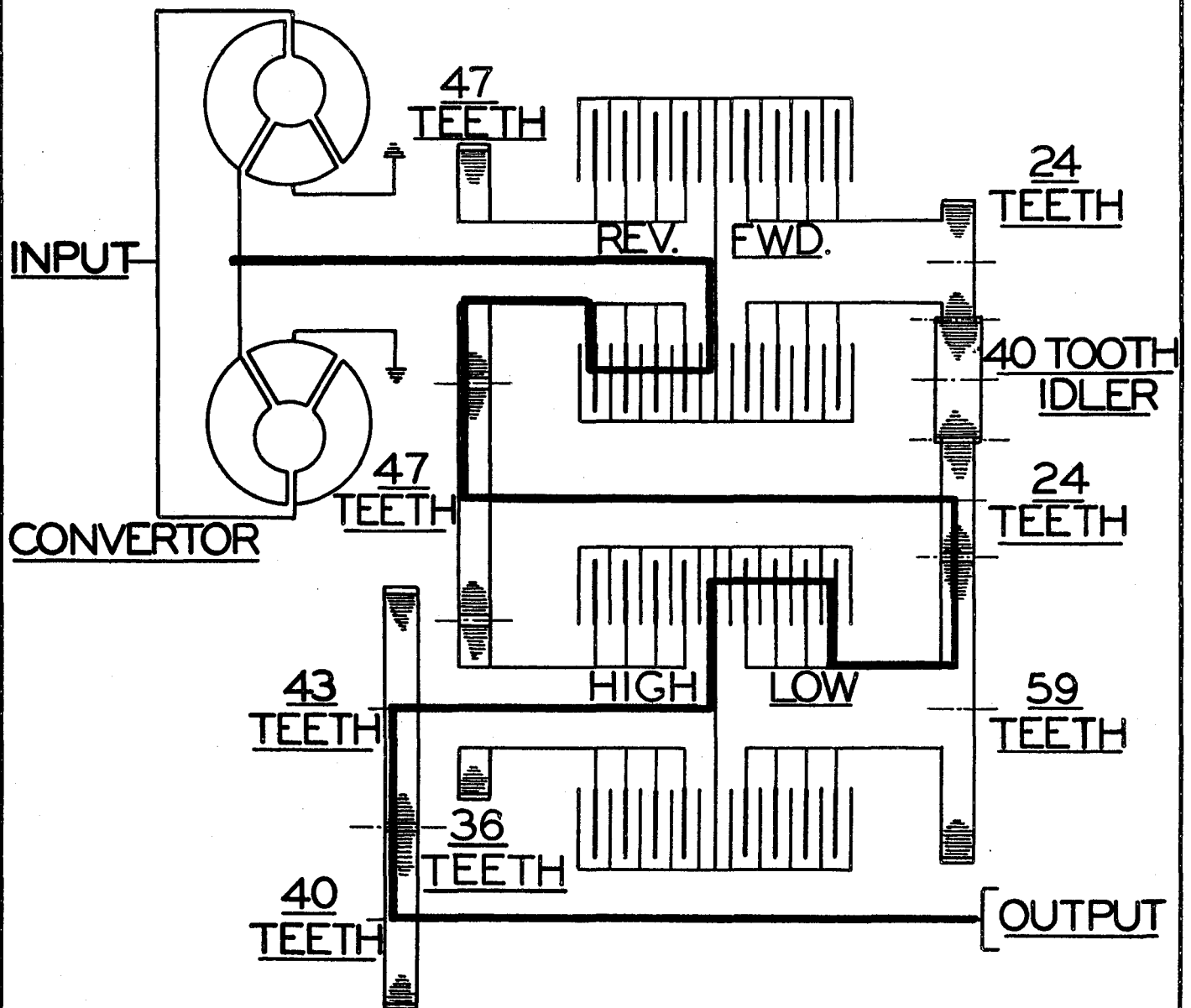
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TWO SPEED FORWARD & REVERSE TRANSMISSION

GEAR REV.-LOW

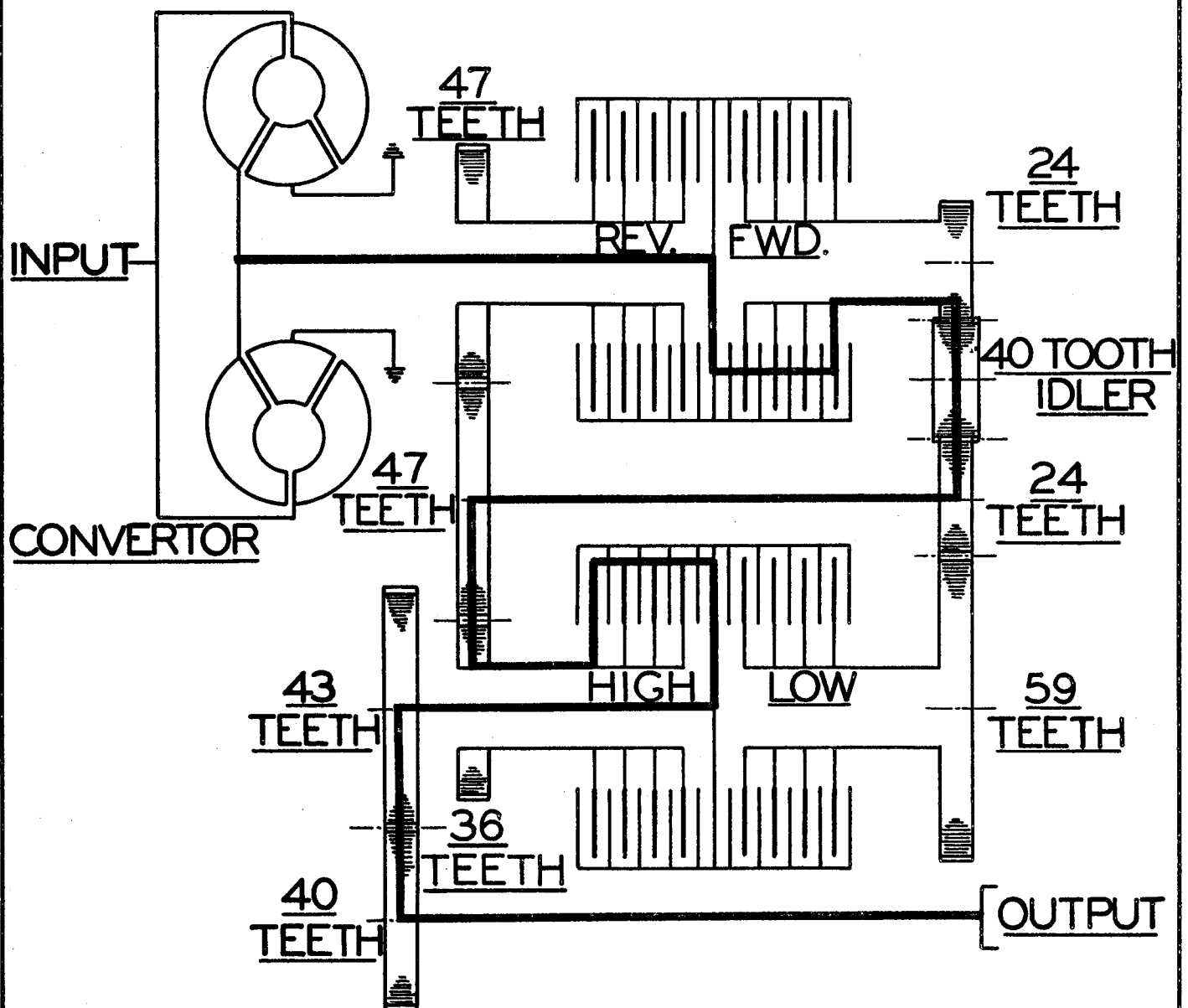
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TWO SPEED FORWARD & REVERSE TRANSMISSION

GEAR FORWARD - HIGH

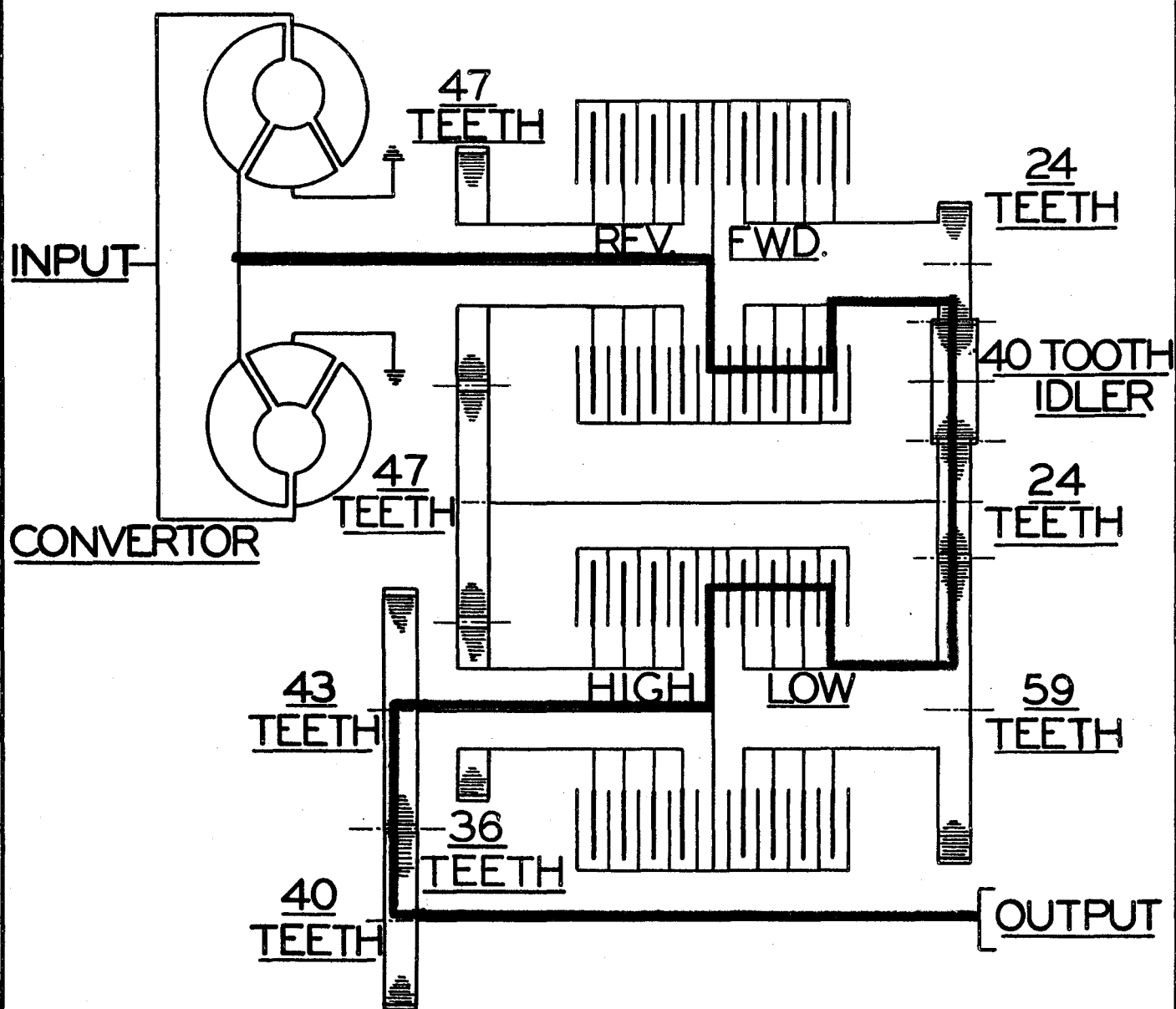
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TWO SPEED FORWARD & REVERSE TRANSMISSION

GEAR FORWARD-LOW

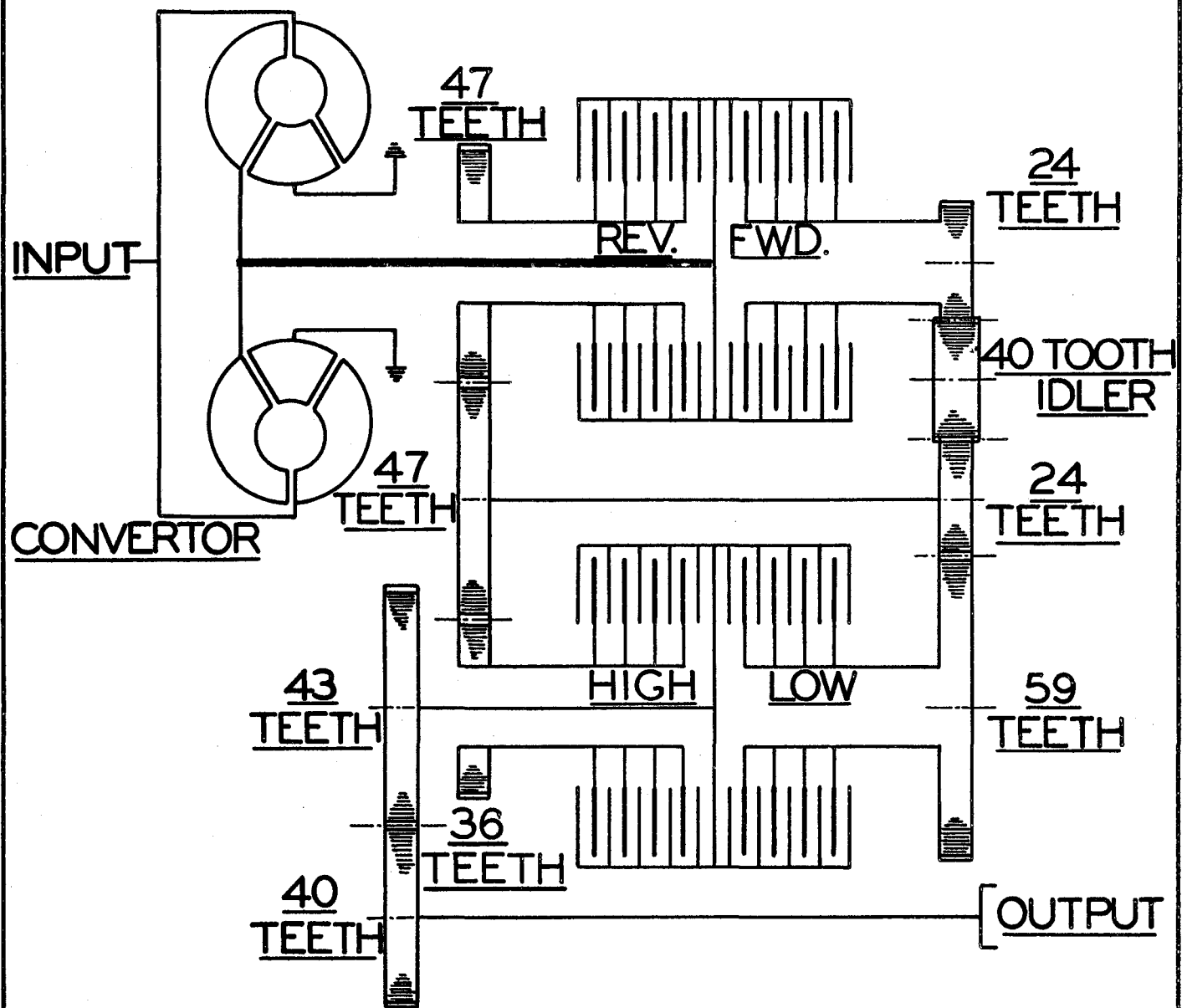
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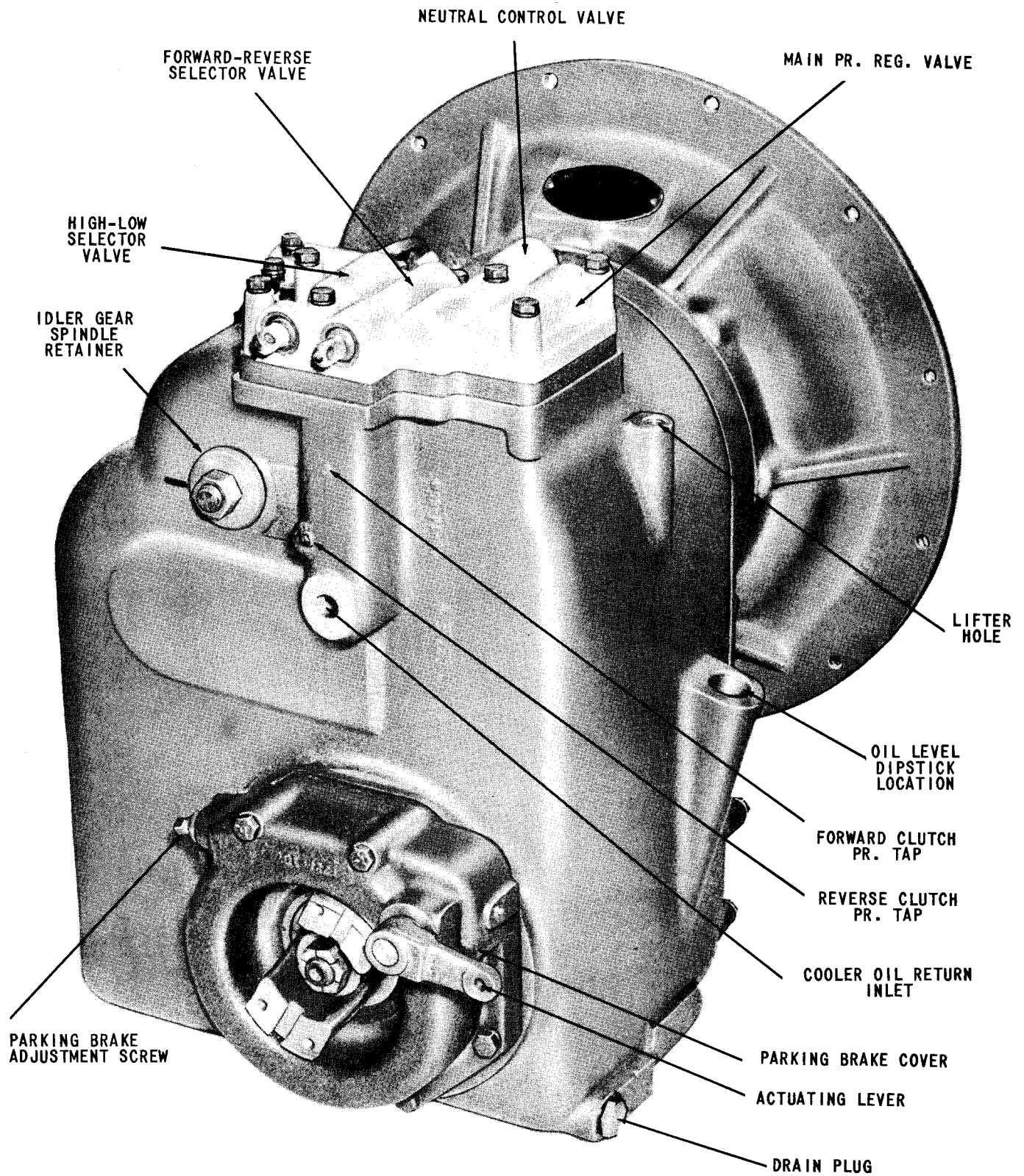


TWO SPEED FORWARD & REVERSE TRANSMISSION

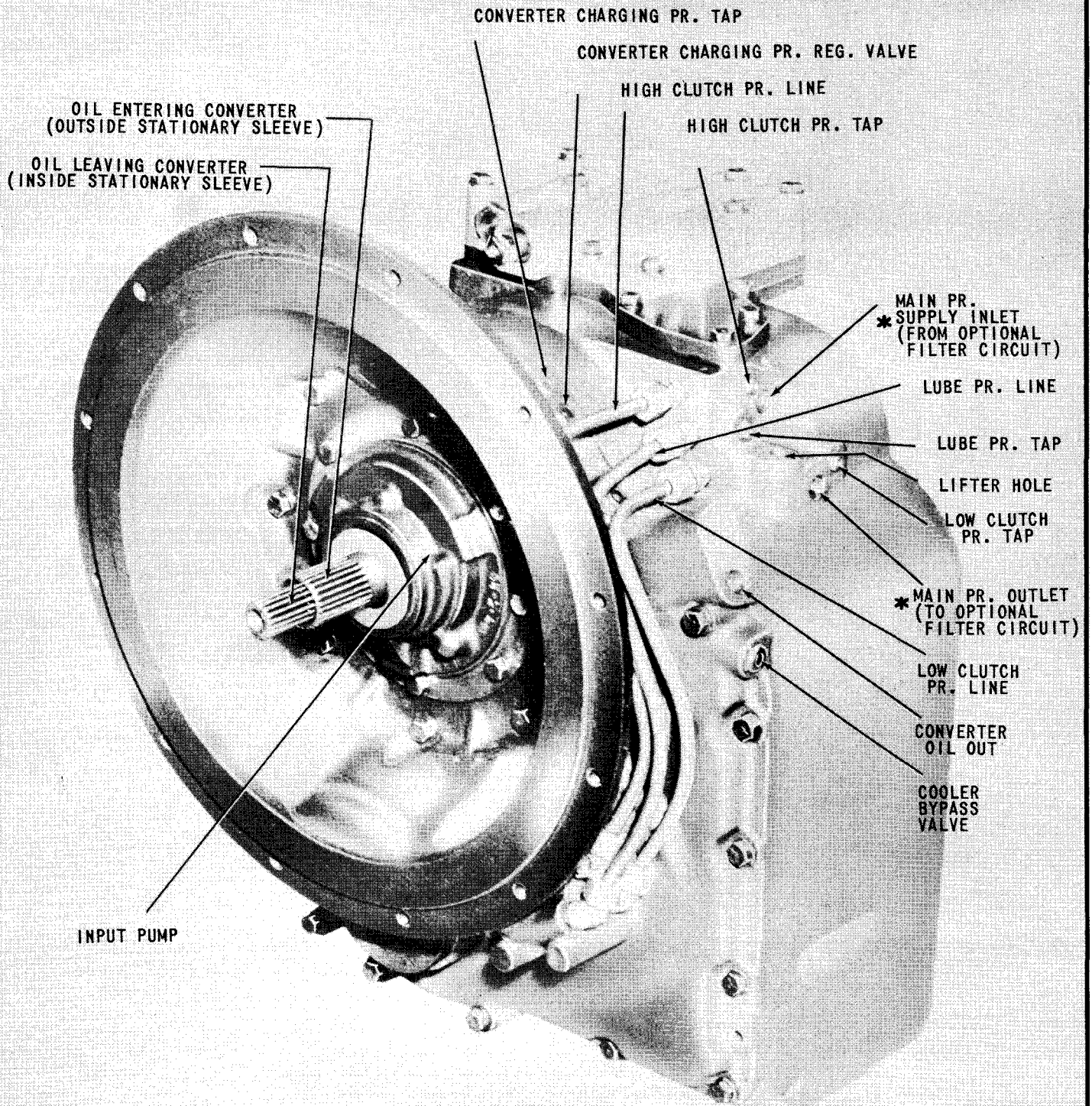
GEAR NEUTRAL

RATIO





WARNER GEAR MODEL AS1 -T22A TRANSMISSION



*** CAUTION:** IF A FILTER IS NOT USED THIS CIRCUIT
MUST BE CONNECTED BY ADDITION OF A
3/8" I.D. MINIMUM EXTERNAL LINE.

WARNER GEAR MODEL AS1 -T22A TRANSMISSION

TWO SPEED FORWARD AND REVERSE TRANSMISSION

SPECIFICATIONS

RATIOS:

<u>Range</u>	<u>Ratios Forward</u>	<u>Ratios Reverse</u>
1	2.29	2.29
2	.713	.713

CLUTCHES:

Self adjusting multiple disc, oil cooled and pressure lubricated, containing sintered bronze plates on steel backing with facing grooved to conform with most suitable characteristics for maximum capacity and smooth engagement.

OIL SYSTEM:

Sump - Integral
Capacity - 11 quarts (average approximate depending on piping arrangement)
Regulating Valves - Integral
Control Valves - Integral
Pressure - Main 120-135 psi
Converter 60-100 psi
Lube - 5-10 psi
Pump Capacity: 8.7GPM (2000 RPM and 200°F.)

GEARING:

Constant mesh, countershaft design, eight pitch straight spur type throughout.

RATING:

Maximum Input Torque at Converter Stall - 375 ft. lbs.

Maximum Input Speed - 2,400 RPM

WEIGHT:

361 lbs. (Dry)

MOUNTING:

Directly on engine (SAE No. 3 or No. 4 flywheel housing)

OUTPUT FLANGE:

Mechanics 4C

PARKING BRAKE:

Integral on output shaft (Warner Gear band type) enclosed for protection, mechanically actuated, (1.5 turn backoff adjustment for proper takeup to maintain actuating lever travel).

DESCRIPTION CON'T.

top of the transmission case housing, regulates main pressure and directs flow of pressure regulated oil into the required channels through use of the following valves:

1. Regulator Valve
2. Neutral Control Valve
3. High-Low Clutch Selector Valve
4. Forward-Reverse Clutch Selector Valve

Other valving contained in the transmission includes:

1. Converter Pressure Regulator Valve
2. Cooler Bypass Valve
3. Clutch Release Valves (Ball bleed type which prevent drag and tendency of a neutral clutch to engage at higher rotational speeds.)

The main case houses the gear train, clutch assemblies, provides sump and oil passages, and serves as a mount on the back side for the heavy duty shaft bearings. A thick sectioned main case cover attaches to the front face of the main case, contains the converter pressure regulator valve, and pump intake passages. This cover serves as a mount for the ground sleeve, converter housing and oil pump. It also serves as a mount for the heavy duty shaft bearings on the front side. After the converter elements are bolted to the engine flywheel the transmission, including converter housing, is brought up to and bolted to the engine flywheel housing. The drive tangs on the converter pump hub are properly mated with slots in the main oil pump drive gear during this operation and the whole assembly forms one complete compact unit.

TWO SPEED FORWARD AND REVERSE TRANSMISSION

DESCRIPTION

The Warner Gear T22 Series industrial transmission is designed to operate in conjunction with Long Division 9.5"-11" Converters or Borg and Beck 12" Converters. All these converters have stall torque multiplication ratios between 2-3:1, are single stage type with optional over running reaction members in the fluid coupling phase of operation. The T22 Series transmissions provide 2 full power shift ratios forward and reverse in a housing which has a 9.14" drop from input to output. Features of this product are:

1. Smooth shifting under full power in any range.
2. High performance (Optimum ratios and low losses)
3. Neutral control valving which permits full power available to be applied to the hydraulic implement pump.
4. Enclosed integral parking brake
5. Complete protection from damage caused by high pressures due to clogged oil lines.
6. Accessible integral control valving.
7. Heavy duty simple construction throughout.
8. Easy service maintenance.
9. Compact, self contained unit.

The transmission contains 9 spur gears, 5 shafts, 8 ball bearings and 1 roller bearing. Clutch gears are mounted on steel backed bronze bushings continually pressure lubricated. Relative motion on bushings occurs only when clutch gears are unloaded which lends an indefinite life to these parts. Feedback speeds, due to constant mesh gearing, are comparatively low which aids in reducing noise level and providing safe operation. The main pump is spur gear crescent type and runs at engine speed. An oil intake screen is provided in the sump for protection to the main pump and lube system. A valve block assembly, mounted on