

R E P O R T R E S U M E S

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VT 005 708

AUTOMOTIVE DIESEL MAINTENANCE 2. UNIT XXIV, MICHIGAN/CLARK  
TRANSMISSION--OIL FLOW THROUGH THE CONTROL COVER ASSEMBLY.

REPORT NUMBER AM-2-24

PUB DATE 21 SEP 67

MINNESOTA STATE DEPT. OF EDUCATION, ST. PAUL

EDRS PRICE MF-\$0.25 HC-\$0.56 12P.

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INDUSTRIAL EDUCATION, \*AUTO MECHANICS (OCCUPATION),  
\*EQUIPMENT MAINTENANCE, KINETICS, DIESEL ENGINES, MOTOR  
VEHICLES, ADULT VOCATIONAL EDUCATION, PROGRAMED MATERIALS,  
TRANSPARENCIES, INDIVIDUAL INSTRUCTION, INSTRUCTIONAL FILMS,  
PROGRAMED INSTRUCTION,

THIS MODULE OF A 25-MODULE COURSE IS DESIGNED TO DEVELOP  
AN UNDERSTANDING OF THE SERVICING PROCEDURES FOR THE CONTROL  
SYSTEM OF A SPECIFIC TRANSMISSION USED ON DIESEL POWERED  
EQUIPMENT. TOPICS ARE EXAMINING THE CONTROL COVER ASSEMBLY,  
REGULATING VALVE AND SAFETY VALVE, AND INSPECTING THE SYSTEM.  
THE MODULE CONSISTS OF A SELF-INSTRUCTIONAL PROGRAMED  
TRAINING FILM "MICHIGAN/CLARK TRANSMISSION--MECHANICAL AND  
HYDRAULIC SHIFT AND OIL FLOW THROUGH THE VALVES AND CONTROL  
COVER ASSEMBLY" AND OTHER MATERIALS. SEE VT 005 685 FOR  
FURTHER INFORMATION. MODULES IN THIS SERIES ARE AVAILABLE AS  
VT 005 685 - VT 005 709. MODULES FOR "AUTOMOTIVE DIESEL  
MAINTENANCE 1" ARE AVAILABLE AS VT 005 655 - VT 005 684. T  
2-YEAR PROGRAM OUTLINE FOR "AUTOMOTIVE DIESEL MAINTENANCE 1  
AND 2" IS AVAILABLE AS VT 006 006. THE TEXT MATERIAL,  
TRANSPARENCIES, PROGRAMED TRAINING FILM, AND THE ELECTRONIC  
TUTOR MAY BE RENTED (FOR \$1.75 PER WEEK) OR PURCHASED FROM  
THE HUMAN ENGINEERING INSTITUTE, HEADQUARTERS AND DEVELOPMENT  
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STUDY AND READING MATERIALS

# AUTOMOTIVE DIESEL MAINTENANCE

# 2

MICHIGAN/CLARK TRANSMISSION--  
OIL FLOW THROUGH THE CONTROL  
COVER ASSEMBLY

UNIT XXIV

- SECTION A EXAMINING THE CONTROL COVER ASSEMBLY
- SECTION B REGULATING VALVE AND SAFETY VALVE
- SECTION C INSPECTING THE SYSTEM

AM 2-24  
9/21/67

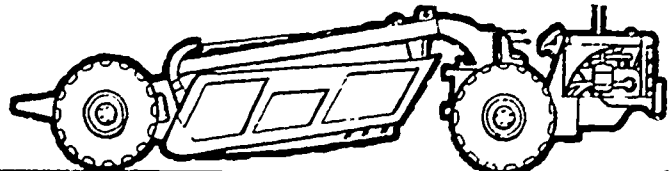
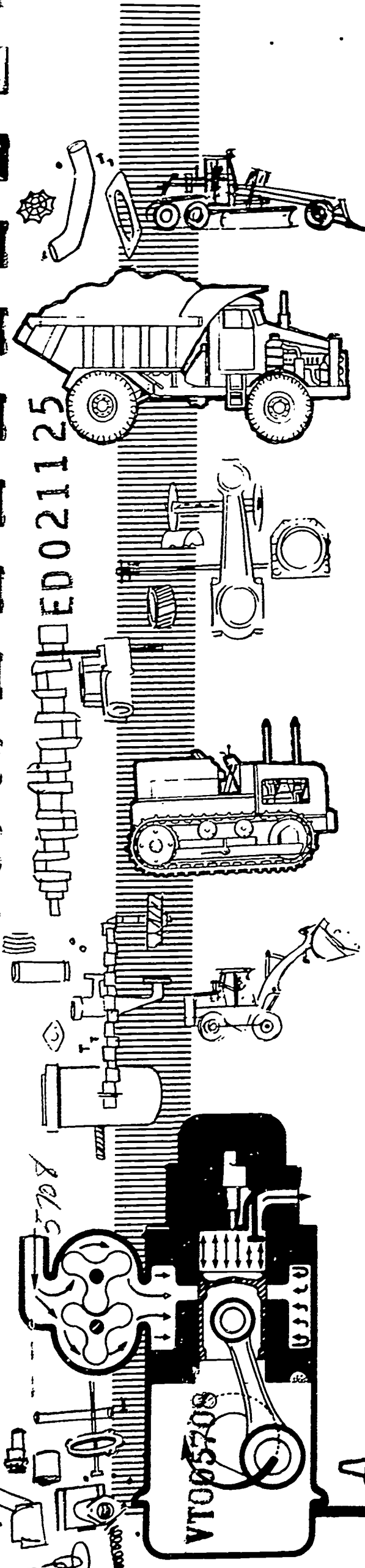
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HUMAN ENGINEERING INSTITUTE



SECTION A -- EXAMINING THE CONTROL COVER ASSEMBLY

NOTE: For the following discussion, refer to Figure 1.

The transmission control cover valve in Figure 1 is positioned with the first speed clutch engaged, and the direction spool in neutral. Under these conditions, the vehicle will not move (two clutches must be engaged to move the vehicle).

Once the oil flows to the clutch, this oil becomes almost static except for a small amount of leakage through the sealing rings. With the vehicle motionless and the engine turning at a low idle, (500-550 rpm), the pressure shown is clutch pressure. See Figure 1. This clutch pressure is created by the clutch regulating valve spring which is set at 180-220 psi.

The regulating valve is similar to a relief valve except that it bypasses oil any time the engine is running. With the engine turning at 2000 rpm (see Figure 2 and remember that the pump produces 31 gpm of oil at this rpm), approximately 1/2 of a gallon of oil is flowing to the 1st speed clutch, leaving 30 1/2 gallons flowing to the converter.

At low idle speed, approximately 8 gallons is flowing to the control cover -- 1/2 gallon to the first speed clutch, and 7 1/2 gallons being bypassed to the converter. See Figure 1.

NOTE: The transmission clutches are always supplied with oil first before any oil is bypassed to the converter.

It takes a very small volume of oil to supply the clutches; this means all of the pump volume is going to the converter for cooling.

The oil flow to the clutches is the same at all speeds; it takes no greater volume of oil to activate one than it does to activate any of the others.

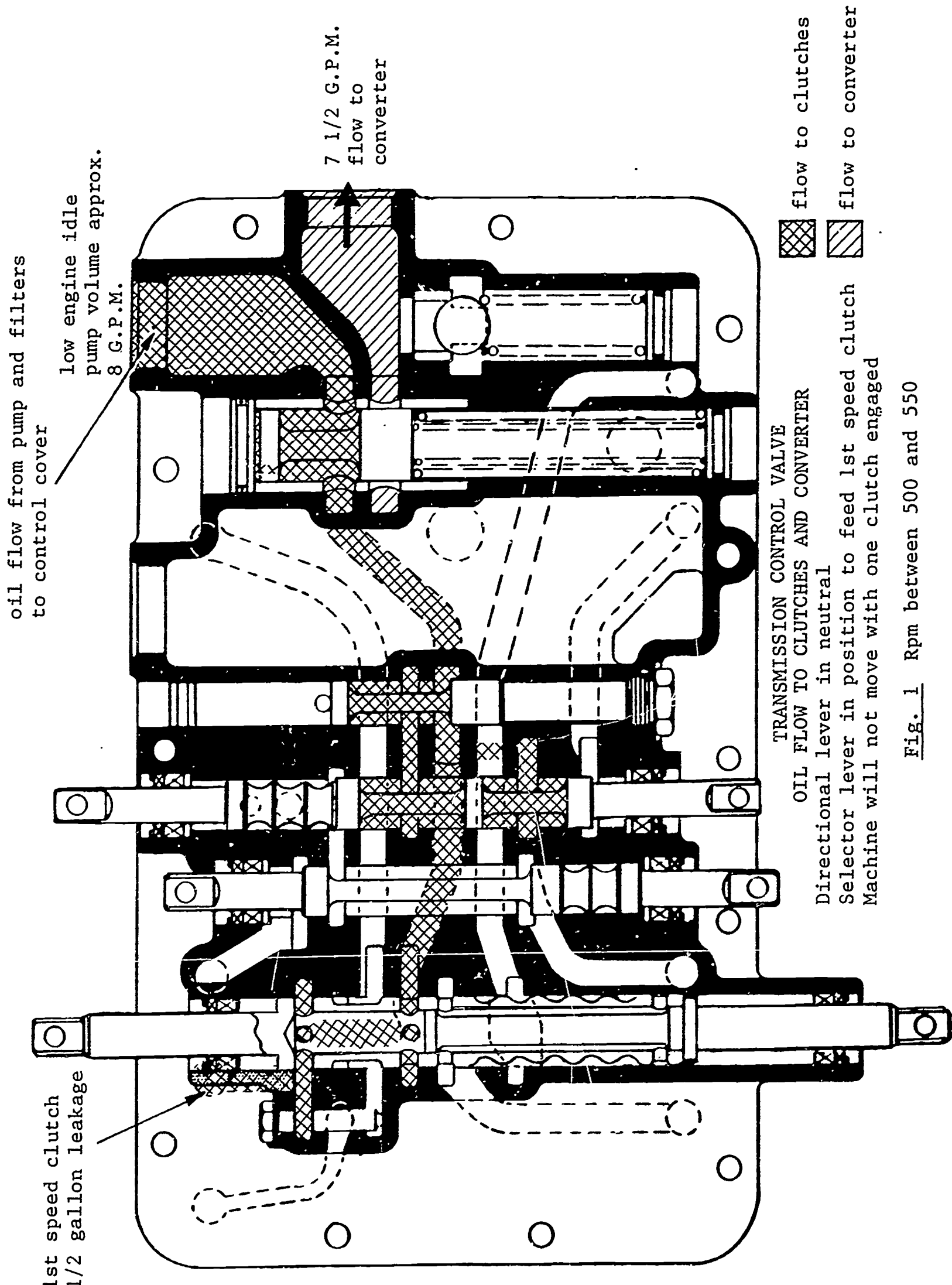


Fig. 1 Rpm between 500 and 550



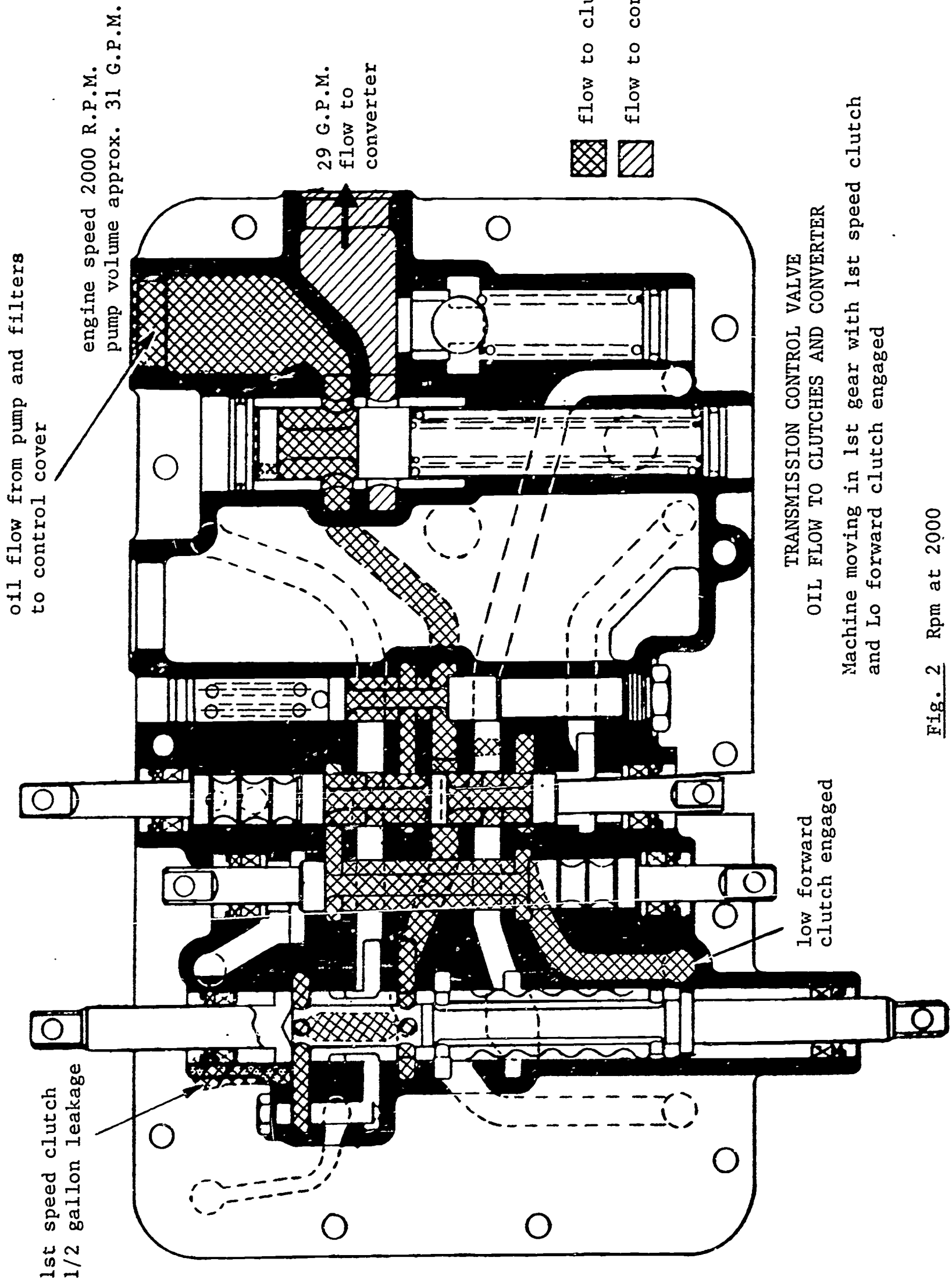


Fig. 2 Rpm at 2000

## SECTION B -- REGULATING VALVE AND SAFETY VALVE

The CLUTCH PRESSURE REGULATING VALVE remains closed until required pressure is delivered to the transmission for activating the clutches and until the hydraulic shift control system is satisfied.

Figure 3 shows an exploded view of the regulating valve. This valve consists of a hardened valve spool operating in a closely fitted bore. Notice in Figure 3 that the valve spool is backed up by a spring that holds the spool against its seat until a specified amount of oil pressure is built up. When enough pressure has accumulated to overcome the spring tension, the spool moves, and a port is uncovered which allows oil to flow to the converter.

The clutch regulating valve spool is designed to allow oil to pass through a small orifice, get behind the valve, and move it toward the spring. The larger end of the spool goes against the spring shown in Figure 3. If the valve was turned around by mistake during assembly, it would not block off the oil. The oil would then go to the converter and would maintain very little pressure on the clutches. Therefore, the vehicle would not move.

**SAFETY VALVE** -- The safety valve is built in the transmission control cover and will open to bypass oil only if an excessive pressure is built up due to a blocked passage. Looking at Figures 3 and 4, if the cooler became plugged due to dirt or foreign material, or if the downstream regulating valve stuck closed due to a particle of dust, the oil pressure would increase and blow an oil seal, causing leakage. Under these conditions, the oil would then bypass through the safety valve and back to the transmission sump. The pressure in the converter could never exceed the safety valve setting of 110-130 psi.

The safety valve is made up of a hardened steel ball and held against a

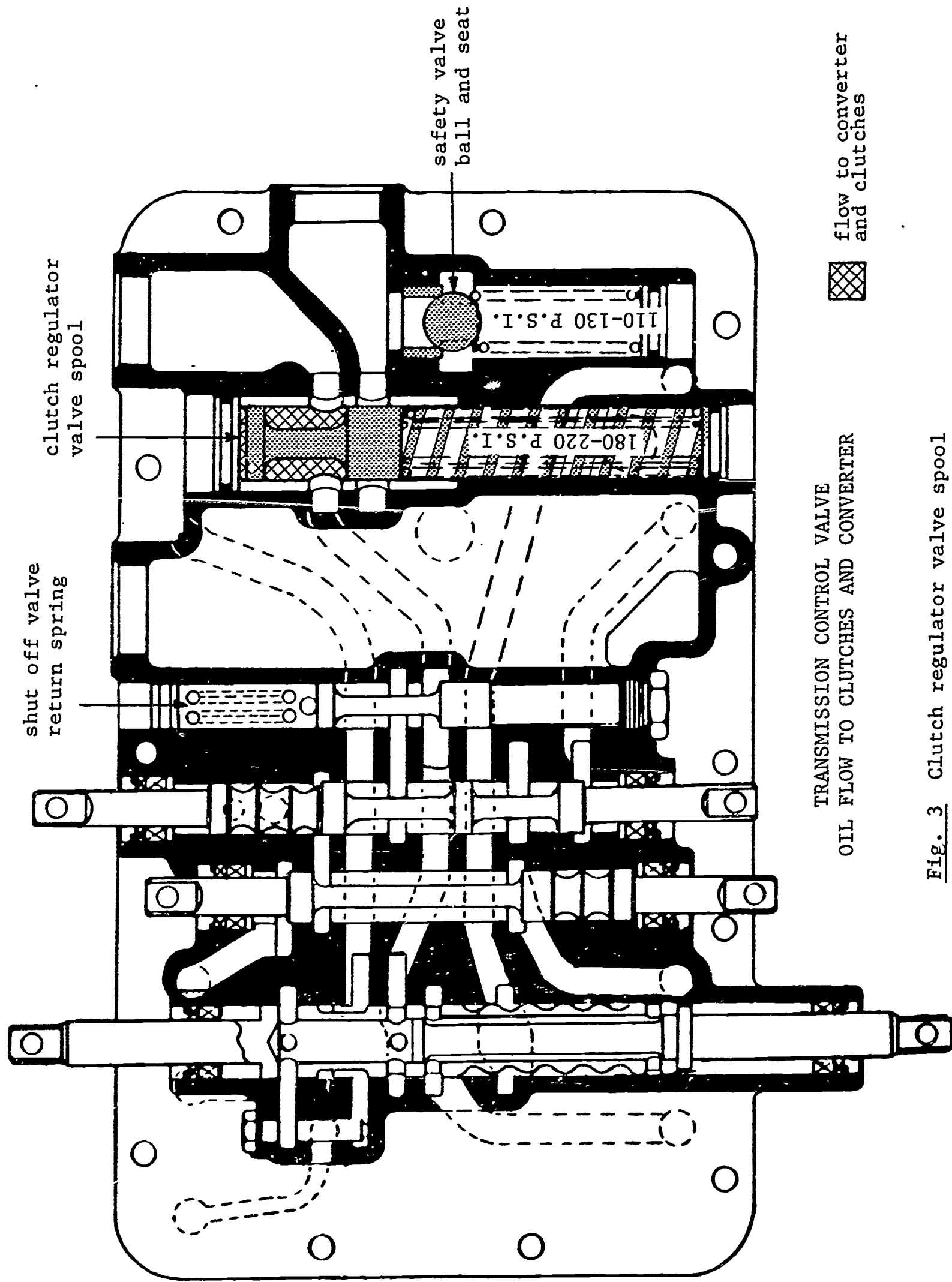


Fig. 3 Clutch regulator valve spool

- "A" PUMP OUT PUT
- "B" CLUTCH PRESSURE
- "C" CONVERTER INTERNAL PRESSURE
- "D" CONVERTER INTERNAL PRESSURE
- "E" COOLER IN PRESSURE
- "F" LUB PRESSURE
- "G" CONVERTER LEAKAGE
- "H" TRANSMISSION LEAKAGE

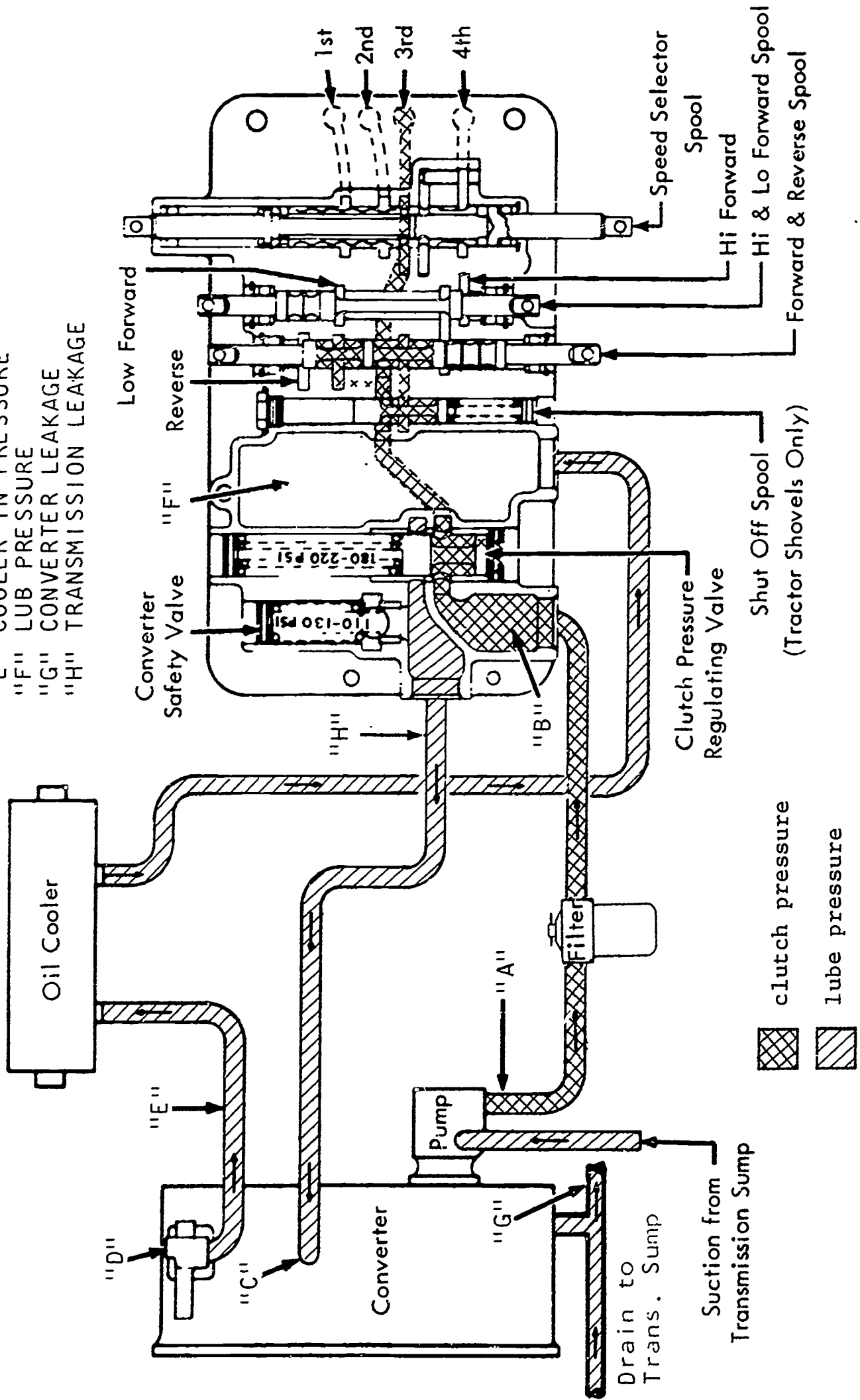


Fig. 4 Transmission control internal oil flow.



hardened steel seat by a spring. Oil pressure readings taken at location "C" will always show pressure below the safety valve setting if the system is free of foreign material or dirt.

### SECTION C -- INSPECTING THE SYSTEM

The converter pump is a gear type, pressure loaded pump with wear plates on both sides of the gears. The pump is never loaded more than 180-220 psi clutch pressure. Therefore, the pump should give many hours of service if the system is kept clean.

It is necessary to change the converter pump if pump output is more than 20 percent below its rated capacity. A converter pump must be replaced and not rebuilt.

A flow meter installed in the line coming from the pump to the filters, or from the filters to the transmission control valve, will give you the capacity of the pump at 2,000 rpm.

Pressure checks can be made at the locations indicated in Figure 4. At location "B", clutch pressure can be obtained. Pressure on clutches must be checked at low engine idle, and only when the oil is hot. Pressures should be checked in all gears. Readings should not vary more than 5 psi between clutches.

Location "C" is the point where "converter in" pressure can be obtained. This reading must be checked at stall and also in neutral, with the turbine member or converter output shaft rotating. At stall, with the output shaft stopped and the engine at full rpm, the inlet pressure at "C" must not drop below 20 psi (with hot oil).

Converter internal pressure can be obtained at location "D". This reading should be 60 psi (+ or - 10 psi) at stall, or with the shift lever in neutral.

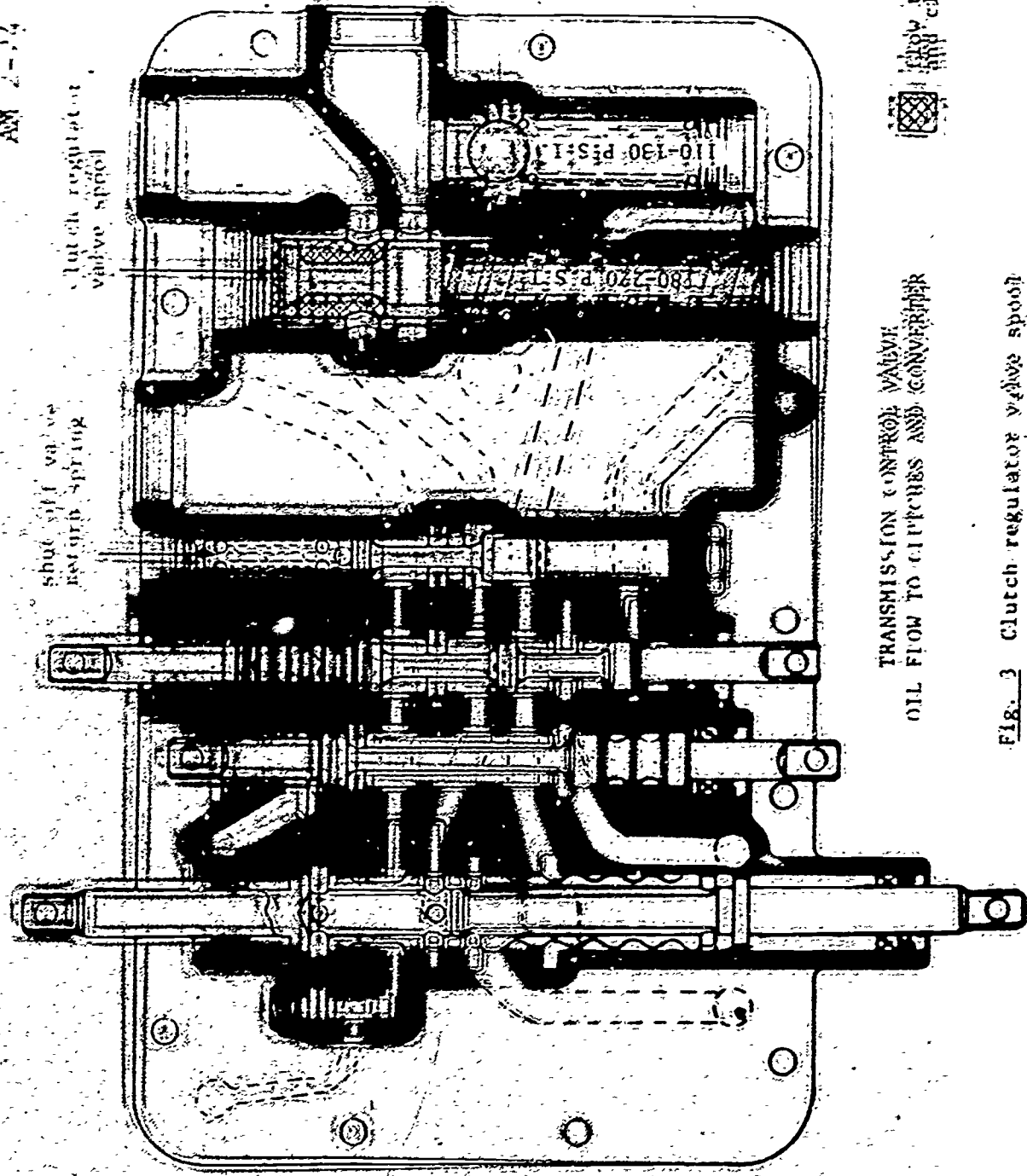
At location "E", the reading should be approximately 25-30 psi. This is pressure or resistance created by the cooler, in the lines to and from the cooler, and oil lube pressure at "F". A reading taken at "F" is pressure created by the resistance of the oil going through the tubing and down to the shaft bearings.

A reading taken at "E" is the total resistance figure of the lube pressure, line pressure and cooler back-pressure. Under normal conditions, this will be 25 to 30 psi.

The normal drop across coolers on Michigan Clark Model 275-111 and 280 dozers is 10 psi. All lines will create 5 to 10 psi back-pressure. The lube pressure normally will run 7 to 10 psi, and by adding up the total resistance from these items, 25 to 28 psi should be the reading.

Always remember that if the pressures are high, there is something plugging up the system. If the pressures are low, there is a low volume oil supply.

AM 2-24 (3)



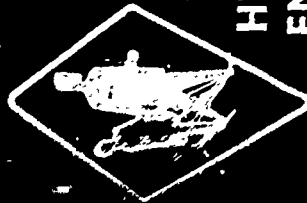
TRANSMISSION CONTROL VALVE  
 OIL FLOW TO CLUTCHES AND CONVERTER

OIL TO CONVERTER  
 OIL TO CLUTCHES

Fig. 3 Clutch regulator valve spool

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## INSTRUCTOR'S GUIDE

Title of Unit: MICHIGAN/CLARK TRANSMISSION --  
OIL FLOW THROUGH THE CONTROL  
COVER ASSEMBLY

AM 2-24

9/21/67

### OBJECTIVES:

1. To trace the flow of oil through the control cover assembly and examine what effect the different valves have on this flow.
2. To discuss pressure checks, where in the system these checks should be made, and how much pressure is expected at each point.

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### LEARNING AIDS suggested:

#### VU CELLS:

- AM 2-22 (2) Transmission Control Internal Oil Flow
- AM 2-22 (7) Neutral Position
- AM 2-24 (1) Clutch Regulator Valve Spool

#### MODELS:

Arrangements can be made to have a working model of a Michigan/Clark transmission at your center. Tear-down and reassembly of this unit on a class participation basis would be excellent for class discussion purposes.

#### NOTE TO INSTRUCTOR:

Test equipment used on Michigan/Clark equipment is always good to have in class. Also worn out or ruptured parts from the transmission are beneficial to let the student examine.

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### QUESTIONS DESIGNED FOR CLASS PARTICIPATION:

1. At what pressure is the clutch regulating valve spring set?
2. How many gallons (approximate) of oil go to a clutch when it is activated, and the engine is turning at 2000 rpm?
3. At low idle speed, does the same amount of oil flow to a clutch as it does when the engine is turning at 2000 rpm?

4. No matter what speed the engine is turning, where does most of the oil flow?
5. Why doesn't the oil flowing to the clutches become 100 percent static?
6. When does the clutch regulating valve open? What two conditions have to be satisfied before this valve will open?
7. What happens when the spool in this valve is installed incorrectly?
8. What is the pressure setting of the safety valve?
9. What could cause the safety valve to move?
10. When must the oil pump be replaced?
11. Where can pressure checks be taken? Explain.