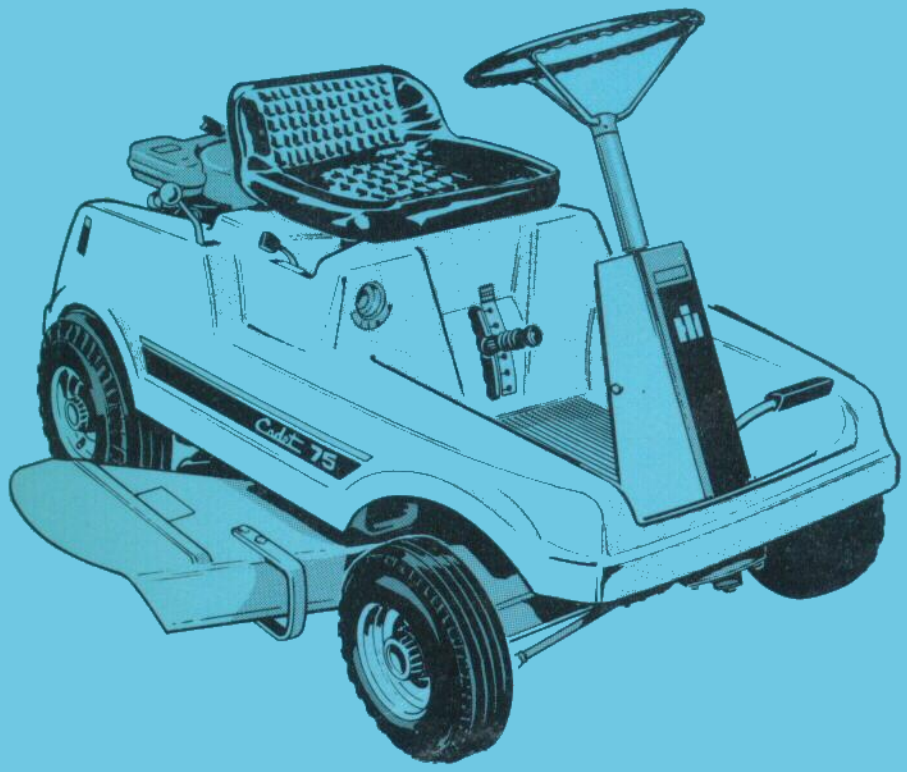
# Service Manual



GSS-1417

# INTERNATIONAL® Cadet® 55, 75 & 95 Riding Mowers

INTERNATIONAL HARVESTER COMPANY
AGRICULTURAL/INDUSTRIAL EQUIPMENT
401 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS, 60611, U.S.A.

# FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester Dealers and their factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, dealers are periodically issued service bulletins to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service IH equipment.

Distribute to dealers having the following contract: J-111

# IMPORTANT NOTE

Always read each step in its entirety before starting to perform it. Necessarily, some vital information may come at the middle or end of the description of a step. Much time can be saved, and damage to parts avoided, if the procedure is studied before work commences.

## LIBRARY FILING INFORMATION

1. File this manual after Divider Tab GSS-1417.
2. Enter the following information in the Service Manual Index.

   In the Mowers and Rakes Section, under the heading of "Complete Unit Overhaul", Print, or preferably type in, the Manual Description and Form Number.

# General Contents

# Standard Torque Data for Nuts and Bolts

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)

B. Joints are rigid, that is, no gaskets or compressible materials are used.

C. When reusing nuts or bolts use minimum torque values.

NOTE: Multiply the standard torque by:

.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when parkerized bolts or nuts are used.
.85 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.

| Bolt or Stud Diameter | Type 1 Studs Only | | Type 1 Bolts 6" length or less | | Type 1 Bolts longer than 6" | | Type 5 (all lengths) | | Type 8 (all lengths) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Only when used † in cast (gray) iron† | | All other applications | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 1/4 | 5 | 6 | 5 | 6 | 3 | 3 | 9 | 10 | 11 | 13 | 12 | 14 |
| 5/16 | 12 | 13 | 12 | 13 | 6 | 7 | 19 | 21 | 24 | 27 | 27 | 30 |
| 3/8 | 21 | 24 | 21 | 24 | 11 | 13 | 33 | 37 | 43 | 47 | 45 | 50 |
| 7/16 | 35 | 38 | 35 | 38 | 19 | 21 | 53 | 60 | 69 | 76 | 75 | 85 |
| 1/2 | 52 | 58 | 52 | 58 | 29 | 32 | 80 | 90 | 104 | 117 | 115 | 130 |
| 9/16 | 70 | 80 | 70 | 80 | 41 | 46 | 115 | 130 | 150 | 170 | 165 | 185 |
| 5/8 | 98 | 110 | 98 | 110 | 57 | 63 | 160 | 180 | 210 | 230 | 220 | 250 |
| 3/4 | 174 | 195 | 174 | 195 | 100 | 112 | 290 | 320 | 350 | 390 | 400 | 450 |
| 7/8 | 300 | 330 | 162 | 181 | 162 | 181 | 420 | 470 | 570 | 630 | 650 | 730 |
| 1 | 420 | 470 | 250 | 270 | 250 | 270 | 630 | 710 | 850 | 950 | 970 | 1090 |
| 1-1/8 | 600 | 660 | 350 | 380 | 350 | 380 | 850 | 950 | 1200 | 1350 | 1380 | 1550 |
| 1-1/4 | 840 | 940 | 490 | 540 | 490 | 540 | 1200 | 1350 | 1700 | 1900 | 1940 | 2180 |
| 1-3/8 | 1100 | 1230 | 640 | 710 | 640 | 710 | 1570 | 1760 | 2300 | 2500 | 2600 | 2800 |
| 1-1/2 | 1470 | 1640 | 850 | 940 | 850 | 940 | 2000 | 2300 | 3000 | 3300 | 3300 | 3700 |
| 1-3/4 | 2350 | 2450 | 1330 | 1490 | 1330 | 1490 | 3300 | 3700 | 4700 | 5200 | 5300 | 6000 |
| 2 | 3500 | 3900 | 2000 | 2200 | 2000 | 2200 | 5000 | 5500 | 7000 | 7800 | 8000 | 9000 |

† When bolt penetration is 1-1/2 times the diameter of the bolt.

## BOLT TYPE IDENTIFICATION CHART

| IH TYPE | S.A.E. GRADE | DESCRIPTION | BOLT HEAD MARKING * |
|---|---|---|---|
| 1 | Equivalent 1 or 2 | WILL HAVE A W STANDARD MONOGRAM IN THE CENTER OF THE HEAD<br>Low or Medium Carbon Steel Not Heat Treated |  |
| 5 | 5 | WILL HAVE A W AND 3 RADIAL LINES<br>Quenched and Tempered Medium Carbon Steel |  |
| 8 | 8 | WILL HAVE A W AND 6 RADIAL LINES<br>Quenched and Tempered Special Carbon or Alloy Steel |  |

*The center marking identifies the bolt manufacturer. The W monogram is currently used. Some bolts may still have an IH or a raised dot which previously identified IH bolts.

# Section 1

# GASOLINE ENGINE

## CONTENTS



## ENGINE

### Removal

1. Disconnect the spark plug wire.

2. Electric Start Models:

   a. Remove the seat.

   b. Disconnect the battery ground wire at the battery.

   c. Disconnect the starter wire.

   d. Disconnect the charging lead.

3. Disconnect necessary electrical wiring.

4. Disconnect the throttle cable.

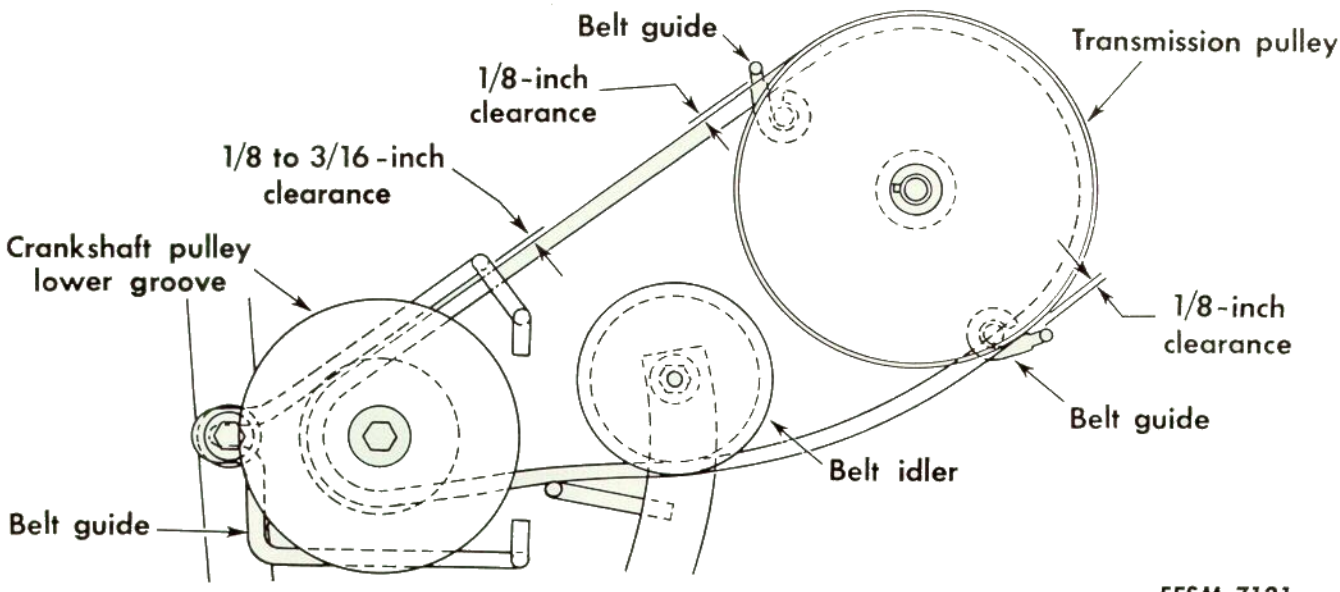
5. Lower the mower and remove the pins from the front hanger.

6. Remove the mower drive belt and main drive belt.

7. Remove the engine mounting bolts and maneuver the engine out of the chassis.

NOTE: For specifications and overhaul procedures, refer to Blue Ribbon Service Manual GSS-1441.

## Installation




Transmission Drive Belt.

1. Install the engine by reversing the removal procedure.

2. Adjust the following as necessary:

   - Governor linkage
   - Carburetor
   - Main drive belt guides

# ELECTRICAL SYSTEM

## Safety Starting Circuit

### General Information

The safety starting circuit consists of a transmission neutral starting switch, mower disengaged safety switch, control module and ignition switch. To start the engine the transmission must be in neutral, the mower drive control in the disengaged position and the ignition switch in the on position.

### Testing the Circuit

1. Connect a timing light to the spark plug lead.

2. Place the transmission in neutral, disengage the mower and turn the ignition switch to the on position.

3. Crank the engine over several times.

4. If the light responds, the ignition and safety start circuits are functioning properly. If the light fails to respond, disconnect the red lead coming from the module at the engine.

5. Crank the engine over several times.

6. If the light responds, the problem is in the safety starting circuit. If the light fails to respond, the problem is in the ignition circuit.

7. Reconnect the red lead at the engine. Check all the electrical connections on the switches. Check that the control module is properly grounded.

8. Crank the engine over several times.

9. If the light does not respond, disconnect the brown leads from the transmission neutral switch and the mower disengaged switch. Connect the two brown leads together with a jumper wire.

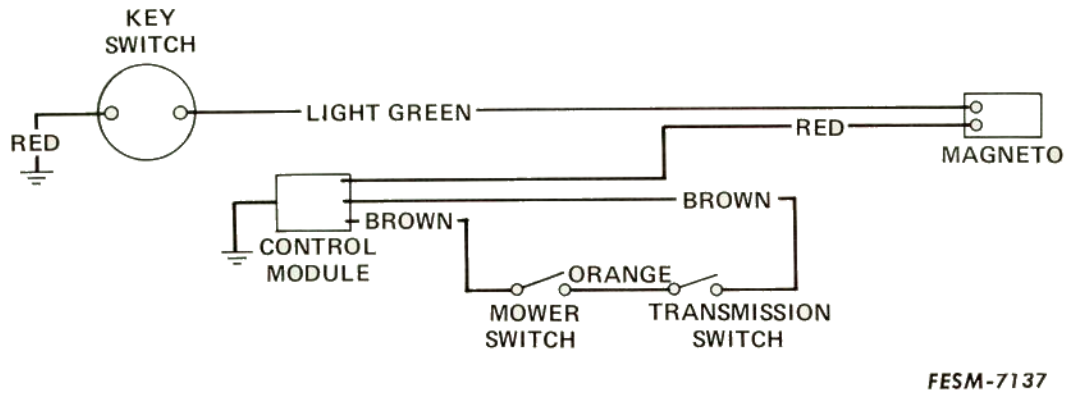
10. Crank the engine over several times.

11. If the light fails to respond, the control module is defective and must be replaced. If the light responds, one of the safety switches is defective.

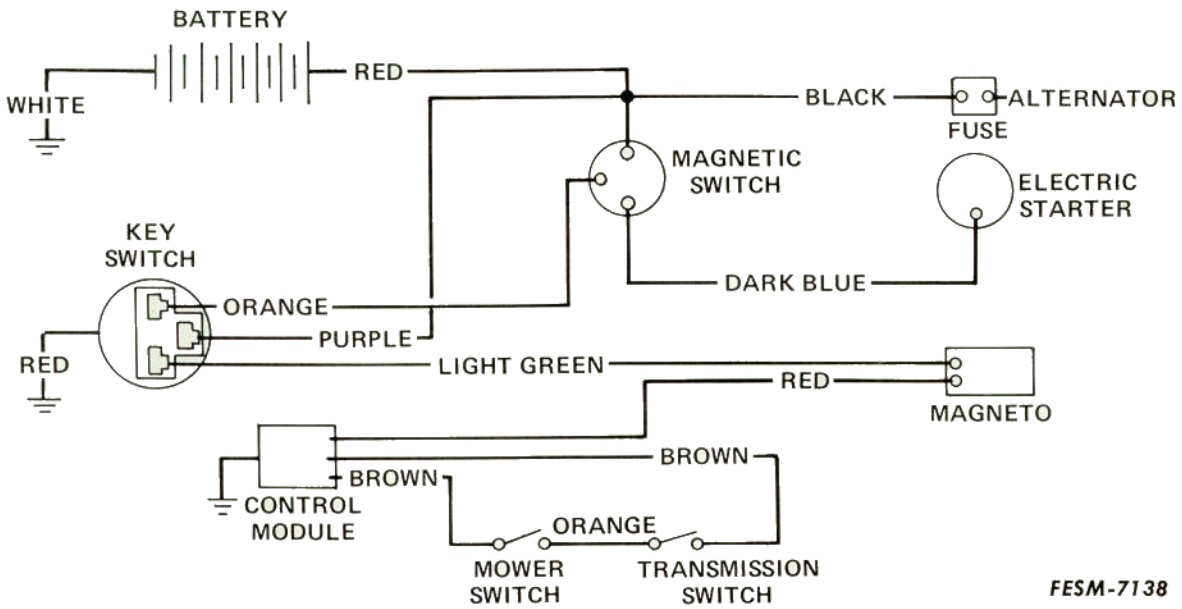
12. Check the switches individually with a continuity tester to determine which one is defective.

## Solenoid and Switches

If a solenoid, key start switch or safety starting switch malfunctions, replacement will be necessary.




Electric wiring diagram — recoil start.




Electric wiring diagram — electric start.

# Section 2

# ELECTRIC DRIVE

## CONTENTS

# SPECIFICATIONS

| | |
|---|---|
| Power supply | 36 volts DC |
| Power source | 3-12 volt batteries |
| Fuse | 100 amp |
| Traction Motor | |
| Size | 1 hp |
| Thermo switch setting | 260° |
| Speed | 2400 RPM |
| Blade Motor | |
| Size | 1/2 hp |
| Thermo switch setting | 260° |
| Circuit breaker | 40 amp |
| Speed | 3550 RPM |

# SPECIAL TOOLS

1. Voltmeter capable of reading 320 volts AC
2. Ohmmeter

# GENERAL INFORMATION


Before operating the International Cadet 95 Electric Riding Mower, read the "Safety Rules" described in the Operators Manual.

Three 12 volt batteries connected in series provide 36 volts DC for operation of the traction and blade motors. A built-in battery charger operates off of household current (115 volts) to recharge the batteries. The charger is equipped with a 12 hour electric timer run by the charger. After plugging the charger into an outlet, the timer may be set for any amount of time up to the 12 hour maximum. Setting the timer places the charger in the maximum charge condition. The rate of charge will automatically decrease as the batteries become charged. After the timer setting has expired, the charger will go to a minimum or trickle charge position.

The batteries should be recharged after each use of the rider. The charger should remain plugged in at all times including storage. Batteries will be severely damaged if stored for prolonged periods in a discharged condition.

CAUTION: Do not use mower batteries to start other vehicles. Battery damage will result. Keep the shroud raised while charging batteries

until the timer returns to the off position. Highly combustible hydrogen gas is vented during the charging cycle. Charge the batteries in a ventilated area. Keep flames away from the batteries. Do not smoke around the batteries during the charging cycle. The shroud may be lowered after the initial charging cycle is completed.

# PRINCIPLES OF OPERATION

**Refer to Foldout No. 1 at the rear of the manual.**

## Starting the Traction Motor

Place the transmission in neutral to close the transmission neutral start switch.

Turn the keyswitch to the "START" position. Current flow is from the battery "+" terminal through the neutral switch, across the closed contacts A and D of the key switch, through the coil winding of the traction motor magnetic switch, through the closed contacts of the thermal switch, through the fuse to the battery "-" terminal. The magnetic switch will now close connecting contacts 1 and 2. Current then flows across the contacts through the motor to the fuse and battery "-" terminal, starting the motor.

The key is spring loaded to return to the run position when released. The magnetic switch remains energized by current flow from terminal 2 to terminal 5 of the blade motor magnetic switch, to terminal E and D of the key switch.

The traction motor is protected from burning out by the thermal switch in the brush holder assembly of the motor. When the thermal switch is activated, current flow through the coil of the magnetic switch is interrupted. The magnetic switch contacts are then opened by plunger spring action.

# Starting the Blade Motors

Current to operate the blade motors starts at terminal 2 of the traction motor magnetic switch. The traction motor magnetic switch must be energized before the blade motors can be operated.

Place the mower switch in the "START" position. Current flow is from terminal 2 to terminal 5 of the blade motor magnetic switch, to the blade motors switch, across contacts C and A of the switch, across contacts B and C of the key switch, through the coil windings of the magnetic switch, through the left motor thermal switch, through the right motor thermal switch and circuit breaker, to the fuse and battery "-" terminal. The magnetic switch will now close connecting contacts 5 and 6. Current will then flow across the contacts through the motors to the fuse and battery "-" terminal, starting the motors.

The blade motor switch will return to the "ON" position when released.

Current flow through the diode to terminal "B" of the blade motor switch keeps the magnetic switch closed.

The blade motors are protected by circuit breakers and thermal switches. If the circuit is overloaded by the blade striking an object, the circuit breaker will open. If the motor overheats, the thermal switch will activate. Interruption of the current flow by either the circuit breaker or thermal switch will open the blade motor magnetic switch contacts by plunger spring action.

NOTE: When the blade motor magnetic switch opens the contacts by spring action, terminal 6 is connected to the battery "-" terminal. This action short circuits the blade motors providing a braking action.

# TROUBLE SHOOTING

| Problem | Possible Cause | Remedy |
|---|---|---|
| Traction motor does not start. | Transmission is not in neutral. | Place transmission in neutral. |
| | Batteries dead. | Refer to Test Procedure - Batteries. |
| | 100 amp fuse is blown. | Replace fuse. Check for cause of fuse failure. |
| | Loose wire connections. | Check and tighten all connections. |
| | Traction motor thermal switch is open. | Thermal switch will reset automatically after motor cools. |
| | Traction motor circuit defective. | Refer to Test Procedure - Traction - Motor Circuit. |
| | Traction motor defective. | Refer to Traction Motor. |
| Traction motor starts but stops when key is released to run position. | Defective key switch. | |
| Blade motors do not start. | Loose wire connections. | Check and tighten all connections. |
| | Circuit breaker open. | Breaker will reset automatically. |
| | Blade motor thermal switch open. | Thermal switch will reset automatically after cooling. |
| | Blade motor circuit is defective. | Refer to Test Procedure - Blade Motors Circuit. |
| | Blade motor defective. | Refer to Section 4 - Blade Motor. |
| Blade motor starts but stops when switch is released to run position. | Defective diode or blade motor switch. | Refer to Test Procedure - Blade Motors Circuit. |
| Only one blade motor runs. | Electrical connector not properly fastened. | Check connectors. |
| | Defective motor. | Refer to Section 4 - Blade Motor. |

# TEST PROCEDURE

## Traction Motor Circuit

**Refer to Foldout No. 1 at the rear of the manual.**

Use the following procedure if the traction motor will not start.

1. Make a visual inspection of the 100 amp fuse. Replace it if it is defective.

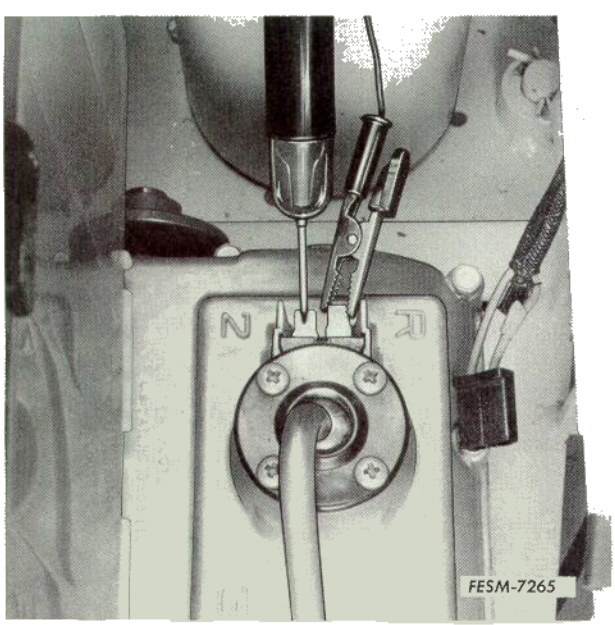
2. Check all battery connections. Make sure they are clean and tight. Make sure the batteries are fully charged.

3. Be sure the transmission is in neutral. Turn the key to the "START" position. You should be able to hear a click as the magnetic switch energizes and closes the contacts.

If the click is not heard, continue with step 4.

If the click is heard, proceed as follows:

a. Disconnect the negative (-) cable from the batteries.




b. Disconnect both red wires from terminal 2 of the traction motor magnetic switch.

c. Reconnect the negative (-) cable to the batteries.

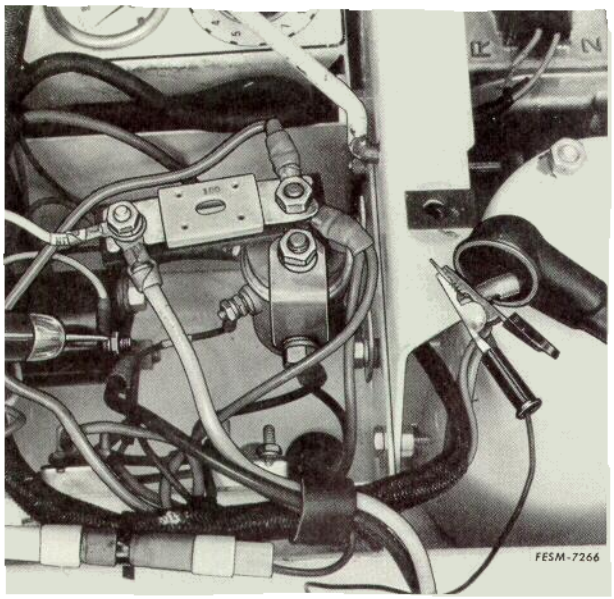
d. Place the key switch in the "START" position. Check the continuity between terminals 1 and 2 of the traction motor magnetic switch.

e. If the test lamp lights, check the motor for internal damage. If the test lamp does not light, replace the magnetic switch.

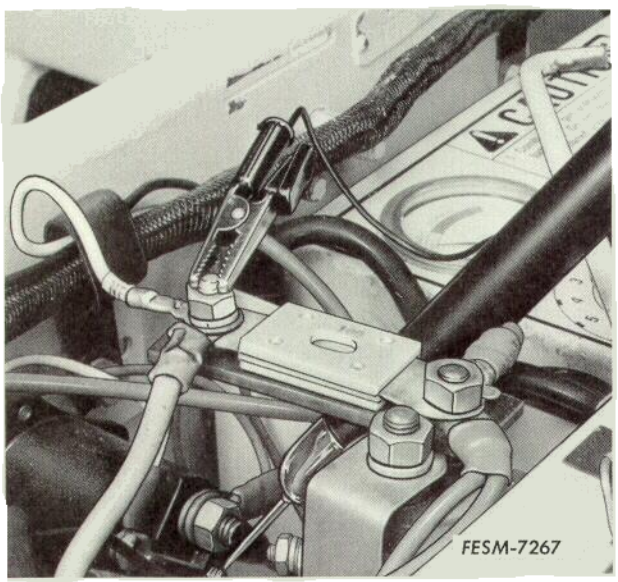
4. Remove the mower body. Refer to Section 3, Mower Body Removal - 95.

5. Remove the key switch from the body. Install it in the harness.

6. Place the transmission in neutral. Use a continuity tester to check the transmission neutral switch. If the test lamp does not light, the switch is defective. Reconnect the harness to the neutral switch before proceeding.




7. Hold the key switch in the start position. Check the continuity from the positive (+) battery connection to terminal 4 of the traction motor magnetic switch. If the tester does not light the key switch is defective.




8. Check the continuity from terminal 3 of the traction motor magnetic switch to the 100 amp fuse. If the tester does not light the traction motor thermal switch is defective.

9. If the preceding checks show no discrepancies, the traction motor magnetic switch is defective.

10. If the traction motor will start but not continue to run when the key is released to the "ON" position, the key switch is defective.

## Blade Motors Circuit

**Refer to Foldout No. 1 at the rear of the manual.**

Use the following procedure if the blade motors will not start.

1. The traction motor circuit must be functional before the blade motors will operate. Correct any deficiencies in that circuit before proceeding.

2. Remove the mower body. Refer to Section 3, Mower Body Removal - 95.

3. Remove the key switch and blade motor switch from the mower body. Install both switches back in the harness.

4. Reinstall the battery support plate and batteries. Connect the batteries back in the circuit.

5. Start the traction motor. Place the blade motor switch in the "START" position. You should be able to hear a click as the magnetic switch energizes and closes the contacts.

If the click is not heard, proceed with step 6.

If the click is heard, proceed as follows:

a. Disconnect the negative (-) cable from the batteries.

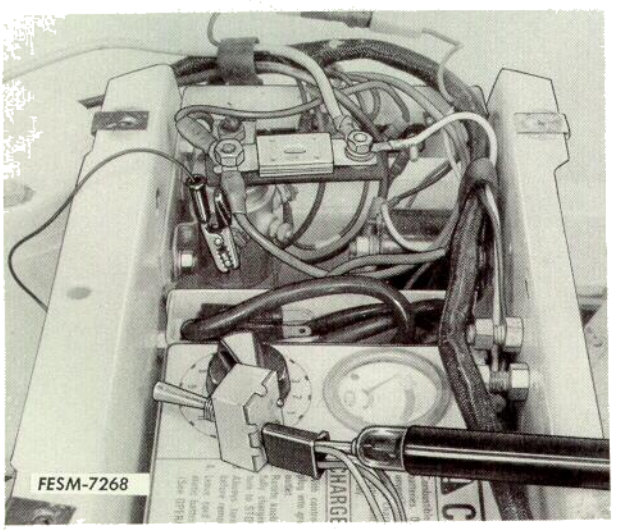
b. Disconnect the dark blue wires from terminal 6 of the blade motor magnetic switch.

c. Reconnect the negative (-) cable to the batteries.

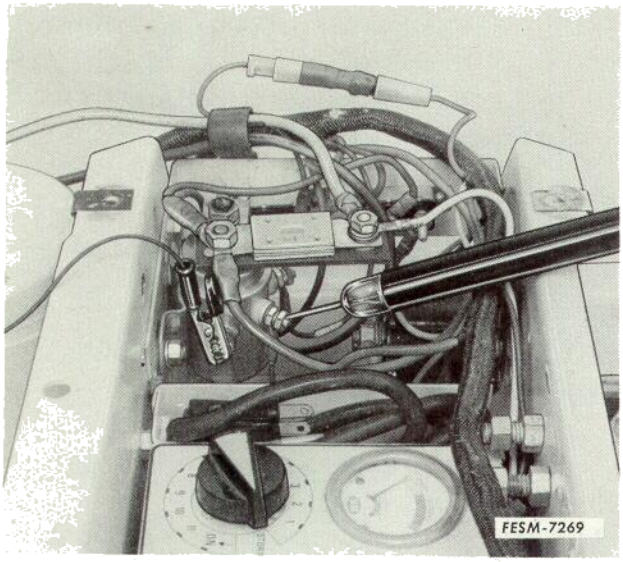
d. Start the traction motor and place the blade motor switch in the "START" position. Check the continuity between terminals 5 and 6.

e. If the test lamp lights, check the motors for internal damage. If the test lamp does not light, replace the magnetic switch.

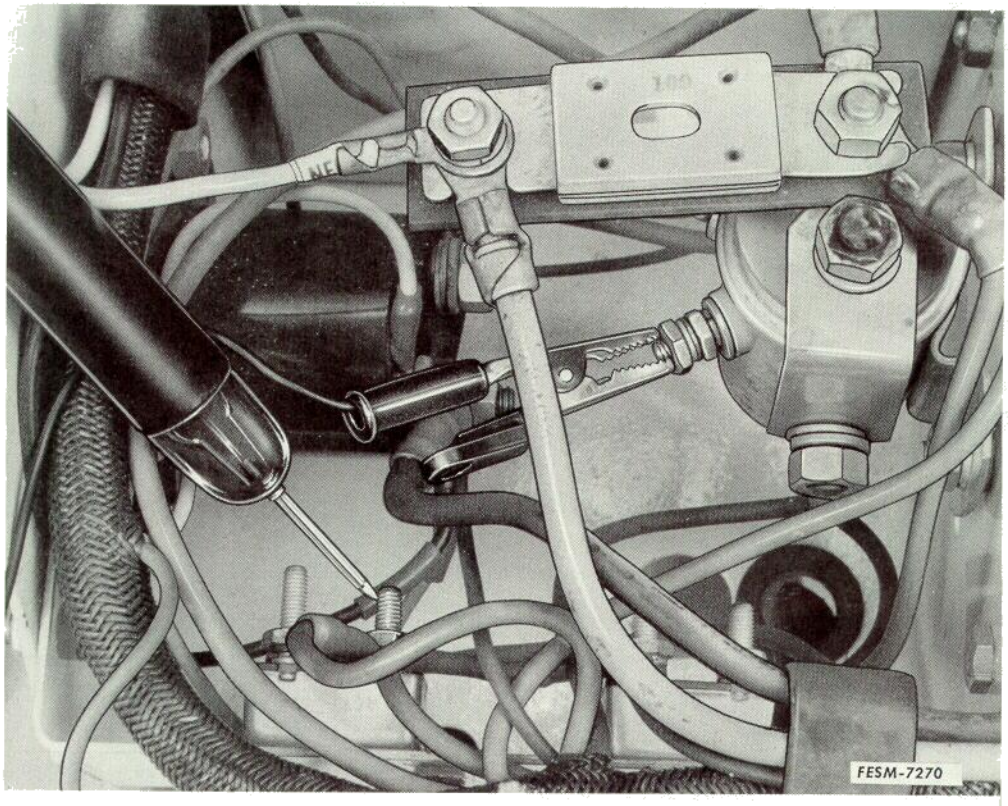
6. Disconnect the batteries from the circuit.



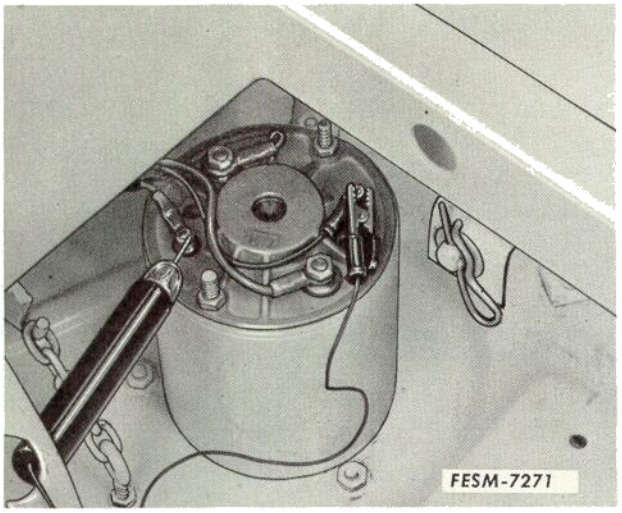

7. Turn the key switch to the "OFF" position. Hold the blade motor switch in the "START" position. Check the continuity between terminal 5 of the blade motor magnetic switch and terminal A (green wire) of the blade motor switch. If the test lamp does not light, the blade motor switch is defective.



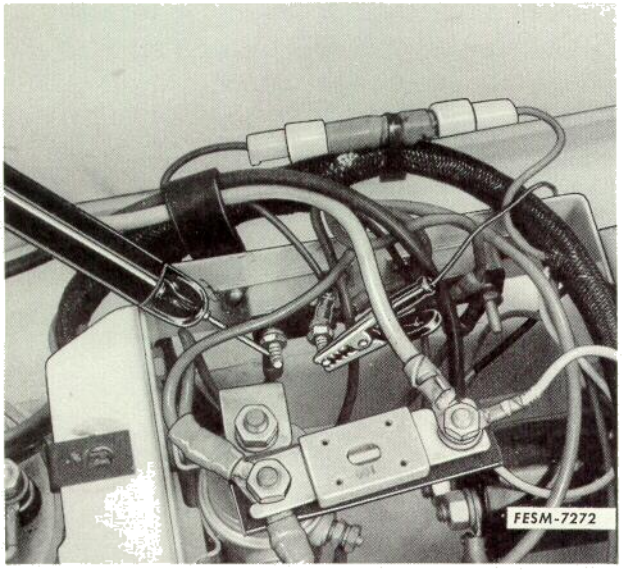

8. Turn the key switch to the "ON" position. Hold the blade motor switch in the "START" position. Check the continuity between terminal 5 and terminal 8 of the blade motor magnetic switch. If the test lamp does not light, the key switch is defective.



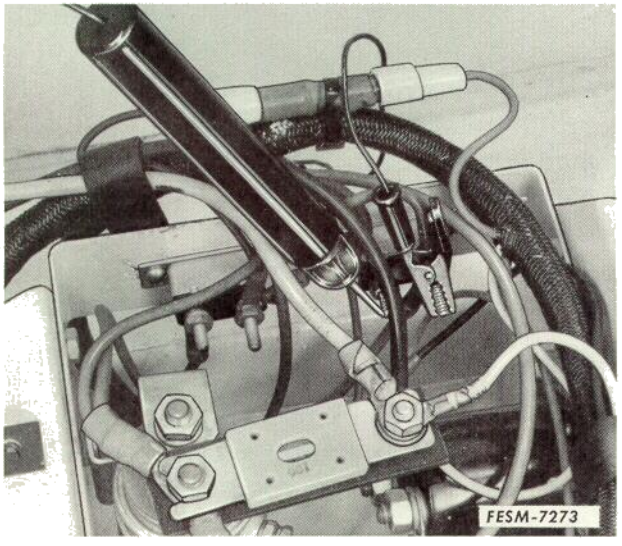

9. Check the continuity between terminal 7 of the blade motor magnetic switch and terminal 9 of the right hand blade motor circuit breaker. If the test lamp does not light, one of the blade motor thermal switches is open.



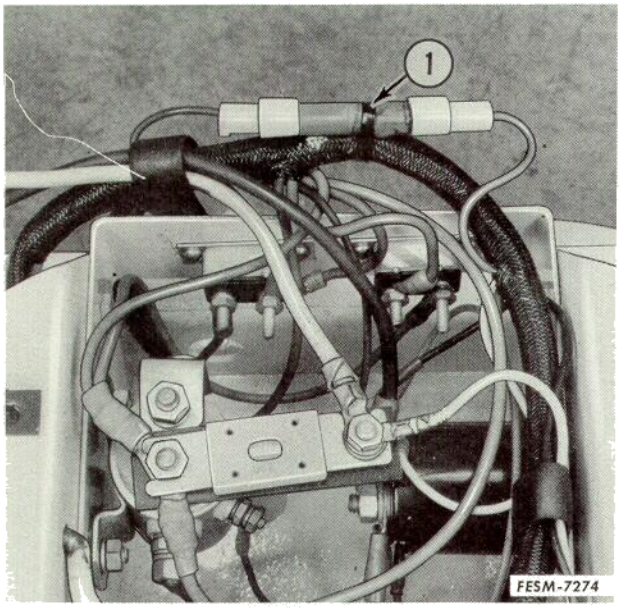

10. The thermal switch of each motor may be checked individually. Remove the motor end cover and check the continuity between the two small terminals.




11. Check the continuity between the circuit breaker terminals.

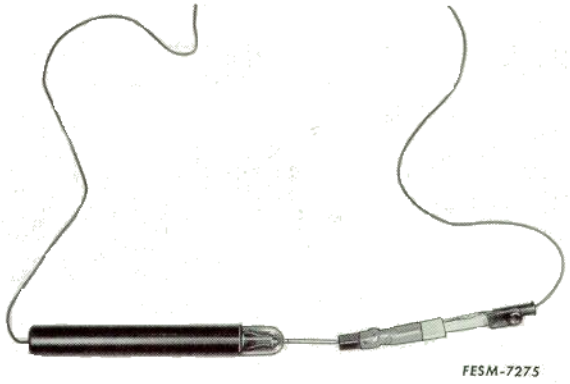



12. If the preceding checks show no discrepancies, the blade motor magnetic switch is defective and should be replaced.




1. Diode

13. If the blade motors start but do not continue to run when the switch is released to the "RUN" position, the diode is defective (open) or the blade motor switch is defective.




14. The diode may be checked with a continuity tester. Connect the tester to the terminals of the diode, then reverse the leads. The tester should light in only one of positions. If the diode does not pass current in either direction, it is open and should be replaced.

The diode prevents current flow from terminal C to B of the blade motor switch in the start position. If the diode shows current flow in both directions, it is shorted and should be replaced. The blade motor switch will probably be defective also.

## BATTERIES

1. Check that all battery connections are clean and tight.

2. Check the level of the electrolyte and add distilled water as necessary.

3. Connect the charger to the AC power source. Set the timer for a 12 hour cycle. Check the ammeter to be sure the charger is functioning. Complete a full 12 hour charge cycle.

4. Check the specific gravity of each cell with a hydrometer. The specific gravity should not be less than 1.220 at 80 degrees room temperature. Readings should not vary more than .030 points between cells.

5. Each battery may be individually load tested. Battery specific gravity should not be less than 1.220 at 80$^{o}$F. Place a 300 amp load on the battery for 15 seconds. Terminal voltage should not be less than 9.0 volts at the end of the test.

# BATTERY CHARGER

1. Plug the charger into a wall receptacle and turn the knob to a charge position. The ammeter of the charger should deflect. This will indicate that the charger is working. The needle may drop back after indicating full charge rate. This is normal if the batteries are already charged. It is not necessary to measure the DC voltage or amperage produced by the charger. Both will vary with the state of charge of the batteries.

2. It is necessary for the wall receptacle to be live and all connections clean and tight in order for the charger to function. If the charger does not function it will be necessary to remove it for servicing.

## Removal and Installation

1. Remove the mower body. Refer to Section 3, Mower Body Removal - 95.

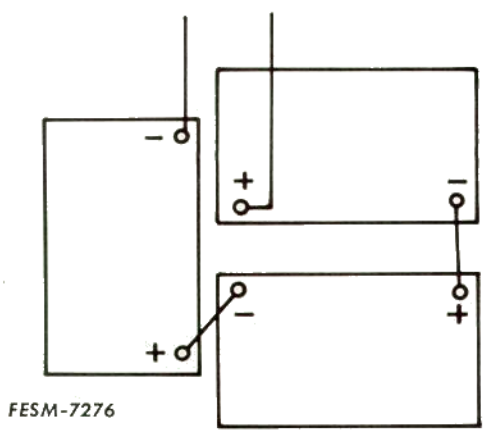
2. Disconnect the DC leads to the circuit and remove the charger.

3. Reverse steps 1 and 2 to install the charger.

## Testing the Charger

**Refer to Foldout No. 2 at the rear of the manual.**

### Transformer



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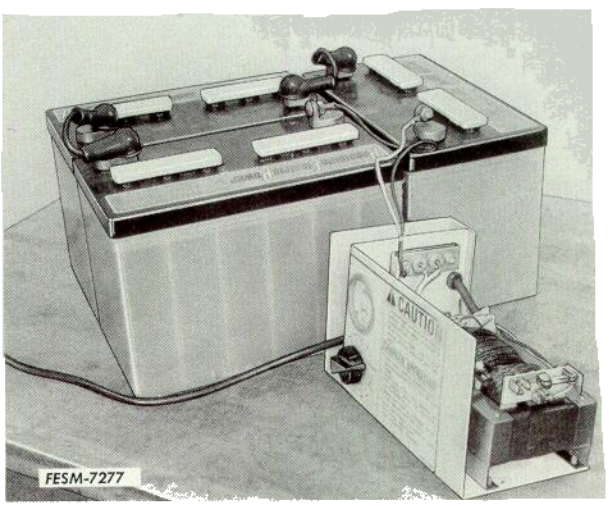

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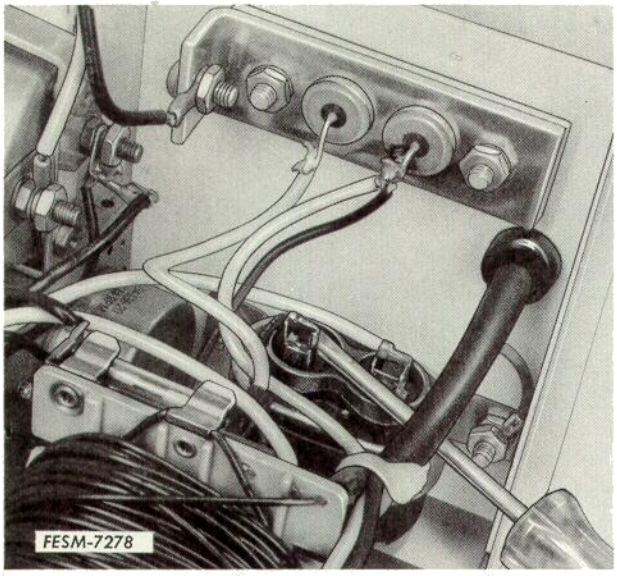
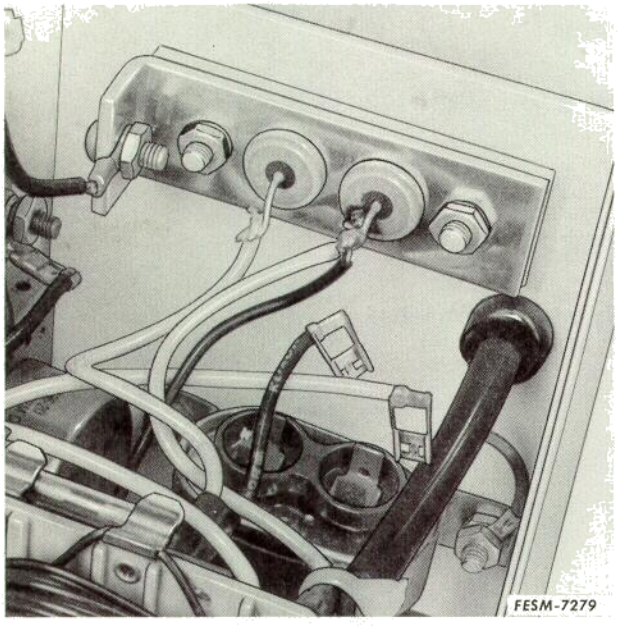
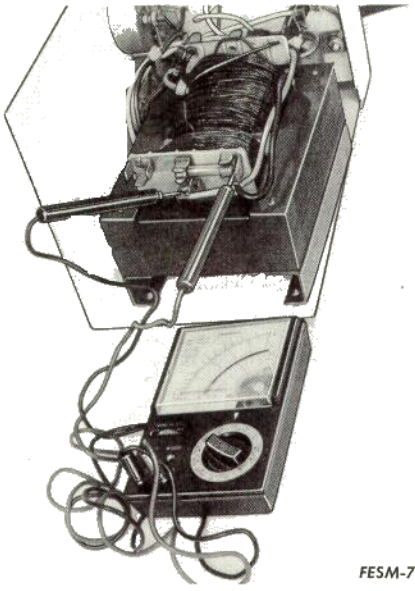
1. Assemble and reconnect the batteries on a work bench as they are in the rider. Connect the battery charger black lead to the battery positive (+) terminal and the white lead to the negative (-) terminal.




2. Be sure the charger is not connected to the AC power source. Discharge the condenser by placing a screwdriver across the terminals.




3. Disconnect the leads from the condenser.



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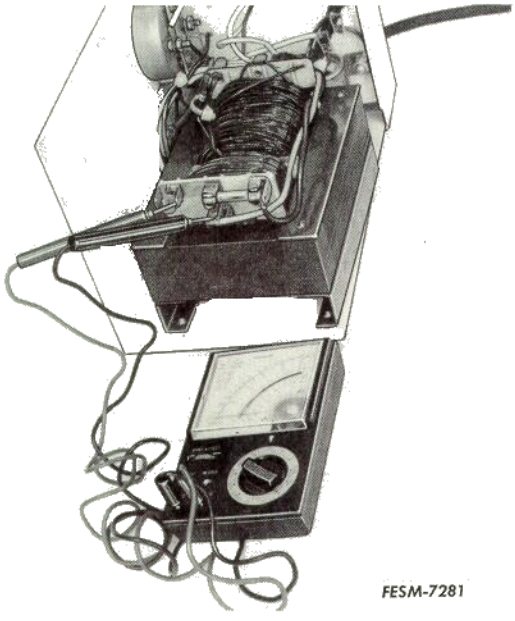

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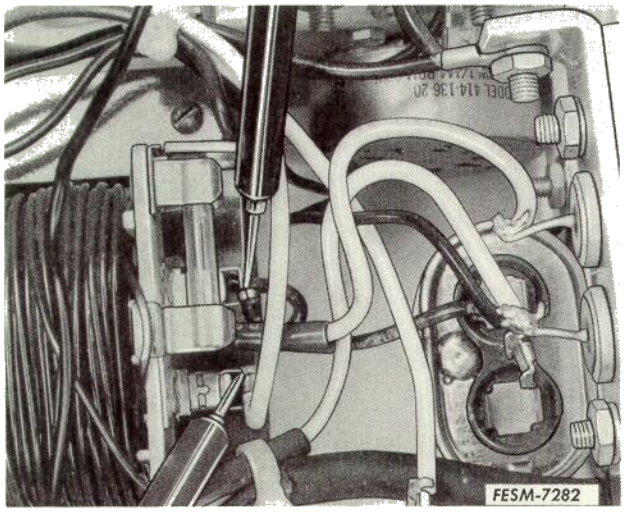

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CAUTION: To prevent electrical shock use extreme caution in conducting the following tests.

4. Connect the charger cord to a 115 volt AC power source.

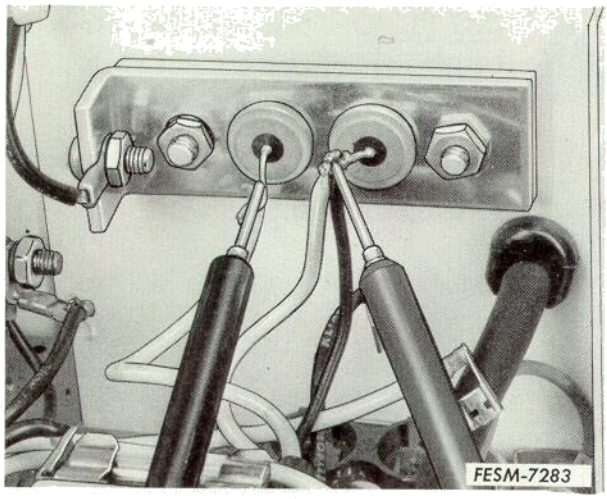
5. Turn the timer to the "ON" or fast charge position.

6. Check the voltage between $P_1$ and $P_2$ with an AC voltmeter. It should indicate approximately 115 volts AC. Check the AC power source and cord if it does not.

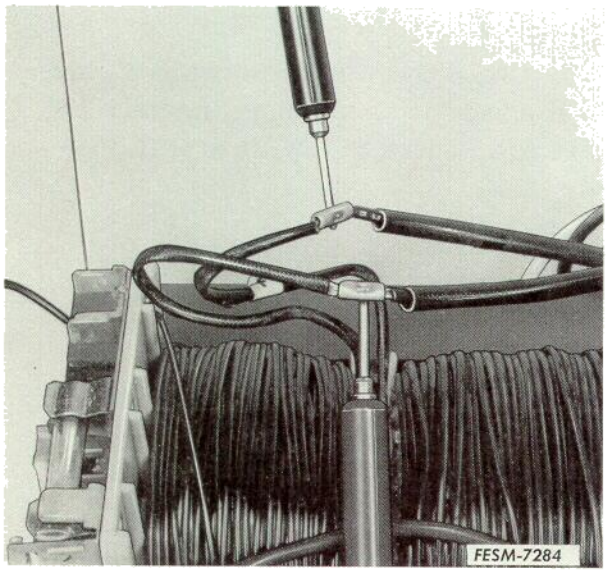
7. Check the voltage between $P_1$ and F. It should indicate approximately 115 volts AC. Check the AC fuse if it does not.

8. To check the transformer proceed as follows:

a. Check the voltage between $C_1$ and $C_2$. Approximately 320 AC volts should be indicated.



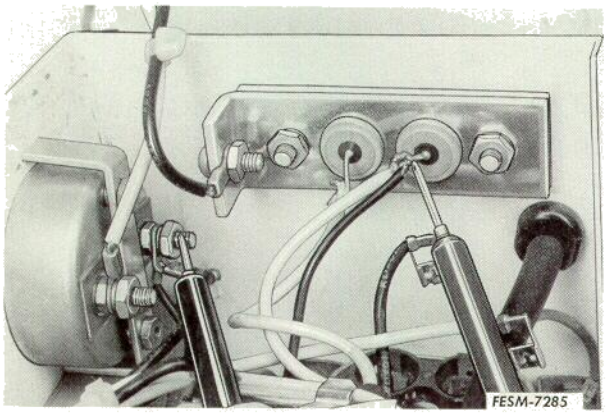

b. Check the voltage between the two diodes. Approximately 62 volts AC should be indicated.




c. Disconnect the battery charger cord from the AC power source. Carefully slide the insulating covers back from the midpoint connectors of the wires coming from the center of the transformer.

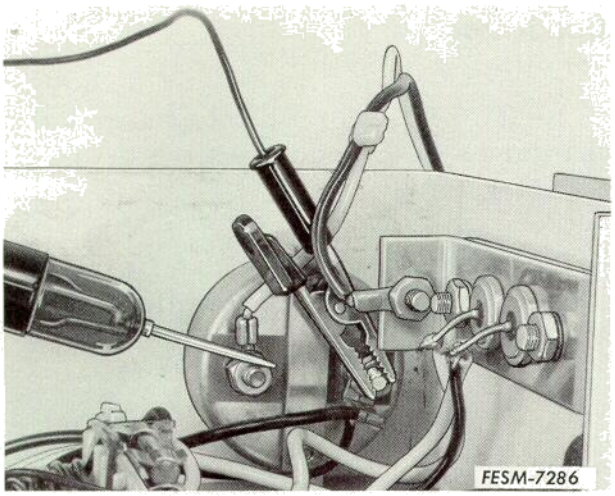
Reconnect the cord to the AC source. Check the voltage between the midpoint connectors. Approximately 50 volts AC should be indicated.

If any of the three checks do not show proper voltage, replace the transformer.




9. Check the voltage between the positive (+) ammeter terminal (where the two black leads connect) and each diode. Approximately 31 volts AC should be indicated.

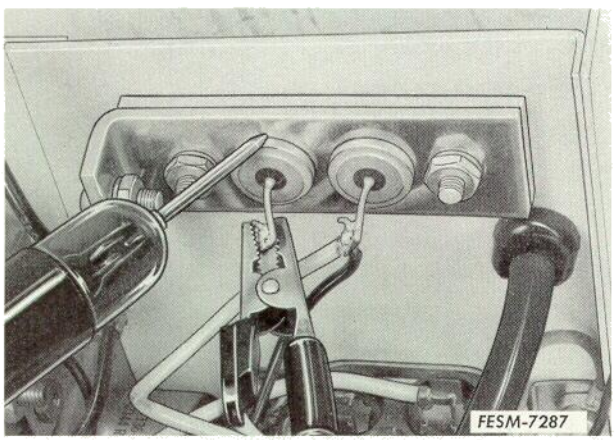
If the proper voltage is not indicated, check the DC fuse and continuity between the timer switch terminals 4 to 5. If the fuse is good and contact is being made between terminals 4 and 5, replace the transformer.




## Ammeter

1. IMPORTANT: Do not connect the charger to the batteries or the AC power source.

2. Check the ammeter for continuity with a tester. If the tester does not light replace the ammeter.



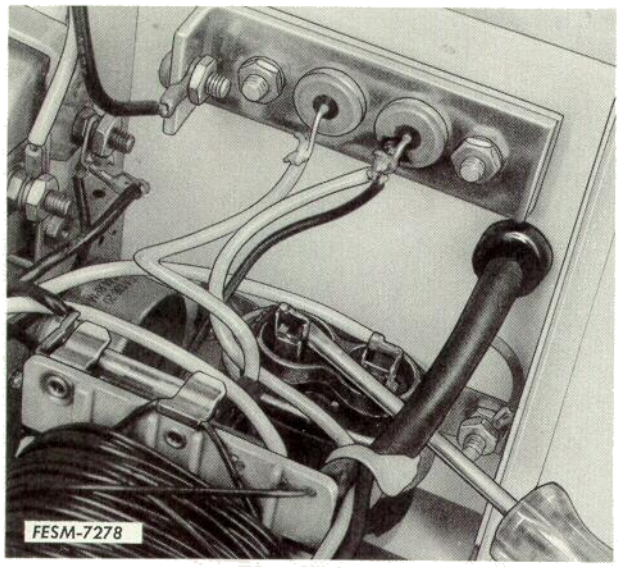

## Diodes

1. IMPORTANT: Do not connect the charger to the AC power source or the batteries.

2. Check each diode with a continuity tester. Place one lead of the tester on the diode lead and the other on the outer case. Reverse the leads. The tester should light in one position only.

3. If the test lamp lights in both or neither position, the diode is defective and the complete diode block must be replaced.

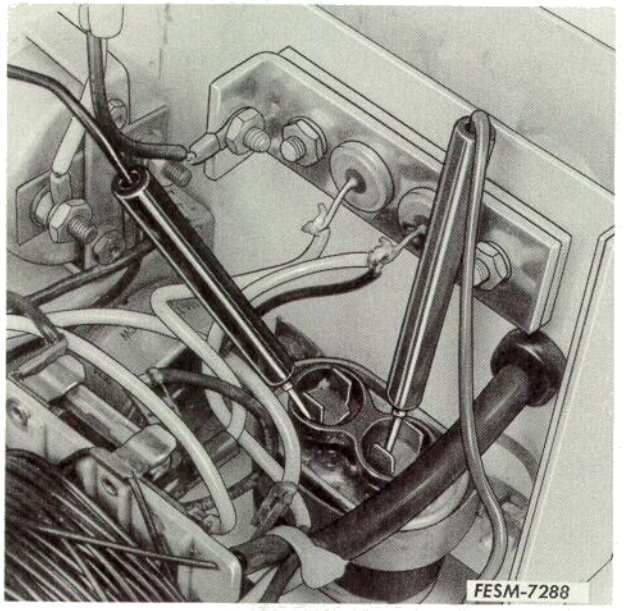
4. When replacing the block be sure the insulating strip is properly positioned between the block and the case. Replacement blocks are supplied with an insulating strip and nylon screws.




## Condenser

1. IMPORTANT: Do not connect the charger to the AC power source or the batteries.

2. Discharge the condenser by placing a screwdriver across the terminals.




3. Disconnect the leads from the condenser terminals.

4. Touch the leads of an ohmmeter to the terminals. Reverse the leads. The indicating needle should deflect and return to its original position one or both times. If the needles does not deflect and return either time, the condenser is defective.

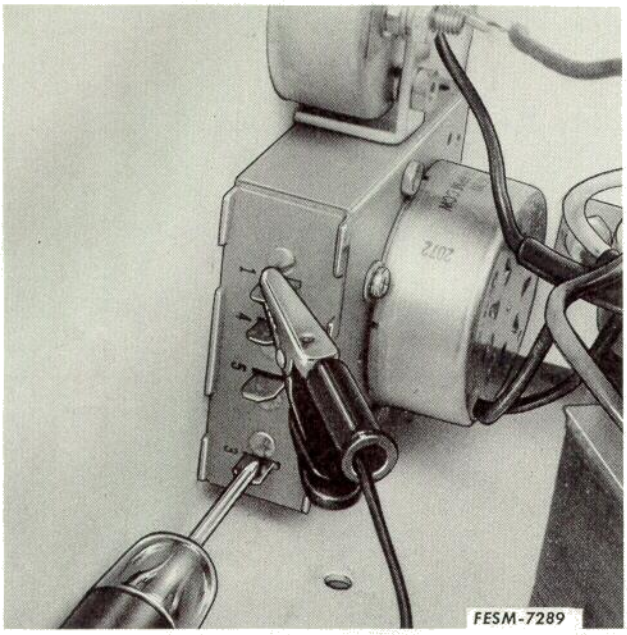
## Timer

1. IMPORTANT: Do not connect the charger to the AC power source or the batteries.

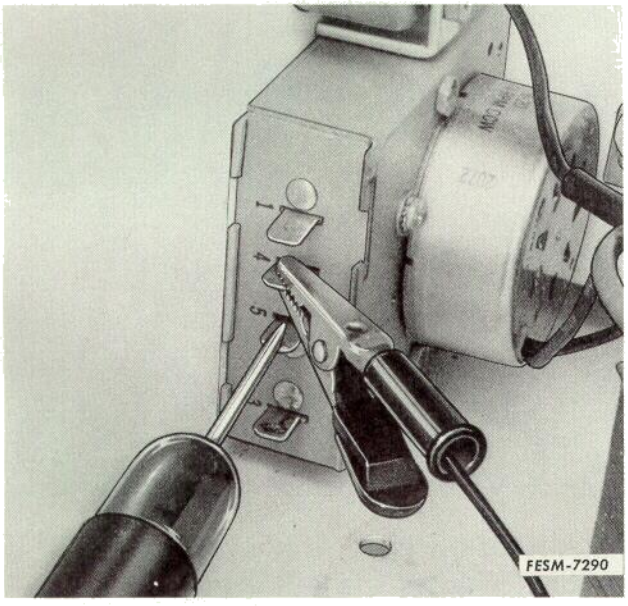
2. It may be necessary to remove the mounting screws and slide the transformer to the side to get to the switch for testing.

3. Disconnect the leads from the timer switches. Tag or record the leads as they are removed for ease in reconnecting.

4. Turn the timer knob to the "ON" or fast charge position.




5. Use a continuity tester to check between terminals 1 and 3 and between 4 and 5. If the tester fails to light, the switch is defective and the timer should be replaced.




6. Turn the knob to the "OFF" position and repeat step 5. The tester should not light.

7. The timer motor can be checked by connecting the charger to the batteries or in the circuit and plugging it into a 115 volt AC power source. Set the knob in the fast charge position and observe if the knob moves. It should make a noticeable move at the end of an hour.

# TRACTION MOTOR

## Removal

1. Remove the mower. Refer to Section 4, Twin Blade Mower - Electric Drive.

2. Remove the mower body. Refer to Section 3, Mower Body Removal - 95 =

3. Loosen the belt guide around the input pulley and slip the drive belt off.

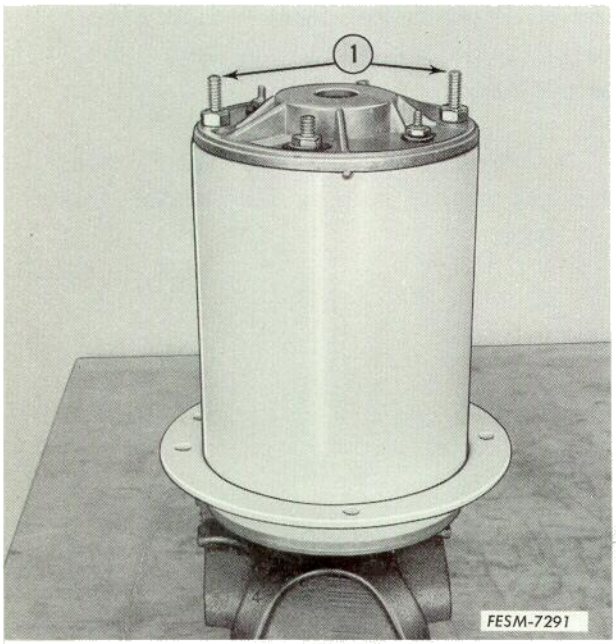
4. Remove the snap ring and drive pulley.

5. Remove the motor end cover.

6. Disconnect the wires from the terminals.

7. Remove the motor from the chassis.

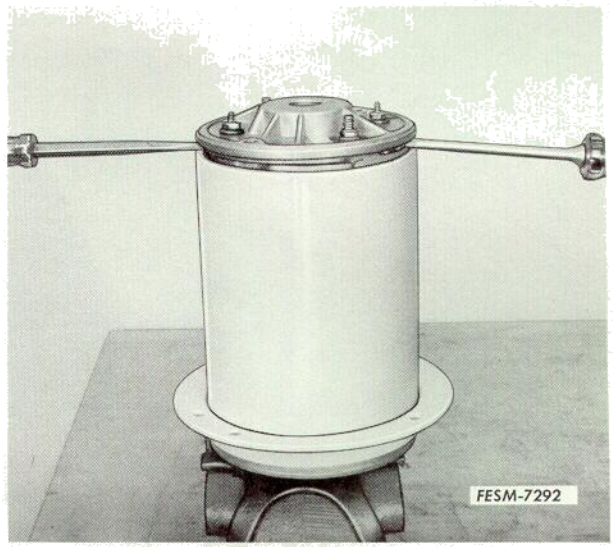
## Disassembly




1. Through bolt

1. Clamp the flat portion of the armature shaft in a vise equipped with brass jaws.

2. Remove the through bolts.

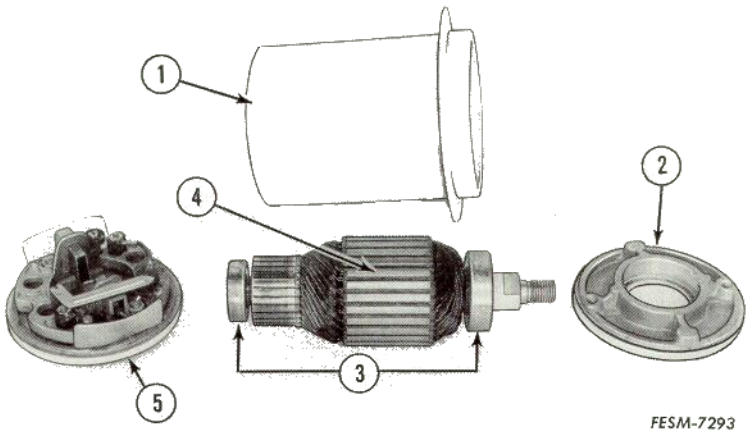



3. Pry the commutator end frame off of the armature end bearing evenly.

4. Grasp the motor housing firmly. With a quick upward thrust remove the housing. The permanent magnets exert a strong force on the armature which must be overcome.

5. Remove the armature and end frame from the vise. Press the armature from the drive end frame.

# Inspection and Repair




FESM-7293

1. Housing
2. Drive end frame
3. End bearing
4. Armature
5. Commutator end frame

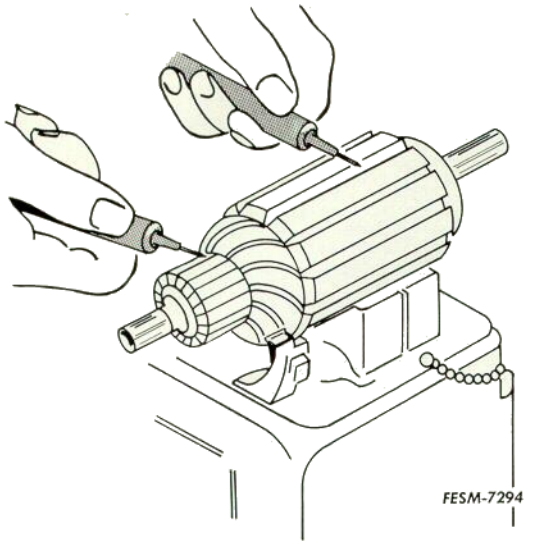
1. Check the housing and magnets for damage. Replace if necessary.

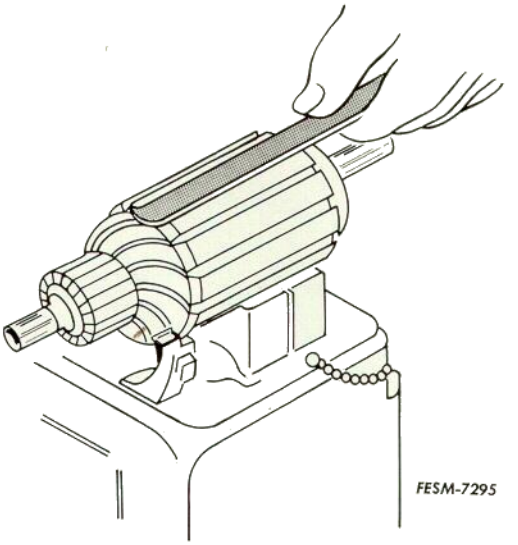
2. Check the drive end frame for cracking or damage. Replace if necessary.

3. Check the commutator end frame for cracking or damage. Visually check the insulators for damage. A continuity tester may be used to check the circuits for openings or grounds.

4. Replace the brushes if they are worn more than one-half their original length. Check that the brushes are free in the holders.

5. Check the armature end bearings for roughness or damage. Replace the bearings as necessary. Use a suitable puller to remove the bearing. Press the new bearing in place.

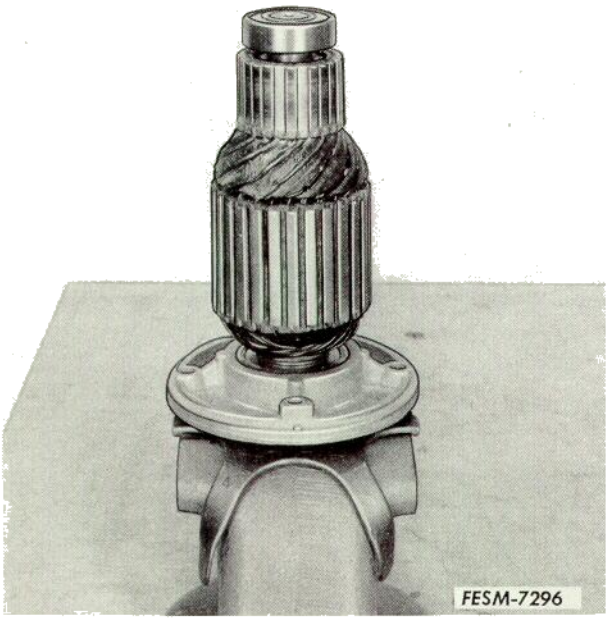



6. Check the armature for open circuit or short circuits. Open circuits in the armature are usually obvious because the open circuited commutator bars will arc each time they pass under the brushes so that they soon become burned. Use a continuity tester to check for open circuits.

Short circuits in the armature are located with the armature tester (growler). The armature is placed in the Vee of the tester and slowly rotated. The thin strip of steel held above the armature will vibrate when the area of the armature core containing a short circuited coil is located.

## Reassembly

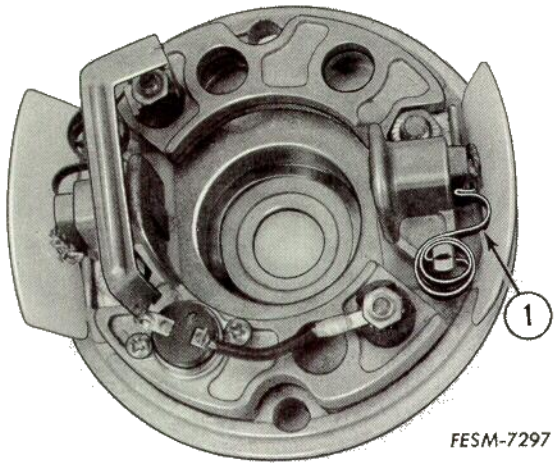



1. Press the armature into the drive end frame.

2. Clamp the flat portion of the armature shaft in a vise equipped with brass jaws.

3. Grasp the motor housing firmly by the sides and set it in place over the armature.

CAUTION: Hold the housing by the sides only. The magnets will pull the housing down sharply against the end plate as it nears the armature.

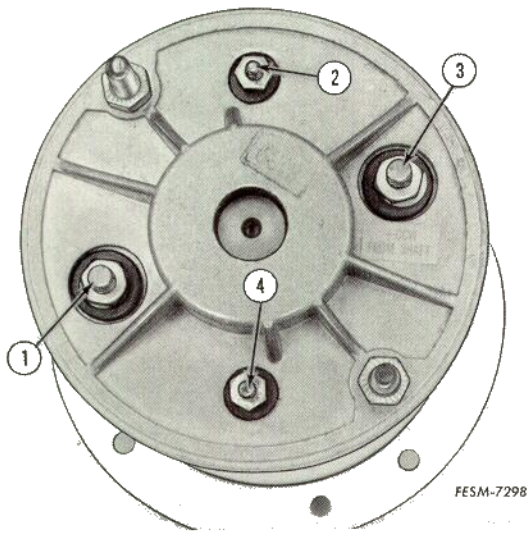



4. Push each brush back into the holder and rest the spring against the brush to hold it in position. Install the commutator end plate part way. Reach in alongside the plastic insulators with a small screwdriver and push the brushes in against the armature.

5. Align the end frames and housing. Install the through bolts.

1. Spring retaining brush in holder

## Installation




1. Install the motor in the frame so that the wires may be easily attached. The positive (red wire) is attached to the post marked "+ CCW".

2. Continue the installation by reversing the removal procedure.

1. Brown wire to 100 amp fuse
2. Gray wire
3. Red wire
4. Pink wire to brown wire on 1

# Section 3

# CHASSIS

## CONTENTS

# SPECIFICATIONS

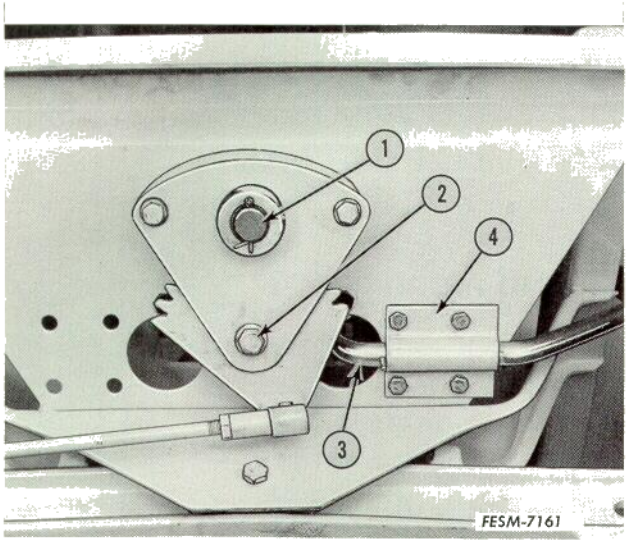
Transmission

| | |
|---|---|
| Backlash-pinion-to-bevel gear - inch . . . . . | .001 min. - .007 max. |
| Shaft assembly end play (either side) - inch . . . . . | .001 min. - .010 max. |
| Clearance between clutch collar keys and gear hubs - inch . . . . . | .001 min. - .030 max. |
| Clearance between bevel gear and output shaft-first gear - inch . . . . . | .025 absolute min. |
| Washer thickness available for adjustments - inch . . . . . | .020, .026, .030, .036, .040, .046, .050 |

Refer to standard torque chart for bolt torques.

# STEERING ASSEMBLY

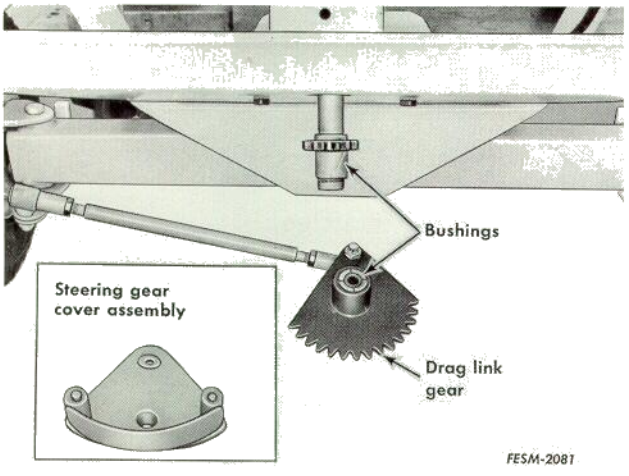
## Removal and Disassembly




1. Remove the cotter pin and plain washers from the steering shaft.

2. Remove the pivot bolt.

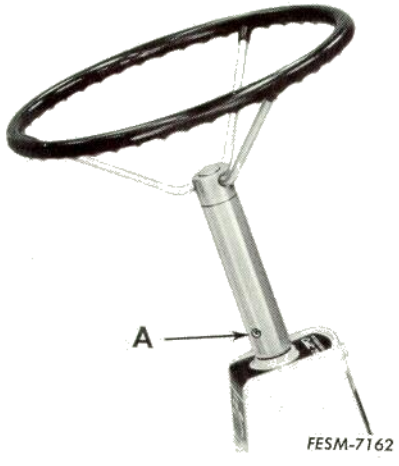
1. Steering shaft
2. Pivot bolt
3. Clutch-brake pedal
4. Pedal pivot clamp




3. Remove the steering drag link gear cover assembly.

NOTE: The steering drag link gear assembly will disengage from the steering shaft gear as the cover is removed.

4. To replace, remove the drag link gear from the ball joint.




5. Remove the steering wheel by removing the roll pin.

6. Lower the steering shaft assembly through the support.

7. To repair or replace, remove the drag link and/or the tie rod assembly from the spindles.

A. Roll pin

## Inspection and Repair

1. Wash all parts in cleaning solvent, then dry thoroughly.

2. Inspect the nylon bearing for wear or damage. Replace as necessary.

3. Check for broken teeth, bent shafts and stripped threads. Replace the damaged parts.

## Reassembly, Installation and Adjustment

1. Reassemble and install in the reverse order of removal and disassembly. Apply IH 251 HEP grease or equivalent #2 multi-purpose lithium grease liberally to the gear assembly, bearings and shaft.

2. Install the drag link ball joint in the R. H. spindle, if it was removed.

3. Set the front wheels in a "straight ahead" position. Position the steering drag link gear assembly to the steering shaft gear so that an equal number of teeth are on either side of the drag link gear when engaging the steering shaft gear. Install and secure the cover.

# WHEELS

## Front Wheels

### Removal

1. Engage the brake and block up the front wheel(s) to be removed.

2. Remove the hub cap, cotter key and flat washer from the outer end of the spindle.

3. Slide the wheel from the spindle.

### Inspection and Repair

1. Disassemble and inspect the entire wheel and hub for weld separation, split tube hub and rim bending.

2. Inspect the bearings for wear or damage.

### Reassembly and Installation

Reassemble the wheel. Lubricate the spindle and slide the wheel on the spindle. Using a sufficient amount of flat washers to eliminate excessive end play, secure the wheel to the spindle with a cotter pin.

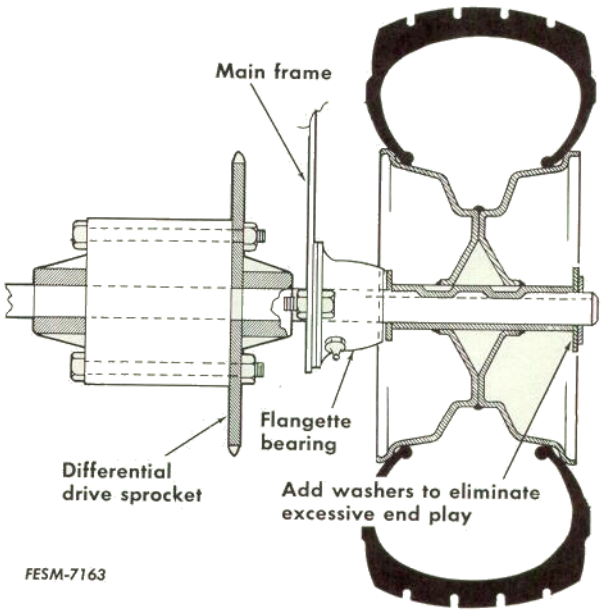
## Rear Wheels

### Removal

1. Engage the brake and block up the wheel to be removed.

NOTE: If both rear wheels are to be removed, be sure to block the front wheels.

2. Remove the hub cap, cotter key and flat washer. Remove the wheel.




### Inspection and Repair

1. Inspect the entire wheel for rim bending.

2. Check the axle for bends, damaged key and keyway. Remove nicks, rust and paint wherever necessary.

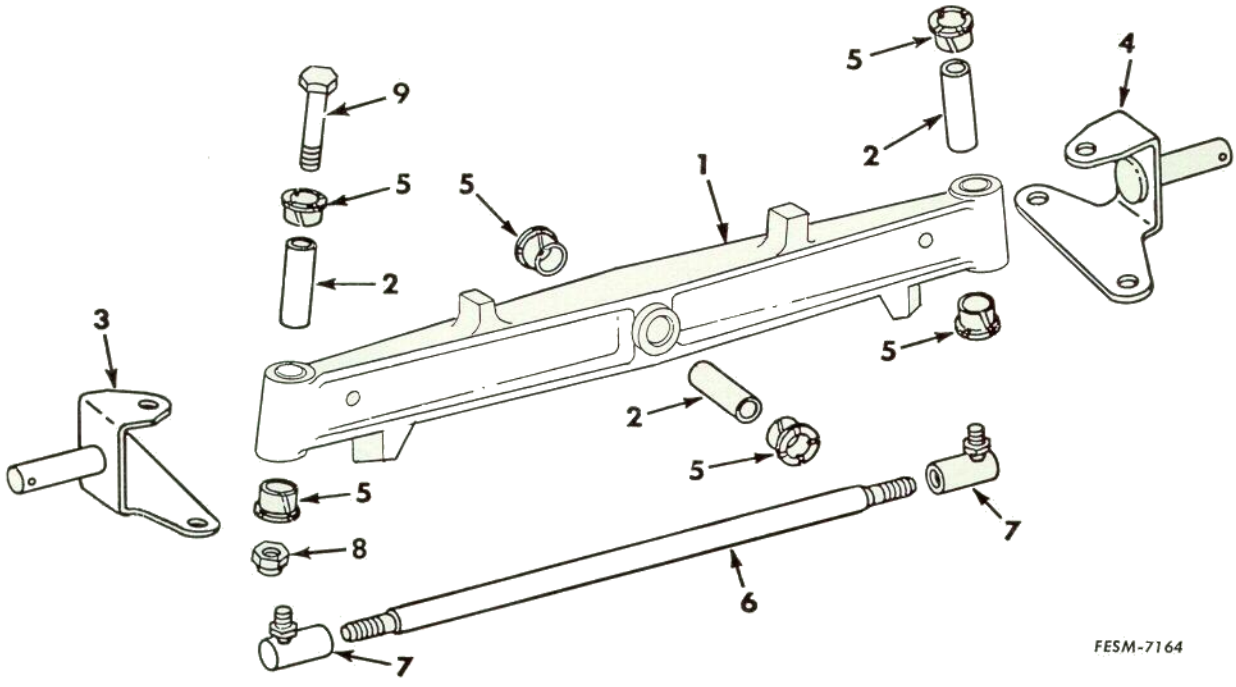
3. Check the axle bearing for wear. Replace if necessary.

### Installation

Install the rear wheels in the reverse of removal.

If more than 1/8 inch end play exists, add washers as necessary to outer end of each wheel, in sequence, beginning with the right hand wheel until the end play is less than 1/8 inch.

# FRONT AXLE




| | | |
|---|---|---|
| 1. Axle | 4. Spindle assembly L.H. | 7. Tie rod end |
| 2. Bushing | 5. Bearing | 8. Locknut |
| 3. Spindle assembly R.H. | 6. Tie rod | 9. Spindle bolt |

## Disassembly

1. Lock the brake, raise the front end of the mower and support it securely.

2. Remove the front wheels.

3. Disconnect the tie-rod ball joints. Disconnect the drag link ball joint from the right hand spindle.

4. Remove the pivot bolt securing the spindle to the axle and remove the spindle.

5. Remove the spindle bushing and nylon bearings.

6. Remove the axle pivot bolt and axle.

## Inspection and Repair

1. Inspect all parts closely for wear, bending or breaks.

2. Check nylon bearings and bushing for wear. Replace as necessary.

## Reassembly

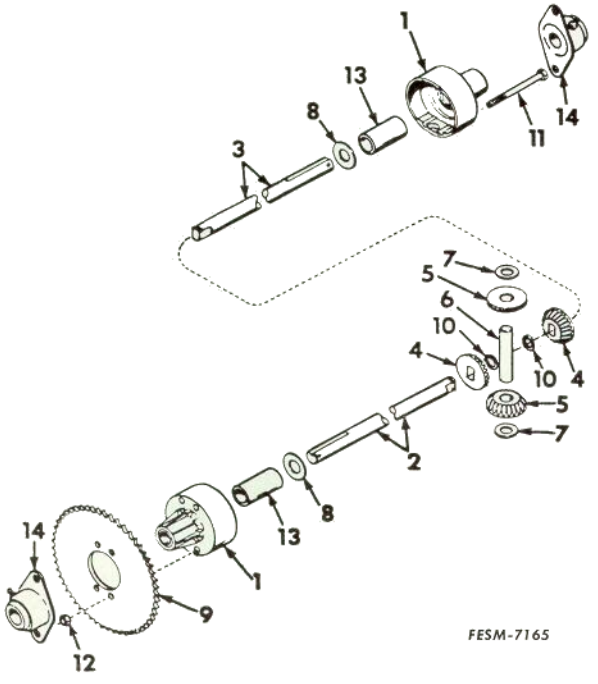
1. Reassemble the front axle and spindles in the reverse order of disassembly.

2. Thoroughly lubricate the front axle bearing, spindle bore and spindles with IH 251 HEP grease or equivalent #2 multi-purpose lithium base grease.

3. Adjust the tie rod so that the front wheels are parallel to each other.

# DIFFERENTIAL AND REAR AXLE

## Removal and Disassembly



FESM-7165

| | |
|---|---|
| 1. Housing | 8. Washer |
| 2. Axle | 9. Sprocket |
| 3. Axle | 10. Snap ring |
| 4. Bevel gear | 11. Screw |
| 5. Pinion gear | 12. Nut |
| 6. Pin | 13. Bushing |
| 7. Thrust washer | 14. Bearing |

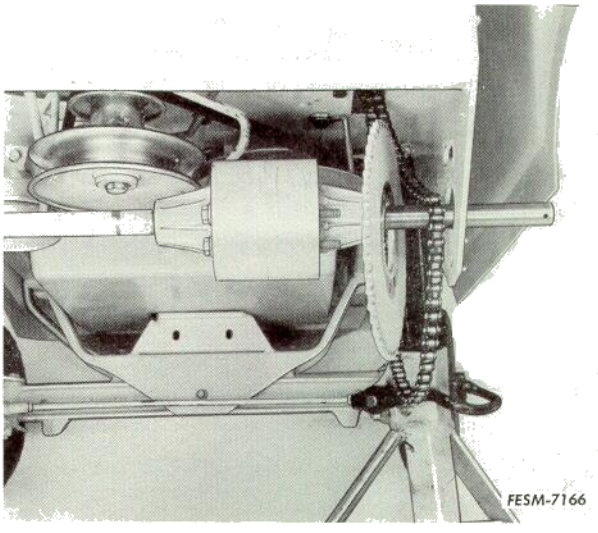
1. Raise the rear of the mower and support securely.

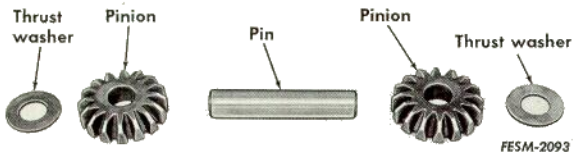
2. Remove the rear wheels.

3. Remove the rear axle flangette bearings.

4. Slip the drive chain off of the sprocket. Remove the locknuts and slide the sprocket off the housing.

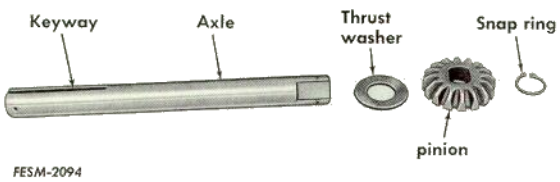
5. Remove the thru-bolts securing the carrier housing. Separate the housing and remove the two halves from the main frame.


FESM-7166




Exploded view of drive pinion.

6. Disassemble the drive pinion.




Exploded view of axle (one end shown).

7. Remove the snap ring, bevel gear and thrust washer from the axle. Slide the axle from the differential carrier.

## Inspection and Repair

1. Inspect the axle shaft for wear at the bearing location.

2. Roll the axle shaft along a flat surface to detect any warping or bending.

3. Check the differential carriers for cracks or breaks. Remove any high spots from the mating surface with a flat file.

4. Check all bearings and replace as necessary.

## Reassembly and Installation

1, Reassembly and installation is the reverse of removal and disassembly. Thoroughly lubricate the axles (around bearing surfaces) and the differential housing gears.

Use 1 ounce IH 251 HEP grease or equivalent in the differential housing.

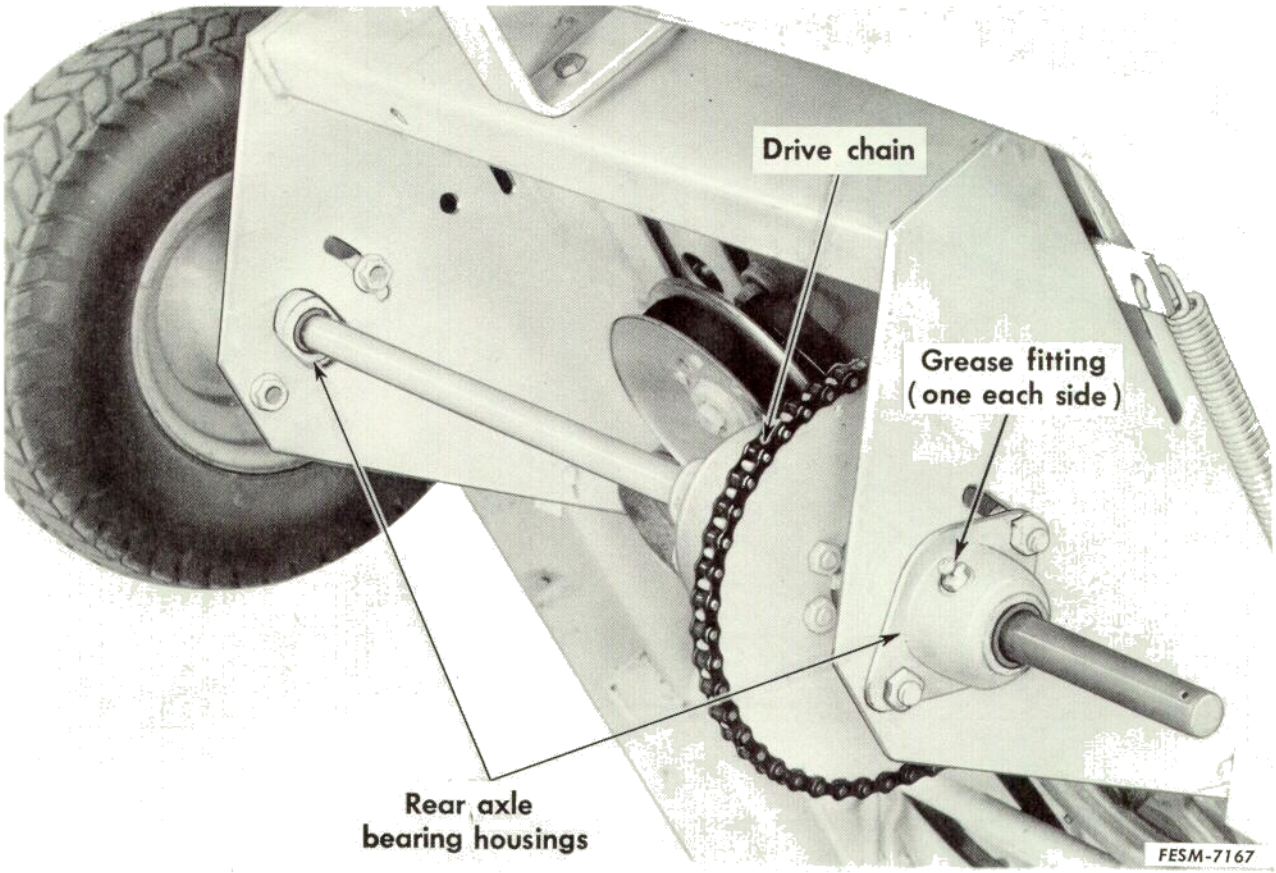
NOTE: No seals or gaskets are required with this unit.

2. Face the grease fitting on the flangette bearings to the rear.

3. Check for excessive end play of the axle and adjust as necessary.

4. Adjust the drive chain tension.

# DRIVE CHAIN ADJUSTMENT

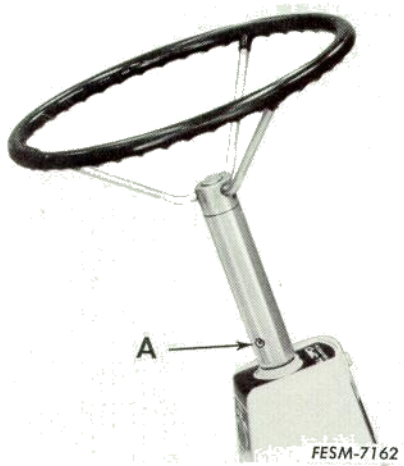



The drive chain can be adjusted to compensate for stretch and wear. The rear axle bearing mounting holes are slotted at the top to move the axle back for proper adjustment.

To properly adjust the drive chain set the transmission in neutral, block the front wheels and raise the rear end of the rider.

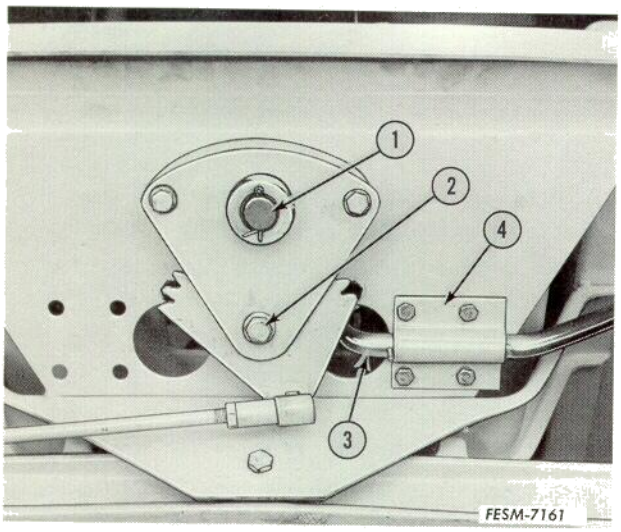
Adjust the bearing housings until the slack is out of the chain. The chain must not be taut. If the drive chain is too tight, excessive wear and stretch will result in premature failure. Not enough tension may allow the chain to jump the sprocket, ride the teeth, break, or whip excessively. The axle must be perpendicular to side of rear frame. Adjust each side an equal amount.

## Removal – 55 and 75



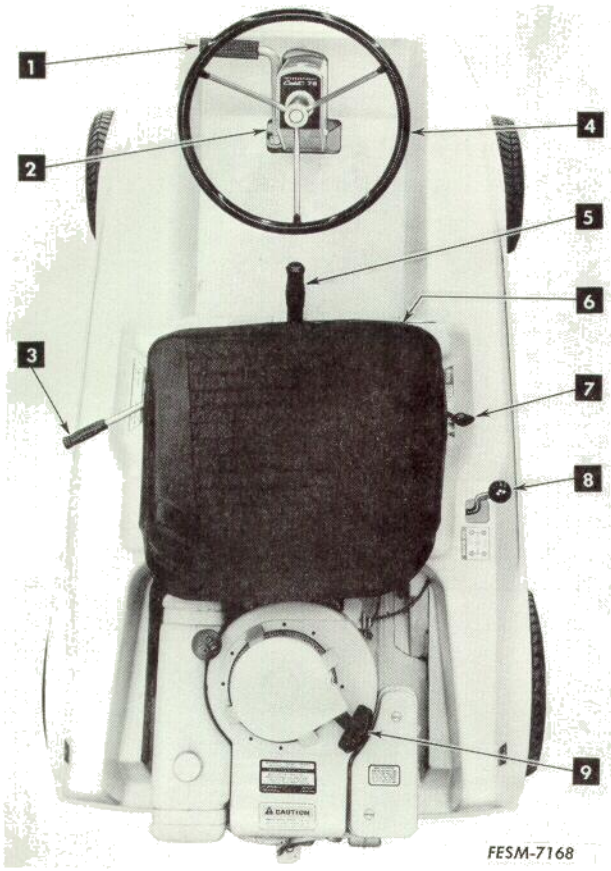

A. Roll pin

1. Drive out the roll pin and remove the steering wheel and shaft.




1. Steering shaft
2. Pivot bolt
3. Clutch-brake pedal
4. Pedal pivot clamp

2. Remove the pedal pivot clamp, cotter key at control rod and clutch-brake pedal.




3. Remove the seat.

4. Disconnect the ignition switch.

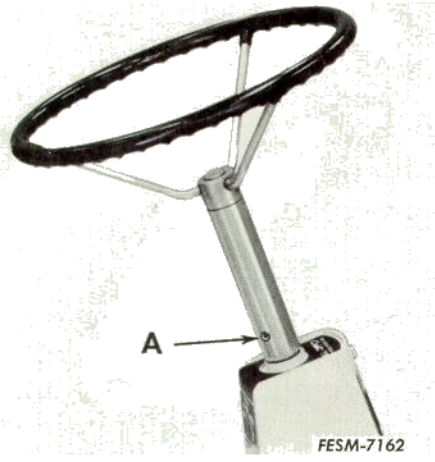
5. Disconnect the throttle cable at the engine.

6. Pull the mower lift lever grip off. Remove the spring loaded cap screw and lift lever.

7. Remove the mounting bolts. Note the location of the body spacers and seat support bumpers. Slide the body up and to the rear slightly to remove it.

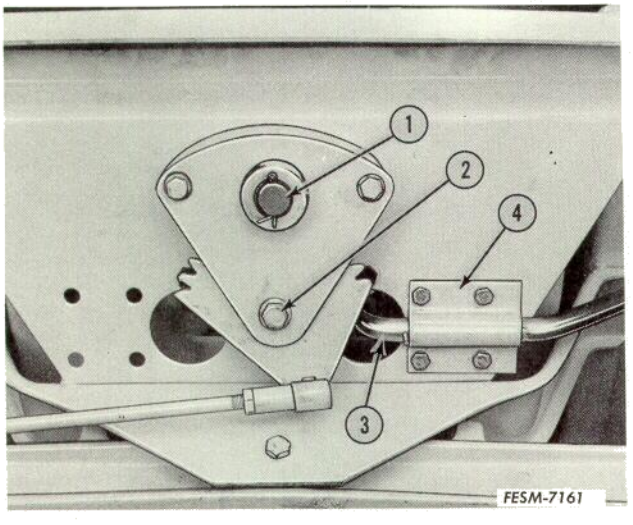
1. Clutch-brake pedal
2. Brake pedal lock
3. Mower clutch lever
4. Steering wheel
5. Mower height control lever
6. Ignition switch
7. Throttle control
8. Gear selector lever
9. Recoil starter

# Removal – 95




1. Drive out the roll pin and remove the steering wheel and shaft.

A. Roll pin




1. Steering shaft
2. Pivot bolt
3. Clutch-brake pedal
4. Pedal pivot clamp

2. Remove the pedal pivot clamp, cotter key at control rod and clutch-brake pedal.

3. Loosen the mounting nuts at the shroud hinge. Lift off the shroud assembly.

4. Disconnect and remove the batteries and mounting plate.

5. Remove the gear shift knob.

6. Remove the mounting bolts. Note the location of the body spacers and shroud support storage clamp. Raise the body and disconnect the harness from the traction motor and blade motor switches. Move the mower lift handle to the highest position and raise the body clear of the handle. Lower the handle and remove the mower body.

## Installation

1. Install the mower body by reversing the removal procedure.

# TRANSMISSION

## Removal

1. Remove the mower. Refer to Section 4.

2. Remove the mower body.

3. Remove the transmission drive belt. Remove the snap ring and drive pulley from the transmission input shaft.

4. Disconnect the brake rod and return spring from the brake actuating arm.

5. Disconnect the transmission neutral start switch.

6. Loosen the drive chain.

7. Remove the transmission.

# Disassembly

**Reference numbers in the text refer to the exploded view of the transmission on page 3-15.**

1. Remove the top cover (37).

2. Lift out the drive shaft and output shaft together. Slip the reverse chain (60) off the sprockets.

3. Disassemble the output shaft as follows:

a. Remove the brake disc (47) and key (30).

b. Remove the retaining ring (4) shim washer (3), bearing (5), gear (6) and key (29).

c. Remove the spring (9), gear (11), key (30) and spacer (14).

d. Remove gear (15), key (30) and spring (9).

e. Remove sprocket (27), key (29), bearing (5) and shim washer (3). Mark or tag the washer for reassembly.

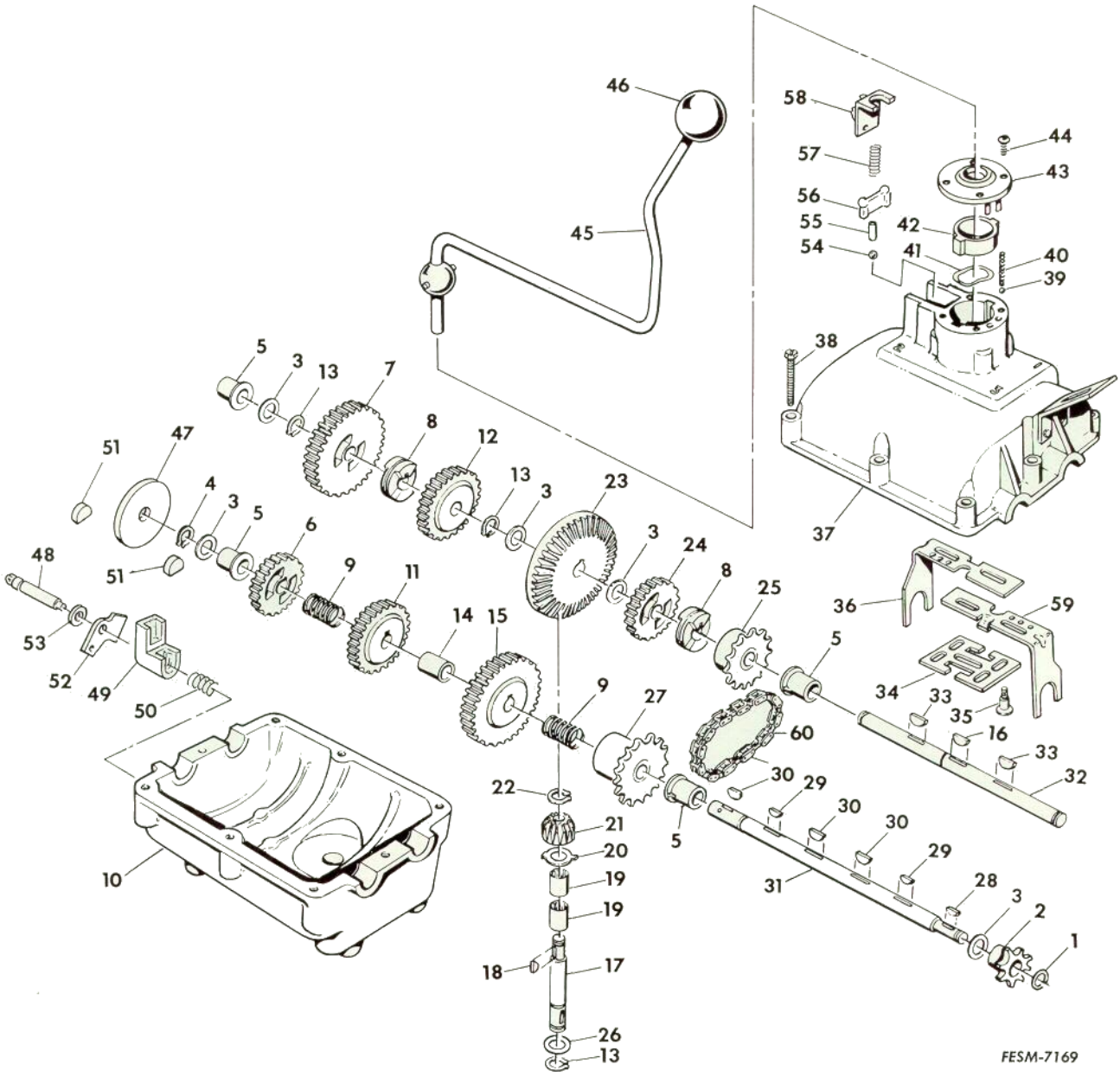
f. Remove retaining ring (1), sprocket (2) and key (28).

4. Disassemble the drive shaft as follows:

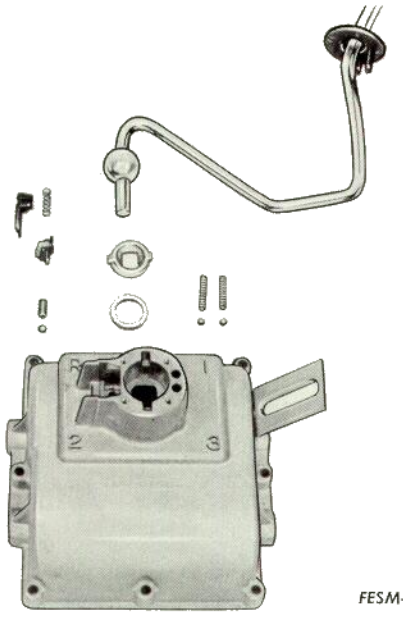
a. Remove the bearing (5), sprocket (25), clutch collar (8), key (33), gear (24), shim washer (3), bevel gear (23) and shim washer (3). Mark or tag the washers for reassembly.

b. Remove the bearing (5), washer (3), retaining ring (13), gear (7), clutch collar (8), key (33) and gear (12).

5. The input shaft assembly should be removed only if the bevel pinion (21), washer (20), bearings (19) or shaft are to be replaced. The input shaft, bearings and bevel gear are removed as an assembly. Remove retaining ring (13), washer (26) and press the assembly to the inside of the case. Remove retaining ring (22) and press the shaft from the gear.




| | | | |
|---|---|---|---|
| 1. Retaining ring | 16. Key | 31. Output shaft | 46. Knob |
| 2. Sprocket | 17. Input shaft | 32. Drive shaft | 47. Brake disc |
| 3. Shim washer | 18. Key | 33. Key | 48. Bolt |
| 4. Retaining ring | 19. Bearing | 34. Lock-out plate | 49. Brake jaw |
| 5. Bearing | 20. Washer | 35. Screw | 50. Spring |
| 6. Driven gear, 20T | 21. Bevel pinion | 36. Shifter fork | 51. Friction puck |
| 7. Drive gear, 30T | 22. Retaining ring | 37. Upper housing | 52. Lever assembly |
| 8. Clutch collar | 23. Bevel gear | 38. Screw | 53. Washer |
| 9. Spring | 24. Drive gear, 20T | 39. Ball | 54. Ball |
| 10. Lower housing | 25. Sprocket | 40. Spring | 55. Pin |
| 11. Driven gear, 25T | 26. Washer | 41. Wave washer | 56. Carrier contact |
| 12. Drive gear, 25T | 27. Sprocket | 42. Insert | 57. Spring |
| 13. Retaining ring | 28. Key | 43. Cover | 58. Terminal |
| 14. Spacer | 29. Key | 44. Screw | 59. Fork |
| 15. Driven gear, 30T | 30. Key | 45. Handle | 60. Chain |



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6. Disassemble the shifter assembly as follows:

a. Remove the four screws from the cover (43) and slide the shift lever (45) out.

b. Remove the insert (42) and wave washer (41).

c. Remove the safety start switch spring (57). Slide the terminal (58) and carrier contact (56) up and off.

d. Use a magnet or tap the housing lightly upside down on a wooden block to remove the pin (55), ball (54), springs (40) and poppet balls (39).

e. If necessary, remove the screws (35) to remove the shift forks (36 and 59) and lockout plate (34).

7. Remove the shoulder bolt (48) to remove the brake assembly.

## Inspection and Repair

1. Wash all parts in a cleaning solvent and blow dry.

2. Check the bearings for loose fit on the shafts; wear, roughness and scoring.

3. Check the gears for broken teeth, wear and burrs.

4. Check the shafts for wear at the bearing locations. Remove any burr with a fine stone.

5. Check the clutch collars for nicks and burrs which may prevent smooth mesh with the gears.

6. Inspect the housings for cracks.

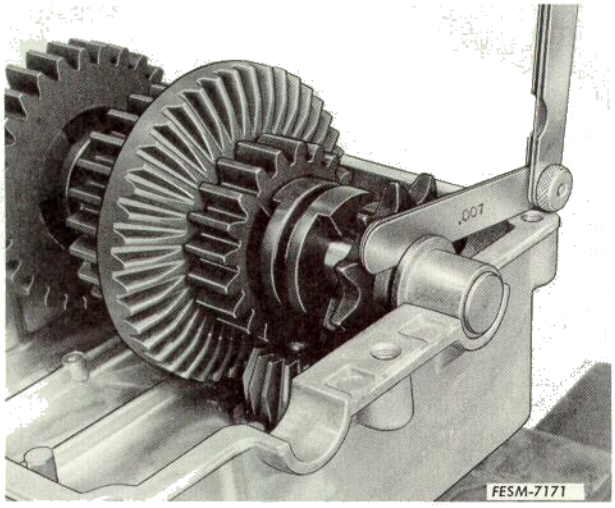
# Reassembly

**Reference numbers in the text refer to the exploded view of the transmission on page 3-15.**

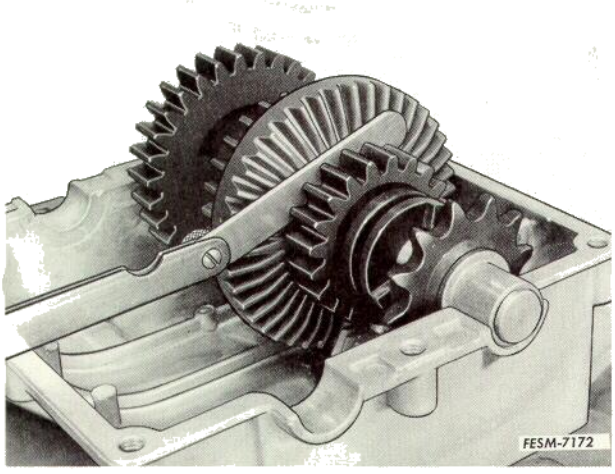
1. Press the bevel pinion bearings (19) into the lower housing (10).

2. Install the bevel pinion shaft (17), thrust washer (20) and key (18). Press the bevel pinion gear (21) on the shaft and install retaining ring (22). Install lower washer (26) and retaining ring (13). Tap the shaft lightly up and down with a brass hammer to seat the bevel pinion against the snap ring.

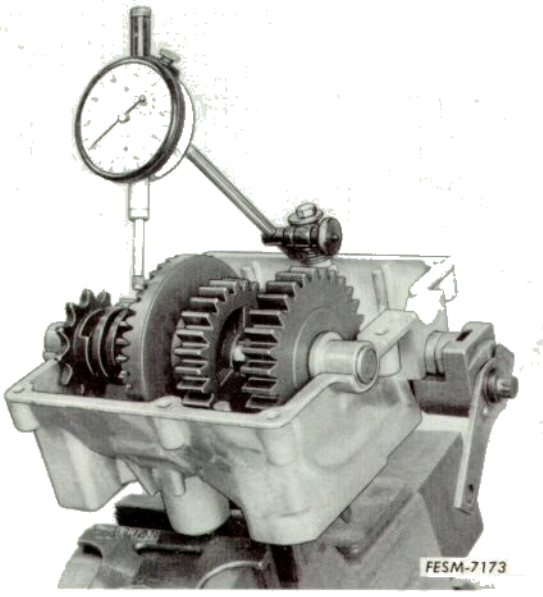
3. Assemble the drive shaft assembly without the shim washers (3). Install the drive shaft in the lower housing.




4. Measure the gap between the flange bearing (5) and sprocket (25). Select a shim washer which will allow .001-.010" end play of the shaft. Install the washer between the flange bearing (5) and snap ring (13) by third speed drive gear (7).

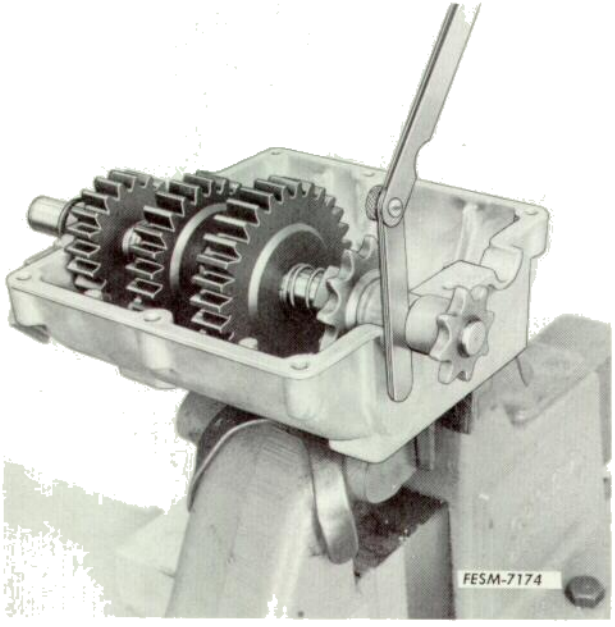



5. Measure the gap between the bevel gear (23) and first speed drive gear (24). Select two shim washers of the same size equal to or slightly less than the measured gap. Install one on each side of the bevel gear. If one shim is smaller, install it between the bevel gear (23) and snap ring (13).

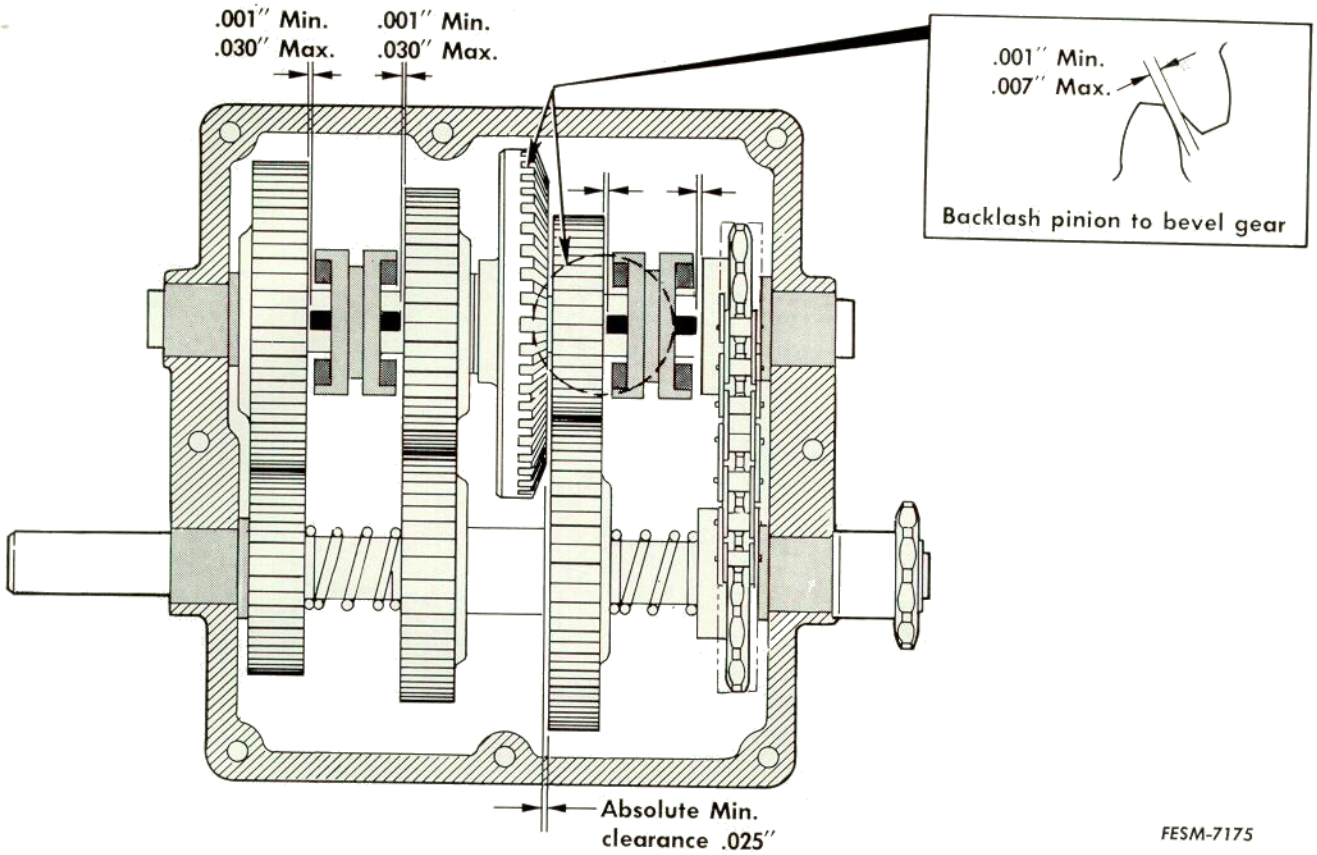



1. FES 67

6. Clamp the input shaft in a vise equipped with brass jaws. Check the bevel gear to pinion backlash. Backlash should be from .001-.007 inch. Push the drive shaft to the loaded side (third speed side) to obtain maximum backlash. Adjust the shim sizes to move the bevel gear in or out as necessary to obtain the correct backlash.




7. Assemble the output shaft without shim washers and install it in the lower housing. Measure the gap between the output sprocket (2) and the lower housing. Select two shim washers approximately the same thickness which will allow .001-.010 inch end play of the shaft. If one shim is thicker, install it on the output sprocket side.




8. There should be a minimum of .025 inch between the face of the bevel gear (23) and first speed driven gear (12). Adjust the shim washers on the output shaft if necessary.

9. Check the clearance between the drive keys (33) and the gears. The gears should turn freely with .001-.030 inch clearance between the gear face and key.

10. Remove the driveshaft and output shaft from the lower housing.

11. Fill the lower housing with 1/2 lb. of IH 251 HEP or equivalent.

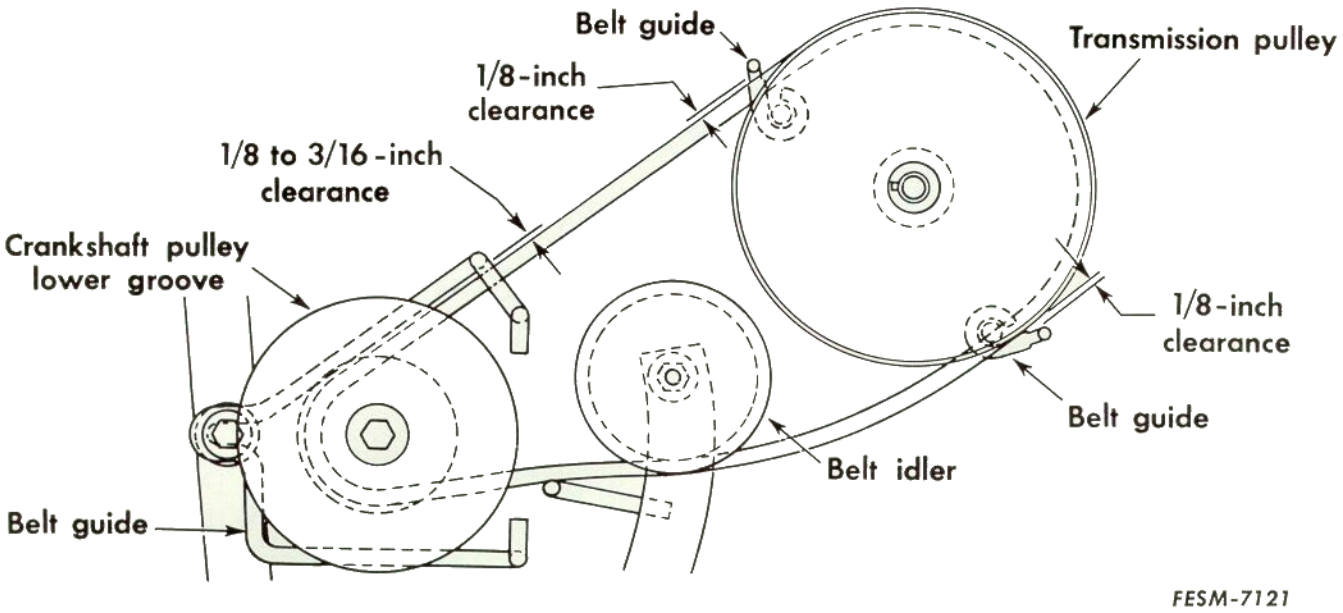
12. Assemble the drive shaft, output shaft and chain as an assembly and install it in the lower housing. Thoroughly lubricate the gear assemblies with IH 251 HEP or equivalent.

13. Assemble the shifter assembly in the upper housing by reversing the disassembly procedure. Thoroughly lubricate the mechanism with IH 251 HEP or equivalent.

14. Install the upper housing to the lower housing. Be sure the shift forks have engaged the clutch collars.

15. Install the brake assembly on the lower housing.

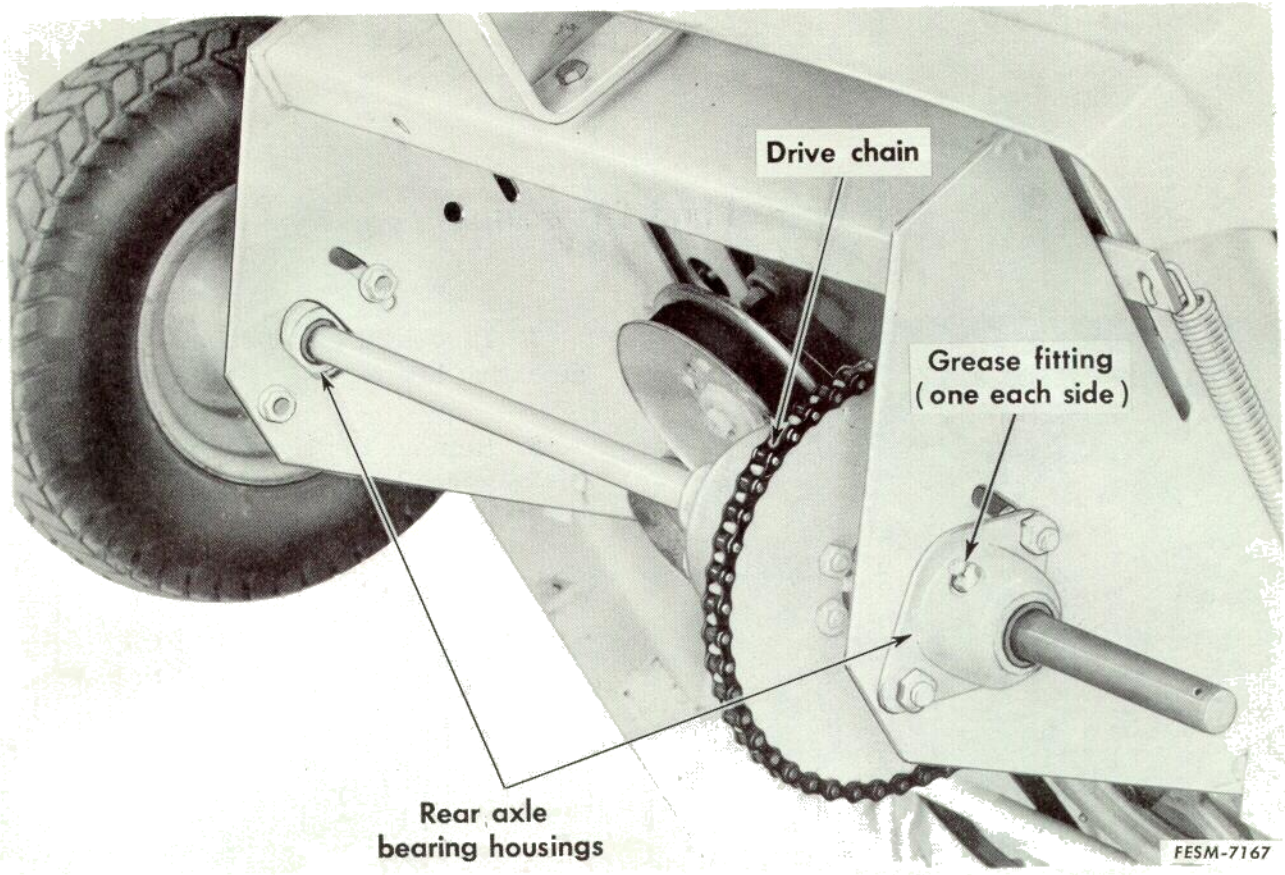
# Installation




Belt Guide Adjustment

1. Install the transmission by reversing the removal procedure.

2. Adjust the transmission drive belt guide clearances.



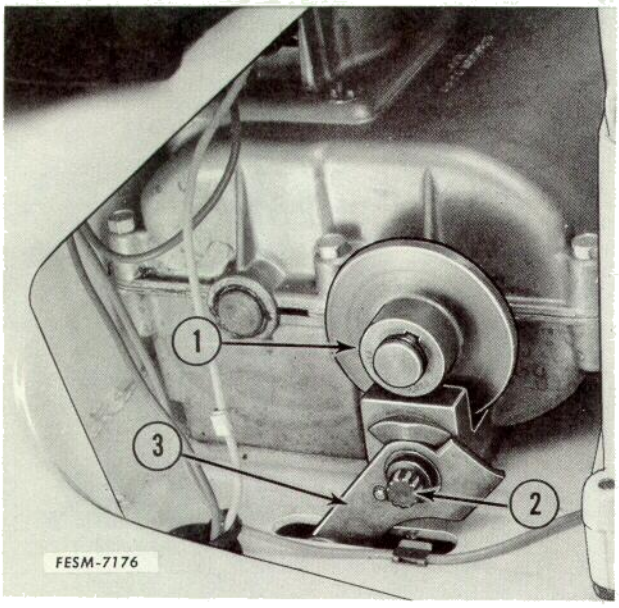

3. Adjust the drive chain tension. The drive chain can be adjusted to compensate for stretch and wear. The rear axle bearing mounting holes are slotted at the top to move the axle back for proper adjustment.

To properly adjust the drive chain, set the transmission in neutral, block the front wheels and raise the rear end of the rider.

Adjust the bearing housings until the slack is out of the chain. The chain must not be taut. If the drive chain is too tight, excessive wear and stretch will result in premature failure. Not enough tension may allow the chain to jump the sprocket, ride the teeth, break, or whip excessively. The axle must be perpendicular to side of rear frame. Adjust each side an equal amount.

# BRAKE

## Removal and Disassembly




1. Disconnect the brake rod from the actuating lever.

2. Remove the shoulder bolt and brake assembly.

1. Brake disc
2. Shoulder bolt
3. Actuating lever

## Inspection and Repair

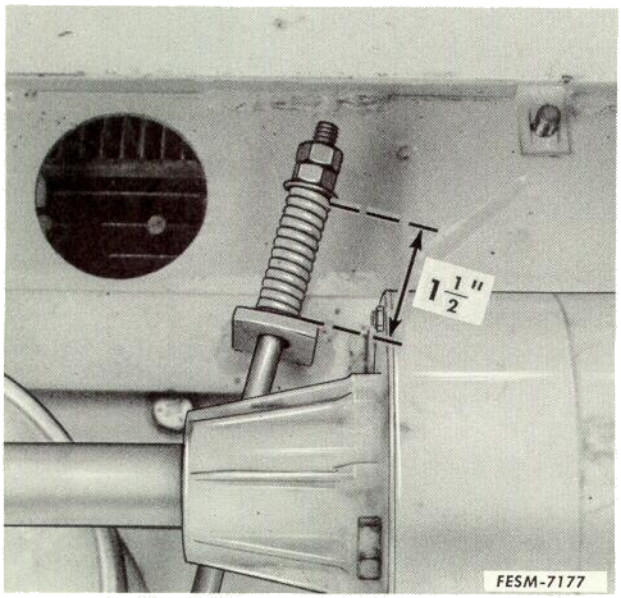
1. Inspect all parts for wear, breakage, scoring and cracking. Replace as necessary.

## Reassembly and Installation

1. Reverse the removal and disassembly procedure.

2. Adjust brake as necessary.

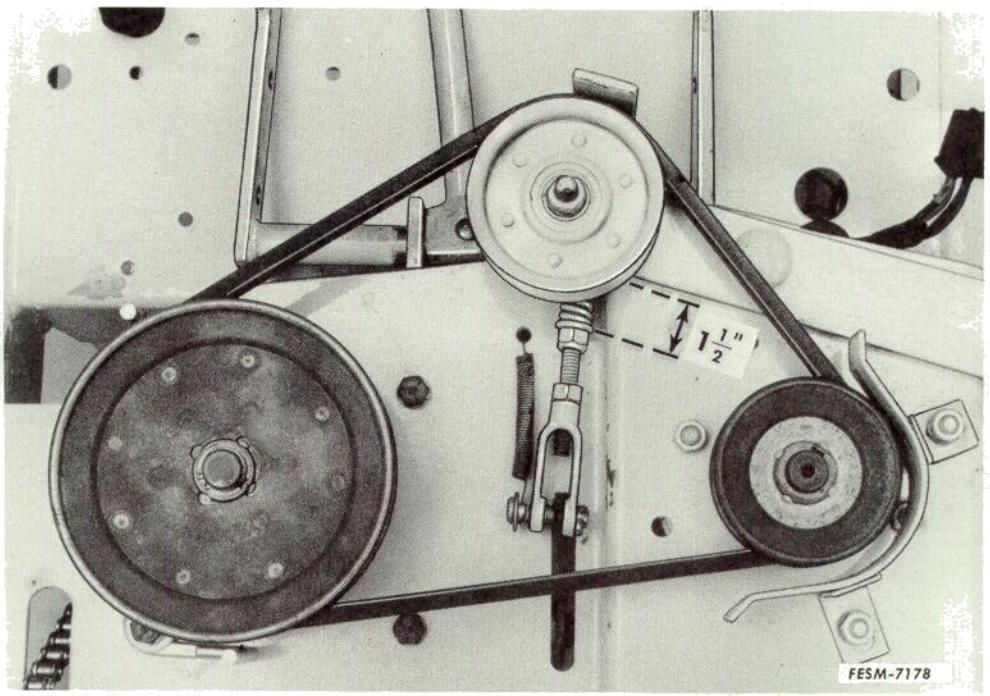
# Adjustment




Gasoline engine.

1. The brake disc must turn freely in the disengaged position.

2. Lock the brake pedal in the engaged position. Adjust the brake rod spring to 1-1/2 inches and lock the nut.




Electric drive.

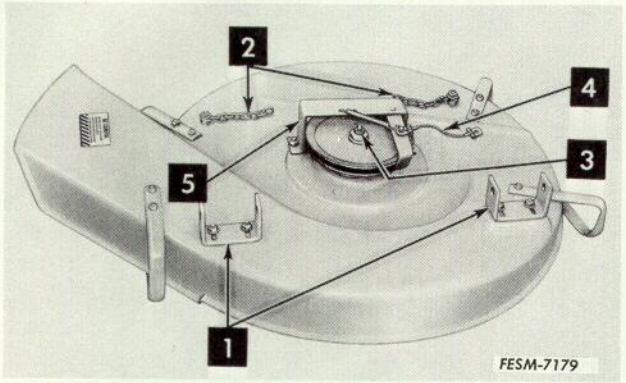
# Section 4

# MOWER

## CONTENTS

# SINGLE BLADE MOWER

## Removal




1. Front mounting brackets
2. Rear hanger chains
3. Lubrication fitting
4. Brake cable
5. Belt guide and brake cable arm

1. Disconnect the spark plug wire and lock the parking brake.

2. Place the mower clutch control handle in the disengaged position and lower the mower.

3. Disconnect the brake cable from the mower clutch control.

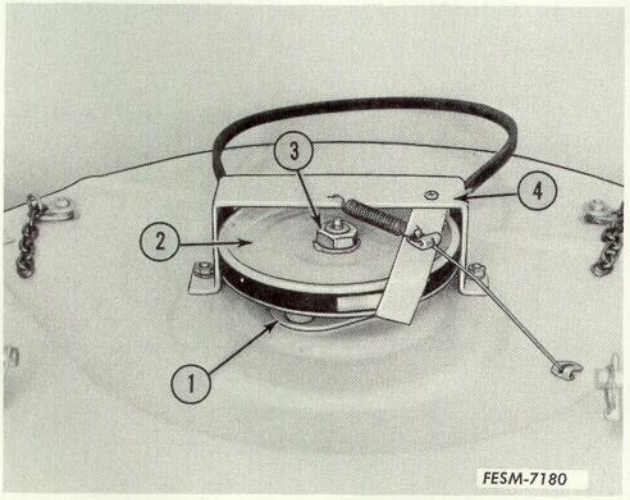
4. Remove the quick attach pins and retaining pins from the front brackets.

5. Raise the rear of the mower and disconnect the lift chains.

6. Slide the mower back and remove the drive belt from the crankshaft pulley.

7. Raise the mower lift handle. Raise the front of the rider sufficiently to slide the mower out.

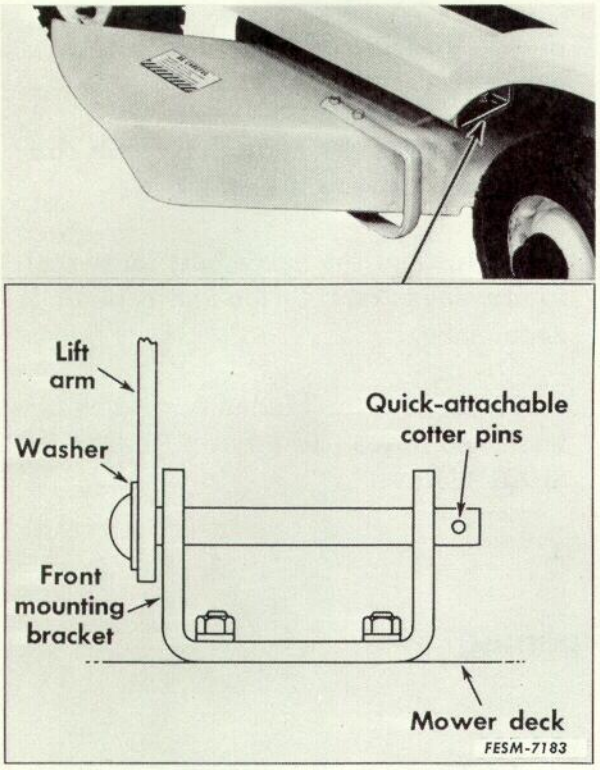
## Disassembly




1. Spindle housing
2. Pulley
3. Pulley nut
4. Belt guide and brake

1. Remove the belt guide and brake assembly.

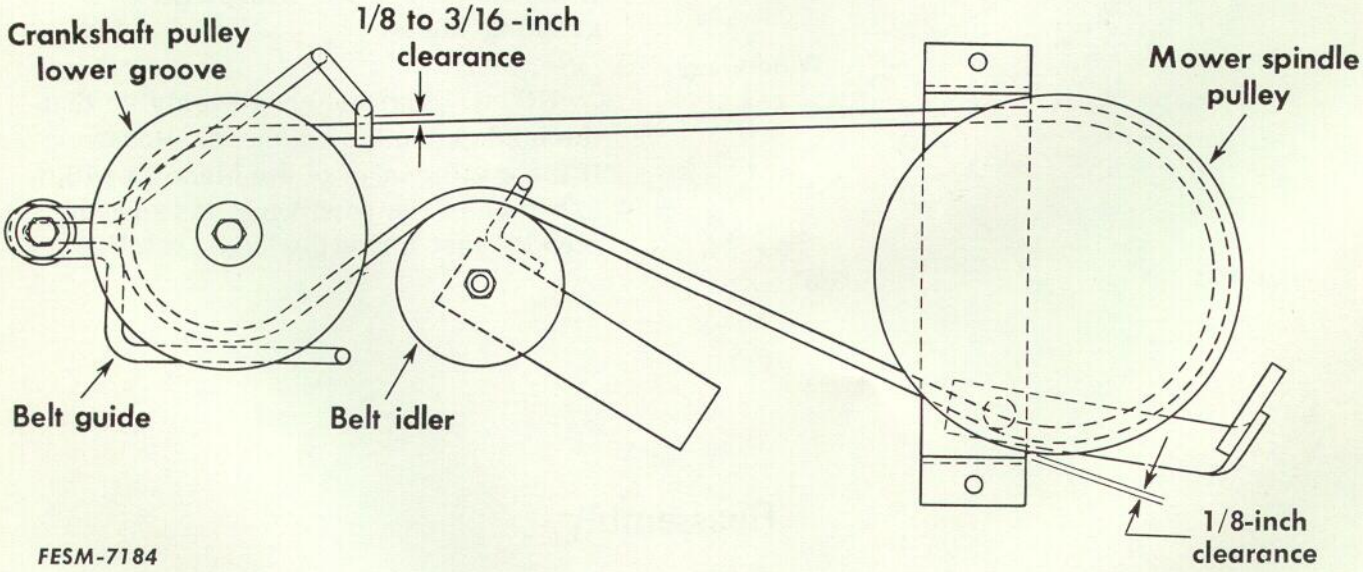
# Installation



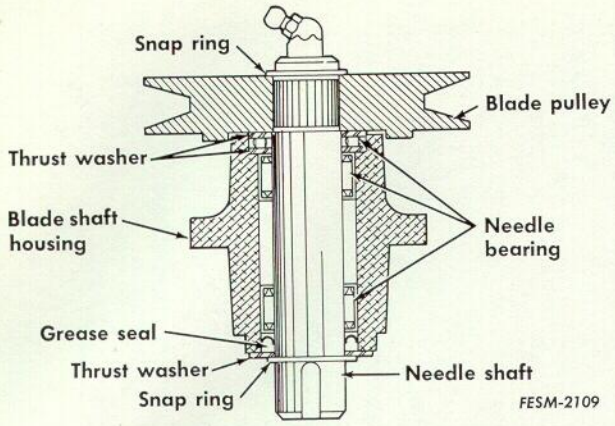

1. To install the mower, reverse the removal procedure.

2. Position mower lift arm to the outside of the front mounting bracket.

3. Check that the belt is properly positioned in the belt guides. If the belt slips or is worn, replace it. There is no adjustment of the belt tension on this model.




Mower drive belt.

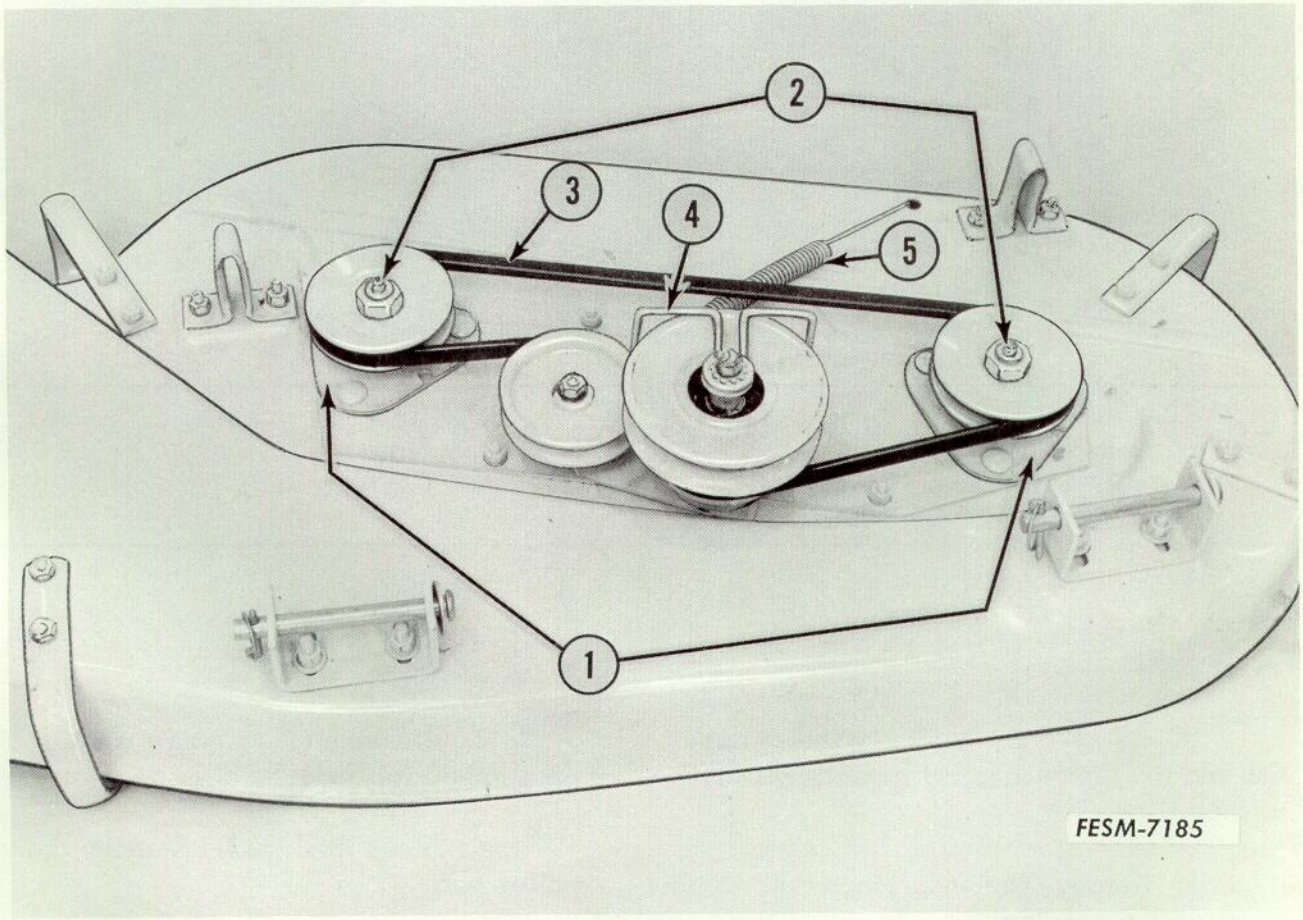



b. Remove the pulley and housing from the mower.

c. Remove the snap ring from the blade end of the housing. Slide the pulley and shaft assembly out of the housing.

d. Remove the grease fitting and snap ring. Press the shaft out of the pulley.

## Disassembly - Side Discharge

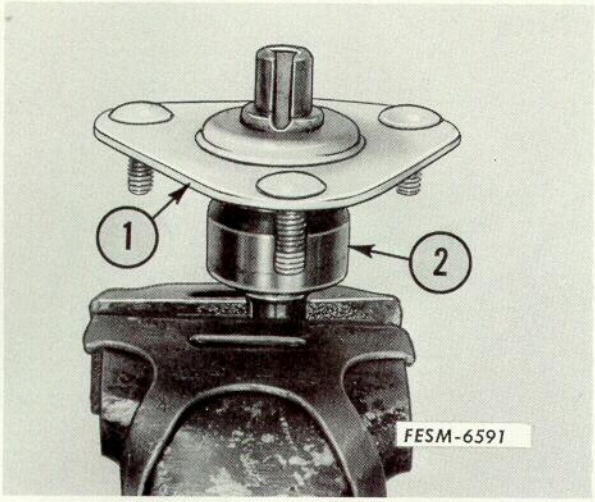



1. Spindle housing
2. Pulley nut
3. Spindle drive belt
4. Belt guide
5. Idler spring

1. Disconnect the idler spring and remove the spindle drive belt.

2. To disassemble the center spindle proceed as follows:

a. Remove the belt guide.




c. Remove the spindle housing and pulley.

d. Remove the pulley from the spindle.

1. Spindle bearing cap
2. Spindle bearing

## Inspection and Repair

1. Inspect the bearings for wear, roughness of operation, or other damage. Replace if necessary.

2. Check the spindle housing for cracks, breaks or wear. Replace if necessary.

3. Inspect the spindle drive belt for wear and replace if necessary.

4. Inspect the pulleys for wear and replace if necessary.

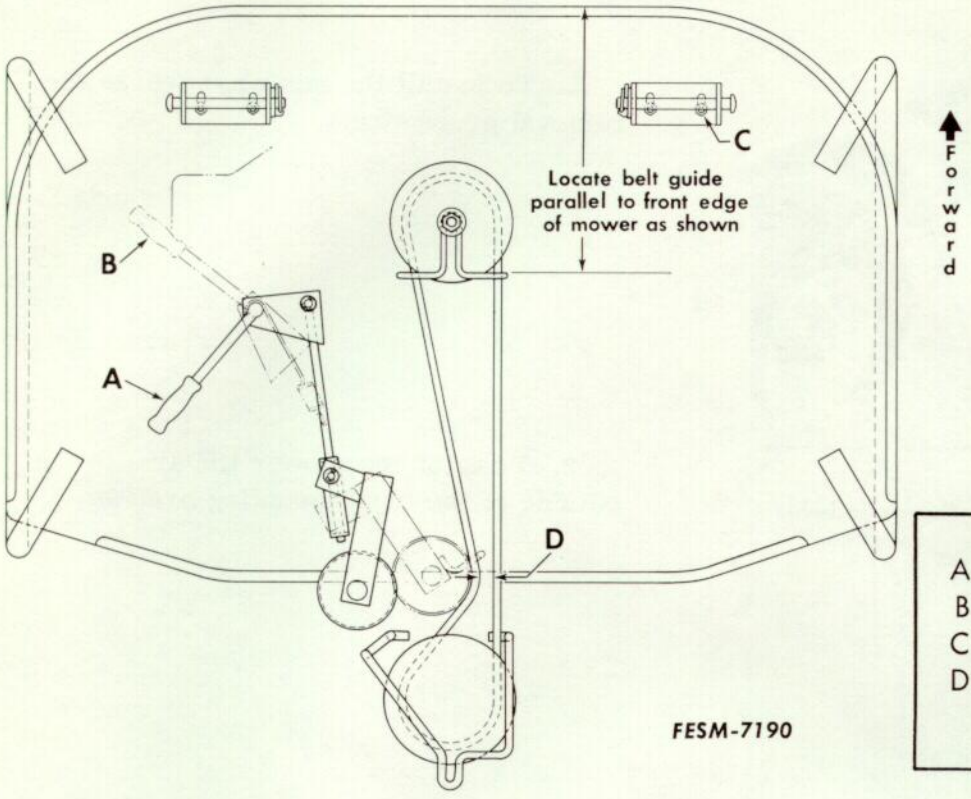
5. Inspect the shroud assembly for dents etc. and repair or replace if necessary.

6. Inspect the main drive belt for wear and replace if necessary.

7. Inspect the drive belt idler pulleys for freeness of rotation and replace if necessary.

8. Inspect the blades for excessive wear and nicks. Refer to "BLADE SHARPENING".

# Drive Belt Adjustment




A. Disengaged position
B. Engaged position
C. Front brackets
D. 1-1/2" clearance for proper adjustment

1. Shut off the engine and disconnect the high tension wire from the spark plug.

2. Lock the tractor brake.

3. Place the mower height control lever in the lowest position.

4. Engage the mower clutch.

5. Put a pencil line on the mower housing in front of the mower front mounting brackets.

6. Adjust the mower forward by loosening the front mounting brackets and sliding the mower forward until the distance between the backsides of the belt is 1-1/2-inch at the idler pulley.

NOTE: The mower should be moved forward an equal distance on each side (approximately 1/4-inch).

7. Tighten the front hangers.

8. Reconnect the high tension wire to the spark plug.

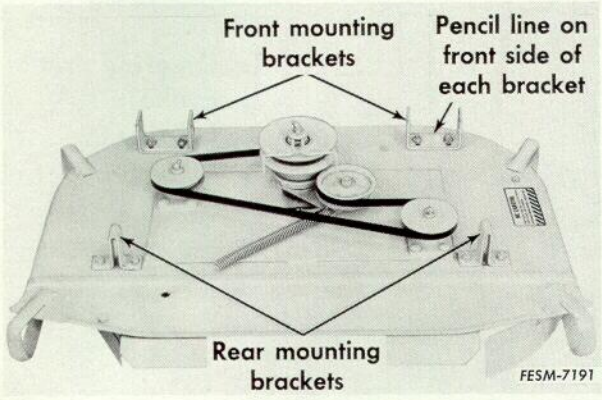
9. Place the mower lift handle in the third position from the bottom. Start the engine and slowly engage the mower clutch control. Then, disengage and check to make sure mower declutches properly. If mower clutch control does not declutch, shut off the engine, detach the spark plug wire, and check position of belt guides. If it still will not declutch, move mower backward 1/16-inch.

10. Raise the mower to the maximum lift position and turn the wheels a full right and full left. If the clearance between the mower housing and the tires is less than 1/8-inch, the mower should be moved back slightly to give clearance.

# Leveling the Mower

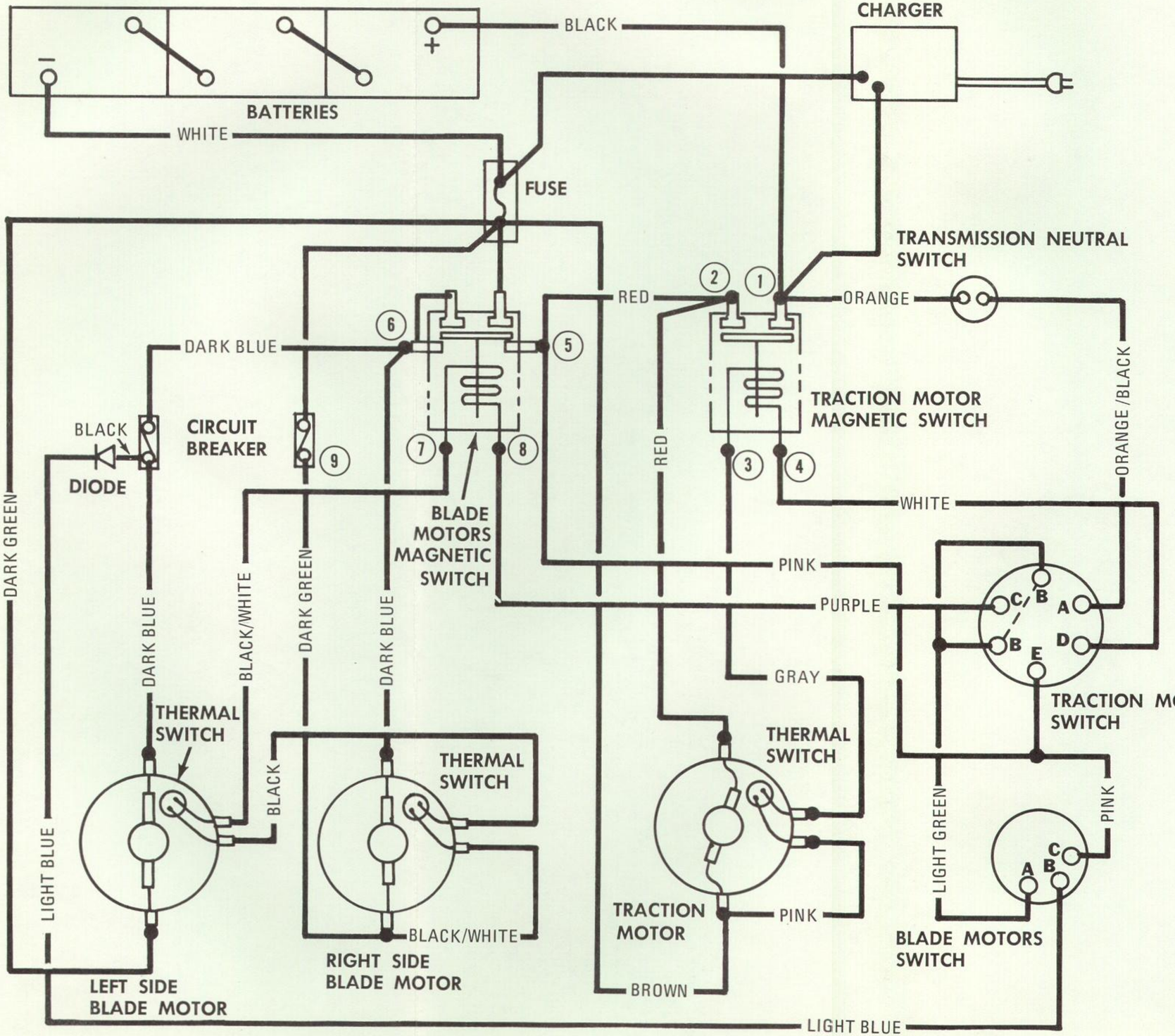
1. Drive the riding mower onto a hard flat surface.

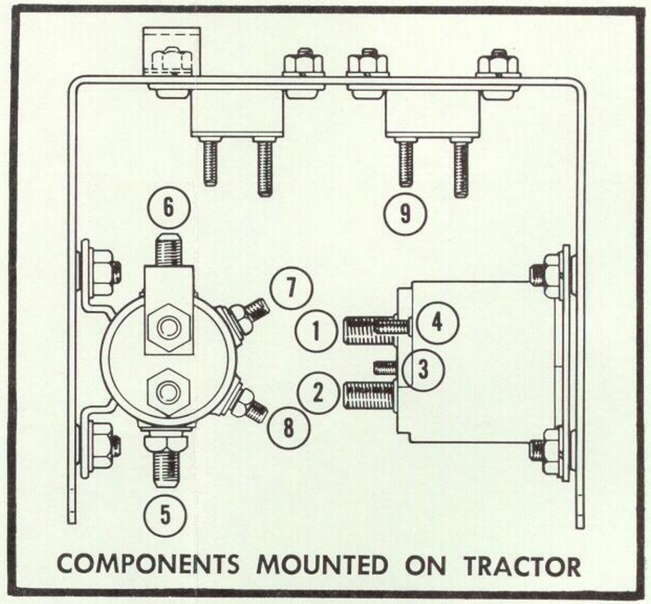
2. Turn the ignition off and disconnect the high tension wire to the spark plug. Lock the brake.

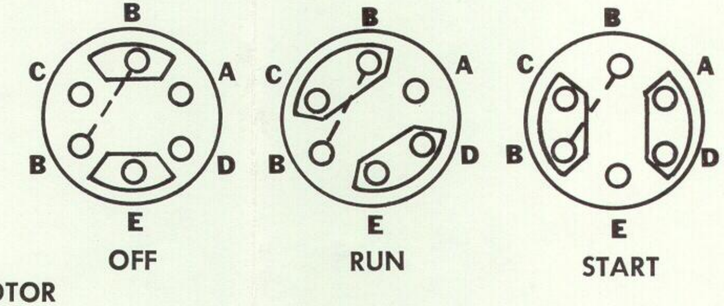



3. Front to Rear: Measure the distance from the ground to the blades (blades parallel to centerline of the rider) front and rear in typical cutting height. Add 11/32-inch washers between both front or rear hanger brackets depending on which measures high.

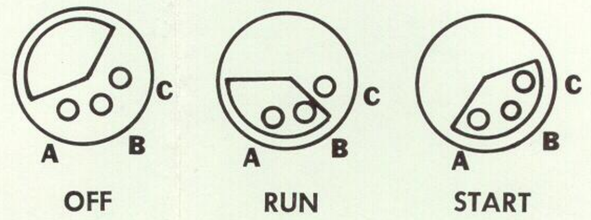
4. Side to Side: Measure the distance from the ground to the blades (blades perpendicular to the centerline of the rider) right and left in typical cutting height. Add 11/32-inch washers between both right or left side mounting brackets depending on which measures high.




BLADE MOTORS SWITCH

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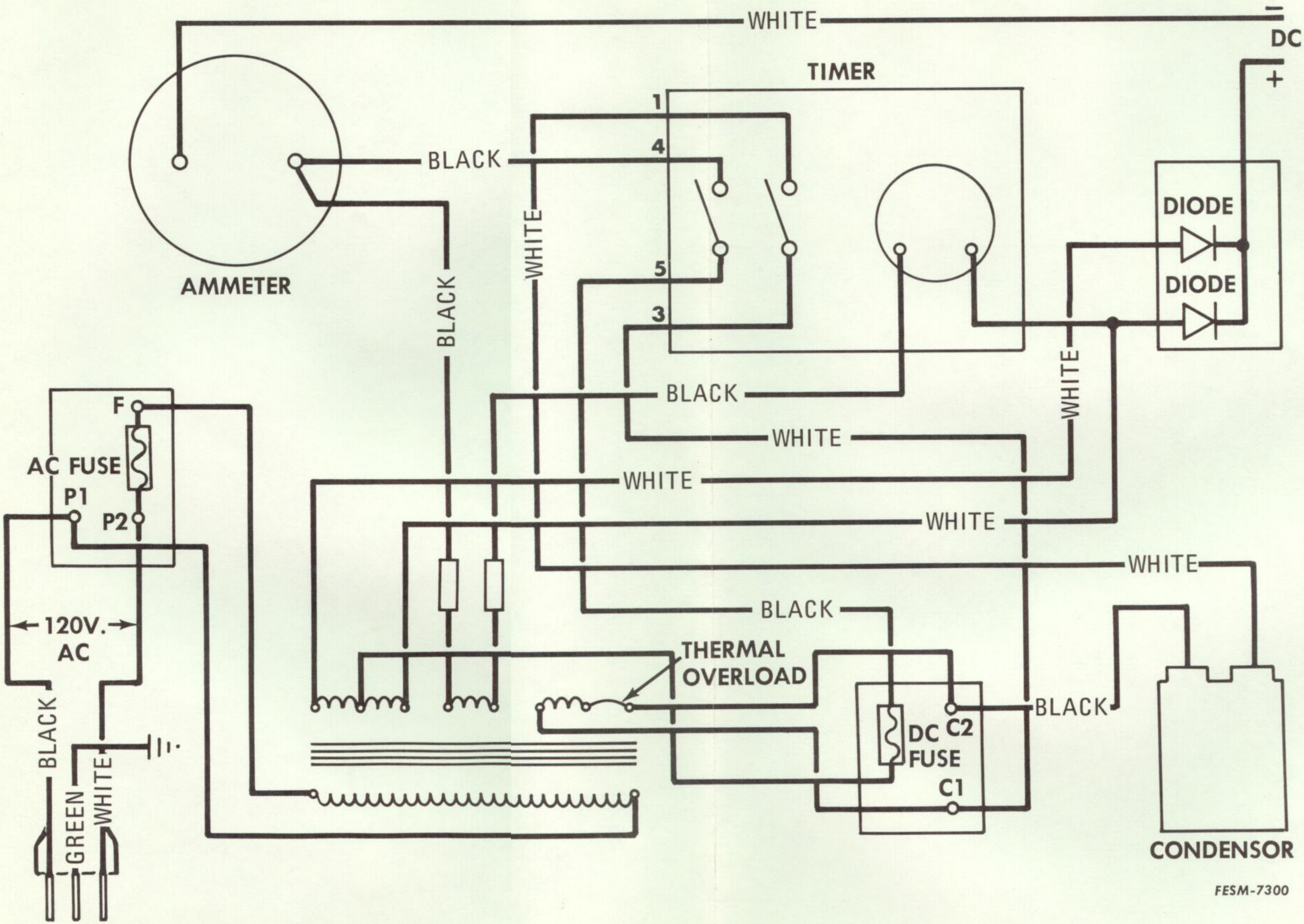


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