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5-1013

TM 5-1013

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GRADER, ROAD, MOTORIZED
DIESEL-DRIVEN, TANDEM-DRIVE
12-FOOT MOLDBOARD
WARCO MODEL 4D-100

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DEPARTMENT OF THE ARMY
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IMPORTANT NOTICE!

CATALOG No. 5106 -A- 1904 MODEL No. 4D-100 (90° BANK SLOPE) SERIAL No. AD105985 & UP

IT IS VERY IMPORTANT WHEN ORDERING REPLACEMENT PARTS FOR W. A. RIDDELL EQUIPMENT THAT YOU SPECIFY THE MODEL AND SERIAL NUMBER STAMPED ON THE PLATE LOCATED ON FRONT PANEL OF SUB-CAB. REMEMBER THAT WE BUILD MANY DIFFERENT TYPES AND MODELS OF EQUIPMENT, AND UNLESS YOU SPECIFY THE MODEL AND SERIAL NUMBER OF THE MACHINE FOR WHICH YOU ORDER PARTS WE CANNOT DETERMINE WHAT YOU WANT OTHER THAN BY GUESSING. MAKING A WRONG GUESS CAUSES DELAY AND EXPENSE TO YOU. SO REMEMBER - IF YOU FAIL TO GIVE US THE MODEL AND SERIAL NUMBER OF THE MACHINE THE FACTORY WILL NOT BE RESPONSIBLE FOR DELAYS AND TRANSPORTATION CHARGES ON ANY PARTS RETURNED.

SERVICE

INSTRUCTIONS FOR ORDERING PARTS

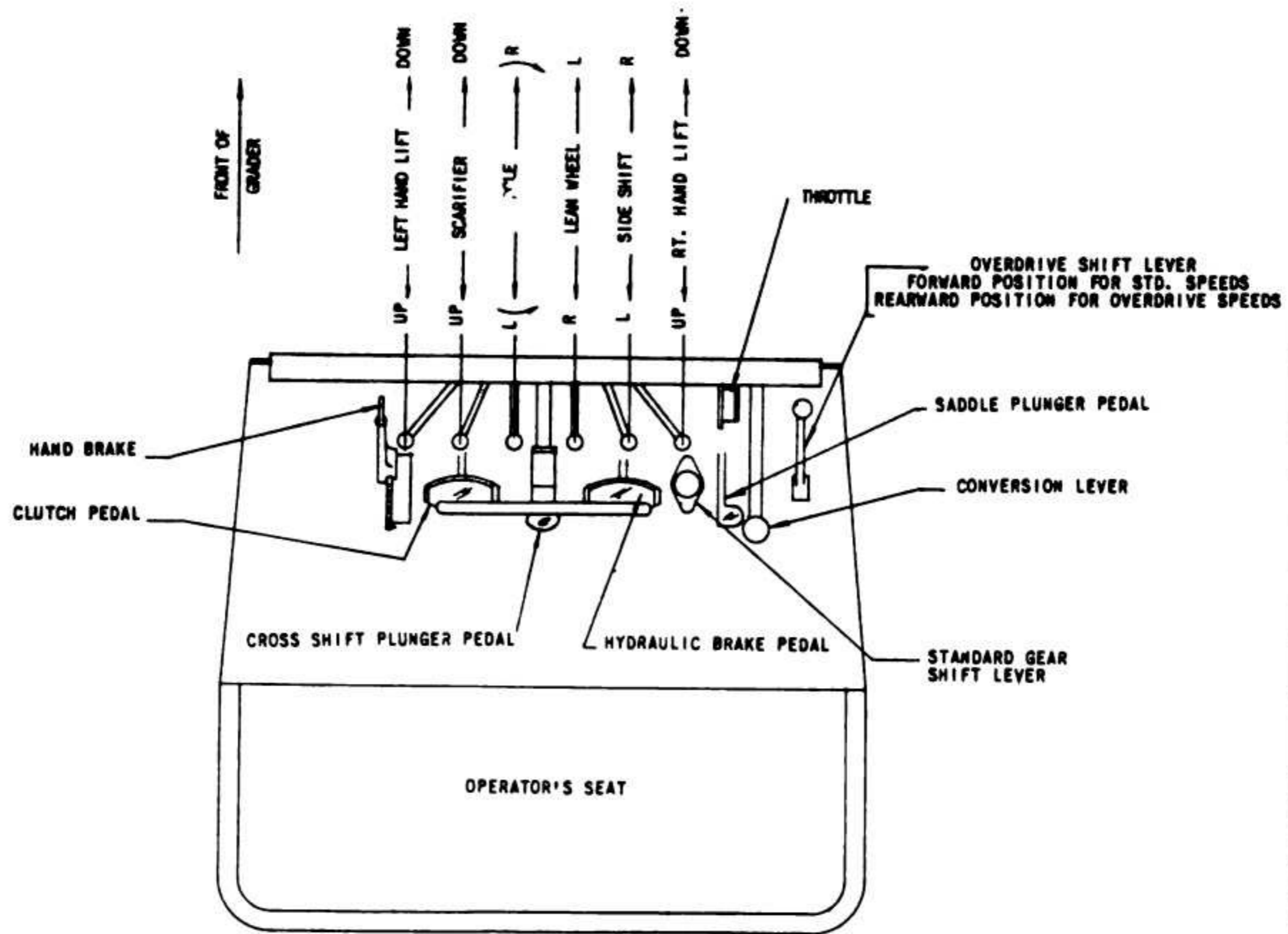
IT IS VERY IMPORTANT IN ORDERING REPLACEMENT PARTS THAT YOU OBSERVE THE FOLLOWING INSTRUCTIONS CLOSELY. THIS WILL ENABLE US TO GIVE YOU THE HIGH STANDARD OF SERVICE ON REPLACEMENT PARTS WHICH WE ENDEAVOR TO MAINTAIN.

1. ALWAYS GIVE SERIAL NUMBER STAMPED ON THE PLATE ATTACHED TO SUB-CAB PANEL OF MACHINE FOR WHICH PARTS ARE WANTED. THIS IS VERY IMPORTANT AS ALL PARTS ARE NOT INTERCHANGEABLE.
2. ORDER BY PART NUMBER AND NAME AS SHOWN IN THE PARTS CATALOG.
3. SPECIFY CAREFULLY AND DEFINITELY HOW SHIPMENT IS TO BE MADE.
4. CONFIRM ALL TELEGRAPH OR LONG DISTANCE TELEPHONE ORDERS BY LETTER OR FORMAL PURCHASE ORDER.
5. SEND SERVICE ORDERS SEPARATE FROM CORRESPONDENCE PERTAINING TO OTHER MATTERS.
6. CLAIMS FOR SHORTAGE OR ERROR IN THE HANDLING OF AN ORDER FOR PARTS MUST BE MADE PROMPTLY ON RECEIPT OF GOODS.
7. WE WILL NOT BE RESPONSIBLE FOR DELAYS AND TRANSPORTATION CHARGES ON PARTS REFUSED OR RETURNED, UNLESS FOREGOING INSTRUCTIONS ARE OBSERVED.
8. ON EXPORT SHIPMENTS WHERE PARTS REQUIRE SPECIAL PACKING AN EXTRA CHARGE WILL BE ASSESSED FOR THIS SERVICE.
9. ALL PRICES QUOTED ARE F.O.B. FACTORY, BUCYRUS, OHIO.

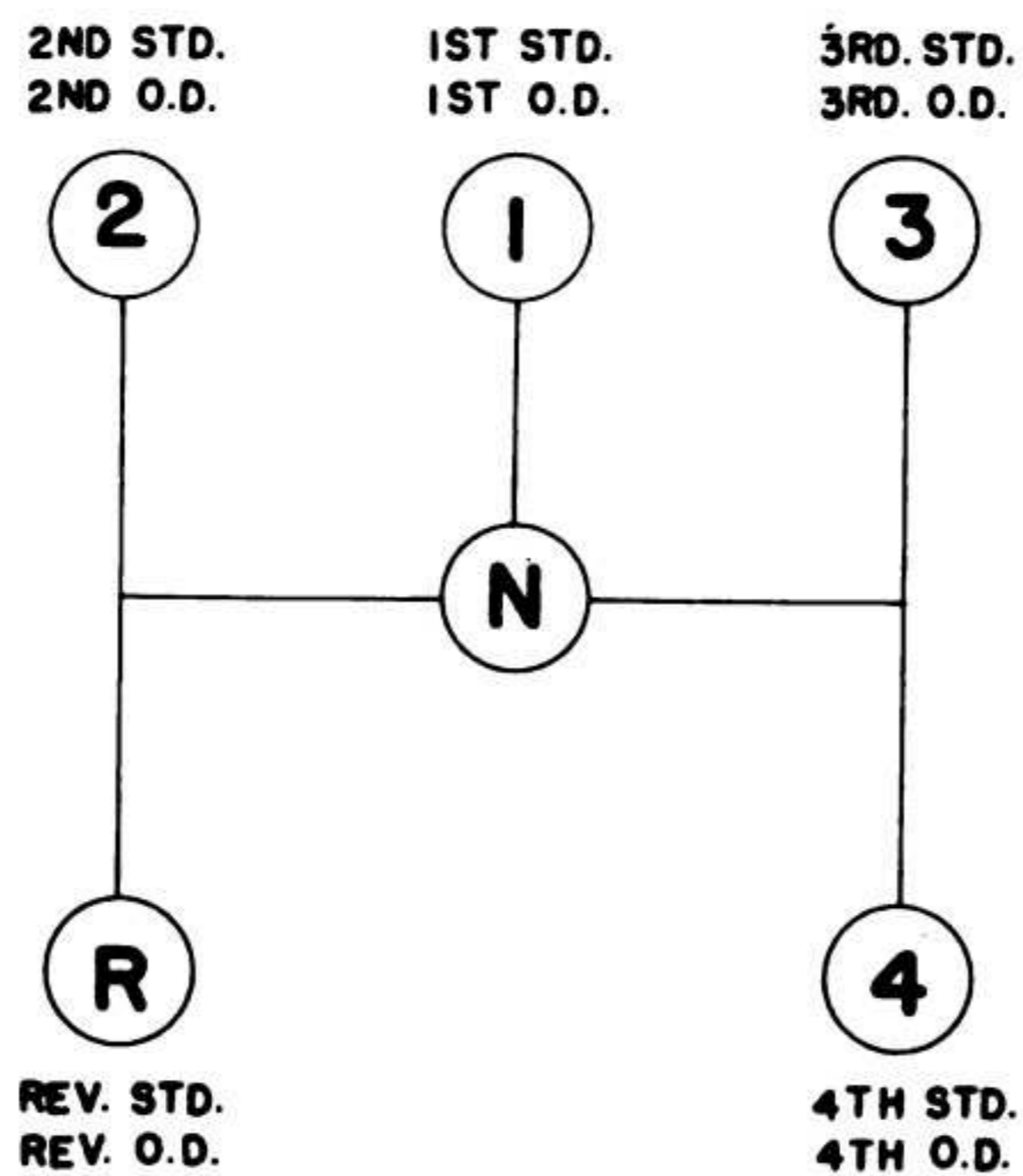
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THE RIGHT TO MAKE CHANGES OR IMPROVEMENTS IN THE DESIGN OR CONSTRUCTION OF ANY PART WITHOUT INCURRING THE OBLIGATION TO INSTALL SUCH CHANGES ON ANY MACHINE PREVIOUSLY DELIVERED IS HEREBY RESERVED.

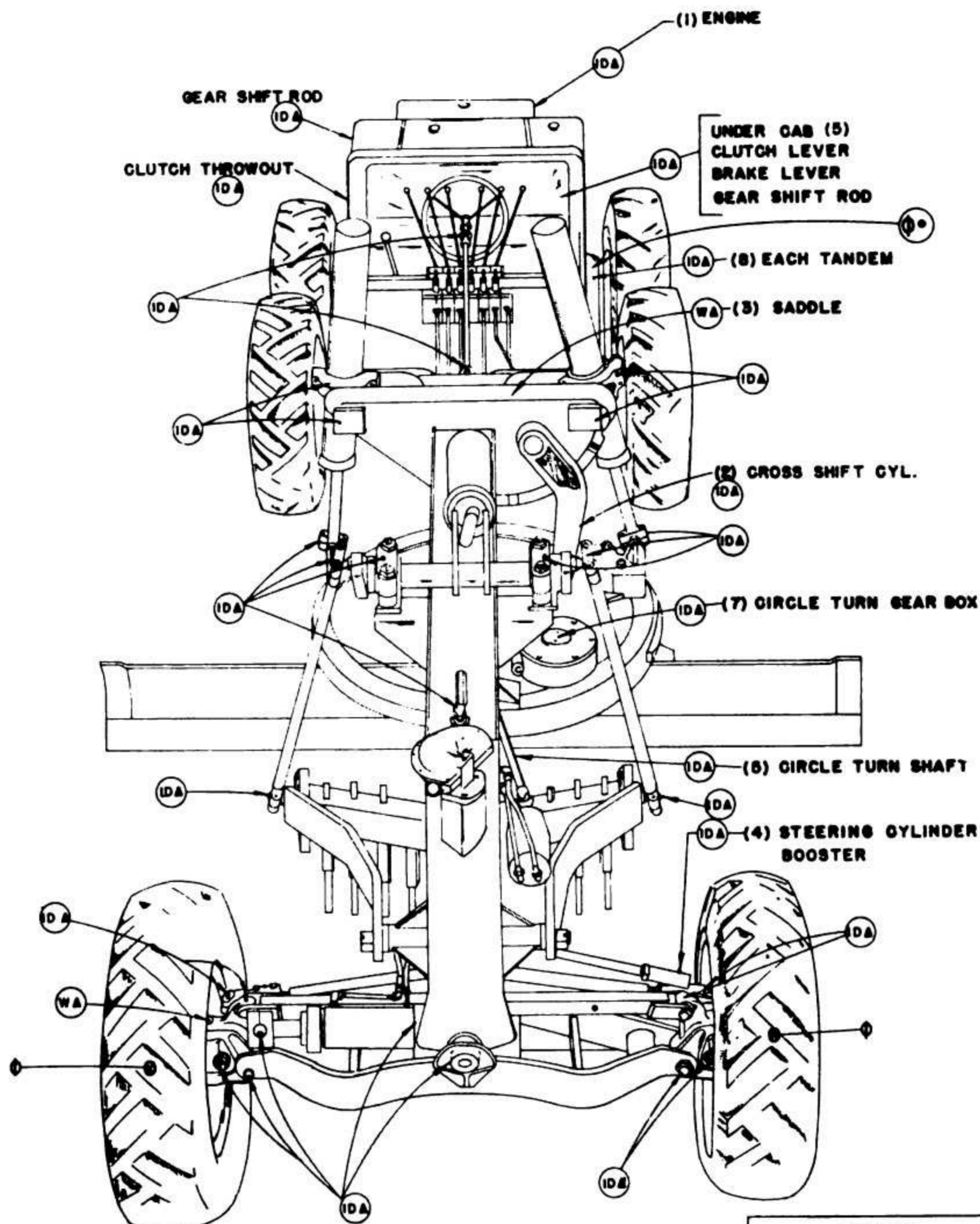




HYDRAULIC GRADER CONTROLS

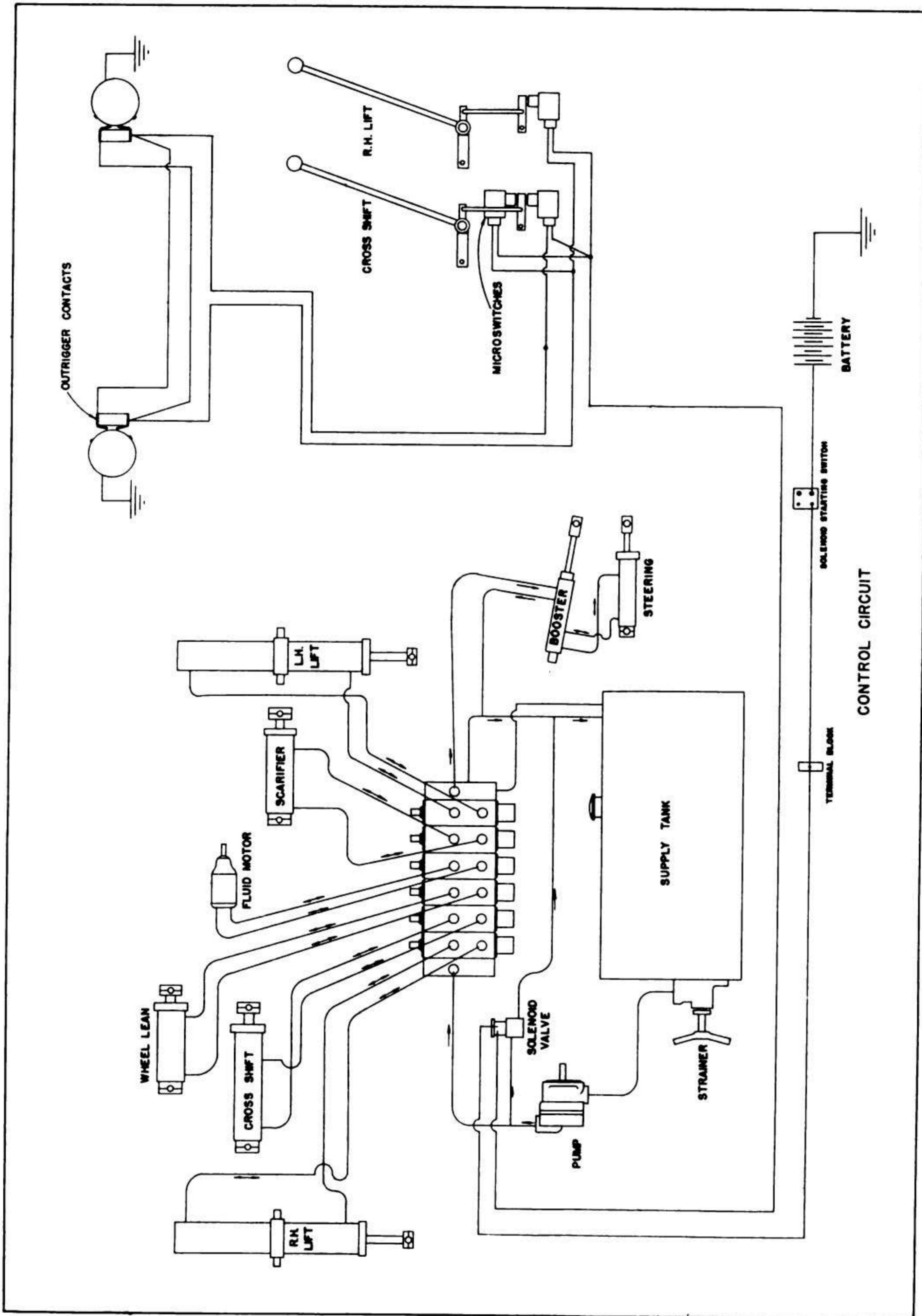


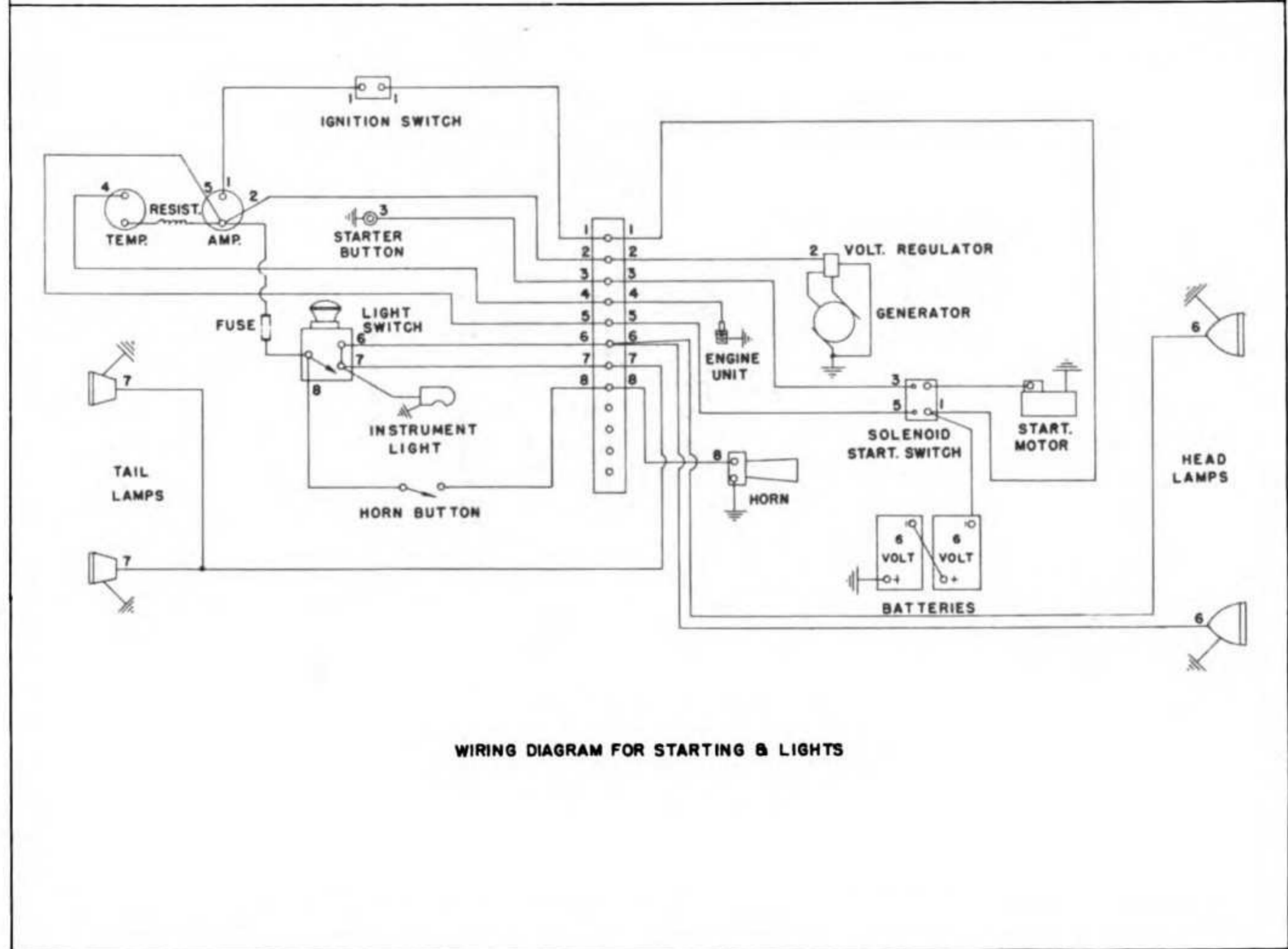
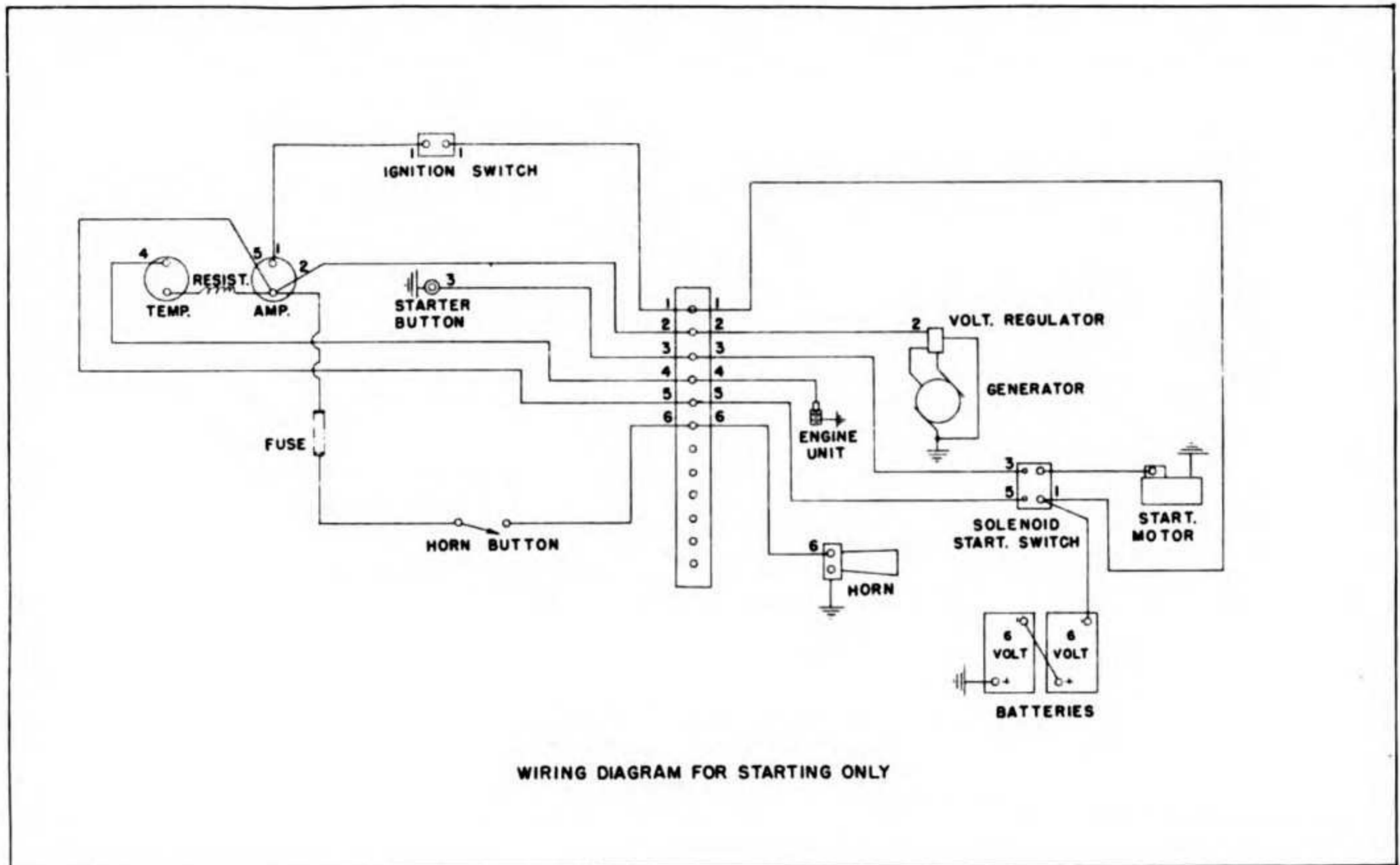
GEAR SHIFT LEVER POSITIONS

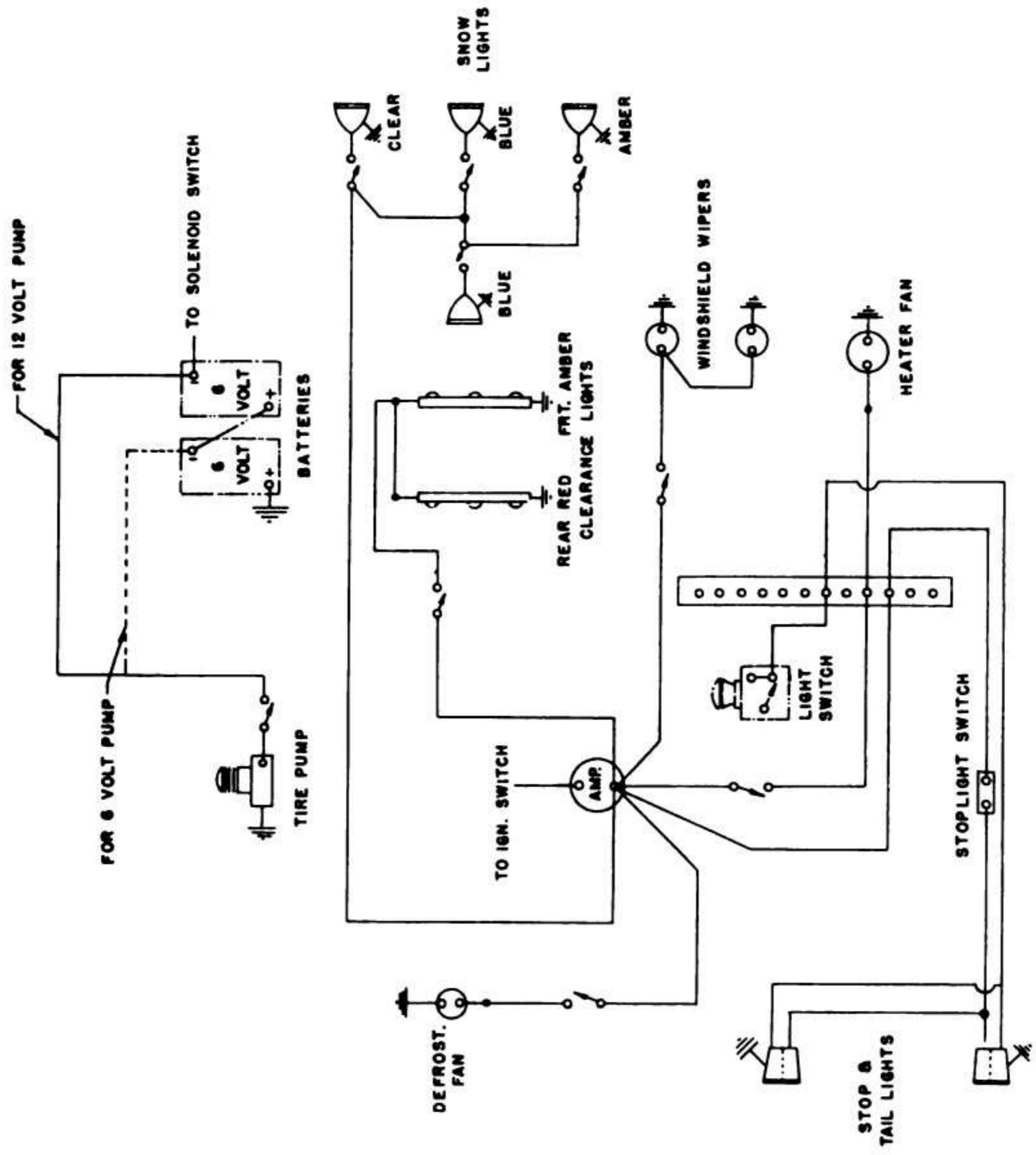


LUBRICATION CHART

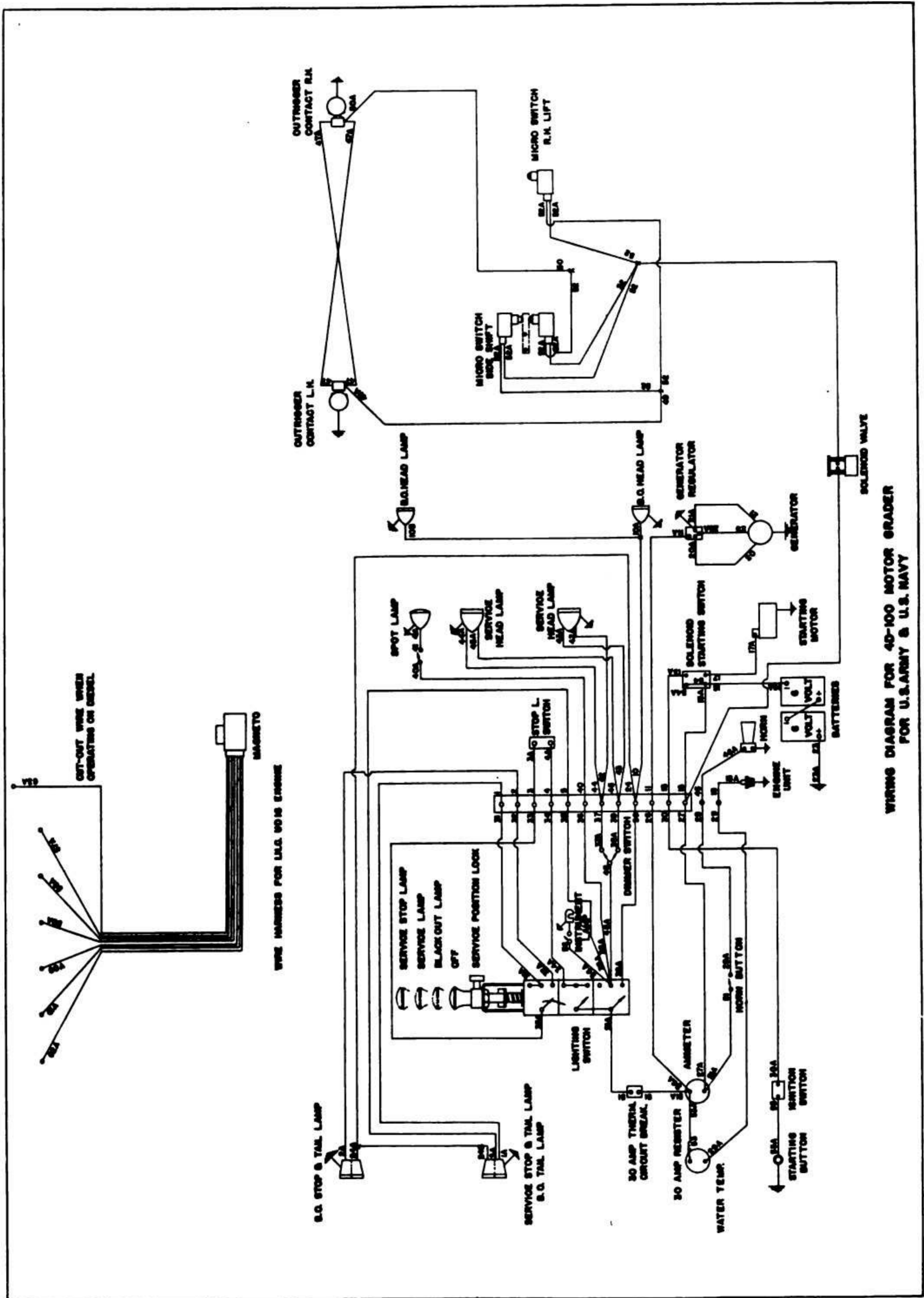
LEGEND	
ID	ONCE DAILY
W	WEEKLY
Φ	ON INSPECTION
▲	ALEMITE
⊗	WHEEL GREASE
()	NO. OF FITTINGS
●	TEMP. ABOVE 32°F... SAE 140
○	TEMP. BELOW 32°F... SAE 90







WIRING DIAGRAM FOR OPTIONAL ELECTRICAL EQUIPMENT



WIRING DIAGRAM FOR 40-100 MOTOR GRADER FOR U.S. ARMY & U.S. NAVY

Harness or Part No.	Wire Marker	Description
4E-20699	26-26A 27-27A 28-28A 29-29A 30-30A	Terminal Block to Ammeter Terminal Block to Ammeter (Hot) Knife Disconnect to Horn Button Knife Disconnect to Temperature Gauge Terminal Block to Ignition Switch
4E-3638	31-31A 32-32A 33-33A 34-34A 35-35A 36-36A 37-37A 38-38A 39-39A	Terminal Block to Lighting Switch for Service Stop Lamp Terminal Block to Lighting Switch for Black-Out Stop Lamp Terminal Block to Lighting Switch for Stop Lamps Terminal Block to Lighting Switch for Stop Lamp Switch Terminal Block to Lighting Switch for Service Tail Lamp Terminal Block to Lighting Switch for Spot Lamp Terminal Block to Dimmer Switch - Lower Beam Service Lamps Terminal Block to Dimmer Switch - Upper Beam Service Lamps Terminal Block to Lighting Switch for Blackout Head & Tail Lamps
4E-4292	1-1A 2-2A 5-5A 11-11A 13-13A 15-15A 18-18A 24-24A-24B	Terminal Block to Service Stop Lamp Terminal Block to Blackout Stop Lamp Terminal Block to Service Tail Lamp Terminal Block to Generator Regulator Terminal Block to Solenoid Starting Switch Terminal Block to Solenoid Starting Switch (Hot) Knife Disconnect to Temperature Gauge Engine Unit Terminal Block to Blackout Tail Lamps
4E-20697 4E-12764	10-10A-10B 46-46A	Terminal Block to Blackout Head Lamps Knife Disconnect to Horn
4E-12830	42-42A 43-43A	Terminal Block to R.H. Lower Beam Service Head Lamp Terminal Block to R.H. Upper Beam Service Head Lamp
4E-12831	44-44A 45-45A	Terminal Block to L.H. Lower Beam Service Head Lamp Terminal Block to L.H. Upper Beam Service Head Lamp
4E-12773	3-3A 4-4A	Terminal Block to Stop Lamp Switch Terminal Block to Stop Lamp Switch
4E-12832 4E-12833 4E-12835 4E-12754	40-40A 41-41A 56-56A 53-53A	Terminal Block to Spot Lamp Switch Spot Lamp Switch to Spot Lamp Lighting Switch to Instrument Lamp Temperature Gauge Resistor to Ammeter
4E-12834	51-51A	Ammeter to Horn Button; Ammeter to Circuit Breaker; Circuit Breaker to Lighting Switch
4E-12768 4E-12759 4E-12750 4E-12748 4E-12747 4E-12746 4E-12749	48-48A 55-55A 54-54A 16-16A 22-22A 23-23A 17-17A	Dimmer Switch to Lighting Switch Ignition Switch to Starter Button Jumper on Solenoid Starting Switch Battery to Solenoid Starting Switch Battery Jumper Battery Ground Solenoid Starting Switch to Starting Motor
4E-20698	20-20A 21-21A 25-25A	Generator Field to Generator Regulator Generator Ground to Generator Regulator Ground Generator to Generator Regulator
4E-4293	57-57A 58-58A 59-59A 60-60A 61-61A 62-62A 63-63A	Distributor Block to No. 1 Spark Plug Distributor Block to No. 2 Spark Plug Distributor Block to No. 3 Spark Plug Distributor Block to No. 4 Spark Plug Distributor Block to No. 5 Spark Plug Distributor Block to No. 6 Spark Plug Magneto to Ignition Cut-Out Switch
4E-20700	50-50A 49-49A	Outrigger Contact R.H. to Splice to Micro Switches Outrigger Contact L.H. to Splice to Micro Switches
4E-12731 4E-12732	47-47A 52-52A	Outrigger Contact L.H. to Outrigger Contact R.H. Limit Switch Splice

CARE, MAINTENANCE AND EMERGENCY REPAIR OF SUPPRESSION

THE PRIME PURPOSE OF SUPPRESSING A MOTOR GRADER IS TO KEEP THE RADIATION OF ELECTRICAL IMPULSES FROM THE ELECTRICAL SYSTEM TO A MINIMUM SO AS NOT TO INTERFERE WITH SURROUNDING ELECTRONIC EQUIPMENT.

THUS IS IS IMPERATIVE THAT THE ELECTRICAL SYSTEM AND METALLIC SHIELDING OF THIS MOTOR GRADER BE MAINTAINED TO THE HIGHEST POSSIBLE STANDARD. REPAIRS SHOULD BE MADE IMMEDIATELY TO EVEN THE SMALLEST DAMAGE OR DEFECT THAT MIGHT ACCRUE.

LISTED BELOW ARE THE COMPONENT PARTS OF THE ELECTRICAL SYSTEM WHICH ARE SUPPRESSED, AND THEIR LOCATION.

A. IGNITION CIRCUIT

1. THE MAGNETO LOCATED ON THE ENGINE HAS A METALLIC SHIELDING BOX #R64205 COVERING THE DISTRIBUTOR COVER.
2. THE SPARK PLUGS ARE A RESISTOR TYPE AND SUPPRESSED. WHEN NECESSARY TO REPLACE THEM USE CHAMPION XE-49 OR EQUIVALENT.
3. IGNITION HARNESS IS 7MM. NEOPRENE COVERED WIRE OR EQUIVALENT. THE METALLIC SHIELDING IS TIN PLATES COPPER BRAID FITTED WITH THE NECESSARY FERRULES AND NUTS FOR PROPER ELECTRICAL AND MECHANICAL BOND TO THE SPARK PLUGS AND MAGNETO SHIELD.

SPARK PLUG WIRES

#1 SPARK PLUG	MARKER 57-57A
#2 SPARK PLUG	MARKER 58-58A
#3 SPARK PLUG	MARKER 59-59A
#4 SPARK PLUG	MARKER 60-60A
#5 SPARK PLUG	MARKER 61-61A
#6 SPARK PLUG	MARKER 62-62A

4. MAGNETO SHORT-CIRCUITING CABLE MARKER 63-63A IS CONNECTED TO THE MAGNETO AND TO THE IGNITION CUT-OFF SWITCH LOCATED INSIDE THE INTAKE MANIFOLD.

B. GENERATOR AND GENERATOR REGULATOR CIRCUIT

1. THE GENERATOR IS LOCATED ON THE ENGINE AND THE GENERATOR REGULATOR IS LOCATED ON THE REAR PANEL OF THE ENGINE. THE THREE WIRES: GENERATOR GROUND TO GENERATOR REGULATOR GROUND MARKER 21-21A; GENERATOR FIELD TO GENERATOR REGULATOR MARKER 20-20A; AND THE GENERATOR TO GENERATOR REGULATOR WIRE MARKER 25-25A, ARE ENCASED IN THE SAME METALLIC BRAID WHICH HAS PIGTAILS AT EACH END. THE PIGTAILS ARE TO BE GROUNDED TO THE GENERATOR AND GENERATOR REGULATOR GROUND POSTS.
2. GENERATOR REGULATOR WIRE MARKER 11-11A FROM GENERATOR REGULATOR TO JUNCTION BLOCK, LOCATED ON REAR OF CAB DASH PANEL UNDER FLOOR BOARD.
3. CONDENSERS (CAPACITORS) WITH A CAPACITY OF .1 MF AT 100 VOLTS ARE ATTACHED TO THE GENERATOR REGULATOR ON THE POSTS WITH MARKERS 25A AND 11A. ACCEPTABLE SUBSTITUTES FOR THESE CONDENSERS ARE CONDENSERS HAVING A CAPACITY OF .2 MF AT 200 VOLTS OR .3 MF AT 300 VOLTS.

CAUTION DO NOT ATTACH CONDENSERS TO THE FIELD WIRE

C. OTHER SUPPRESSED CIRCUITS

1. MARKERS 13-13A AND 15-15A FROM SOLENOID STARTING SWITCH, LOCATED ON THE REAR PANEL OF ENGINE, TO JUNCTION BLOCK.
2. MARKER 18-18A FROM ENGINE TEMPERATURE UNIT IN ENGINE BLOCK TO JUNCTION BLOCK.
3. MARKER 46-46A FROM HORN IN FRONT OF CAB DASH PANEL ON FRAME TO JUNCTION BLOCK.
4. THE FOLLOWING SUPPRESSED WIRES FROM INSTRUMENT PANEL ON CAB DASH PANEL TO JUNCTION BLOCK.

26-26A	AMMETER - GENERATOR WIRE
27-27A	AMMETER - FEED WIRE
28-28A	HORN BUTTON
29-29A	TEMPERATURE GAUGE
30-30A	IGNITION SWITCH

D. TOOTH LOCK WASHERS HAVE BEEN USED THROUGHOUT THE SUPPRESSED ELECTRICAL SYSTEM AND ARE VITAL FOR PROPER ELECTRICAL CONTACTS.

FOR POSITIVE SUPPRESSION OF THIS MOTOR GRADER ALL PIGTAILS, GROUND STRAPS, SPARK PLUG AND MAGNETO FITTINGS, NUTS AND BOLTS MUST BE WRENCH TIGHT TO ASSURE POSITIVE ELECTRICAL CONTACT.

E. ALL ELECTRICAL WIRING ON THIS MOTOR GRADER HAS BEEN TREATED FOR MOISTURE AND FUNGUS CONTROL IN ACCORDANCE WITH SPECIFICATION JAN-T-152. WHEN REPLACING ANY WIRING USE ONLY WIRE WHICH HAS BEEN TREATED AS SPECIFIED ABOVE.

F. EMERGENCY REPAIRS WHEN NECESSARY REPLACEMENT PARTS ARE NOT AVAILABLE.

1. MAGNETO SHIELD R-64205 CAN BE REPLACED BY A METALLIC CONTAINER WITH SUITABLE OPENINGS FOR THE METAL BRAID COVERING THE SPARK PLUG WIRES AND THE WIRES TO BE INSERTED. THE METAL BRAID MUST BE GROUNDED TO THE MAGNETO SHIELD SO THERE IS NO GAP BETWEEN THE BRAID AND THE HOLE WHERE IT IS INSERTED THIS CAN BE DONE BY SOLDERING.
2. THE METALLIC BRAID CAN BE SOLDERED TO THE SPARK PLUG SHIELD IF NUTS OR FERRULES SHOULD BECOME USELESS DUE TO DAMAGE.
3. SHOULD THE TERMINALS ON THE PIGTAILS OF THE METALLIC BRAID ON THE OTHER WIRES BECOME DAMAGED OR BROKEN OFF, REPLACE WITH A NEW TERMINAL, OR THE PIGTAIL CAN BE SOLDERED TO THE NEAREST GROUND.
4. IF BRAIDED SHIELDING SHOULD BECOME DAMAGED BEYOND REPAIR RIGID METALLIC CONDUIT CAN BE USED TO REPLACE IT. THE POINTS WHERE THE GROUND IS MADE ON THE CONDUIT SHOULD BE PLATED OR TINNED IF IT IS NOT MADE OF CORROSION RESISTANT MATERIAL.
5. THERE IS NO SUITABLE WAY TO REPAIR A DAMAGED CONDENSER (CAPACITOR) AND IT MUST BE REPLACED AS SOON AS POSSIBLE WITH ANY OF THE CONDENSERS SHOWN IN PARAGRAPH B3.
6. NO GROUNDS SHOULD BE MADE ON PAINTED SURFACES. REMOVE ALL PAINT AND FOREIGN MATERIAL BEFORE SECURING BANDS, STRAPS, OR BRACKETS.

PROCEDURE FOR 90° BANK SLOPING
TO RIGHT OR LEFT HAND SIDE
OF MOTOR GRADER

1. LOWER BLADE DOWN ON GROUND TO RELIEVE FRICTION ON SADDLE PLUNGER AND CROSS SHIFT ARM PLUNGER.
2. COMPRESS CROSS SHIFT PLUNGER PEDAL AND PLACE CROSS SHIFT ARM PLUNGER AT BOTTOM NOTCH.
3. COMPRESS SADDLE PLUNGER PEDAL AND PLACE PLUNGER IN TOP NOTCH.
4. RAISE RIGHTHAND BLADE LIFT AND LOWER LEFTHAND BLADE LIFT. ALTERNATE CONTROL LEVERS.
5. RUN CROSS SHIFT PISTON OUT APPROXIMATELY HALF WAY. RAISE RIGHTHAND BLADE LIFT; LOWER LEFTHAND BLADE LIFT. ALTERNATE CONTROL LEVERS.
6. RUN CROSS SHIFT PISTON TO EXTREME POSITION.
7. TURN BLADE IN VERTICAL POSITION.

NOTE: ABOVE PROCEDURE FOR BANK SLOPING RIGHTHAND SIDE. SAME PROCEDURE FOR LEFTHAND SIDE EXCEPT CROSS SHIFT ARM PLUNGER IN TOP NOTCH AND SADDLE PLUNGER IN LOWER NOTCH.

NOTE: REVERSE THE ABOVE PROCEDURES FOR RETURNING TO NORMAL POSITION.

BELOW IS AN EXAMPLE OF THE OPERATION OF THE SOLENOID LIMIT CONTROL IN RELATION TO HYDRAULIC CYLINDERS.

WHEN EXTENDING BLADE TO THE RIGHT AS FAR AS POSSIBLE, THE LIFT BRACKET REMAINS IN THE HORIZONTAL POSITION; THE SIDE SHIFT ARM IS INDEXED TO THE LOWER SLOT AND THE SIDE SHIFT CYLINDER IS EXTENDED BY PRESSING FORWARD ON THE CONTROL LEVER; WHEN THIS LEVER IS PRESSED FORWARD THE UPPER LIMIT SWITCH ON THE PANEL IS CLOSED. AS THE LEFT HAND LIFT CYLINDER IS ADVANCED INTO THE FRAME, IT ROTATES THE YOKE RETAINER ON THE FRONT OF THE LIFT BRACKET. WHEN THE CYLINDER COMES WITHIN 2 TO 3 INCHES OF THE FRAME THE LOWER SCREW MAKES CONTACT WITH THE SPRING BLADE, THUS COMPLETING A CIRCUIT AND ENERGIZING THE SOLENOID VALVE, OPENING IT AND BY-PASSING THE HYDRAULIC OIL BACK TO THE TANK; AND NO PRESSURE CAN BE OBTAINED IN THE HYDRAULIC SYSTEM. WHEN THE SIDE SHIFT LEVER IS RELEASED, AND RETURNS TO NEUTRAL, OR IS PULLED BACK, THE UPPER LIMIT SWITCH OPENS, BREAKING THE CIRCUIT, AND THE SOLENOID VALVE CLOSES, AND THE HYDRAULIC OIL IS THEN PUMPED BACK THROUGH THE MAIN CONTROL SET, GIVING POWER TO ANY STATION OPERATED, UNLESS THE SIDE SHIFT IS PRESSED FORWARD AGAIN.

GENERAL DESCRIPTION

WARCO "4D" MOTOR GRADERS ARE AVAILABLE IN TWO MODELS - 4D-76, A 21,375 POUND UNIT; AND 4D-100, A 23,000 POUND UNIT, BOTH DESIGNED FOR USE IN THE CONSTRUCTION AND MAINTENANCE OF ROADS, GENERAL GRADING, AND SNOW REMOVAL. THE MAIN FRAME IS BOX CONSTRUCTION TO PROVIDE THE UTMOST STRENGTH AND RIGIDITY, AND UNOBSTRUCTED VISION FOR THE OPERATOR.

THE 4D-76 AND 4D-100 MOTOR GRADERS ARE ALIKE IN CONSTRUCTION, WITH THE EXCEPTION OF THE ENGINES. THE 4D-76 IS POWERED BY A 76 HORSEPOWER, 4-CYLINDER DIESEL ENGINE IHC MAKE, MODEL UD-14A. THE 4D-100 MOTOR GRADER IS POWERED BY A 100 HORSEPOWER, 6-CYLINDER DIESEL ENGINE, IHC MAKE, MODEL UD-16. POWER FROM THE ENGINE IS TRANSMITTED THROUGH THE ENGINE CLUTCH TO THE TRANSMISSION, AND FROM THE TRANSMISSION INTO THE TANDEM DRIVE SHAFTS. THE TANDEM WHEELS ARE DRIVEN BY HEAVY ROLLER CHAINS, WHICH CONNECT THE SPROCKETS ON THE TANDEM DRIVE SHAFTS.

TWO WHEELS OF THE TANDEM DRIVES ARE EQUIPPED WITH HYDRAULIC BRAKES; FOUR WHEEL HYDRAULIC BRAKES ARE OPTIONAL EQUIPMENT. A LEVER CONTROLLED MECHANICAL TRANSMISSION PARKING BRAKE IS STANDARD EQUIPMENT.

A HYDRAULIC CONTROL FOR OPERATING THE MOLDBOARD; FRONT WHEEL LEAN; STEERING WITH HYDRAULIC BOOSTER; AND SCARIFIER (OR SNOW PLOW), IS LOCATED DIRECTLY IN FRONT OF THE OPERATOR. THE MOLDBOARD CAN BE ROTATED A FULL 360 DEGREES, PERMITTING WORK TO BE DONE WITH THE MACHINE TRAVELING BACKWARD OR FORWARD.

THE MOLDBOARD CAN BE TILTED TO SEVERAL PITCH POSITIONS TO OBTAIN THE DESIRED ROLLING OR CUTTING ACTION, AND CAN ALSO BE SHIFTED OUT TO EITHER SIDE UP TO 90 DEGREES FOR CUTTING DITCHES OR SLOPING BANKS.

THE OPERATOR CAN REMAIN IN CAB TO OBTAIN ANY DITCH OR BANKSLOPING POSITION. THE FRONT WHEELS CAN BE LEANED 20 DEGREES TO RIGHT OR LEFT TO COUNTERACT SIDE DRAFT.

THE HIGH ARCHED FRONT AXLE PROVIDES AMPLE CLEARANCE FOR HANDLING HEAVY WINDROW OF DIRT, GRAVEL OR OIL MIX MATERIAL.

PROVISION IS MADE FOR MOUNTING AND OPERATING SPECIAL EQUIPMENT SUCH AS A SCARIFIER OR SNOW PLOW OR WING.

OPERATION AND MAINTENANCE

ALWAYS OPERATE THE GRADER IN A GEAR WHICH WILL ALLOW THE ENGINE TO OPERATE AT FULL SPEED. THIS WILL INSURE THE MOST POWER FROM THE ENGINE AND WILL ALLOW THE ENGINE TO OPERATE AT ITS NORMAL TEMPERATURE AND AT ITS HIGHEST EFFICIENCY.

START INTO A CUT WITH THE GEARS SHIFTED INTO THE SPEED RANGE THAT WILL PERMIT COMPLETING THE CUT WITHOUT FURTHER SHIFTING, THUS AVOIDING UNNECESSARY WEAR ON CLUTCH FACINGS.

KEEP THE GRADER DIRECTLY ABOVE THE WORK AS MUCH AS POSSIBLE. THIS WILL PREVENT SIDE DRAFT WITH ITS RESULTANT LOSS OF POWER, AND WILL ALSO PREVENT UNNECESSARY SIDE STRESS ON THE VARIOUS PARTS AFFECTED WHEN IT IS NECESSARY TO WORK WITH THE MOLDBOARD SHIFTED OUT TO ONE SIDE. LEAN THE FRONT WHEELS ENOUGH TO COUNTERACT THE RESULTING SIDE DRAFT. IF A DEEP CUTTING ACTION IS DESIRED, TILT THE TOP OF THE MOLDBOARD BACK. LESS PRESSURE WILL THEN BE REQUIRED TO FORCE THE CUTTING EDGE OF THE MOLDBOARD INTO GROUND.

IF A ROLLING ACTION IS DESIRED, AS WHEN MIXING OIL WITH GRAVEL, TILT THE TOP OF THE MOLDBOARD FORWARD. THIS WILL CAUSE THE MATERIAL TO ROLL SEVERAL TIMES, AND TO MIX MORE THOROUGHLY BEFORE IT IS DISCHARGED FROM THE HEEL END OF THE MOLDBOARD.

DO NOT ATTEMPT TO TURN THE CIRCLE WHILE ONE END OF THE MOLDBOARD IS UNDER HEAVY LOAD; HOWEVER, THIS CAN BE DONE IN LIGHT MAINTENANCE WORK.

MAINTAIN PROPER ADJUSTMENT OF CIRCLE GUIDES AND MESH OF CIRCLE REVERSE PINION IN LARGE INTERNAL GEAR ON CIRCLE. THIS PINION ADJUSTMENT IS FULL DEPTH, GOVERNED BY A COMPLETE ROTATION OF CIRCLE.

THE FACE OF THE CIRCLE IS TREATED AT THE FACTORY TO PREVENT RUSTING. THIS TREATMENT SHOULD BE REMOVED BEFORE GRADER IS PUT INTO OPERATION. DO NOT USE OIL OR GREASE ON THE CIRCLE FACE, AS THIS WILL MIX WITH DIRT AND CAUSE HARD "CAKING". IF LUBRICATION IS DESIRED, FREQUENT APPLICATION OF FUEL OIL WILL PROVE THE MOST SATISFACTORY. THIS WILL ALSO PREVENT MUD OR SNOW FROM FREEZING TO THE CIRCLE WHEN OPERATING IN COLD WEATHER.

DO NOT USE HYDRAULIC POWER TO REMOVE MUD OR SNOW WHICH IS FROZEN TO THE CIRCLE. THIS MAY DAMAGE THE GEAR AND GEAR SEGMENTS. APPLY HEAT TO LOOSEN MATERIAL FROZEN TO THESE PARTS.

THE MOLDBOARD CUTTING EDGES SHOULD BE REMOVED AND SHARPENED WHEN THE EDGES BECOME BLUNT. NEW CUTTING EDGES SHOULD BE INSTALLED BEFORE THE OLD ONES ARE WORN TO THE POINT WHERE FURTHER USE WOULD CAUSE WEAR ON THE MAIN STRUCTURE OF THE MOLDBOARD. THE END BITS ARE ALSO REPLACEABLE AND SHOULD BE SHARPENED OR REPLACED WHEN IT BECOMES NECESSARY.

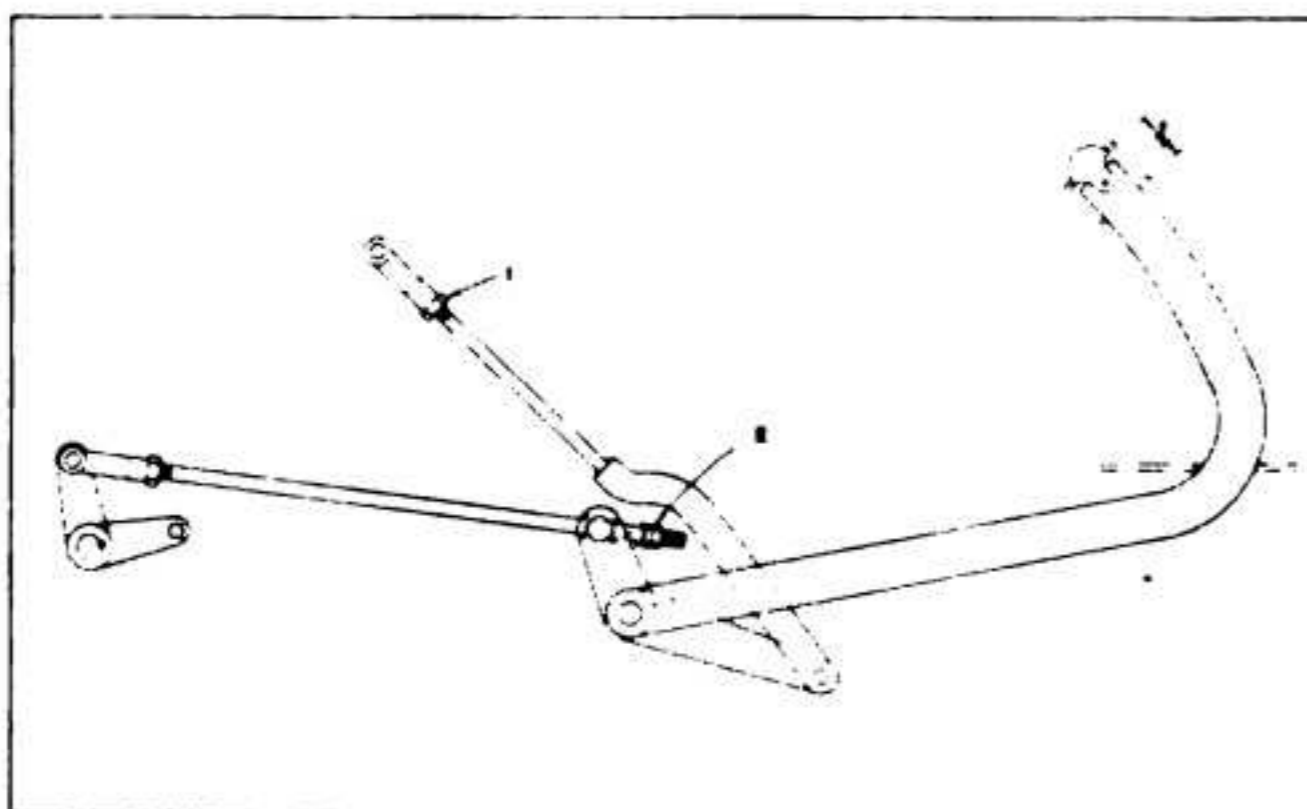
WHEN ATMOSPHERIC TEMPERATURE DROPS TO THE FREEZING POINT OR BELOW, THE ENGINE CRANK-CASE MUST BE DRAINED AND REFILLED WITH OIL OF LIGHTER VISCOSITY, AND THE AIR CLEANER WILL ALSO REQUIRE LIGHTER OIL. REFER TO "OPERATOR'S ENGINE MANUAL".

THE COOLING SYSTEM MUST BE CHECKED FOR LEAKS AND FILLED WITH AN ANTI-FREEZE SOLUTION TO PROTECT IT FROM FREEZING. ALL LEAKING OR DAMAGED HOSE AND GASKETS SHOULD BE REPLACED, AND ALL CONNECTIONS TIGHTENED TO PREVENT LOSS OF ANTI-FREEZE SOLUTION. PROVIDE SIDE COVERS FOR ENGINE AND COVER FOR THE RADIATOR IF THE THERMOSTAT PROVES INADEQUATE TO MAINTAIN OPERATING TEMPERATURE BETWEEN 160 AND 185 DEGREES F. IF THE ENGINE IS OPERATED BELOW THIS TEMPERATURE RANGE, SLUDGE WILL BUILD UP IN THE ENGINE. ENGINE EFFICIENCY WILL DROP AND CONDITIONS MAY DEVELOP TO CAUSE DAMAGE TO THE ENGINE PARTS.

DEPENDABLE STARTING OF A DIESEL ENGINE BY ANY MEANS CAN BE OBTAINED ONLY WITH ADEQUATE CRANKING SPEED. FOR THIS REASON IT IS NECESSARY THAT THE BATTERIES, CABLES, GENERATOR AND GENERATOR REGULATOR BE INSPECTED AND PUT IN FIRST CLASS CONDITION AT THE ONSET OF COLD WEATHER. IF THE GRADER IS TO BE OPERATED IN ARCTIC TEMPERATURES. CONSULT YOUR NEAREST AUTHORIZED DEALER.

RIDING OF CLUTCH AND CLUTCH ADJUSTMENTS

RIDING OF THE CLUTCH WILL CAUSE FREEZING OF THE BEARING ON THE CLUTCH SHAFT AND BURNING OF THE CLUTCH FINGERS. DO NOT RIDE CLUTCH.



THE CLUTCH PEDAL SHOULD HAVE 2" FREE MOVEMENT BEFORE DISENGAGEMENT BEGINS. AT NO TIME SHOULD THIS FREE MOVEMENT BE LESS THAN 1-1/2" MINIMUM. AS THE CLUTCH WEARS THE FREE MOVEMENT DECREASES AND ADJUSTMENT SHOULD BE MADE BEFORE IT HAS BECOME LESS THAN 1-1/2" MINIMUM.

WHEN ADJUSTMENT IS NECESSARY IT CAN BE ACCOMPLISHED BY LOOSENING THE LOCKING NUT AT UPPER END OF CLUTCH ROD AND TURNING YOKE END TO LENGTHEN ROD. AFTER ADJUSTMENT HAS BEEN MADE TIGHTEN LOCKING NUT.

THIS IS THE ONLY ADJUSTMENT NECESSARY TO COMPENSATE FOR CLUTCH WEAR.

TO ADJUST THE CLUTCH BRAKE LOOSEN THE LOCKING NUTS (2) AT SPRING END OF CLUTCH BRAKE PULL ROD AND WHILE HOLDING CLUTCH PEDAL AGAINST THE FLOOR TIGHTEN NUT TO COMPRESS SPRING TO 11/16" TIGHTEN LOCKING NUT SECURELY.

CAUTIONS

EVERY OPERATOR SHOULD BE CAUTIONED AS TO THE FOLLOWING:

- DON'T RIDE THE CLUTCH PEDAL.
- DON'T OPERATE THE GRADER WITH IMPROPER CLUTCH ADJUSTMENT.
- DON'T SLIP THE CLUTCH IN AN EFFORT TO PULL AN OVERLOAD. TO AVOID UNNECESSARY WEAR ON THE CLUTCH, SHIFT TO A LOWER GEAR.
- DON'T IDLE THE ENGINE FOR LONG PERIODS OF TIME.
- DON'T ATTEMPT ANY ADJUSTMENTS YOU ARE NOT SURE OF.

ALWAYS STOP GRADER WHEN CHANGING OVERDRIVE LEVER FROM ONE POSITION TO THE OTHER. BECAUSE GEARS ARE STRAIGHT TOOTHED AND WILL NOT MESH WHEN GRADER IS IN MOTION. FORCING WHEN IN MOTION WILL BEND SHIFTING LEVER, AND GEAR WILL NOT HAVE FULL DEPTH AND WILL SOON BEGIN JUMPING OUT OF GEAR.

KEEP GREASE IN TRANSFER DRIVE TO THE LEVEL OF FILLER PLUG ON L.H. SIDE OF TRANSMISSION CASE. IF GREASE IS NOT UP TO LEVEL, IT WILL NOT BE CARRIED TO TOP SHAFT AND BEARING, WHICH NEED CONSTANT LUBRICATION. FILLER PIPE IS LOCATED BEHIND OPERATOR'S SEAT.

CHECK OIL IN THE INJECTION PUMP EACH MORNING TO SEE THAT IT HAS PLENTY OF OIL - NOT DIESEL FUEL. IF YOU DO NOT HAVE GOOD CLEAN OIL IN THE CASE TO OIL THE PUMP IT WILL CAUSE THE PUMP TO PULL HARD, CUT DOWN POWER AND CAUSE WEAR ON THE TIMING GEARS, AND IN SOME CASES "TEAR" THE TEETH OFF OF THE TIMING GEAR, THROWING THE MOTOR OUT OF TIME. IF THE ABOVE CAUTION IS NOT EXERCISED, CUTTINGS WILL BE NOTICED FIRST ON THE FUEL FILTER CARTRIDGE WHEN GEARS BEGIN TO CUT.

A MANDREL IS INCLUDED WITH EACH SET OF TOOLS. ITS PURPOSE IS TO HOLD THE DRIVING SPROCKET SPLINED HUB IN LINE WITH SPLINED TRANSMISSION AXLE WHENEVER IT IS NECESSARY TO REMOVE EITHER OF THE TANDEM FROM THE GRADER. IT MUST ALWAYS BE USED WHEN REMOVING OR REPLACING TANDEM.

WHEN REMOVING TANDEM FROM AXLE BE SURE THIS MANDREL IS SLIPPED IN THE SPROCKET, AND ALSO FASTENED WITH CAPSCREWS PROVIDED. UNLESS THIS PROCEDURE IS FOLLOWED, THE DRIVING SPROCKET WILL DROP INTO THE TANDEM CASE, AS IT HAS NO OTHER SUPPORT TO HOLD IT IN PLACE.

WHEN AGAIN REPLACING TANDEM BE SURE THE SPROCKET IS STARTED ON THE SPLINED SHAFT UNTIL END OF AXLE IS AGAINST MANDREL. THEN REMOVE CAPSCREWS AND PUSH SPROCKET COMPLETELY ONTO AXLE, THUS FORCING OUT MANDREL.

GRADER, ENGINE, TRANSMISSION SERIAL NUMBERS

ON ALL PARTS ORDERS, AND IN ALL CORRESPONDENCE RELATIVE TO A GRADER, IT IS NECESSARY THAT GRADER, ENGINE, AND TRANSMISSION SERIAL NUMBERS BE GIVEN. THIS WILL PROPERLY IDENTIFY THE PARTICULAR GRADER AND WILL INSURE OBTAINING THE CORRECT REPLACEMENT PARTS FOR IT. THE GRADER SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE DASH PANEL OF THE SUB-CAB. THE ENGINE SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE FLYWHEEL HOUSING. THE TRANSMISSION SERIAL NUMBER IS STAMPED ON THE BOSS LOCATED AT THE BOTTOM OF THE TRANSFER DRIVE.

SPECIFICATION OF LUBRICANTS

REFER TO YOUR OPERATOR'S MANUAL FOR ALL ENGINE LUBRICANTS.

REFER TO YOUR ENGINE OVER AXLE TRANSMISSION MANUAL FOR ALL TRANSMISSION LUBRICANTS.

LUBRICATION IS AN ESSENTIAL PART OF PREVENTIVE MAINTENANCE. CONTROLLING TO A GREAT EXTENT THE USEFUL LIFE OF THE GRADER. DIFFERENT LUBRICANTS ARE NEEDED, AND SOME UNITS IN THE GRADER REQUIRE MORE FREQUENT LUBRICATION THAN OTHERS. IT IS IMPORTANT THAT INSTRUCTIONS IN THE OPERATOR'S MANUAL BE FOLLOWED. PERIODIC LUBRICATION IS THE MOVING PARTS REDUCES TO A MINIMUM THE POSSIBILITY OF MECHANICAL FAILURES.

TO PREVENT MINOR IRREGULARITIES FROM DEVELOPING INTO SERIOUS CONDITIONS THAT MIGHT INVOLVE SHUT-DOWN AND MAJOR REPAIR, OTHER SERVICES ARE RECOMMENDED AT THE SAME INTERVALS AS THE PERIODIC LUBRICATION. THE PURPOSE OF SUCH SERVICES OR INSPECTIONS, WHICH REQUIRE ONLY A FEW MINUTES, IS TO INSURE UNINTERRUPTED OPERATION OF THE GRADER BY REVEALING THE NEED FOR ADJUSTMENT CAUSED BY NORMAL WEAR. THE NEED FOR SOME MINOR ADJUSTMENT, IF NEGLECTED, COULD RESULT IN FAILURE AND SHUT-DOWN.

DIESEL FUEL SPECIFICATIONS

REFER TO YOUR OPERATOR'S ENGINE MANUAL FOR DIESEL FUEL SPECIFICATIONS.

PREPARING NEW GRADER FOR USE

MAKE A COMPLETE INSPECTION OF THE GRADER. BE SURE NO PARTS HAVE BEEN LOST OR DAMAGED WHILE IN TRANSIT OR IN STORAGE.

FILL THE FUEL TANK WITH CORRECT GRADE OF FUEL. REFER TO FUEL OIL SPECIFICATIONS IN YOUR OPERATOR'S ENGINE MANUAL. USE CARE TO PREVENT THE ENTRANCE OF DIRT OR FOREIGN MATERIAL WHILE FILLING THE TANK.

CHECK THE OIL LEVELS IN THE ENGINE CRANKCASE, TRANSMISSION CASE, TRANSFER DRIVE, TANDEM CASES, HYDRAULIC CONTROL TANK, STEERING GEAR HOUSING.

LUBRICATE ALL POINTS WHERE FITTINGS ARE PROVIDED FOR USE OF PRESSURE GUN. BE SURE THE OIL IN THE AIR CLEANER IS AT THE PROPER LEVEL AS INDICATED ON AIR CLEANER.

BE SURE ALL THE TIRES ARE PROPERLY INFLATED.

FILL THE COOLING SYSTEM WITH CLEAN WATER THAT IS FREE FROM LIME OR ALKALI.

OPERATE THE GRADER UNDER LIGHT LOAD FOR THE FIRST 60 HOURS. CHANGE OIL IN THE ENGINE CRANKCASE AFTER THE FIRST 30 HOURS. BRING THE ENGINE TEMPERATURE TO THE NORMAL RANGE OF 160 TO 185 DEGREES F. AS SOON AS POSSIBLE AFTER EACH STARTING PERIOD AND MAINTAIN THIS TEMPERATURE AS CLOSELY AS POSSIBLE. MAINTAINING THE NORMAL OPERATING TEMPERATURE IS ONE OF THE MOST IMPORTANT FACTORS IN "RUNNING IN" A NEW ENGINE. LOW TEMPERATURE IS CONDUCIVE TO THE FORMATION OF GUM OR SLUDGE, BOTH HIGHLY DETRIMENTAL TO AN ENGINE.

SINCE ALL OPERATING PARTS ARE TIGHT AND STIFF WHEN NEW, MAKE FREQUENT INSPECTIONS DURING THE FIRST HOURS OF OPERATION; BE SURE PARTS ARE LUBRICATED PROPERLY AND THAT EXCESSIVE HEATING IS NOT TAKING PLACE. MAKE A COMPLETE INSPECTION OF THE GRADER WHILE SERVICING IT AT THE END OF THE FIRST 10 HOUR PERIOD, TO DETECT LOOSE PARTS. TIGHTEN ALL WHEEL DISC NUTS.

TIGHTEN ALL WHEEL NUTS.

CHECK THE ADJUSTMENT OF THE CLUTCH AND BRAKE PEDALS.

CHECK ADJUSTMENT OF ENGINE AND OVERDRIVE CONTROLS.

CHECK ADJUSTMENT OF VALVES, TIMING AND FUEL INJECTORS.

REFER TO OPERATOR'S ENGINE MANUAL FOR ENGINE ADJUSTMENT PROCEDURE.

THE OPERATOR OF THE GRADER MUST FAMILIARIZE HIMSELF WITH THE VARIOUS CONTROLS AND INSTRUMENTS PROVIDED FOR ITS PROPER OPERATION. ALTHOUGH MANY OF THESE CONTROLS ARE SIMILAR TO THOSE OF OTHER MOTOR GRADERS, THERE ARE IMPORTANT DIFFERENCES, AND IT IS NOT WISE, REGARDLESS OF PREVIOUS EXPERIENCE, TO OPERATE THE MACHINE BEFORE FULLY UNDERSTANDING THE PURPOSE OF EACH CONTROL AND INSTRUMENT.

THE HYDRAULIC POWER CONTROL SYSTEM

HYDRAULIC CONTROL SET

YOUR MOTOR GRADER, WHEN LEAVING THE FACTORY, HAS GULF #561, OR EQUIVALENT, HYDRAULIC OIL IN THE SYSTEM. THE CONTROL VALVE IS A SECTIONAL FOUR-WAY SERIES TYPE WITH BUILT IN RELIEF VALVE. THE RELIEF VALVE IS SET AT THE FACTORY TO LIMIT PRESSURE IN SYSTEM TO 950 LBS. PER SQUARE INCH, WHICH IS SUFFICIENT WORKING PRESSURE FOR NORMAL OPERATION OF THE MACHINE. RELIEF VALVE SETTING SHOULD NOT BE CHANGED WITHOUT A GAUGE TO MEASURE THE PRESSURE, AND IN NO CASE SHOULD THE SETTING EXCEED 1,000 LBS. PER SQUARE INCH. OTHERWISE, DAMAGE TO THE PUMP, SEALS, AND OTHER PARTS OF THE MACHINE WILL OCCUR. THE CONTROL LEVERS OF THIS MASTER VALVE UNIT WILL RETURN TO AND STAY IN NEUTRAL POSITION WHEN RELEASED BY THE OPERATOR. THE HYDRAULIC FLUID IS LOCKED IN EACH CYLINDER, SO THAT IT CANNOT MOVE AS LONG AS THE LEVER REMAINS IN NEUTRAL POSITION. THERE CAN, THEREFORE, BE NO MOVEMENT IN ANY STATION UNLESS THE OPERATOR MOVES A CONTROL LEVER.

WHEN ALL THE LEVERS ARE IN NEUTRAL POSITION, OIL FROM THE PUMP BY-PASSES THROUGH THE VALVE UNIT TO THE SUPPLY TANK UNDER NO PRESSURE. THIS RELIEVES THE PUMP OF ANY WORK EXCEPT WHEN THE OPERATOR WISHES TO OPERATE A STATION BY MOVING THE CONTROL LEVER.

THESE CONTROL VALVES ARE A BALANCED TYPE VALVE. THE SEAL IS CREATED BY EXTREMELY CLOSE FIT. DIRTY OIL, OR OIL WITHOUT LUBRICATING QUALITY, MAY CAUSE RAPID WEAR OF THE SEALING SURFACES AND MATERIALLY SHORTEN THE LIFE OF THE VALVE. WHEN AN INDIVIDUAL SECTION OF THIS VALVE WILL NO LONGER HOLD THE PRESSURE EXERTED ON IT, THE FAULTY SECTION MUST BE REPLACED (SEE VICKERS OIL DATA SHEET FOR CORRECT OIL - PAGE 6.)

THE ONLY PACKING USED IN THIS VALVE IS THE CONVENTIONAL SEAL AT THE VALVE STEM. THIS MAY BE REPLACED IF IT SHOWS A LEAK. THERE IS NO PRESSURE AT THIS POINT IN THE VALVE.

PAINT ON THE VALVE STEM WILL CUT THE SEAL OUT. RUST AND ROUGH SPOTS WILL ALSO CUT THE SEAL OUT. WHEN REPLACING VALVE SECTIONS IT IS IMPORTANT THAT THE TIE BOLTS BE TIGHTENED WITH A TORQUE-WRENCH TO A 1000 POUNDS PER SQUARE INCH. WE RECOMMEND REPLACING ALL GASKETS BETWEEN SECTIONS.

HYDRAULIC PUMP

THE HYDRAULIC PUMP IS VANE TYPE MOUNTED ON THE TRANSMISSION POWER TAKE-OFF UNDER THE SEAT.

HYDRAULIC CYLINDER ROD PACKINGS

THESE PACKINGS ARE SYNTHETIC "V" PACKINGS AND REQUIRE LITTLE IF ANY PACKING GLAND PRESSURE. OPERATOR SHOULD BE CAUTIONED AGAINST RUNNING THE GLAND NUT TOO TIGHT WHEN ATTEMPTING TO STOP A LEAK, AS TOO MUCH GLAND PRESSURE WILL CRUSH THE PACKING AND SPOIL ITS SEALING QUALITY. USUALLY A FRACTION OF A TURN OF ADJUSTMENT IS SUFFICIENT.

"CUNO" HYDRAULIC OIL FILTER

THE HYDRAULIC OIL RESERVOIR IS LOCATED IN THE LEFT END OF THE FUEL TANK. A CUNO FILTER IS USED IN THE SUCTION LINE. THIS IS LOCATED IN THE BOTTOM OF THE RESERVOIR AT REAR. THE CUNO FILTER IS CLEANED BY A COMPLETE REVOLUTION OF THE EXTERNAL HANDLE ON THE ROTATIONAL SHAFT; THIS IS DONE WHILE THE FILTER IS OPERATING, OR WHEN THE PUMP IS RUNNING. THIS OPERATION SHOULD BE PERFORMED PERIODICALLY, DEPENDING UPON THE CONDITION OF THE OIL. THIS FILTER IS LOCATED INSIDE OF A PARTITION, WHICH FORMS A SUMP IN THE HYDRAULIC TANK. PERIODICALLY THE CUNO FILTER SHOULD BE REMOVED FROM THE SUMP TANK AND THE ACCUMULATION OF SLUDGE REMOVED THROUGH THE FILTER HOLE.

IF CONTROLS FAIL TO OPERATE

THE FOLLOWING CAN CAUSE STARVING, OR LACK OF FLUID GOING INTO THE PUMP:

INSUFFICIENT FLUID IN THE RESERVOIR. REMOVE THE FILLER CAP FROM THE RESERVOIR AND MEASURE THE AMOUNT OF FLUID. THE FLUID LEVEL SHOULD BE WITHIN THREE INCHES OF THE TOP OF THE RESERVOIR; IF LESS THAN THAT AMOUNT, ADD ENOUGH TO BRING UP TO THAT LEVEL.

AIR IN THE LINE. THIS CAN CAUSE THE FLOW OF FLUID TO BE CHECKED TO SUCH AN EXTENT AS TO STARVE THE PUMP. IF THIS IS THE CASE, THE MOTION SECURED FROM THE STATION WILL BE JERKY, AND THE WHINE FROM THE PUMP IRREGULAR. TO CORRECT THIS, REMOVE THE FILLER CAP FROM THE HYDRAULIC RESERVOIR AND OPERATE ALL STATIONS BOTH WAYS UNTIL THE WHINE CEASES. AFTER THE AIR HAS BEEN REMOVED FROM THE LINE, CHECK THE FLUID LEVEL IN THE RESERVOIR TO SEE THAT IT IS WITHIN THREE INCHES OF THE TOP. IF BELOW THAT LEVEL, ADD FLUID.

CLOGGED FILTER. FILTER SHOULD BE CLEANED AS EXPLAINED UNDER "CUNO FILTER". IF THIS FILTER BECOMES CLOGGED IT WILL RESTRICT THE FLOW OF OIL TO PUMP.

VICKERS Inc.

HYDRAULIC OIL RECOMMENDATIONS FOR VICKERS HYDRAULIC PUMPS AND CONTROLS

HYDRAULIC OIL must have good lubricating qualities as well as certain other physical and chemical characteristics. The properties of any hydraulic oil are dependent on the type of crude from which it is made, and the method of manufacture. Consequently, a wide variation in quality is possible and the purchaser must rely to a great extent on the oil manufacturer. Good oils are the most economical. Specifications can be set up which will indicate, to a limited degree, the characteristics essential in a good hydraulic oil. These are listed herein and should be checked with the oil manufacturer prior to the use of his product.

Oil in the hydraulic system lubricates, as well as transmits and controls power, and is required to stand up under severe pressure and temperature changes. All precautions should be taken, therefore, to keep the oil clean and free of chips, grit, water, sludge, coolants, cutting oils, deteriorated paint, sealing compounds, etc. A properly installed hydraulic system should provide a means to protect the hydraulic oil. Periodic inspection, flushing and changing hydraulic oil, are also recommended. Operating conditions, protection from dirt, etc., are determining factors. Always use good quality, clean hydraulic oil. Care in installation and maintenance are also essential.

TYPE

High quality lubricating oil especially manufactured for service in hydraulic systems is preferred. If oil of this type is not available a turbine type oil is usually satisfactory when within the recommended specification limits. Fluids such as water, crude oil, soluble oils, etc., should never be used.

VISCOSITY

Viscosity is the measure of fluidity. The oil must have sufficient body to provide adequate sealing effect between working parts of pumps, valving, cylinders, etc., but not enough to cause pump intake cavitation, sluggish valve action, or in extreme cases, resistance to flow. Viscosity recommendations must at best be a compromise, which takes into consideration the working temperature range, the type of hydraulic equipment used and the class of service. Refer to table of oil viscosity recommendations.

VISCOSITY INDEX

The viscosity index is a measure of the rate at which temperature changes cause a change in oil viscosity. It is very desirable that the oil viscosity remain as nearly constant as possible under the wide range of temperature conditions encountered in operating mobile and construction machinery. The viscosity index (V.I.) of hydraulic oil should be high, not less than 78 for this type of service. A high viscosity index, however, should not be obtained at a sacrifice of other characteristics.

DEMULSIBILITY

Temperature changes may cause condensation of moisture inside the oil tank. Hydraulic oil should therefore have good demulsibility, or the property of ready separation from water, and should not lose this characteristic in continued service.

POUR POINT

The pour point indicates the lowest temperature at which the oil is fluid, and is a consideration for extreme starting conditions when operating mobile and construction machinery under a wide range of temperature variations. Hydraulic oil should pour freely and have a viscosity of not more than 4000 S.S.U. at the lowest starting temperature.

NEUTRALIZATION NUMBERS

The neutralization number is a measure of the acidity of the oil. Good oil will have a low neutralization number. In addition, good oil resists an increase in the neutralization number. Because different kinds of acids may be present, it is not possible to specify a safe maximum value of the neutralization number. Should any doubt exist, consult your oil supplier.

ADDITIVES

Research has developed a number of addition agents which materially improve various characteristics of hydraulic oils. They may be compounded with a view toward increasing chemical stability, improving lubricating properties, or inhibiting corrosion.

Proper use of addition agents requires specialized knowledge and they should be incorporated by the oil manufacturer only, as serious trouble may otherwise result.

OIL VISCOSITY RECOMMENDATIONS FOR VICKERS EQUIPMENT USED ON MOBILE AND CONSTRUCTION MACHINERY

(Operating in seasonal temperatures 120° F to -25° F.)

Hot Summer or Tropical (120° F. and above)	Summer (60° F. to 120° F.)	Winter (-5° F. to 65° F.)	Very Cold Winter (-25° F. to 0° F.)
225-425 S.S.U. @ 100° F.	150-225 S.S.U. @ 100° F.	90-100 S.S.U. @ 100° F.	70-80 S.S.U. @ 100° F.
(S.A.E. #20-30)	(S.A.E. #10-10W)	(*)	(**)

FOR EMERGENCY ONLY

If oil with viscosity specifications recommended for winter is not available, use S.A.E. #10 or 10W and dilute with kerosene.

* 25% kerosene mixture

** 50% kerosene mixture

Data above pertains to average conditions. Abnormal speed, pressure and temperature conditions require special engineering consideration.

GENERAL OPERATION OF GARRISON HYDRAULIC POWERED STEERING BOOSTER

THE MANUAL EFFORT OF THE OPERATOR TURNING THE STEERING WHEEL MOVES THE PITMAN ARM OF THE STEERING WORM IN AN ARC FORWARD OR REVERSE DEPENDING ON THE DIRECTION OF STEERING. THE 'GARRISON' VALVE IS INSTALLED AS AN INTEGRAL PART OF THE DRAG-LINK. THE FORWARD OR REVERSE MOVEMENT OF THE 'PITMAN' ARM AGAINST THE DRAG-LINK APPLIES EFFORT AGAINST THE VALVE BALL SOCKET WHICH IS DIRECTLY CONNECTED TO THE VALVE PISTON. THIS FORWARD OR REVERSE MOVEMENT OF THE PISTON PERMITS OIL TO FLOW TO THE POWER CYLINDER THUS ADDING HYDRAULIC ASSISTANCE TO THE MANUAL STEERING EFFORT. UNTIL THE PISTON IS DISPLACED FROM CENTER BY SUFFICIENT MANUAL EFFORT THE STEERING FEEL IS THE SAME AS THOUGH NO POWER ASSISTANCE WAS EMPLOYED.

WITH THE PISTON IN ITS NEUTRAL OR CENTER POSITION ALL PORTS ARE OPEN AND CONNECTED PERMITTING CONTINUOUS OIL FLOW AND SELF BLEEDING OF THE SYSTEM. IF THE PISTON IS MOVED SLIGHTLY FROM ITS CENTER POSITION, THE BY PASS THROUGH THE VALVE IS CLOSED AND THE OIL DIVERTED TO THE CYLINDER DIRECTLY. THIS OPERATION IS REPEATED IN THE OPPOSITE DIRECTION FOR THE REVERSE CYLINDER ACTION.

FIELD ADJUSTMENT

SOME OF THE OBJECTIONABLE CONDITIONS THAT MAY SHOW UP ON CERTAIN INSTALLATIONS ARE AS FOLLOWS:

- (A) VEHICLE HARD TO STEER IN EITHER OR BOTH DIRECTIONS.
- (B) WHEEL JERKS OR SHIMMYS WHEN TURNING, WITH THE VEHICLE IN MOTION OR STANDING.
- (C) A TENDENCY FOR THE VALVE TO BIND OR STICK WHICH CAN BE FELT THROUGH THE STEERING WHEEL.

HARD STEERING IN BOTH DIRECTIONS, IF NOT DUE TO A LOW OIL SUPPLY OR TOO HEAVY AN OIL IN THE SYSTEM, MAY BE CAUSED FROM HAVING THE DRAG-LINK SLEEVE PLUG NO. 15 SCREWED IN TOO SNUG AGAINST THE BALL STUD. THIS WOULD IN EFFECT DECREASE THE AMOUNT OF VALVE TRAVEL BELOW THE $1/32$ " AS ADJUSTED AT THE FACTORY WHILE AT THE SAME TIME INCREASING THE SPRING TENSION TO BE OVERCOME BEFORE THE PISTON CAN BE MOVED.

HARD STEERING IN ONLY ONE DIRECTION MAY BE CAUSED BY THE PISTON LANDS NOT BEING CENTERED WITH THE PORTS IN THE SLEEVE OR BY AN UNBALANCED PRESSURE DROP CONDITION IN THE OVERALL INSTALLATION. THIS CAN BE OVERCOME BY LOOSENING THE NUT - NO. 7 - AND ADJUSTING THE POSITION OF THE PISTON STEM - NO. 23 - WITH A SCREW DRIVER. EITHER MOVING THE CENTER POSITION OF THE PISTON FORWARD OR TO THE REAR AS REQUIRED. AFTER THE JAM NUT IS AGAIN TIGHTENED THE PISTON STROKE SHOULD BE CHECKED TO MAKE CERTAIN THE VALVE DOES NOT BIND OR STICK IN ITS NEW POSITION.

WHEEL SHIMMY MAY BE CAUSED BY AN INSUFFICIENT CENTERING SPRING TENSION TO SUIT THE PARTICULAR APPLICATION. PERMITTING ROAD SHOCK OR THE SPRING EFFECT OF THE TIRES WHEN THE STEERING GEAR IS TURNED, TO REACT AGAINST THE PISTON. THIS MAY REQUIRE THAT THE PLUG NO. 15 SHOULD BE SCREWED IN UNTIL THE SPRING TENSION IS SUFFICIENT TO STABILIZE THE VALVE.

IF THE VALVE TRAVEL IS REDUCED TOO MUCH THE BY-PASS THROUGH THE VALVE WILL NOT CLOSE AND INSUFFICIENT POWER WILL BE DELIVERED TO THE CYLINDER.

BENDIX BRAKES

General Adjustment Instructions

HYDRAULICALLY CONTROLLED BENDIX DUO-SERVO BRAKES UTILIZE A STANDARD HYDRAULIC BRAKE ACTUATING SYSTEM HAVING A COMPENSATING TYPE MASTER CYLINDER, AND A BRAKE ACTUATING CYLINDER AT EACH WHEEL.

DEPRESSING THE BRAKE PEDAL MOVES THE MASTER CYLINDER PISTON **B** THROUGH COMPRESSION ROD **A**, DISPLACING THE BRAKE FLUID IN THE MASTER CYLINDER AHEAD OF CUP **D** THROUGH OUTLET ORIFICE **J** AND THE TUBING CONNECTIONS INTO THE WHEEL CYLINDERS. THEREBY MOVING THE BRAKE SHOES INTO CONTACT WITH THE DRUMS.

WHEN PRESSURE AGAINST THE FOOT PEDAL IS RELEASED, THE RETURN SPRINGS ON THE BRAKE SHOES RETRACT AND RETURN THE WHEEL CYLINDER PISTONS TO THEIR NORMAL OR "OFF" POSITION, THUS FORCING THE BRAKE FLUID BACK INTO THE MASTER CYLINDER.

- FIGURE 1
- A.-PISTON COMPRESSION ROD
 - B.-MASTER CYLINDER PISTON
 - C.-COMPENSATING PORT
 - D.-MASTER CYLINDER PACKING CUP
 - E.-MASTER CYLINDER SECONDARY CUP
 - G.-MASTER CYLINDER BOOT
 - J.-OUTLET ORIFICE
 - R.-RESERVOIR BY-PASS PORT

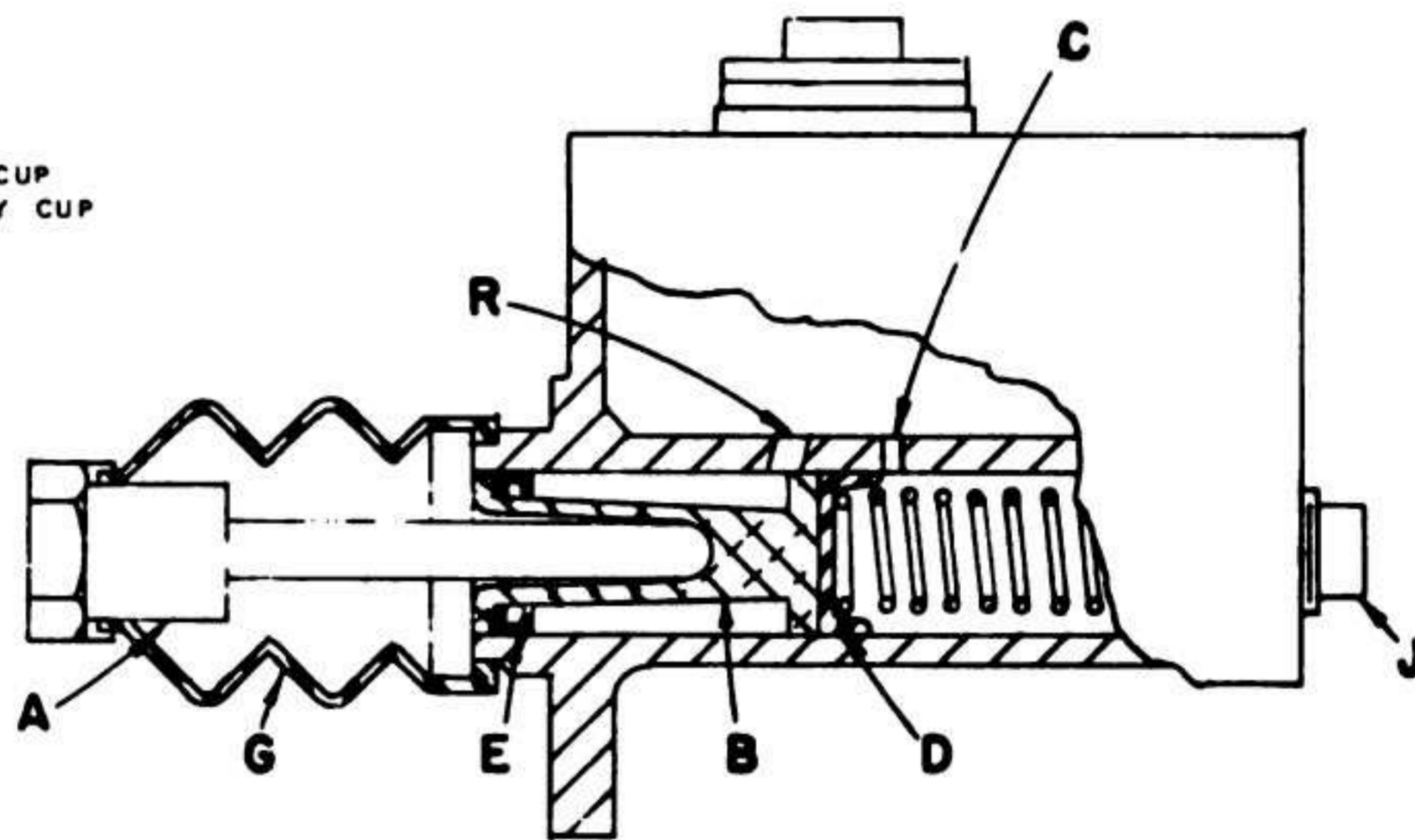


Fig. 1. Compensating Type Master Cylinder

THE COMPENSATING TYPE MASTER CYLINDER PERFORMS TWO FUNCTIONS: (1) IT MAINTAINS A CONSTANT VOLUME OF FLUID IN THE SYSTEM AT ALL TIMES REGARDLESS OF EXPANSION (HEAT) OR CONTRACTION (COLD). (2) IT PERMITS ADDITIONAL FLUID TO ENTER THE SYSTEM TO COUNTERBALANCE ANY LOSS DUE TO GRAVITY SEEPAGE. PISTON (B) AND CUP (D) RETURN TO RELEASE POSITION MUCH FASTER THAN THE FLUID RETURNS TO THE MASTER CYLINDER THROUGH FITTINGS (J).

A MOMENTARY VACUUM IS CREATED IN THE CYLINDER BARREL AND ADDITIONAL FLUID IS DRAWN INTO THE SYSTEM FROM THE SUPPLY RESERVOIR THROUGH THE DRILLED HOLES IN PISTON (B) AND PAST THE LIP OF CUP (D). AS THE FLUID RETURNS FROM THE WHEEL CYLINDERS ANY EXCESS OF FLUID IN THE SYSTEM IS BY-PASSED THROUGH PORT (C) INTO THE RESERVOIR. THUS THE CYLINDER IS ALWAYS FULL OF FLUID FOR THE NEXT BRAKE APPLICATION.

PEDAL ADJUSTMENT. PEDAL ADJUSTMENT IS MADE AS FOLLOWS: IT IS IMPORTANT THAT ROD (A) BE ADJUSTED FOR CLEARANCE WHERE IT SEATS IN PISTON (B) THERE SHOULD BE $3/4$ " TO 1" FREE MOVEMENT OF BRAKE PEDAL PAD BEFORE THE PRESSURE STROKE STARTS.

SHOULD ROD (A) BE ADJUSTED TIGHTLY AGAINST PISTON (B), PORT HOLD (C) MAY BE BLOCKED BY CUP (D). AND THE COMPENSATING ACTION OF THE MASTER CYLINDER WILL BE DESTROYED. CUP (D) MUST BE CLEAR OF PORT (C) WHEN PISTON (B) IS IN ITS OFF OR RETURNED POSITION THIS CAN BE DETERMINED BY ASSURING THAT THERE IS A SLIGHT AMOUNT OF FREE MOVEMENT OF THE PEDAL BEFORE THE PISTON STARTS TO MOVE.

SECONDARY CUP (E) PREVENTS FLUID FROM LEAKING OUT OF MASTER CYLINDER INTO BOOT (G).

BLEEDING HYDRAULIC LINES: WHENEVER A TUBING LINE HAS BEEN DISCONNECTED AT THE MASTER CYLINDER IT IS NECESSARY TO "BLEED" THE HYDRAULIC SYSTEM AT ALL WHEELS TO EXPEL ALL AIR. WHENEVER A LINE IS DISCONNECTED FROM ANY INDIVIDUAL WHEEL, THAT WHEEL CYLINDER ONLY MUST BE BLED.

FILL THE MASTER CYLINDER SUPPLY TANK WITH GENUINE "LOCKHEED" OR "DELCO" BRAKE FLUID BEFORE BEGINNING THIS OPERATION. AND KEEP TANK AT LEAST HALF FULL OF FLUID AT ALL TIMES.

REMOVE CAP SCREW FROM END OF BLEEDER CONNECTION AND SCREW IN STANDARD BLEEDER DRAIN TUBE. ALLOW TUBE TO HANG IN CLEAN CONTAINER, SUCH AS A PINT MASON JAR. UNSCREW THE BLEEDER CONNECTION THREE-QUARTERS OF A TURN AND DEPRESS FOOT PEDAL SLOWLY BY HAND, ALLOWING RETURN SPRING TO RETURN PEDAL **SLOWLY** TO "OFF" POSITION. THIS PRODUCES A PUMPING ACTION WHICH FORCES FLUID THROUGH TUBING AND OUT AT WHEEL CYLINDER, CARRYING WITH IT ANY AIR THAT MAY BE PRESENT.

WATCH FLOW OF FLUID FROM HOSE. THE END OF WHICH SHOULD BE KEPT BELOW SURFACE OF FLUID; WHEN ALL AIR BUBBLES CEASE TO APPEAR AND WHEN FLUID STREAM IS A SOLID MASS, CLOSE BLEEDER CONNECTION.

FLUID WITHDRAWN IN "BLEEDING" OPERATION SHOULD NOT BE USED AGAIN. FLUID SHOULD BE REPLENISHED IN SUPPLY TANK AFTER EACH CYLINDER IS BLED. SHOULD SUPPLY TANK BE DRAINED DURING BLEEDING OPERATION, AIR WILL ENTER THE SYSTEM AND "RE-BLEEDING" WILL THEN BE NECESSARY. WHEN BLEEDING IS COMPLETED, SUPPLY TANK MUST BE REFILLED.

TO PREVENT BRAKE DRAG IT IS NECESSARY THAT PORT C BE OPEN WHEN THE BRAKE PEDAL IS IN RELEASE POSITION. (SEE PEDAL ADJUSTMENT ABOVE.)

MINOR ADJUSTMENTS

(To compensate for Lining Wear Only)

BRAKE DRUMS SHOULD BE APPROXIMATELY ROOM TEMPERATURE WHEN MAKING ADJUSTMENTS. IF BRAKES ARE ADJUSTED WHEN DRUMS ARE HOT AND EXPANDED. THE SHOES MAY DRAG WHEN THE DRUMS COOL AND CONTRACT.

1. JACK UP REAR END OF GRADER.
2. CHECK PEDAL ADJUSTMENT TO MAKE SURE PEDAL PAD TRAVELS APPROXIMATELY $3/4$ " TO 1" BEFORE MASTER CYLINDER PISTON STARTS TO MOVE. (SEE HYDRAULIC SECTION.)
LUBRICATE PEDAL LINKAGE.

REPEAT THE FOLLOWING OPERATIONS AT EACH WHEEL.

3. CHECK ANCHOR PIN NUTS WITH A 16-INCH WRENCH TO MAKE SURE THEY ARE TIGHT. IF AN ANCHOR PIN NUT IS FOUND LOOSE, RE-SET ANCHOR PIN ACCORDING TO INSTRUCTIONS UNDER "MAJOR ADJUSTMENT".
4. REMOVE ADJUSTING HOLE COVER FROM BACKING PLATE. EXPAND BRAKE SHOES BY TURNING ADJUSTING SCREW, MOVING HANDLE OF SCREW DRIVER OR ADJUSTING TOOL TOWARD THE AXLE AS SHOWN IN FIG. 2 UNTIL BRAKE SHOES ARE AGAINST DRUMS.
5. BACK OFF ADJUSTING SCREW 3 NOTCHES (MOVING HANDLE OF TOOL AWAY FROM AXLE).
NOTE: IF THERE IS INSUFFICIENT PEDAL RESERVE AFTER COMPLETING A MINOR ADJUSTMENT AT ALL WHEELS, ADJUST SHOE CENTRALIZER AT ALL WHEELS AS FOLLOWS: LOOSEN SHOE CENTRALIZER MOUNTING BOLT NUTS UNTIL THEY ARE JUST FREE OF LOCKWASHER TENSION SO THAT THE CENTRALIZER, FIG. 3, CAN FLOAT FREELY. EXPAND THE ADJUSTING SCREWS UNTIL THE BRAKE SHOES ARE TIGHT AGAINST THE DRUMS. TAP BACKING PLATE NEAR CENTRALIZER WITH LIGHT HAMMER TO INSURE CENTRALIZER TAKING CORRECT POSITION. THEN SECURELY TIGHTEN THE CENTRALIZER MOUNTING BOLT NUTS. RELEASE ADJUSTING SCREW 3 NOTCHES.
6. RE-INSTALL ADJUSTING HOLE COVERS IN BACKING PLATE AND LOWER GRADER.

MAJOR ADJUSTMENTS

THE FOLLOWING ADJUSTMENTS ARE NECESSARY WHEN MINOR ADJUSTMENT FAILS TO GIVE SATISFACTORY RESULTS OR WHEN REPLACING SHOE AND LINING ASSEMBLIES.

1. JACK UP GRADER AND REMOVE HUB AND DRUM ASSEMBLIES FOR INSPECTION OF DRUMS, LININGS, AND BRAKE OPERATING MECHANISM.
2. CHECK LININGS FOR WEAR AND LOOSE RIVETS. REMOVE ANY METAL OR OTHER FOREIGN PARTICLES WHICH MAY BE IMBEDDED IN THE SURFACE OF THE LINING. LININGS SOAKED WITH LUBRICANT OR HYDRAULIC BRAKE FLUID MUST BE REPLACED.

LUBRICANT LEAKAGE AT FRONT OR REAR WHEEL BEARING MUST BE CORRECTED BY REPLACING LUBRICANT SEALS. ANY BRAKE FLUID LEAKS AT THE WHEEL CYLINDERS MUST BE CORRECTED BY REPLACING OR RECONDITIONING THE CYLINDERS.

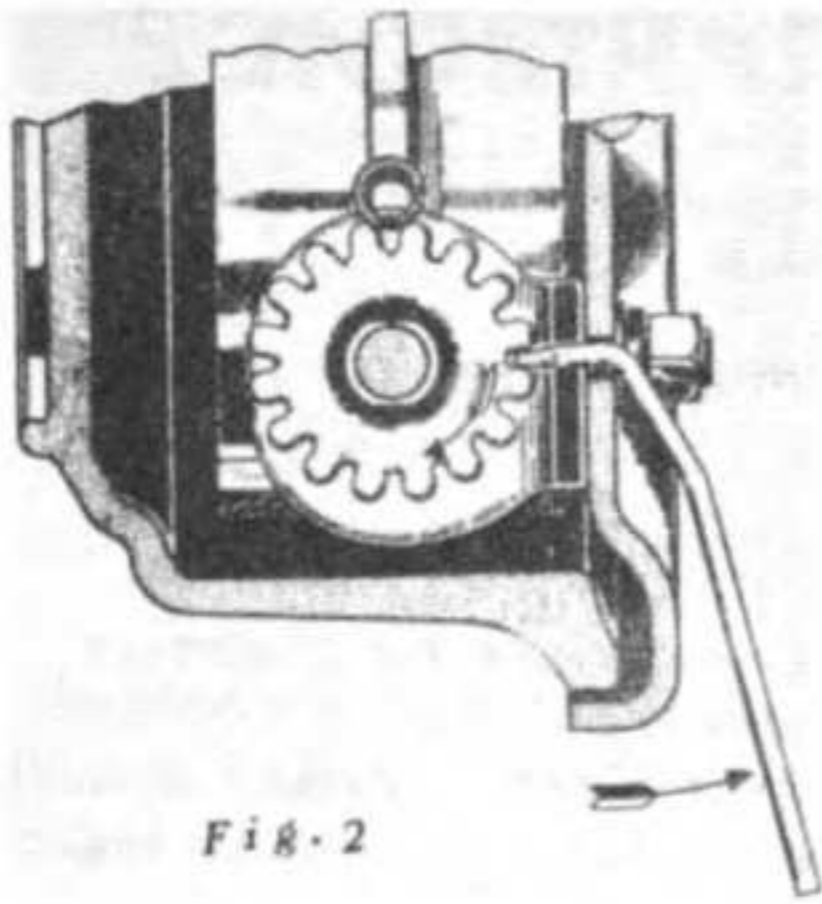


Fig. 2

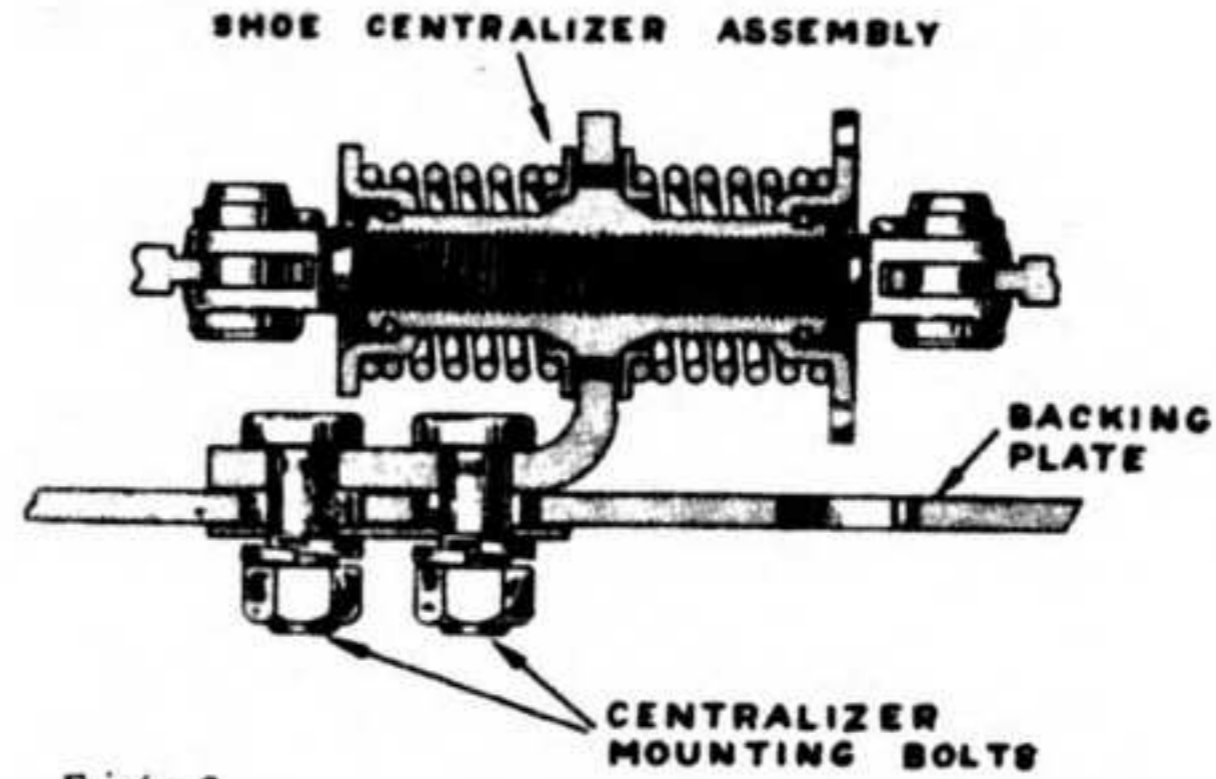


Fig. 3

IF SHOES ARE TO BE REMOVED, USE A CLAMP TO PREVENT THE PISTONS BEING FORCED OUT OF THE WHEEL CYLINDERS, BY AN ACCIDENTAL MOVEMENT OF THE BRAKE PEDAL. PISTON EJECTION WOULD CAUSE LOSS OF FLUID AND ALLOW AIR TO ENTER THE SYSTEM, NECESSITATING BLEEDING THE SYSTEM TO REMOVE ALL AIR.

3. INSPECT EACH DRUM BRAKING SURFACE AND REBORE OR REPLACE DRUM IF NECESSARY. IF DRUMS ARE REBORED REMOVE ONLY SUFFICIENT METAL TO PROVIDE A SMOOTH SURFACE. IF EXCESS MATERIAL IS REMOVED, THE DRUM MAY BE WEAKENED TO THE EXTENT THAT ERRATIC BRAKING AND RAPID LINING WEAR WILL RESULT.
4. THOROUGHLY CLEAN SHOES AND BRAKE BACKING PLATES WITH A STEEL BRUSH. ALL BRAKE FRICTIONAL POINTS SHOULD BE THOROUGHLY CLEANED, AND A THIN COAT OF "BENDIX BRAKE LUBRICANT" SHOULD BE APPLIED.
5. INSPECT BOLTS THAT HOLD BACKING PLATES TO AXLE HOUSING, AND TIGHTEN IF FOUND LOOSE.

NOTE: THE NUT END OF EACH ANCHOR PIN IS MARKED WITH AN ARROW TO INDICATE THE HIGH SIDE OF THE ECCENTRIC PART OF ANCHOR, WHEN ASSEMBLING NEW SHOES, SET ANCHOR PINS WITH ARROWS POINTING TOWARD EACH OTHER.

6. WHEN CONNECTING THE CENTRALIZER MECHANISM TO A PAIR OF RELINED SHOES, BE SURE THAT THE ADJUSTING SCREW NOTCHED WHEEL IS AT THE RIGHT-HAND SHOE WHEN THE SHOES ARE ASSEMBLED TO EACH BRAKE BACKING PLATE. THIS APPLIES TO ALL BRAKES HAVING THE CENTRALIZER MECHANISM. RELEASE THE ADJUSTING SCREW SEVERAL NOTCHES TO PROVIDE CLEARANCE FOR DRUM INSTALLATION.
7. BEFORE RE-INSTALLING BRAKE DRUM, REMOVE EXCESS GREASE FROM INSIDE TO PREVENT GREASE LEAKAGE ONTO THE BRAKE ASSEMBLY AND LINING. CLEAN DRUM BRAKING SURFACE WITH CLEAN ALCOHOL, CARBON TETRACHLORIDE, OR LACQUER THINNER.
8. AFTER INSTALLING BRAKE DRUM ASSEMBLIES, REPEAT THE FOLLOWING OPERATIONS AT EACH WHEEL:
9. REMOVE BRAKE ADJUSTING HOLE COVER IN BACKING PLATE AND FEELER GAUGE HOLE COVER IN BRAKE DRUM OR IN BACKING PLATE RIM.

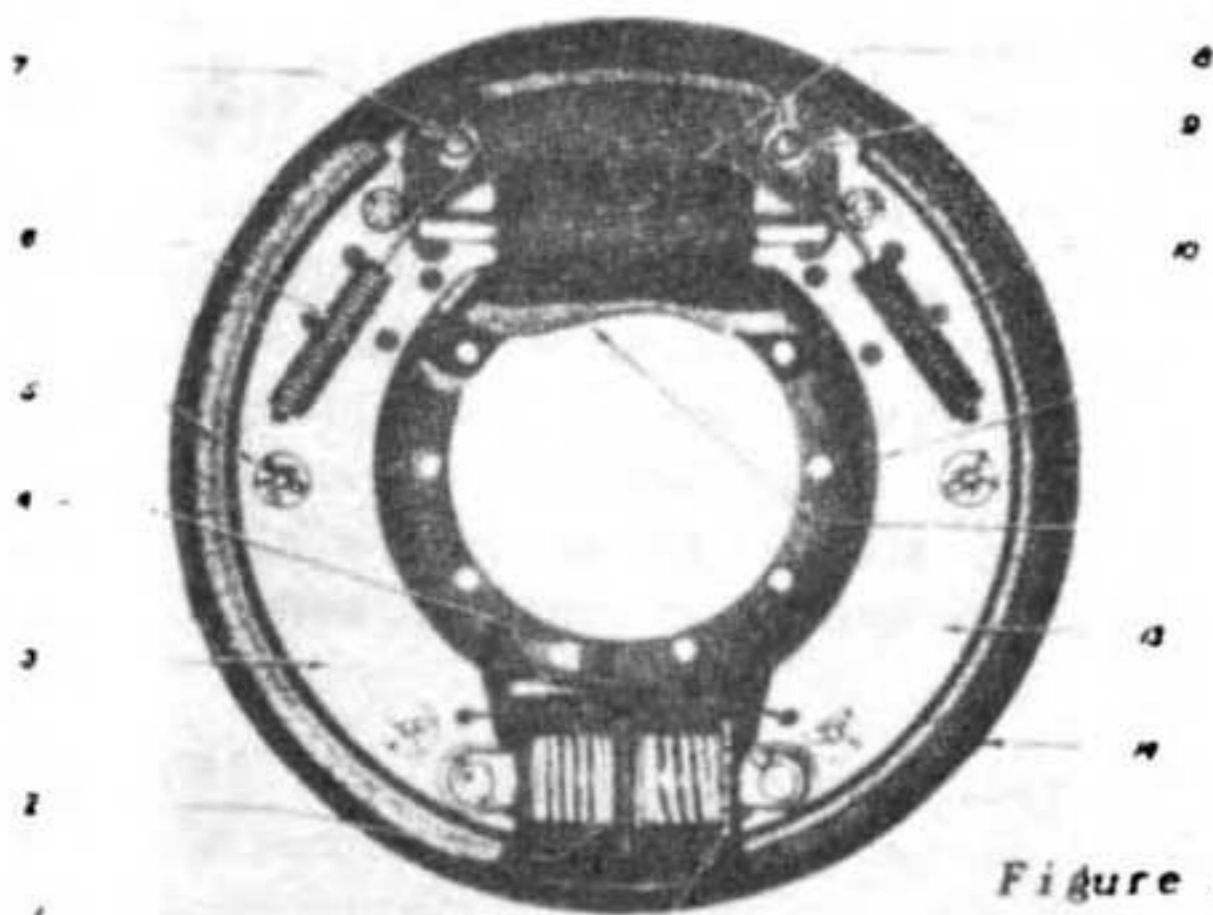


Figure 4 Left Rear Brake

1. ADJUSTING SCREW
2. SHOE CENTRALIZER ASSEMBLY
3. PRIMARY BRAKE SHOE
4. ADJUSTING SCREW SPRING
5. BRAKE SHOE HOLD DOWN SPRING
6. PRIMARY SHOE RETURN SPRING
7. PRIMARY SHOE ANCHOR PIN
8. HYDRAULIC WHEEL CYLINDER
9. SECONDARY SHOE ANCHOR SPRING
10. SECONDARY SHOE RETURN SPRING
13. SECONDARY BRAKE SHOE
14. BACKING PLATE

10. BE SURE THAT THE SHOE CENTRALIZER MOUNTING BOLT NUTS, FIG. 3, ARE JUST FREE OF LOCKWASHER TENSION SO THAT THE CENTRALIZER CAN FLOAT FREELY.
11. TURN ADJUSTING SCREW (MOVING HANDLE OF TOOL OR SCREW DRIVER TOWARD THE AXLE AS SHOWN IN FIG. 2 UNTIL BRAKE SHOES ARE EXPANDED TIGHTLY AGAINST THE DRUM,
12. THEN TAP BACKING PLATE NEAR CENTRALIZER WITH A LIGHT HAMMER TO INSURE CENTRALIZER (FIG.3) TAKING CORRECT POSITION BETWEEN SHOE ENDS.
13. TIGHTEN CENTRALIZER MOUNTING BOLT NUTS.
14. BACK OFF ADJUSTING SCREW (MOVING HANDLE OF TOOL AWAY FROM THE AXLE) AND CHECK THE SECONDARY SHOE LINING TO DRUM CLEARANCES AT BOTH ENDS OF THE LINING. A CLEARANCE OF $.008''$ AT THE TOP END AND CLEARANCE OF $.014''$ AT THE ADJUSTING SCREW END OF EACH SHOE INDICATES CORRECT SHOE POSITION. IF THESE CLEARANCES (WITHIN $.003''$) ARE NOT FOUND, IT IS NECESSARY TO CORRECT THE SHOE POSITION BY ADJUSTING THE ANCHOR PIN.
15. TO ADJUST THE ANCHOR PINS, LOOSEN EACH ANCHOR NUT ABOUT ONE TURN. TURNING THE ARROW POINT (ON NUT END OF ANCHOR) AWAY FROM THE CENTER OF AXLES MOVES THE ANCHOR END OF SHOE LINING TOWARDS THE DRUM AND DECREASES LINING TO DRUM CLEARANCES. TO INCREASE CLEARANCES, TURN ANCHOR IN OPPOSITE DIRECTION.
16. EACH SHOE IS ADJUSTED INDEPENDENT OF THE OTHER.
17. IT WILL BE NECESSARY TO READJUST THE ADJUSTING SCREW EACH TIME THE ANCHOR PIN IS MOVED TO OBTAIN THE PROPER CLEARANCE AT EACH END OF THE SHOE.
18. NOW REPEAT THE SHOE POSITIONING OPERATIONS AT THE PRIMARY SHOE.
19. TIGHTEN ANCHOR NUTS SECURELY WITH A 16- INCH WRENCH WHILE CAREFULLY HOLDING THE ECCENTRIC ANCHOR PIN WITH ANOTHER WRENCH TO PREVENT IT FROM TURNING DURING THE TIGHTENING OPERATION. AFTER TIGHTENING THE NUTS, RECHECK THE CLEARANCE AT EACH END OF BOTH SHOES TO MAKE CERTAIN THE ANCHOR PINS HAVE NOT MOVED
20. RE-SET SHOE CENTRALIZER BY REPEATING OPERATIONS DESCRIBED IN PARAGRAPHS 10, 11, 12 AND 13. BACK OFF ADJUSTING SCREW 3 NOTCHES AFTER TIGHTENING CENTRALIZER BOLT.
21. REPLACE ADJUSTING SCREW HOLE COVERS IN BACKING PLATES AND FEELER GAUGE HOLE COVERS IN DRUMS. LOWER GRADER.
22. ROAD TEST GRADER

PRECAUTIONS For Hydraulically Actuated Brake Systems

USE ONLY GENUINE LOCKHEED OR DELCO BRAKE FLUID. SUBSTITUTES MAY DO MUCH DAMAGE TO THE SYSTEM.

USE ONLY ALCOHOL TO CLEAN RUBBER PARTS OR INSIDE OF CYLINDERS. KEROSENE OR GASOLINE WILL CAUSE TROUBLE.

DO NOT ALLOW GREASE, OIL, PAINT, OR BRAKE FLUID TO COME IN CONTACT WITH BRAKE LINING.

DO NOT ALLOW THE SUPPLY TANK TO BECOME LESS THAN HALF FULL OF BRAKE FLUID.

DO NOT ATTEMPT TO RELINE BRAKES - USE ONLY GENUINE [®]BENDIX REPLACEMENT SHOES[®].

SUNDSTRAND MULTIPLE SECTION VALVES

(Hydraulic Control Valve furnished on this Grader is the 4-Way Sectional Multiple Series Valve with Spring Centered Sections)

Service Information

GENERAL DESCRIPTION

SUNDSTRAND MULTIPLE SECTION VALVES or STACK VALVES are made to provide directional control of oil for hydraulically actuated cylinders and motors. They are usually constructed of the series type so that one or a number of such cylinders or motors may be operated at the same time from one pump or oil pressure source regardless of load on the moving part, as long as the total load on all moving parts does not exceed Relief Valve setting. This is accomplished by directing the return oil from an actuated cylinder or motor to the pressure port of the next valve section in the series. In this manner, any other section of the valve has an oil supply available for work. More than one cylinder or motor will operate at the same time, and their working pressures do not have to be the same. These valves are made up of individual sections for control of each actuated cylinder or motor and may be built up to ten sections in a single assembly.

4-WAY SECTIONS refer to sections having an inlet port, an outlet port and two cylinder ports. These are the sections most commonly used in a Multiple Section Series Valve and are designed to be used for *double-acting* hydraulic cylinders and for reversible hydraulic motors when it is desired to operate several such cylinders or motors at one time as described above. 4-Way Sections may be either Detent-Positioned or Spring Centered.

A DETENT POSITIONED SECTION will remain in the position the operator places it until it is again moved by the operator to another position.

A SPRING-CENTERED SECTION returns to the neutral position as soon as the operator releases the control lever. In the neutral position the actuated cylinder or motor remains stationary until the operator again moves the valve stem from the neutral position with his control lever. The two cylinder ports serve to admit or return oil from either end of a double-acting cylinder or to give both directions of rotation to a hydraulic motor.

3-WAY SECTIONS may also be incorporated in a Multiple Section Valve. A 3-Way Section has an inlet port, an outlet port and one cylinder port and may be of

the Series or Parallel Type. It is used for a single-acting cylinder where the actuated cylinder is returned by gravity, or for a motor where only one direction of rotation is necessary.

SERIES TYPE 3-WAY SECTIONS may be placed anywhere in the Multiple Section Valve provided that when they are actuated it is not necessary to actuate sections later in the series at the same time. This is because oil supply is available to sections following the series type 3-Way sections only when the 3-Way sections are not positioned to actuate their cylinders or motors. Therefore, a series 3-Way section may be used where it is not desired to operate sections following in the series until the 3-Way has been returned to neutral.

THE PARALLEL TYPE 3-WAY SECTION is used together with one or more similar sections for the purpose of simultaneously actuating two or more *single-acting* cylinders. Their inlet ports are joined to a common pressure source to accomplish this. Parallel type 3-Way sections must be placed last in the assembly since it is necessary that the supply oil from the common pressure source be blocked at the last section in order to supply oil under pressure to the cylinders or motors to be actuated when stems are moved to proper position.

SUNDSTRAND MULTIPLE SECTION VALVES are compact and can be conveniently placed for control of moving members from one station. The stem for each section is sealed against oil leakage as well as infiltration of dirt or other foreign material that may give improper operation.

OVERLOAD AND PRESSURE CONTROL can be provided by a built-in Adjustable Relief Valve. In addition, Ball-Check Valves in each section, (two for 4-Way sections and one for 3-Way sections) provide for positive starting and stopping characteristics of hydraulic cylinders or motors. If a hydraulic cylinder or motor is stopped under load, then given motion again in the same direction, the Ball-Check valves insure against momentary reversal before motion is resumed.

The mounting position of the valve is in no way restricted. The oil capacity of the valve is 15 GPM and the maximum operating pressure that the unit is built to withstand is 1500 PSI. However the suggested operating pressure is 1000 PSI.

FUNCTION OF UNIT

SUNDSTRAND MULTIPLE SECTION VALVES permit the use of standardized assemblies in many different combinations so that valves engineered for particular installations are available. Valve sections are assembled in any desired sequence. In a valve composed of 4-Way sections in series, oil flows from the pressure inlet of one section to the hydraulic cylinder or motor to be operated, and oil returned from the cylinder or motor flows back to the valve section and out its discharge port to the pressure inlet of the next valve section in the series. For valve sections not detent-positioned, centering springs return the section to neutral when the stem is released. When all sections are in the neutral position, the pump discharges directly to tank, resulting in reduced wear and minimum power consumption. In neutral, cylinders or motors are locked in position hydraulically.

THE RELIEF VALVE WHEN OPENED, passes the oil through all sections directly to the tank return line. This is done by means of a Relief Valve Port machined into each section. By dumping the oil directly to the tank return line, there is no possibility of oil flow to sections beyond the one on which the overload is present.

THE BALL-CHECK VALVES located in each section prevent oil from flowing back when the Valve Section Stem is shifted to pressurize a cylinder or motor under load. For example, if a cylinder is under load so that a pressure of 400 PSI is being exerted on a Ball-Check Valve and the Valve Section Stem is shifted to lift the cylinder, the pressure must build to 400 PSI before it is possible to lift the Ball-Check. In this way, positive cylinder movement is always maintained and no momentary reversal of the cylinder is possible as the stem is shifted.

THE OPERATION or movement of each Valve Section is by manual control. The end of each Valve Section Stem is made to receive a Clevis.

THE SPRING CHAMBER of each section is drained normally to a drilled hole passing through all sections to the Outlet Section. The drain passage is normally connected to the return chamber of the Outlet Section. The valve may be used in this manner as long as there is no back pressure on the tank return line. If the valve is to be used in an application where back pressure is required, the Spring Chamber drain must be connected to tank separately. This is done by inserting a 1/16" Pipe Plug in the tapped hole leading into the Return Chamber of the Outlet Section and attaching a separate drain line.

Service Information

NOTE: Individual sections may be disassembled and reassembled without removing them from the Multiple Section Valve. It is NOT necessary to remove a section from the valve unless it is desired to replace the section, or unless it is desired to modify the function of the valve by removal or addition of sections.

The exploded view of a 2-Section Multiple Section Valve shows one 4-Way section disassembled and the Relief Valve in the Inlet Section disassembled, with the parts labeled.

If it is required to disassemble the Multiple Section Valve itself, the following service hints may be helpful:

To tighten the tie-rods holding the sections together, a torque wrench is recommended with the torque set at 85 ft-lbs., although the tie-rods may be tightened by hand if reasonable care is taken to tighten them to sufficient and uniform tightness.

It is not necessary to assemble with the unit under pressure to eliminate binding or shifting of sections.

It is good practice to replace the old gaskets between each section with new gaskets when reassembling.

DISASSEMBLY OF INLET SECTION AND RELIEF VALVE

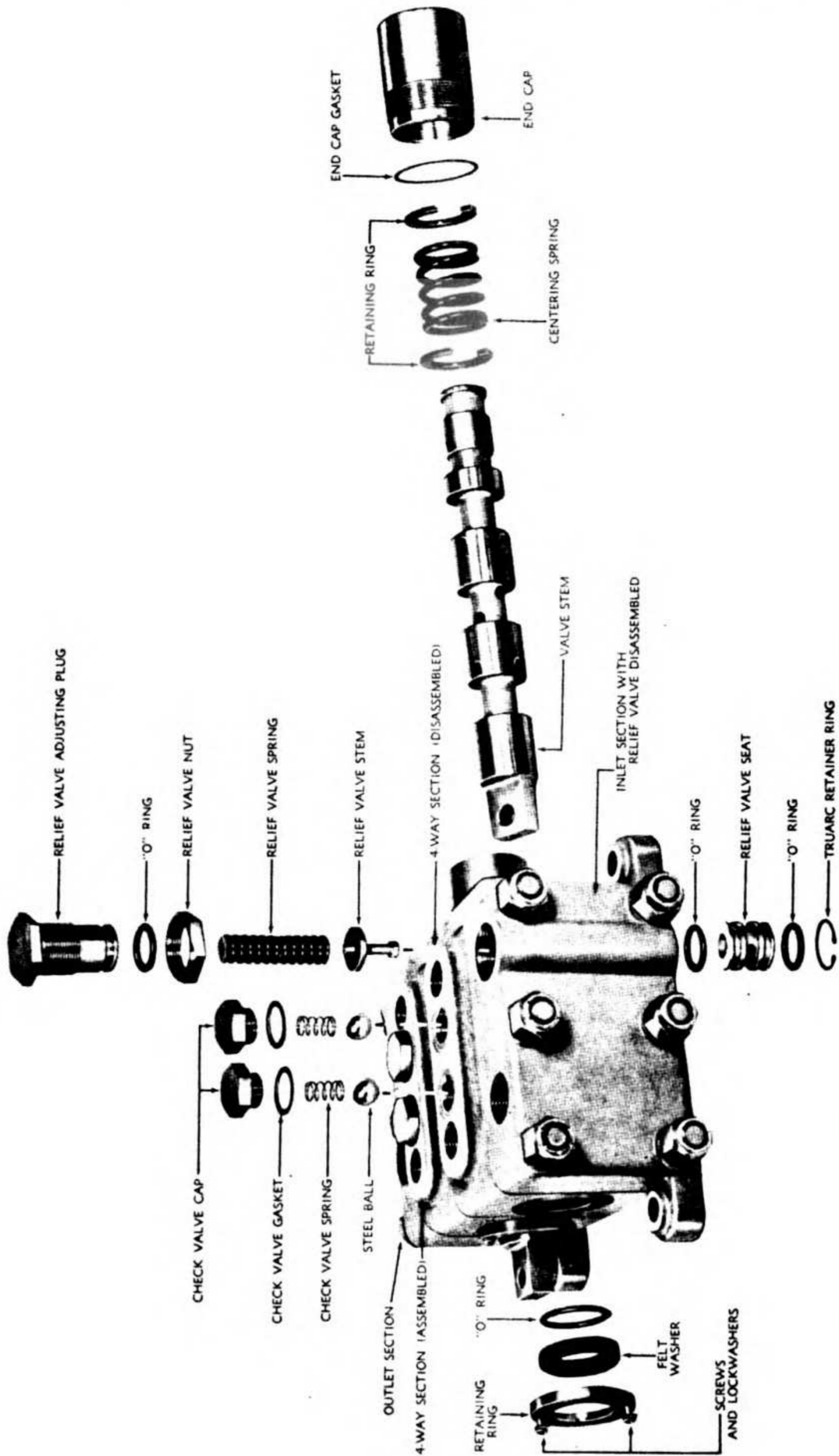
To remove the Relief Valve, loosen the Lock Nut first, then back off the Adjusting Plug. The Relief Valve Spring may then be removed. With the aid of a magnet or long nosed pliers, the Relief Valve stem may be removed. Using a Waldes Truarc Pliers #1-NAS37-102, the Truarc Ring Retainer may be removed from the underside of the section. With the Truarc Ring removed, the Valve Seat is then easily removed from within the body bore.

REASSEMBLY

Reverse the procedure making sure that all parts are free of any dirt or foreign matter. A light film of oil on all parts will aid in reassembling.

CAUTION
DO NOT AT ANY TIME EXERT ANY GREAT AMOUNT OF FORCE IN PLACING THE SEAT IN POSITION, AS THIS MAY DAMAGE THE OPERATION OF THE RELIEF VALVE.

Exploded View of 2-Section Multiple Section Valve
 Composed of Inlet Section With Relief Valve, Two 4-Way Sections and Outlet Section.
 The Inlet Section and One 4-Way Section Are Shown Disassembled.



4-WAY SECTION DISASSEMBLY

1. Disconnect the connecting rod or whatever type of operating device that is connected to the Valve Section Stem.

2. Remove the two Screws and Lockwashers that hold the Retaining Ring and the Felt-Washer in place.

3. With a #482 Williams Adjustable Spanner Wrench, remove the End Cap.

4. The Valve Stem is now ready to be removed and should be pulled out from the end of the valve where the End Cap was removed. This should come out easily, and if not, can be tapped lightly on the end of the Valve Stem. Care must be taken in removing the Valve Stem or the "O" Ring may be damaged. When removing the Valve Stem, be sure that the End Cap Gasket is not damaged. If damage should result, a new End Cap Gasket should be used when reassembling.

5. If difficulty is incurred in removing the Valve Stem, the stem may be lightly polished with crocus cloth. Be sure to clean stem thoroughly before reassembly.

6. To replace the Centering Spring the Retaining Ring near the end of the Valve Stem must be removed. The ring must be spread open in order to be removed from the Valve Stem. This may be done with a hammer and chisel.

7. The spring may then be removed from the end of the Valve Stem.

8. To service Ball-Check Valves:

- A. Remove the Check Valve Caps.
- B. Remove the Check Valve Gasket.
- C. Remove the Check Valve Spring.
- D. Remove the Ball.

REASSEMBLY

1. After putting the Centering Spring on the Valve Stem use a new split Retainer Ring. Clamp the new ring with just enough pressure to hold the ring in place. Hold the spring on the Valve Stem by hand. Push the end of the Valve Stem through the ring, putting a small amount of force on the spring. When this is done, apply pressure to the ring to hold the spring in its proper position. By applying pressure at intervals around the ring, the ring may be drawn into position so that the entire Valve Stem will move freely in the End Cap. **TRY THE SPRING END OF THE VALVE STEM IN THE END CAP TO BE SURE THERE IS NO BINDING.**

2. Reverse the remaining disassembly procedure, making sure that all parts are free of any dirt or other foreign matter. A light film of oil on the stem will aid in reassembling.

NOTE: If the Valve Section is detent-positioned there will be grooves in the Valve Stem and a spring-loaded Ball in the End Cap and there will be no Centering Spring. The Spring and Ball may be removed by shaking the End Cap and may be replaced by hand when reassembling.

3-WAY SECTION DISASSEMBLY AND REASSEMBLY

Identical with 4-way Section Disassembly and Assembly except that there is one less Ball-Check Valve.

Service Helps

1. IF THE DEVICE TO BE OPERATED FAILS TO FUNCTION:

A. Check the Relief Valve setting. The pressure may have to be increased. This is done by unloosening the Lock Nut and turning the Adjusting Screw of the Relief Valve in a clockwise direction. Care should be taken when adjusting the Relief Valve since only small adjustments will cause the pressure to vary considerably.

B. Remove the Valve Stem and examine same to determine if excessive wear has taken place. Check closely all tubing, lines, and fittings in the circuit to see that no leakage is present.

C. Check the oil reservoir to determine that there is an adequate supply of oil available and that it is in good condition. Clean the strainer. (All reservoirs should be equipped with a strainer that can be easily cleaned.)

D. Dirt, grit, or other foreign matter may be holding the Relief Valve in a partly open position, or the Relief Valve Spring may be broken, so that working pressure is not permitted to build up to the necessary level. Check to determine if the Relief Valve seats properly and remove any foreign matter that may be interfering with its operation. Replace the spring if it is broken.

2. IF THE CONTROL ATTACHED TO THE CLEVIS OF THE VALVE STEM FAILS TO RETURN TO NEUTRAL POSITION, remove the End Cap as previously explained and remove the Valve Stem from the Control Valve Body. Examine the Spring to see if it has not been broken. Look the Valve Stem over closely for any indications of scouring or burring. Examine the bore of the body for any burrs, dirt, or foreign matter. Check to see if the spring end of the Valve Stem is able to move freely in the End Cap. Check all linkages to be certain there are no tight spots which might cause the system to bind.

3. IF VALVE WILL NOT STAY IN NEUTRAL, check Spring Chamber Drain Line to see that there is no back pressure on it. If Spring Chamber is not drained separately, there should be no back pressure on the tank line.

4. IF THE VALVE STEM STICKS, it may be the result of a particularly dirty application such that a small amount of dirt or grit has gotten into the bore and scratched the stem or bore raising small burrs. Polish stem and bore to remove any burrs.

5. IF THERE IS EXCESSIVE LEAKAGE AROUND THE CLEVIS END OF THE STEM, back the stem out and check the condition of the "O" ring seal. Also check the condition of the felt seal since it may be defective and allowing dirt to get to the "O" ring seal to damage the seal.

6. IF LEAKAGE EXISTS BETWEEN THE STACKS OR IF THE STEM BINDS, the tie-rods may have loosened during shipment. Tighten the tie-rods.

7. IN A DETENT-POSITIONED 4-WAY SECTION, IF THE VALVE STEM FAILS TO REMAIN IN A GIVEN POSITION, the spring which holds a steel ball against grooves in the end of the Valve Stem may be broken or weakened. Remove the End Cap and check the condition of the spring and ball. Replace spring if necessary.

8. IF THE DEVICE BEING OPERATED IS UNDER LOAD AND REVERSES MOMENTARILY BEFORE RESUMING MOTION IN A GIVEN DIRECTION AS THE VALVE STEM IS SHIFTED, the Ball-Check Valves may not be functioning correctly. Remove and check the Check Valve Spring and Ball. If spring is broken, replace. If ball is pitted or otherwise damaged, replace. Also check the Valve Seat for foreign matter which may be interfering with proper seating of the Ball, and clean if necessary.

MAINTENANCE. For long, efficient, trouble-free service, oil should be clean. Make sure there is a strainer in the system between tank and valve and clean the strainer occasionally.

When the valve is subjected to unusually rigorous applications such as being constantly in an atmosphere of dust or grit, occasionally check the condition of the Felt Washer which is responsible for keeping foreign matter away from the Valve Stem and Bore. Replace the Felt Washer if it appears to be in poor condition.

ALWAYS GIVE GRADER SERIAL NUMBER

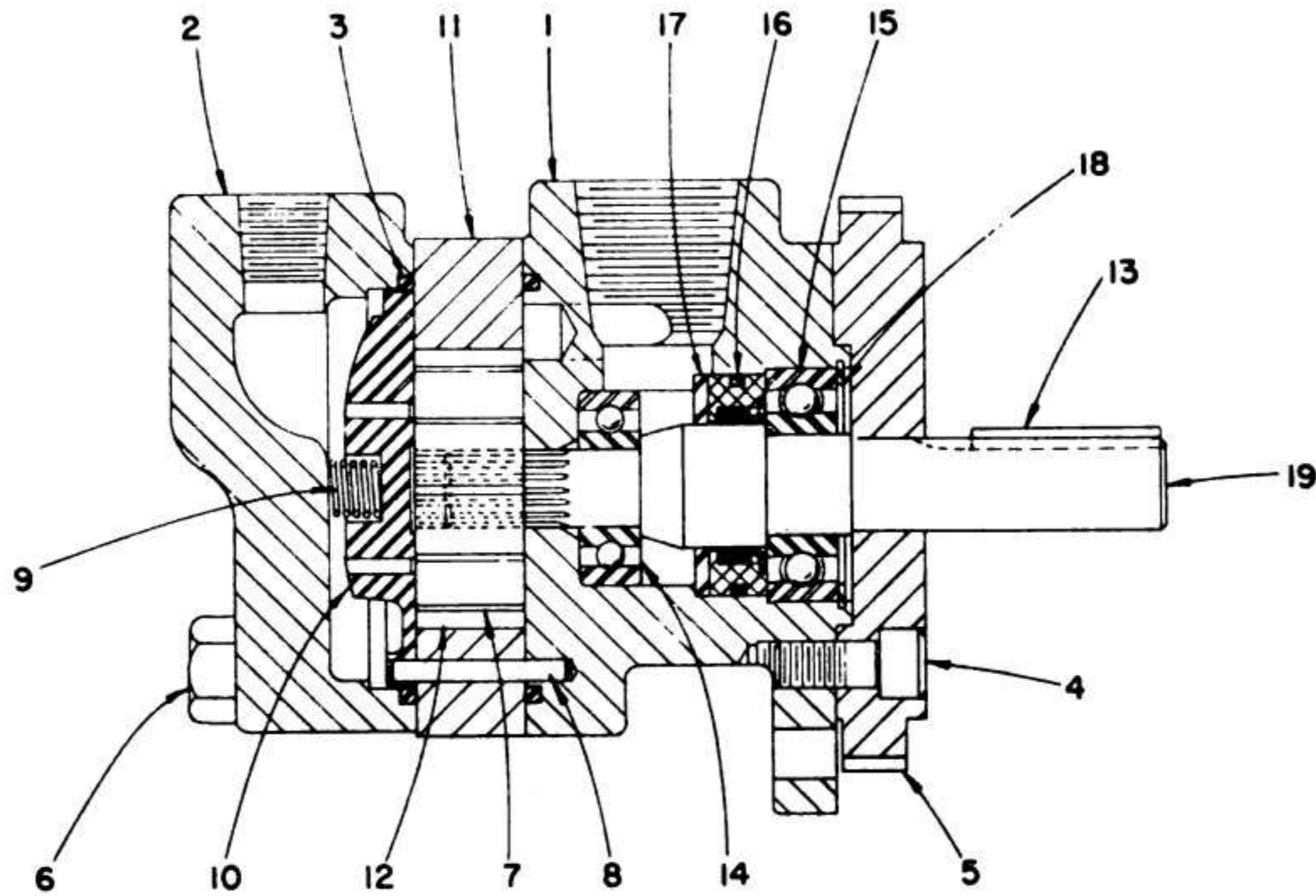


PLATE NO. 1

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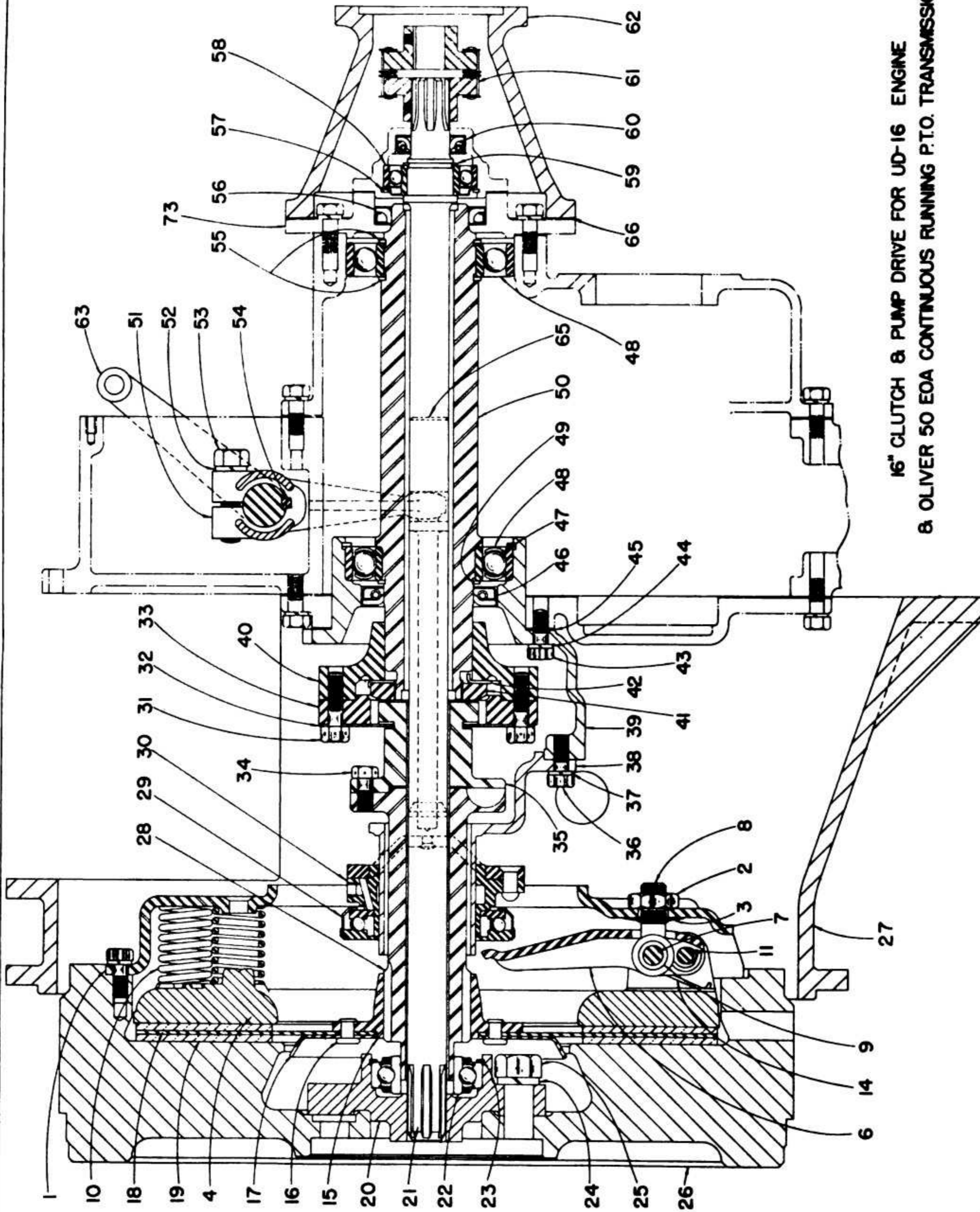
VICKERS V-235-11-1D-12 HYDRAULIC PUMP

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D.
1	119986	PUMP BODY	1
2	129343	COVER	1
3	84120	1/2" RING	2
4		3/8" N.C. x 3/4 SOCKET HEAD SCREW	6
5	2319	FLANGE	1
6		1/2" N.C. x 3 HEX HEAD CAP SCREW	4
7	127315	VANE	12
8	2478	PIN	2
9	114139	SPRING	1
10	131317	PRESSURE PLATE	1
11	114172	RING	1
12	127314	ROTOR	1
13	5881	KEY	1
14	1703	BALL BEARING	1
15	98574	BALL BEARING	1
16	122626	OIL SEAL	1
17	126199	SPACER	1
18	109975	SNAP RING	1
19	116644	SHAFT	1

4D7610090 A-1900

PLATE NO. 1

ALWAYS GIVE GRADER SERIAL NUMBER



16" CLUTCH & PUMP DRIVE FOR UD-16 ENGINE
& OLIVER 50 EOA CONTINUOUS RUNNING P.T.O. TRANSMISSION

PLATE NO. 2

40100

SEE REVERSE SIDE FOR REF. & PART NO'S.

16" CLUTCH & PUMP DRIVE FOR UD-16 ENGINE &
OLIVER 50 EPA CONTINUOUS RUNNING P.T.O. TRANSMISSION

REL. NO.	PART NO.	DESCRIPTION	NO. REQ'D
	CLA-1894-1-AB	16" CLUTCH ASSEMBLY COMPLETE	1
1	CL-7044	BACK PLATE	1
2	CL-6825	EYEBOLT NUT	4
3	CL-6824	WASHER (REF. NOS. 1, 2, & 3 ORDER UCL-7044)	4
4	CL-6801-3	PRESSURE PLATE	1
5	CL-7079	BUSHING (NOT SHOWN) (REF. NOS. 4 & 5 ORDER UCL-6801-3)	8
6	CL-6412	RELEASE LEVER	4
7	CL-6280	PIN	4
8	CL-6295	EYEBOLT	4
9	CL-7080	BUSHING (REF. NOS. 6, 7, 8 & 9 ORDER UCL-6412)	4
10	CL-6615-5	PRESSURE SPRING	24
11	CL-6283	LEVER PIN	4
12	CL-6284	WASHER (NOT SHOWN)	4
13	CL-7575	COTTER PIN (NOT SHOWN)	4
14	CL-7888	RELEASE LEVER SPRING	4
15	CL-5867-1	CLUTCH HUB	1
16	CL-2167	RIVET	12
17	CL-2339-4	HUB REINFORCEMENT	1
18	CL-6336	CLUTCH, DRIVEN DISC	1
19	CL-7589 CL-7478-1	CLUTCH FACING WITH RIVET (REF. NOS. 15 TO 19 INCL. (1 ASSEMBLY) ORDER UCL-13-5867-1)	12 42
IF COMPLETE CLUTCH LESS CLUTCH DRIVEN DISC ASSEMBLY IS REQUIRED ORDER PART UCLA-7-7044.			
20	IHC-8978-DAM	CONTINUOUS P.T.O. COUPLING	1
21	4E-20488	POWER TAKE OFF SHAFT	1
22	ND-88507	PILOT BEARING	1
23	B-1071	SNAP RING	1
24	IHC-24943-D	FLYWHEEL BOLT LOCK	3
25	57916-DA	FLYWHEEL BOLT	6
26	256172R11	FLYWHEEL WITH RING GEAR COMPLETE	1
27	4E-3351	FRAME ADAPTOR	1
28	A-3071-D	CLUTCH SHAFT WITH 2 - S-2891 KEYS. SHAFT TO COUPLING	1
29	AS-5022-A	BEARING, CLUTCH RELEASE (AS-5022-B WILL WORK) (AETNA A-1511)	1
30	AS-3064-G	SLEEVE, CLUTCH RELEASE BEARING	1
31	A-3091	CAPSCREW, CLUTCH SHAFT COUPLING RETAINER (3/8-24 X 1-1/2 DRILLED HEAD)	6
32	A-3090	RETAINER, CLUTCH SHAFT COUPLING	2
33	A-3089-A	RING, CLUTCH SHAFT COUPLING	1
34	A-3093	CAPSCREW, CLUTCH SHAFT COUPLING (3/8-24 X 7/8 DRILLED HEAD)	6
35	A-3092	COUPLING, CLUTCH SHAFT	1
36		S-903 CAPSCREW, SUPPORT TO INPUT SHAFT REAR BEARING CAGE	3
37		S-205 LOCKWASHER, SUPPORT TO INPUT SHAFT REAR BEARING CAGE	3
38	A-3065-A	SUPPORT, CLUTCH RELEASE BEARING SLEEVE	1
39	A-3024-D	CAGE, INPUT SHAFT REAR BEARING (ORDER AS-3024-D)	1
40	A-3016-L	COUPLING, INPUT SHAFT	1
4D-100			PLATE NO. 2

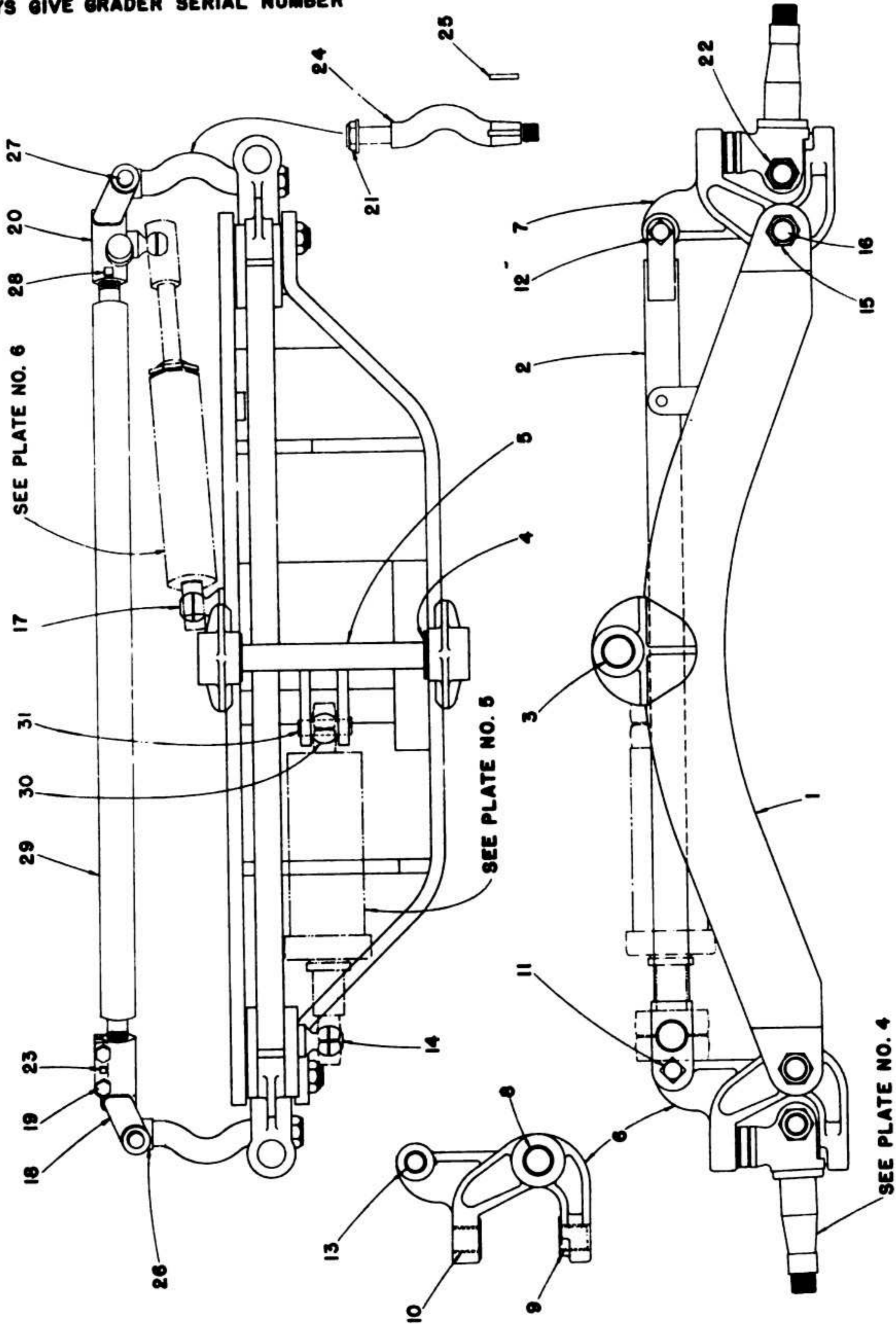
16" CLUTCH & PUMP DRIVE FOR UD-16 ENGINE &
OLIVER 50 EOA CONTINUOUS-RUNNING P.T.O. TRANSMISSION

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
41	A-3112	NUT, INPUT SHAFT COUPLING	1
42	A-3113	LOCKWASHER, INPUT SHAFT COUPLING	1
43		S-903 CAPSCREW, CAGE TO TRANSFER HOUSING TOP PLATE	5
44		S-205 LOCKWASHER, CAGE TO TRANSFER HOUSING TOP PLATE	5
45	A-3048	GASKET, INPUT SHAFT REAR BEARING CAGE	1
46	A-3111	OIL SEAL, INPUT SHAFT REAR BEARING	1
47	A-3028-B	SNAP RING, INPUT SHAFT REAR BEARING	1
48	AS-5030-A	BEARING, INPUT SHAFT (ND-8506 SINGLE SEAL BALL BEARING)	2
49	A-1070	SNAP RING, INPUT SHAFT BEARING	1
50	A-3014-H	SHAFT, TRANSFER DRIVE INPUT	1
51	A-3062-A	FORK, CLUTCH SHIFTER	1
52		S-203 LOCKWASHER, FORK CLAMPING	2
53		S-905 CAPSCREW, FORK CLAMPING	2
54		S-3003 KEY, SHAFT TO FORK	1
55	A-1070	SNAP RING, INPUT SHAFT BEARING	2
56	B-693	OIL SEAL, INPUT SHAFT - FRONT	1
57	B-1076	SNAP RING, POWER TAKE OFF SHAFT BEARING	1
58	AS-5031	BEARING, POWER TAKE OFF SHAFT (ND-8506 SINGLE SEAL BALL BEARING)	1
59	B-1069	SNAP RING, POWER TAKE OFF SHAFT	1
60	H-620-A	OIL SEAL, POWER TAKE OFF SHAFT BEARING	1
61	4E-20489	PUMP COUPLING ASSEMBLY	1
62	4E-3557	HYDRAULIC PUMP ADAPTOR	1
63	A-581-D	SHAFT, CLUTCH SHIFTER	1
64	A-583	BUSHING, CLUTCH SHIFTER SHAFT	2
65	A-3070-A	ROD, CLUTCH RELEASE	2
66	A-3097	GASKET P.T.O. SHAFT BEARING CAGE	1
67	AS-588-A	OIL TUBE ASSEMBLY (NOT SHOWN)	1
68		S-129 NUT " "	1
69		S-241 WASHER " "	1
70		A-589 FELT WASHER " "	1
71		1/8 STREET ELBOW " "	1
72		#1610 HYDRAULIC FITTING (NOT SHOWN)	1
73	A-3023-C	RETAINER	1

4D100

PLATE NO. 2

ALWAYS GIVE GRADER SERIAL NUMBER



FRONT AXLE ASSEMBLY

PLATE NO. 3

407610090A1898

FRONT AXLE ASSEMBLY

REF. NO.	PART NO.		NO. REQ'D
1	4E-3495	FRONT AXLE ASSEMBLY	1
2	4E-3559	AXLE TIE BAR ASSEMBLY	1
3	4E-11226	FRONT AXLE BEARING BUSHING	2
4	4E-11225	FRONT AXLE PIN THRUST WASHER	3
5	4E-11752	FRONT AXLE PIN	1
6	4E-2900	STEERING KNUCKLE YOKE, R.H. WITH BUSHING	1
7	4E-2901	STEERING KNUCKLE YOKE, L.H. WITH BUSHING	1
8	H-1952	STEERING KNUCKLE YOKE BUSHING (BUN.)	2
9	4E-11758	STEERING KNUCKLE PIVOT PIN BUSHING - LOWER	2
10	F-1444	STEERING KNUCKLE PIVOT PIN BUSHING - UPPER	2
11		1" N.C. X 5" LG. MACHINE BOLT, R.H. WITH 2 - 49TU-168 ESNA STOP NUTS - 1"	1
12		1" N.C. X 4-1/2" LG. MACHINE BOLT, L.H. WITH 2 - 49TU-168 ESNA STOP NUTS - 1"	1
13	4E-10030	KNUCKLE YOKE SPACER	2
14	4E-12567	BALL	1
15	49TE-242	1-1/2 ESNA STOP NUT	2
16	4E-20020	STEERING KNUCKLE YOKE BOLT	2
17	4E-12449	BALL	1
18	4E-3527	STEERING TIE ROD END, R.H.	1
19		5/8" N.C. X 3-1/4" MACHINE BOLT, HEX NUT & 5/8" LOCK WASHER	2
20	4E-3526	STEERING TIE ROD END ASSEMBLY, L.H.	1
21	49TE-164	1" N.F. ESNA NUT & SAC FL. WASHER	2
22	49TE-202	1-1/4" ESNA STOP NUT	2
23		1-2 N.C. X 1-1/2 SQ. HD. CUP POINT SET SCREW	1
24	4E-3519	STEERING ARM	2
25	4E-11740	KEY	2
26	4E-12515	STEERING TRUNNION	2
27	4E-12447	TRUNNION PIN	4
28	4E-12469	TIE ROD END BOLT, CASTLE NUT & LOCK WASHER	1
29	4E-3524	STEERING TIE LINK ASSEMBLY	1
30	4E-12057	WHEEL LEAN CYLINDER BALL	1
31	4E-12347	CYLINDER ANCHOR PIN WITH 1/8 X 1-1/2 COTTER PINS - (2)	1

4D7610090 A-1904

PLATE NO. 3

ALWAYS GIVE GRADER SERIAL NUMBER

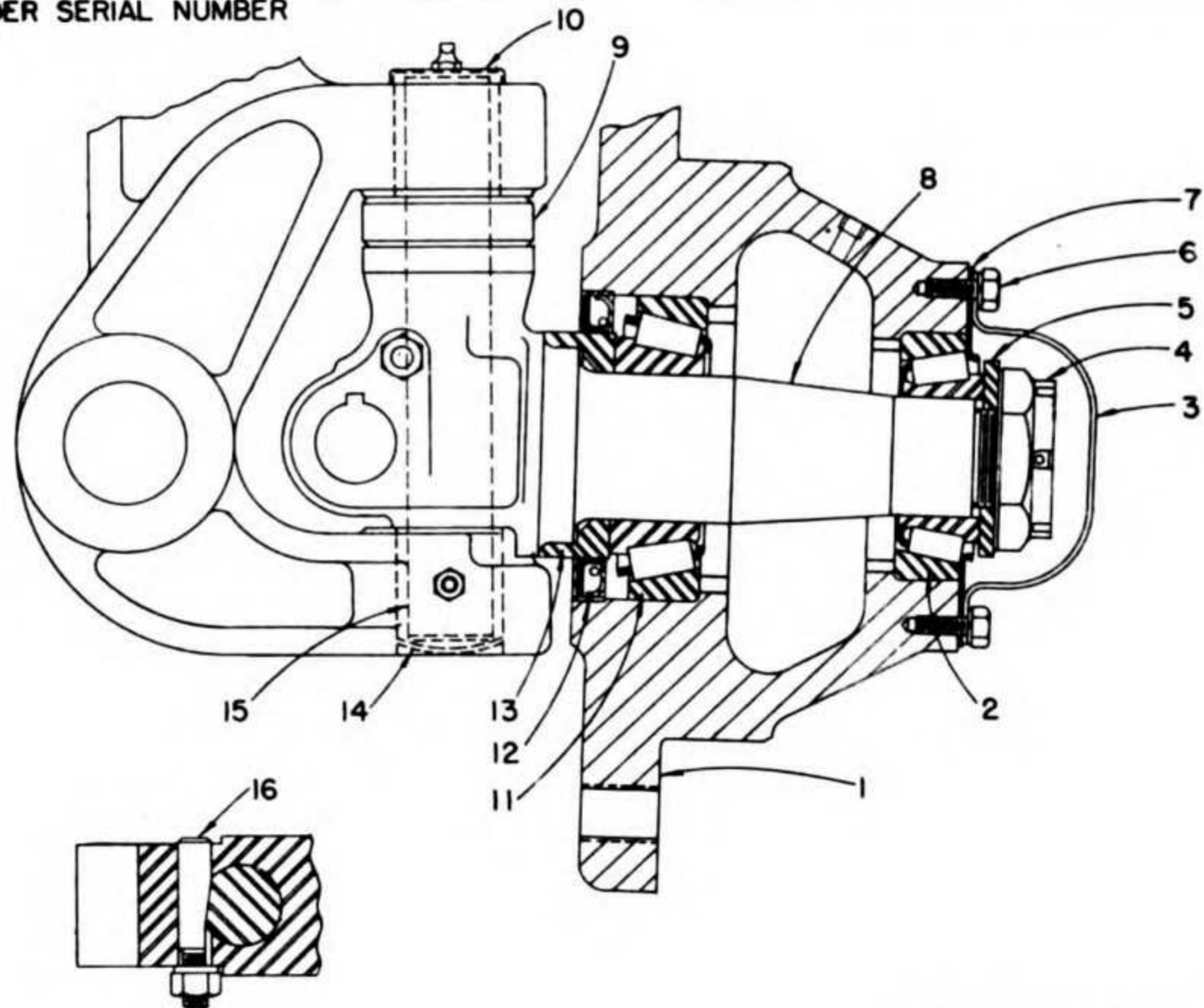


PLATE NO. 4

4D76100

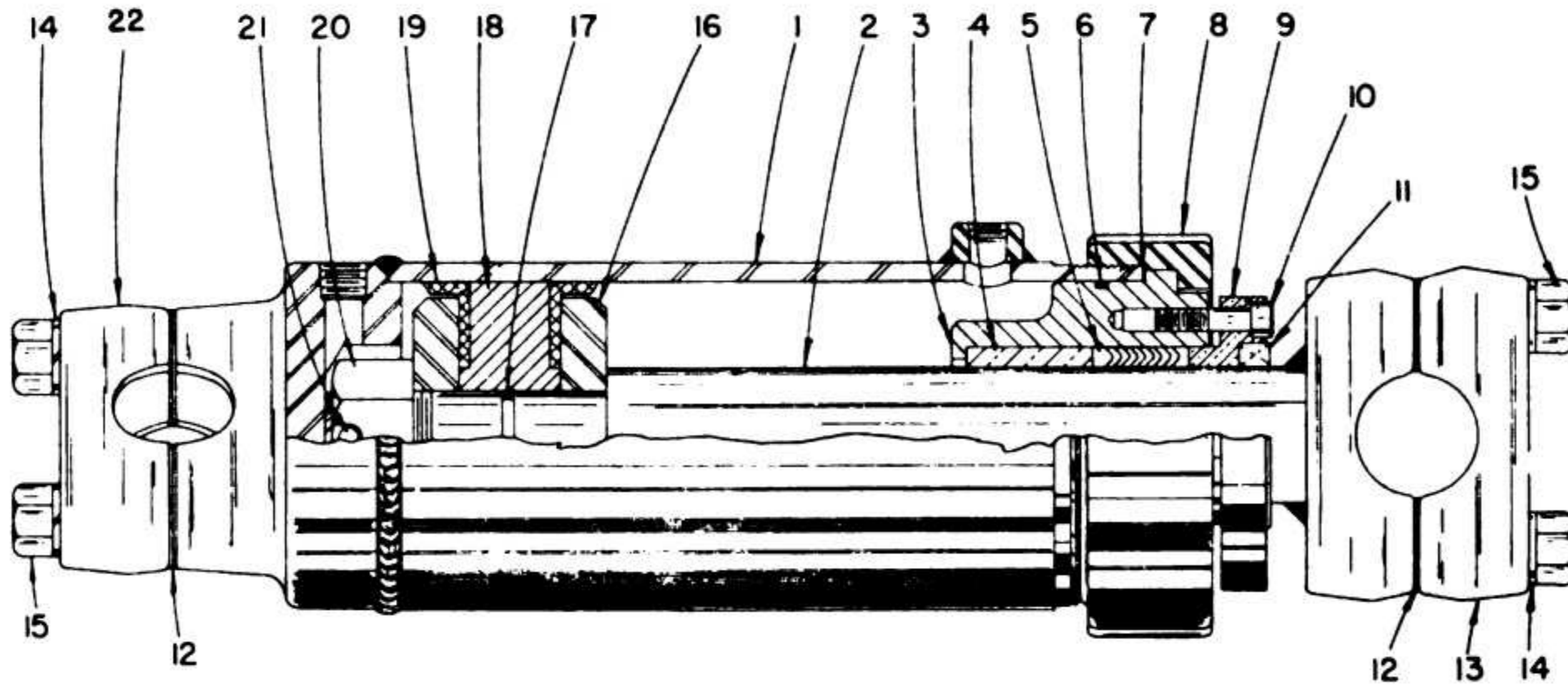
FRONT WHEEL PARTS

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-3388	FRONT WHEEL CENTER	2
2	539-532-A	FRONT WHEEL BEARING	2
3	W-457	FRONT WHEEL HUB CAP	2
4	F-328-1	FRONT SPINDLE NUT	2
5	F-911-1	FRONT SPINDLE WASHER	2
6		5/16" N.C. X 3/4" HEX HEAD CAP SCREWS & LOCK WASHERS	12
7	4E-2881	FRONT WHEEL HUB CAP GASKET	2
8	4E-3283 4E-3284	STEERING KNUCKLE, R.H. STEERING KNUCKLE, L.H.	1 1
9	T-151	STEERING KNUCKLE THRUST BEARING	2
10	F-615	STEERING KNUCKLE PIN DUST CAP	2
11	641-632	FRONT WHEEL BEARING	2
12	55036	FRONT WHEEL OIL SEAL	2
13	4E-2880	OIL SEAL COLLAR	2
14		1-7/8" EXPANSION PLUG	2
15	F-611-6	STEERING KNUCKLE PIVOT PIN	2
16	F-372	STEERING KNUCKLE PIVOT DRAW KEY	2

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PLATE NO. 4

ALWAYS GIVE GRADER SERIAL NUMBER



LEANING WHEEL CYLINDER ASSEMBLY
4E-3543

PLATE NO. 5

4D76100A1904

4E-3543 LEANING WHEEL CYLINDER ASSEMBLY

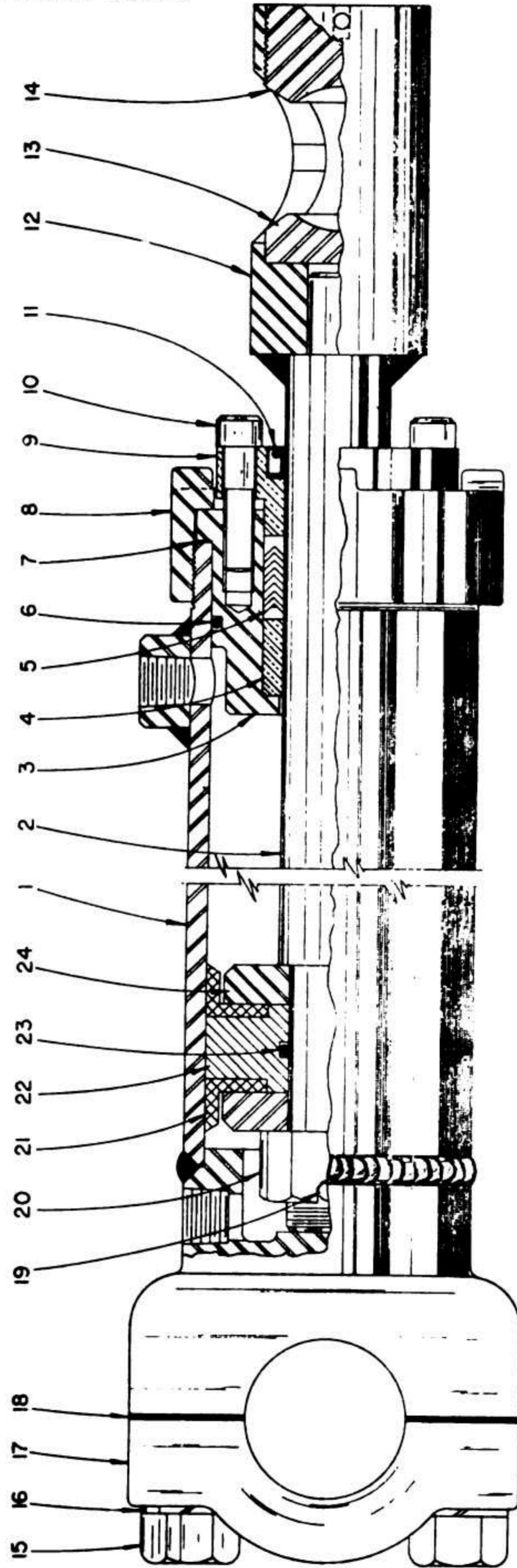
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20447	LEANING WHEEL CYLINDER BODY ASSEMBLY	1
2	4E-20296	PISTON ROD ASSEMBLY	1
3	4E-20481	STUFFING HEAD	1
4	4E-12565	STUFFING HEAD BUSHING	1
5	4E-12513	PACKING RING ASSEMBLY	1 SET
6	4E-12138	"O" RING	1
7	4E-12514	CYLINDER END GASKET	1
8	4E-20453	HEAD NUT	1
9	4E-12535	PACKING GLAND	1
10		3/8 NC X 1-1/2 HEX SOCKET TYPE CAP SCREW	4
11	4E-12560	WIPER	1
12	4E-11629	BALL SOCKET SHIM	8
13	4E-11626	BALL SOCKET	1
14		5/8 LOCK WASHER	4
15		5/8 X 3 HEX HEAD CAP SCREW	4
16	4E-12158	CUP FOLLOWER	2
17	4E-12137	"O" RING	1
18	4E-12488	PISTON	1
19	4E-12612	CUP	2
20		1-1/2 - 12 SLOTTED HEX NUT	1
21		5/16 X 2 COTTER PIN	1
22	4E-11668	BALL SOCKET	1

4D76100

A-1904

PLATE NO. 5

ALWAYS GIVE GRADER SERIAL NUMBER



STEERING CYLINDER ASSEMBLY
4E-3551

PLATE NO. 6

4076100A1899

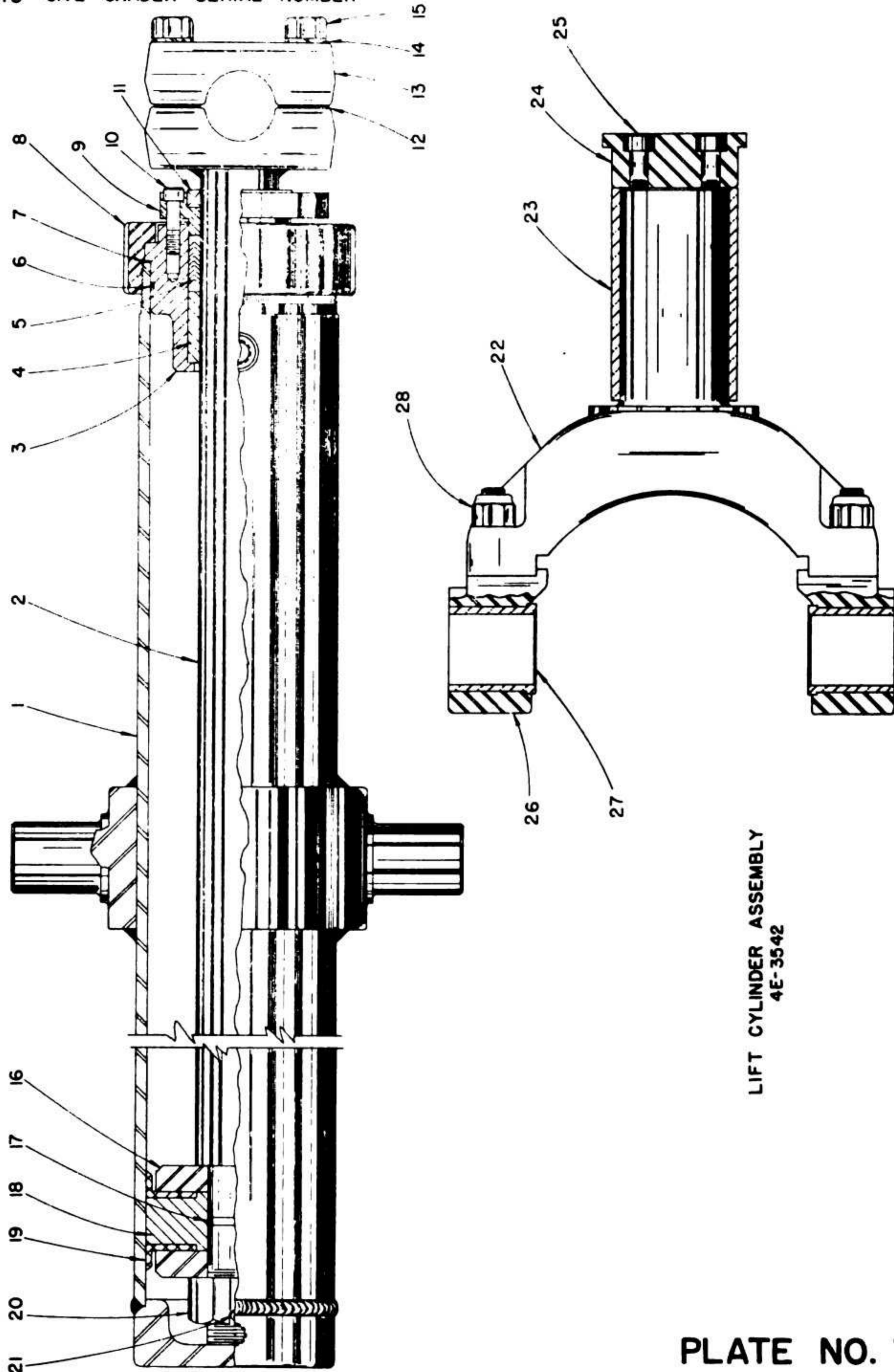
4E-3551 STEERING CYLINDER ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D.
1	4E-20467	STEERING CYLINDER BODY ASSEMBLY	1
2	4E-20470	STEERING CYLINDER PISTON ROD ASSEMBLY	1
3	4E-20472	STEERING CYLINDER STUFFING HEAD	1
4	4E-12546	STUFFING HEAD BUSHING	1
5	4E-12547	PACKING RING ASSEMBLY.	1 SET
6	4E-12336	O RING	1
7	4E-12549	END GASKET	1
8	4E-20473	HEAD NUT	1
9	4E-12550	PACKING GLAND	1
10		3/8" x 1-1/2" LG. SOCKET HEAD SCREW	4
11	4E-12564	WIPER	1
12	4E-20372	ROD END (FURNISHED WITH 4E-20470 ONLY)	
13	28DB25	BEARING	1
14	4E-12422	BALL SOCKET & PLUG	1
15		5/8" NC x 2" HEX HEAD CAP SCREW	2
16		5/8" LOCK WASHER	2
17	4E-3342	TIE ROD CAP	1
18	4E-11746	SHIM	4
19		7/32" x 1-1/2" COTTER PIN	1
20		1" - 14 SLOTTED HEX NUT	1
21	4E-12543	PISTON CUP	2
22	4E-12544	PISTON	1
23	4E-12335	O RING	1
24	4E-12542	CUP FOLLOWER	2

4D-76100 A-1899

PLATE NO. 6

ALWAYS GIVE GRADER SERIAL NUMBER



LIFT CYLINDER ASSEMBLY
4E-3542

PLATE NO. 7

4D76100A1899

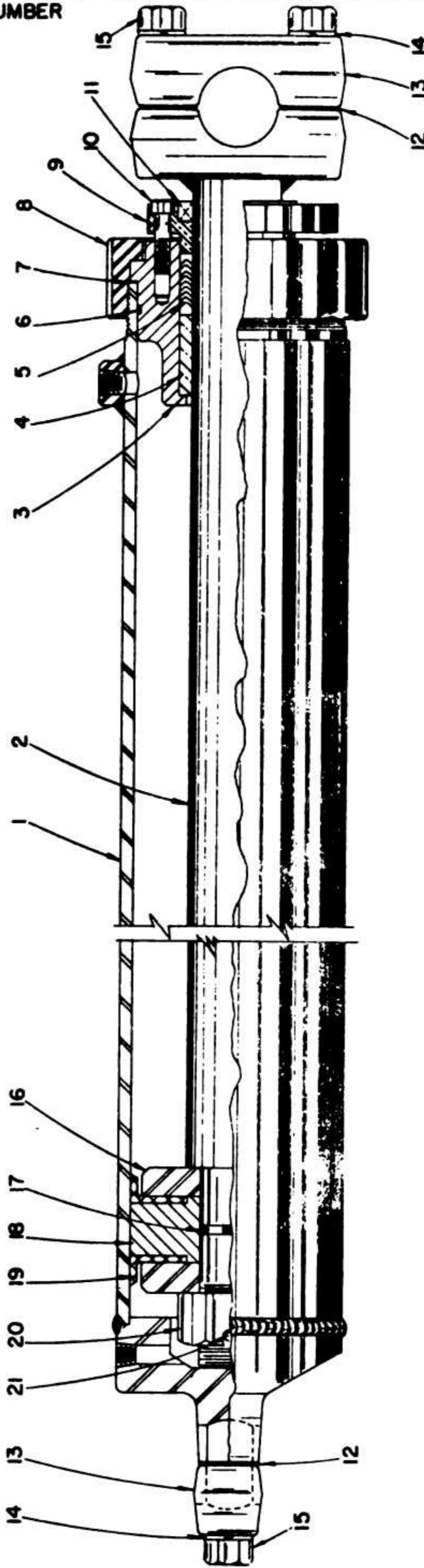
4E-3542 LIFT CYLINDER ASSEMBLY(2 REQ'D)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20443	LIFT CYLINDER BODY ASSEMBLY	1
2	4E-20466	PISTON ROD ASSEMBLY	1
3	4E-20446	STUFFING HEAD	1
4	4E-12512	STUFFING HEAD BUSHING	1
5	4E-12513	PACKING RING ASSEMBLY	1 SET
6	4E-12138	1 1/2" O.D. RING	1
7	4E-12514	CYLINDER END GASKET	1
8	4E-20453	HEAD NUT	1
9	4E-12535	PACKING GLAND	1
10		3/8 N C X 1-1/2 HEX SOCKET TYPE CAP SCREW	4
11	4E-12560	WIPER	1
12	4E-11629	BALL SOCKET SHIM	4
13	4E-11626	BALL SOCKET	1
14		5/8 LOCK WASHER	2
15		5/8 X 3 HEX HEAD CAP SCREW	2
16	4E-12158	CUP FOLLOWER	2
17	4E-12137	1 1/2" O.D. RING	1
18	4E-12488	PISTON	1
19	4E-12612	CUP	2
20		1-1/2 - 12 SLOTTED HEX NUT - SEMI-FIN.	1
21		5/16 X 2 COTTER PIN	1
22	4E-3371	LIFT CYLINDER YOKE ASSEMBLY	2
23	1-8604	LIFT ARM BUSHING (BUN.)	2
24	4E-12504	CYLINDER YOKE RETAINER R.H.	1
	4E-12629	CYLINDER YOKE RETAINER L.H.	1
25		1/2 X 1-3/4 SOCKET HEAD CAP SCREW	2
26	4E-20267	CYLINDER YOKE BEARING	4
27	4E-11854	CYLINDER YOKE BUSHING	4
28	49U-101	ESNA STOP NUT	8

4D76100 A-1904

PLATE NO. 7

ALWAYS GIVE GRADER SERIAL NUMBER



CROSS SHIFT CYLINDER ASSEMBLY
4E-3621

PLATE NO. 8

4D76100

A1903

4E-3621 CROSS SHIFT CYLINDER ASSEMBLY

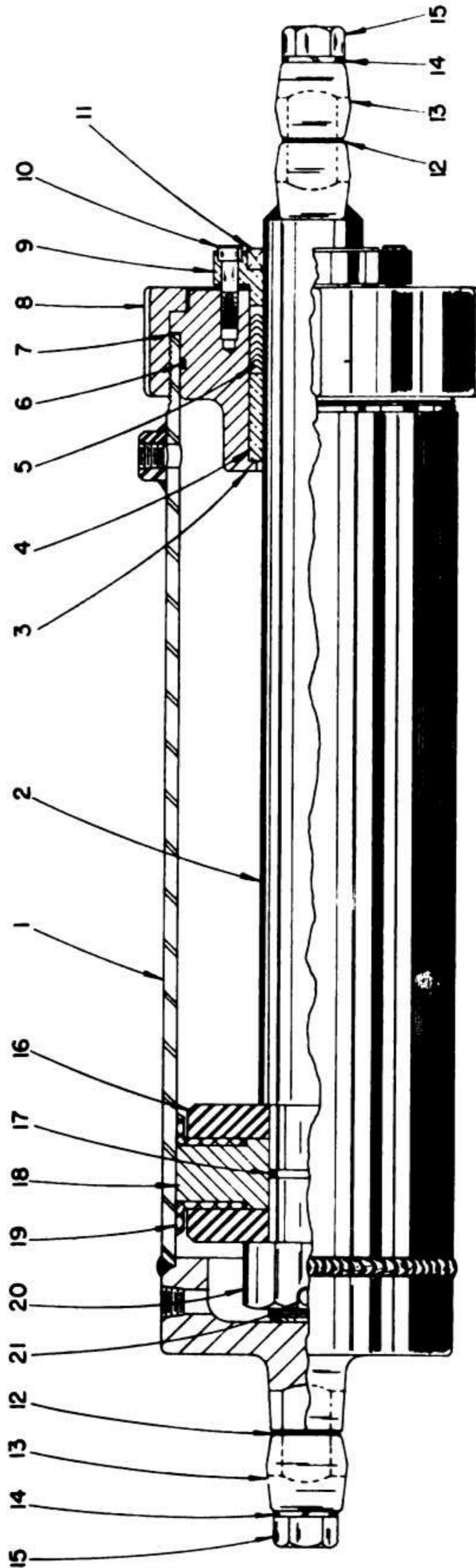
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20649	CROSS SHIFT CYLINDER BODY ASSEMBLY	1
2	4E-20452	PISTON ROD ASSEMBLY	1
3	4E-20446	STUFFING HEAD	1
4	4E-12512	STUFFING HEAD BUSHING	1
5	4E-12513	PACKING RING ASSEMBLY	1 SET
6	4E-12138	"O" RING	1
7	4E-12514	CYLINDER END GASKET	1
8	4E-20453	HEAD NUT	1
9	4E-12535	PACKING GLAND	1
10		3/8 NC X 1-1/2 HEX SOCKET TYPE CAP SCREW	4
11	4E-12560	WIPER	1
12	4E-11629	BALL SOCKET SHIM	8
13	4E-11626	BALL SOCKET	2
14		5/8 LOCK WASHER	4
15		5/8 X 3 HEX HEAD CAP SCREW	4
16	4E-12158	CUP FOLLOWER	2
17	4E-12137	"O" RING	1
18	4E-12488	PISTON	1
19	4E-12612	CUP	2
20		1-1/2 · 12 SLOTTED HEX NUT - SEMI-FIN.	1
21		5/16 X 2 COTTER PIN	1

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A-1903

PLATE NO. 8

ALWAYS GIVE GRADER SERIAL NUMBER



SCARIFIER CYLINDER ASSEMBLY
4E-3553

PLATE NO. 9

4D76100A1899

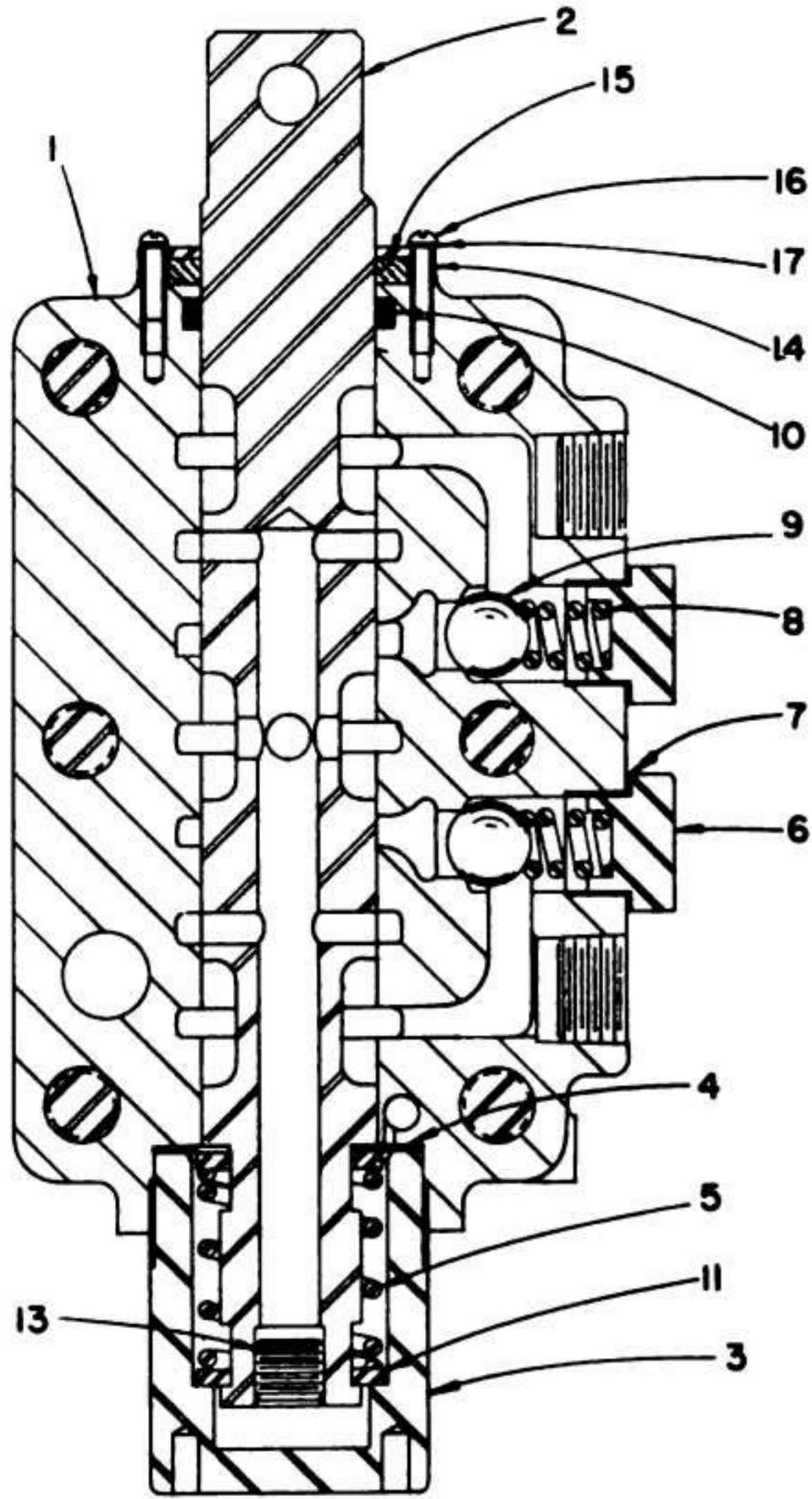
4E-3553 SCARIFIER CYLINDER ASSEMBLY COMPLETE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20474	SCARIFIER CYLINDER BODY ASSEMBLY	1
2	4E-20477	PISTON ROD ASSEMBLY	1
3	4E-20479	STUFFING HEAD	1
4	4E-12512	STUFFING HEAD BUSHING	1
5	4E-12513	PACKING RING ASSEMBLY	1 SET
6	4E-12357	O RING	1
7	4E-12554	CYLINDER END GASKET	1
8	4E-20480	HEAD NUT	1
9	4E-12535	PACKING GLAND	1
10		3/8" NC x 1-1/2" HEX SOCKET TYPE CAP SCREW	4
11	4E-12560	WIPER	1
12	4E-12572	BALL SOCKET SHIM	8
13	4E-12577	BALL SOCKET	2
14		3/4" LOCK WASHER	4
15		3/4" x 3" HEX HEAD CAP SCREW	4
16	4E-12562	CUP FOLLOWER	2
17	4E-12561	O RING	1
18	4E-12551	PISTON	1
19	4E-12621	CUP	2
20		1-3/4"-12 NZ SLOTTED HEX NUT	1
21		5/16" x 2-1/2" COTTER PIN	1

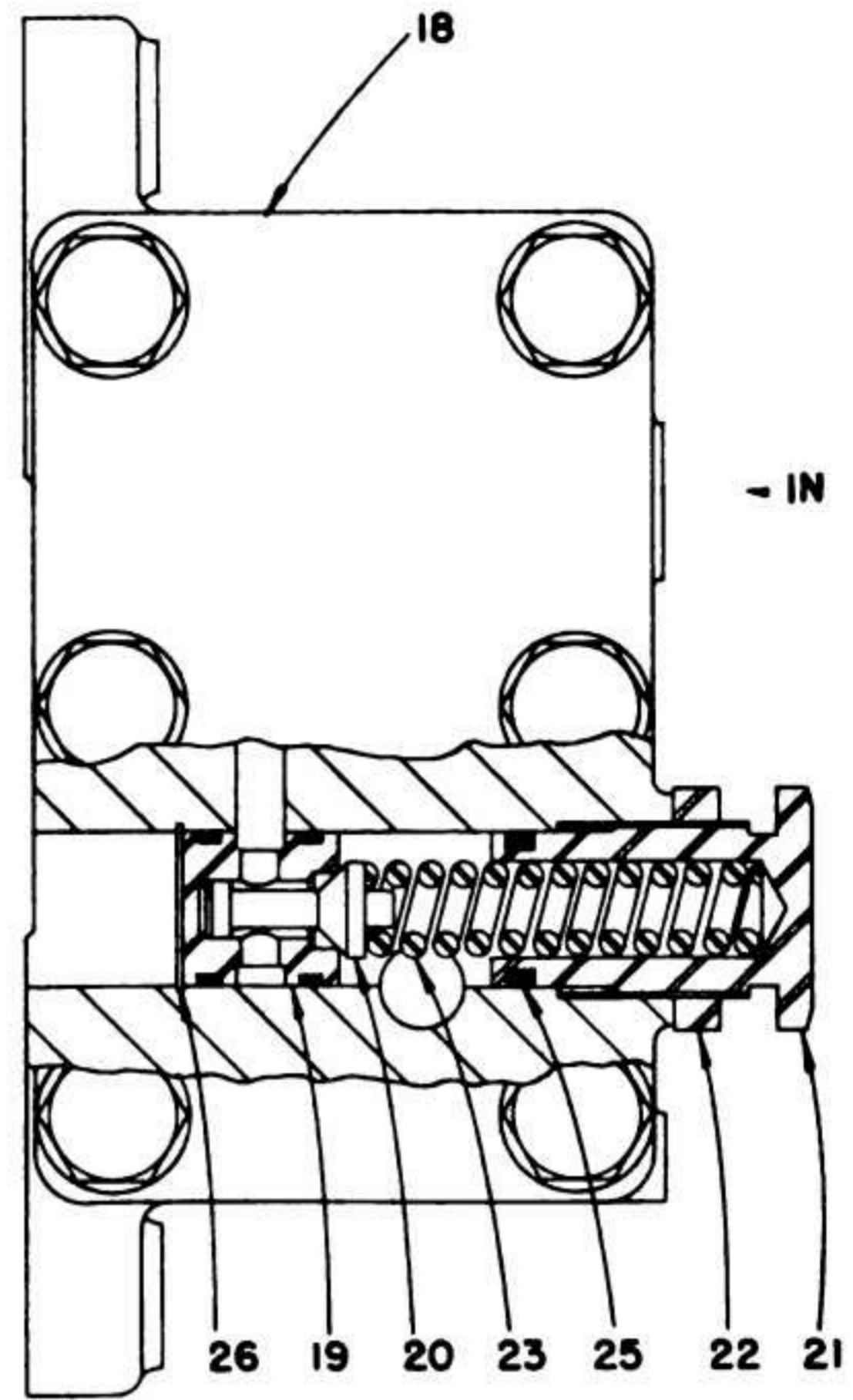
4D-76100 A-1904

PLATE NO. 9

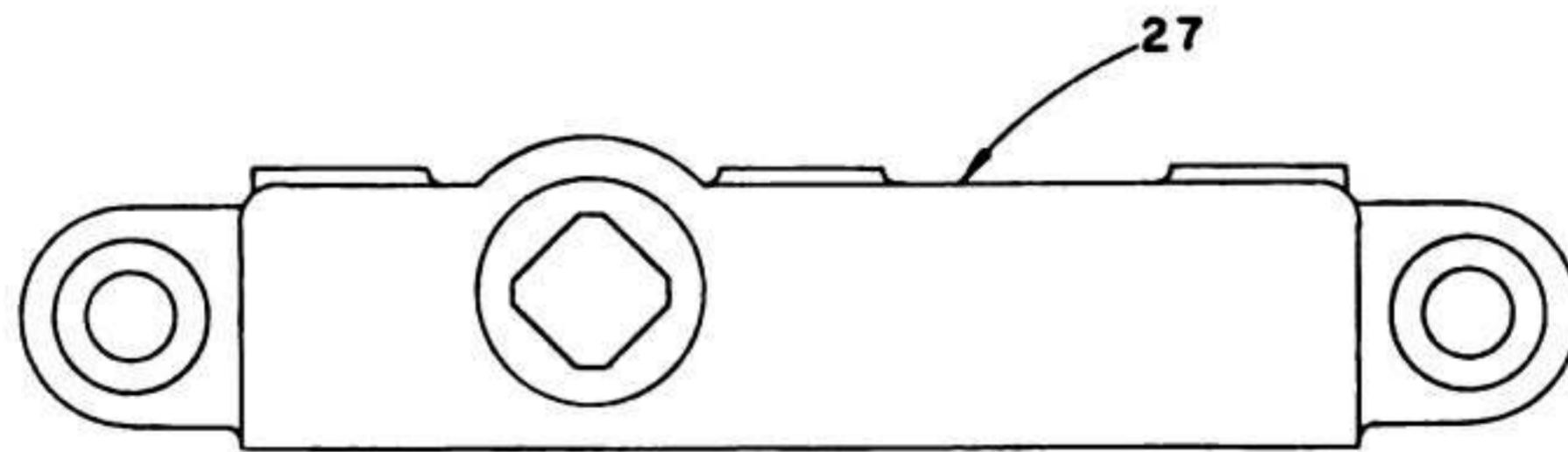
ALWAYS GIVE GRADER SERIAL NUMBER



S-10-H STACK SECTION



S-10-R INLET SECTION



S-10-G OUTLET SECTION

PLATE NO. 10

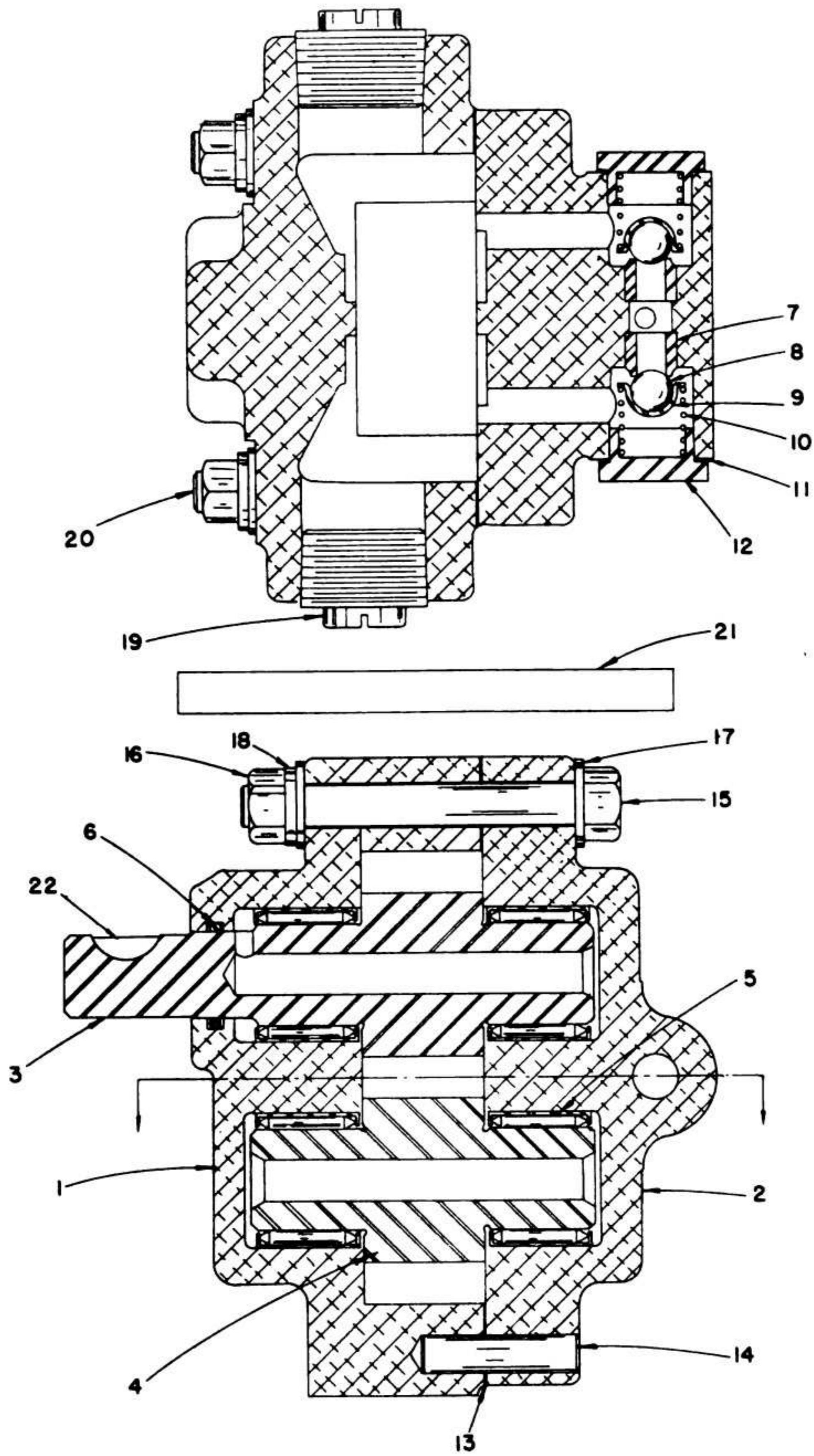
.S.10R-6H-G COMPLETE 6 STATION CONTROL SET

REFI NO.	PART NO.	DESCRIPTION	NO. REQ'D.
	503409	S.10.H STACK VALVE SECTION ASSEMBLY	6
1	503354	VALVE BODY	6
2	503303	VALVE STEM	6
3	501722	END CAP	6
4	501711	END CAP GASKET	6
5	501681	CENTERING SPRING	6
6	501751	CHECK VALVE CAP	12
7	501741	CHECK VALVE GASKET	12
8	501731	CHECK VALVE SPRING	12
9	24512	5/8 STEEL BALL	12
10	25789	"O" RING	6
11	29274	RETAINING RING	12
12	501632	SECTION GASKET (NOT SHOWN)	7
13	24801	PLUG 1/4" STEEL ALLEN	6
14	503381	RETAINING RING	6
15	503371	FELT WASHER	6
16		SCREW #8-32 X 1/2"	12
17		LOCK WASHER	12
	502519	S-10-R INLET SECTION & RELIEF VALVE ASSEMBLY	1
18	501603	RELIEF VALVE HOUSING	1
19	502762	RELIEF VALVE SEAT	1
20	502751	RELIEF VALVE STEM	1
21	501802	RELIEF VALVE ADJ. PLUG	1
22	501791	RELIEF VALVE NUT	1
23	502731	RELIEF VALVE SPRING	1
25	25853	"O" RING	3
26	29281	RETAINER RING	1
	503429	S-10-G OUTLET VALVE SECTION	1
27	504583	HOUSING	1

4D-7610090

PLATE NO. 10

ALWAYS GIVE GRADER SERIAL NUMBER



HYDRAULIC MOTOR ASSEMBLY

PLATE NO. II

A-1901

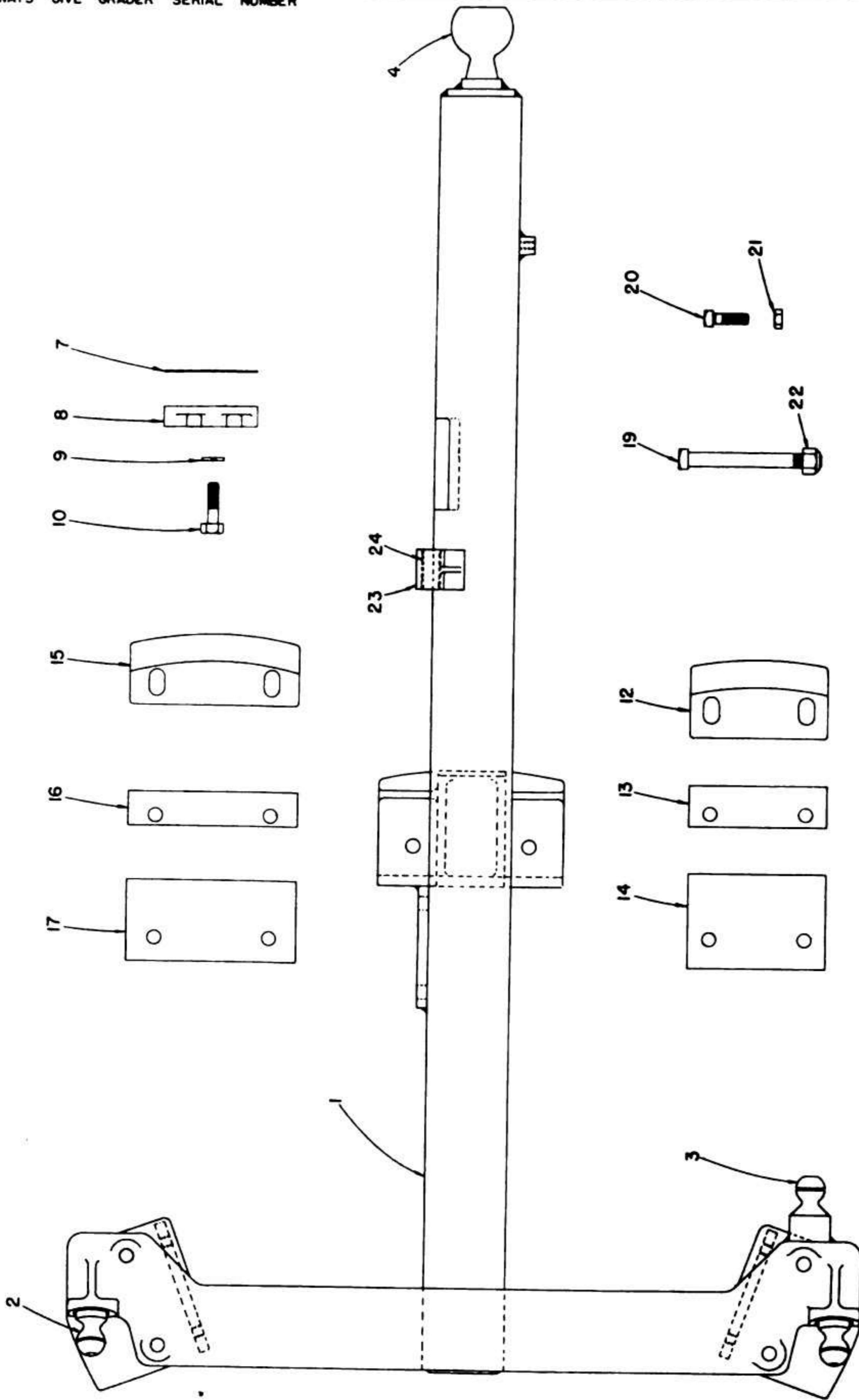
051724.01 0 - 0 1 HYDRAULIC MOTOR ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	05-10078	BODY	1
2	05-10079	COVER	1
3	05-10080	DRIVE GEAR	1
4	05-10081	DRIVEN GEAR	1
5	99-1006	NEEDLE BEARING	4
6	99-1005	SEAL RING	1
7	779-22	VALVE SEAT	2
8	313-11A	BALL	2
9	779-23	BALL RETAINER	2
10	779-24	SPRING	2
11	779-25	GASKET	2
12	779-26	VALVE RETAINER	2
13	05-10084	SHIM .001	AS REQ'D
	05-10084.1	SHIM .0015	AS REQ'D
	05-10084.2	SHIM .003	AS REQ'D
14	99-975	DOWEL PIN	2
15		1/2" x 4" HEX HD. CAP SCREW	4
16		1/2" HEX NUT	8
17		1/2" PLAIN WASHER	16
18		1/2" LOCK WASHER	8
19	248-52	SHIPPING PLUG	2
20		1/2" x 4-1/2" HEX HD. CAP SCREWS	4
21	4E-20529	MOUNTING PLATE	1
22		#11 WOODRUFF KEY	1
23	4E-20542	TUBE ASSEM. SHORT (NOT SHOWN)	1
24	4E-20543	TUBE ASSEM. LONG (NOT SHOWN)	1

4D-1007690

PLATE NO. 11

ALWAYS GIVE GRADER SERIAL NUMBER



CIRCLE DRAWBAR ASSEMBLY

PLATE NO. 12

407610090A1900

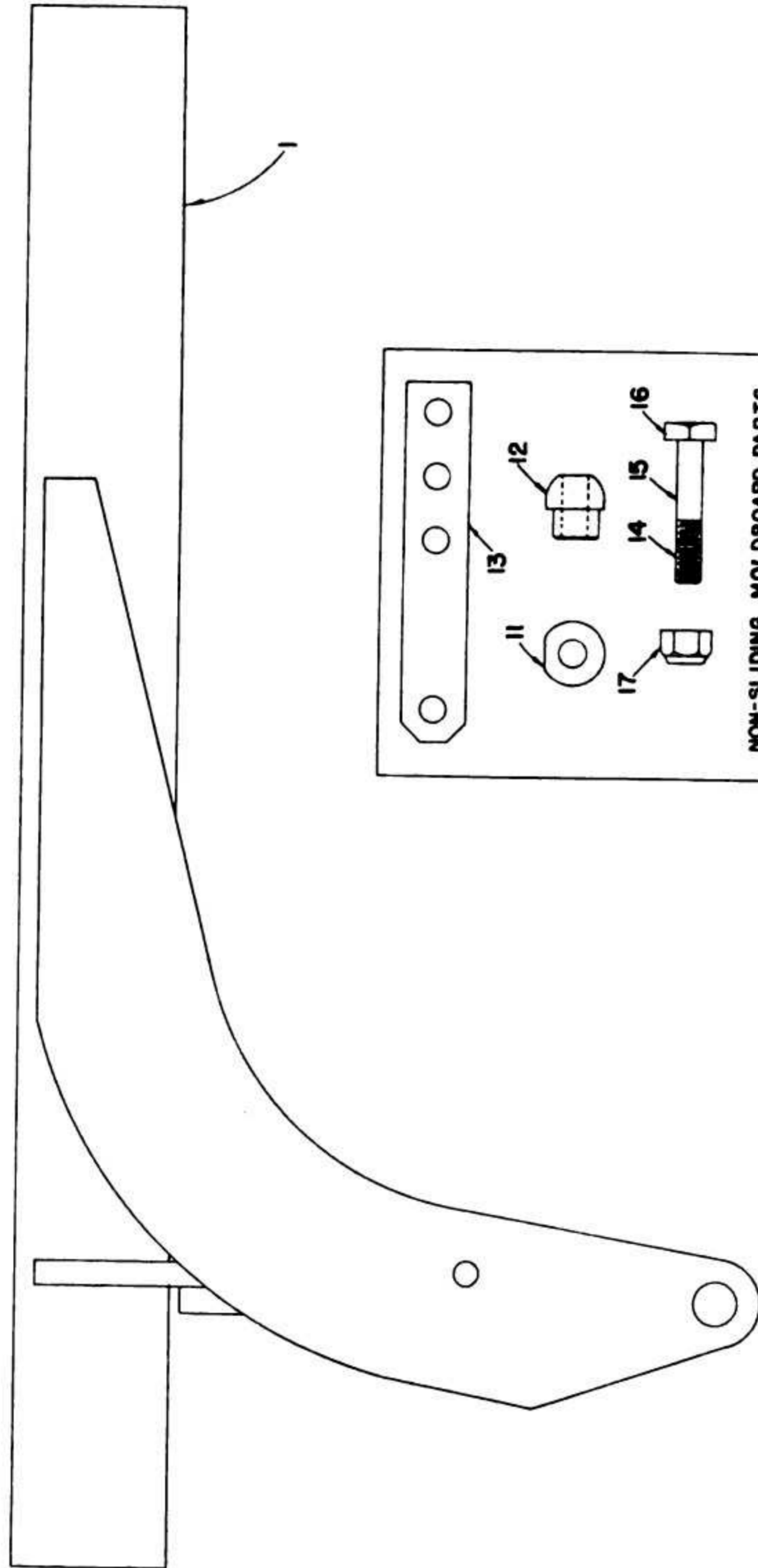
CIRCLE DRAWBAR ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-4267	CIRCLE DRAWBAR ASSEMBLY	1
2	4E-12563	BALL	2
3	4E-12194	CROSS SHIFT BALL	1
4	4E-12648	DRAWBAR BALL	1
7	4E-20219	DRAWBAR BALL CAP SHIM	1
8	4E-20552	DRAWBAR BALL CAP	1
9		3/4" LOCK WASHER	6
10		3/4" X 3" HEX HEAD CAPSCREW	6
12	4E-2954	CIRCLE GUIDE - REAR	2
13	4E-11983	CIRCLE GUIDE SHIM - REAR	4
14	4E-11984	WEARING PLATE - REAR	2
15	4E-2955	CIRCLE GUIDE - FRONT WITH 2 - 1" X 4 1/2" MACHINE BOLTS	1
16	4E-11982	CIRCLE GUIDE SHIM - FRONT	2
17	4E-11985	WEARING PLATE - FRONT	1
19	4E-12267	CIRCLE GUIDE BOLT - LONG, REAR	4
20		3/4" X 2 1/2" SQ. HEAD CUP POINT SET SCREW	6
21		3/4" HEX JAM NUTS	6
22	49U-168	ESNA STOP NUT	6
23	4E-20273	CIRCLE TURN SHAFT BEARING HOUSING	1
24	4E-12317	CIRCLE TURN SHAFT BEARING	1

407610090 A-1900

PLATE NO. 12

ALWAYS GIVE GRADER SERIAL NUMBER



CIRCLE ASSEMBLY & MOLDBOARD HANGER PARTS

PLATE NO. 13

4D76100 A1903

CIRCLE ASSEMBLY & MOLDBOARD HANGER PARTS			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-5021	CIRCLE ASSEMBLY	1

NON-SLIDING MOLDBOARD PARTS

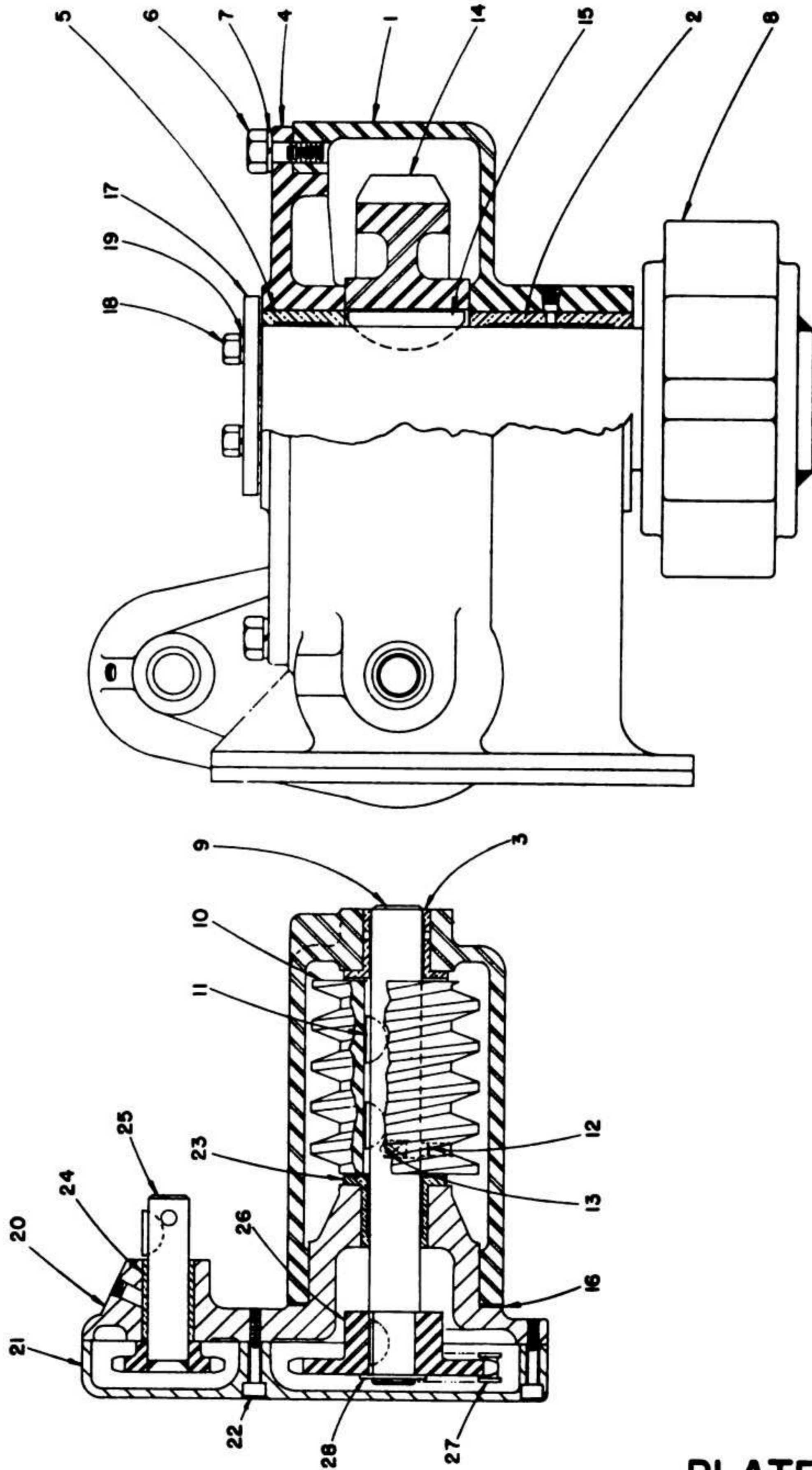
11	4E-12627	MOLDBOARD HANGER SPACER	2
12	4E-12624	MOLDBOARD HANGER BALL	2
13	4E-12628	MOLDBOARD PITCH BAR	2
14		1" N.C. X 3 HEX HD. CAP SCREW	2
15		1" N.C. X 3-1/2 HEX HD. CAP SCREW	2
16		1" N.C. X 5 HEX HD. CAP SCREW	2
17	49U-168	1" N.C. ESNA STOP NUT	6

4D76100

A-1903

PLATE NO. 13

ALWAYS GIVE GRADER SERIAL NUMBER



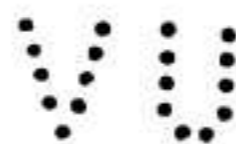
CIRCLE TURN GEAR HOUSING ASSEMBLY

PLATE NO. 14

4D7610090 A-1900

4E-4214 CIRCLE TURN GEAR HOUSING COMPLETE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-4215	GEAR HOUSING & BUSHING ASSEMBLY	1
2	4E-11977	GEAR HOUSING BUSHING	1
3	4E-11979	WORM SHAFT BUSHING	1
4	4E-20095	GEAR HOUSING COVER ASSEMBLY	1
5	4E-11976	GEAR HOUSING COVER BUSHING	1
6		1/2 N.C. X 1-1/4 HEX HEAD CAP SCREW	6
7		1/2 LOCK WASHER	6
8	4E-3398	CIRCLE TURN SHAFT & PINION ASSEMBLY	1
9	4E-20527	CIRCLE TURN WORM SHAFT	1
10	4E-20084	CIRCLE TURN WORM, R.H.	1
11		#18 WOODRUFF KEY	4
12	E-222	PIN	1
13	E-223	SPRING	1
14	4E-3329	CIRCLE TURN GEAR	1
15		#36 WOODRUFF KEY	1
16	4E-11981	BEARING CAP SHIM	13
17	4E-11980	GEAR SHAFT WASHER	1
18		3/8 N.C. X 1-1/4 HEX HEAD CAP SCREW	2
19		3/8 LOCK WASHER	2
20	4E-3493	BEARING RETAINER SPROCKET HOUSING ASSEMBLY	1
21	4E-3483	SPROCKET COVER	1
22		3/8 N.C. X 1-1/2 HEX SOCKET TYPE CAPSCREW	2
23	4E-11979	WORM SHAFT BUSHING	1
24	4E-12307	12 T SPROCKET BEARING	1
25	4E-12302	12 T SPROCKET ASSEMBLY	1
26	4E-12611	24 T SPROCKET	1
27	D-449	ROLLER CHAIN WITH CONNECTING LINK - 36 PITCHES LONG, A.S.A. NO. 50 (DIAMOND)	1
28		1" DIA. SERIES 2 SNAP RING	1

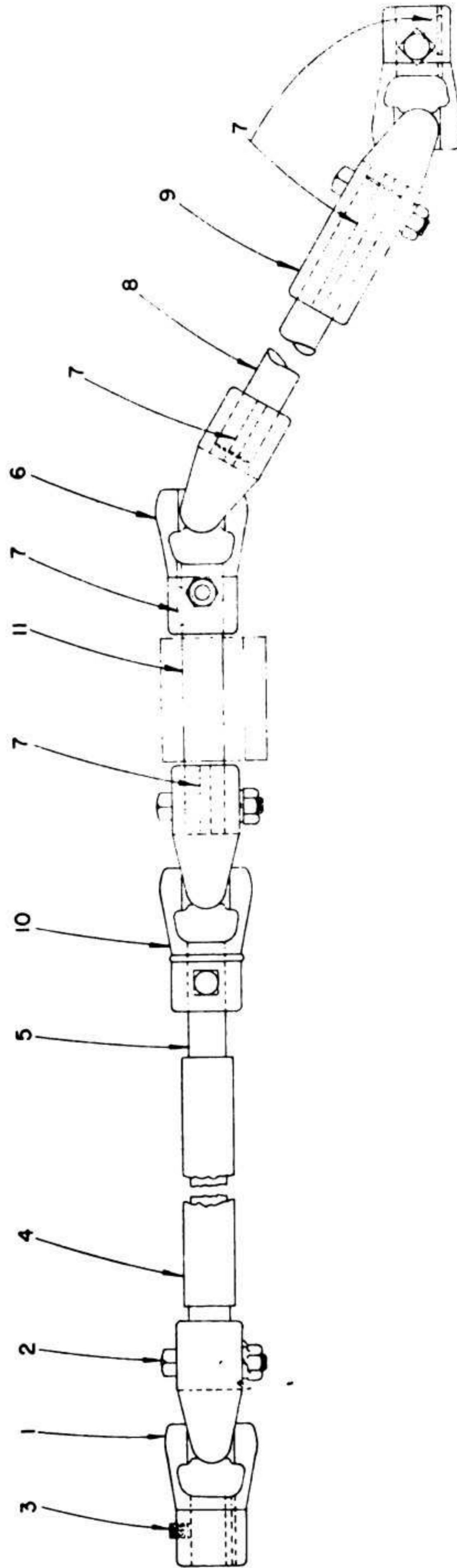


4D7610090

A-1900

PLATE NO. 14

ALWAYS GIVE GRADER SERIAL NUMBER



CIRCLE TURN CONTROL SHAFT ASSEMBLY

PLATE NO. 15

407610090

CIRCLE TURN CONTROL SHAFT ASSEMBLY

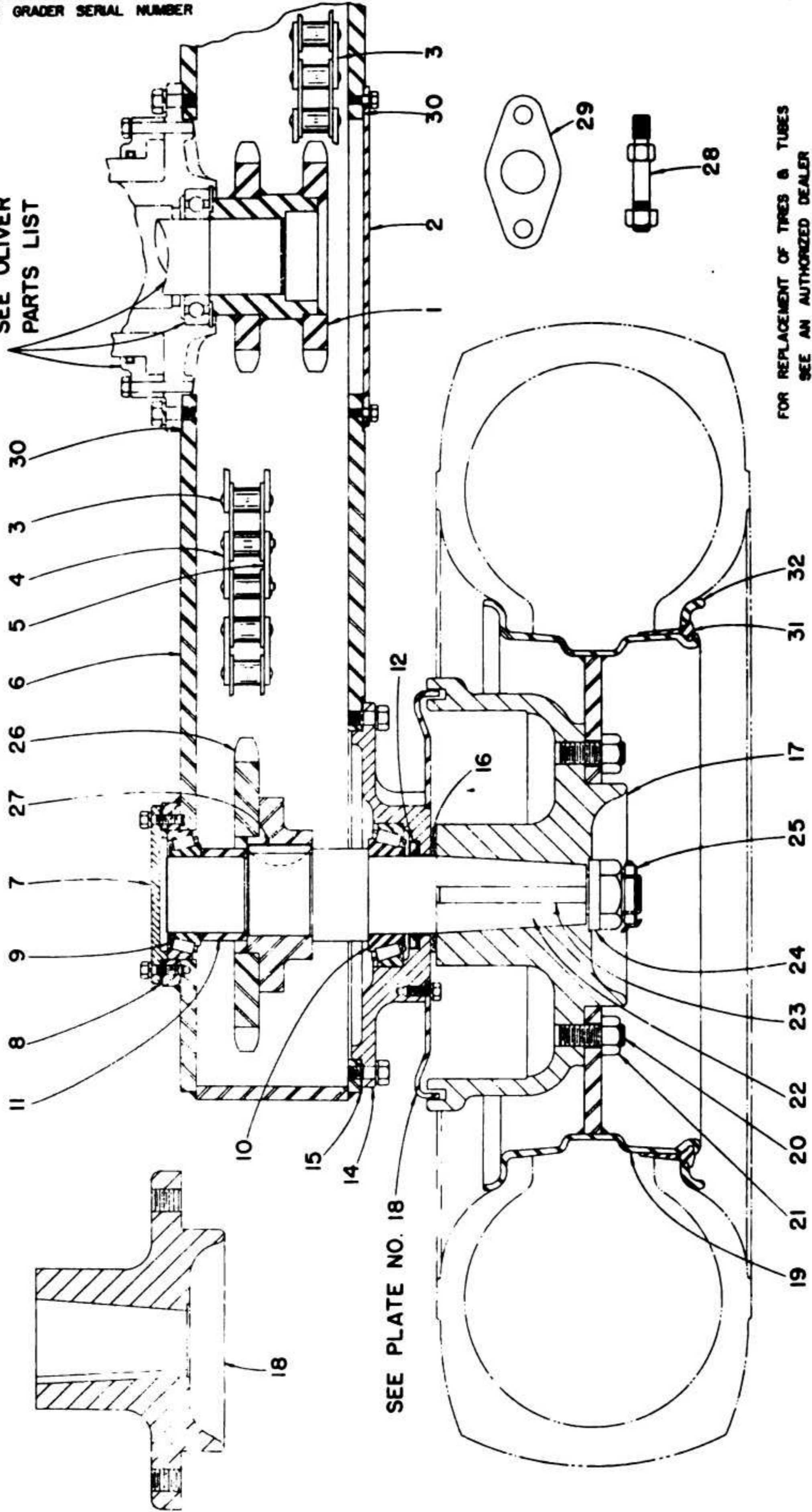
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20545	UNIVERSAL JOINT	1
2		3/8" x 2 1/2" MACHINE BOLT & HEX NUT. WITH 3/8" L. WASHER	6
3		3/8" N.C. x 1/2" ALLEN HEADLESS CUP POINT SET SCREW	1
4	4E-12290	CIRCLE TURN TELESCOPING TUBE ASSEMBLY	1
5	4E-12292	CIRCLE TURN SQUARE SHAFT	1
6	9A-2086	UNIVERSAL JOINT	1
7		#18 WOODRUFF KEY	4
8	4E-12324	CIRCLE TURN SHAFT	1
9	4E-20279	LONG HUB UNIVERSAL JOINT	1
10	9A-2089	UNIVERSAL JOINT	1
11	4E-12293	CIRCLE TURN SHAFT UPPER	1

4D7610090 A-1901

PLATE NO. 15

ALWAYS GIVE GRADER SERIAL NUMBER

SEE OLIVER
PARTS LIST



FOR REPLACEMENT OF TIRES & TUBES
SEE AN AUTHORIZED DEALER

MODEL 53 CHAIN DRIVE TANDEM ASSEMBLY
FOR 4D100

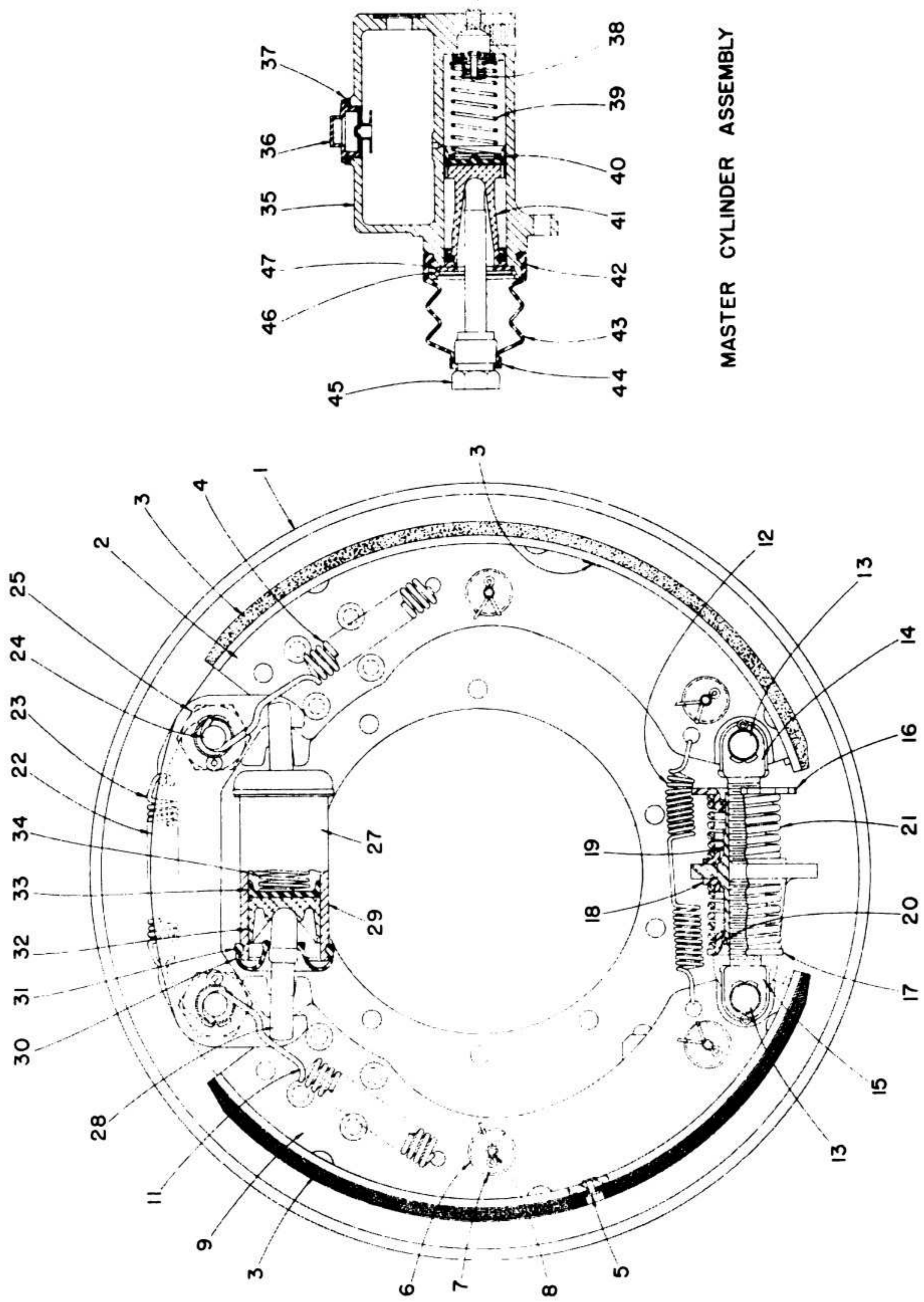
PLATE NO. 17

4D100

MODEL 53 CHAIN DRIVE TANDEM ASSEMBLY			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
	4E-5029	MODEL 53 CHAIN DRIVE TANDEM ASSEMBLY COMPLETE	1
1	4E-20188	DRIVE SPROCKET ASSEMBLY	2
2	4E-20082	COVER PLATE - OUTER	2
3	D-478	ROLLER CHAIN A.S.A.NO. 160 - 48 PITCHES LONG	4
4	X-1610	ROLLER CHAIN LINK	VARIABLE
5	X-1609	ROLLER CHAIN CONNECTING LINK	VARIABLE
6	4E-5019	TANDEM FRAME ASSEMBLY	2
7	4E-20187	WHEEL BEARING RETAINER	4
8	4E-12154	BEARING RETAINER SHIM	VARIABLE
9	593-592A	REAR WHEEL BEARING (INNER)	4
10	681-672	REAR WHEEL BEARING (OUTER)	4
11	4E-12150	WHEEL BEARING SPACER	4
12	500320	OIL RETAINER	4
14	4E-3387	WHEEL AXLE BEARING CAGE (OUTER)	4
15	X-1655	BEARING CAGE GASKET	4
16	4E-12152	FELT WASHER	4
17	4E-5018	REAR WHEEL CENTER FOR BRAKES	2
18	4E-3389	REAR WHEEL CENTER	2
19	4E-3391	WHEEL ASSEMBLY (ALL WHEELS, FRONT & REAR, INTERCHANGEABLE)	4
20	4E-11975	WHEEL STUD	46
21		WHEEL STUD NUT - 1" N.F. HEX NUT	46
22	4E-3462	WHEEL AXLE	4
23	4E-12155	AXLE KEY	4
24	4E-12151	WHEEL WASHER	4
25		1-3/4 N.C. HEAVY SLOTTED HEX NUT	4
26	4E-20190	DRIVEN SPROCKET ASSEMBLY	4
27		#36 WOODRUFF KEY	4
28	4E-12153	WHEEL PULLER STUD	2
29	X-1581	WHEEL PULLER	1
30	4E-11974	FLANGED SLEEVE GASKET	4
31	RB-8166-7	LOCKING RING (FIRESTONE)	4
32	RB-7361	SIDE RING ()	4

4D-100

PLATE NO. 17



MASTER CYLINDER ASSEMBLY

BRAKE ASSEMBLY
LEFT HAND SHOWN

PLATE NO. 18

HYDRAULIC 17 x 4 x 3/8 BRAKE ASSEMBLY 2-SHOE INTERNAL BRAKE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
	38851	BRAKE ASSEMBLY - L.H. (SHOWN)	1
1	38853	BACKING PLATE ASSEMBLY - L.H.	1
2	1113-S-84	SECONDARY SHOE & LINING ASSEMBLY - R.H.	1
3	46503	LINING PACKAGE (1 COMPLETE SET FOR 2-WHEEL BRAKES)	1 SET
4	37199	ANCHOR TO SHOE SPRING - SECONDARY	1
6	37809	SHOE HOLD DOWN SPRING CUP	8
7	38618	SHOE HOLD DOWN SPRING	4
8	37177	SHOE HOLD DOWN PIN	4
9	1131-S-6	PRIMARY SHOE & LINING ASSEMBLY - L.H.	1
11	37200	ANCHOR TO SHOE SPRING - PRIMARY	1
12	37800	ADJUSTING SCREW SPRING	1
13	75-S-81-K6	BRAKE SHOE PIVOT PIN	2
14	37666	ADJUSTING SCREW, R.H.	1
15	37665	ADJUSTING SCREW, L.H.	1
16	37668	WHEEL ADJUSTING NUT	1
17	37669	CENTRALIZER SPRING RETAINER - OUTER	1
18	37670	CENTRALIZER SPRING RETAINER - INNER	2
19	37672	ADJUSTING NUT	1
20	37667	SPRING RETAINER LOCK	4
21	37784	CENTRALIZER SPRING	2
22	37180	ANCHOR PIN REINFORCEMENT PLATE	1
23	37831	PRIMARY TO SECONDARY SHOE SPRING	1
24	37100	ANCHOR PIN	2
25	44825	1-1/8 S.A.E. STANDARD NUT	2
26	28868	LOCKWASHER - ANCHOR PIN (SPECIAL, NOT SHOWN)	2
	38852	BRAKE ASSEMBLY - R.H. (NOT SHOWN)	1
1	38854	BACKING PLATE ASSEMBLY - R.H.	1
2	1131-S-7	PRIMARY SHOE & LINING ASSEMBLY	1
4	37200	ANCHOR TO SHOE SPRING - PRIMARY	1
9	1113-S-85	SECONDARY SHOE & LINING ASSEMBLY - L.H.	1
11	37199	ANCHOR TO SHOE SPRING SECONDARY	1
		ITEMS 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, SAME AS L.H. BRAKE 38851 ASSEMBLY	
WHEEL CYLINDER ASSEMBLY (WAG.)			
27	FD-3171-C	WHEEL CYLINDER ASSEMBLY COMPLETE (WAG)	1
28	37101	WHEEL CYLINDER CONNECTING LINK (BEN.)	2
29	FD-3172	CASTING	1
30	FC-4741	BOOT	2
31	FC-4742	BOOT STRAP	2
32	FC-975	PISTON	2
33	FC-966	PISTON CUP	2
34	FC-965	SPRING	1

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A-1900

(CONTINUED ON SHEET 2)

PLATE NO. 18

HYDRAULIC 17 X 4 X 3/8 BRAKE ASSEMBLY 2-SHOE INTERNAL BRAKE

SHEET 2 CONTINUED			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
		MASTER CYLINDER ASSEMBLY (WAG.)	
	FC-672	MASTER CYLINDER ASSEMBLY (COMPLETE)	1
35	FC-3964	TANK & CYLINDER CASTING	1
36	FC-12105	TANK FILLER PLUG	1
37	FC-2037	FILLER PLUG GASKET	1
38	FC-1266	CHECK VALVE ASSEMBLY	1
39	FC-1318	PISTON RETURN SPRING ASSEMBLY	1
40	FD-962	PISTON CUP	1
41	FC-1338	PISTON ASSEMBLY	1
42	FC-1333	BOOT STRAP-LARGE	1
43	FC-1331	BOOT	1
44	FC-1332	BOOT STRAP - SMALL	1
45	FC-1320	PISTON PUSH ROD	1
46	FC-1330	STOP PLATE WIRE LOCK	1
47	FC-1321	PISTON STOP PLATE	1

4D7610090 A-1900

PLATE NO. 18

ALWAYS GIVE GRADER SERIAL NUMBER

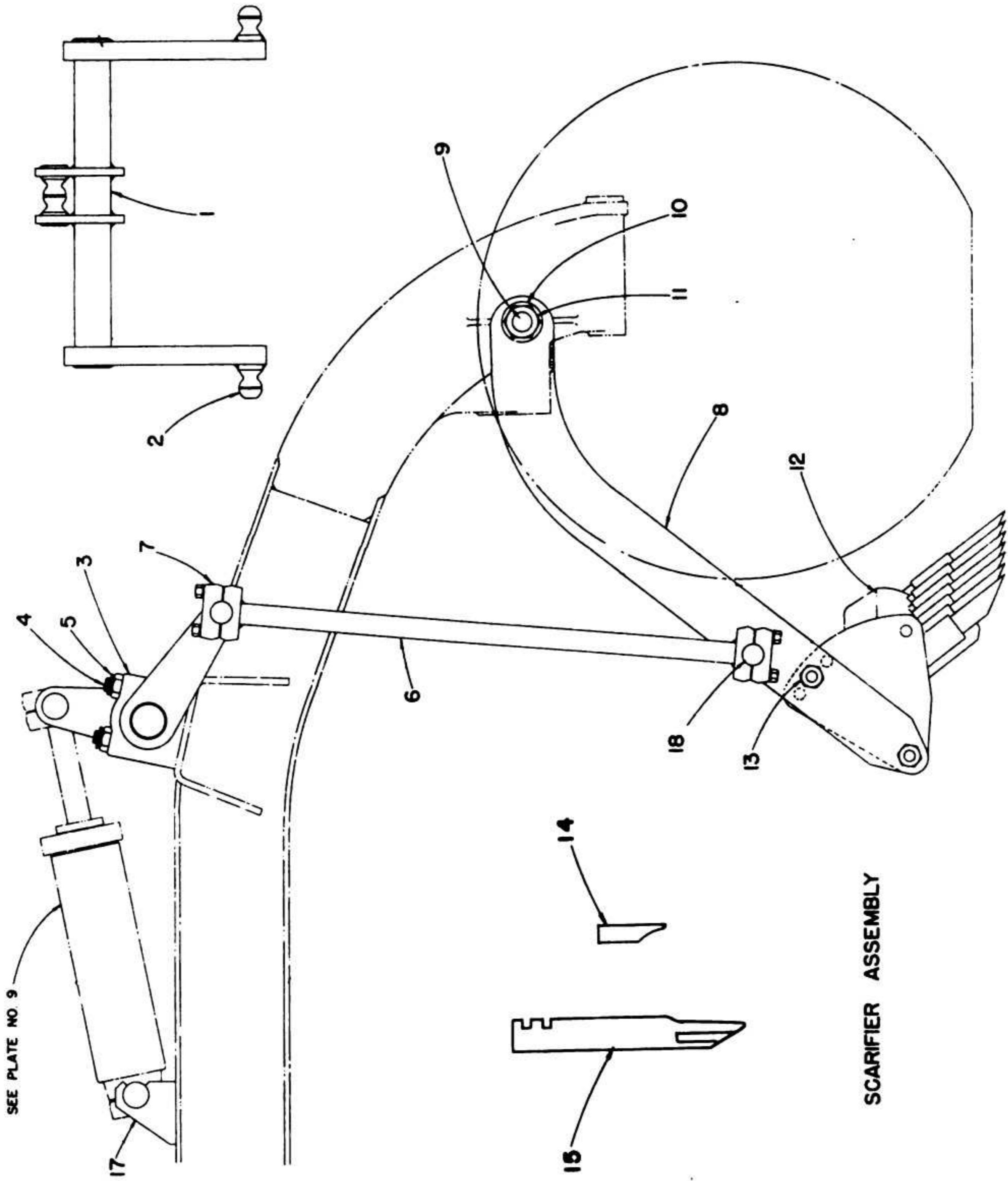


PLATE NO. 20

SEE REVERSE SIDE FOR REF. & PART NO'S.

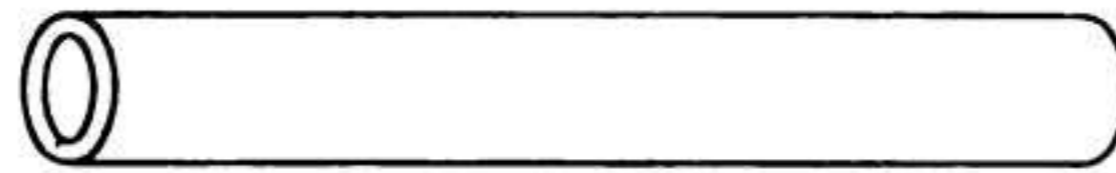
SCARIFIER ASSEMBLY			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-3567	SCARIFIER LIFT SHAFT ASSEMBLY	1
2	4E-12563	LIFT ARM BALL	2
3	4E-12148	SCARIFIER SHAFT BEARING ASSEMBLY (INCLUDES 4 & 5)	2
4		1-1/4 N.C. X 9" MACHINE BOLT	4
5	20FN-2007	1-1/4 N.C. LOCK NUT (FLEX.)	4
6	4E-20177	SCARIFIER LIFT LINK ASSEMBLY	2
7	4E-11626	SCARIFIER LIFT LINK BALL SOCKET	4
8	4E-3565 4E-3564	SCARIFIER DRAWBAR ASSEMBLY, R.H. SCARIFIER DRAWBAR ASSEMBLY, L.H.	1 1
9	4E-20176	SCARIFIER DRAWBAR PIN	1
10		2" PL. WASHER	2
11		2" N.C. REGULAR SLOTTED HEX NUT	2
12	4E-4270	11-TOOTH V-TYPE SCARIFIER BLOCK	1
13	10FA-1608	1" N.C. NUT (FLEX.)	4
14	4E-20589	TOOTH TIP	11
15	4E-3599	TOOTH SHANK	11
17	4E-12636	SCARIFIER CYLINDER ANCHOR ASSEMBLY	1
18	4E-12563	DRAWBAR BALL	2

4D7610090

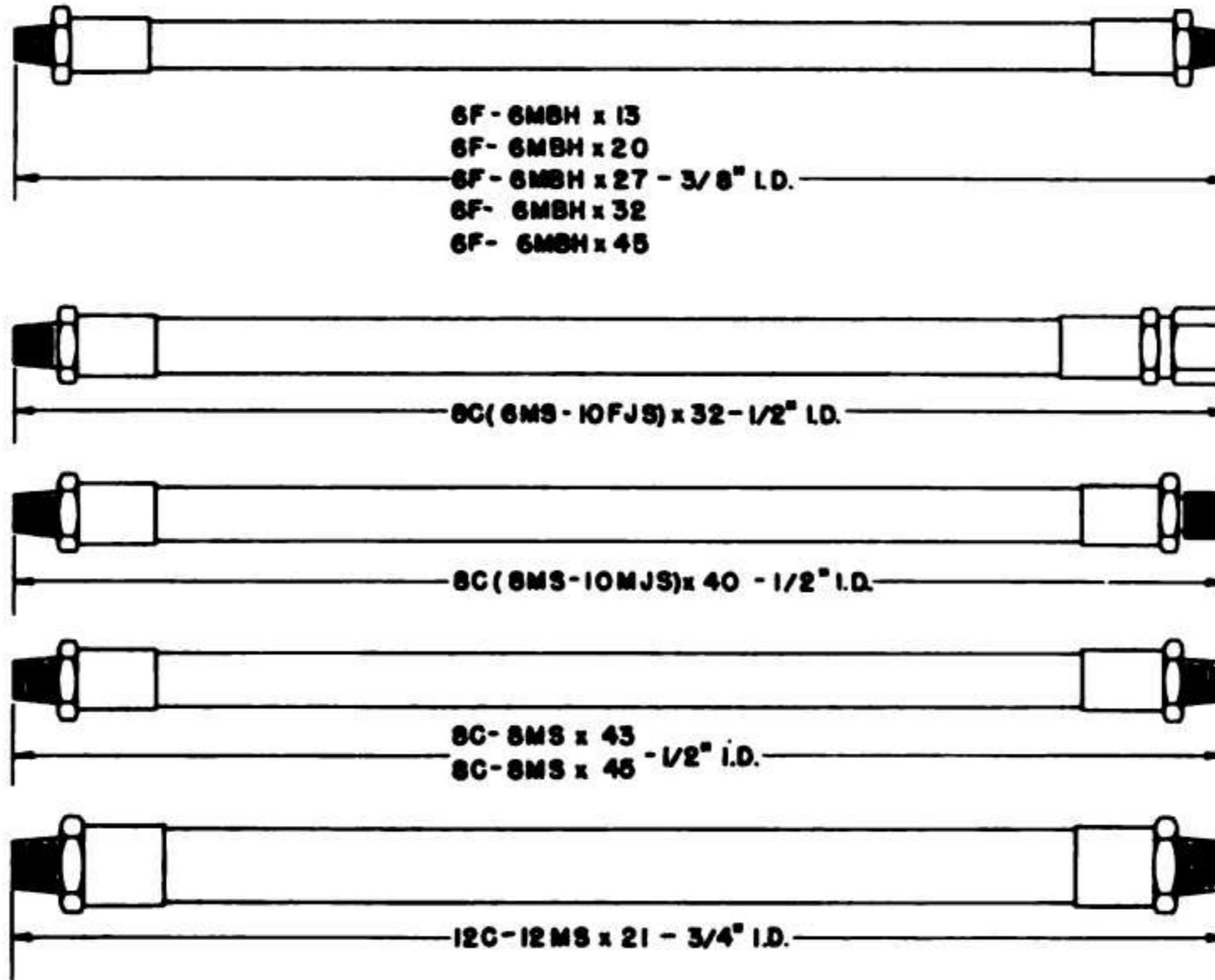
A-1903

PLATE NO. 20

ALWAYS GIVE GRADER SERIAL NUMBER



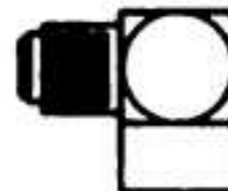
1" I.D. x 10' L.G. SUCTION HOSE



STR. ADAPTER
 10-37-2 (5/8 x 1/2)
 12-8-37-2 (3/4 x 1/2)
 12-37-2 (3/4 x 3/4)
 16-37-2 (1 x 1)



STR. FEMALE CPLG
 12-8-37-3 (3/4 x 1/2)
 12-37-3 (3/4 x 3/4)



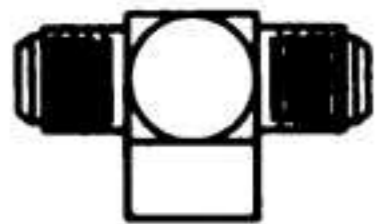
90° FEM. ELBOW
 10-6-37-7 (5/8 x 3/8)
 10-37-7 (5/8 x 1/2)



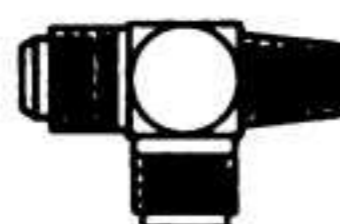
90° MALE ELBOW
 10-37-6 (5/8 x 1/2)
 12-37-6 (3/4 x 3/4)



45° ELBOW
 16-37-5 (1 x 1)



FEMALE TEE
 12-37-10 (3/4 x 3/4)



MALE TEE
 12-37-12 (3/4 x 3/4)



NUT
 10-37-15 (5/8)
 12-37-15 (3/4)
 16-37-15 (1)



STR. ADAPTER
 6M-6UFS (3/8 x 3/8)
 8M-12UFS (1/2 x 3/4)



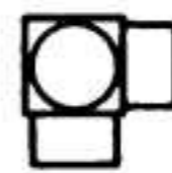
90° ADAPTER
 6MA-6UFS (3/8 x 3/8)
 6MA-8UFS (3/8 x 1/2)



90° ADAPTER-LONG
 6MA-6UFS-2-1/2
 4D76100A1904



90° FEM. ADAPTER
 8FA-6UFS (1/2 x 3/8)



90° ELBOW
 6-19PC (3/8 x 3/8)



90° STREET ELBOW
 6-18PC (3/8 x 3/8)



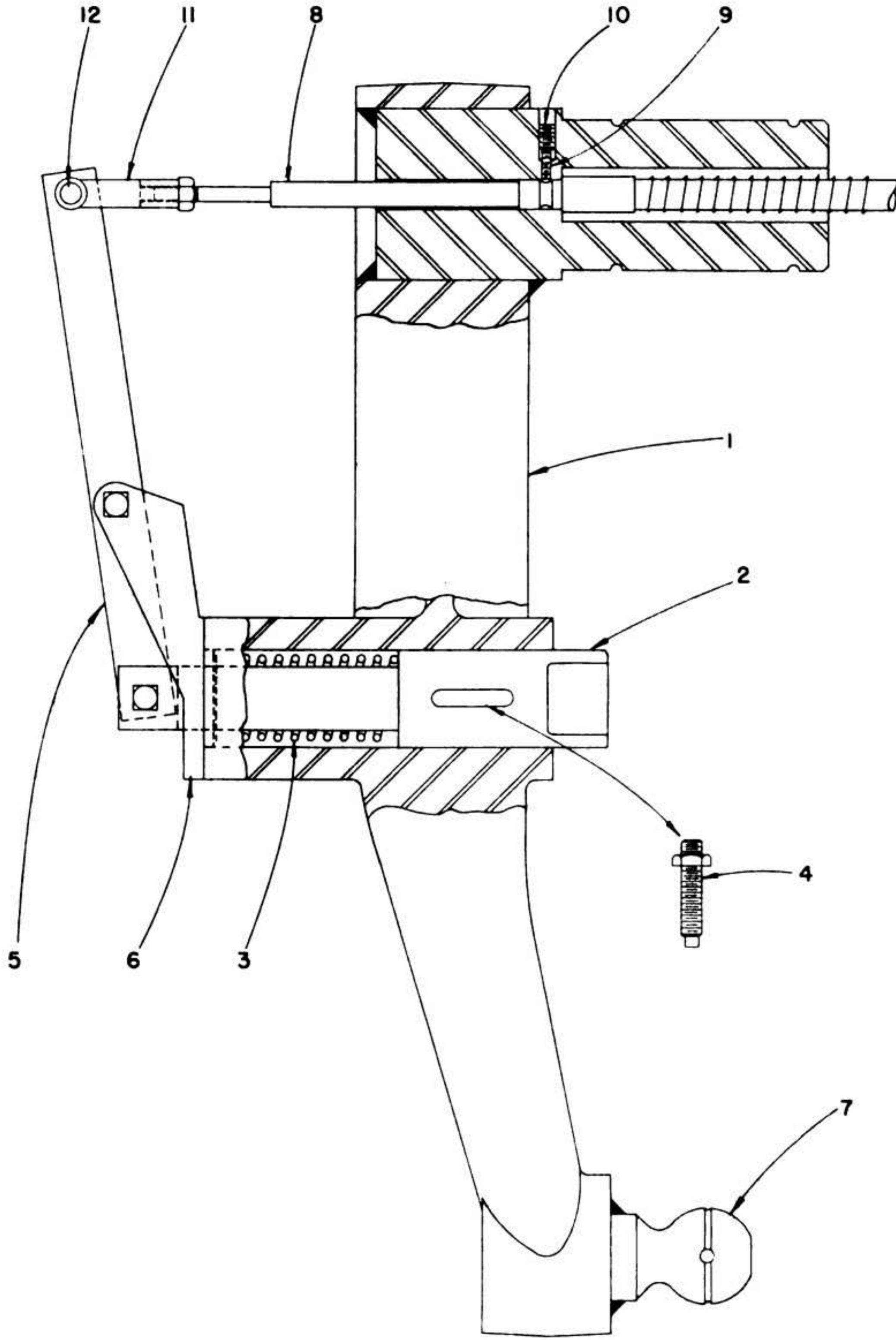
PIPE NIPPLE
 6-PN-2 (1/2 x 2)

PLATE NO. 22

SEE REVERSE SIDE

HYDRAULIC HOSE & TUBE ASSEMBLIES		
PART NO.		NO. REQ'D
4E-20693	TANK TO PUMP PIPING	1
PUMP TO VALVE PIPING		
4E-20663	PUMP TO VALVE TUBE ASSEMBLY	1
12C-12MSx21	TWO WIRE BRAID HOSE ASSEMBLY	1
PUMP TO TANK PIPING		
4E-20691	TEE TO TEE TUBE ASSEMBLY	1
4E-20690	VALVE TO TEE TUBE ASSEMBLY	1
4E-20692	TEE TO TANK TUBE ASSEMBLY	1
L.H. BLADE LIFT PIPING		
4E-20678	TUBE - UPPER ASSEMBLY	1
4E-20679	TUBE - LOWER ASSEMBLY	1
6F-6MBH x 45	SINGLE WIRE BRAID HOSE ASSEMBLY	2
R.H. BLADE LIFT PIPING		
4E-20681	TUBE - UPPER ASSEMBLY	1
4E-20682	TUBE - LOWER ASSEMBLY	1
6F-6MBHx45	SINGLE WIRE BRAID HOSE ASSEMBLY	2
WHEEL LEAN PIPING		
4E-20665	WHEEL LEAN TUBE ASSEMBLY	2
6F-6MBHx27	SINGLE WIRE BRAID HOSE ASSEMBLY	2
CIRCLE TURN PIPING		
4E-20672	CIRCLE TURN TUBE ASSEMBLY	2
4E-20673	FLUID MOTOR - SHORT ASSEMBLY	1
4E-20674	FLUID MOTOR TUBE - LONG ASSEMBLY	1
SIDE SHIFT PIPING		
4E-20669	TUBE - UPPER ASSEMBLY	1
4E-20670	TUBE - LOWER ASSEMBLY	1
6F-6MBHx45	SINGLE WIRE BRAID HOSE ASSEMBLY	2
SOLENOID VALVE PIPING		
4E-20684	PRESSURE TUBE ASSEMBLY	1
4E-20685	RETURN TUBE ASSEMBLY	1
POWER STEERING PIPING		
4E-20687	PRESSURE TUBE ASSEMBLY	1
4E-20688	RETURN TUBE ASSEMBLY	1
8C(8MS-10FJS)x32	TWO WIRE BRAID HOSE ASSEMBLY	2
6F-6MBHx20	SINGLE WIRE BRAID HOSE ASSEMBLY	1
6F-6MBHx27	SINGLE WIRE BRAID HOSE ASSEMBLY	1
SCARIFIER PIPING		
4E-20667	SCARIFIER TUBE ASSEMBLY	2
6F-6MBHx13	SINGLE WIRE BRAID HOSE ASSEMBLY	1
6F-6MBHx32	SINGLE WIRE BRAID HOSE ASSEMBLY	1
POWER SLIDING MOLDBOARD PIPING		
4E-20695	TUBE ASSEMBLY IN FRAME	2
4E-20696	TUBE ASSEMBLY ON DRAWBAR	2
8C(8MS 10NJS)x40	TWO WIRE BRAID HOSE ASSEMBLY	2
8C-8MSx43	TWO WIRE BRAID HOSE ASSEMBLY	1
8C-8MSx45	TWO WIRE BRAID HOSE ASSEMBLY	1
4D76100A1904		PLATE NO. 22

ALWAYS GIVE GRADER SERIAL NUMBER



CROSS SHIFT ARM ASSEMBLY

PLATE NO. 23

4D761006090

SEE REVERSE SIDE FOR REF. & PART NO.'S.

CROSS SHIFT ARM ASSEMBLY			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-3437	CROSS SHIFT ARM ASSEMBLY	1
2	4E-20143	CROSS SHIFT ARM INDEX PIN	1
3	4E-12309	CROSS SHIFT ARM INDEX PIN SPRING	1
4		1/2 N.C. X 3 ALLEN FULL DOG POINT HEADLESS SET SCREW. WITH 1/2 HEX JAM NUT	1
5	4E-12119	CROSS SHIFT ARM LEVER	1
6	4E-3449	SPRING RETAINER & BEARING	1
7	4E-12067	CROSS SHIFT ARM BALL	1
8	3SN-251-90	INDEX PIN CONTROL CABLE	1
9		1/4 N.C. X 3/4 ALLEN OVAL POINT HEADLESS SET SCREW	1
10		3/8 N.C. X 1 ALLEN FLAT POINT HEADLESS SET SCREW	1
11	2708-4A	YOKE END	2
12	2708 $\frac{1}{2}$ -4A	YOKE PIN ASSEMBLY	2

4D761006090

PLATE NO. 23

ALWAYS GIVE GRADER SERIAL NUMBER

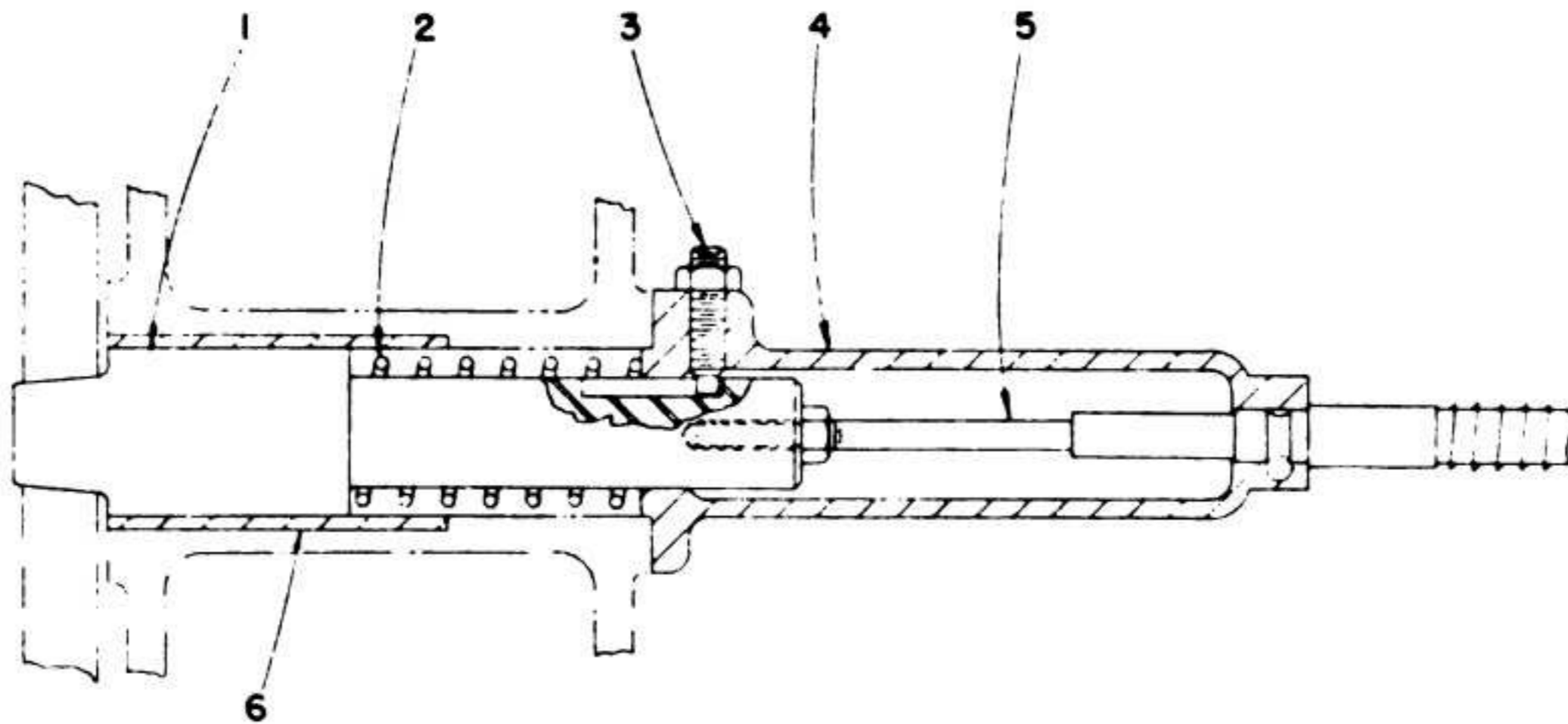


PLATE NO. 24

4D7610090

SADDLE INDEX PIN ASSEMBLY

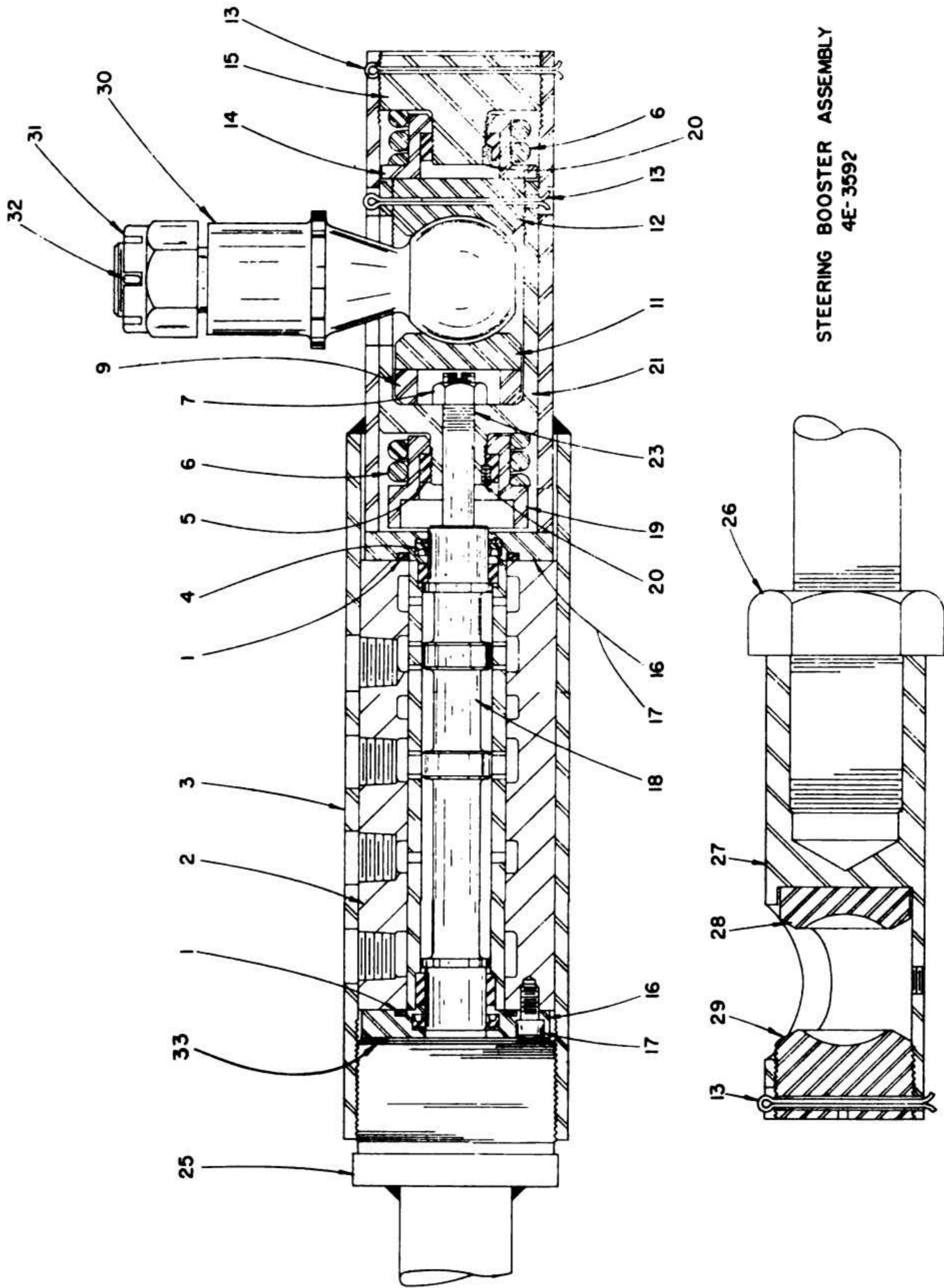
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20274	SADDLE INDEX PIN	1
2	4E-12309	SADDLE INDEX SPRING	1
3		1/2 N.C. X 2 ALLEN HEADLESS FULL DOG POINT SET SCREW & JAM NUT	1
4	4E-3535	SPRING RETAINER COUPLING	1
5	2SN-251-136	PUSH PULL CONTROL (SADDLE)	1
6	A-2605-2	BEARING (OILITE)	1

WHEN ASSEMBLING THE $\frac{1}{8}$ " SET SCREW WHICH RETAINS 4E-20274 SADDLE INDEX PIN, SCREW IT IN UNTIL IT SEATS ON THE INDEX PIN, THEN BACK OFF 1 TURN. THIS WILL HELP ELIMINATE THE BREAKAGE OF THIS PIN IN THE FIELD.

4D7610090 A-1904

PLATE NO. 24

ALWAYS GIVE GRADER SERIAL NUMBER



STEERING BOOSTER ASSEMBLY
4E-3592

PLATE NO. 25

4D7610090A-1904

4E-3592 (G #1136) STEERING BOOSTER ASSEMBLY

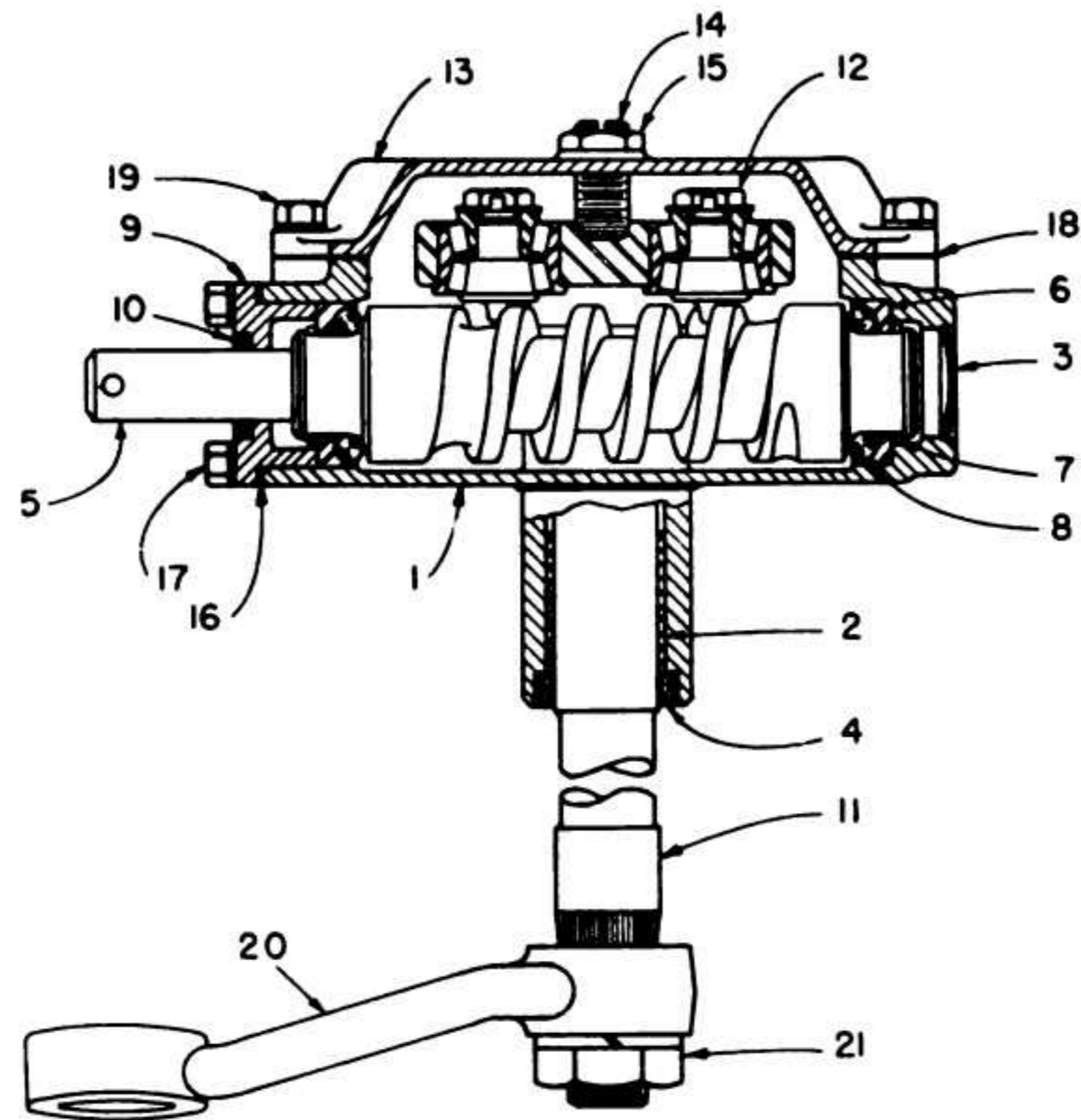
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	AN6227-24	1" O.D. RING	2
2	189	VALVE CASTING & CAGE ASSEMBLY	1
3	155T	VALVE SLEEVE ASSEMBLY	1
4	83	1/2" V PACKING SET - 13/16 BORE	2
5	113	SPRING RETAINER NUT	2
6	115	SPRING	2
7		7/16 N.C. HEX JAM NUT	1
9	123	BALL SOCKET SPACER	1
11	122	BALL SOCKET SEAT	1
12	121	BALL SOCKET PLUG	1
13		5/32 X 2-1/2 COTTER PIN	2
14	199	FEMALE RETAINER	1
15	126	DRAG LINK SLEEVE PLUG	1
16	190	VALVE CAP	2
17		1/4 N.C. X 3/8 ALLEN HD. SET SCREW	12
18	193	PISTON	1
19	192	FEMALE SPRING RETAINER	1
20		#10-24 X 1/4 CUP POINT SET SCREW	2
21	141	BALL SOCKET	1
23	194	VALVE PISTON STEM	1
25	742	DRAG LINK	1
26		1-1/2 N.C. JAM NUT	1
27	4E-20367	DRAG LINK END	1
28	28DB25	BEARING	1
29	4E-12422	BALL SOCKET & PLUG	1
30	686	BALL STUD	1
31		1" N.C. CASTLE NUT - WITH 1 - 1" FLAT WASHER	1
32		1/8 X 1-3/4" COTTER PIN	1
33	183	ADAPTER NUT SPACER	1

4D7610090

A-1904

PLATE NO. 25

ALWAYS GIVE GRADER SERIAL NUMBER



4E-3481 STEERING GEAR ASSEMBLY COMPLETE

PLATE NO. 26

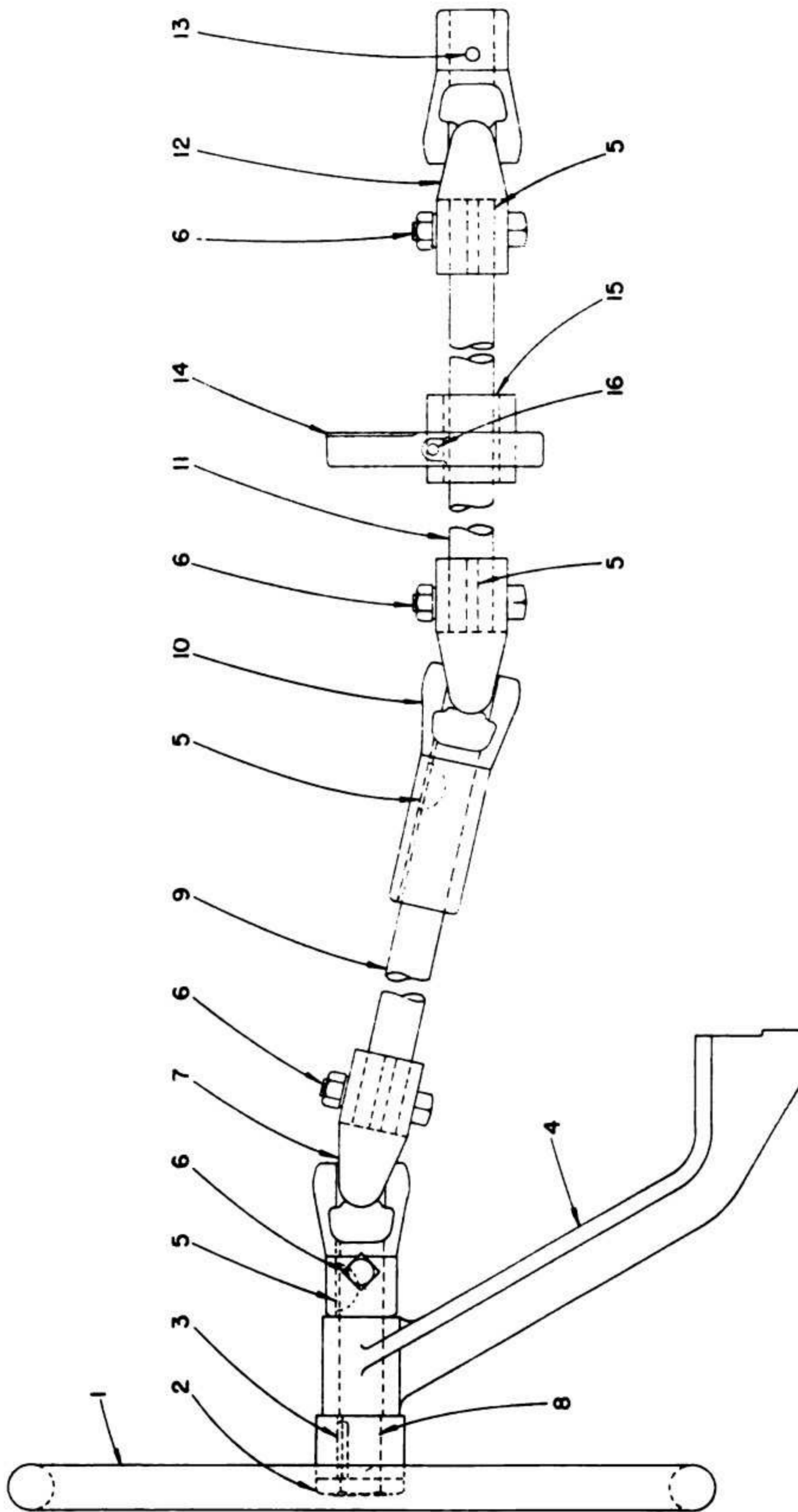
4E-3481 STEERING GEAR ASSEMBLY COMPLETE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
	505482	HOUSING ASSEMBLY, INCLUDES REF. NOS: 1,2,3.&4	1
1	TA712015	HOUSING (OA-6½ TB-4-3/8)	1
2	069501	BUSHING (1 INNER, 1 OUTER)	2
3		2" DIA. EXPANSION PLUG	1
4	504085	OIL SEAL UNIT	1
5	9207-13½	CAM & WHEEL SHAFT ASSEMBLY	1
6	400020	BALL CUP	2
7	400005	RETAINING RING	2
8	400014	STEEL BALL - 3/8" DIA.	28
9	TA666008	UPPER COVER	1
10	505104	OIL SEAL UNIT	1
11	9209-31-7/8	LEVER SHAFT	1
12	503982	SET OF STUD-ROLLER BEARING UNITS (CONSISTS OF (2) #044982 MATCHED UNITS)	1 (SET)
13	TA715002	HOUSING SIDE COVER	1
14	021065	ADJUSTING SCREW	1
15	025031	LOCK NUT	1
16	(033042 033036 033037	UPPER COVER SHIM .002 THICK UPPER COVER SHIM .003 THICK UPPER COVER SHIM .010 THICK	VARIABLE VARIABLE VARIABLE
17		3/8" X 1" S.A.E. CAPSCREW & LOCK WASHER	4
18	TA719000	SIDE COVER GASKET	1
19	020139	3/8" X 1½" HEX HEAD CAPSCREW	8
20	4E-3520	PITMAN ARM	1
21	025003	LEVER SHAFT NUT & LOCK WASHER	1

4D7610090

PLATE NO. 26

ALWAYS GIVE GRADER SERIAL NUMBER



STEERING ASSEMBLY

PLATE NO. 27

4D7610090

SEE REVERSE SIDE FOR REF. 8 PART NO.'S.

71

STEERING ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	924	STEERING WHEEL (SHELLER)	1
2		7/8 N.F. HEX JAM NUT	1
3	4E-12103	STEERING WHEEL KEY	1
4	4E-3445	STEERING COLUMN SUPPORT BRACKET	1
5		#18 WOODRUFF KEY	5
6		3/8 N.C. X 2-1/4 MACHINE BOLT & HEX NUT WITH 3/8 LOCK WASHER	4
7	9A-2086	UNIVERSAL JOINT	1
8	4E-12339	STEERING WHEEL SHAFT	1
9	4E-12349	STEERING SHAFT - SHORT	1
10	9A-2087	UNIVERSAL JOINT (LONG HUB)	1
11	4E-12350	STEERING SHAFT - LONG	1
12	4E-20307	UNIVERSAL JOINT	1
13	4E-12358	UNIVERSAL JOINT PIN	1
14	4E-20302	STEERING SHAFT BRACKET	1
15	4E-12351	STEERING COLUMN BEARING CAGE ASSEMBLY	1
16	4E-12353	STEERING COLUMN BEARING LOCK PIN	1

407610090

PLATE NO. 27

ALWAYS GIVE GRADER SERIAL NUMBER

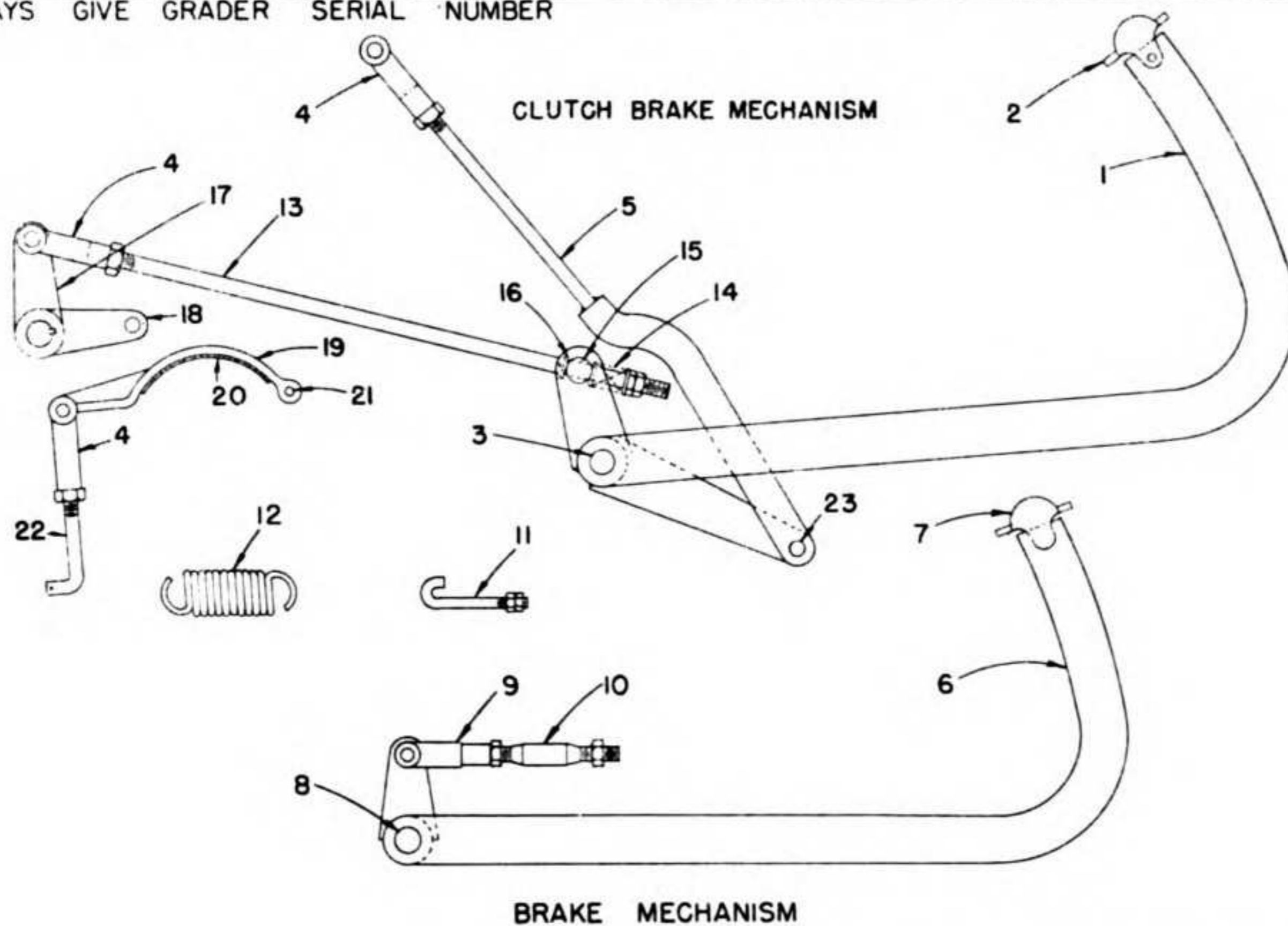


PLATE NO. 29

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D.
CLUTCH BRAKE MACHANISM			
1	4E-3500	CLUTCH PEDAL ASSEMBLY	1
2	4E-11882	PEDAL PAD	1
3	4E-12075	CLUTCH PEDAL PIVOT PIN	1
4	2708-6A	YOKE END	3
5	4E-20350	CLUTCH LINK FORK ASSEMBLY	1
13	4E-20352	CLUTCH BRAKE LINK ROD	1
14	4E-12702	CLUTCH BRAKE ADJ. SPRING	1
15	4E-12380	CLUTCH BRAKE JOURNAL PIN	1
16		1/2" S.A.E. PL. WASHER	3
17	4E-20349	CLUTCH BRAKE SHAFT ASSEMBLY	1
18	4E-12370	CLUTCH BRAKE INSIDE LEVER	1
19	4E-20346	CLUTCH BRAKE SHOE	1
20	4E-12385	CLUTCH BRAKE LINING	1
21	4E-12372	CLUTCH BRAKE SHOE PIN	1
22	4E-12371	CLUTCH BRAKE LINK SHORT	1
23	4E-12373	CLUTCH LEVER PIN	1
BRAKE MECHANISM			
6	4E-3614	BRAKE PEDAL ASSEMBLY	1
7	4E-11882	PEDAL PAD	1
8	4E-12237	BRAKE PEDAL PIVOT PIN	1
9	2708-6A	YOKE END	1
10	4E-12238	BRAKE ROD WITH JAM NUTS	1
11	4E-12074	PEDAL SPRING ADJ. ROD	1
12	P-72	SPRING	1

4D761006090 A-1904

PLATE NO. 29

ALWAYS GIVE GRADER SERIAL NUMBER

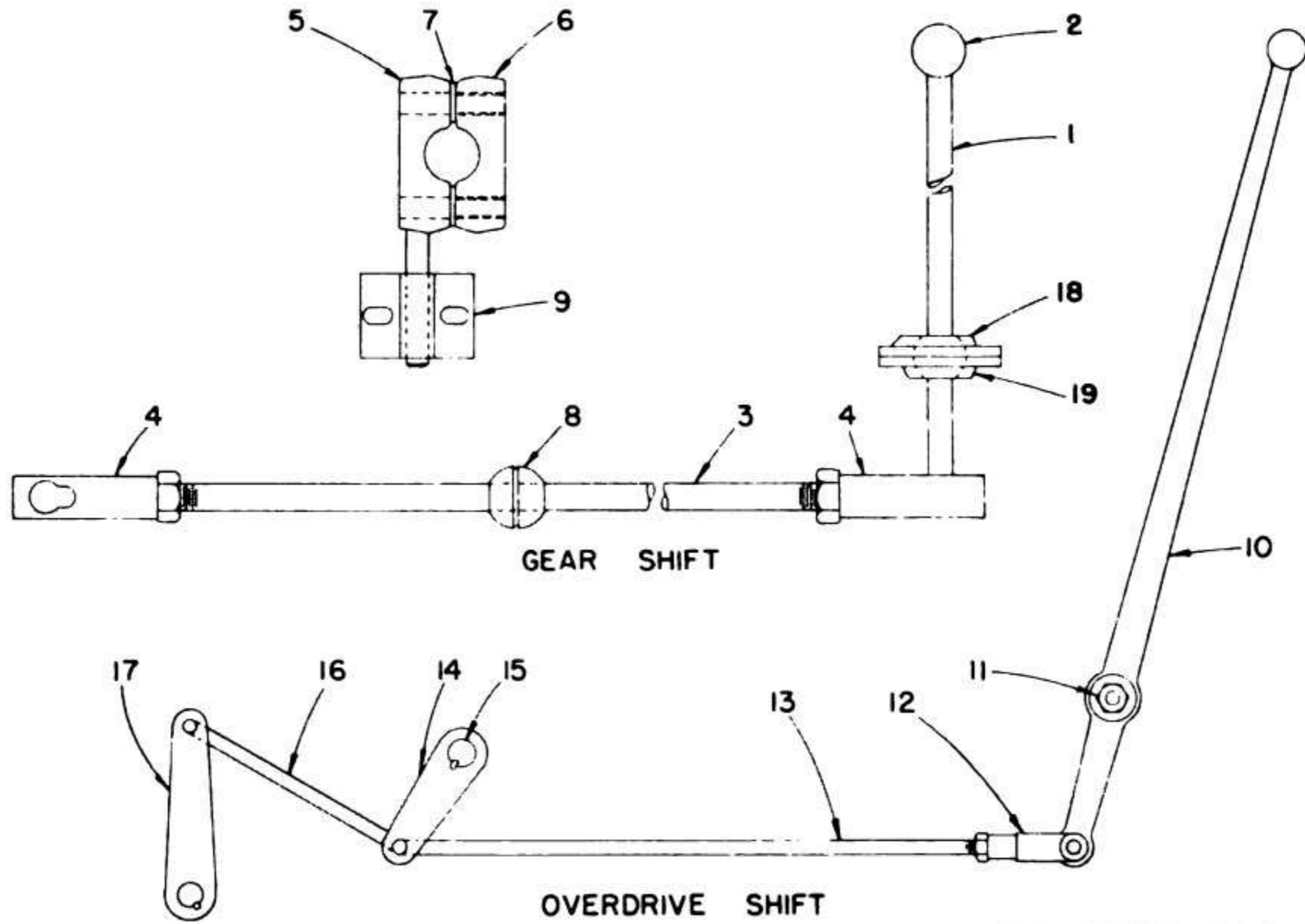


PLATE NO. 30

4D76100 A-1904

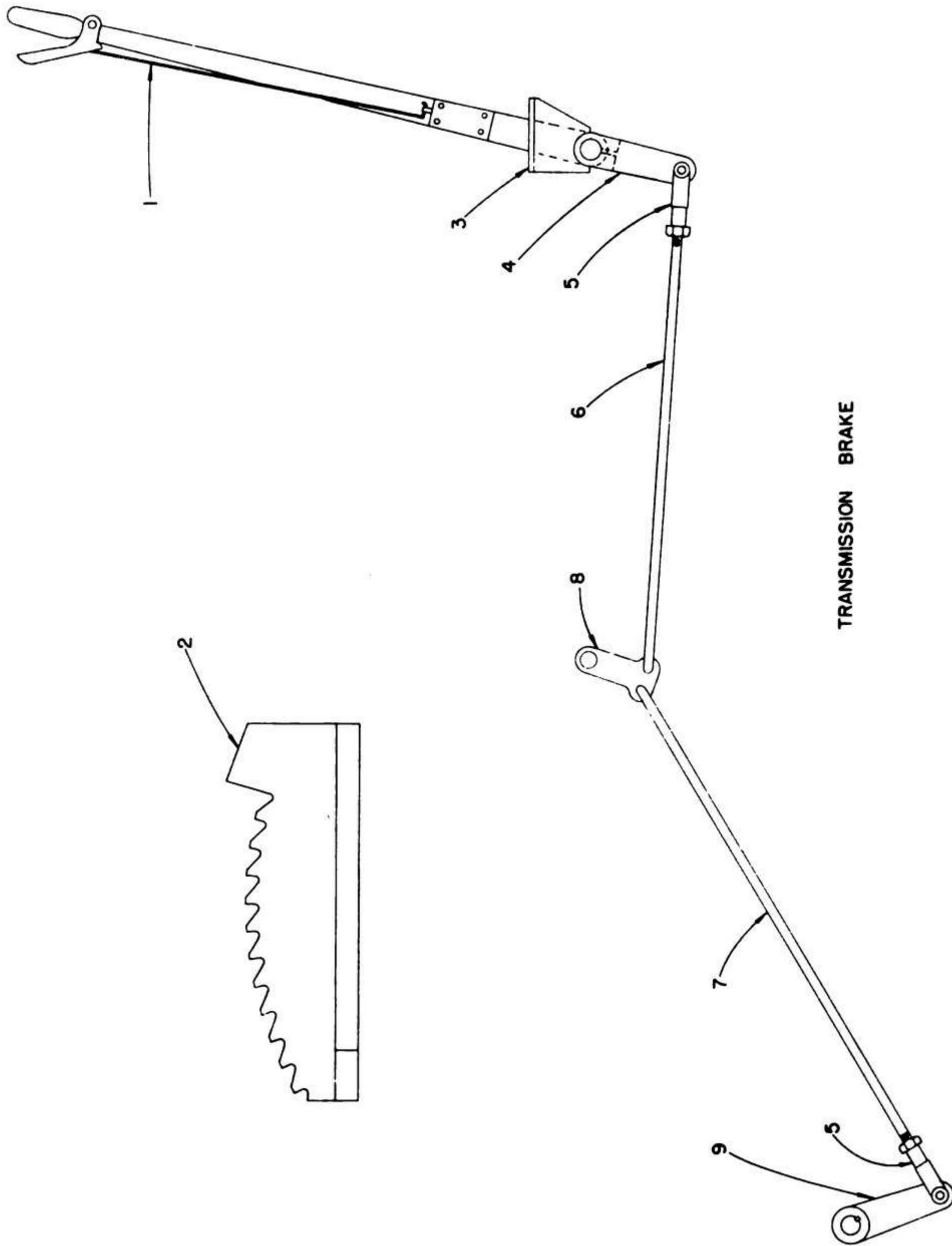
GEAR SHIFT

REF. NO.	PART NO.		NO. REQ'D
1	4E-20652	GEAR SHIFT LEVER ASSEMBLY	1
2	M-54	BALL	1
3	4E-12745	GEAR SHIFT ROD WITH (2) 1" N.F. HEX JAM NUTS	1
4	AS-1160-A	TIE ROD END ASSEMBLY	2
5	4E-20103	GEAR SHIFT BALL SOCKET ASSEMBLY	1
6	4E-11627	BALL SOCKET	1
7	4E-11629	BALL SOCKET SHIM	8
8	4E-12003	GEAR SHIFT ROD BALL	1
9	4E-12001	GEAR SHIFT ROD BRACKET ASSEMBLY	1
18	4E-12805	GEAR SHIFT SOCKET - UPPER	1
19	4E-12806	GEAR SHIFT SOCKET - LOWER	1
OVERDRIVE SHIFT			
10	4E-20105	OVERDRIVE SHIFT LEVER	1
11	49TE-126	ESNA STOP NUT & 3/4 P. WASHER	1
12	2708-6A	YOKE END & YOKE PIN ASSEMBLY	1
13	4E-12004	OVERDRIVE ROD - LONG	1
14	4E-11821	OVERDRIVE ARM	1
15	4E-20104	LEVER SHAFT & (2) #15 WOODRUFF KEYS	1
16	4E-12343	OVERDRIVE ROD - SHORT	1
17	4E-12342	OVERDRIVE LEVER WITH 3/8 x 3/4 SO. HD CUP POINT SET SCREWS	1

4D76100A1904

PLATE NO. 30

ALWAYS GIVE GRADER SERIAL NUMBER



TRANSMISSION BRAKE

PLATE NO. 31

40761006090

SEE REVERSE SIDE FOR REF. & PART NOS.

TRANSMISSION BRAKE			
REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	AS-924-A	BRAKE HAND LEVER ASSEMBLY	1
2	4E-20218	BRAKE LEVER RATCHET ASSEMBLY	1
3	4E-20110	TRANSMISSION BRAKE PIVOT ASSEMBLY	1
4	4E-20108	BRAKE LEVER ASSEMBLY	1
5	2708-6A	YOKE END & PIN ASSEMBLY	2
6	4E-20106	BRAKE ROD - SHORT, WITH JAM NUT	1
7	4E-20107	BRAKE ROD - LONG, WITH JAM NUT	1
8	4E-12007	INTERMEDIATE PIVOT ASSEMBLY	1
9	4E-2969	TRANSMISSION BRAKE ARM & SET SCREW	1

4D761006090

PLATE NO. 31

ALWAYS GIVE GRADER SERIAL NUMBER

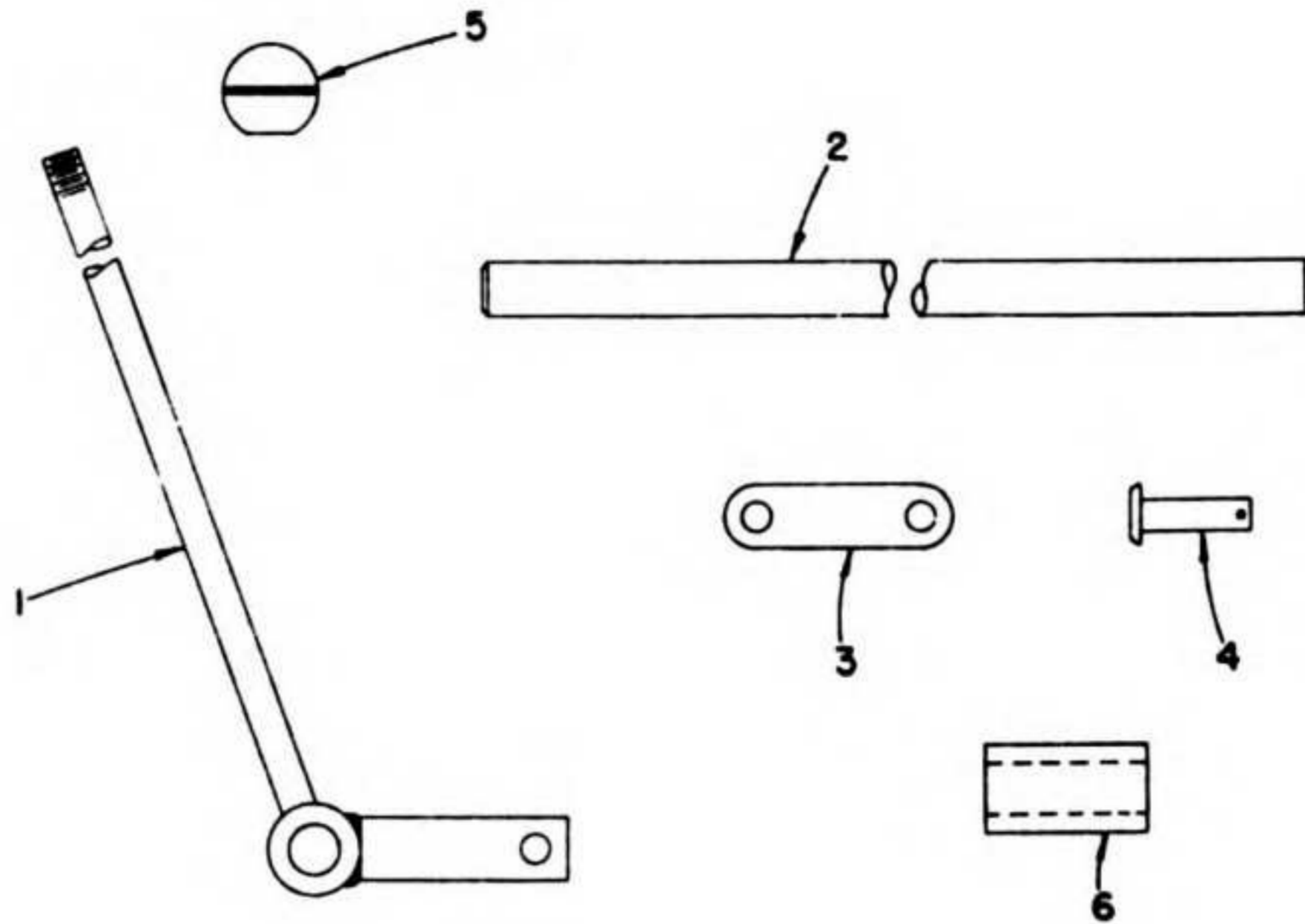


PLATE NO. 32

4D7610090

CONTROL LEVERS

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20490	CIRCLE TURN LEVER ASSEMBLY	1
	4E-20491	LEANING WHEEL LEVER ASSEMBLY	1
	4E-20492	SCARIFIER LEVER ASSEMBLY	1
	4E-20596	L.H. LIFT LEVER	1
2	4E-12330	CONTROL LEVER SHAFT	1
3	4E-12569	CONTROL LEVER LINK	12
4	2708 $\frac{1}{2}$ -5A	YOKE PIN ASSEMBLY	12
5	M-80	LEVER KNOB	3
6	4E-12105	CONTROL LEVER SPACER	1

PLATE NO. 32

4D-7610090 A1903

ALWAYS GIVE GRADER SERIAL NUMBER

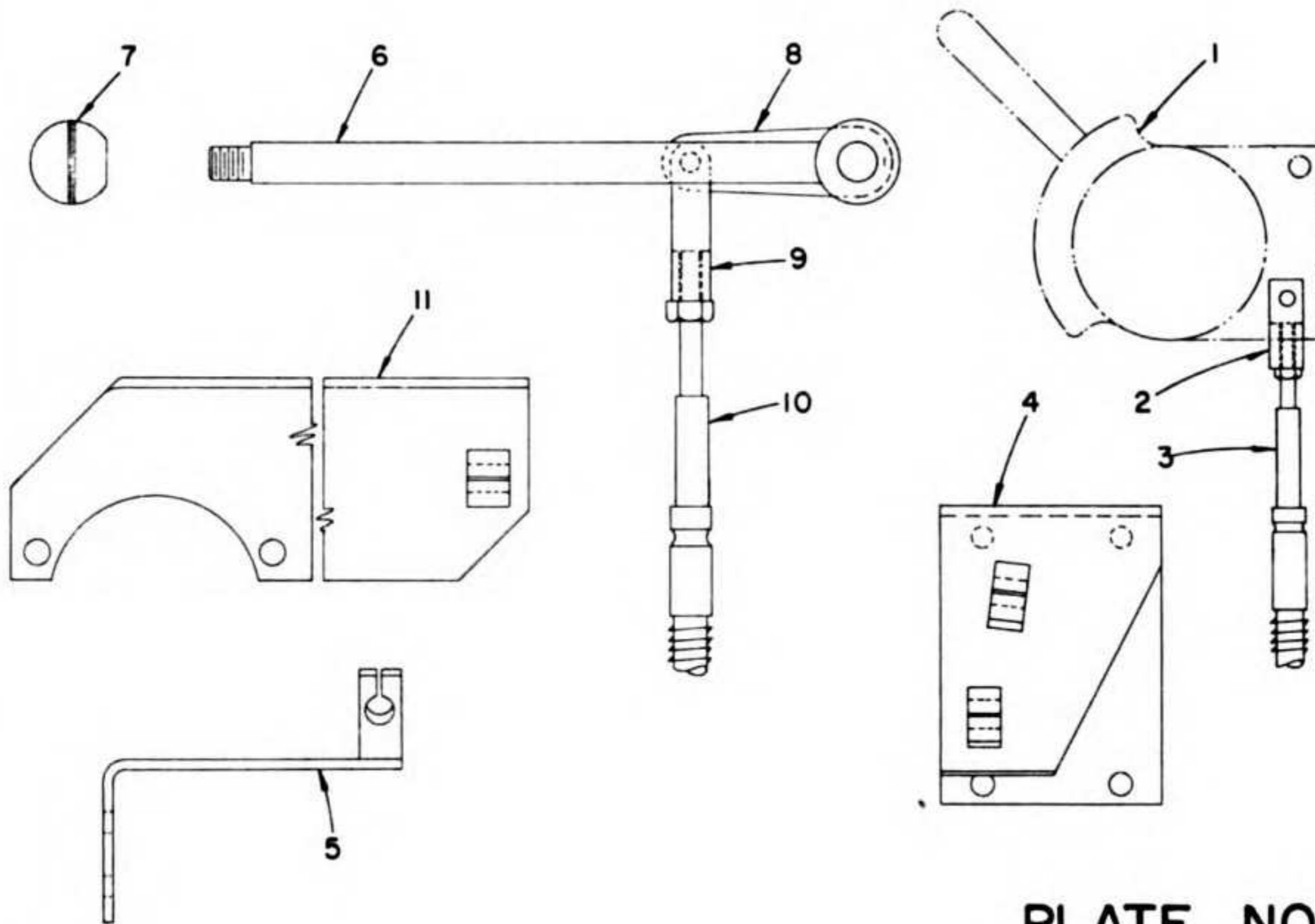


PLATE NO. 33

4D761006090

THROTTLE CONTROL

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	64584-D	GOVERNOR CONTROL LEVER ASSEMBLY (IHC)	1
2	4E-12108	THROTTLE CONTROL CLEVIS	1
3	3SN-125-120	TRU-LAY PUSH-ALL CONTROL (120 th LG.)	1
4	4E-20170	CONTROL BRACKET ASSEMBLY (4D-100)	1
5	4E-11937	CONTROL BRACKET ASSEMBLY (4D-76)	1

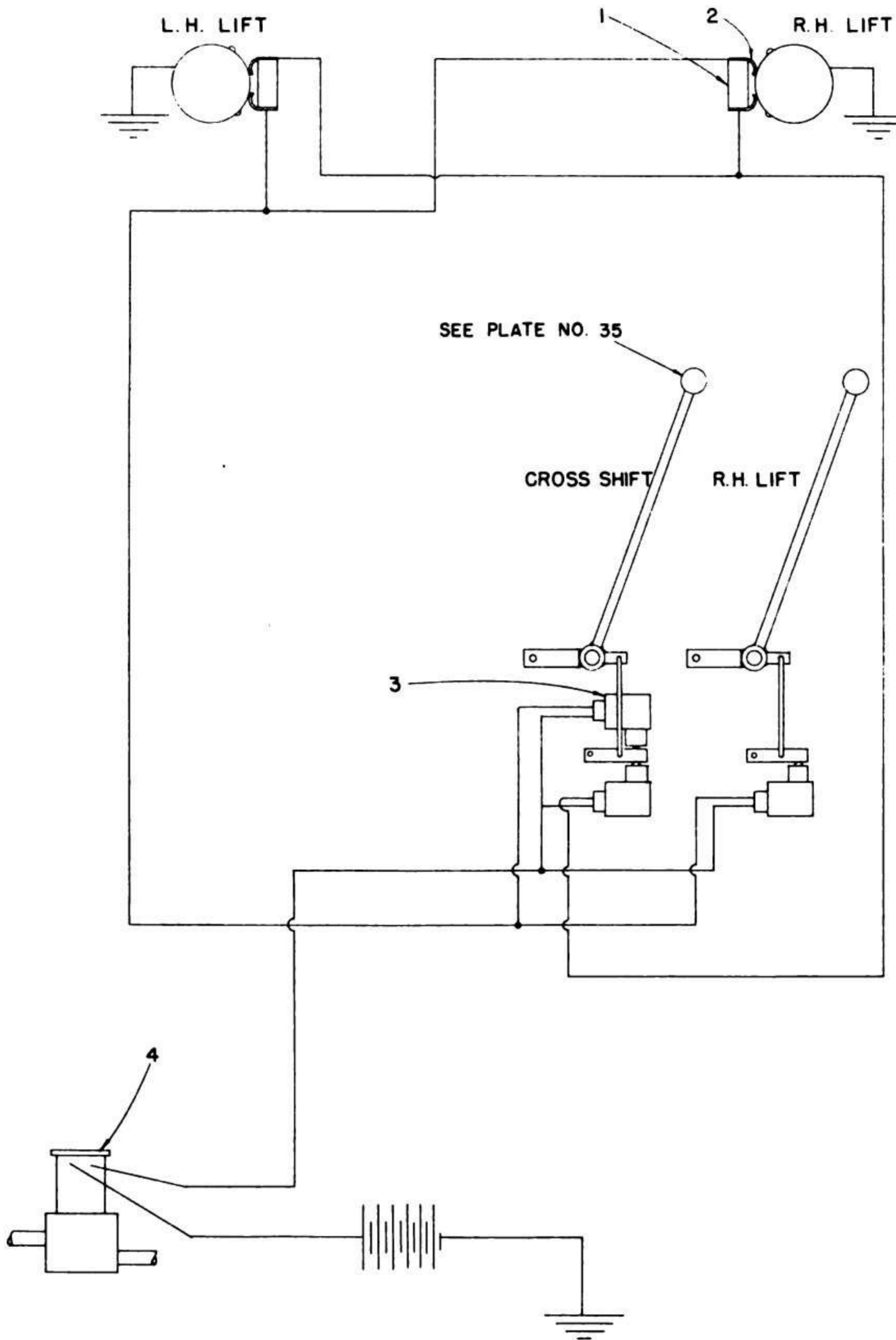
CONVERSION CONTROL

6	4E-12037	SHIFT LEVER ASSEMBLY	1
7	M-54	SHIFT LEVER BALL & INSERT	1
8	4E-12040	SHIFT LEVER SHAFT ASSEMBLY	1
9	2708-4A	YOKE END WITH PIN ASSEMBLY	2
10	3SN-251-110	TRU-LAY PUSH-ALL CONTROL	1
4	4E-20170	CONTROL BRACKET ASSEMBLY (4D-100)	1
11	4E-20181	CONTROL BRACKET ASSEMBLY (4D-76)	1

4D761006090

PLATE NO. 33

ALWAYS GIVE GRADER SERIAL NUMBER



SEE PLATE NO. 35

LIMIT CONTROL ELECTRICAL CIRCUIT

PLATE NO. 34

4D76100A1903

SEE REVERSE SIDE FOR REF. & PART NO'S.

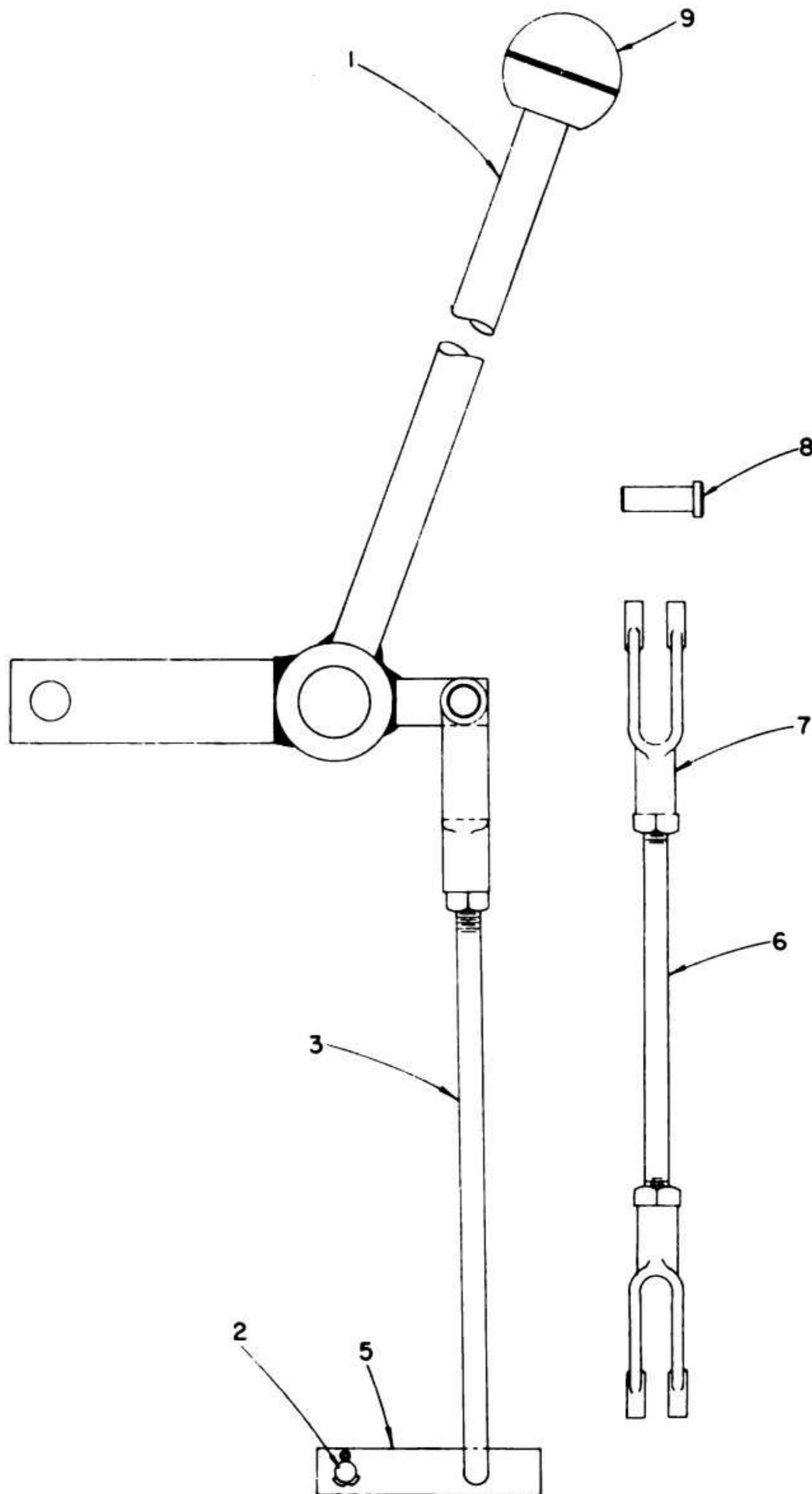
LIMIT CONTROL ELECTRICAL CIRCUIT

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-12495	OUTRIGGER CONTACT BASE	2
2	4E-12494	OUTRIGGER CONTACT	4
3	YZE-7-RNT	LIMIT SWITCH	3
4	314-6	SOLENOID VALVE	1

407610090 A-1903

PLATE NO. 34

ALWAYS GIVE GRADER SERIAL NUMBER



LIMIT CONTROL LEVER & ACTUATOR ASSEMBLY

PLATE NO. 35

4D76100AI903

SEE REVERSE SIDE FOR REF. & PART NO' S.

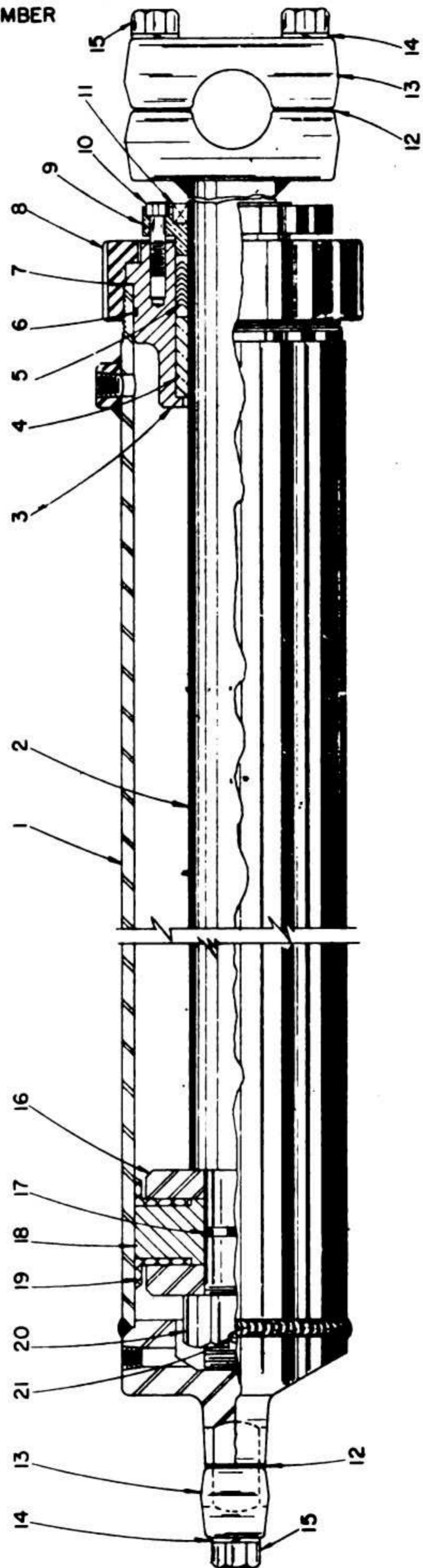
LIMIT CONTROL LEVER AND ACTUATOR ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20435	R.H. LIFT LEVER ASSEMBLY	1
	4E-20433	SIDE SHIFT LEVER ASSEMBLY	1
2	4E-12706	ACTUATOR PIVOT	1
3	4E-12497	ACTUATOR LINK - DUAL	1
5	4E-12502	LIMIT SWITCH ACTUATOR	2
6	4E-12501	ACTUATOR LINK	1
7	2708-2A	YOKE END	3
8	2708 ¹ -2A	YOKE PIN ASSEMBLY	3
9	M-80	LEVER KNOB	2

4D7610090 A-1903

PLATE NO. 35

ALWAYS GIVE GRADER SERIAL NUMBER



4E-3593 MOLDBOARD SHIFT CYLINDER ASSEMBLY

PLATE NO.36

4D76100

SEE REVERSE SIDE FOR REF. & PART NO'S.

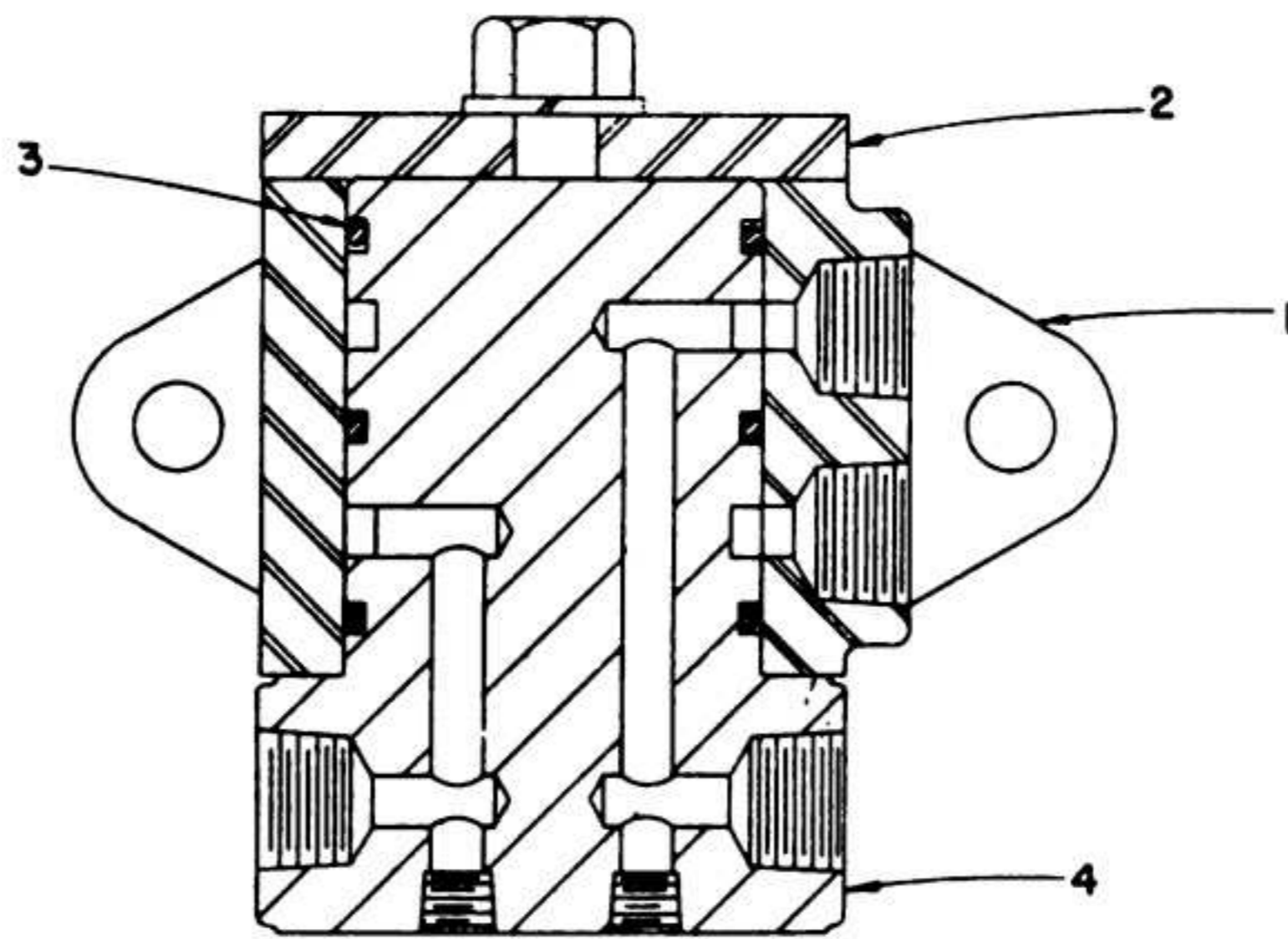
4E-3593 MOLDBOARD CYLINDER ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D.
1	4E-20555	MOLDBOARD CYLINDER BODY ASSEMBLY	1
2	4E-20557	PISTON ROD ASSEMBLY	1
3	4E-20446	STUFFING HEAD	1
4	4E-12512	STUFFING HEAD BUSHING	1
5	4E-12513	PACKING RING ASSEMBLY	1 SET
6	4E-12138	"0" RING	1
7	4E-12514	CYLINDER END GASKET	1
8	4E-20453	HEAD NUT	1
9	4E-12535	PACKING GLAND	1
10		3/8 NC X 1-1/2" HEX SOCKET TYPE CAP SCREW	4
11	4E-12560	WIPER	1
12	4E-11629	BALL SOCKET SHIM	8
13	4E-11626	BALL SOCKET	2
14		5/8" LOCK WASHER	4
15		5/8" X 3 HEX HEAD CAP SCREW	4
16	4E-12158	CUP FOLLOWER	2
17	4E-12137	"0" RING	1
18	4E-12488	PISTON	1
19	4E-12612	CUP	2
20		1-1/2 - 12 SLOTTED HEX NUT - SEMI-FIN.	1
21		5/16 X 2 COTTER PIN	1
22	D17208-8X40	FRAME HOSE	2
23	D-7208 X 43	CYLINDER HOSE	1
24	D-7208 X 45	CYLINDER HOSE	1
25	4E-20562	MOLDBOARD POWER SLIDE TUBE ASSEMBLY (IN FRAME)	2
26	4E-20563	POWER SLIDE TUBE ASSEMBLY (ON DRAWBAR)	2

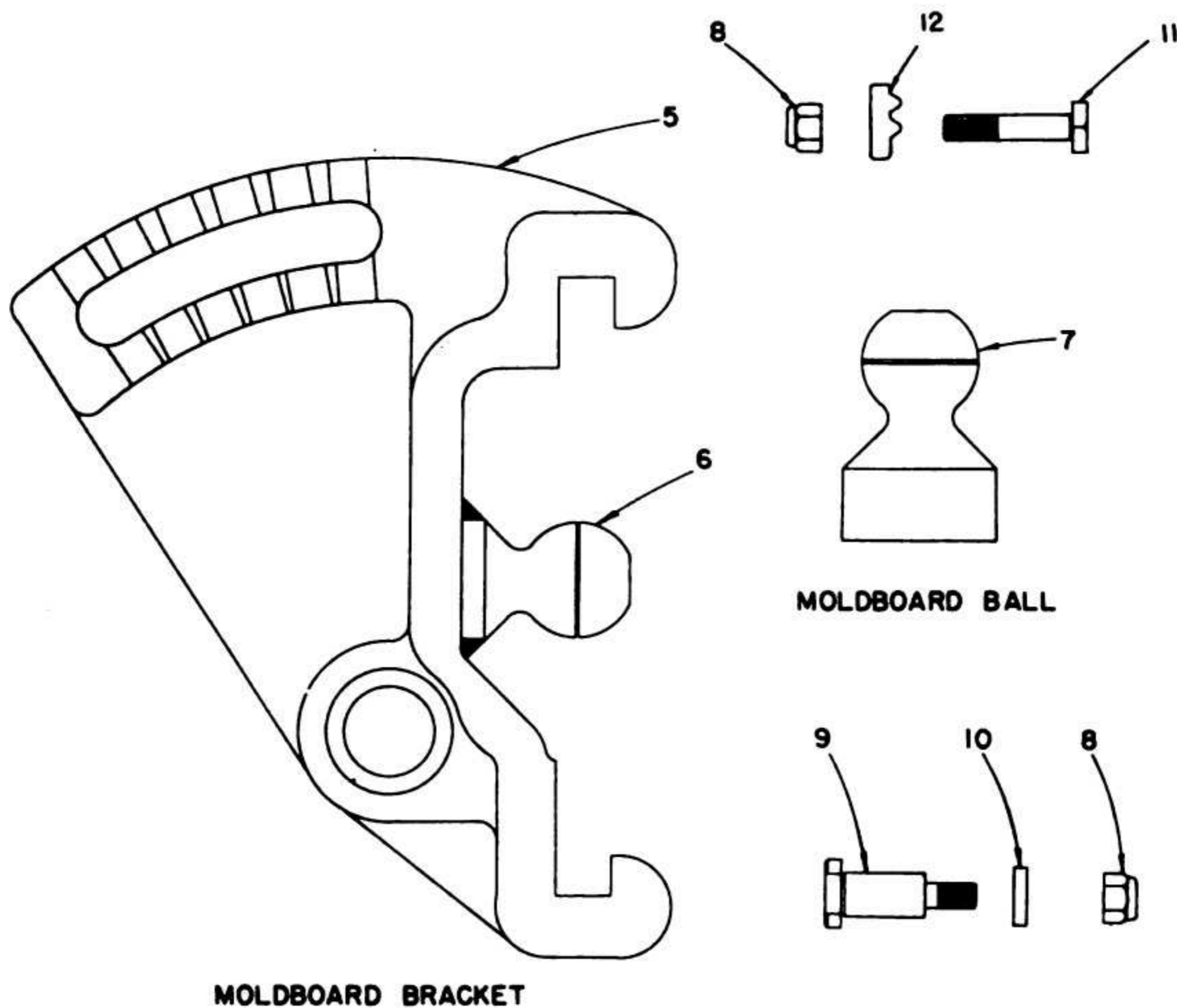
4D7610090 A-1900

PLATE NO. 36

ALWAYS GIVE GRADER SERIAL NUMBER



SWIVEL VALVE ASSEMBLY



MOLDBOARD BRACKET

MOLDBOARD BALL

PLATE NO. 37

SEE REVERSE SIDE FOR REF. & PART NO'S.

REF. NO.	PART NO.	DESCRIPTION	NO. REQ'D
1	4E-20559	SWIVEL VALVE CASE	1
2	4E-12662	SWIVEL VALVE CAP	1
3	4E-12664	R ₀ ^H RING	3
4	4E-20560	SWIVEL VALVE SPOOL	1
5	4E-3598	MOLDBOARD BRACKET ASSEM. R.H.	1
	4E-3597	MOLDBOARD BRACKET ASSEM. L.H.	1
6	4E-12563	BALL	1
7	4E-12655	MOLDBOARD BALL	1
8	49U-168	STOP NUT	4
9	4E-20138	MOLDBOARD HANGER PIVOT BOLT	2
10	4E-12062	PIVOT BOLT WASHER	2
11		1 x 5 $\frac{1}{2}$ BOLT	2
12	4E-20482	MOLDBOARD PITCH DOG	2

4D7610090

PLATE NO. 37

