SM

Service Manual

John Deere Electric 90 Mower (Serial No. 1001-)

SM-2098

Litho in U.S.A. (M) New

SERVICE MANUAL

ELECTRIC 90 MOWER

(Serial No. 1001-)

CONTENTS

(All information, illustrations, and specifications contained in this service manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.)

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INTRODUCTION

This service manual contains service and maintenance information for the John Deere Electric 90 Mower (Serial No. 1001-).

The manual is divided into sections. Each section pertains to a certain component or operational system of the mower. This information is divided into groups within each section.

Emphasis is placed on diagnosing malfunctions, analysis and testing. Diagnosing malfunctions includes possible troubles, their causes and how to correct them. Under specific components these troubles are analyzed to help you understand what is causing the problem. In this way, you can eliminate the cause rather than just replacing parts and have the same problem keep recurring.

Machine specifications are found in Section 10. Test specifications are given at the point of instruction where they apply rather than at the end of each section, because specific test procedures must be followed to obtain accurate test readings.

Also refer to Section 10 for test equipment and special tools you should have before beginning certain service procedures.

This manual can be kept in its own cover, or it can be filed in your service manual rack or placed behind the service manual tab in your Consumer Products Service Information Binder.

Whenever new or revised pages are provided, insert them into your manual as soon as you receive them. Your service manual will always be up-to-date and be a valuable asset in your service department.

⚠ This safety alert symbol identifies important safety messages in this manual. When you see this symbol be alert to the possibility of personal injury and carefully read the message that follows.

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Section 10
GENERAL

Group 5
MACHINE IDENTIFICATION

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SERIAL NUMBER

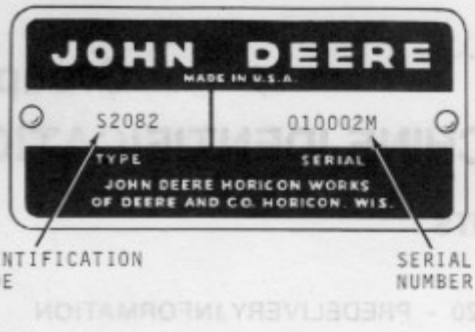

Fig. 1-Machine Serial Number Plate

Fig. 1 shows a typical serial number plate.

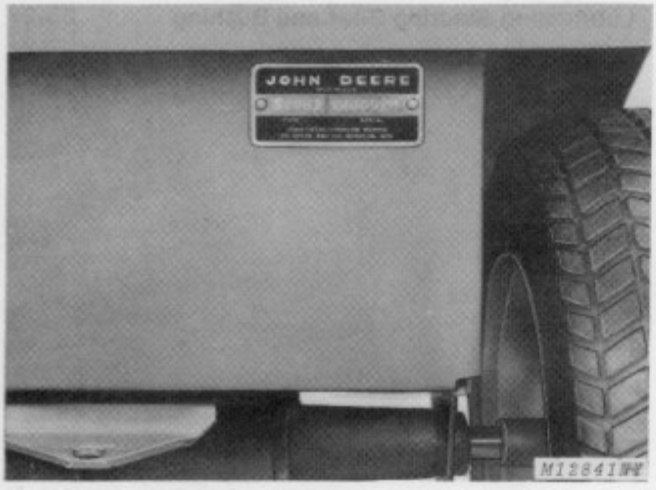

Fig. 2-Serial Number Plate Location

The serial number plate is located at the rear of the mower frame as shown in Fig. 2.

MOWER IDENTIFICATION CODES

Two identification codes are used for Electric 90 Mowers:

S2082 - with mower
S2083 - without mower

Group 10
SPECIFICATIONS

MACHINE SPECIFICATIONS

DIMENSIONS AND WEIGHT
- Wheelbase ..... 40 in.
- Tread
  - Front ..... 22 in.
  - Rear ..... 25 in.
- Height ..... 37 in.
- Length ..... 52-1/2 in.
- Width (incl. mower) ..... 43 in.
- Weight (approx. curb weight) ..... 475 lb.
- Tires (pneumatic)
  - Front ..... 11 x 4.00
  - Rear ..... 16 x 16.50
  - Tire Pressure
    - Front - 11 x 4.00 - 5 ..... 8 psi
    - Rear - 16 x 6.50 - 8 ..... 6 psi

BATTERIES
- Number used 3
- Weight (each, dry) ..... 34-1/2 lbs.
- Voltage ..... 12 volts
- Type . . . John Deere 55 ampere-hour AM33995 motive-type, lead-acid batteries specifically designed to give long cycle life and withstand deep charging.
- Electrical protection ..... 100 AMP metal fuse

CHARGER (Reactance Limited)
- Charge capacity ..... 100% replacement, 6 to 12 hours; 80% replacement, 5 hours
- Line voltage . . . 100/125 volt AC household current
- Temperature range recharge capability ..... 0 to 100° F.
- Charger protection ..... Thermal overload

TRACTION MOWER
- Type ..... Permanent-magnet, 2-pole
- Voltage ..... 36 volts
- Speed - AM33907 Motor (Serial No. 1001-10,000) . 2400 rpm
  AM34576 Motor (Serial No. 10,001-) . 3600 rpm
- Continuous horsepower - AM33907 Motor . .90 hp
  AM34576 Motor 1.25 hp
- Peak horsepower - AM33907 Motor ..... 2.70 hp
  AM34576 Motor .... 3.40 hp
- Protection ..... Thermostat
- Amperage draw (No load) - (clutch engaged)
  - AM33907 Motor ..... 13 amps max.
  - AM34576 Motor ..... 7.5 amps max.

MOWER MOTORS
- Number 2
- Type ..... Permanent-magnet, 2-pole
- Voltage ..... 36 volts DC
- Speed - AM33910 Motor (Serial No. 1001-10,000) . 3200 rpm
  AM34656 Motor (Serial No. 10,001-) . 3200 rpm
- Continuous horsepower - AM33910 Motor . .55 hp
  AM34656 Motor 1.05 hp
- Peak horsepower - AM33910 Motor ..... 1.40 hp
  AM34656 Motor .... 2.80 hp
- Protection - AM33910 Motor ... Circuit breakers
  AM34656 Motor ..... Thermostats
- Amperage draw (No Load) with mower blades
  - AM33910 Motor ..... 15 amps max.
  - AM34656 Motor ..... 15 amps max.

SYSTEM AMPERAGE DRAW
- No load, all motors running, with mower blades ..... 43 amps max.

TRANSAXLE
- Capabilities ..... 3 forward speeds, 1 reverse speed
- Maximum ground speeds .... 1st gear - 1.4 mph
  2nd gear - 2.8 mph
  3rd gear - 4.2 mph
  Reverse - 2.1 mph
- Transaxle lubricant ..... SAE 90 (AM30200)
- Transaxle Capacity ..... 24 oz.
- Clutch .... V-belt from traction motor to transaxle

BRAKES
- Type (Serial No. 1001-10,000) . . Band on transaxle-mounted drum
  (Serial No. 10,001-) .... Disk on transaxle
- Lock ..... Hand-operated parking lock

STEERING
- Type ..... Gear reduction
- Ratio 4:1

MOWER
- Width of cut ..... 34 in.
- Lift ..... Pedestal-mounted, lever-spring assisted
- Height of cut ..... 1 to 4 in. above ground
- Blades ..... 2 direct-motor-driven

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BOLT TORQUE CHART

Grade of Bolt		SAE-2	SAE-5	SAE-8	
Min. Tensile Strength		64,000 PSI	105,000 PSI	150,000 PSI	
Grade Marking on Bolt					Socket or Wrench Size
U.S. Standard					U.S. Regular
Bolt Dia.	U.S. Dec. Equiv.	TORQUE IN FOOT POUNDS			Bolt Head / Nut
1/4	.250	6	10	14	7/16 / 7/16
5/16	.3125	13	20	30	1/2 / 1/2
3/8	.375	23	35	50	9/16 / 9/16
7/16	.4375	35	55	80	5/8 / 11/16
1/2	.500	55	85	120	3/4 / 3/4
9/16	.5625	75	130	175	13/16 / 7/8
5/8	.625	105	170	240	15/16 / 15/16
3/4	.750	185	300	425	1-1/8 / 1-1/8
7/8	.875	* 160	445	685	1-5/16 / 1-5/16
1	1.000	250	670	1030	1-1/2 / 1-1/2

Multiply Readings by 12 for inch pound values.

* *"B" Grade bolts larger than 3/4-inch are sometimes formed hot rather than cold which accounts for the lower recommended torque.*

NOTE: Allow a tolerance of plus or minus 10 percent on all torques given in this chart.

SET SCREW SEATING TORQUE CHART

Screw Size	Cup Point	Square Head
	Torque in Inch Pounds	
#5	9	--
#6	9	--
#8	20	--
#10	33	--
1/4	87	212
5/16	165	420
3/8	290	830
7/16	430	--
1/2	620	2100
9/16	620	--
5/8	1225	4250
3/4	2125	7700

Divide Readings by 12 for foot pound values.
NOTE: Allow a tolerance of plus or minus 10 per cent on all torques given in this chart.

WIRE GAUGE CHART

Gauge	Use	Amperage Capacity
8	Battery Connections	50 amps
10	Traction motor leads	20 amps
10	Jumper from main solenoid to mower solenoid	30 amps
12	Mower motor leads	15 amps
16	Charger DC leads	10 amps
	All other wiring	1/2 amp or less

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Group 15
TEST EQUIPMENT AND SPECIAL TOOLS

TEST EQUIPMENT

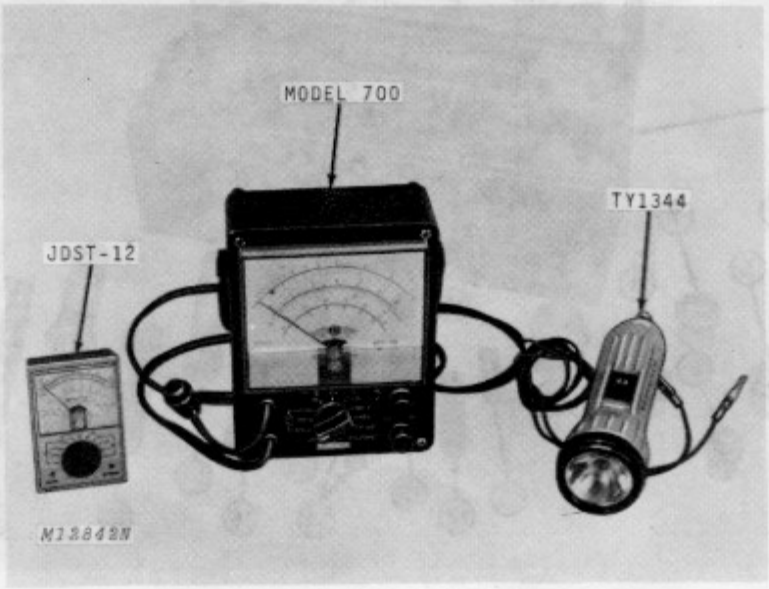

Fig. 1-Electronic Testers

Number	Name	Use	Order from:
JDST-12	AC-DC Multimeter	AC or DC Volts and Ohm Tester	Service Tools Inc. 1901 Indiana Ave. Chicago, Illinois 60616
TY 1344	Flashlight Continuity Tester	Testing Continuity	John Deere Branch Parts Depot
Model 700	Volt - Amp - Ohm Meter	Testing Volts, Amps or Ohms	Merc-O-Tronics Instruments Corp. 215 Branch Street Almont, Michigan 48003

SPECIAL TOOLS

Model 21	Peerless Grinder	Sharpen Blades	S.I.P. Grinding Machine Co. 722 Porter Street Lansing, Michigan 48906
.....	Magna-Matic Balancer	Balance Blades	Magna-Matic Division A.J. Karrels Co. Port Washington, Wisconsin 53074

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SPECIAL TOOLS—Continued

3-Speed Transaxle

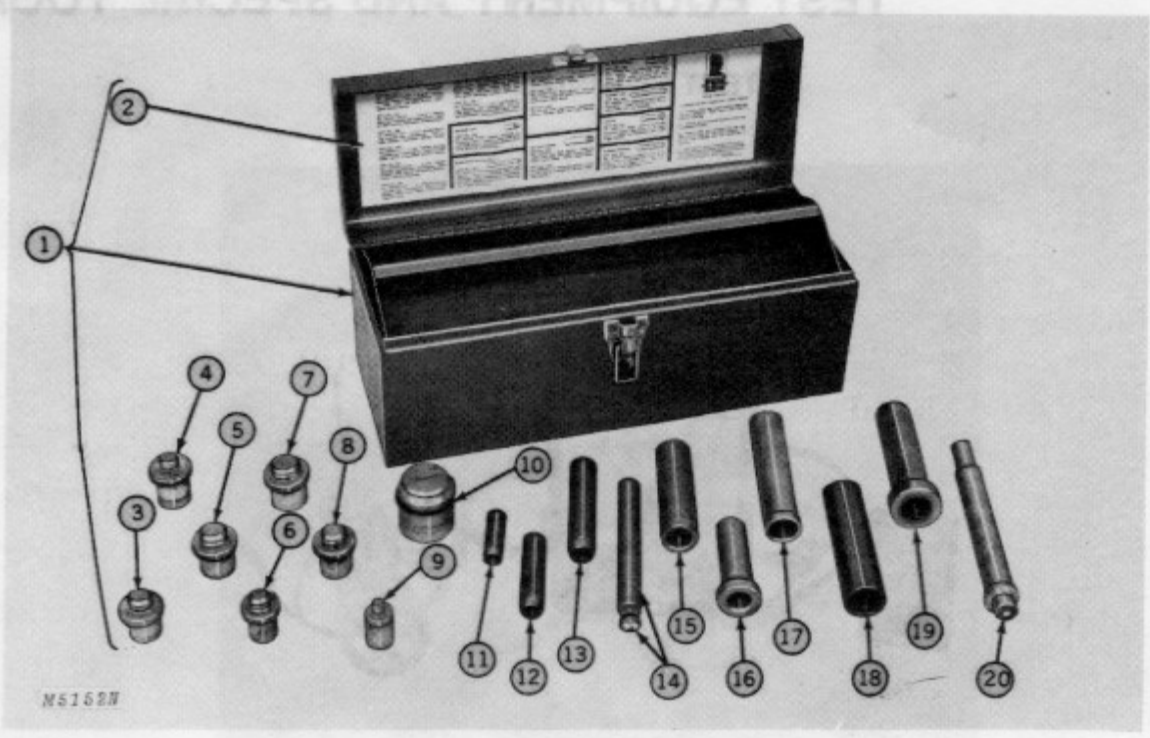

Fig. 2-Tools for Servicing Transaxle

Key	Part No.	Description
1	670188	Transaxle Tool Kit (Includes all parts listed below)
2	691246	Instruction Sheet
3	670173	Tool, 1" - 1-1/4" Bearing Assembly and Disassembly
4	670176	Tool, 3/4" - 1-1/4" Bearing Assembly and Disassembly
5	670171	Tool, 15/16" - 1-3/16" Bearing Assembly and Disassembly
6	670175	Tool, 3/4" - 1" Bearing Assembly and Disassembly
7	670170	Tool, 1-1/8" - 1-3/8" Bearing Assembly and Disassembly
8	670172	Tool, 7/8" - 1-1/8" Bearing Assembly and Disassembly
9	670194	Shifter Shaft Bearing Driver Tool
10	670174	Tool, 1-3/4" - 2-1/8" Bearing Assembly and Disassembly
11	670182	Oil Seal Installation Cone, 3/4"
12	670185	7/8" Seal Sleeve
13	670179	Oil Seal Installation Cone, 1"
14	670177	Burnishing Rod and 7/8" Ball
15	670186	7/8" Shaft Seal Driver
16	670184	Oil Seal and Ball Bearing Installation Tool
17	670180	Oil Seal Installation Tool, 1"
18	670162	Bearing Support
19	28679	1" Ball Bearing Driver
20	670183	Bushing Assembly and Disassembly Tool, 7/8"

Individual items or replacements may be ordered from the above list.

ORDER DIRECT FROM: Lauson-Power Products Parts Depot, Grafton, Wisconsin 53024.

Not illustrated:

. . .	OTC1340	Retaining Ring Pliers	Remove retaining rings from axle ends

Order from Service Tools, Inc. - 1901 Indiana Ave. - Chicago, Ill. 60616

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Group 20
PRE-DELIVERY INFORMATION

PRE-DELIVERY CHECK LIST

Item	Reference
1. Properly assemble riding mower as instructed in Operator's Manual.	. . . . .
2. Lower mower.	Page 40-10-3
3. Lubricate grease fittings.	Page 10-25-1 Page 10-25-2
4. Check battery charger.	Page 20-20-2
5. Activate batteries.	Page 20-15-1
6. Charge batteries. IMPORTANT: Use only built-in charger, no other! Charger should return to "OFF" at the end of 12-hour period.	Page 20-15-2 Page 20-15-3
7. Clean and polish mower. Touch-up scratches.	. . . . .

DELIVERY CHECK LIST

[ ] Instruct customer in safe operation of Electric 90 Mower.

[ ] Explain recommended daily and periodic service.

[ ] Explain operating adjustments as covered in Operator's Manual.

[ ] Stress the importance of using only John Deere parts.

[ ] Be sure customer has his Operator's Manual.

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Group 25
LUBRICATION

CHECKING TRANSAXLE LUBRICANT

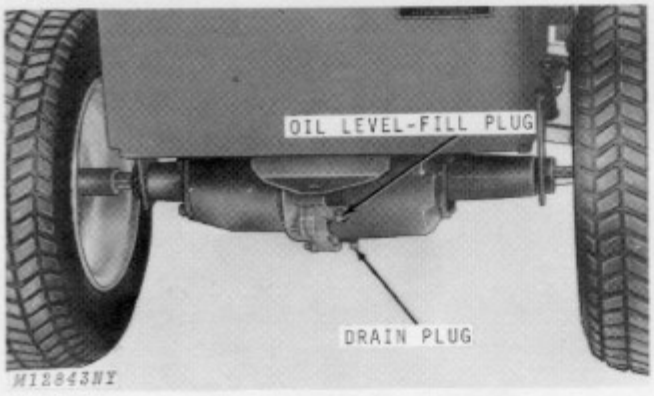

Fig. 1-Transaxle Oil Level - Fill Plug and Drain Plug

Every 200 hours or two years, whichever comes first, remove transaxle drain plug, Fig. 1, and drain all oil. Replace plug and add three 8-ounce cans of AM30200 Transmission Lubricant or its equivalent through oil level fill plug hole.

John Deere SAE 90 Gear Lubricant or an equivalent SCL multipurpose-type gear oil can be used in the transaxle.

A JD94 Pressure Oil Can is available from your John Deere dealer.

LUBRICATING FRONT WHEEL FITTINGS

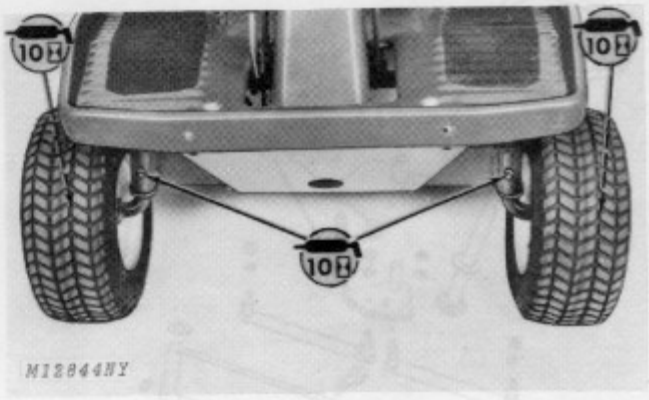

Fig. 2-Front Wheel Grease Fittings

Lubricate the four grease fittings, Fig. 2 with John Deere Multi-Purpose Lubricant or an equivalent SAE multi-purpose-type grease every 10 hours of operation. Use either a hand grease gun or the John Deere Pisto-Luber with flexible hose.

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LUBRICATING STEERING GEAR AND BUSHING

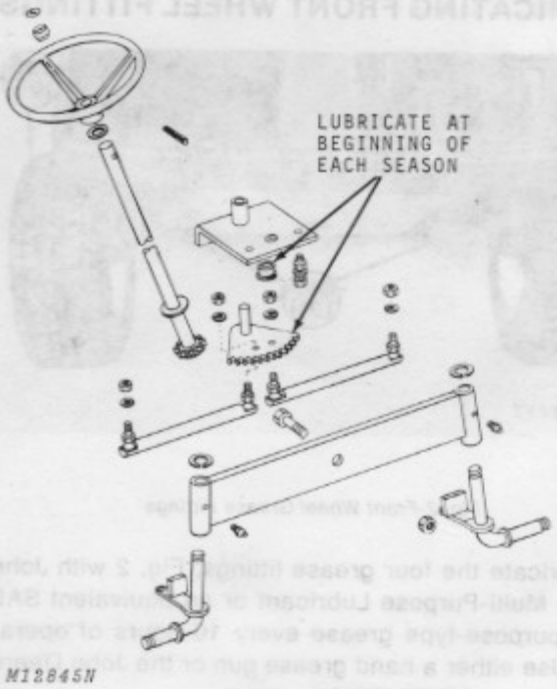

Fig. 3-Exploded View of Steering Assembly

At the beginning of each mowing season lubricate the steering gear, Fig. 3, and steering shaft bushing with oil.

Section 20
ELECTRICAL SYSTEM

Group 5
GENERAL INFORMATION

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PRINCIPLE OF OPERATION

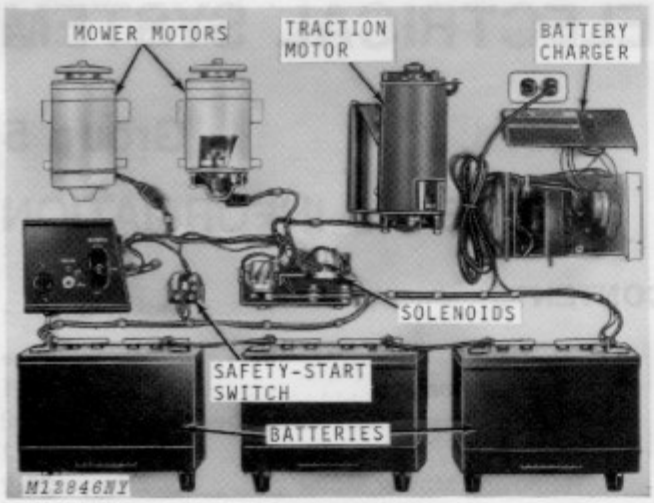

Fig. 1-Electrical Components (Serial No. 1001-10,000)

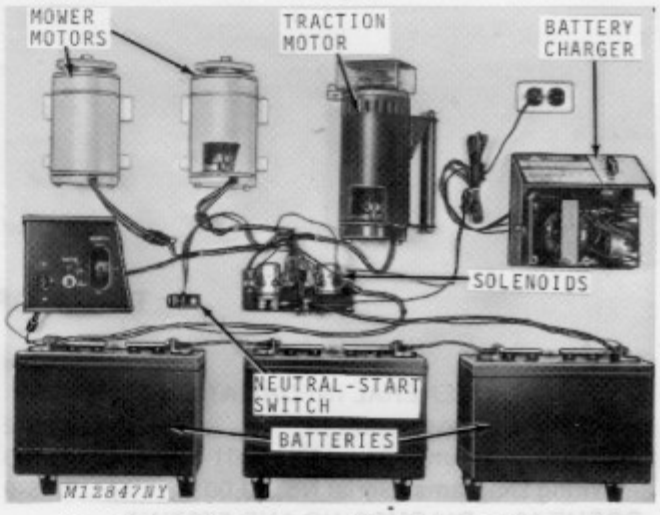

Fig. 2-Electrical Components (Serial No. 10,001-)

The electrical system of the Electric 90 Mower utilizes two 36-volt, permanent-magnet DC motors for the mower blades and one 36-volt, permanent-magnet DC traction motor.

Power for the motors is supplied by three 12-volt, deep-cycle, motive-type, lead-acid batteries connected in series. These deep-cycle batteries are especially designed for the Electric 90 Mower to provide an acceptable reserve of electrical power during the operational time period.

Both the traction and mower motors are of the permanent-magnet-field design which provides maximum power with a minimum of current usage.

Mower and traction motors are controlled by magnetic solenoid switches to provide optimum current flow with a minimal current loss.

The electrical system also incorporates motor protection circuit breakers and a safety-start system for the mower (Serial No. 1001-10,000) or thermostats and a neutral-start system (Serial No. 10,001-).

A reactance-limited battery charger is used for controlled recharging of the battery pack. The charger provides an optimum charging rate with a minimum of electrolyte usage. The charger also has the ability to tailor-finish voltage to fully charge the battery pack. Battery charging is automatic and self-controlled after initial setting of the timer control knob.

To better understand the function of each component and to aid in locating a malfunction, use the wiring diagrams and trouble shooting charts.

WIRING DIAGRAMS (Serial No. 1001-10,000)

Charging Circuit (Serial No. 1001-10,000)

Recharging is accomplished by forcing electric current through the batteries in the opposite direction from the normal battery current flow.

When the battery pack supplies power, the normal current is from the positive (+) to the negative (−) terminals through the external circuit.

Starting at the charger, Fig. 3, follow the current as it progresses through the battery pack from the positive (+) to the negative (−) terminals.

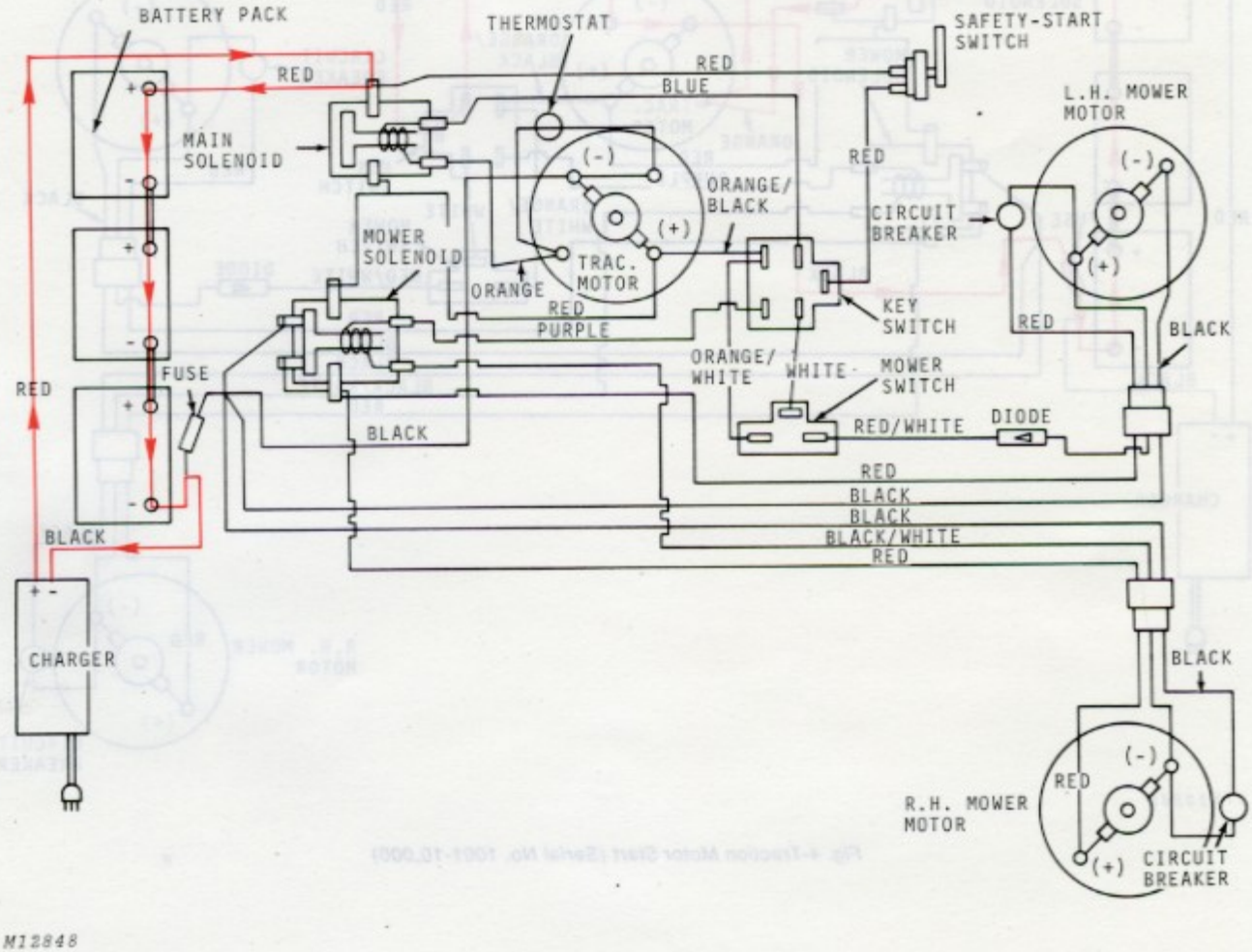

Fig. 3-Charging Circuit (Serial No. 1001-10,000)

Traction Motor Start (Serial No. 1001-10,000)

Starting at the positive (+) terminal of the battery pack, Fig. 4, follow the path of the current as it progresses through the safety-start switch, key switch, main solenoid, thermostat, and back to the negative (−) terminal of the battery pack.

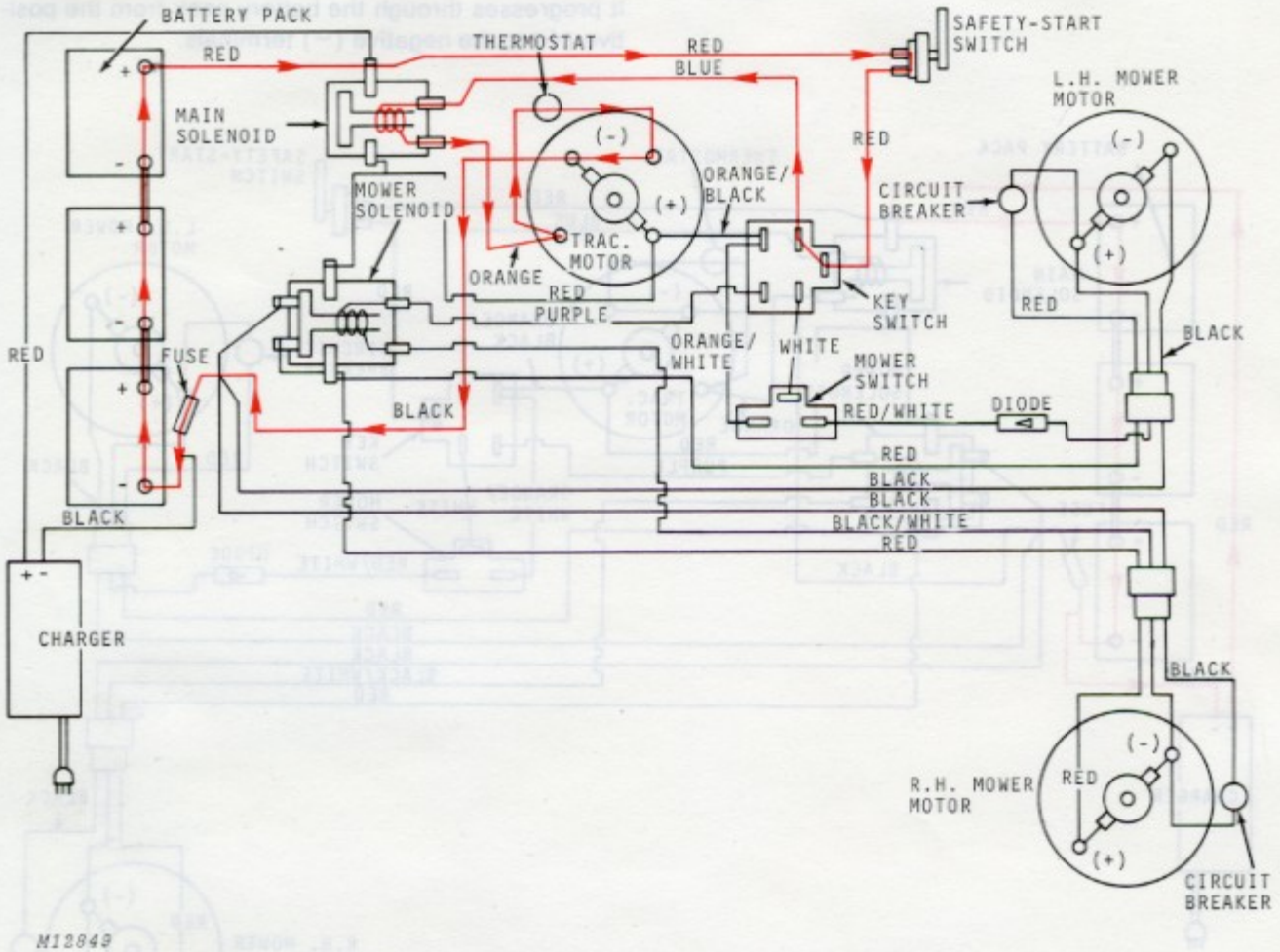

Fig. 4-Traction Motor Start (Serial No. 1001-10,000)

Traction Motor Run (Serial No. 1001-10,000)

Note the change in electrical current between the traction motor start, Fig. 4, and run, Fig. 5.

The safety-start switch drops out of the circuit and the main solenoid closes, completing a path for current flow through the traction motor.

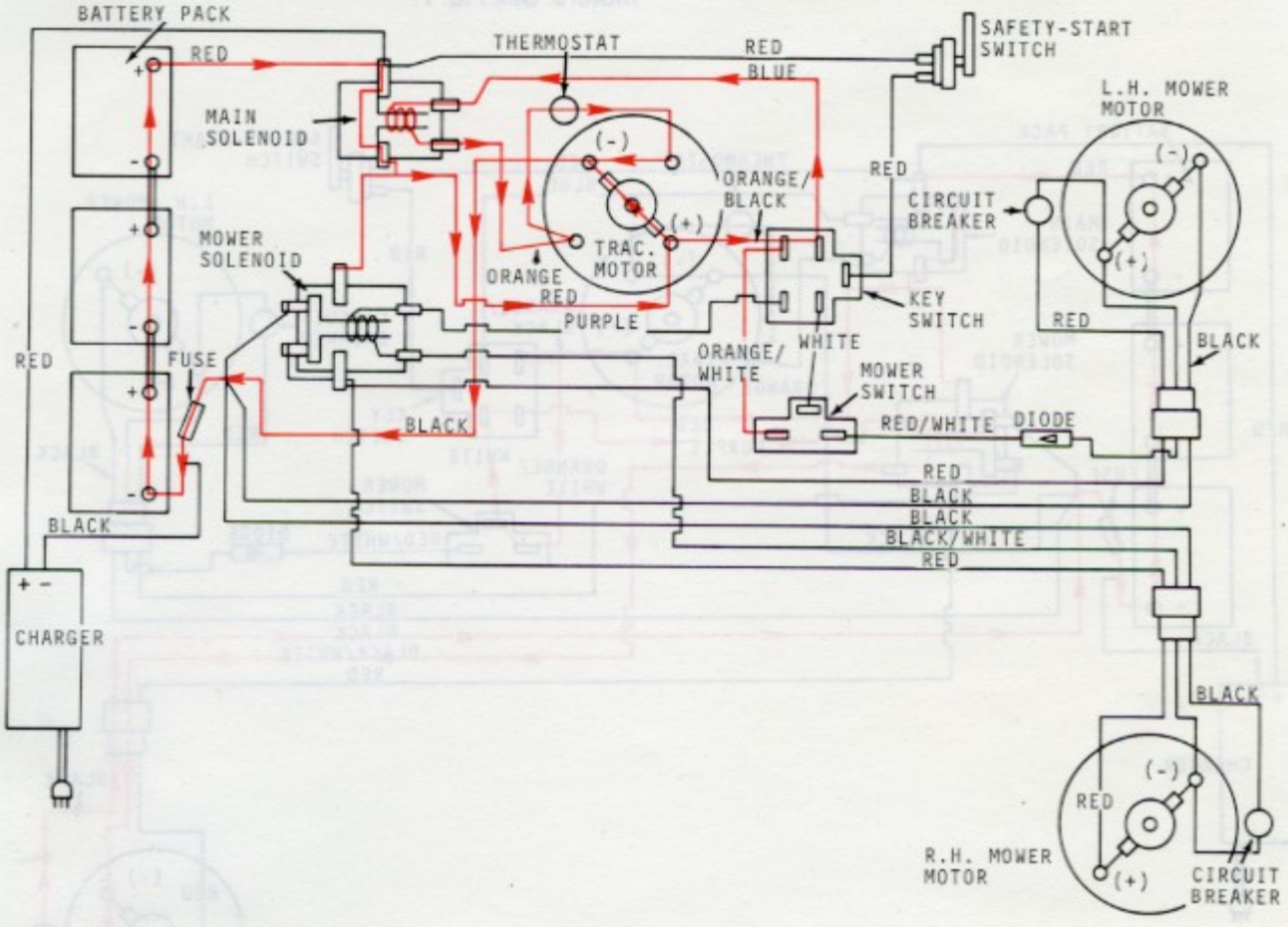

Fig. 5-Traction Motor Run (Serial No. 1001-10,000)

Mower Motor Start (Serial No. 1001-10,000)

After the traction motor has been started, the mower motors may be energized. For clarity, the traction motor circuit has been omitted from the mower motor start circuit in Fig. 6.

Follow the current flow through the main solenoid and key switch to the mower switch. This flow of current energizes the hold-in winding, closing the mower solenoid.

With the mower solenoid energized, the circuit is now complete, allowing current flow to both mower motors. See Fig. 7.

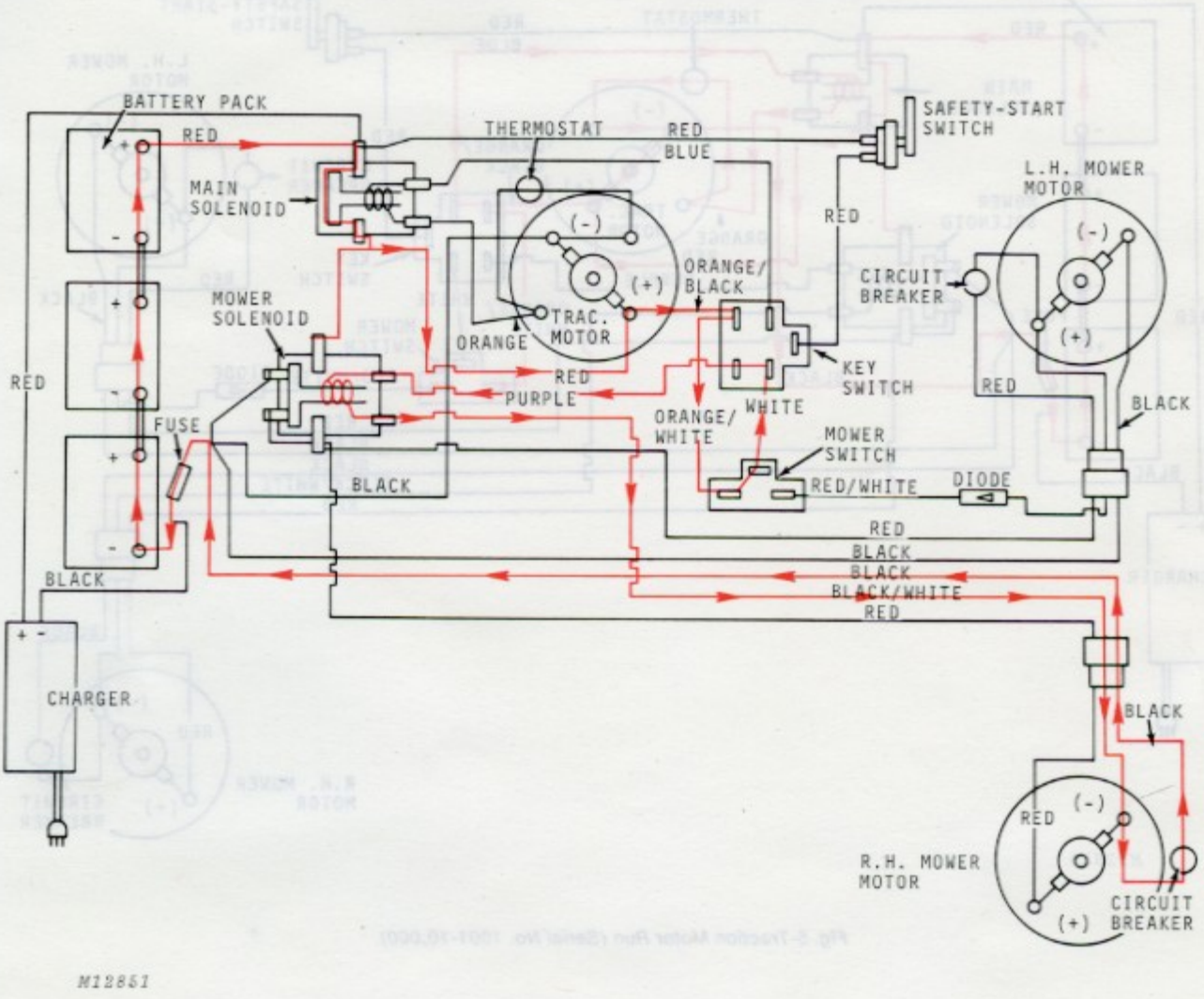

Fig. 6-Mower Motor Start (Serial No. 1001-10,000)

Mower Motor Run (Serial No. 1001-10,000)

With the mower motors running, the circuitry for the entire mower is now in operation. In Fig. 7, the mower solenoid is energized and is being held in a closed position by the shunting of current from the left-hand mower motor. An interruption of this current through either circuit breaker will cause a shut-down of both mower motors.

Turning the key switch to "OFF" cuts current flow to the hold-in windings of the main and mower solenoids. This causes both solenoids to open and shut down the system.

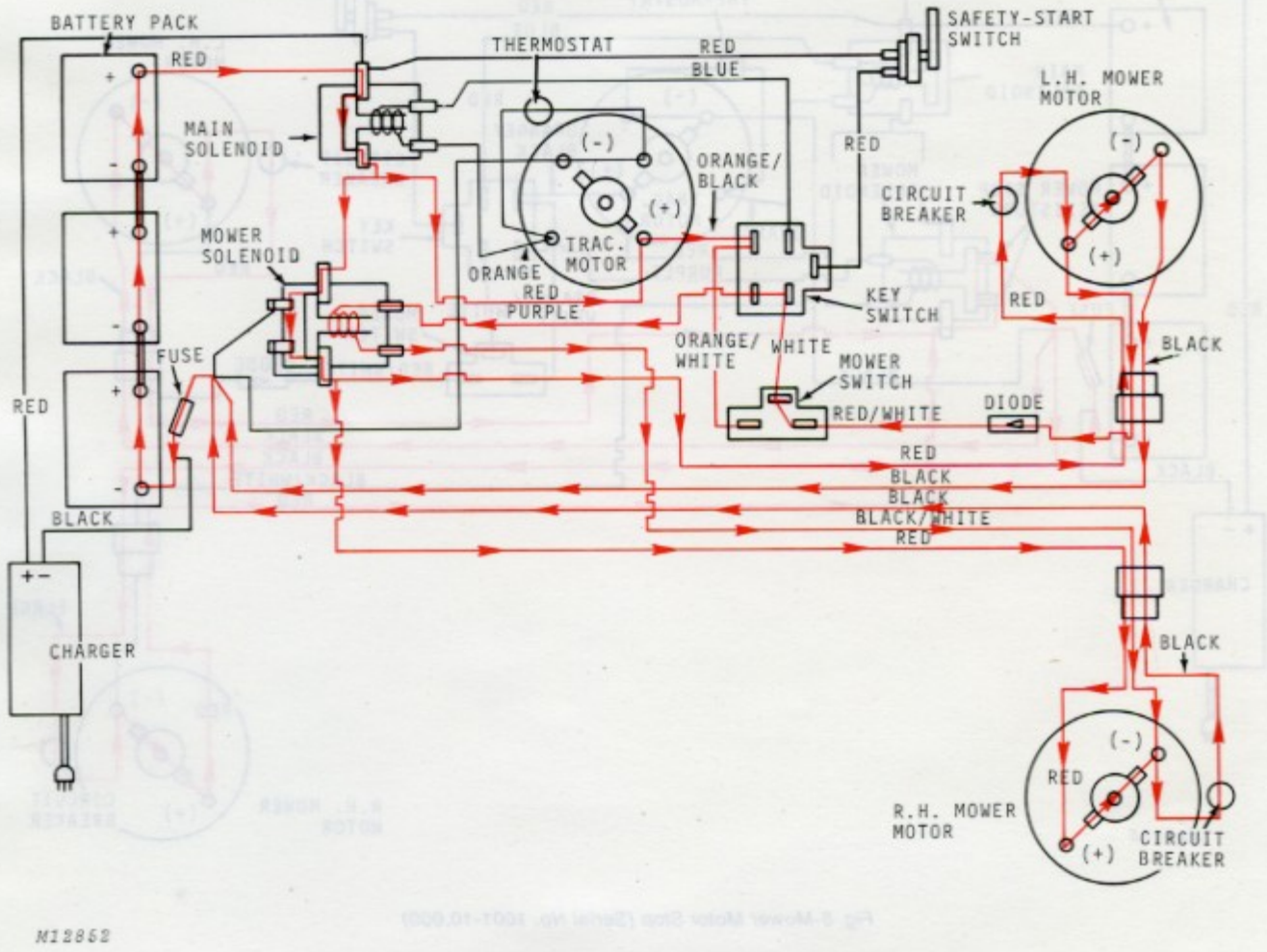

Fig. 7-Mower Motor Run (Serial No. 1001-10,000)

Mower Motor Stop (Serial No. 1001-10,000)

To stop the mower blades quickly, the mower solenoid is designed to route electrical energy through two stop resistors, Fig. 8.

This arrangement reverses the current flow through the mower motor armatures, thereby applying magnetic braking action to the mower motor armatures and blades.

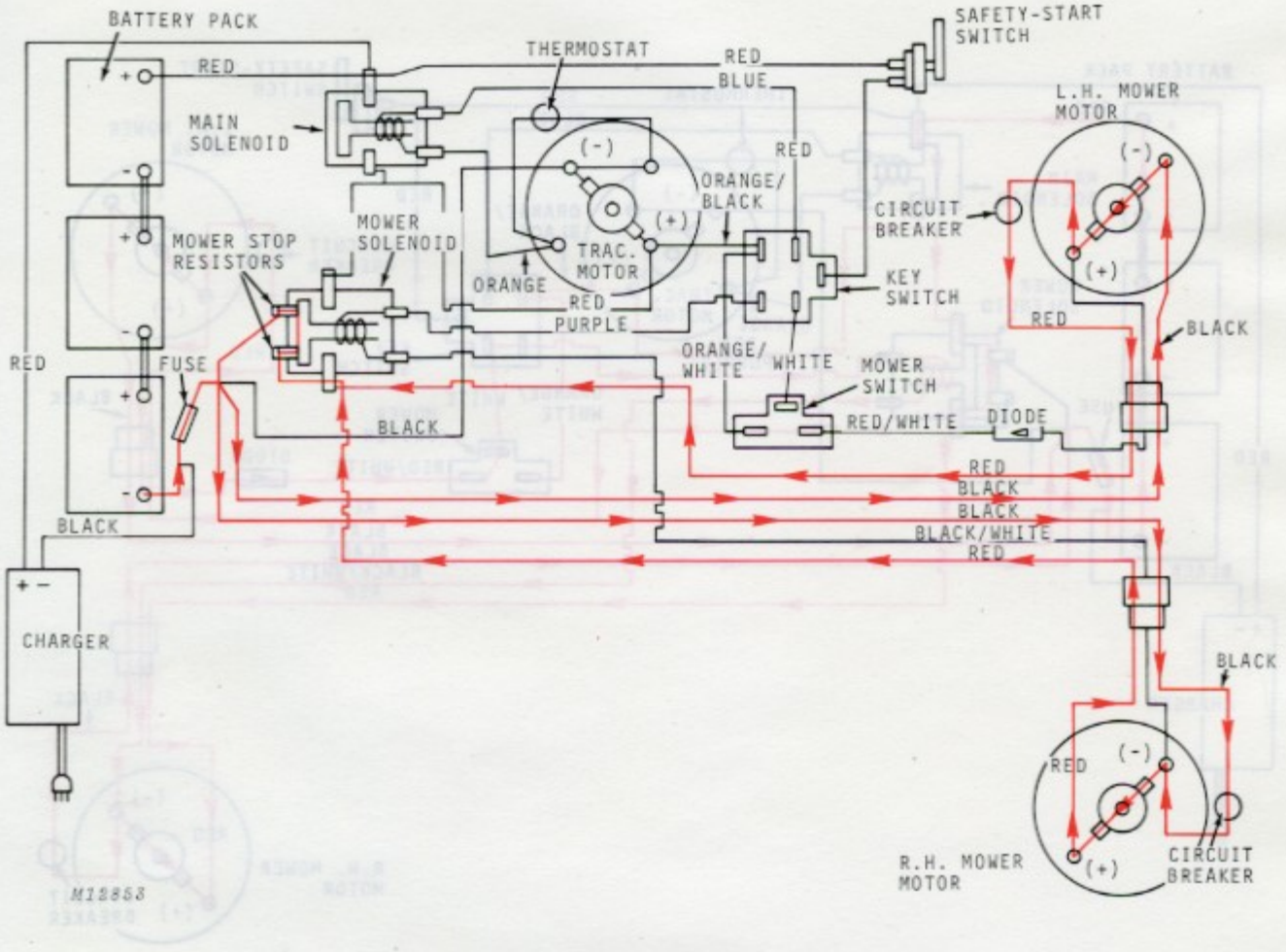

Fig. 8-Mower Motor Stop (Serial No. 1001-10,000)

WIRING DIAGRAMS (Serial No. 10,001-)

Charging Circuit (Serial No. 10,001-)

Recharging is accomplished by forcing electric current through the batteries in the opposite direction from the normal battery current flow.

When the battery pack supplies power the normal current is from the positive (+) to the negative (−) terminals through the external circuit.

Starting at the charger, Fig. 9, follow the current as it progresses through the battery pack from the positive (+) to the negative (−) terminals.

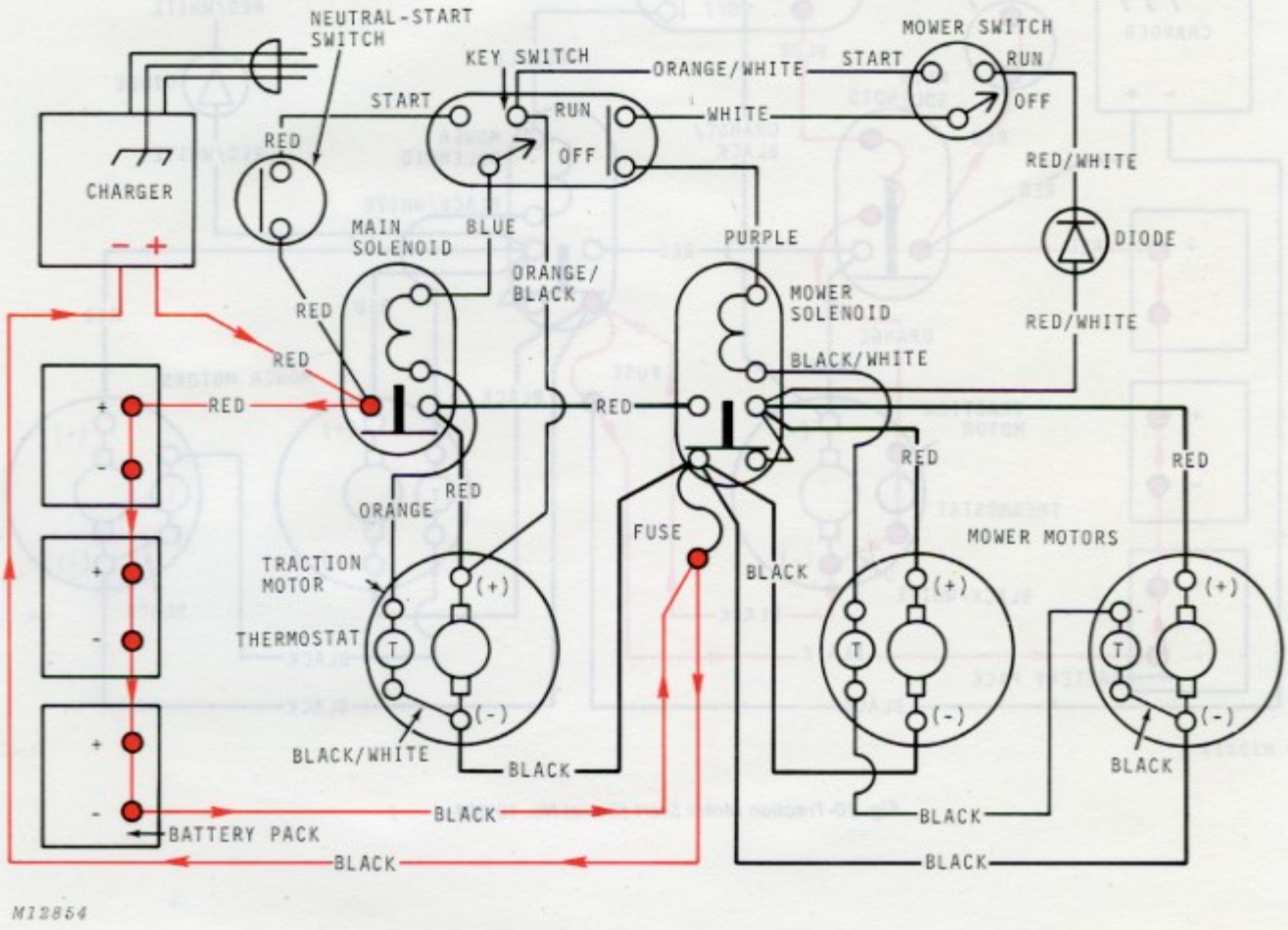

Fig. 9-Charging Circuit (Serial No. 10,001-)

Traction Motor Start (Serial No. 10,001-)

Starting at the positive (+) terminal of the battery pack, Fig. 10, follow the path of the current as it progresses through the neutral-start switch, key switch, main solenoid, thermostat, and back to the negative (−) terminal of the battery pack.

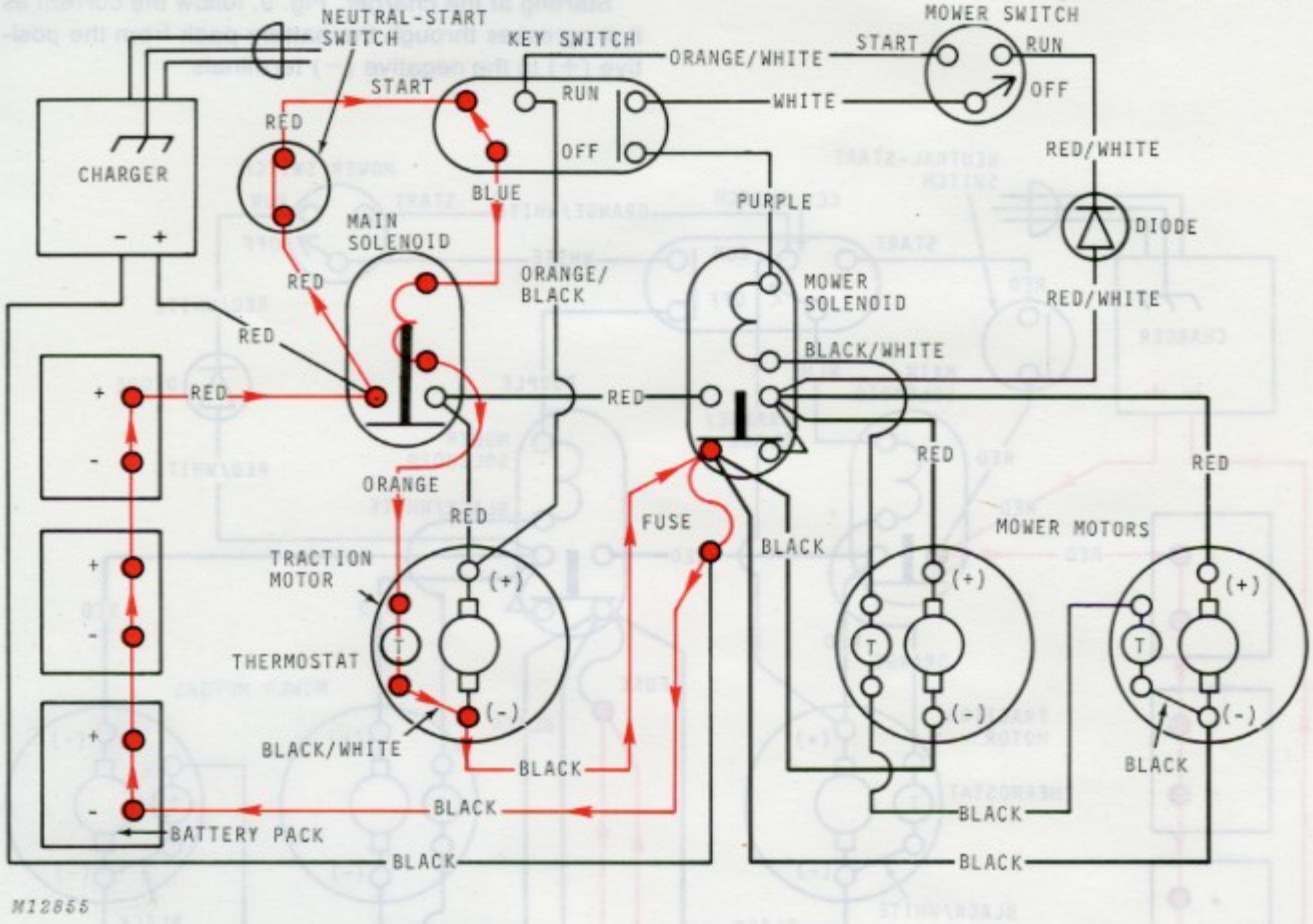

Fig. 10-Traction Motor Start (Serial No. 10,001-)

WIRING DIAGRAMS (Serial No. 10,001-)

Charging Circuit (Serial No. 10,001-)

Recharging is accomplished by forcing electric current through the batteries in the opposite direction from the normal battery current flow.

When the battery pack supplies power the normal current is from the positive (+) to the negative (−) terminals through the external circuit.

Starting at the charger, Fig. 9, follow the current as it progresses through the battery pack from the positive (+) to the negative (−) terminals.

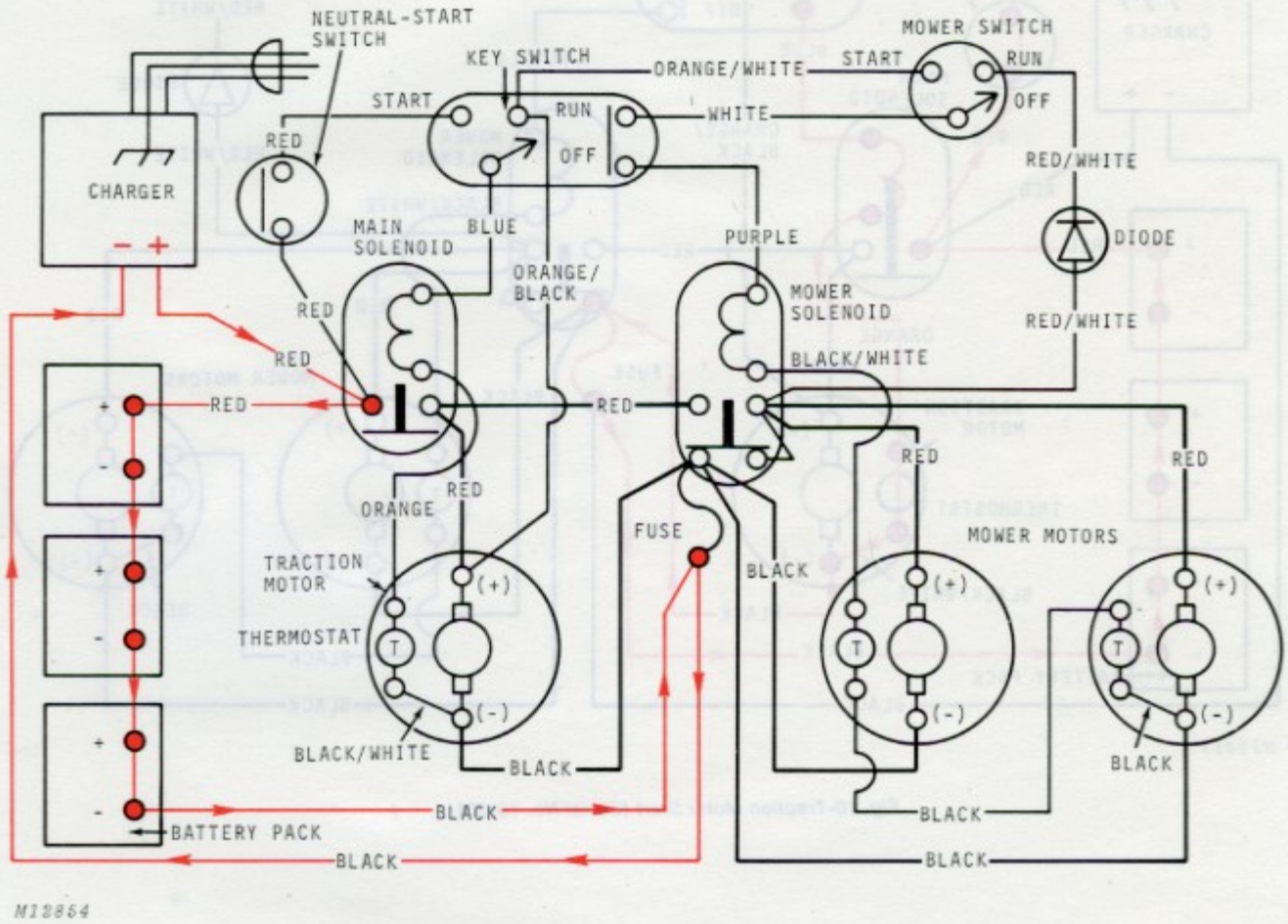

Fig. 9-Charging Circuit (Serial No. 10,001-)

Traction Motor Start (Serial No. 10,001-)

Starting at the positive (+) terminal of the battery pack, Fig. 10, follow the path of the current as it progresses through the neutral-start switch, key switch, main solenoid, thermostat, and back to the negative (−) terminal of the battery pack.

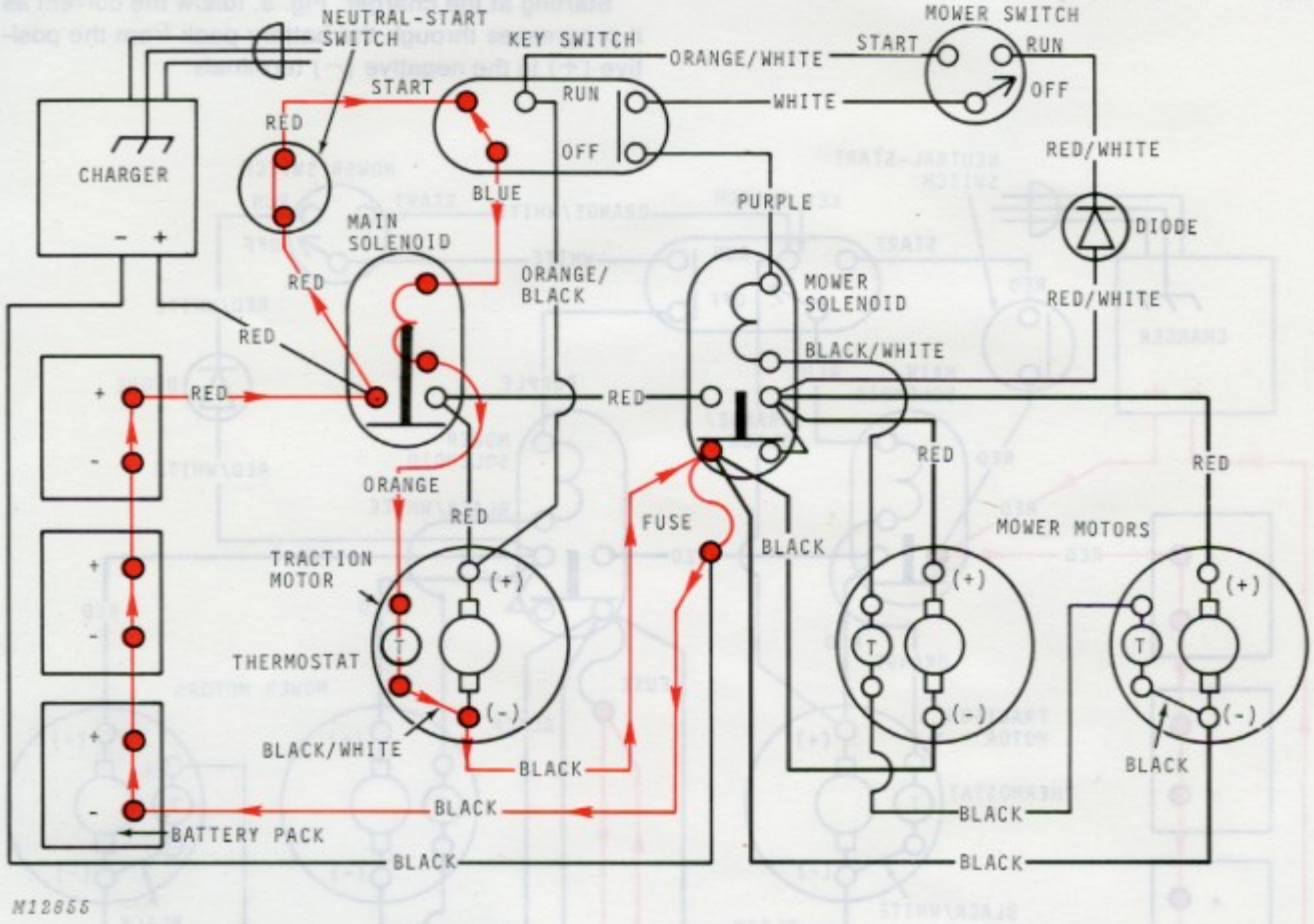

Fig. 10-Traction Motor Start (Serial No. 10,001-)

Traction Motor Run (Serial No. 10,001-)

Note the change in electrical current between the traction motor start, Fig. 10, and run, Fig. 11.

The neutral-start switch drops out of the circuit and the main solenoid closes, completing a path for current flow through the traction motor.

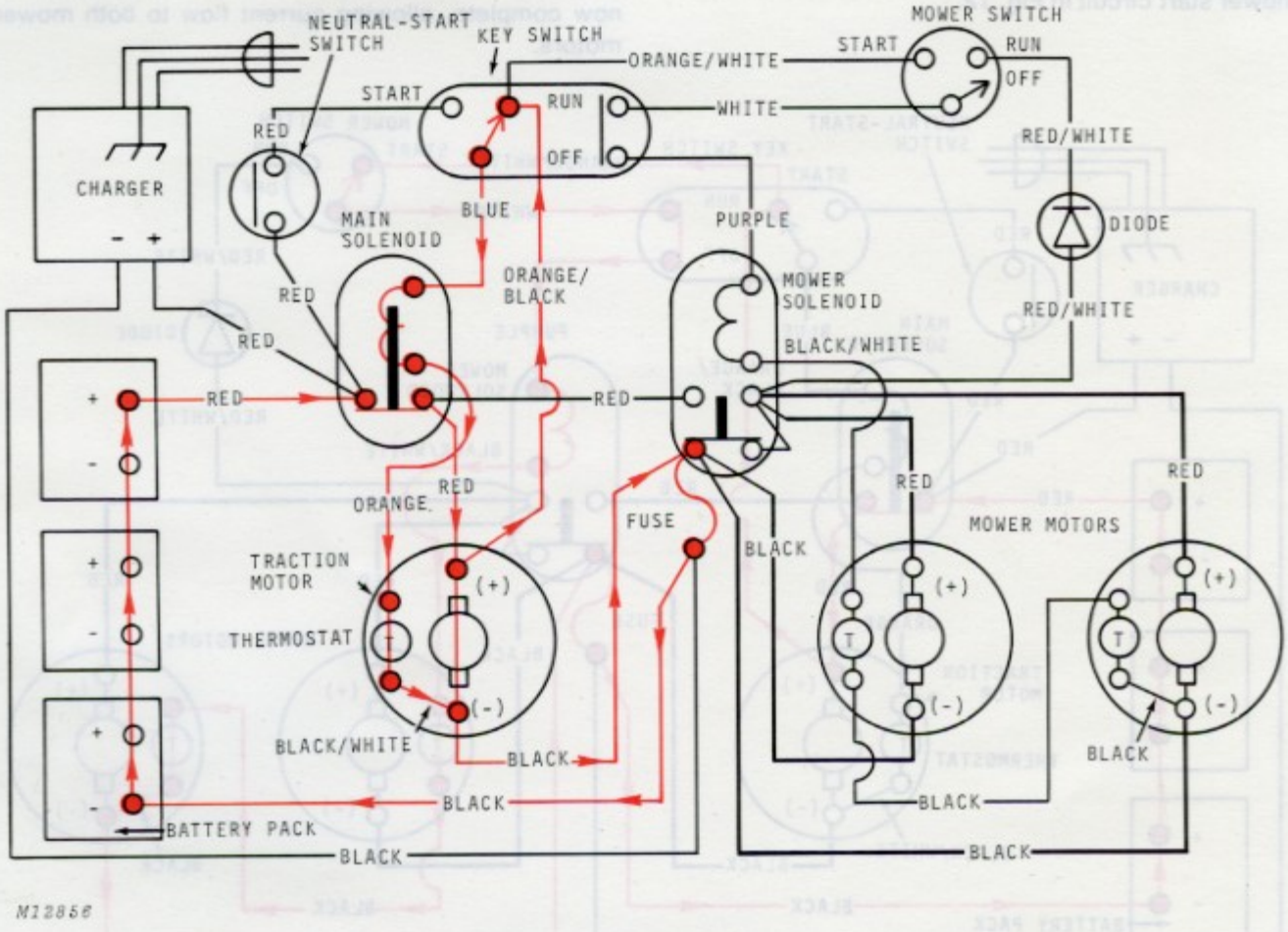

Fig. 11-Traction Motor Run (Serial No. 10,001-)

Mower Motor Start (Serial No. 10,001-)

After the traction motor has been started, the mower motors may be energized. For clarity, the traction motor circuit has been omitted from the mower start circuit in Fig. 12.

Follow the current flow through the main solenoid and key switch to the mower switch. This flow of current energizes the hold-in winding, closing the mower solenoid.

With the mower solenoid energized, the circuit is now complete, allowing current flow to both mower motors.

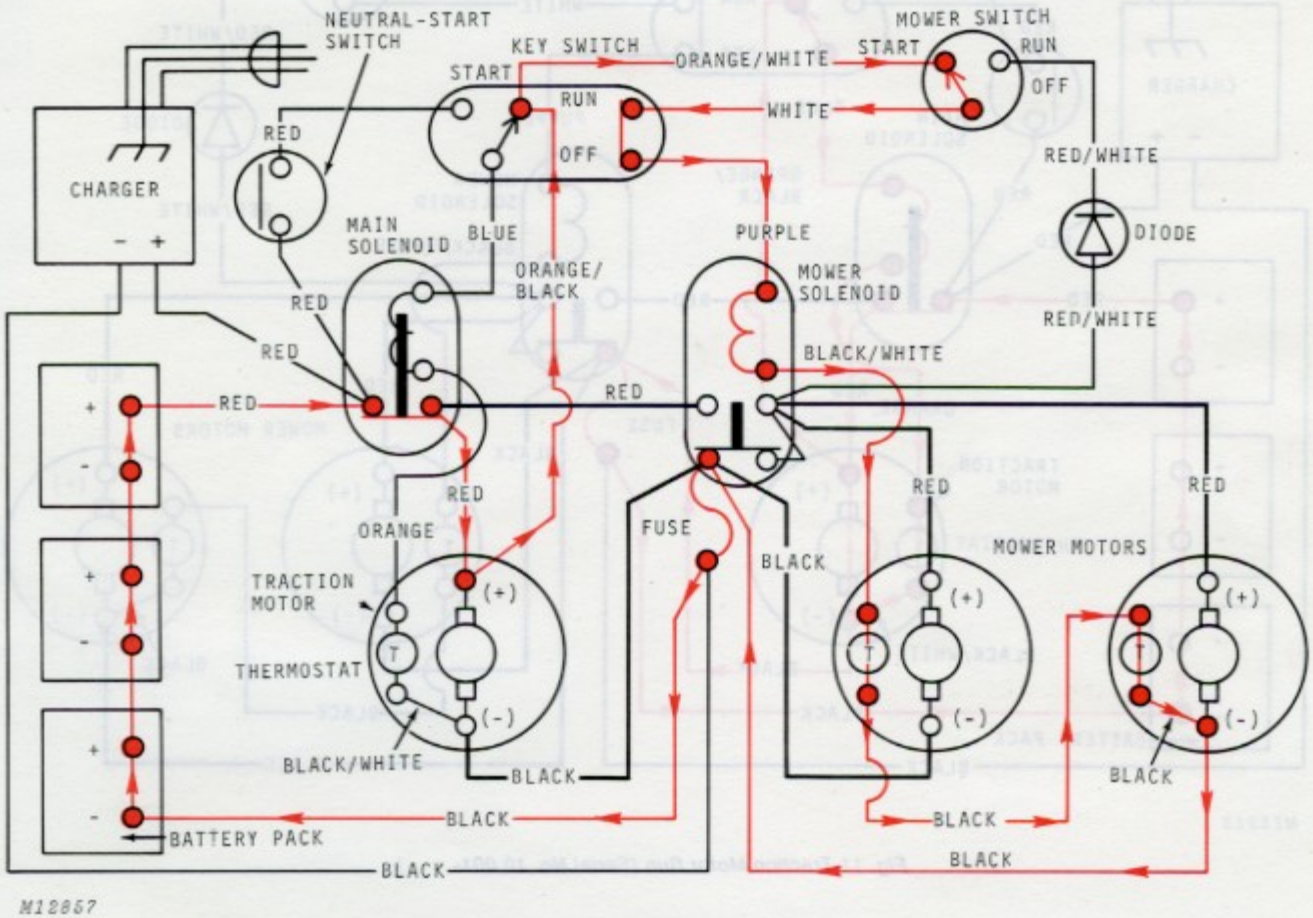

Fig. 12-Mower Motor Start (Serial No. 10,001-)

Mower Motor Run (Serial No. 10,001-)

With the mower motors running, the circuitry for the entire mower is now in operation. In Fig. 13, the mower solenoid is energized and is being held in a closed position by the shunting of current from the mower solenoid. An interruption of this current through either thermostat will cause a shut-down of both mower motors.

Turning the key switch to "OFF" cuts current flow to the hold-in windings of the main and mower solenoids. This causes both solenoids to open and shut down the system.

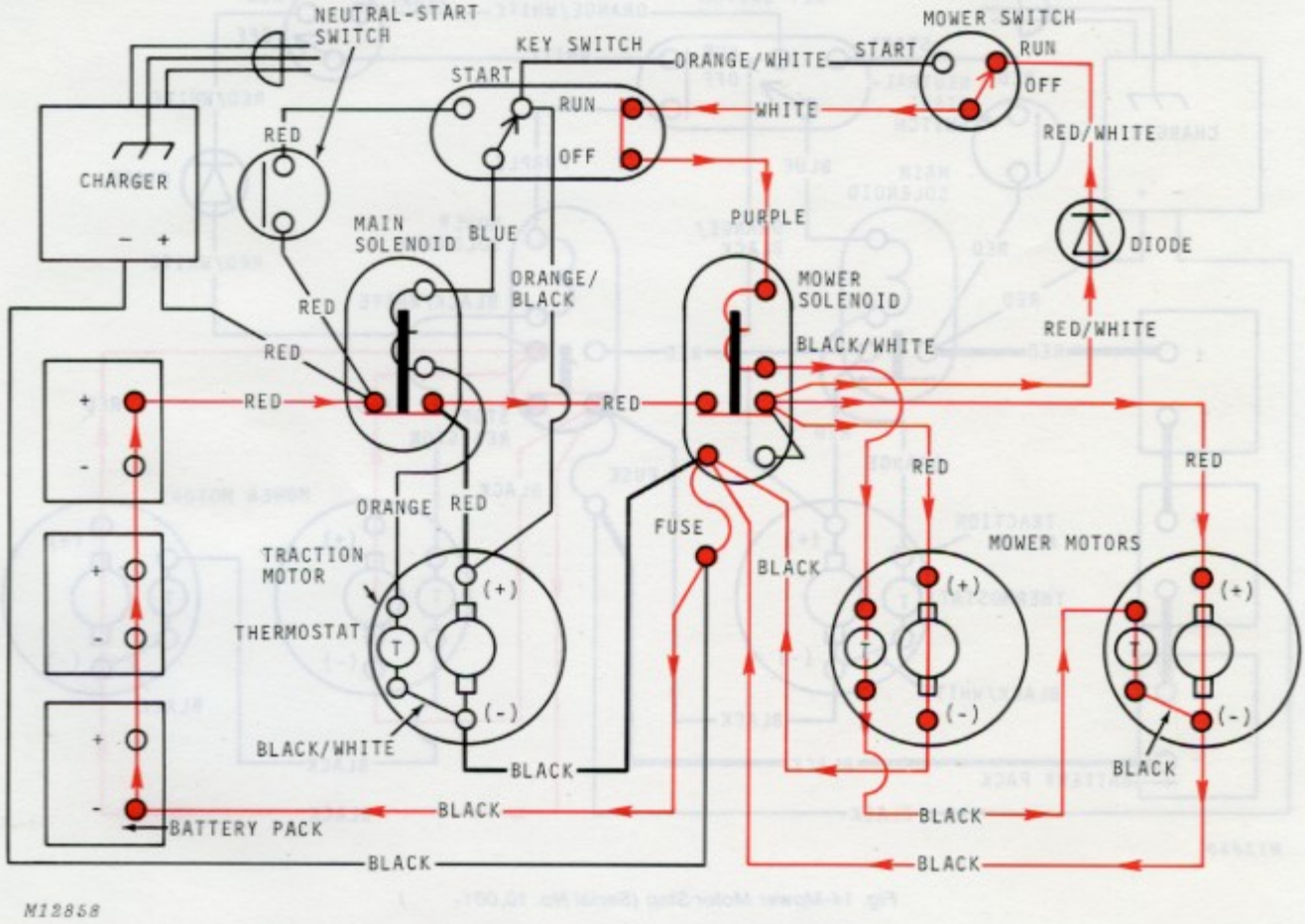

Fig. 13-Mower Motor Run (Serial No. 10,001-)

Mower Motor Stop (Serial No. 10,001-)

To stop the mower blades quickly, the mower solenoid is designed to route electrical energy through one stop resistor, Fig. 14.

This arrangement reverses the current flow through the mower motor armatures, thereby applying magnetic braking action to the mower motor armatures and blades.

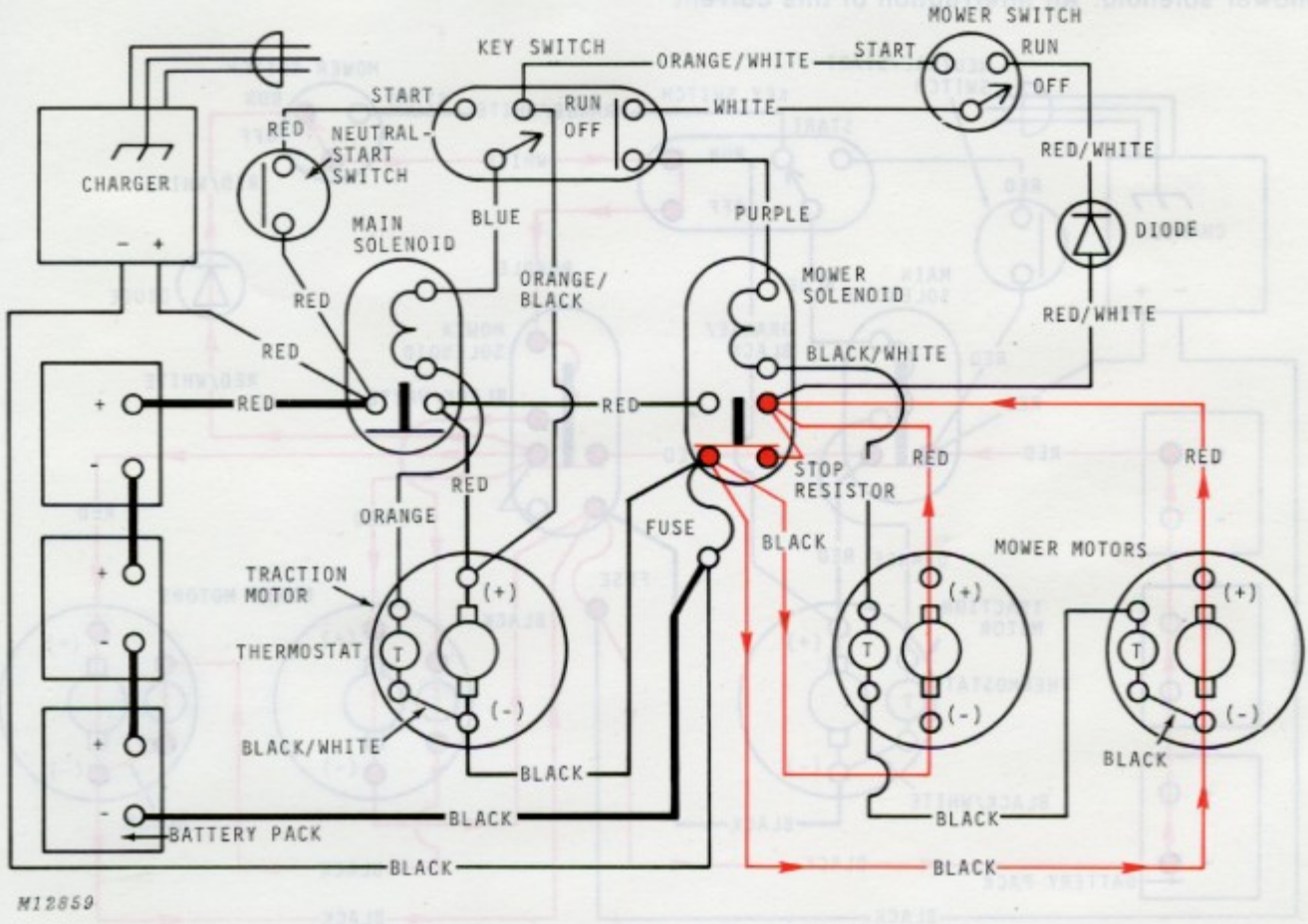

Fig. 14-Mower Motor Stop (Serial No. 10,001-)

Group 10
DIAGNOSING AND TESTING

PRELIMINARY TESTS

There are four preliminary tests for diagnosing electrical malfunctions.

Voltmeter Test

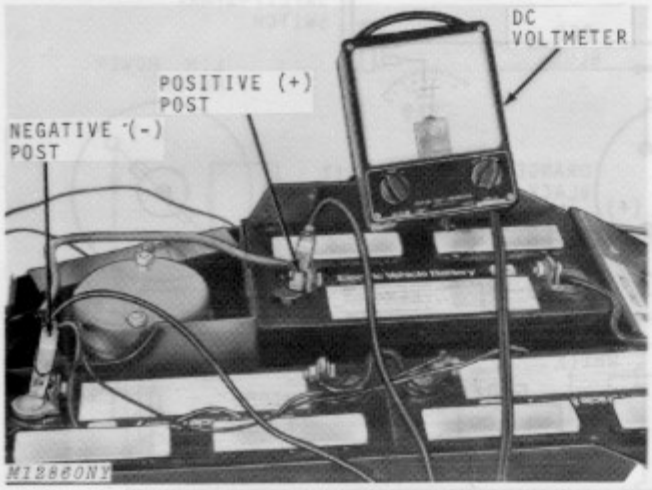

Fig. 1-Voltmeter Test

Connect a voltmeter to the positive (+) and negative (−) post of the battery pack, Fig. 1. Meter should show a nominal 36-volts DC.

Ampere Draw Test

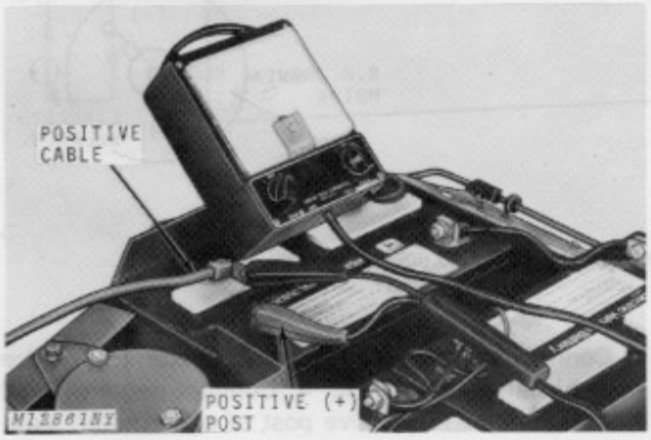

Fig. 2-Ampere Draw Test

⚠ CAUTION: Keep feet and hands clear of the mower blades when conducting this test.

Disconnect positive cable from battery pack. Connect one lead from ammeter to positive cable and one lead to positive post of battery pack, Fig. 2. Meter should show a maximum ampere draw of 43 amps. with all motors running, transmission in neutral and clutch engaged. A higher reading would indicate a faulty motor in the system, dirty or plugged mower deck or a faulty transaxle.

NOTE: Refer to Specifications, page 10-10-1 for individual motor amperage draw.

Hot Frame Test

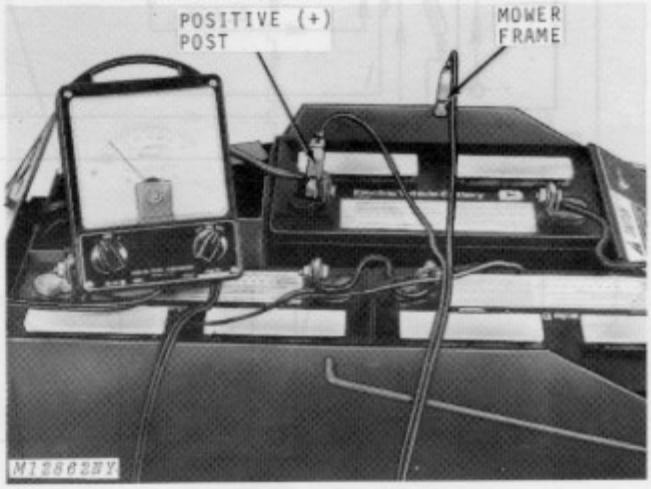

Fig. 3-Hot Frame Test

Connect one lead from a voltmeter to the positive (+) post of the battery pack and one lead to mower frame, Fig. 3. Voltmeter should read "0". If a reading is obtained, there is a short or ground somewhere in the system.

NOTE: Electrolyte spillage can cause a reading. Be sure batteries and compartment are clean.

Voltage Drop Test

Use this test when traction or mower motors operate intermittently. This test will determine if there is a poor electrical connection within the system. Refer to Figs. 4 and 5 or 6 and 7.

Positive Voltage Drop Test (Serial No. 1001-10,000)

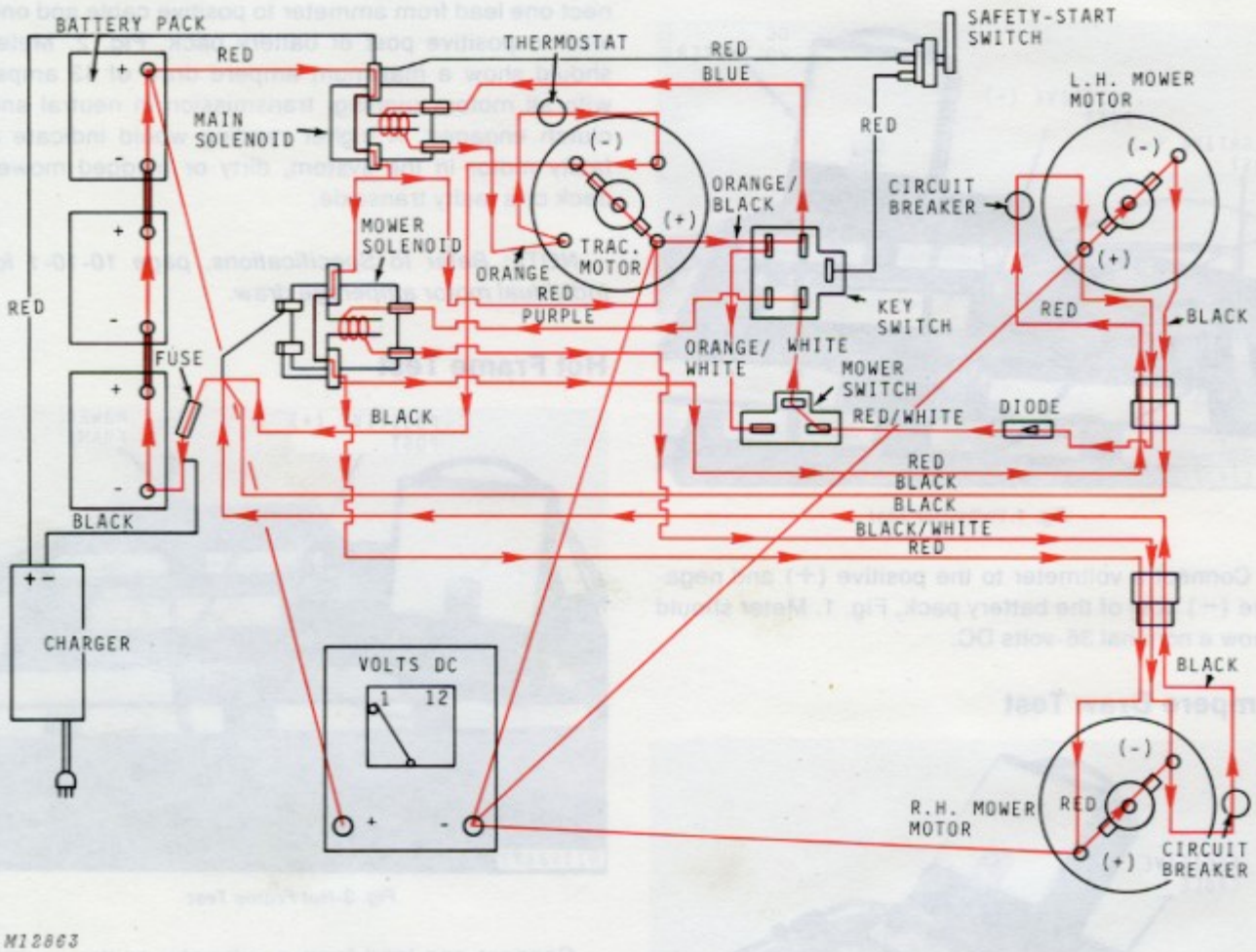

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Fig. 4-Positive Voltage Drop Test (Serial No. 1001-10,000)

CAUTION: Keep feet and hands clear of the mower blades when conducting this test.

Connect positive lead from voltmeter to positive post of battery pack, Fig. 4. Connect negative lead from voltmeter to positive post of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.

Negative Voltage Drop Test
(Serial No. 1001-10,000)

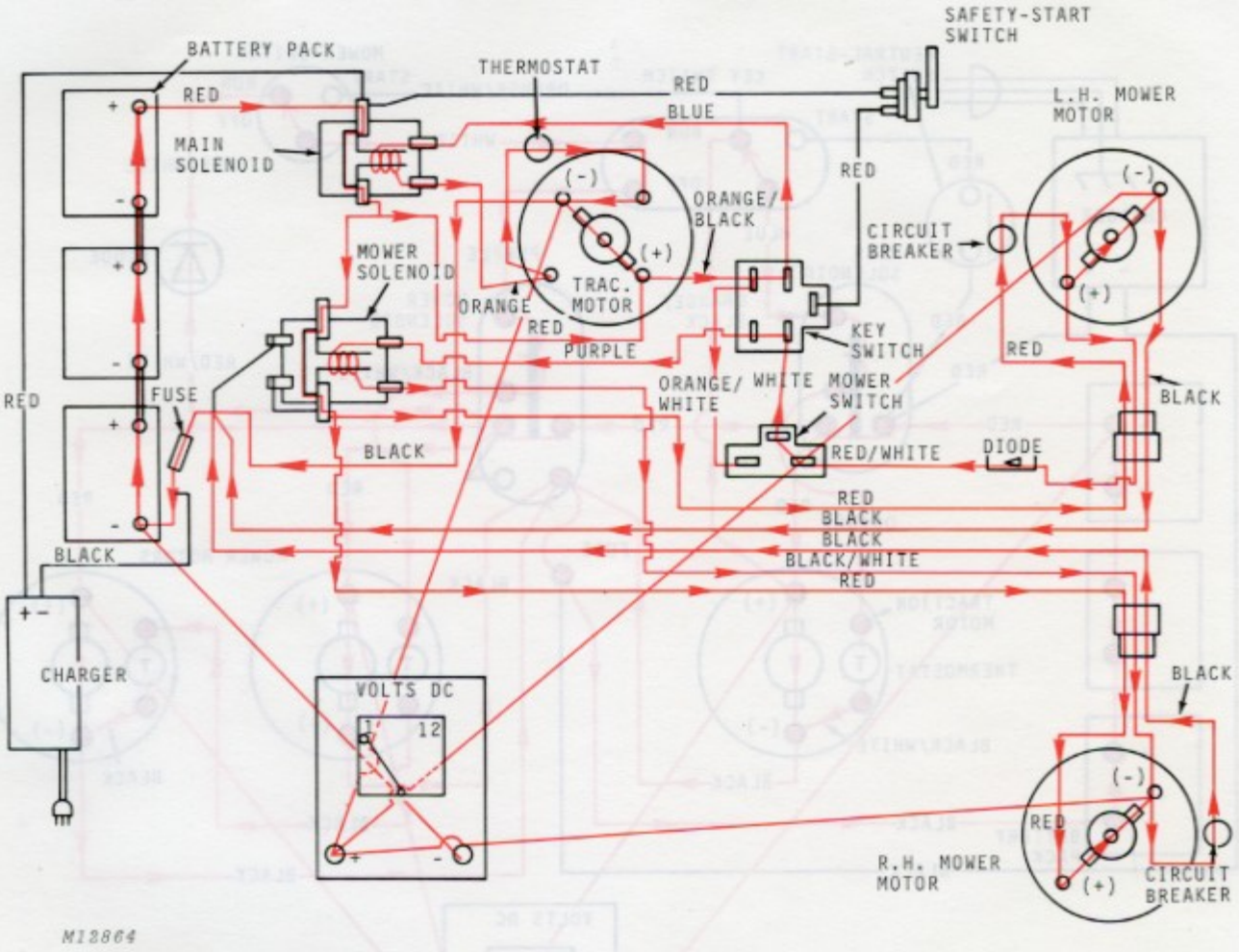

Fig. 5-Negative Voltage Drop Test (Serial No. 1001-10,000)

CAUTION: Keep feet and hands clear of the mower blades when conducting this test.

On this test connect negative lead from voltmeter to negative post of battery pack, Fig. 5. Connect positive lead from voltmeter to negative post of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.

Positive Voltage Drop Test
(Serial No. 10,001-)

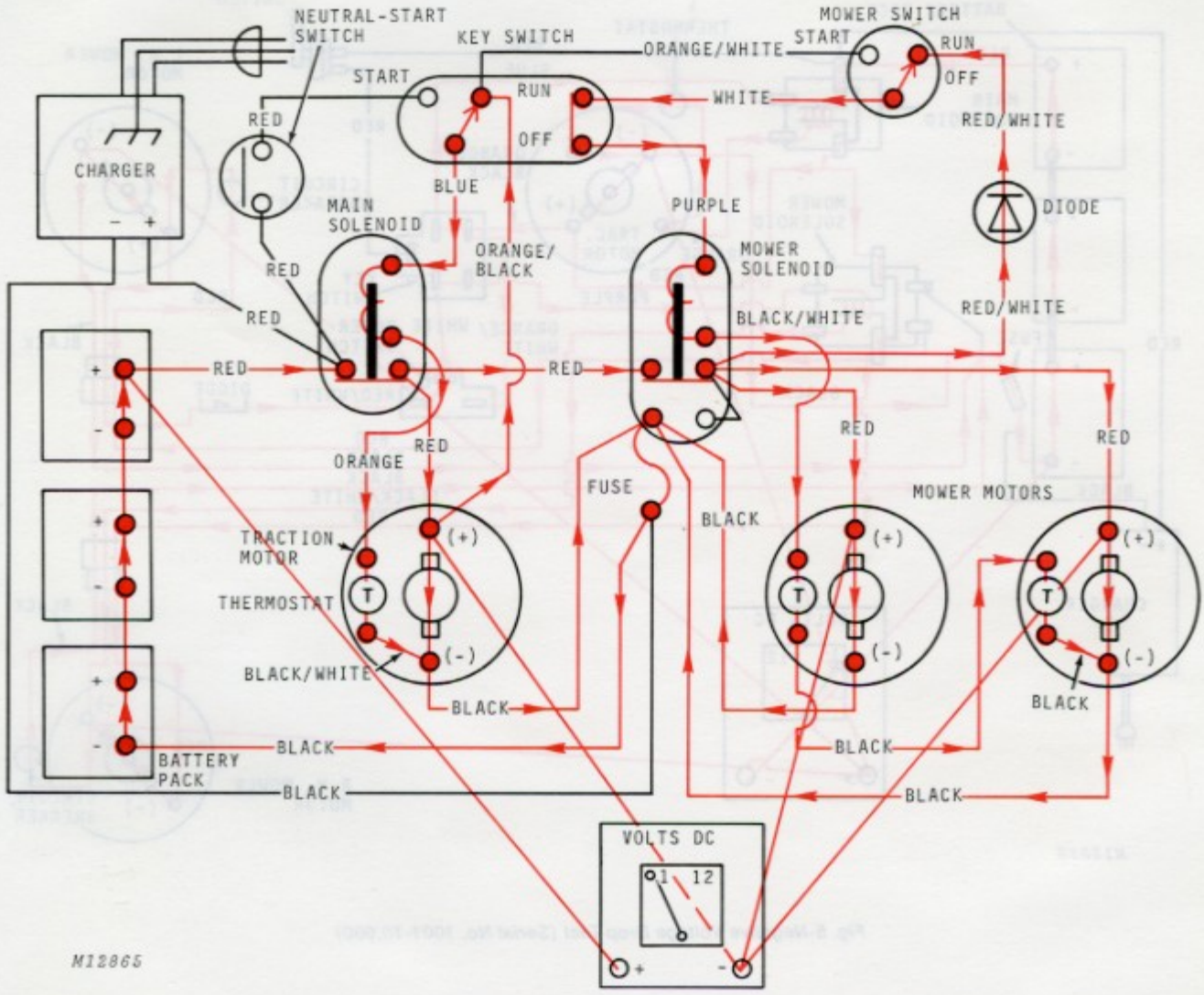

Fig. 6-Positive Voltage Drop Test (Serial No. 10,001-)

CAUTION: Keep feet and hands clear of the mower blades when conducting this test.

On this test connect positive lead from voltmeter to positive post of battery pack, Fig. 6. Connect negative lead from voltmeter to positive post of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.

Negative Voltage Drop Test
(Serial No. 10,001-)

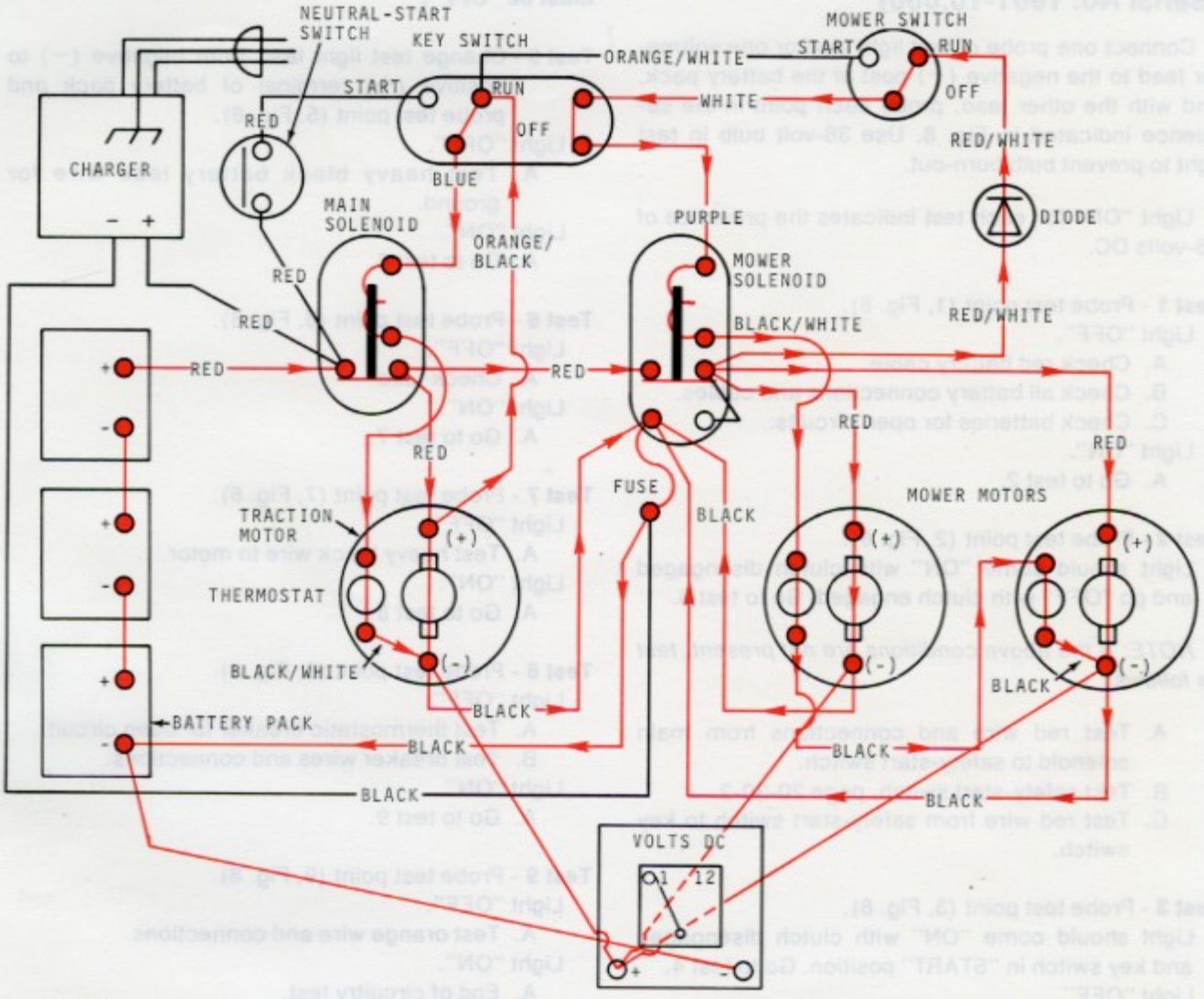

Fig. 7-Negative Voltage Drop Test (Serial No. 10,001-)

CAUTION: Keep feet and hands clear of the mower blades when conducting this test.

On this test connect negative lead from voltmeter to negative post of battery pack, Fig. 7. Connect positive lead from voltmeter to negative post of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.

CIRCUIT TESTS (Serial No. 1001-10,000)

Traction Motor Inoperative (Serial No. 1001-10,000)

Connect one probe of test light lead or one voltmeter lead to the negative (−) post of the battery pack, and with the other lead, probe each point in the sequence indicated in Fig. 8. Use 36-volt bulb in test light to prevent bulb burn-out.

Light "ON" for each test indicates the presence of 36-volts DC.

Test 1 - Probe test point (1, Fig. 8).
Light "OFF".
A. Check red battery cable.
B. Check all battery connections and cables.
C. Check batteries for open circuits.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 8).
Light should come "ON" with clutch disengaged and go "OFF" with clutch engaged. Go to test 3.

NOTE: If the above conditions are not present, test as follows:

A. Test red wire and connections from main solenoid to safety-start switch.
B. Test safety-start switch, page 20-30-2.
C. Test red wire from safety-start switch to key switch.

Test 3 - Probe test point (3, Fig. 8).
Light should come "ON" with clutch disengaged and key switch in "START" position. Go to test 4.
Light "OFF".
A. Test key switch. See page 20-30-2.
B. Test blue wire from key switch to solenoid.

Test 4 - Disconnect orange wire from main solenoid terminal. Probe solenoid terminal (4, Fig. 8) with key switch in "START" position, and clutch disengaged.
A. Light "ON" verifies solenoid coil continuity. If light is "OFF", replace solenoid.
B. Light "ON". Proceed as follows: Reconnect orange wire to solenoid. Disengage clutch and activate key switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary. See pages 20-30-2 and 20-30-4.
C. If click is heard, go to test 5.

IMPORTANT: For tests 5 through 9, key switch must be "OFF".

Test 5 - Change test light lead from negative (−) to positive (+) terminal of battery pack and probe test point (5, Fig. 8).
Light "OFF".
A. Test heavy black battery lead wire for ground.
Light "ON".
A. Go to test 6.

Test 6 - Probe test point (6, Fig. 8).
Light "OFF".
A. Check fuse.
Light "ON".
A. Go to test 7.

Test 7 - Probe test point (7, Fig. 8).
Light "OFF".
A. Test heavy black wire to motor.
Light "ON".
A. Go to test 8.

Test 8 - Probe test point (8, Fig. 8).
Light "OFF".
A. Test thermostatic breaker for open circuit.
B. Test breaker wires and connections.
Light "ON".
A. Go to test 9.

Test 9 - Probe test point (9, Fig. 8).
Light "OFF".
A. Test orange wire and connections.
Light "ON".
A. End of circuitry test.

NOTE: If traction motor starts but will not continue to run, make test 10.

Test 10 - Change test lead to negative (−) terminal of battery pack and probe test point (10, Fig. 8), with clutch disengaged and key switch in "START" position.
Light "OFF".
A. Test key switch for continuity between orange/black and blue wire terminals.
B. Test orange/black wire.

NOTE: If motor still does not run, disassemble and test motor. See Group 25.

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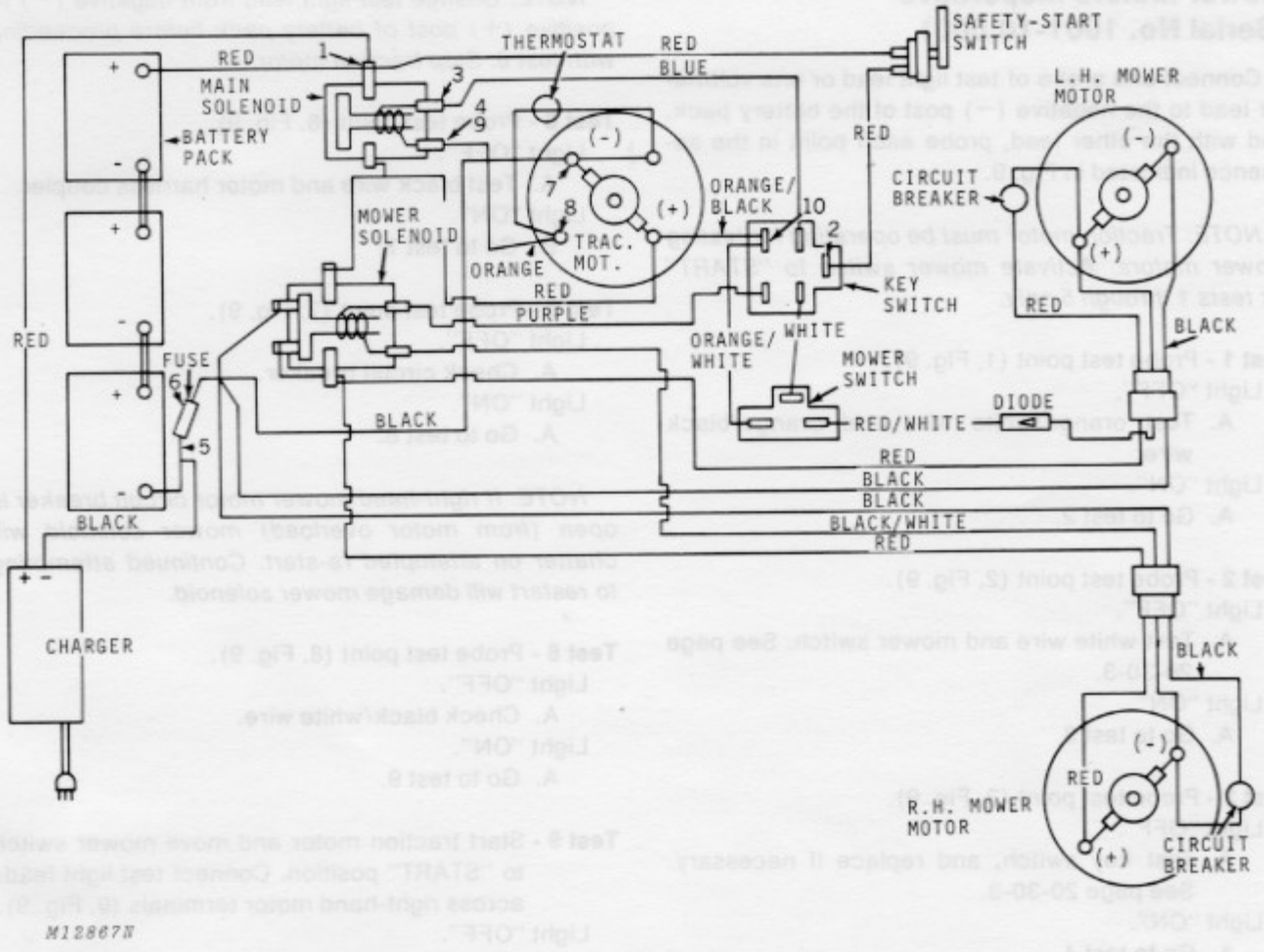

Fig. 8-Test Points for Inoperative Traction Motor (Serial No. 1001-10,000)

Mower Motors Inoperative (Serial No. 1001-10,000)

Connect one probe of test light lead or one voltmeter lead to the negative (−) post of the battery pack, and with the other lead, probe each point in the sequence indicated in Fig. 9.

NOTE: Traction motor must be operating for testing mower motors. Activate mower switch to "START" for tests 1 through 5 only.

Test 1 - Probe test point (1, Fig. 9).
Light "OFF".
A. Test orange/white wire and orange/black wire.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 9).
Light "OFF".
A. Test white wire and mower switch. See page 20-30-3.
Light "ON".
A. Go to test 3.

Test 3 - Probe test point (3, Fig. 9).
Light "OFF".
A. Test key switch, and replace if necessary. See page 20-30-3.
Light "ON".
A. Go to test 4.

Test 4 - Probe test point (4, Fig. 9).
Light "OFF".
A. Test purple wire and connections.
Light "ON".
A. Go to test 5.

Test 5 - Disconnect black/white wire from mower solenoid terminal. Probe solenoid terminal (5, Fig. 9).
A. Light "ON", verifies solenoid coil continuity. If light is "OFF", replace solenoid.
B. Light "ON", proceed as follows: Reconnect black/white wire to solenoid and activate mower switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary. See pages 20-30-2 and 20-30-4.
C. If click, is heard, go to test 6.

NOTE: Change test light lead from negative (−) to positive (+) post of battery pack before proceeding with test 6. Stop traction motor.

Test 6 - Probe test point (6, Fig. 9).
Light "OFF".
A. Test black wire and motor harness coupler.
Light "ON".
B. Go to test 7.

Test 7 - Probe test point (7, Fig. 9).
Light "OFF".
A. Check circuit breaker.
Light "ON".
A. Go to test 8.

NOTE: If right-hand mower motor circuit breaker is open (from motor overload) mower solenoid will chatter on attempted re-start. Continued attempting to restart will damage mower solenoid.

Test 8 - Probe test point (8, Fig. 9).
Light "OFF".
A. Check black/white wire.
Light "ON".
A. Go to test 9.

Test 9 - Start traction motor and move mower switch to "START" position. Connect test light leads across right-hand motor terminals (9, Fig. 9).
Light "OFF".
A. Check heavy red wire from mower solenoid to motor.
Light "ON".
A. End of tests.

NOTE: If voltmeter test reveals 36-volts DC at motor terminals and motor will not operate, remove motor and test armature and brushes. Repair or replace components as necessary.

NOTE: Repeat tests for left-hand motor.

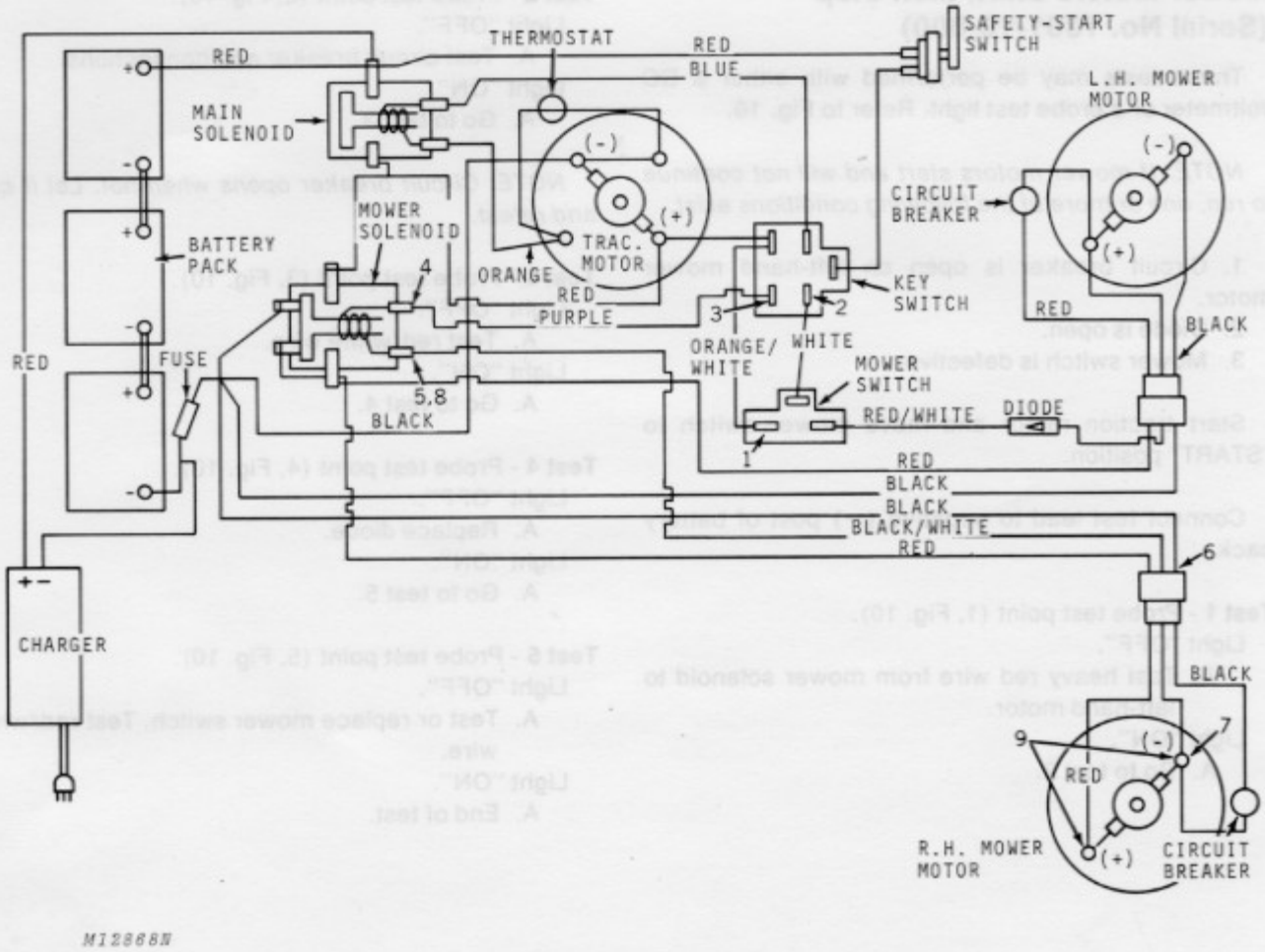

Fig. 9-Test Points for Inoperative Mower Motors (Serial No. 1001-10,000)

Mower Motors Start, then Stop (Serial No. 1001-10,000)

These tests may be performed with either a DC voltmeter or a probe test light. Refer to Fig. 10.

NOTE: If mower motors start and will not continue to run, one or more of the following conditions exist.

1. Circuit breaker is open on left-hand mower motor.
2. Diode is open.
3. Mower switch is defective.

Start traction motor and move mower switch to "START" position.

Connect test lead to negative (−) post of battery pack.

Test 1 - Probe test point (1, Fig. 10).
Light "OFF".
A. Test heavy red wire from mower solenoid to left-hand motor.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 10).
Light "OFF".
A. Test circuit breaker and connections.
Light "ON".
A. Go to test 3.

NOTE: Circuit breaker opens when hot. Let it cool and retest.

Test 3 - Probe test point (3, Fig. 10).
Light "OFF".
A. Test red/white wire.
Light "ON".
A. Go to test 4.

Test 4 - Probe test point (4, Fig. 10).
Light "OFF".
A. Replace diode.
Light "ON".
A. Go to test 5.

Test 5 - Probe test point (5, Fig. 10).
Light "OFF".
A. Test or replace mower switch. Test red/white wire.
Light "ON".
A. End of test.

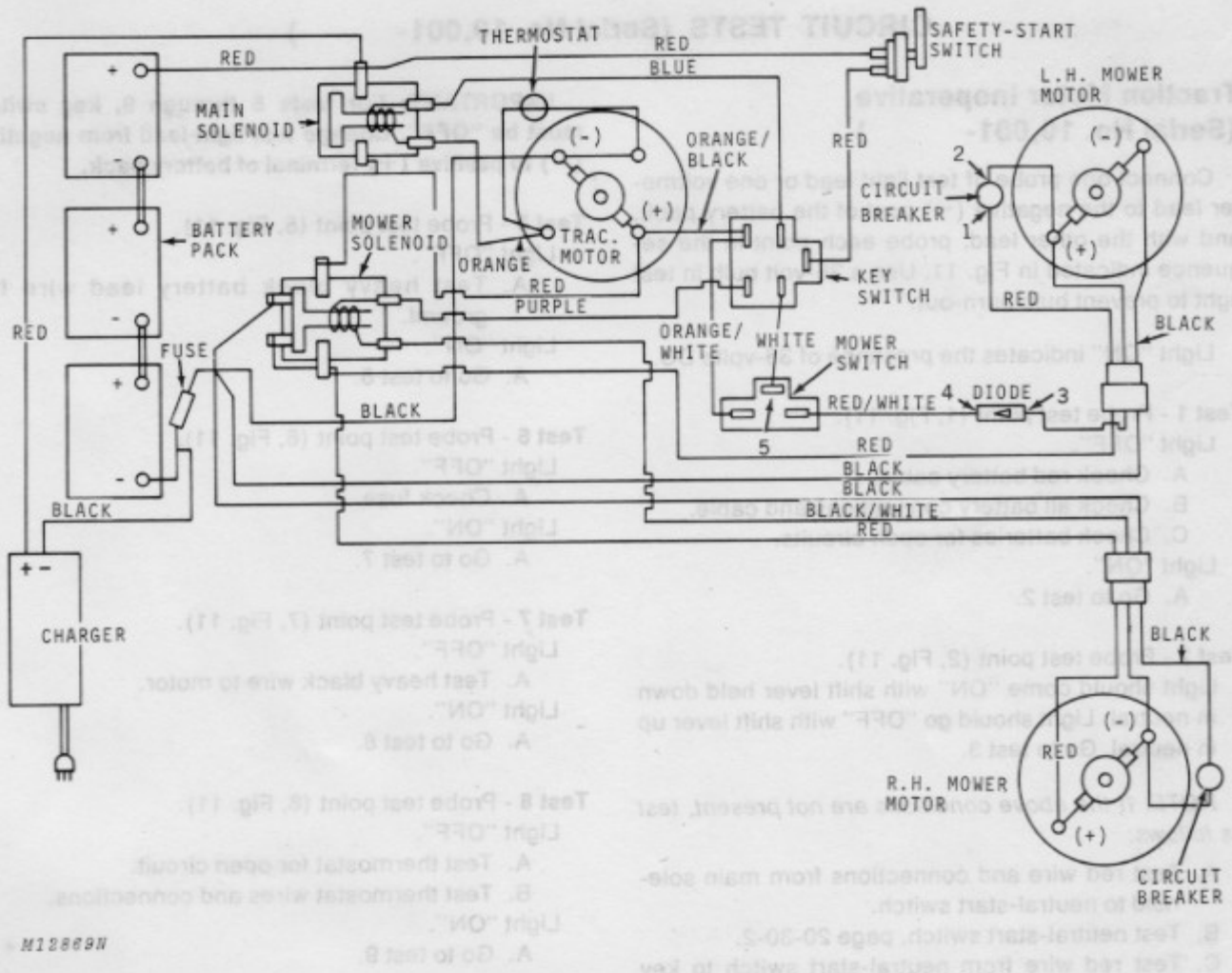

Fig. 10-Test Points for Mower Motors, Starting, then Stopping (Serial No. 1001-10,000)

CIRCUIT TESTS (Serial No. 10,001-)

Traction Motor Inoperative (Serial No. 10,001-)

Connect one probe of test light lead or one voltmeter lead to the negative (−) post of the battery pack, and with the other lead, probe each point in the sequence indicated in Fig. 11. Use a 36-volt bulb in test light to prevent bulb burn-out.

Light "ON" indicates the presence of 36-volts DC.

Test 1 - Probe test point (1, Fig. 11).
Light "OFF".
A. Check red battery cable.
B. Check all battery connections and cable.
C. Check batteries for open circuits.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 11).
Light should come "ON" with shift lever held down in neutral. Light should go "OFF" with shift lever up in neutral. Go to test 3.

NOTE: If the above conditions are not present, test as follows:

A. Test red wire and connections from main solenoid to neutral-start switch.
B. Test neutral-start switch, page 20-30-2.
C. Test red wire from neutral-start switch to key switch.

Test 3 - Probe test point (3, Fig. 11).
Light should come "ON" with shift lever held down in neutral and key switch in "START" position. Go to test 4.
Light "OFF".
A. Test key switch. See page 20-30-3.
B. Test blue wire from key switch to solenoid.

Test 4 - Disconnect orange wire from main solenoid terminal. Probe solenoid terminal (4, Fig. 11) with key switch in "START" position and shift lever held down in neutral.
A. Light "ON" verifies solenoid coil continuity. If light is "OFF", replace solenoid.
B. Light "ON". Proceed as follows: Reconnect orange wire to solenoid, hold shift lever down in neutral and activate key switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary. See pages 20-30-2 and 20-30-4.
C. If click is heard, go to test 5.

IMPORTANT: For tests 5 through 9, key switch must be "OFF". Change test light lead from negative (−) to positive (+) terminal of battery pack.

Test 5 - Probe test point (5, Fig. 11).
Light "OFF".
A. Test heavy black battery lead wire for ground.
Light "ON".
A. Go to test 6.

Test 6 - Probe test point (6, Fig. 11).
Light "OFF".
A. Check fuse.
Light "ON".
A. Go to test 7.

Test 7 - Probe test point (7, Fig. 11).
Light "OFF".
A. Test heavy black wire to motor.
Light "ON".
A. Go to test 8.

Test 8 - Probe test point (8, Fig. 11).
Light "OFF".
A. Test thermostat for open circuit.
B. Test thermostat wires and connections.
Light "ON".
A. Go to test 9.

Test 9 - Probe test point (9, Fig. 11).
Light "OFF".
A. Test orange wire and connections.
Light "ON".
A. End of circuitry test.

NOTE: If traction motor starts but will not continue to run, make test 10.

IMPORTANT: Change test lead to negative (−) terminal of battery pack and probe test point (10, Fig. 11), with shift lever held down in neutral and key switch in "START" position.

Test 10 - Light "OFF".
A. Test key switch for continuity between orange/white and blue wire terminals with key switch in "RUN" position.
B. Test orange/black wire.

NOTE: If motor still does not run, disassemble and test motor. See Group 25.

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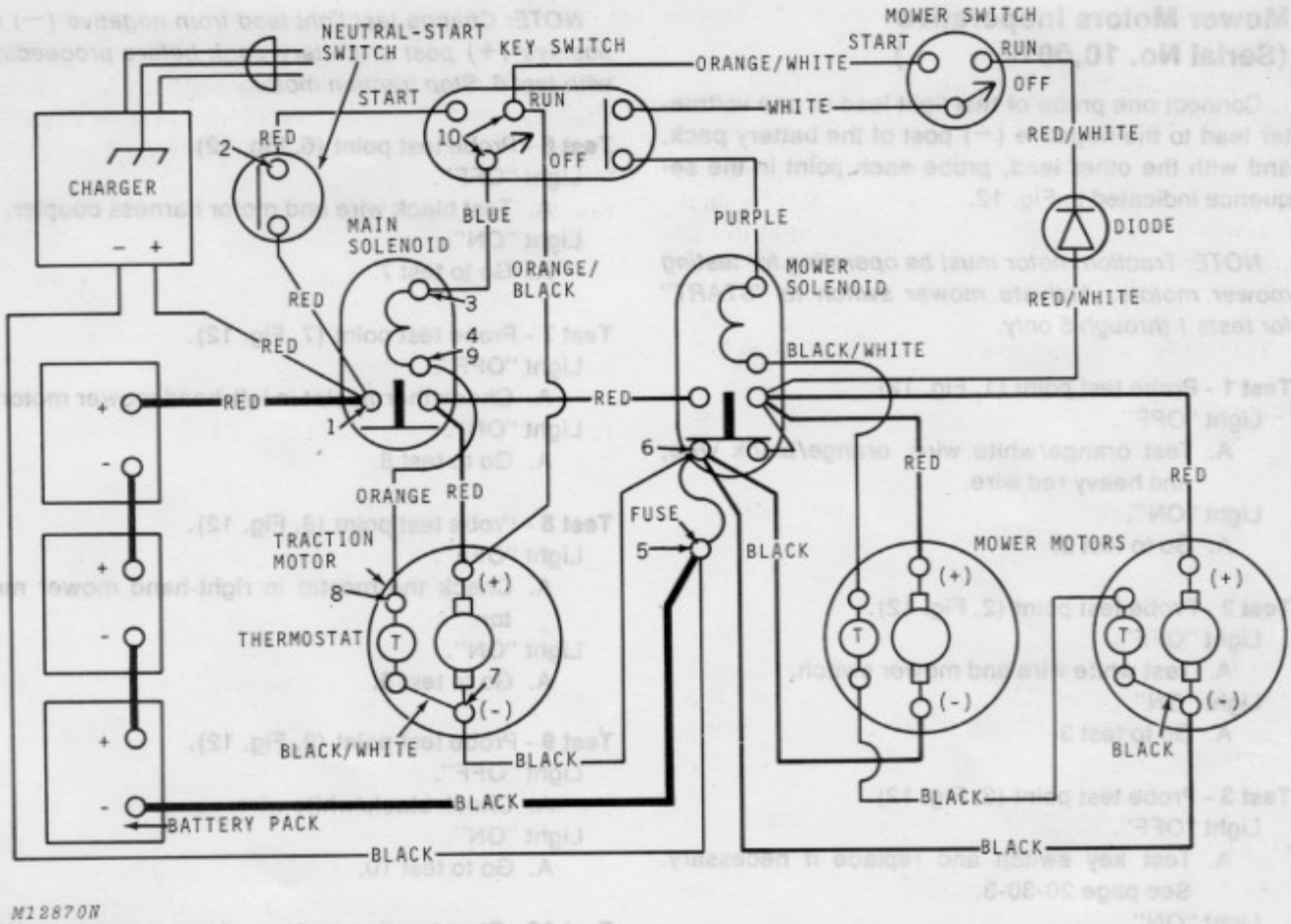

Fig. 11-Test Points for Inoperative Traction Motor (Serial No. 10,001-)

Mower Motors Inoperative (Serial No. 10,001-)

Connect one probe of test light lead or one voltmeter lead to the negative (−) post of the battery pack, and with the other lead, probe each point in the sequence indicated in Fig. 12.

NOTE: Traction motor must be operating for testing mower motors. Activate mower switch to "START" for tests 1 through 5 only.

Test 1 - Probe test point (1, Fig. 12).
Light "OFF".
A. Test orange/white wire, orange/black wire, and heavy red wire.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 12).
Light "OFF".
A. Test white wire and mower switch.
Light "ON".
A. Go to test 3.

Test 3 - Probe test point (3, Fig. 12).
Light "OFF".
A. Test key switch and replace if necessary. See page 20-30-3.
Light "ON".
A. Go to test 4.

Test 4 - Probe test point (4, Fig. 12).
Light "OFF".
A. Test purple wire and connections.
Light "ON".
A. Go to test 5.

Test 5 - Disconnect black/white wire from mower solenoid terminal. Probe solenoid terminal (5, Fig. 12).
A. Light "ON", verifys solenoid coil continuity. If light is "OFF", replace solenoid.
B. Light "ON". Proceed as follows: Reconnect black/white wire to solenoid and activate mower switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary. See pages 20-30-2 and 20-30-4.
C. If click is heard, go to test 6.

NOTE: Change test light lead from negative (−) to positive (+) post of battery pack before proceeding with test 6. Stop traction motor.

Test 6 - Probe test point (6, Fig. 12).
Light "OFF".
A. Test black wire and motor harness coupler.
Light "ON".
A. Go to test 7.

Test 7 - Probe test point (7, Fig. 12).
Light "OFF".
A. Check thermostat in left-hand mower motor.
Light "ON".
A. Go to test 8.

Test 8 - Probe test point (8, Fig. 12).
Light "OFF".
A. Check thermostat in right-hand mower motor.
Light "ON".
A. Go to test 9.

Test 9 - Probe test point (9, Fig. 12).
Light "OFF".
A. Check black/white wire.
Light "ON".
A. Go to test 10.

Test 10 - Start traction motor and move mower switch to "START" position. Connect test light leads across right-hand mower motor terminals (10, Fig. 12).
Light "OFF".
A. Check heavy red wire from mower solenoid to motor.
Light "ON".
A. End of tests.

NOTE: If voltmeter test reveals 36-volts DC at motor terminals and motor will not operate, remove motor and test armature and brushes. Repair or replace components as necessary. See Group 25.

Repeat test 10 for the left-hand mower motor.

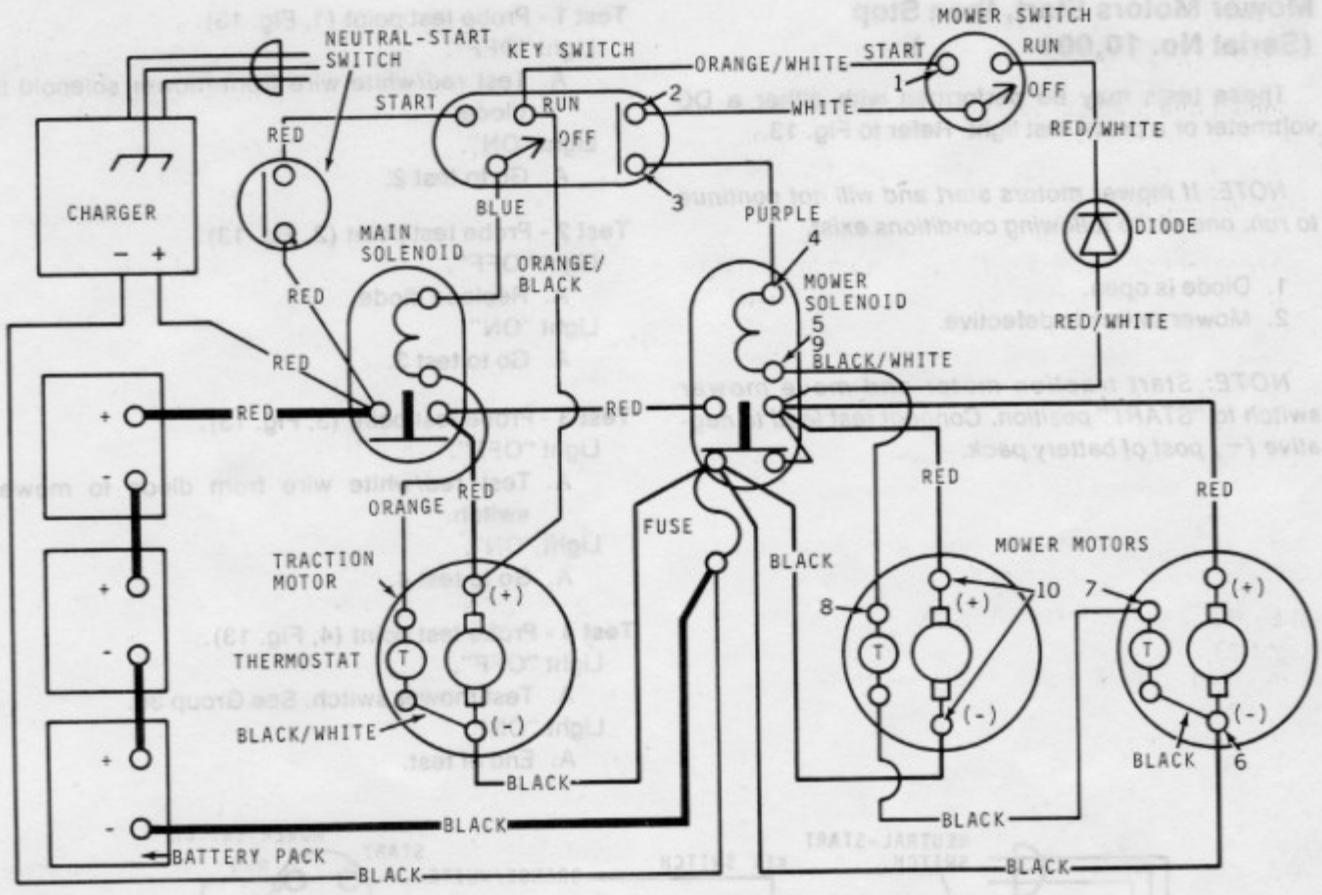

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Fig. 12-Test Points for Mower Motors Inoperative (Serial No. 10,001-)

Mower Motors Start, then Stop (Serial No. 10,001-)

These tests may be performed with either a DC voltmeter or a probe test light. Refer to Fig. 13.

NOTE: If mower motors start and will not continue to run, one of the following conditions exist.

1. Diode is open.
2. Mower switch is defective.

NOTE: Start traction motor and move mower switch to "START" position. Connect test lead to negative (−) post of battery pack.

Test 1 - Probe test point (1, Fig. 13).
Light "OFF".
A. Test red/white wire from mower solenoid to diode.
Light "ON".
A. Go to test 2.

Test 2 - Probe test point (2, Fig. 13).
Light "OFF".
A. Replace diode.
Light "ON".
A. Go to test 3.

Test 3 - Probe test point (3, Fig. 13).
Light "OFF".
A. Test red/white wire from diode to mower switch.
Light "ON".
A. Go to test 4.

Test 4 - Probe test point (4, Fig. 13).
Light "OFF".
A. Test mower switch. See Group 30.
Light "ON".
A. End of test.

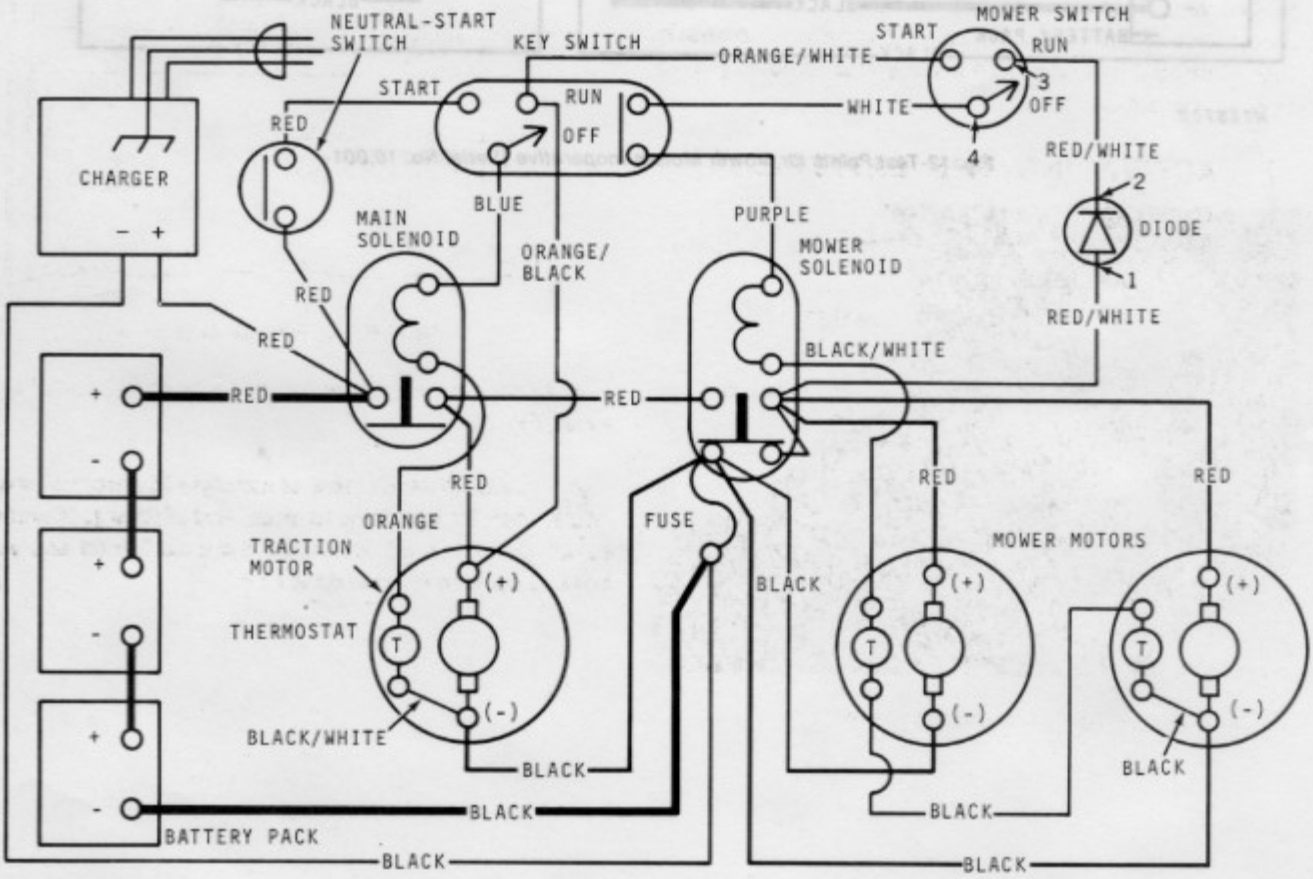

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Fig. 13-Test Points for Mower Motors Starting, then Stopping (Serial No. 10,001-)

Group 15
BATTERIES

GENERAL INFORMATION

The batteries are of the lead-acid variety. Lead is used in the construction of the cell plates and a sulfuric acid solution serves as the electrolyte.

Batteries are shipped dry-charged. This means the plates are charged, but electrolyte must be added just before using.

Each battery has a polypropylene case with six individual cells. Each cell contains positive or negative charge plates.

All plates of like charge are interconnected so that the accumulative charges are present at the positive and negative battery terminals.

As a battery discharges and the energy is not replenished, the sulfuric acid is withdrawn from the electrolyte and the lead sulfate deposits build up on the plates. This causes the specific gravity of the electrolyte to diminish. Charging the battery reverses the chemical reaction, restoring the electrolyte to original potential.

ACTIVATING THE BATTERIES

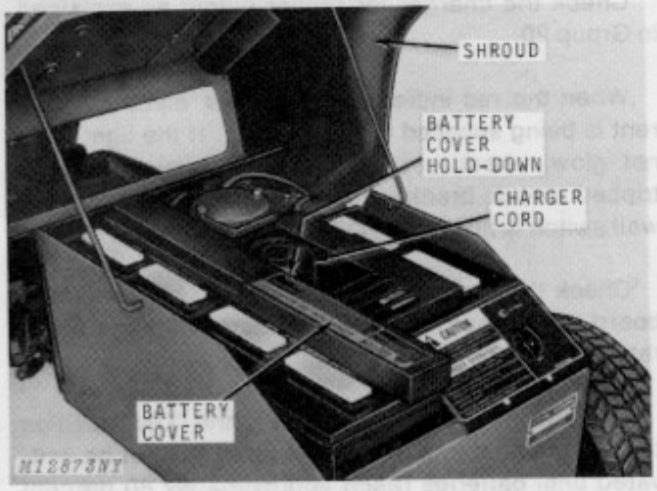

Fig. 1-Battery Compartment

Remove shroud by pivoting it forward, Fig. 1. Then lift it upward and remove it from slotted deck opening.

Remove charger cord from storage compartment.

Depress battery cover hold-down and turn 1/4-turn right or left to unhook hold-down from base. Lift cover off.

Disconnect cables and charger wires from battery terminals. Remove batteries from compartment.

IMPORTANT: Be sure to remove batteries before filling with electrolyte. This will prevent accidental damage in case of acid spill.

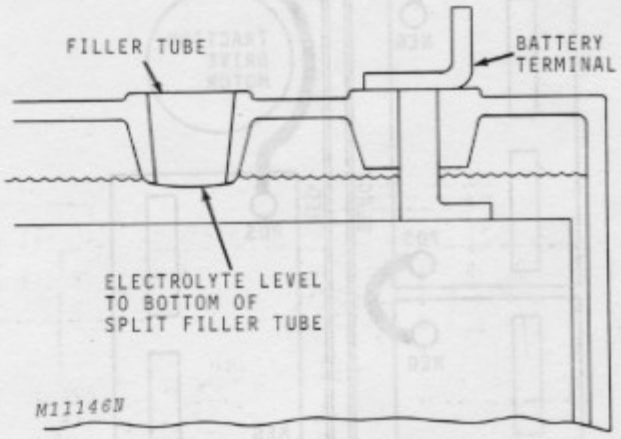

Fig. 2-Battery Electrolyte Level

Fill batteries with electrolyte to bottom of split filler tube, Fig. 2.

⚠ CAUTION: Battery electrolyte is poisonous and can be injurious to eyes and clothing. Handle it carefully. If spilled, clean with a solution of one part baking soda to four parts water.

Electrolyte is not furnished with the Electric 90 Mower. It is available from your Parts Depot in the following quantities:

Part No.	Description
4098522	5 gallons
4098532	6 quarts
409240	Hose for 5 gallon package

Use only battery grade sulfuric acid electrolyte with 1.265 specific gravity plus or minus 0.005 corrected to 80 degrees Fahrenheit.

Clean and dry batteries and install in battery compartment.

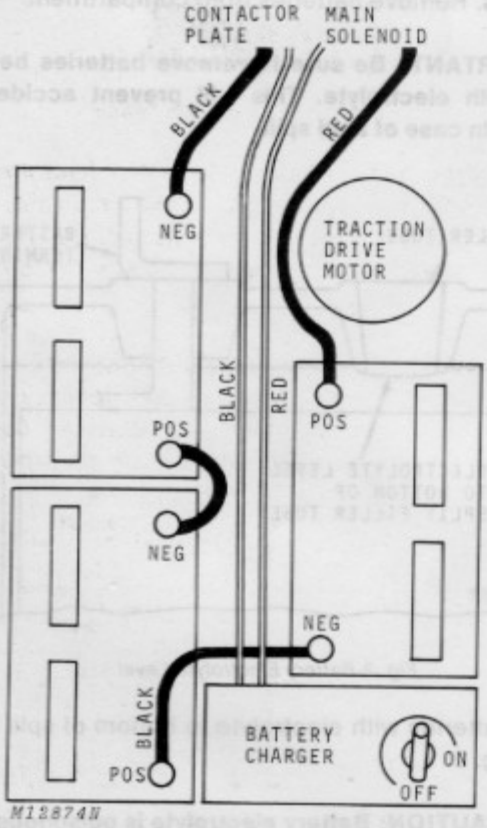

Fig. 3-Battery Wiring Diagram (Serial No. 10,001-)

Connect battery cables, Fig. 3. On Electric 90 (Serial No. 1001-10,000), connect charger wires to original battery terminals. On Electric 90 (Serial No. 10,001-) the charger wires are connected to the main solenoid and contactor plate.

When replacing shroud, be sure notches on shroud hinges engage pivot brace at sides of frame.

NOTE: Keep rags and clutter out of cavity in battery terminal cover because this is an air vent for cooling charger.

CHARGING THE BATTERIES

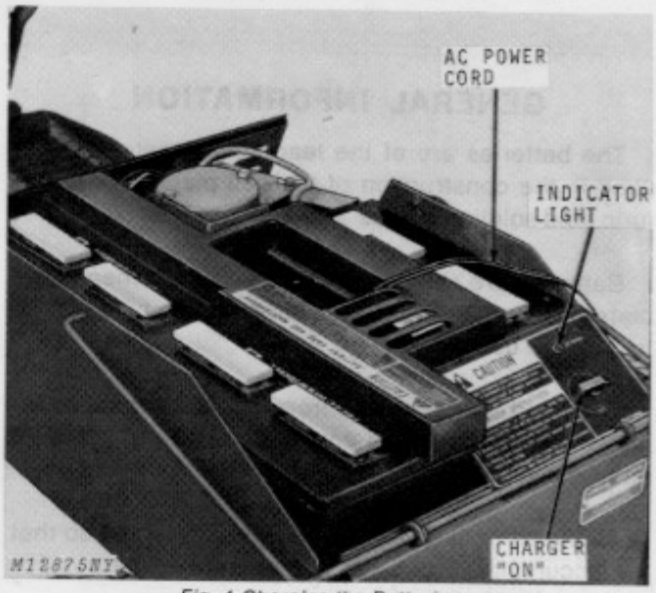

Fig. 4-Charging the Batteries (Shroud Removed For Illustration Purposes)

Raise the shroud and pivot the brace forward to hold the shroud in the raised position.

Remove the AC power cord from the storage compartment between the batteries and plug it into a grounded alternating current (AC) outlet supplying 105 to 130 volts. Turn charger knob to the "ON" position, Fig. 4.

Check the charger for proper output as explained in Group 20.

When the red indicator light glows, electrical current is being supplied to the charger. If the light does not glow, check supply circuit for blown fuses, a tripped circuit breaker, or to see that a controlling wall switch is not in the "OFF" position.

Check the thermal overload on the charger circuit board. If the thermal overload has melted and separated the red indicator light will not glow.

Turn the timer knob clockwise to the "ON" position to start the charging cycle. The timer will not be activated until batteries reach approximately 80 percent of full charge. The timer will then operate for an additional six hours to fully charge the batteries.

⚠ CAUTION: Highly combustible hydrogen gas is vented from the batteries during the charging cycle. Keep the shroud raised while charging batteries until timer returns to "OFF." Charge batteries in ventilated area. Keep flames away from and do not smoke around batteries.

Litho in U.S.A.

NOTE: The complete charging cycle will take from 6 to 12 hours, depending upon condition of batteries.

The charger also contains an automatic boost timer that turns the charger on once every 24 hours to permit a 12- to 15-minute boost charge. This keeps the batteries at full charge at all times. Only one full charge is required after each mowing.

IMPORTANT: After the batteries have been charged, DO NOT reset the charge control timer knob to the "ON" position. This will cause the batteries to "boil away" the electrolyte. Leave charger connected so the boost timer will be able to operate. Light will remain "ON" indicating AC line voltage is being supplied to the charger.

IMPORTANT: Keep the charger connected to a live electrical outlet whenever the machine is not in use . . . even during winter storage. Batteries can be severely damaged if stored for prolonged periods in a discharged condition.

NOTE: Specific gravity after charging should be from 1.260 to 1.280 (corrected for 80°F. electrolyte temperature). See "Testing the Batteries" at the right.

As long as the charger is plugged into the electrical outlet, the indicator light will glow. Movement of the timer knob during full charging is not noticeable due to the length of the charging cycle.

It is normal for the charger to become warm while in operation. A thermal overload within the charger prevents charger from becoming too warm. Keeping the shroud raised and the air passage in the battery cover open helps to cool the charger.

The shroud does not have to be in the raised position after the timer has returned to the "OFF" position. The shroud can be lowered during the daily automatic charging cycles.

⚠ CAUTION: Do not charge batteries with any other charger. Do not use the mower batteries to start other vehicles. Battery damage will result.

CHECKING ELECTROLYTE LEVEL

Check electrolyte level periodically (at least once each month). If necessary, add distilled water to bring the level to the bottom of the split filler tubes. Check more frequently if mower is operated and recharged more than once each week.

TESTING THE BATTERIES

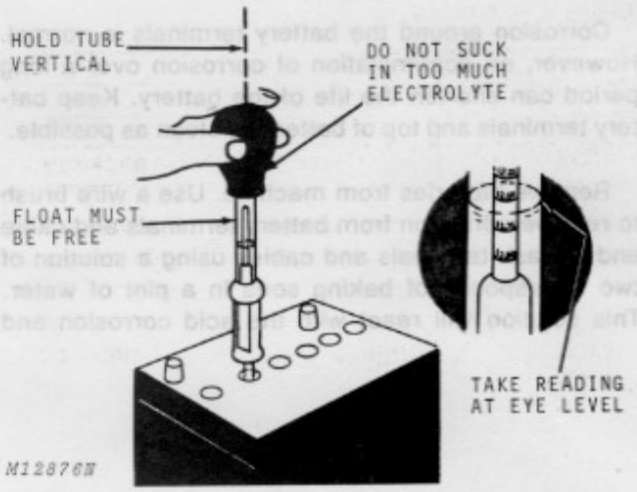

Fig. 5-Testing Battery with Hydrometer

Testing the battery electrolyte with a hydrometer, Fig. 5, will tell you whether the battery is usable, requires recharging or should be replaced. Regular periodic testing provides a means of anticipating battery failure.

Always us a hydrometer with a thermometer when making specific gravity tests, since specific gravity readings vary with changing temperatures due to expansion and contraction of the battery electrolyte.

Specific Gravity	Capacity
1.260 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.140 to 1.160	Very little useful capacity
1.110 to 1.130	Discharged

The above table illustrates typical ranges of specific gravity (amount of unused sulfuric acid remaining in the solution) for a cell in various states of charge at 80°F.

Specific Gravity (Corrected to 80°F.)	Electrolyte Freezing Temperatures
1.250	−62°F.
1.200	−16°F.
1.150	+ 5°F.
1.100	+19°F.

Litho in U.S.A.

CLEANING BATTERIES AND CONNECTIONS

Corrosion around the battery terminals is normal. However, an accumulation of corrosion over a long period can shorten the life of the battery. Keep battery terminals and top of battery as clean as possible.

Remove batteries from machine. Use a wire brush to remove corrosion from battery terminals and cable ends. Wash terminals and cables using a solution of two tablespoons of baking soda in a pint of water. This solution will react with the acid corrosion and cause considerable foaming. Apply until foaming stops.

IMPORTANT: Keep water or soda and water solution from entering the battery through the breather hole in each cap because it will weaken the acid in the electrolyte.

Wash away residue with clear water. Wash battery compartment with clear water. DO NOT allow water to get into the battery charger.

Group 20
BATTERY CHARGER

GENERAL INFORMATION

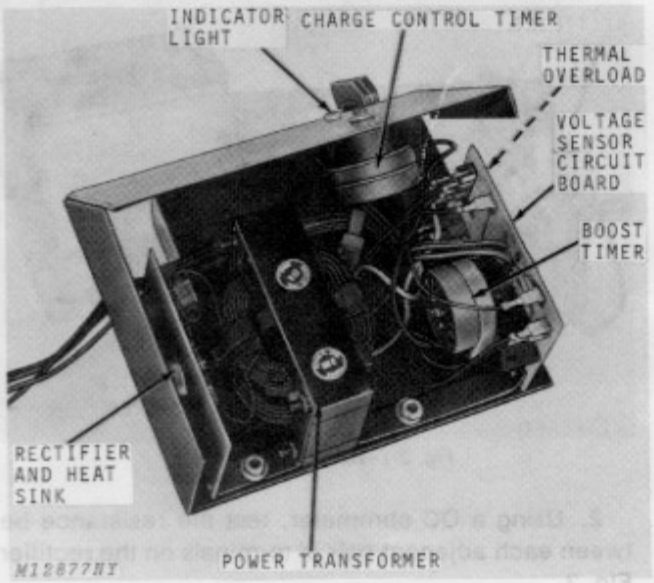

Fig. 1-Battery Charger

The reactance-limited battery charger, Fig. 1, increases voltage, as necessary, to complete the final charge. The charger maintains a near constant finish amperage charge rate. The charger capacity is 10 amps with a charge finish rate of 3 amps average (2.5 to 4 amps). The batteries are charged in series.

The operation of the charger components is explained below.

Power Transformer -

The power transformer converts AC line voltage to lower AC voltage and supplies this lower AC voltage to the rectifier.

Rectifier and Heat Sink -

The rectifier converts the transformer lower AC voltage into direct current suitable for charging the batteries. The heat sink dissipates the heat generated by the rectifier.

Voltage Sensor Circuit Board -

The circuit board has an electronic circuit which closes an electrical contact in the reed relay when the batteries reach approximately 80% full charge. Sensing is based on battery voltage and temperature.

Charge Control Timer -

When the electrical contact in the reed relay closes it provides power to the charge control timer motor. The charge control timer will now operate for a 6-hour period, rotating the knob on the control panel from the "ON" to "OFF" position, finish-charging the batteries.

Boost Timer -

The boost timer turns the charger on for 12 to 15 minutes every 24 hours for maintenance-charging. It bypasses the charge control timer and operates when the charge control timer is in the "OFF" position.

Indicator Light -

The AC indicator light advises that AC line voltage is present at the charger. It is important that AC line voltage be present at the charger when the system is not being used so the boost timer can operate.

Thermal Overload -

This component protects the charger from extreme temperatures. The thermal overload is designed to break the circuit at 204°F. and turn off the charging current. Should this occur, it is necessary to replace the thermal overload.

TESTING BATTERY CHARGER

The charger may fail in two different ways:

1. The charger does not charge the batteries. Proceed to Test 1.

2. The charger charges the batteries, possibly boiling away the electrolyte, but the charge control timer knob does not return to the "OFF" position. This malfunction can be attributed to the charger circuit board or the charge control timer. If the above is observed, proceed to Test 4.

Test 1 - Testing Charger Output

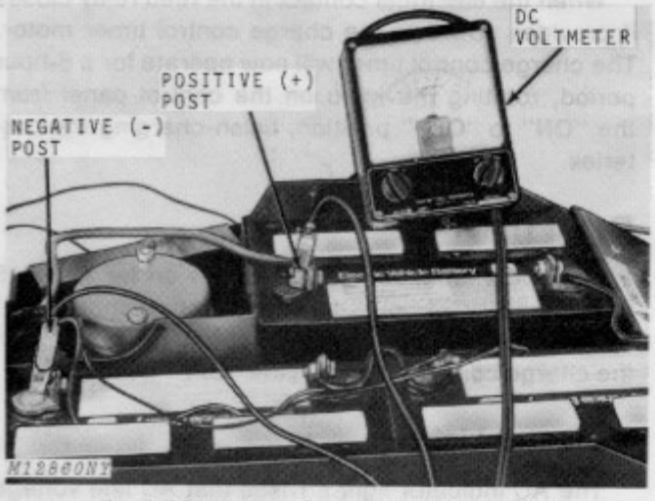

Fig. 2-DC Voltmeter Connected to Battery Pack

1. Connect a DC voltmeter to the battery pack, Fig. 2.

2. Start the traction motor and allow the machine to run in neutral for about one minute to remove "SURFACE CHARGE" from the batteries.

3. Shut off motor. Read and record battery voltage.

4. Plug the charger into an AC outlet and turn the charge control timer knob to the "ON" position. Allow the charger to operate for two minutes. Battery voltage should show at least a one-volt increase within two minutes.

5. If the one-volt increase is not present, the problem is in the rectifier or transformer. Proceed to Tests 2 and 3.

Test 2 - Testing Rectifier

1. Disconnect charger leads from the battery circuit and remove the charger from the machine. Place the charger on a bench.

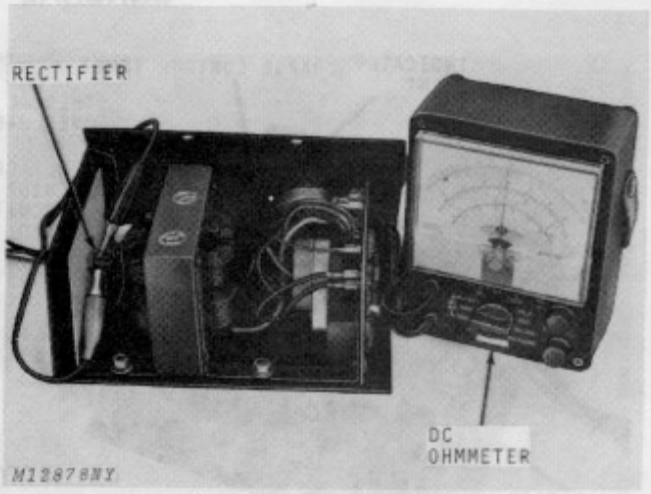

Fig. 3-Testing Retifier Diodes

2. Using a DC ohmmeter, test the resistance between each adjacent pair of terminals on the rectifier, Fig. 3.

3. With ohmmeter leads attached one way, a mid-scale reading should be observed between each pair of adjacent terminals. Reversing the ohmmeter leads should show a high resistance or open condition.

4. Check all four terminals in this manner to determine if the diodes in the rectifier are functioning correctly. Replace the rectifier if necessary.

Test 3 - Testing Transformer

1. Visually inspect the transformer windings. If the insulation appears burned or an unusual burned odor is present, replace the transformer.

2. If the transformer appears to be in good condition, install the charger and again check for a one-volt increase in battery voltage after a two-minute charge (Test 1).

Test 4 - Testing Circuit Board

1. Remove the charger from the machine and reconnect the charger battery leads to the battery circuit. Position the charger so the circuit board can be reached easily. Do NOT turn the charger on.

2. Start and run the traction motor (machine in neutral) for two minutes.

3. Connect a DC voltmeter across the battery pack. The voltmeter should read less than 38 volts.

4. Plug the charger into a 115-volt AC outlet. Turn the charge control timer knob to the "ON" position.

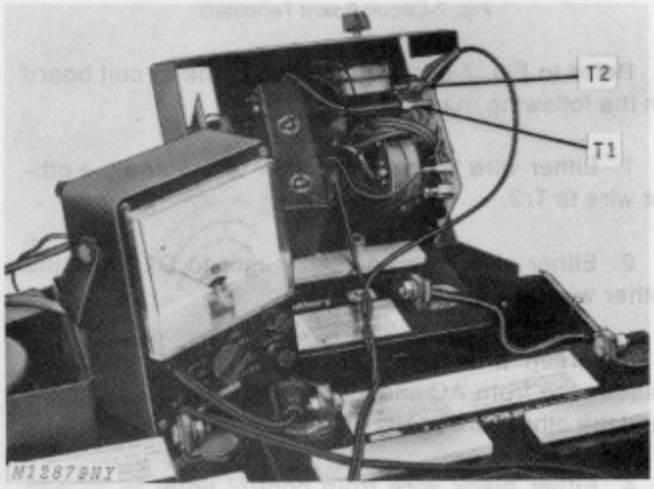

Fig. 4-Testing Circuit Board with AC Voltmeter

5. Use an AC voltmeter and probe two points on the circuit board, T1 and T2, Figs. 4 and 7. Wires from the charge control timer motor are connected at these two points. With less than 38-volts DC across the battery pack, no AC voltage should be present at T1 and T2.

6. Allow the charger to operate until at least 42-volts DC but less than 44-volts DC are present across the battery pack. Once again use an AC voltmeter and probe points T1 and T2 on the circuit board. Line voltage should be present at points T1 and T2. If line voltage is present, the circuit board is operating, if not, the circuit board must be replaced.

NOTE: If line voltage is present at T1 and T2, the charge control timer is defective and should be replaced.

REPLACING CHARGER COMPONENTS

Disconnect red and black charger wires from the battery circuit and remove charger.

REPLACING TRANSFORMER AND RECTIFIER

Removal

Disconnect two black wires from the negative (−) terminal on circuit board and small red wire from positive (+) terminal. See Fig. 7.

Disconnect two sets of red wires from boost timer. Note that the two red wires with the insulated spade terminal are connected to the center terminal (No. 2) of the boost timer.

Remove two screws securing boost timer to circuit board. Disconnect two black wires from boost timer to circuit board and remove boost timer.

Disconnect all other wires from circuit board.

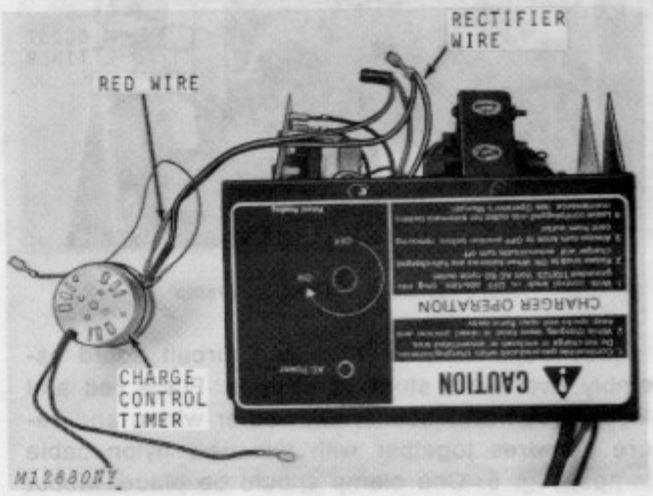

Fig. 5- Charge Control Timer Wiring

Turn charge control timer knob until set screw is accessible. Loosen screw and remove knob. Remove lock nut and external lockwasher and remove control timer. Disconnect red wire from control timer that is paired with red wire from rectifier, Fig. 5.

Remove four nuts, two lockwashers and two flat washers securing transformer-rectifier assembly to chassis weld studs and remove assembly.

NOTE: It will be necessary to cut the nylon clamps securing the wires in order to free the red and black wires soldered to the rectifier. Discard nylon clamps. Use new clamps for assembly.

Use a 13/64-inch drill to drill out the rivets holding the circuit board to the rectifier-transformer assembly.

Installation

Install circuit board to NEW transformer-rectifier assembly. Use No. 10 hardware. On each end place one internal star washer between the circuit board and foot of assembly, and the other internal star washer between nut and foot of assembly. Tighten nuts securely.

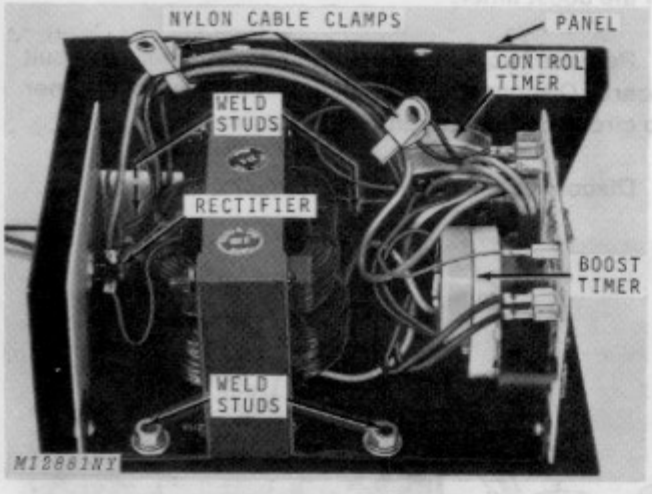

Fig. 6-Installing Nylon Cable Clamp

Place transformer-rectifier and circuit board assembly over weld studs in chassis. Place red and black wires from rectifier with other wiring and secure all wires together with two new nylon cable clamps, Fig. 6. One clamp should be placed about four inches from the rectifier. Place wires and clamp in chassis with clamp over weld stud. Install the second nylon cable clamp over the other weld stud. Install hex nuts and tighten. Install flat washers, lock washers and hex nuts on the other two studs and tighten nuts.

Connect red wire to control timer. This is the wire that is paired with the red wire from the rectifier, Fig. 5.

Place control timer in panel and secure with external lockwasher and special nut. Install control knob with set screw facing flat of shaft and tighten set screw.

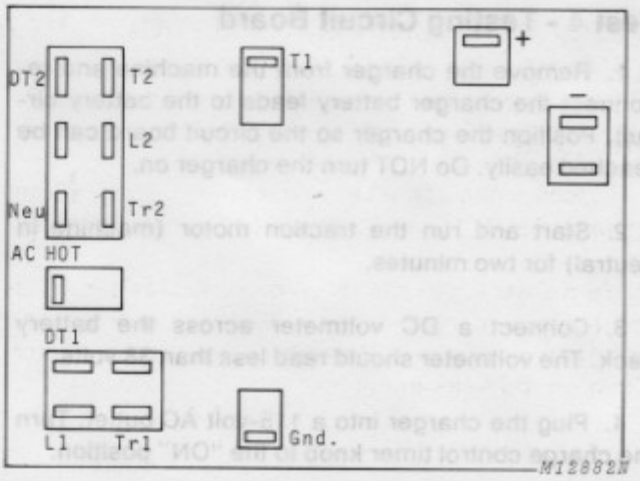

Fig. 7-Circuit Board Terminals

Refer to Fig. 7 and install wires to the circuit board in the following manner:

1. Either wire from transformer to Tr1 and the other wire to Tr2.

2. Either wire from indicator light to DT1 and the other wire to blank opposite L2.

3. Green wire from AC line input to Gnd. Either black wire from AC line input to Neu on circuit board and the other wire to HOT.

4. Either black wire from control timer to T1 and the other wire to T2.

5. Either black wire from boost timer to L2 and the other wire to blank next to DT1.

6. Position boost timer with the three connections up and secure to circuit board with two screws.

7. Install paired red wires from control timer and rectifier to No. 1 of the boost timer.

8. Install paired red wires from control timer and battery electrical circuit (insulated spade) to No. 2 (center) post of boost timer.

9. Small red wire from control timer to positive (+) terminal on circuit board.

10. Black wire from rectifier and black wire from battery electrical circuit to negative (−) terminal on circuit board.

IMPORTANT: Test the charger as outlined under "Testing the Charger", page 20-20-2, before installing in the Electric 90 Mower.

REPLACING CHARGE CONTROL TIMER AND KNOB

Removal

Disconnect black wires of the charge control timer from terminals T1 and T2 on the circuit board, Fig. 7.

Turn timer knob until set screw is accessible. Loosen screw and remove knob. Remove lock nut and external washer and remove charge control timer. Remove red wires from timer.

Installation

Fig. 8-Charge Control Timer Terminals

Hold charge control timer in left-hand with shaft pointing up and terminals pointing away from you, Fig. 8. Install small red wire from positive (+) terminal of circuit board to the left-hand terminal of charge control timer. Install insulated red wire from center terminal of boost timer to center terminal of charge control timer. Connect the other red wire from the boost timer to the right-hand terminal of the charge control timer.

Install charge control timer in panel with connections down and rotated slightly to the left when viewing the charge control timer from the rear. Secure timer with external lockwasher and nut. Install control knob with set screw facing flat of shaft and tighten set screw.

REPLACING CIRCUIT BOARD

Removal

Disconnect two black wires from negative (−) terminal and small red wire from the positive (+) terminal of the circuit board, Fig. 7.

Remove two screws securing boost timer to the circuit board, Fig. 6. Disconnect two black wires of the boost timer from the circuit board and lay boost timer with all wires connected over the front panel.

Disconnect all other wires from the circuit board.

Punch out steel center of rivets holding circuit board and use a 13/64" drill to drill out rivets.

Installation

Use No. 10 hardware to install new circuit board. Place one internal star washer on each end of the circuit board between board and mounting bracket. Install screw, internal star washer and nut. Tighten nuts securely.

Refer to Fig. 7 and install wires to the circuit board in the following manner:

1. Either wire from transformer to Tr1 and the other wire to Tr2.

2. Either wire from indicator light to DT1 and the other wire to blank opposite L2.

3. Green wire from AC line input to Gnd. Either black wire from AC line input to Neu and the other wire to HOT.

4. Either black wire from control timer to T1 and the other wire to T2.

5. Either black wire from boost timer to L2 and the other wire to blank next to DT1.

6. Position boost timer with red wires up and secure to circuit board with two screws.

7. Small red wire from control timer to positive (+) terminal on circuit board.

8. Black wire from rectifier and black wire from battery electrical circuit to negaitve (−) terminal on circuit board.

REMOVING AND TESTING BOOST TIMER

Disconnect two sets of red wires from boost timer. Note that the two red wires with the insulated spade terminal are connected to the center terminal (No. 2) of the boost timer.

Remove two screws securing boost timer to circuit board. Disconnect two black wires from boost timer to circuit board and remove boost timer.

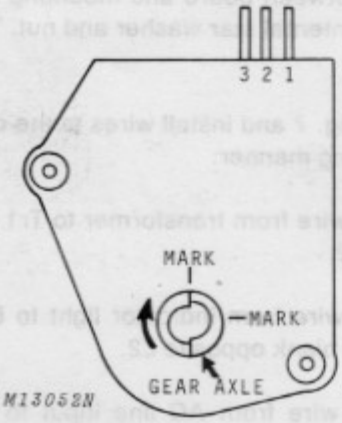

Fig. 9-Testing Boost Timer

Install a flashlight tester to terminals 1 and 2, Fig. 9. DO NOT connect tester to any other terminals. Be sure tester leads do not touch each other.

The following test will determine the 15 minute boost charge to the batteries:

Rotate the gear axle clockwise SLOWLY one full revolution (this is the 24 hour cycle) until a click is felt. The flashlight tester will FLICKER at the exact moment the click takes place. This indicates that the boost timer is only operating for 15 minutes every 24 hours. If the flashlight tester is on all the time when connected to terminals 1 and 2 the boost timer is operating all the time and will boil away the electrolyte in the batteries. Install new boost timer.

To check boost timer motor:

Connect either black wire from boost timer to L2 and the other wire to blank next to DT1. Place boost timer so the side that goes on the circuit board is visible. Use chalk and make two marks as shown in Fig. 9. Charger should be connected to battery pack and plugged into 105 to 130 volt AC outlet. DO NOT turn control timer knob to the "ON" position. Boost timer will run with the control timer knob in the "OFF" position.

Allow 6 hours time and check movement of gear axle. Axle should move about 1/4 revolution, indicating that the timer motor is working.

When installing boost timer, connect either black wire to L2 and the other wire to blank next to DT1.

Position boost timer with the three connections up and secure to circuit board with two screws.

Install paired red wires from control timer and rectifier to No. 1 of the boost timer. Install paired red wires from control timer and battery circuit (insulated spade) to No. 2 (center) post of boost timer.

REPLACING INDICATOR LIGHT

Disconnect indicator light wires from the circuit board.

Use a screw driver to pry the locking plate loose and remove plate. Remove the light, with wires, out the front of the panel.

Install new light with wires through the front of the panel. Pass each wire through a new locking plate and slide plate until light is held firm in panel.

Install either wire to terminal DT1 on circuit board and the other wire to blank opposite L2.

REPLACING AC POWER CORD

Disconnect power cord leads from Neu, HOT, and Gnd on circuit board.

Remove hex. nuts securing nylon cable clamps and cut clamps. This will allow power cord to be removed.

Install new power cord, green wire to Gnd on circuit board, either black wire to Neu and the other wire to HOT on circuit board.

Place new nylon cable clamps around the wires and secure clamps with hex. nuts.

REPLACING POSITIVE (RED) BATTERY WIRE

Remove charge control timer, see page 20-5. Install the wires from center terminal of boost timer and charge control timer.

Remove hex. nuts securing nylon cable clamps and cut clamps. This will allow removal of wire.

Install new wire as follows: double wire with insulated terminal to center terminal of boost timer, and single wire with insulated terminal to center terminal of control timer. Install charge control timer, see page 20-5.

Install new nylon cable clamps and secure with hex. nuts.

REPLACING THERMAL OVERLOAD

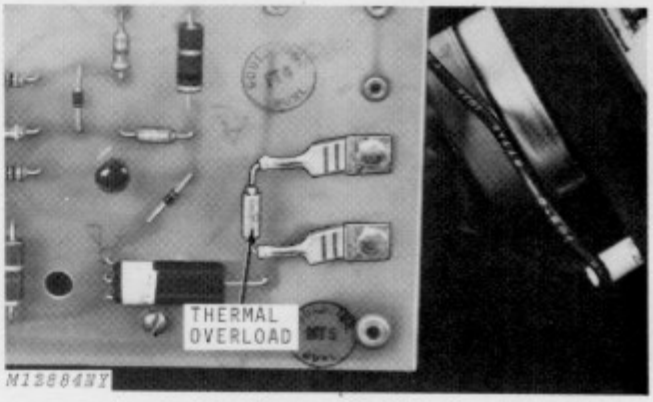

Fig. 10-Thermal Overload

The thermal overload is equipped with spade connectors on each end. To replace it, pull the spade connectors from the terminals of the circuit board and install a new thermal overload on the terminals, Fig. 10.

Group 25
TRACTION AND MOWER MOTORS

GENERAL INFORMATION

Both the traction and mower motors are 2-pole, 36-volt DC permanent-magnet motors. They differ from the conventional wire-wound motors in construction and torque characteristics.

This type motor requires considerable less current to operate. The lower current demand means lower operating temperatures and longer brush life.

On conventional motors, a relatively heavy current is directed through the field coils and armature to build up a strong magnetic field necessary to start the armature turning.

The permanent-magnet motor needs current only for the armature in order to set up opposing magnetic fields to start it turning. This current is induced into the motor in the usual manner with a switch, batteries, solenoid and brushes.

The motors are protected by circuit breakers or thermostats.

DIAGNOSIS AND TESTING

Preliminary Motor Test (Traction or Mower)

Disconnect all wires from motor terminals prior to testing.

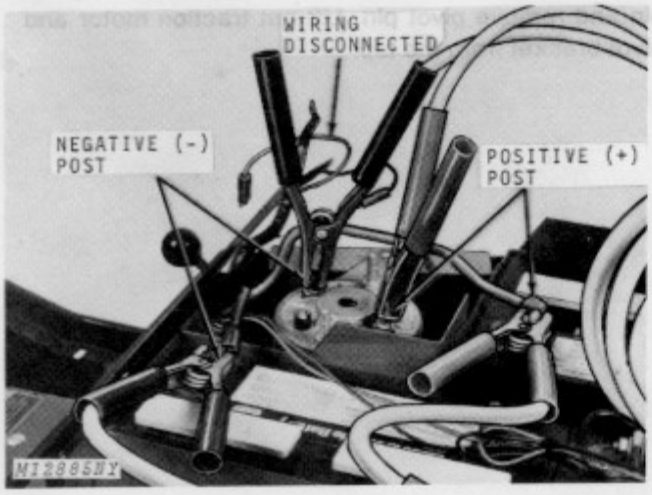

Fig. 1-Preliminary Motor Test

Carefully attach a set of heavy-duty jumper cables from the positive (+) and negative (−) terminals of each motor to the positive (+) and negative (−) posts of the battery pack, Fig. 1. Be sure cables are connected positive-to-positive and negative-to-negative.

If motor will not run, test the motor brushes.

NOTE: Brushes could hang-up in the holders and not be in contact with the commutator, causing the motor to be inoperative.

Testing Motor Brushes

NOTE: All wires should be disconnected from the motor terminals.

Connect a flashlight continuity tester between the heavy main terminals of the motor. If the light does not light, remove the commutator end bell and inspect for a burned commutator or damaged brushes. Replace brushes as instructed in this group. If motor still will not run, test armature.

Testing Armature

Remove and disassemble motor.

Test the armature for shorts, grounds and opens.

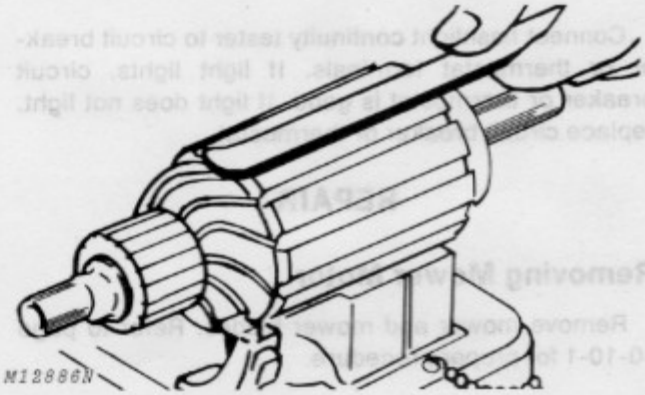

Fig. 2-Testing Armature for Short Circuits

1. SHORTS - A burned commutator bar indicates a shorted armature. Short circuits are located by rotating the armature on a growler with a steel strip (hacksaw blade) held on the armature, Fig. 2. The steel strip will vibrate at the area of the short circuit.

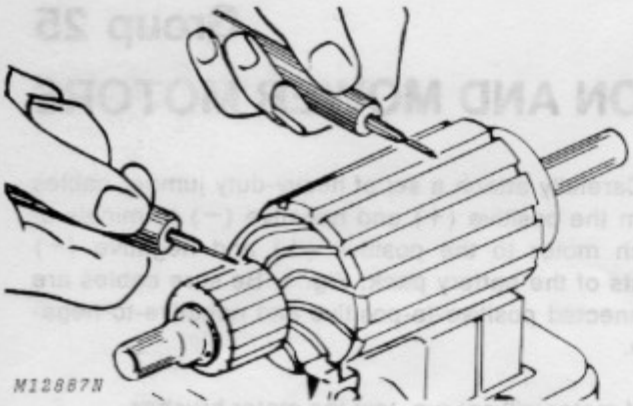

Fig. 3-Testing Armature for Grounds

2. GROUNDS - Grounds in the armature can be detected with a test light, Fig. 3. If the test light lights when one lead is placed on the commutator and the other lead on the armature core or shaft, the armature is grounded.

3. OPENS - Inspect for loose connections at the point where the armature windings are attached to the commutator bars. Poor connections cause arcing and burning of the commutator.

If tests reveal any short, ground or open, replace the armature.

Testing Circuit Breakers or Thermostats

NOTE: A circuit breaker can fail to reset, therefore, testing is a must when diagnosing electrical system malfunctions.

Disconnect circuit breaker or thermostat prior to testing to isolate breaker from balance of system.

Connect flashlight continuity tester to circuit breaker or thermostat terminals. If light lights, circuit breaker or thermostat is good. If light does not light, replace circuit breaker or thermostat.

REPAIR

Removing Mower Motor

Remove mower and mower blades. Refer to page 40-10-1 for proper procedure.

Remove cap screws securing motor to mower deck and remove motor from the bottom of the mower.

Removing Traction Motor

Remove the seat and shroud assembly.

Remove the terminal cover from the traction motor and disconnect all wiring. Mark terminals for wire color codes.

Use a hoist and raise the front of the mower.

⚠ CAUTION: Do not raise the front too far or electrolyte will spill from the batteries.

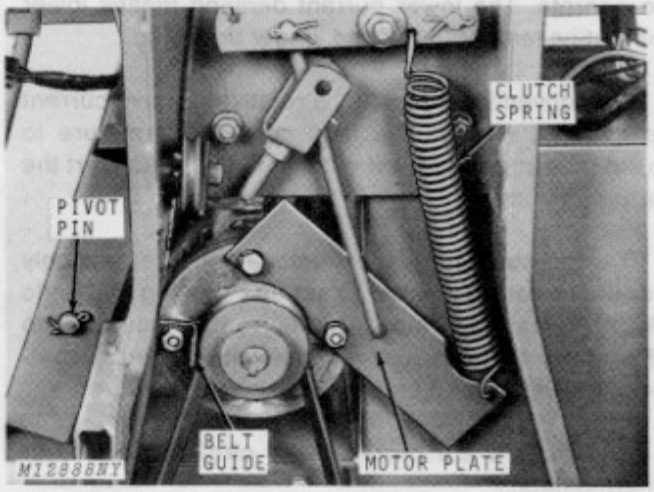

Fig. 4-Removing Traction Motor

Disconnect clutch spring, remove belt guide and motor plate, Fig. 4.

Remove the belt from the traction motor drive sheave.

Remove the cotter pin from the bottom of the pivot pin and remove pivot pin. Lift out traction motor and pivot bracket from the top.

Litho in U.S.A.

Disassembling Traction Motor

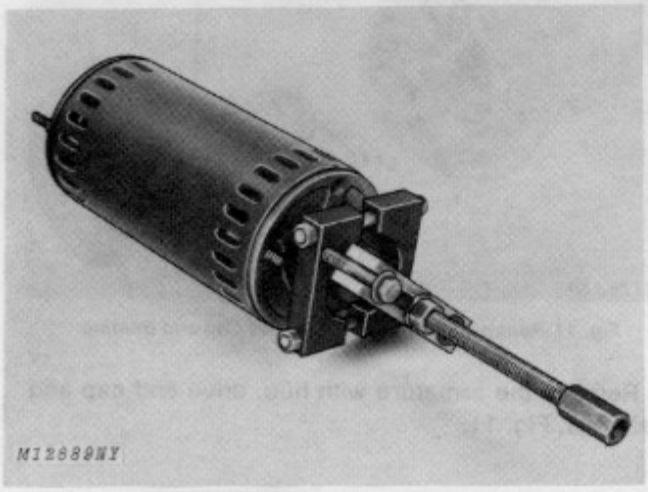

Fig. 5-Removing Sheave From Armature Shaft

Loosen set screws in drive sheave and use a puller to remove the sheave from the armature shaft, Fig. 5.

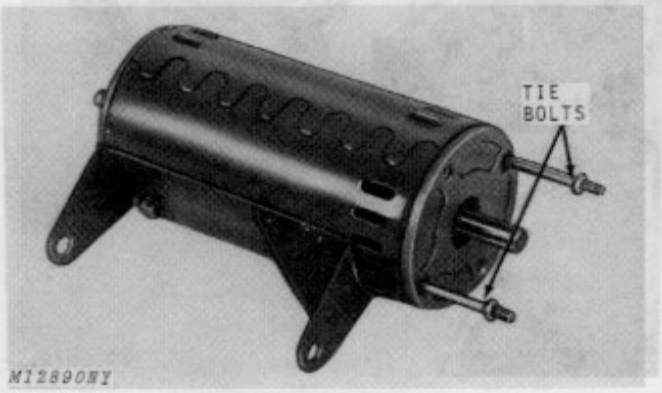

Fig. 6-Removing Tie Bolts

Remove nuts from tie bolts and remove tie bolts from the drive end, Fig. 6.

Remove commutator end cap with brushes and thermostat.

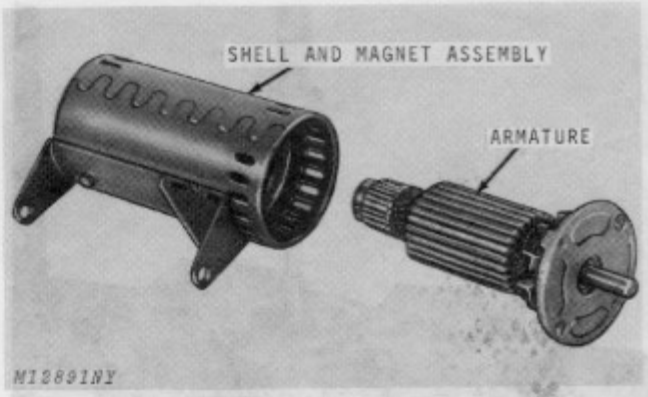

Fig. 7-Removing Armature

Remove armature from the shell and magnet assembly. Drive end cap, fan and bearings are all removed with the armature, Fig. 7.

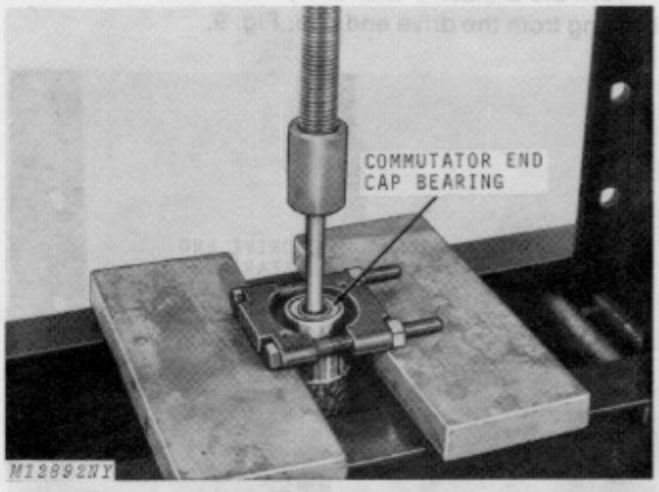

Fig. 8-Removing Commutator End Cap Bearing

Use a press to remove the commutator end cap bearing from the armature shaft, Fig. 8.

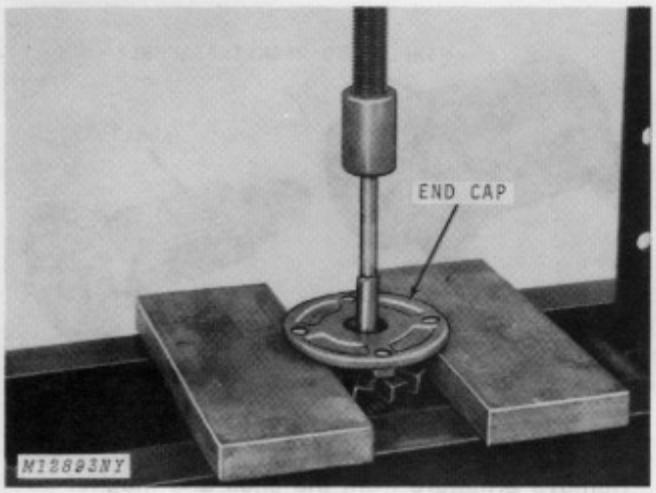

Fig. 9-Removing Armature and Bearing from Drive End Cap

Turn the armature over and press the armature and bearing from the drive end cap, Fig. 9.

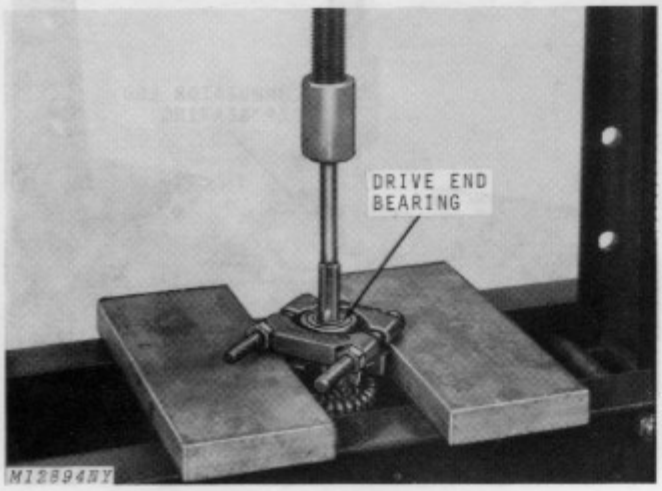

Fig. 10-Removing Drive End Bearing from Armature

Press the drive end cap bearing from the armature, Fig. 10.

Disassembling Mower Motor

Remove hub guards.

Remove terminal cover from the mower motor. Mark each wire terminal for wire color code and disconnect all wires.

Remove nuts from tie bolts and remove bolts. Lift out commutator end cap with brushes and thermostat (or circuit breaker) from the housing.

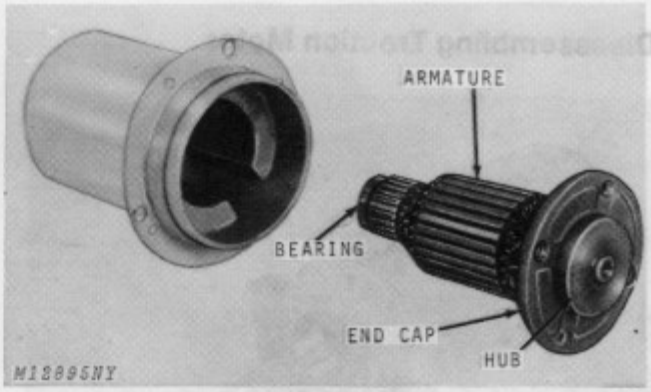

Fig. 11-Removing Armature, Hub, End Cap and Bearing

Remove the armature with hub, drive end cap and bearings, Fig. 11.

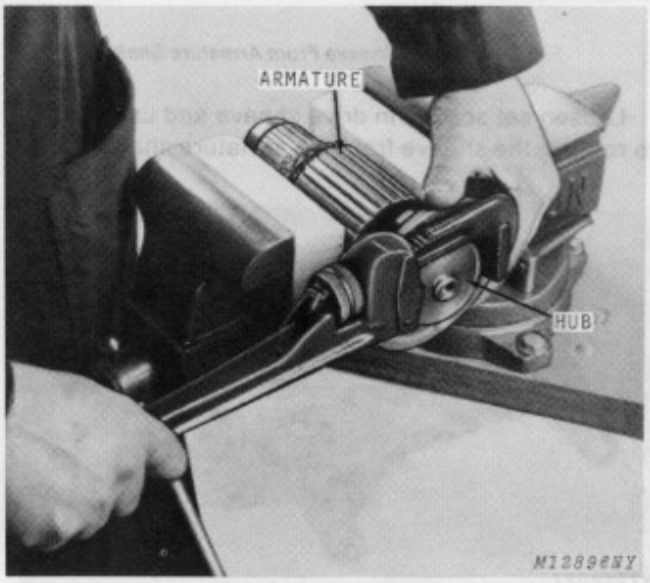

Fig. 12-Removing Hub

Place the armature assembly in a vise between two blocks of wood. Use a pipe wrench and turn the hub in a counterclockwise direction, Fig. 12, to remove it.

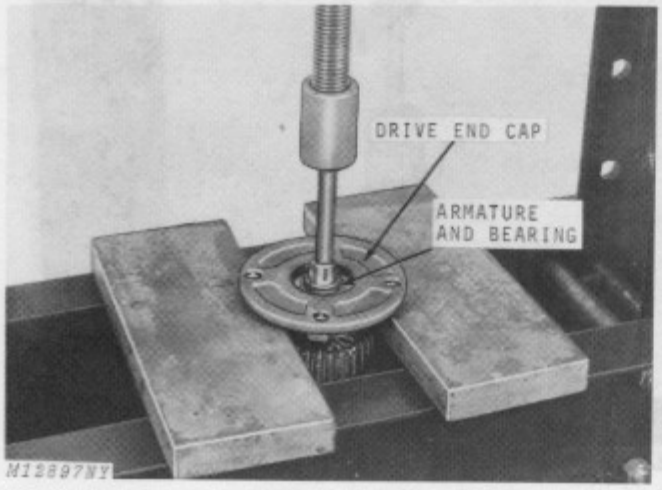

Fig. 13-Removing Armature and Bearing from Drive End Cap

Use a press, Fig. 13, to remove the armature with bearings from the drive end cap.

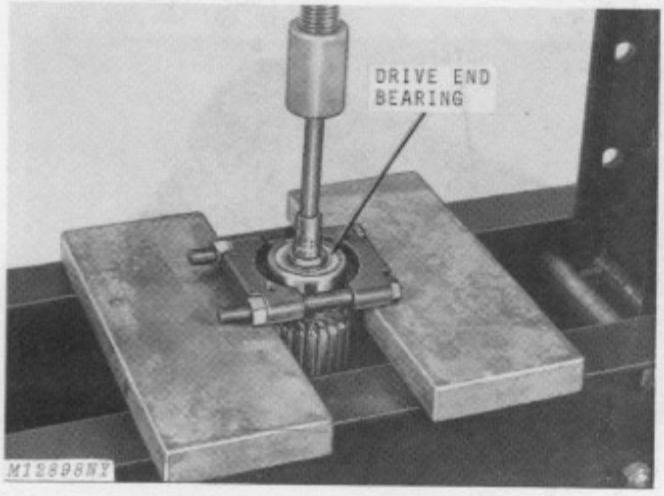

Fig. 14-Removing Drive End Bearing

Use a press to remove the drive end bearing from the armature, Fig. 14.

Remove the commutator end bearing in the same manner.

Inspecting Traction and Mower Motors

Inspect bearings, armature, commutator end cap, drive end cap and brushes. Replace as necessary.

The commutator end of the armature can be trued up on a lathe. Undercut mica and use No. 00 sandpaper to polish the commutator. Do not use emery cloth.

Check magnet fields for cracks or other damage. Replace as necessary.

Replacing Brushes

Replace brushes if they are worn to approximately 7/16 inch (one-half their original length).

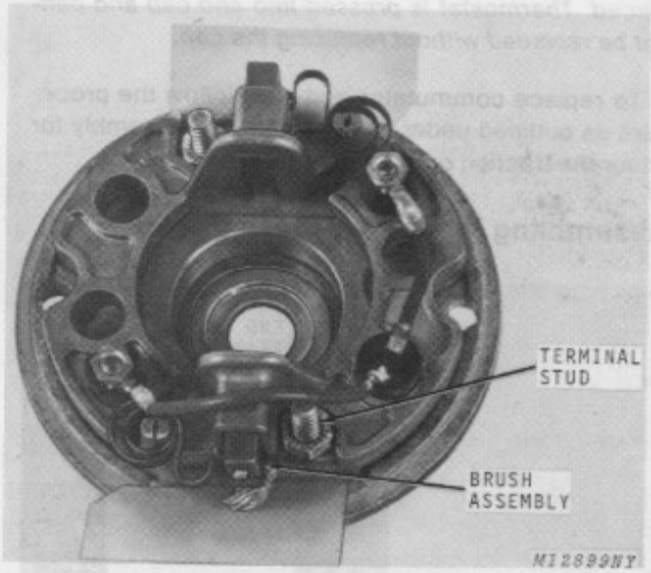

Fig. 15-Brush Assembly

Remove terminal stud, Fig. 15. The lock nut on the opposite end will come off, freeing the brush assembly from the end cap. Hold the brush retaining spring and remove the brushes.

Pull spring out so brush can be installed from the outside toward the center of the cap. Install stud, place brush retaining clip over stud and install lock nut. Hold the nut and turn the stud to tighten.

NOTE: Torque on stud must not exceed 50 inch-lbs. If this torque is exceeded, the plastic separator in the brush holder may distort and cause the brush to bind.

Replacing Bearings

To replace the bearings (traction or mower motors), follow the procedures as outlined under disassembly and assembly for each motor.

Replacing Circuit Breakers (Serial No. 1001-10,000)

Remove motor terminal cover. Disconnect wires from circuit breaker, remove nuts from tie bolts and lift out circuit breakers.

Reverse the above procedure for installation.

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Replacing Thermostats (Serial No. 10,001-)

NOTE: If test, page 20-25-2, reveals the thermostat is defective, the commutator end cap must be replaced. Thermostat is pressed into end cap and cannot be replaced without replacing the cap.

To replace commutator end cap, follow the procedure as outlined under disassembly and assembly for either the traction or mower motors.

Assembling Traction Motor

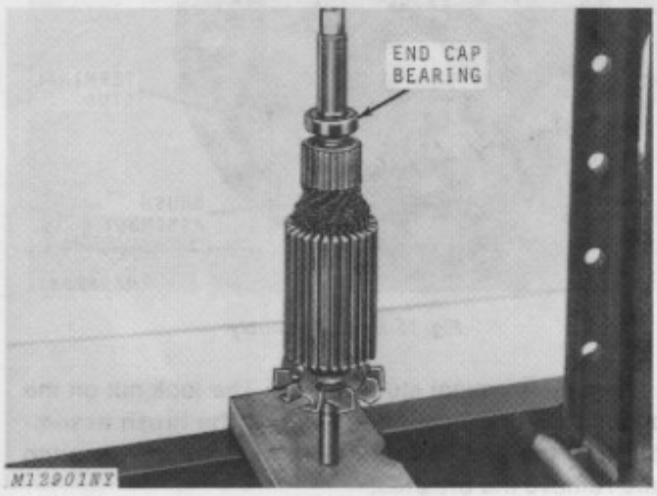

Fig. 16-Installing Commutator End Cap Bearing

Use a press to install the commutator end cap bearing, Fig. 16, on the armature shaft.

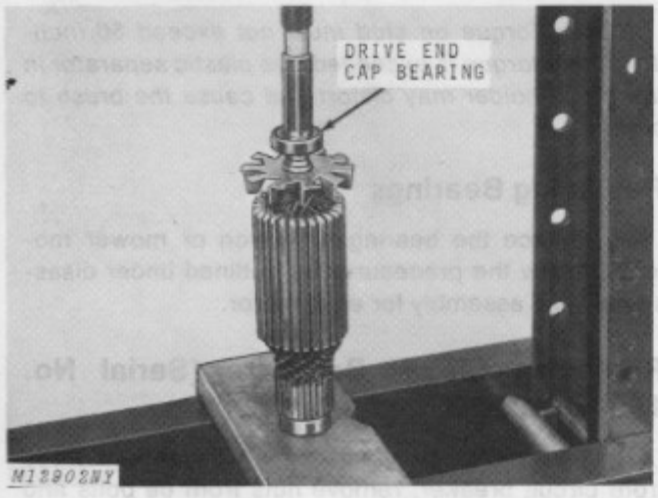

Fig. 17-Installing Drive End Cap Bearing

Turn the armature over and install drive end cap bearing, Fig. 17.

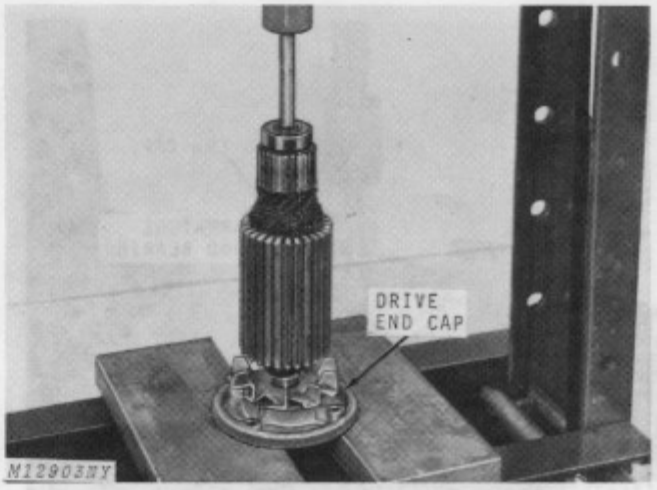

Fig. 18-Installing Armature and Bearing in Drive End Cap

Install drive end cap bearing and armature, Fig. 18, in drive end cap.

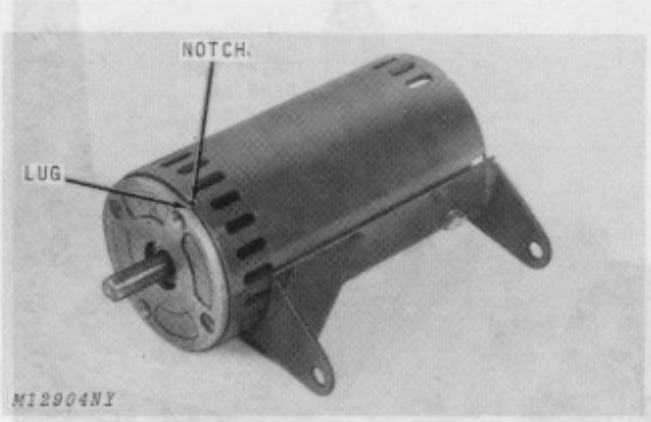

Fig. 19-Installing Armature in Housing

Install armature, Fig. 19, in shell and magnet housing assembly. Be sure end cap lug fits properly in housing notch. Install tie bolts from the drive end.

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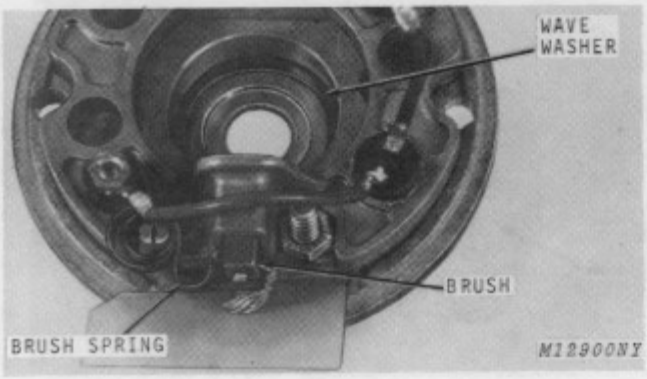

Fig. 20-Brushes Held in Place by Brush Spring

Prepare commutator end cap for installation by pushing brushes to the outside. Hold brushes in place by positioning brush spring against side of brush, Fig. 20. This will hold brush in a retracted position until commutator end cap is in position over armature.

Put a small amount of grease on wave washer and install washer in commutator end cap. The grease holds the wave washer in place while installing end cap.

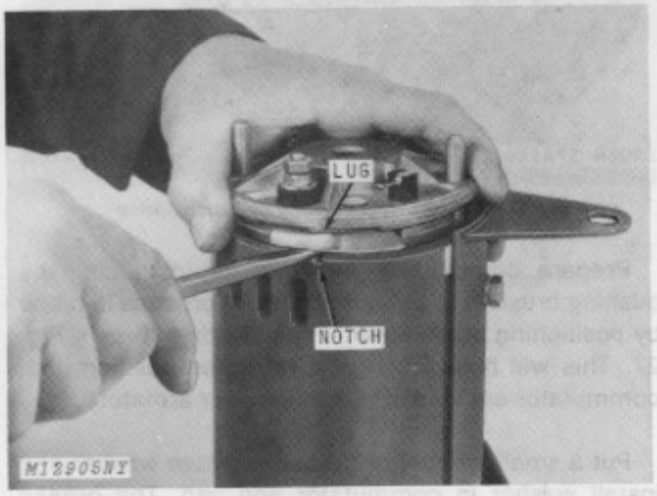

Fig. 21-Pressing Brushes in Place

Slide end cap onto armature end bearing gently until positioned as shown in Fig. 21. Use a screwdriver to press the brushes into place. Position the end cap in place making sure the lug on the end cap fits properly in the housing notch.

Install lock nuts on tie bolts and tighten.

NOTE: Use a flashlight continuity tester and connect to heavy main terminals of motor. Test light should light, indicating that the brushes are seated properly against the commutator.

NOTE: Wiring and terminal cover are installed after the traction motor is installed in the mower.

Install drive sheave by lining up keyway in sheave with key in shaft. Tighten set screws.

Assembling Mower Motor

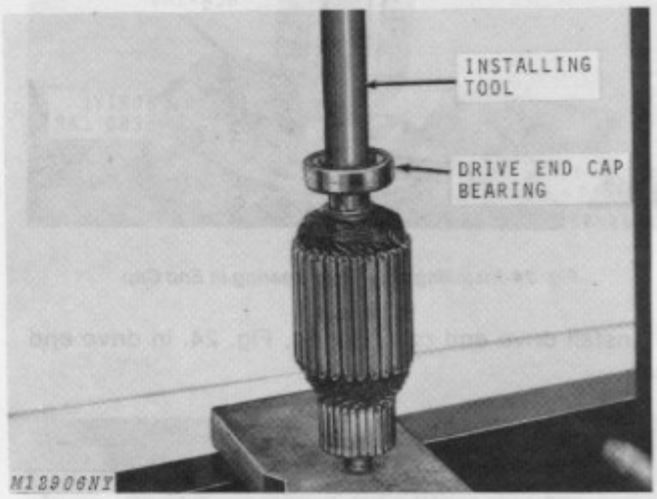

Fig. 22-Installing Drive End Bearing

Use a press to install the drive end cap bearing, Fig. 22, on the armature shaft.

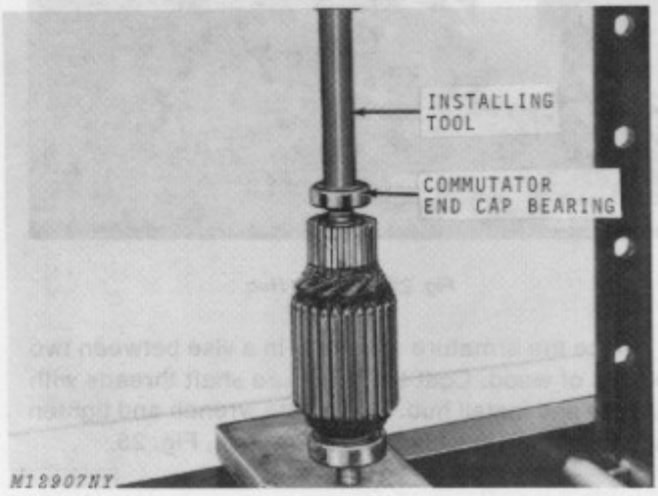

Fig. 23-Installing Commutator End Bearing

Turn the armature over and install the commutator end cap bearing, Fig. 23.

NOTE: When installing the drive end cap and commutator end cap bearings, be sure the installing tool just fits over the shaft and contacts the inner race of the bearing. This will keep from distorting the bearing.

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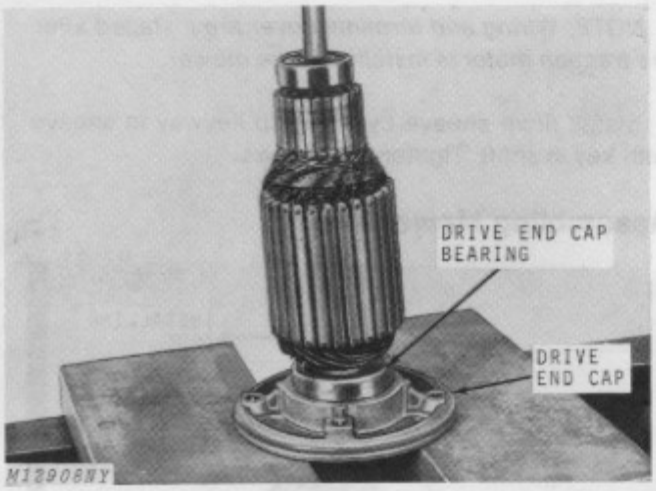

Fig. 24-Installing Drive End Bearing in End Cap

- Install drive end cap bearing, Fig. 24, in drive end cap.

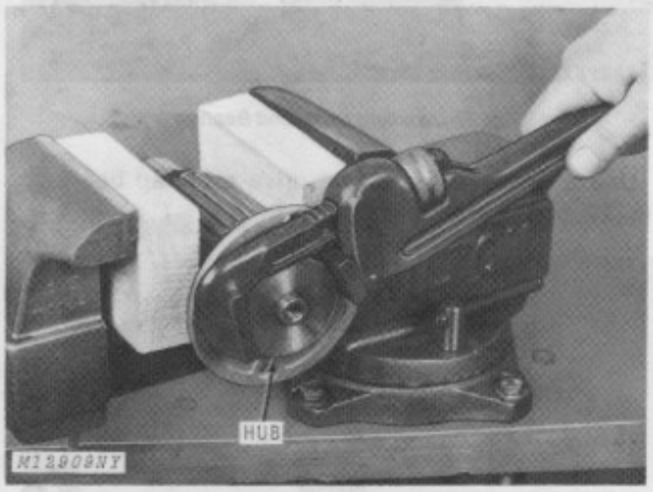

Fig. 25-Installing Hub

Place the armature assembly in a vise between two blocks of wood. Coat the armature shaft threads with Loctite and install hub. Use a pipe wrench and tighten hub by turning in a clockwise direction, Fig. 25.

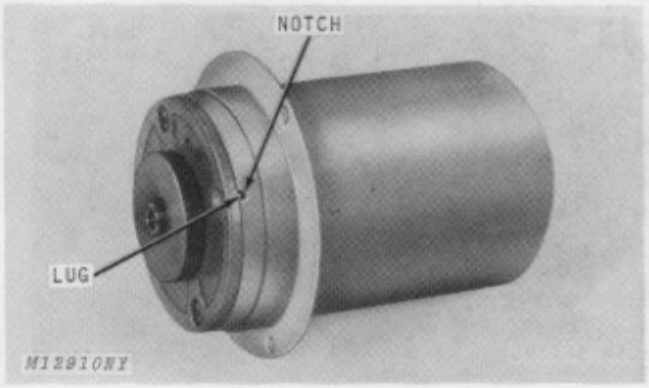

Fig. 26-Notch and Lug Properly Positioned

Install armature, Fig. 26, in shell and magnet housing assembly. Be sure end cap lug fits properly in housing notch. Install tie bolts from the drive end.

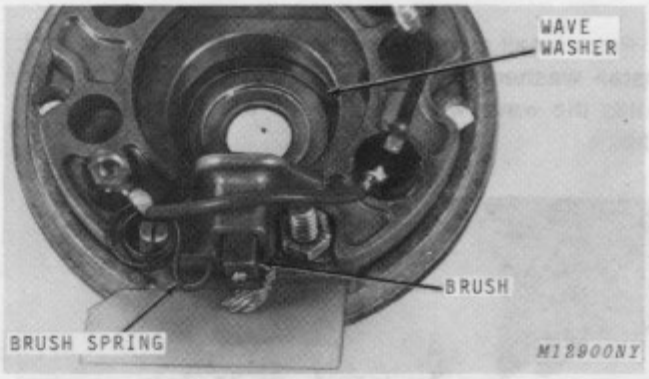

Fig. 27-Brushes Held in Place by Brush Spring

Prepare commutator end cap for installation by pushing brushes to the outside. Hold brushes in place by positioning brush spring against side of brush, Fig. 27. This will hold brush in a retracted position until commutator end cap is in position over armature.

Put a small amount of grease on wave washer and install washer in commutator end cap. The grease holds the wave washer in place while installing end cap.

Fig. 28-Pressing Brushes in Place

Slide end cap onto commutator end bearing gently until in position as shown in Fig. 28. Use a screwdriver to press the brushes into place. Position the end cap in place making sure the lug on the end cap fits properly in the housing notch.

Install lock nuts on tie bolts and tighten.

NOTE: Connect a flashlight continuity tester to heavy main terminals of motor. Test light should light, indicating that the brushes are seated properly against the commutator.

Reconnect wiring to the motor using the color code marked on the end cap during disassembly.

Install terminal cover and hub guard.

INSTALLATION

Installing Mower Motor

Install motor from the bottom of the deck. Flange on motor should be flush with deck. Install cap screws from the bottom with lock washer and nut on top. Tighten nuts securely.

Install mower blade, (bend in blade toward top of mower deck), drive washer and cap screw. Tighten cap screw to 55 ft-lbs torque.

NOTE: Place a screwdriver in the recess in the hub guard and twist using it as a wedge to hold the hub while tightening the blade, Fig. 29.

Refer to page 40-10-1 for installing mower on Electric 90.

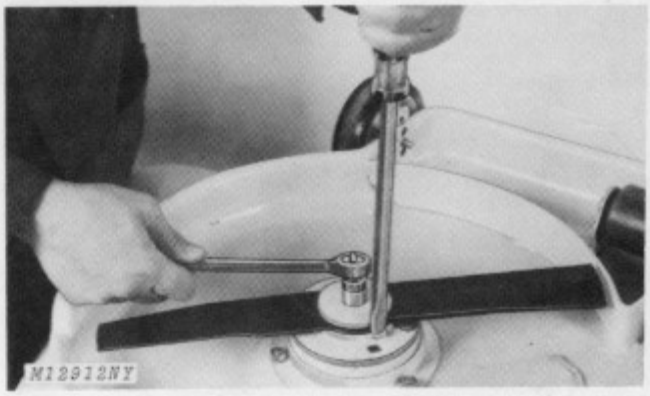

Fig. 29-Wedging Mower Motor Hub

Installing Traction Motor

Install traction motor in Electric 90 with pivot pin and cotter pin.

Use a hoist and raise the front of the mower.

⚠ CAUTION: Do not raise the front too far or electrolyte will spill from the batteries.

Install the drive belt on the traction motor drive sheave.

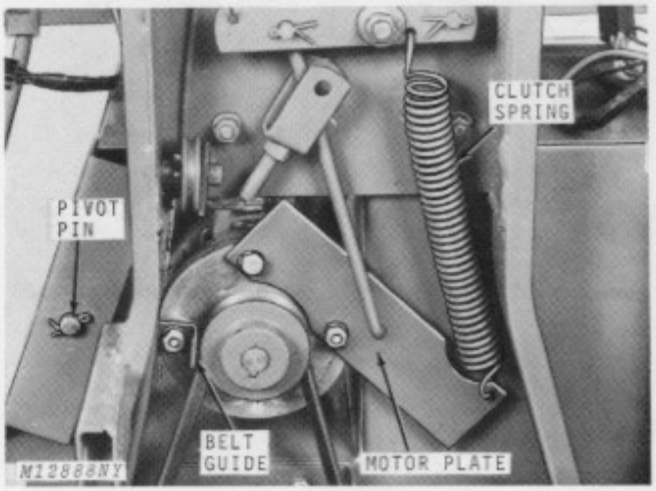

Fig. 30-Installing Traction Motor

Install motor plate, belt guard and connect clutch spring, Fig. 30.

Lower the mower.

Connect wiring to the proper terminals as color coded during the removal procedure.

Install terminal cover and seat and shroud assembly.

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Group 30
SOLENOIDS, SWITCHES, FUSE, AND DIODE

GENERAL INFORMATION

Solenoids

Solenoids on the Electric 90 are designed to do mechanical jobs by means of electromagnets and operate in only one direction.

Solenoids of this type are contacts and windings around a hollow cylinder containing a moveable plunger.

When the winding is energized by the batteries through a switch, the plunger is pulled giving the necessary mechanical movement.

The solenoids are sealed units and must be replaced if defective.

Switches

A switch is a device which opens, closes, or directs an electrical circuit. All switches do basically the same job. The difference is the way they are operated.

The ignition key switch used on the Electric 90, to start the traction motor, must have a key inserted before it can be operated. This type of switch is used because of safety and to avoid theft of the machine.

The toggle switch used to control the mower motors is an "on-off" flip switch. It has a "START" and "RUN" position but will not function until the traction motor is operating.

The neutral or safety-start switch is used to assure that the mower is in neutral before the traction motor is energized. This is a clutch-operated arm-type switch on mowers (Serial No. 1001-10,000) and a shift-lever button-switch on mowers (Serial No. 10,001-).

If any of the switches are defective they must be replaced. Do not try to repair a defective switch. It is cheaper and safer to replace it.

Fuse

The electrical system is protected by a 100 ampere metal strip fuse. The fuse will blow only if a massive short circuit occurs in the system.

A blown fuse will completely shut down the electrical system except for the battery charger. If the mower refuses to operate, always check for a blown fuse and correct the trouble.

Diode

The diode is an isolation diode which allows electrical flow in only one direction. It's purpose is to prevent mower switch burn-out.

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TESTING

Testing Main Solenoid

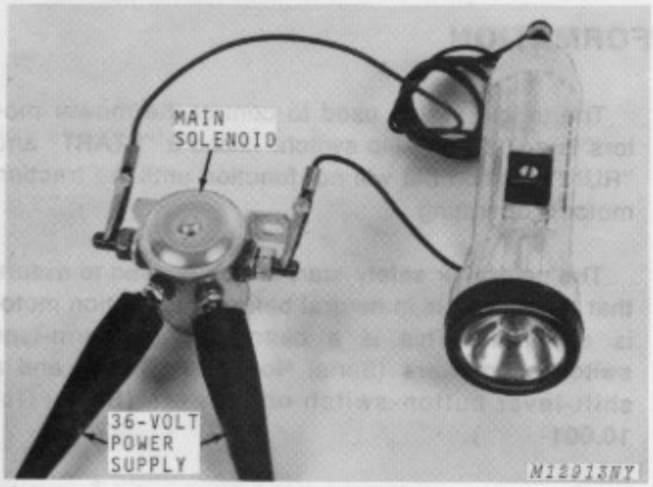

Fig. 1-Testing Main Solenoid

Connect a flashlight continuity tester to the two side terminals. Connect a 36-volt DC power supply to the two small terminals, Fig. 1. The solenoid should click sharply and the test light should light. When the 36-volt DC power supply is removed, the test light should go out.

Testing Mower Solenoid

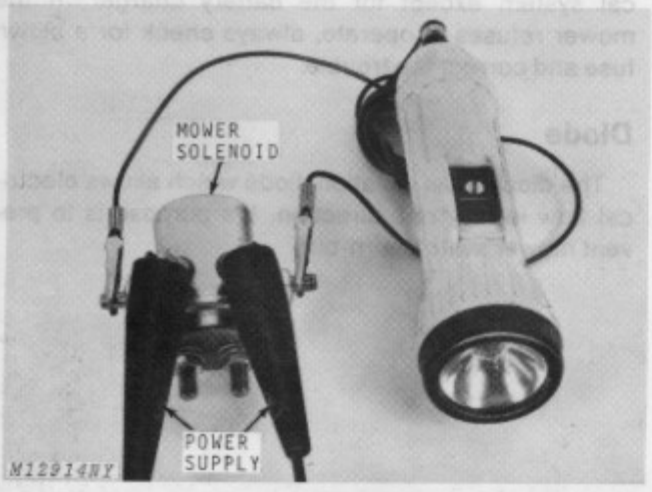

Fig. 2-Testing Mower Solenoid Side Terminals

Test 1 - Connect a flashlight continuity tester to the two side terminals. Connect a 36-volt DC power supply to the two small terminals, Fig. 2. The solenoid should click sharply and the test light should light. When the 36-volt DC power supply is removed, the test light should go out.

Fig. 3-Testing Mower Solenoid Bottom Terminals

Test 2 - Connect a flashlight continuity tester to the bottom terminals of the solenoid. The test light should light. Connect a 36-volt DC power supply to the small terminals, Fig. 3. The test light should not light when a 36-volt DC power supply is connected to the solenoid.

Testing Switches

Neutral or Safety-Start Switch

Fig. 4-Testing Neutral or Safety-Start Switch

Remove both red wires from the switch and connect a flashlight continuity tester to the switch terminals, Fig. 4.

Depress the clutch pedal (Serial No. 1001-10,000) or press the shift lever down in neutral (Serial No. 10,001-), and the test light should light. With the pedal released or the shift lever in gear, the test light should not light.

A malfunction indicates either a faulty switch or that adjustment is required to permit full movement of the actuating arm or button. Adjust or replace the switch as necessary.

Key Switch

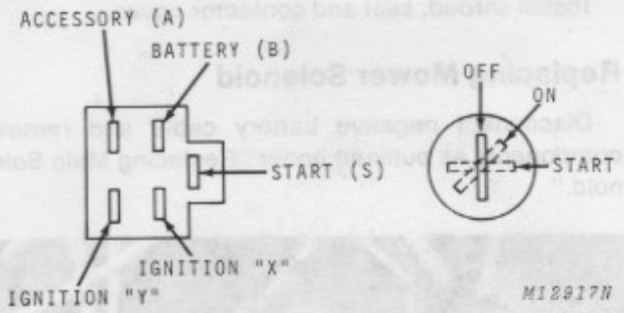

Fig. 5-Testing Key Switch

Test the key switch with a flash light continuity tester. Check for continuity between terminals with the switch placed in each of three positions. See Fig. 5 and the chart below for the correct current flow diagram. Replace switch if defective.

Position	Function	Circuit
1	OFF	—
2	RUN	B & A X & Y
3	START	B & S X & Y

Mower Switch

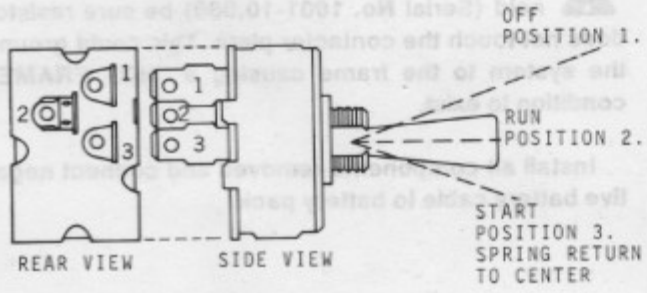

Fig. 6-Testing Mower Switch

With switch in "RUN" position, connect a flashlight continuity tester between terminals 2 and 3, Fig. 6. The light should light. With switch held in "START" position, connect a test light between terminals 1 and 2 and terminals 2 and 3. The light should light.

With switch in "OFF" position, the light should NOT light on any combination of terminals. Replace switch if necessary.

Testing Diode

NOTE: A blown diode will let the mower motors start, but they will not continue to run.

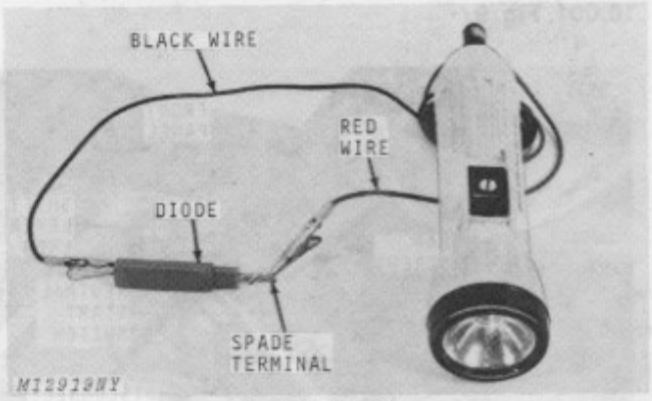

Fig. 7-Testing Diode

Use a flashlight continuity tester to check the diode, Fig. 7, for continuity in one direction ONLY.

With the leads connected one way, the test light should light. With the leads reversed, the test light should not light. If the light does not light in either direction, the diode has failed in the "OPEN" position and must be replaced.

Testing Fuse

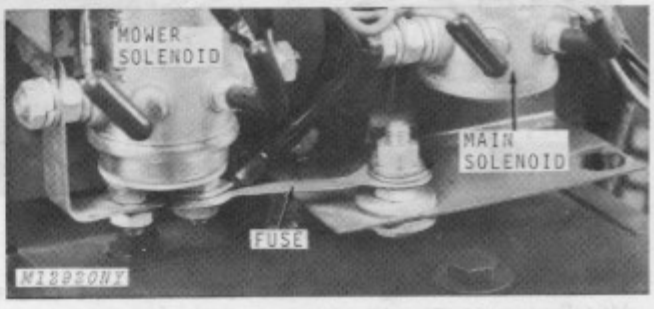

Fig. 8-Fuse (Serial No. 10,001-)

There is no test for the fuse, Fig. 8. If the fuse has blown, replace it with a new fuse.

REPAIR

Replacing Main Solenoid

Remove seat, shroud and contactor cover over solenoids.

Disconnect negative battery cable from battery pack.

Remove shift lever knob.

Disconnect wiring harness from key switch, mower switch and neutral-start switch. The neutral-start switch is on the front panel beginning with Serial No. 10,001, Fig. 9.

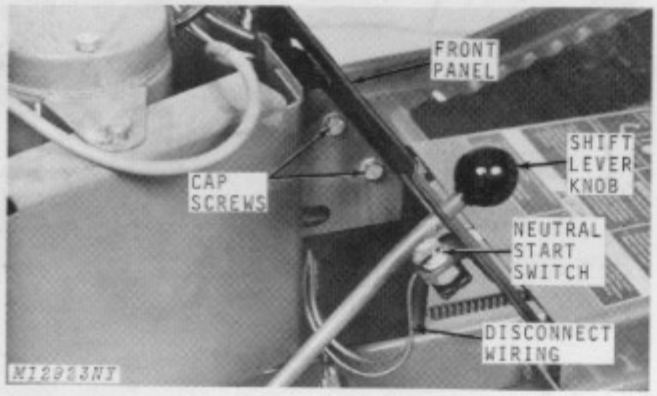

Fig. 9-Removing Front Panel

Remove cap screws (two on each side), Fig. 9, and shift lever knob. Lift off front panel.

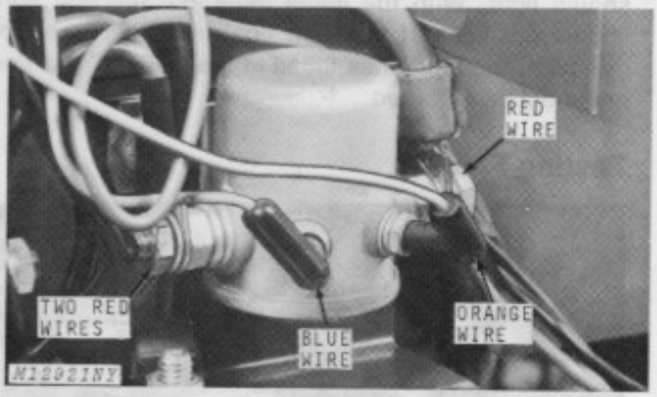

Fig. 10-Removing Main Solenoid

Disconnect wiring from the four terminals of the main solenoid, Fig. 10, and remove the main solenoid from the contactor plate.

Install a new main solenoid on contactor plate and reconnect wiring, Fig. 10.

Install front panel, wiring connectors to switches, shift lever knob and connect negative battery cable to the battery pack.

Install shroud, seat and contactor cover.

Replacing Mower Solenoid

Disconnect negative battery cable and remove components as outlined under "Replacing Main Solenoid."

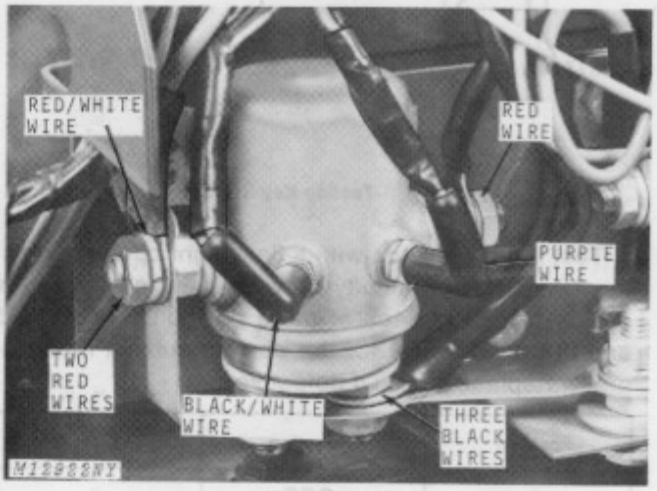

Fig. 11-Removing Mower Solenoid

Disconnect wiring from the five terminals on the mower solenoid, Fig. 11, and remove solenoid from the contactor plate.

Install a new mower solenoid on contactor plate and reconnect wiring to solenoid, Fig. 11.

⚠ CAUTION: When connecting resistor to solenoid (Serial No. 1001-10,000) be sure resistor does not touch the contactor plate. This could ground the system to the frame causing a "HOT FRAME" condition to exist.

Install all components removed and connect negative battery cable to battery pack.

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Replacing Switches (Main, Mower, and Neutral-Start)

Disconnect wiring harness couplers from switches. Remove lock nut securing switch to front panel and remove switch. Reverse procedure for installation.

NOTE: The safety-start switch on Electric 90 Mowers (Serial No. 1001-10,000) is located under the mower frame and is removed by taking out two self-tapping screws.

Replacing Diode

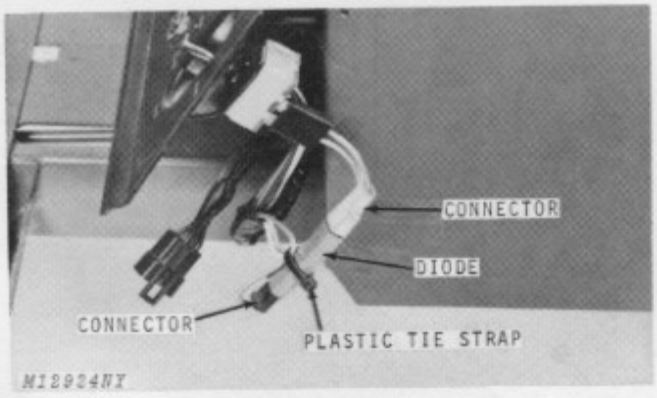

Fig. 12-Replacing Diode

Pull the connector from each end of the diode, Fig. 12. Install a new diode.

Replacing Fuse

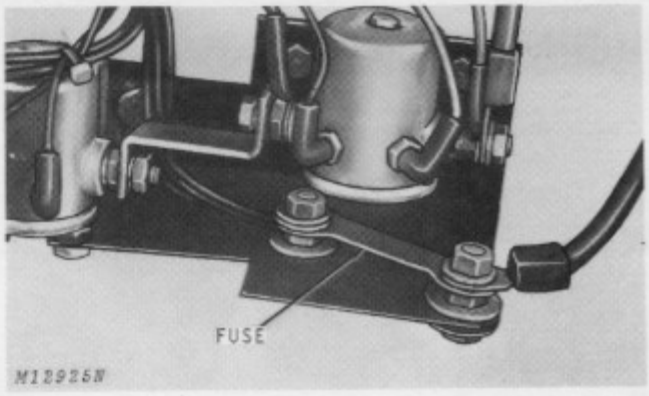

Fig. 13-Fuse (Serial No. 1001-10,000)

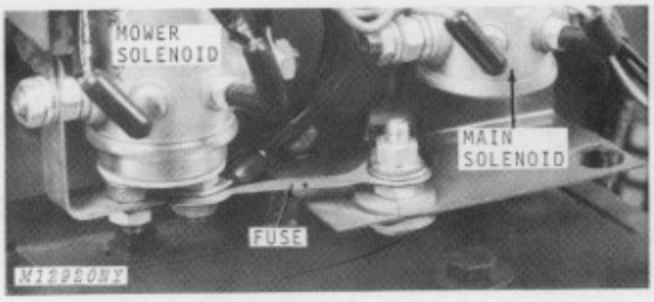

Fig. 14-Fuse (Serial No. 10,001-)

Fig. 13 shows the fuse for mowers (Serial No. 1001-10,000) and Fig. 14 shows the fuse for mowers (Serial No. 10,001-). Remove and replace if necessary.

Group 35
WIRING HARNESSES

WIRING HARNESS (Serial No. 1001-10,000)

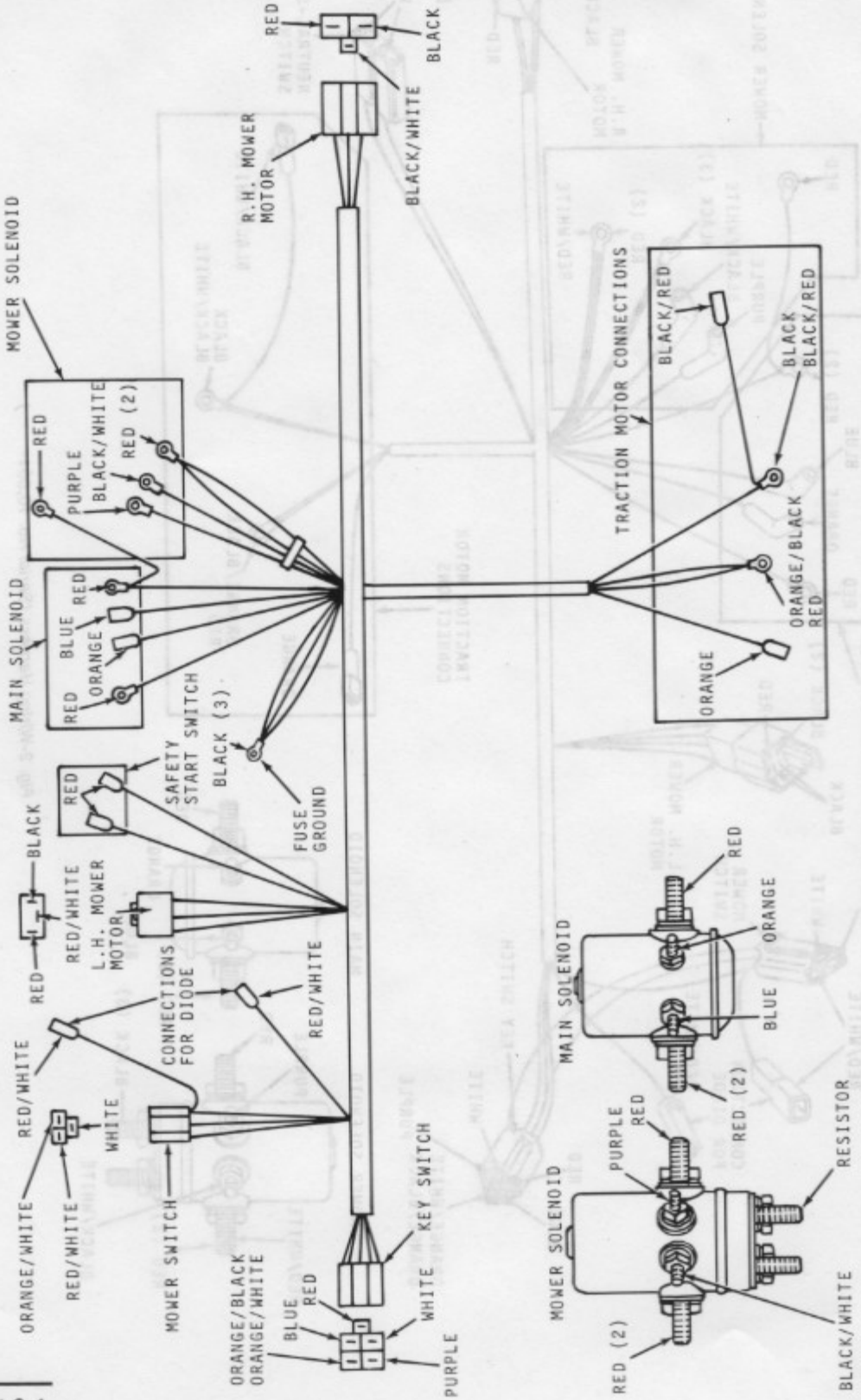

Fig. 1-Wiring Harness (Serial No. 1001-10,000)

WIRING HARNESS (Serial No. 10,001-)

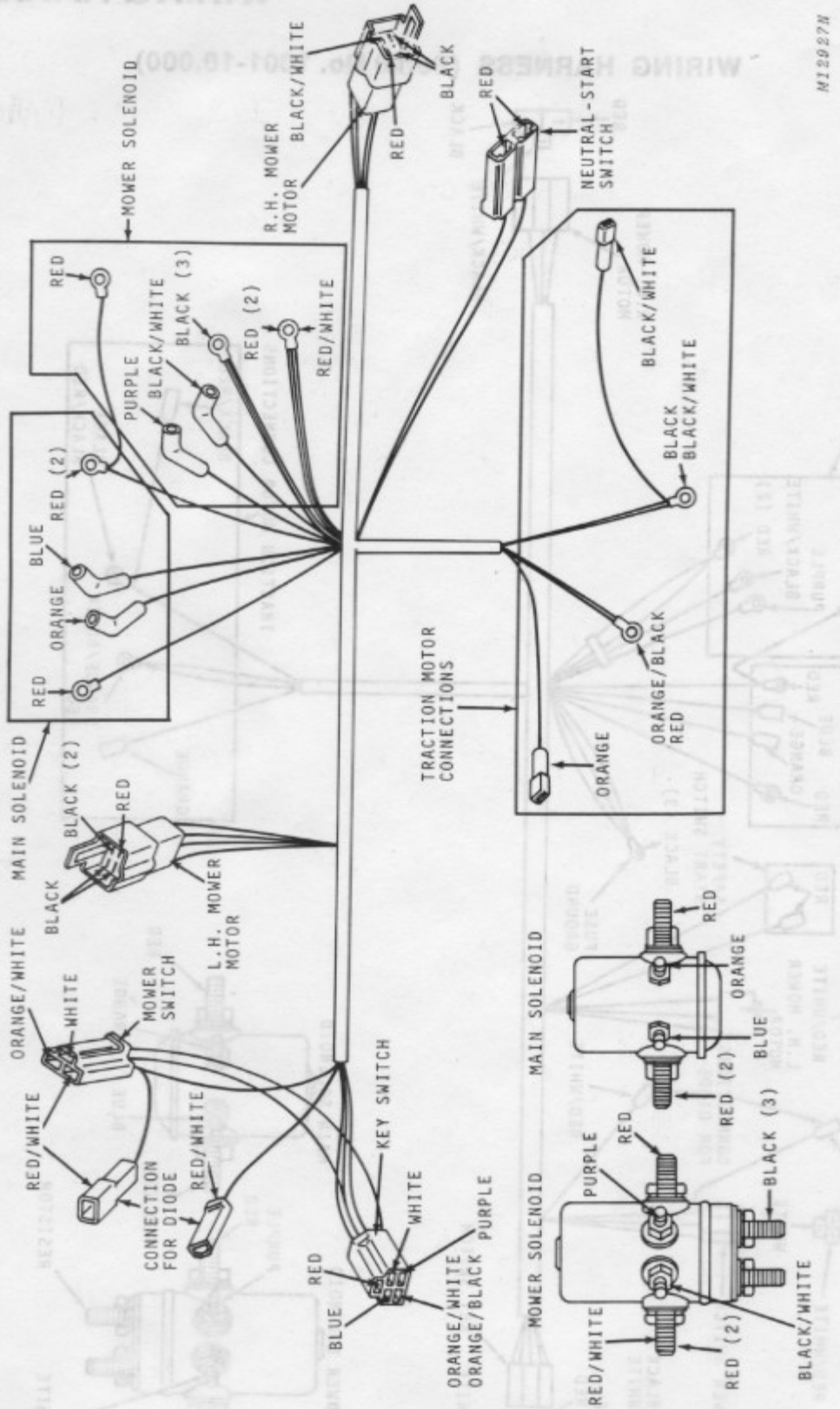

Fig. 2-Wiring Harness (Serial No. 10,001-)

Section 30
POWER TRAIN

Group 5
GENERAL INFORMATION

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Litho in U.S.A.

DESCRIPTION

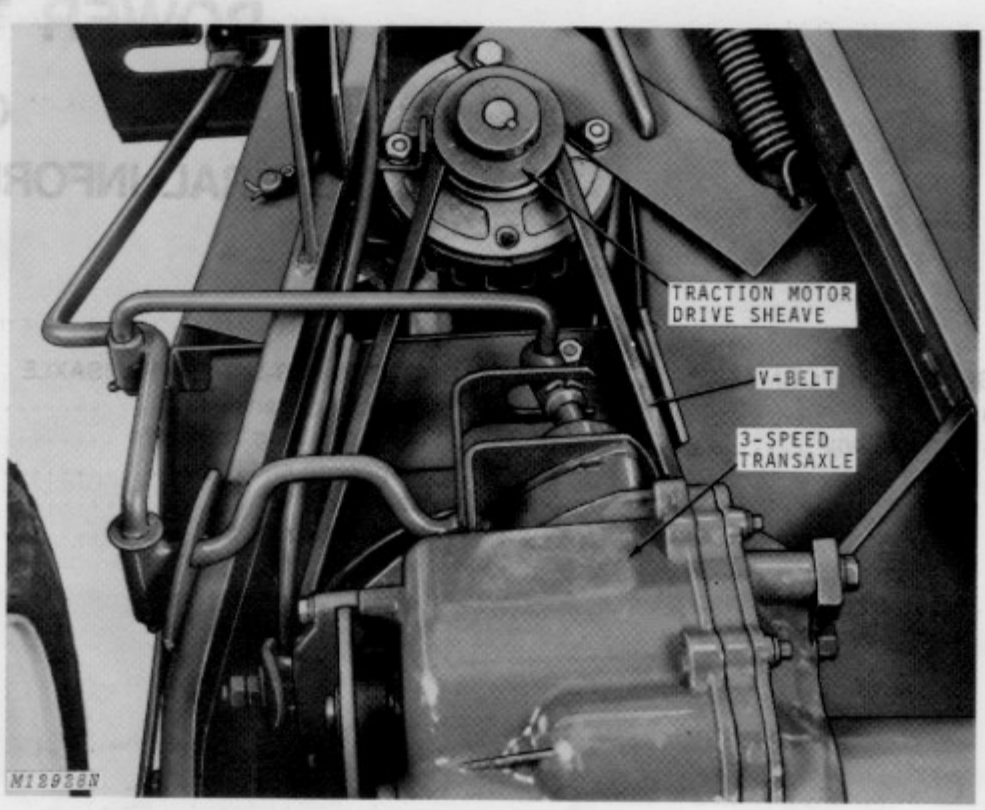


Fig. 1-Electric 90 Power Train

The power train on the Electric 90 Mower, Fig. I, consists of a traction motor drive sheave, V-belt and a 3-speed transaxle. Power flow is through the V-belt to the transaxle.

The transaxle is a complete unit consisting of a transmission and differential axle and performs three specific functions: speed selection, rear axle support and braking.

Gear shifting is accomplished with a shift lever, mounted on the transaxle and two separate shifter forks and gear assemblies. One fork controls the reverse and first gear positions and the other fork controls the second and third gear positions.

The transaxle has automotive-type alloy gears turning on anti-friction bearings and is oil-bath lubricated. Needle bearings are used throughout.

DIAGNOSING MALFUNCTIONS

Unit Cannot Be Shifted (Or Difficult To Shift)

Gears improperly installed.

Forks and rod assembly incorrectly installed.

Axle housing not tight (seal retainers not properly seated).

Shift lever improperly positioned.

Shift lever housing misaligned to case.

Shifter stop assembled backwards.

Chamfer on shift gears on wrong side.

Unit Is Noisy

Unit low on oil.

Metallic pieces and/or other foreign objects in unit.

Worn gears.

Worn bearings - mainly input shaft ball bearing.

Unit Jumps Out Of Gear

Shift lever improperly assembled in housing.

Teeth of gears are worn beyond tolerances.

Spring in shifter fork weak or broken.

Screws for shift lever and housing not properly torqued.

Shift lever bent and hitting unit frame.

Shift rod grooves worn.

Shift rod of improper length.

Shift rod improperly grooved.

Constant mesh gears improperly installed on counter shaft.

Axles Cannot Be Turned (Same Direction) With Unit In Neutral Gear

Axle housing not tight (seal retainers not properly seated).

Burrs on gearing.

Parts missing.

Broken shifter stop allowing unit to be shifted into two speeds at the same time.

Thrust washers in wrong position.

Bearings not pressed in deep enough.

Improper fit of case to cover.

Dowel pins not installed.

Gears improperly installed.

Input shaft not properly installed.

Differential installed improperly.

Seal retainers improperly positioned.

Unit Does Not Drive

Differential bevel gears broken.

3-gear cluster countershaft key sheared.

Stripped teeth on gears.

Key sheared in drive pulley.

Broken input gear.

Litho in U.S.A.

Group 10
3-SPEED TRANSAXLE

REMOVING TRANSAXLE

Remove mower, refer to page 40-10-1.

Remove seat and shroud.

Disconnect and remove batteries.

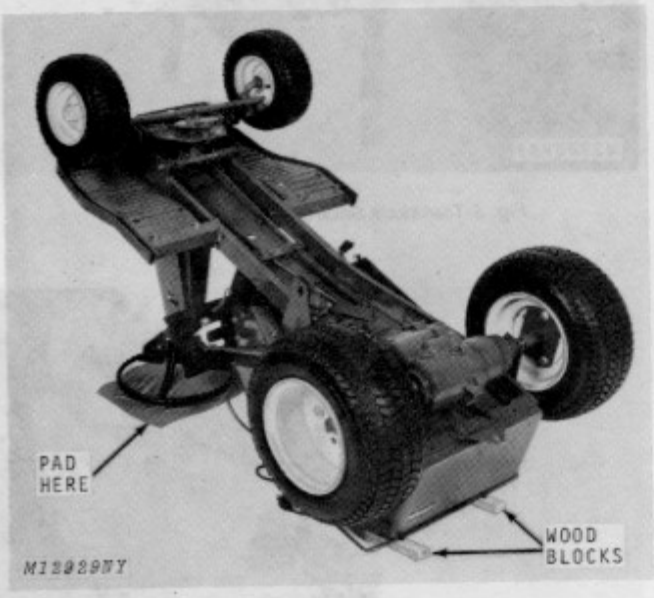


Fig. 1-Electric 90 Upside Down

Turn the Electric 90 upside down as shown in Fig. 1. Use padding under the machine and steering wheel to keep from scratching it.

Fig. 2-Removing Wheels and Hubs

Remove bolts securing right- and left-hand wheel hubs to axle, Fig. 2, and remove wheels with hubs.

Depress clutch pedal and remove drive belt from traction motor drive sheave.

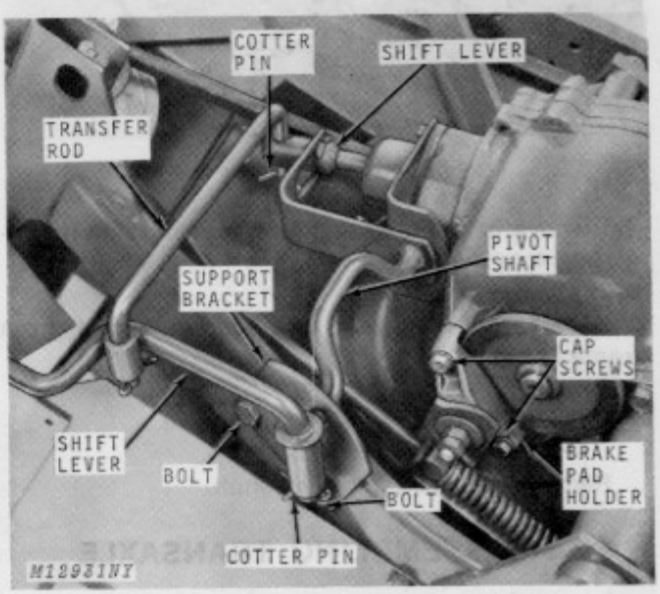


Fig. 3-Removing Shift Lever and Transfer Rod

Remove cotter pins, Fig. 3, and lift out shift lever and transfer rod.

Remove two bolts securing pivot shaft support to frame, Fig. 3.

Remove cap screws securing brake pad holder to transaxle (Serial No. 10,001-), Fig. 3. Brake pad and brake pad plate come off with holder. On Electric 90 (Serial No. 1001-10,000), remove the brake band assembly.

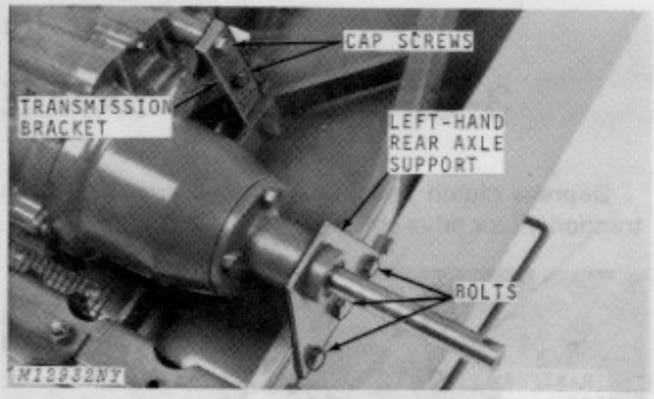


Fig. 4-Removing Transmission Bracket

Remove cap screws securing transmission bracket, Fig. 4, to transaxle.

Remove left-hand rear axle support, Fig. 4, from frame and axle.

Remove drive belt from driven sheave.

Remove transaxle with pivot shaft.

DISASSEMBLING TRANSAXLE

Loosen two set screws securing driven sheave to input shaft and remove sheave.

Remove disk brake by sliding it off brake shaft and remove brake pad from recess in transaxle case.

Place shift lever in neutral.

Remove pivot shaft and shift lever housing from transaxle. Tip transaxle to drain the lubricant.

Remove Woodruff keys from the input and brake shafts.

Remove the rear axle housings. Place the unit in a bench receptacle or soft jaw vise with the socket-head cap screws facing up, Fig. 5.

Remove the socket-head cap screws and drive out the dowel pins (one on each side) used to align the case and cover, Fig. 6.

Tape the end of the axle shaft to protect the seal in the cover assembly and lift off the cover. Discard the gasket.

NOTE: The seal is a single lip-type seal and it may be reused if care is taken so that it isn't damaged.

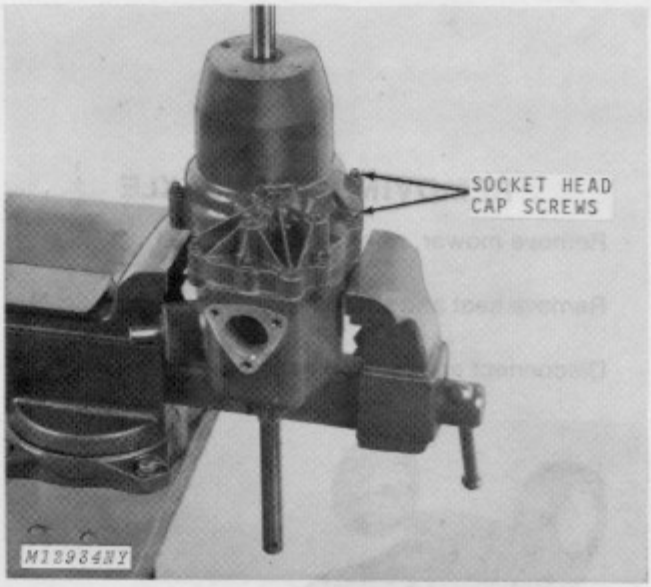


Fig. 5-Transaxle Socket-Head Cap Screws

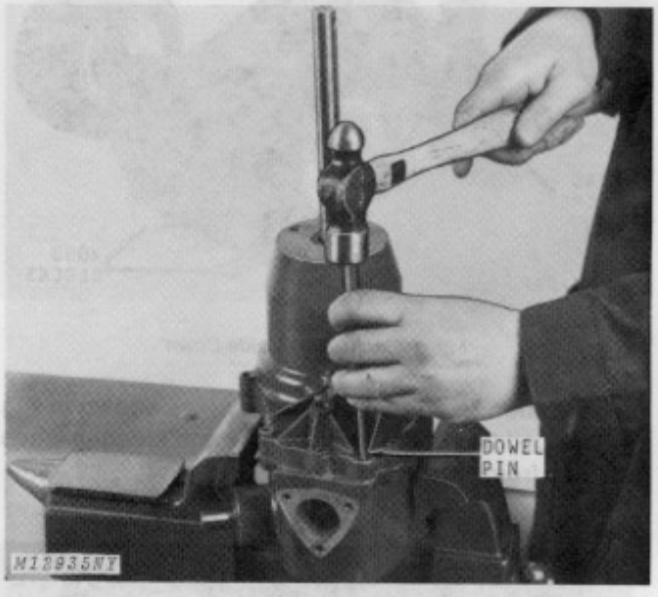


Fig. 6-Removing Dowel Pins

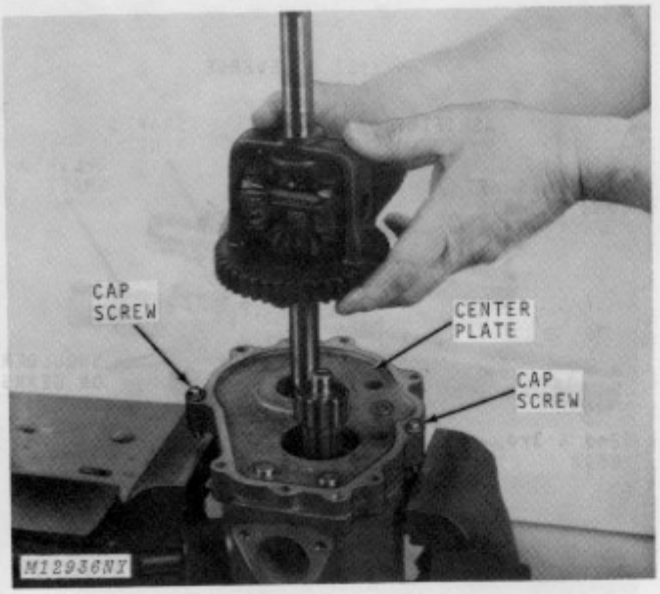


Fig. 7-Removing Differential Assembly

To remove differential assembly, Fig. 7, it may be necessary to replace two or three socket head screws to hold center plate in place. Pull assembly straight up. If tight, tap on lower axle shaft with soft mallet. Remove temporary retaining screws and center plate. Discard gasket.

Fig. 8-Removing Shifter Assembly

Remove reverse idler spacer, shaft and reverse idler gear, Fig. 17.

Remove complete shifter assembly by grasping shifter gears, shaft and both shifter rods, Fig. 8. Remove as a unit.

Remove gear cluster assembly, Fig. 8, idler gear, beveled idler gear, thrust washers and thrust bearing, Fig. 13.

Remove oil seal and snap ring from input shaft and remove shaft with two thrust washers and bearing from transaxle case, Fig. 13.

INSPECTION AND REPAIR

Replace all gears having chipped, broken or worn teeth. Scored gears must be replaced.

Replace any shaft that is bent, scored or worn. Replace any shaft showing side wear or spline damage.

NOTE: Chipped or broken teeth or excessive wear on gear teeth ends is usually caused by shifting gears while mower is moving or by gears not being properly meshed when mower is under load. Gear wear can cause gears to jump out of position.

When the gears slide out of mesh, especially under load, gear chipping or cracking will result.

Prolonged heavy hitch plate loads and wheel slippage, are the most common causes of bevel pinion gear failure, in the differential section of the transaxle.

3-Gear Cluster

Dissassemble 3-gear cluster and check shaft and gears for damage or wear. Replace parts as necessary. Reassemble in the following manner:

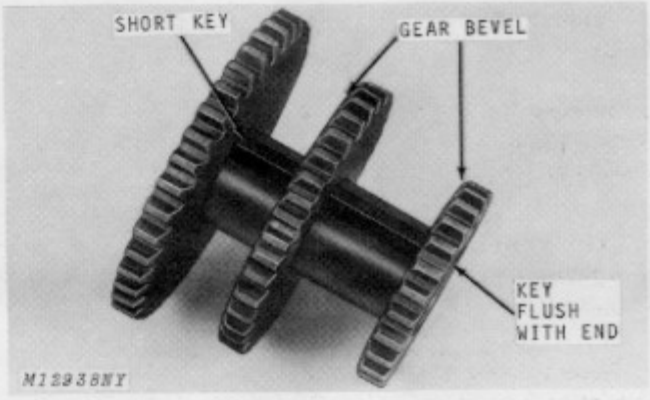


Fig. 9-3-Gear Cluster Assembly

The small and middle gear bevels face the large gear, Fig. 9. The short section of key is between the large and middle gear. The key must be flush with shaft ends when properly assembled.

Shifter Assembly

Disassemble shifter assembly and check each shaft, shifters and gears for damage or wear. Replace parts as necessary.

Reassemble in the following manner:

Install 1st and reverse gears and 2nd and 3rd gears on splined shaft with shoulders on gears facing each other, Fig. 10.

Move shifter into detents on shifter shafts until one notch is visible, Fig. 10, between shifter and snap ring on the shaft. This is neutral position.

NOTE: If shifter will not stay in detent, replace ball and spring located in the shifter.

Place leg of shifter into appropriate shoulder of gear.

Install shifter stop, Fig. 11, so the notch on the stop lines up with notches on the shifters. Press entire assembly together with your hands so that shifters and shifter stop are together, Fig. 11.

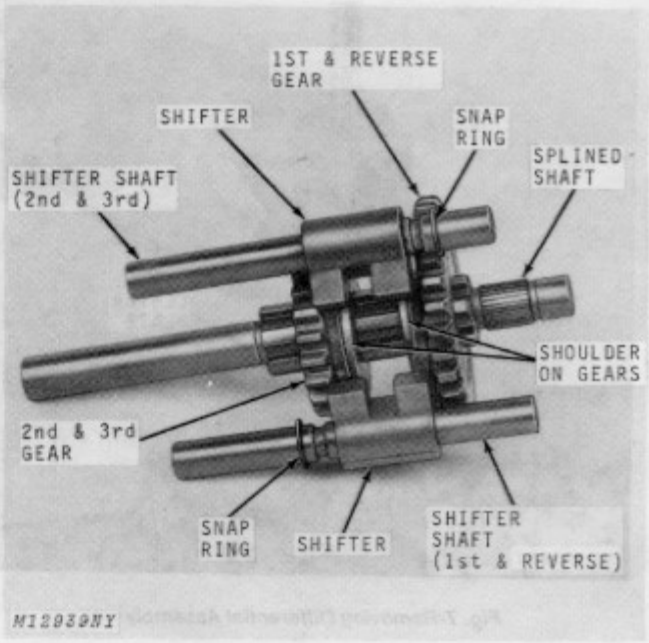


Fig. 10-Installing Gears on Splined Shaft

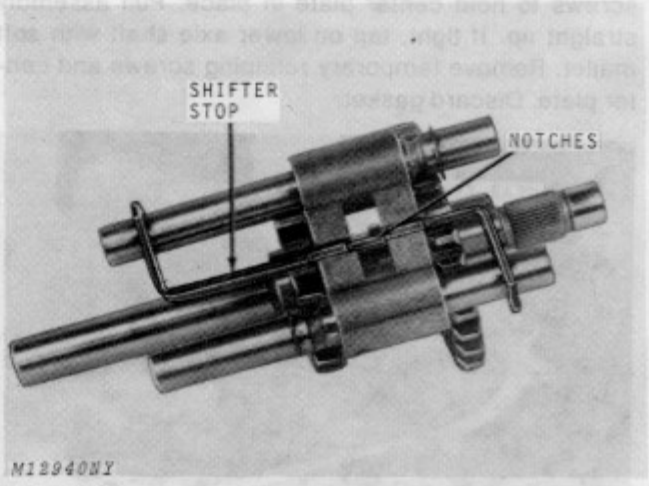
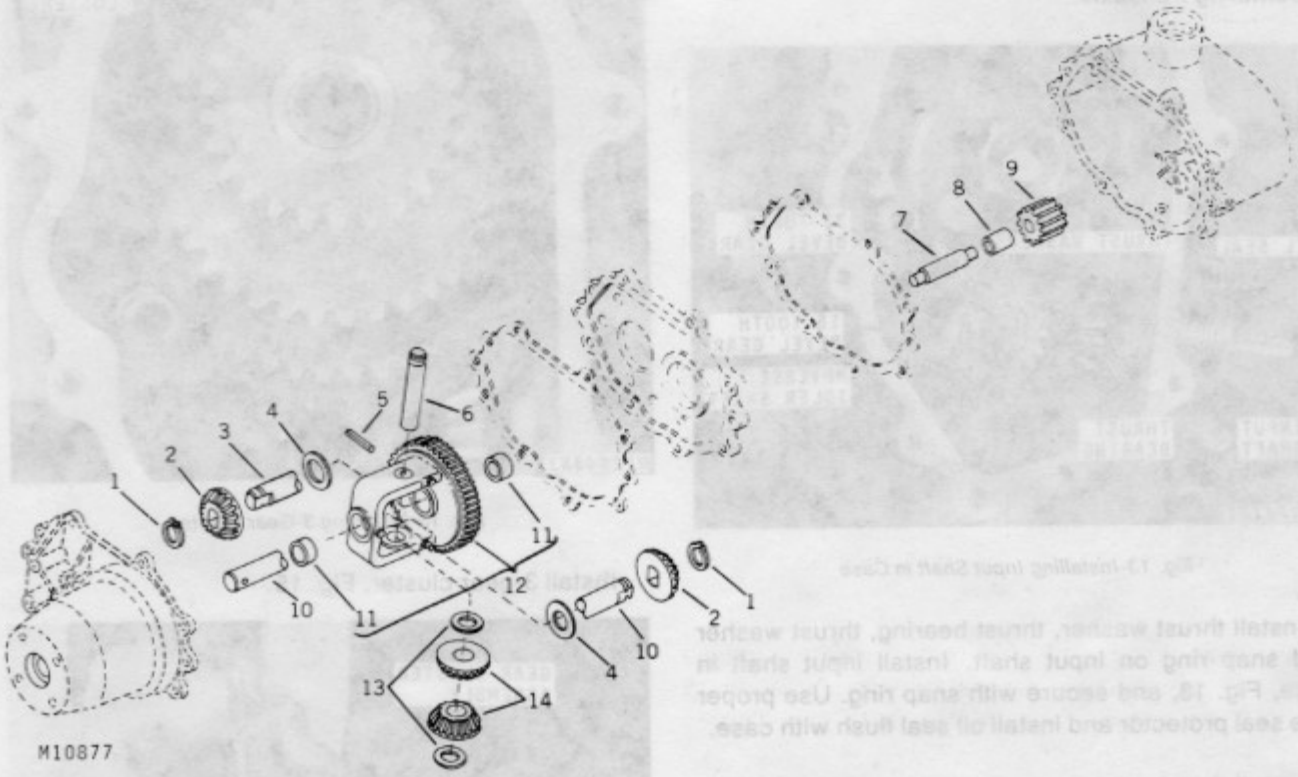


Fig. 11-Installing Shifter Stop

Differential Assembly



1—Snap Ring
2—Bevel Gear
3—Right-Hand Axle
4—Thrust Washer
5—Spring Pin
6—Drive Pin
7—Reverse Idler Shaft
8—Reverse Idler Spacer
9—Reverse Idler
10—Left-Hand Axle
11—Bronze Bearing
12—Differential Gear
13—Thrust Washer
14—Bevel Pinion

Fig. 12-Exploded View of Differential Assembly

Use a suitable driver and drive out spring pin, (5, Fig. 12), securing drive pin (6) to differential gear (12). Remove drive pin (6).

Remove thrust washers (13). Remove bevel pinions (14) simultaneously by rotating the bevel gears (2) in opposite directions; pinions will move out of position.

Remove snap rings (1), bevel gears (2) and thrust washers (4) from right and left-hand axles. Remove axles (3 and 10) from differential gear (12).

Inspect bushings, pinions, gears and shafts for wear and replace as necessary.

Install right-hand (long) axle (3, Fig. 12) into differential gear. Place thrust washer (4) and bevel gear (2) on axle. Secure with snap ring (1).

Install short axle (left-hand) in differential carrier. Place thrust washer (4) and bevel gear (2) on axle. Secure with snap ring.

Install bevel pinions (14) **Simultaneously From Opposite Sides** by rotating pinions in opposite direction while sliding them into position. Check alignment by inserting fingers into drive pin holes. If not aligned, drive pin cannot be inserted. Remove and replace bevel pinions, because one tooth out of position will cause misalignment.

After aligning, insert thrust washers (13) behind each pinion. Install drive pin (6) and secure with spring pin (5).

ASSEMBLY

NOTE: Always use new oil seals and gaskets when assembling transaxle.

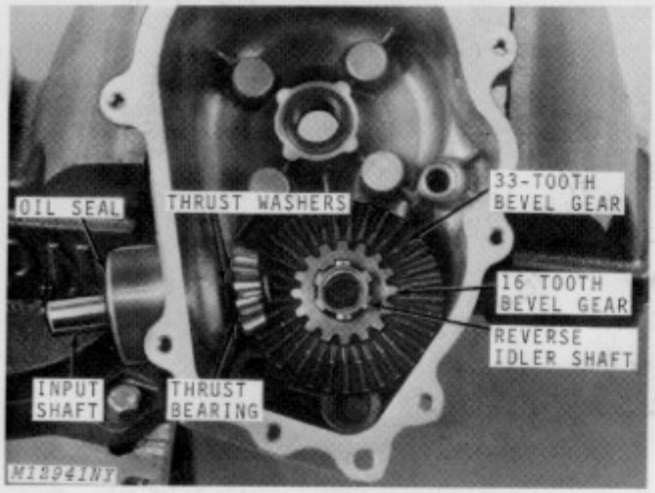


Fig. 13-Installing Input Shaft in Case

Install thrust washer, thrust bearing, thrust washer and snap ring on input shaft. Install input shaft in case, Fig. 13, and secure with snap ring. Use proper size seal protector and install oil seal flush with case.

Install thrust washer, thrust bearing, thrust washer and 33-tooth bevel gear in case. Install 16-tooth gear on idler shaft and install idler shaft in bevel gear, Fig. 13. This helps hold thrust washers and thrust bearing in place when installing shifter assembly.

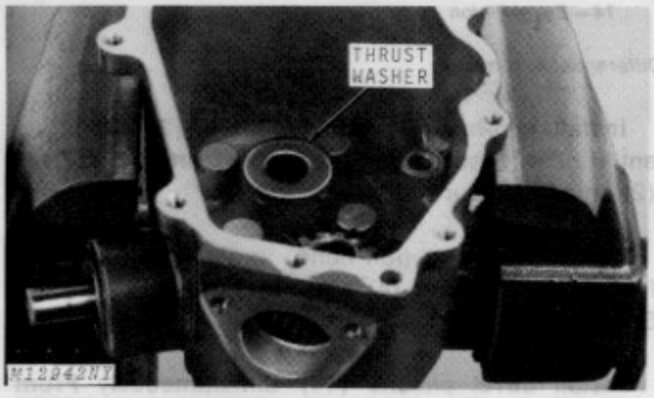


Fig. 14-Installing 3-Gear Cluster Thrust Washer

Install 3-gear cluster thrust washer, Fig. 14.

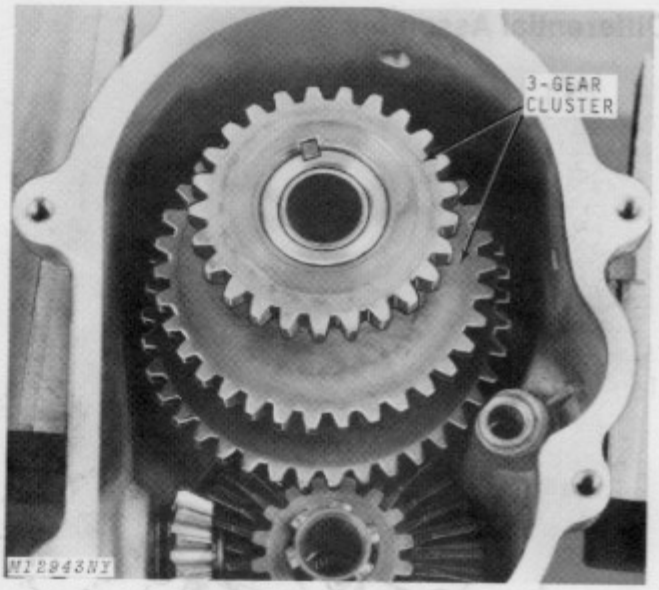


Fig. 15-Installing 3-Gear Cluster

Install 3-gear cluster, Fig. 15.

Fig. 16-Installing Shifter Assembly

Grasp shifter assembly firmly and install in case, Fig. 16. Be sure shifter shafts fit in holes in case and splined shaft is properly positioned in idler shaft.

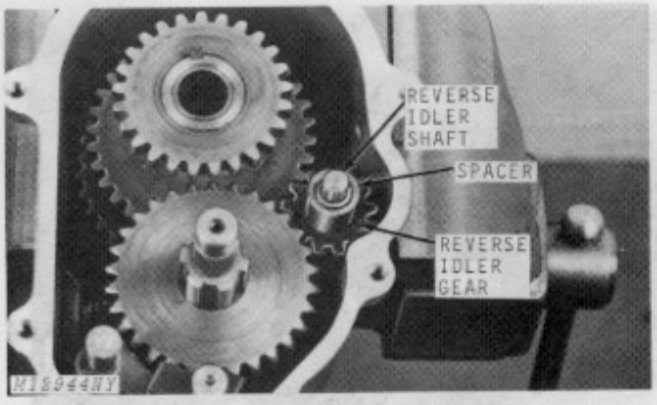


Fig. 17-Installing Reverse Idler Gear, Shaft and Spacer

Install reverse idler shaft, reverse idler gear, (beveled edge of gear up) and spacer, Fig. 17.

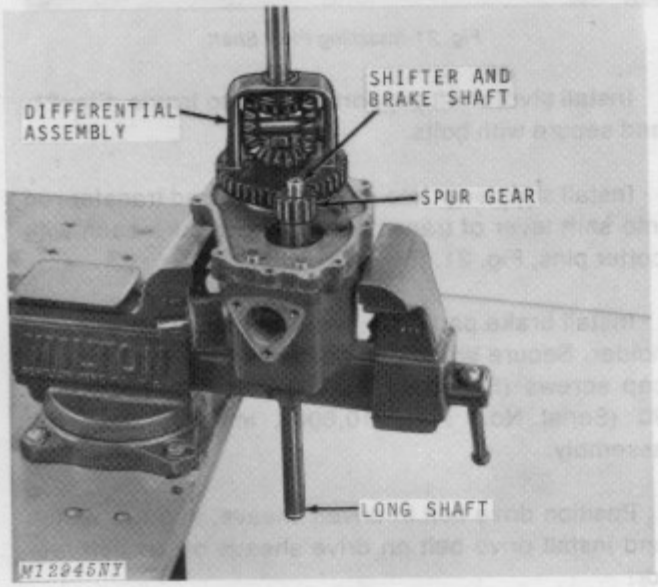


Fig. 18-Installing Differential Assembly

Install new gasket and center plate. Be sure shifter shafts protrude through center plate, Fig. 18. Install spur gear on shifter and brake shaft. Install differential assembly with the long shaft of the assembly through the case, Fig. 18.

Install new gasket on top of center plate. Tape the end of the shaft to protect cover seal from damage and install cover assembly.

Start dowel pins and tap them gently in place to align case, cover plate and cover. Install and tighten socket-head cap screws to 7 to 9 ft-lbs.

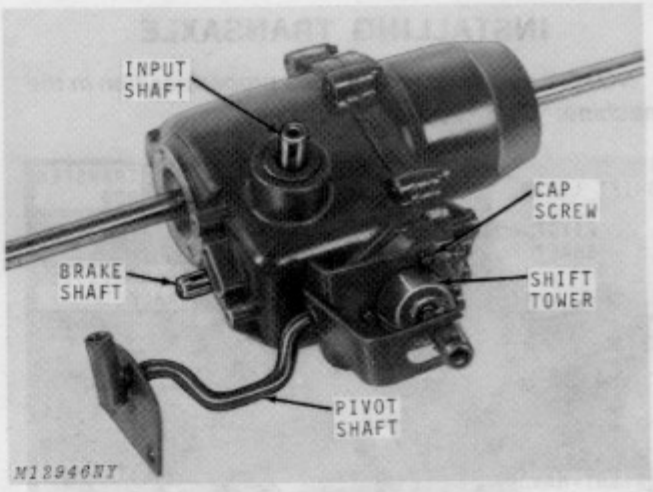


Fig. 19-Installing Shift Tower and Pivot Shaft Assembly

Turn the transaxle so the shift lever hole is up and fill the transaxle with 24 ounces of AM30200 Transmission Lubricant or SAE 90 gear lubricant. Install shift tower with pivot shaft assembly and tighten cap screws to 10 ft-lbs torque, Fig. 19.

Install right and left-hand rear axle housings and tighten cap screws to 13 to 15 ft-lbs torque.

Install Woodruff key in input shaft. Install driven sheave on input shaft. Be sure keyway in sheave and Woodruff key line up. Tighten set screws to secure sheave to shaft.

Install brake pad in recess in transaxle case and Woodruff key in brake shaft. Install disk brake over key and shaft to hold brake pad in place.

INSTALLING TRANSAXLE

NOTE: Lay the drive belt in its proper position in the machine.

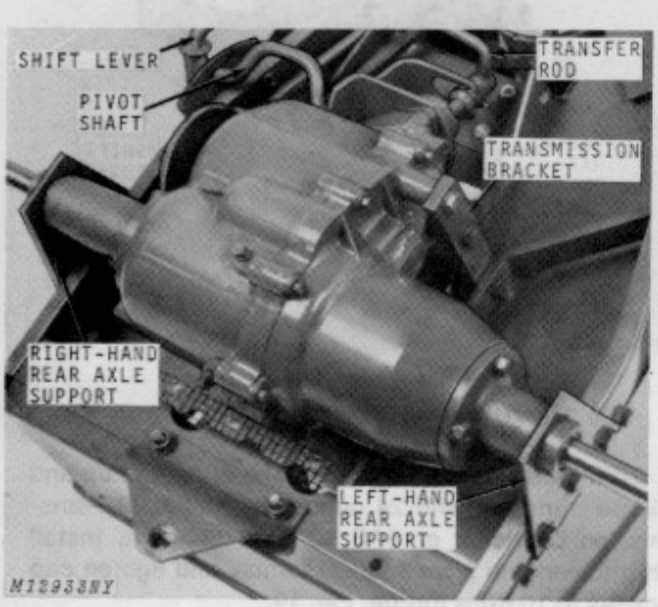


Fig. 20-Installing Transaxle

Install right-hand axle in right-hand axle support, Fig. 20. Install left-hand axle support over left-hand axle and secure to frame with bolts, lock washers and nuts.

Install transmission bracket to transmission and secure with cap screws, Fig. 20.

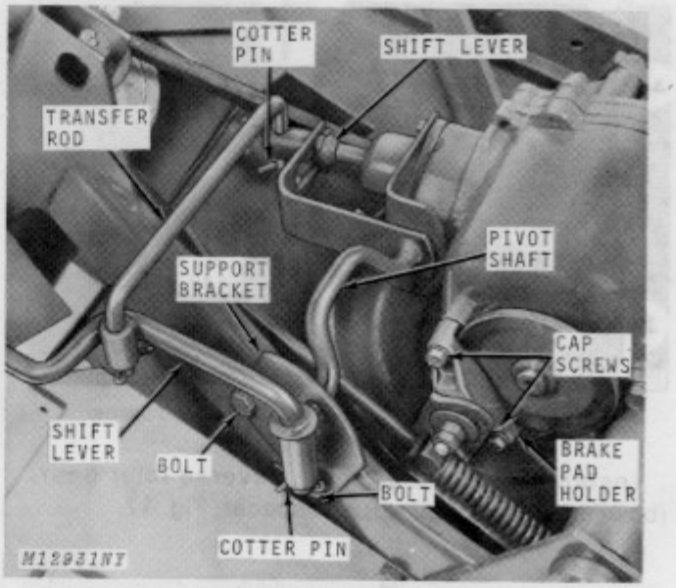


Fig. 21-Installing Pivot Shaft

Install pivot shaft support bracket to frame, Fig. 21, and secure with bolts.

Install shift lever into pivot bracket and transfer rod into shift lever of transmission, and secure each with cotter pins, Fig. 21.

Install brake pad plate and brake pad in brake pad holder. Secure brake pad holder to transmission with cap screws (Serial No. 10,001-). On Electric 90 (Serial No. -10,000), install brake band assembly.

Position drive belt in driven sheave, depress clutch and install drive belt on drive sheave of traction motor.

Install wheels with hubs on axles. Secure each wheel hub to the axle with bolts, lock washers and lock nuts.

IMPORTANT: Inspect bolt for wear and apply Loctite on that part of the bolt which contacts the axle only.

Set the Electric 90 right side up. Install and connect batteries, seat and shroud.

Install mower, page 40-10-1.

Section 40
MISCELLANEOUS

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Group 5
BRAKE, CLUTCH, STEERING, AND SEAT

BRAKE

Replacing and Adjusting Brake Band (Serial No. 1001-10,000)

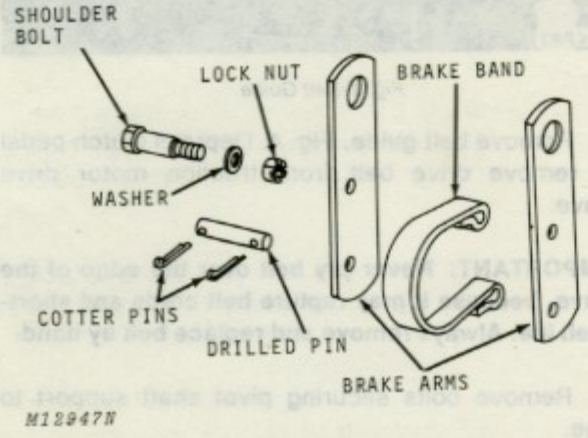

Fig. 1-Exploded View of Brake Band (Serial No. 1001-10,000)

To replace the brake band, brake must be unlocked.

Remove inner cotter pin, Fig. 1, and remove drilled pin from brake arms and brake band. Remove lock nut, washer and shoulder bolt. Remove the brake band.

Reverse the procedure for installation.

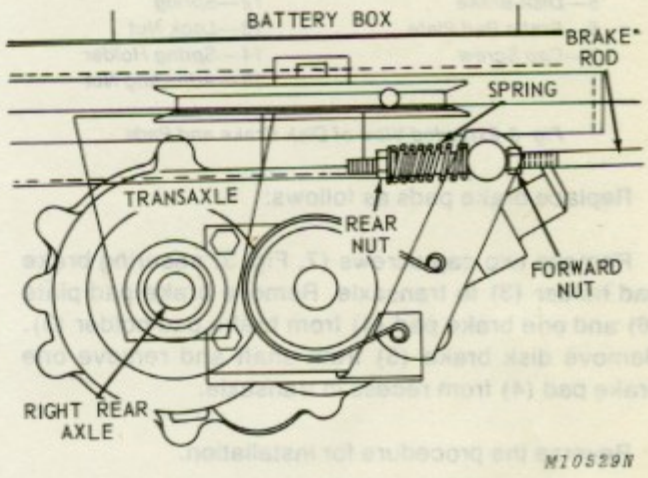

Fig. 2-Brake Adjustment (Serial No. 1001-10,000)

Adjust brake as follows:

Apply brake and lock with parking brake lever. Back off forward nut, Fig. 2, approximately 1/2 inch.

Tighten rear nut until spring is completely compressed; then, back off rear nut four or five turns.

Tighten forward nut.

NOTE: If excessive pedal pressure is required to set parking brake lever, rear nut may be backed off additional turns.

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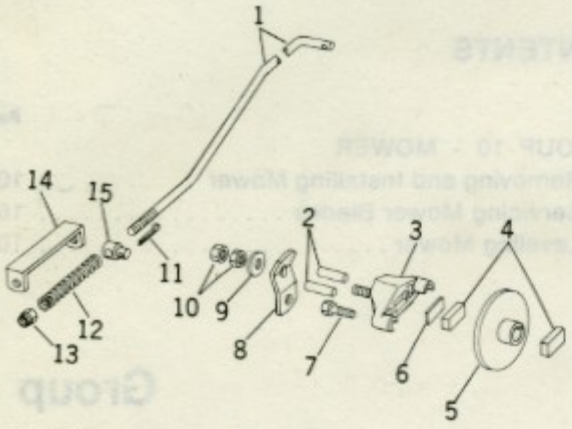
Replacing and Adjusting Brake Pad (Serial No. 10,001-)



M12948N

1—Brake Rod
2—Dowel Pins
3—Brake Pad Holder
4—Brake Pad
5—Disk Brake
6—Brake Pad Plate
7—Cap Screw
8—Brake Lever
9—Plain Washer
10—Lock Nut
11—Cotter Pin
12—Spring
13—Lock Nut
14—Spring Holder
15—Adjusting Nut

Fig. 3-Exploded View of Disk Brake and Pads

Replace brake pads as follows:

Remove two cap screws (7, Fig. 3) securing brake pad holder (3) to transaxle. Remove brake pad plate (6) and one brake pad (4) from brake pad holder (3). Remove disk brake (5) from shaft and remove one brake pad (4) from recess in transaxle.

Reverse the procedure for installation.

Adjust the brake as follows:

NOTE: Brake must be free and NOT in a locked position.

Remove cotter pin (11, Fig. 3), to free adjusting nut (15) from brake lever (8). Brake lever should have 1/2 inch of free movement without moving either dowel pin. This adjustment is obtained by either tightening or loosening lock nuts (10).

Place brake lever (8) in a vertical position. Tighten or loosen lock nut (13) on the brake rod (1) until adjusting nut (15) will just fit into brake lever (8). Secure with cotter pin (11).

Wear on brake pads (4) can be compensated for by tightening lock nut (13) on brake rod (1). Tighten one or two turns at a time until braking is effective.

CLUTCH AND DRIVE BELT

Replacing Drive Belt

Remove mower to provide access to drive belt.

Jack up the Electric 90 and remove the right-hand rear wheel with hub.

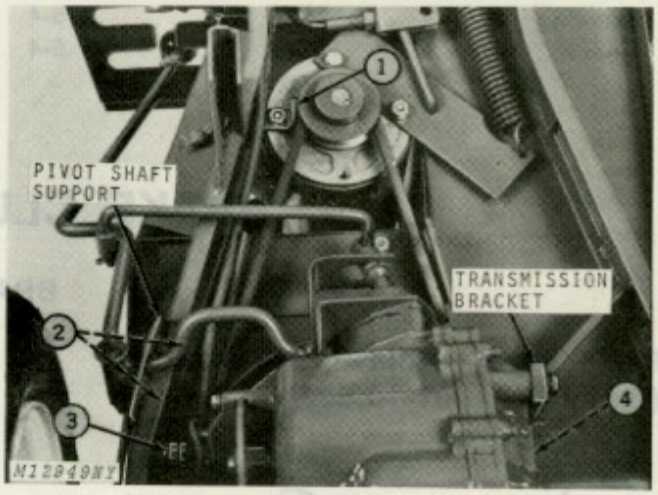


Fig. 4-Belt Guide

1. Remove belt guide, Fig. 4. Depress clutch pedal and remove drive belt from traction motor drive sheave.

IMPORTANT: Never pry belt over the edge of the sheave, because it may rupture belt cords and shorten belt life. Always remove and replace belt by hand.

2. Remove bolts securing pivot shaft support to frame.

3. Disconnect brake rod.

4. Disconnect transmission bracket from transaxle. Pivot transaxle downward and remove belt from driven sheave.

Reverse procedure for installation. Be sure belt is inside all belt guides.

V-Belt Care and Maintenance

V-belts transmit power by friction and a wedging action against the sheaves. Belts should be checked often to be certain belt wear is normal. Normal wear can be recognized as even wear - both on the belt and sides of the sheaves. All belts and sheaves wear with use.

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NOTE: A slight raveling of the belt covering does not indicate premature failure. Cut off the raveling if the covering peels at the lap.

Check for causes of unusual belt wear as follows:

1. Examine sheaves for bent or chipped side walls. A bent sheave reduces gripping power of the belt.

2. Check sheave for excessive side wall wear. Damaged sheaves cause rapid belt wear.

3. Replace sheaves having any of the above defects.

4. Check to be sure dirt has not lodged and packed in sheave V-groove. Loosen dirt so it will fall out when traction motor is started.

Checking and Cleaning V-Belt

A lumpy V-belt can cause vibration. Check belt for swells and lumps.

Whenever unusual V-belt wear, tear or failure occurs, check immediately for the cause. After correcting the cause, replace V-belt. Install only a factory recommended V-belt of the proper length.

CAUTION: Do not attempt to clean the belt while traction motor is running.

Clean belt by wiping it with a clean cloth. Do not use solvents. Solvents will soften the material and cause the belt to grab.

Do not use belt dressings. Dressings often give only temporary gripping action while softening the belt and causing eventual deterioration and shortening of belt life. Dressing may also cause a "grabby" clutch.

Adjusting Clutch Pedal (Serial No. 1001-10,000)

The clutch pedal should be adjusted so the back edge of the pedal just contacts the pedal stop when in the "Engaged" position, Fig. 5.

To adjust, remove spring-locking pin securing the drilled pin. Remove the drilled pin.

Turn the yoke off the clutch rod to increase clearance and onto the clutch rod to decrease clearance.

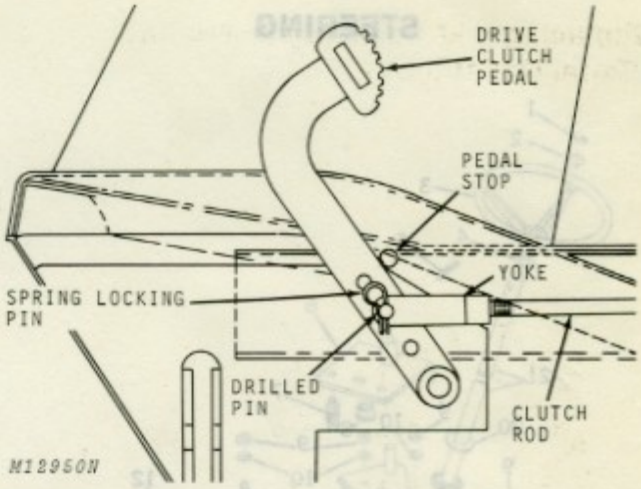

Fig. 5-Adjusting Clutch Pedal (Serial No. 1001-10,000)

Adjusting Clutch Pedal (Serial No. 10,001-)

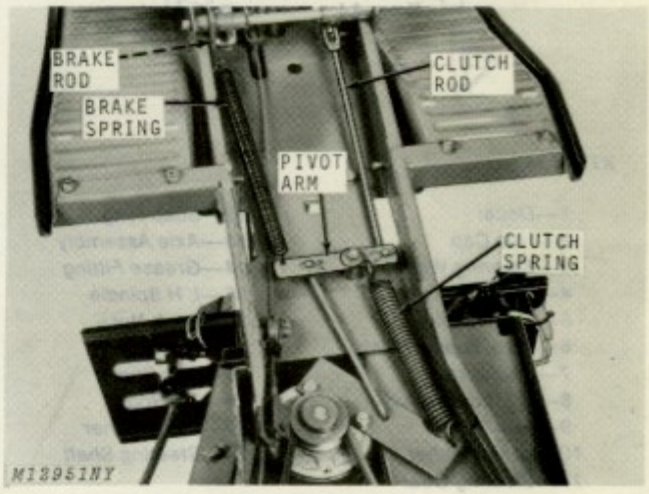

Fig. 6-Adjusting Clutch Pedal (Serial No. 10,001-)

Brake spring and clutch spring should be hooked to clutch pivot arm, Fig. 6. Brake rod should be secured to brake pedal with cotter pin.

Turn clutch rod until it just fits in hole in clutch pivot arm (rod goes in from backside) and install cotter pin. Back edge of clutch pedal should just be touching pedal stop in console. This adjustment allows approximately 0.020 to 0.030-inch movement of the clutch pedal before clutch engagement begins.

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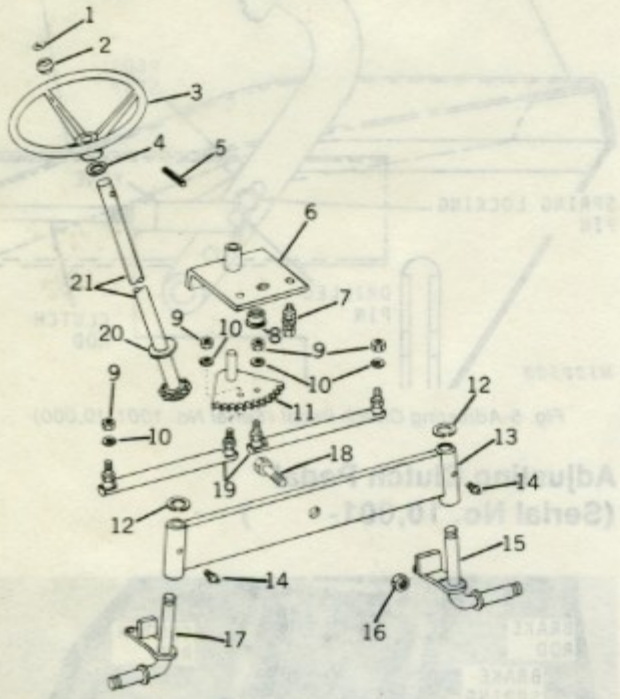
STEERING



M12952N

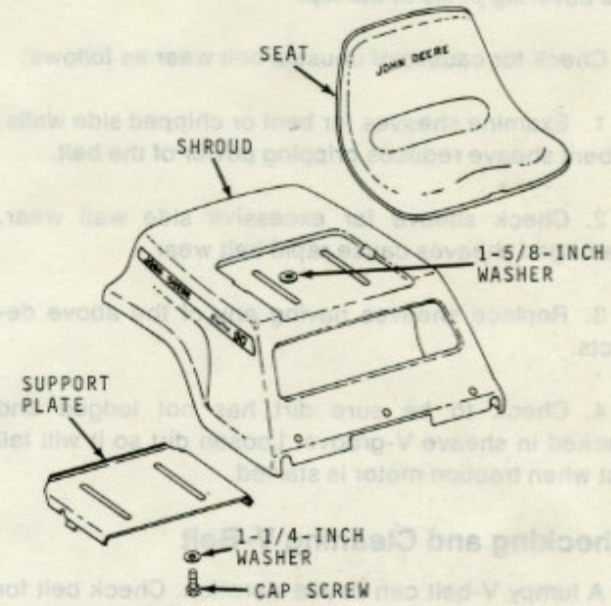
1—Decal
2—Hub Cap
3—Steering Wheel
4—Washer
5—Groove Pin
6—Gear Support Plate
7—Cap Screw
8—Plastic Bushing
9—Jam Nut
10—Lock Washer
11—Steering Gear
12—Snap Ring
13—Axle Assembly
14—Grease Fitting
15—L H Spindle
16—Lock Nut
17—R H Spindle
18—Cap Screw
19—Tie Rods
20—Flat Washer
21—Steering Shaft

Fig. 7-Exploded View of Steering Assembly

Use the exploded view, Fig. 7, as a guide for disassembling the steering shaft, steering gear, tie rods and spindles.

Refer to Section 10, Group 25 of this manual for lubrication of steering and front end.

SEAT



M12953N

Fig. 8-Seat Assembly

Adjust the seat by loosening four cap screws, Fig. 8. Slide the seat forward or backward and tighten the cap screws.

To remove the seat, remove the four cap screws and washers.

Group 10
MOWER

REMOVING AND INSTALLING MOWER

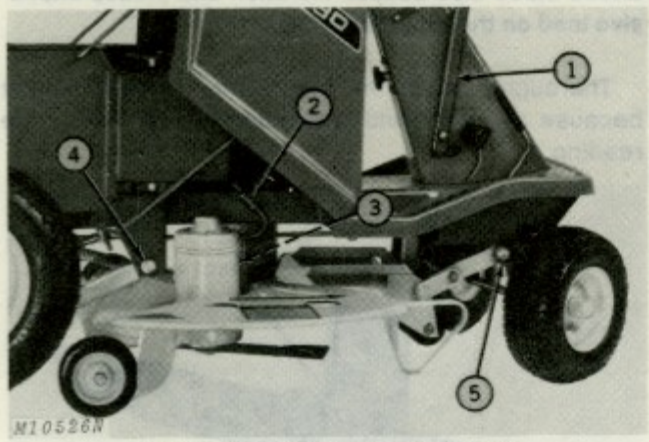


Fig. 1-Removing and Installing Mower

Refer to Fig. 1 for removing and installing mower.

1. Lower mower with lift lever.
2. Raise shroud and disconnect both mower motors.
3. Pull spring-locking pin and remove drilled pin to disconnect lift cable yoke.
4. Pull spring-locking pin and remove drilled pin in rear draft link.
5. Pull spring-locking pins and remove drilled pins in front of machine.
6. Partially raise front of machine to remove mower.

CAUTION: Do not tip Electric 90 on end with batteries installed. Electrolyte will run out.

Reverse procedure to install mower.

SERVICING MOWER BLADES

Removing Mower Blade

Turn the mower deck over. Insert a screwdriver into the slot in the hub guard to wedge the armature hub and keep it from turning, Fig. 2. Remove mower blade.

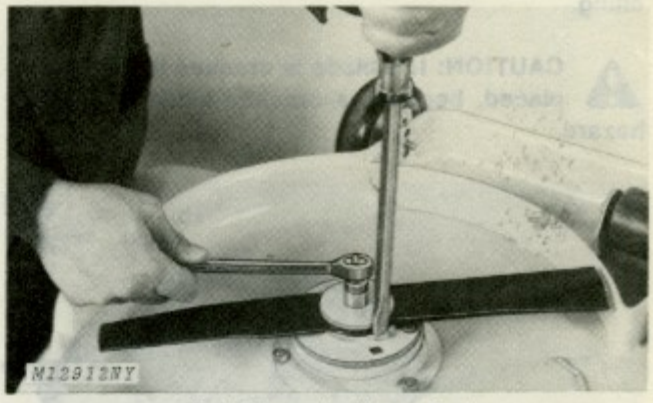


Fig. 2-Removing Mower Blade

Sharpening Blade

Good mower maintenance includes keeping the blade sharp and free from nicks.

A sharp blade requires less power to operate and provides a neater, smoother mowing job. A dull blade will tear, rather than cut, grass.

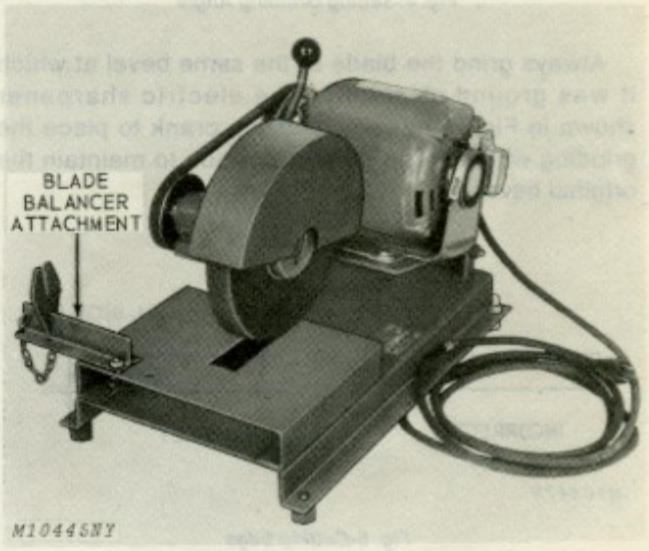


Fig. 3-Electric Blade Sharpener

The electric blade sharpener illustrated in Fig. 3 is a good tool for fast accurate blade sharpening.

If an electric blade sharpener is not available, a conventional grinder or hand file can be used.

Clean and inspect blade thoroughly before sharpening.

⚠ CAUTION: If a blade is cracked it must be replaced, because a cracked blade is a safety hazard.

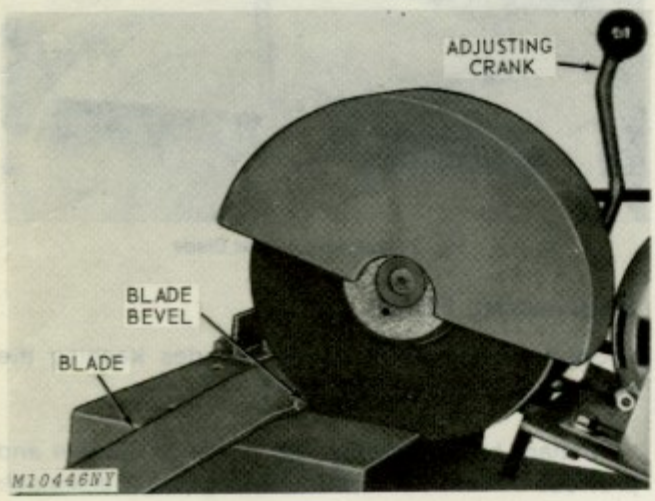


Fig. 4-Setting Grinding Angle

Always grind the blade at the same bevel at which it was ground originally. The electric sharpener shown in Fig. 4, has an adjusting crank to place the grinding wheel in the correct position to maintain the original bevel.

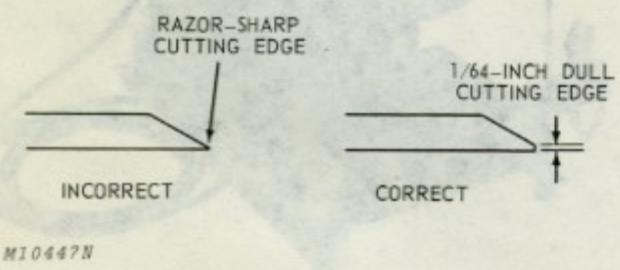


Fig. 5-Cutting Edge

A properly sharpened blade must have a 1/64-inch dull cutting edge, Fig. 5. A razor-sharp cutting edge will chip more easily and also roll over, thus dulling more quickly.

Balancing Blade

IMPORTANT: Whenever a blade is removed for sharpening, balance it before installing it in the mower. An unbalanced blade is a safety hazard. An unbalanced blade also causes vibration and places excessive load on the motor bearings.

Thoroughly clean the blade prior to balancing it because any dirt build-up would give an inaccurate reading.

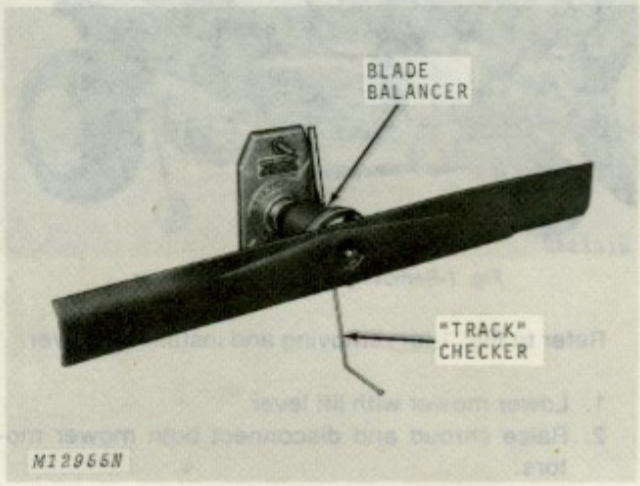


Fig. 6-Blade Balancer

The blade balancer shown in Fig. 6 has a precision bearing. When correctly balanced, the blade will remain horizontal as illustrated.

If this type of balancer is not available, the blade can be centered on a sharp edge to check balance. Fig. 3 shows a balancer of this type installed on the blade sharpener.

Use a grinder to remove metal from the heel of the blade on the heavy side until balance is obtained.

The balancer in Fig. 6 features a "track" checker. Adjust the "track" checker so it just misses one tip of the blade. Rotate the blade, bringing the other tip next to the "track" checker. The tips should be within 1/16-inch alignment.

Blades can also be checked on the mower. Disconnect the wiring to the mower motors. Measure the distance from each blade tip to a flat floor. Rotate the blades 180 degrees and recheck. Tips should be within 1/16-inch alignment on a horizontal plane.

Installing Mower Blade

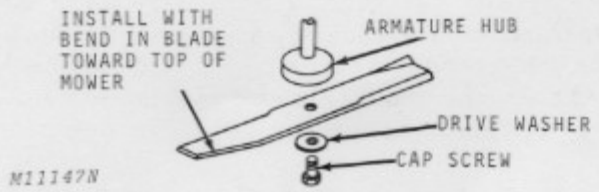


Fig. 7-Installing Mower Blade

Install the mower blade as illustrated in Fig. 7. Be sure the bend in the blade is toward the top of the mower.

Wedge a screwdriver into the slot in the hub guard to wedge the armature hub and keep it from turning. Tighten cap screw to 55 ft-lbs.

LEVELING MOWER

Park the mower on a flat surface. Check to see that the tires are inflated correctly.

⚠ CAUTION: Turn key to "OFF" and remove key from switch before leveling mower.

With the mower in the raised position, measure the distance of each blade tip from the ground. Rotate the blades and measure this distance at the front, rear and side of the mower.

When properly leveled, the dimensions on each side of the mower will be equal. The front of the mower should be 1/8 inch to 1/4 inch lower than the back of the mower for most efficient cutting.

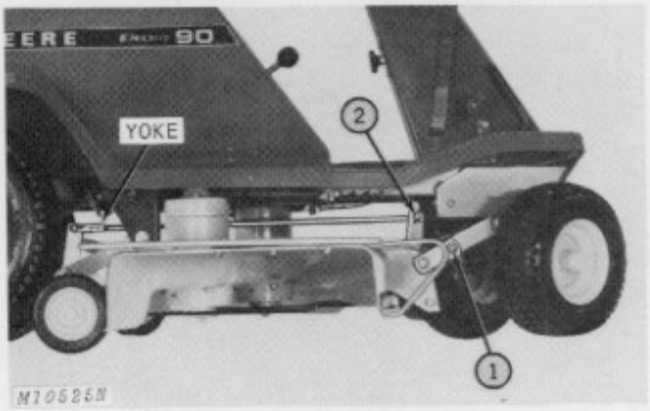


Fig. 8-Leveling Adjustments

1. To adjust for side-to-side level, Fig. 8, loosen bolt on right front draft arm and raise or lower mower deck until blades are level. Tighten nut securely.

2. To adjust for rear-to-front pitch, pull cotter pin in rod and remove rod from bracket. Turn rod into yoke to raise rear of mower, or out of yoke to lower rear of mower.

SUPPLEMENT FOR 1974 AND 1975 MODEL ELECTRIC 90 AND 96 MOWERS SERVICE MANUAL SM-2098

GENERAL INFORMATION

Section 50 contains service information for the 1974 model Electric 90 Mower (Serial No. 11,705 - 30,000) and 1975 Electric 96 Mower (Serial No. 30,001 -).

The information contained in this section is different from Sections 10, 20, 30 and 40.

MACHINE WIRING DIAGRAM

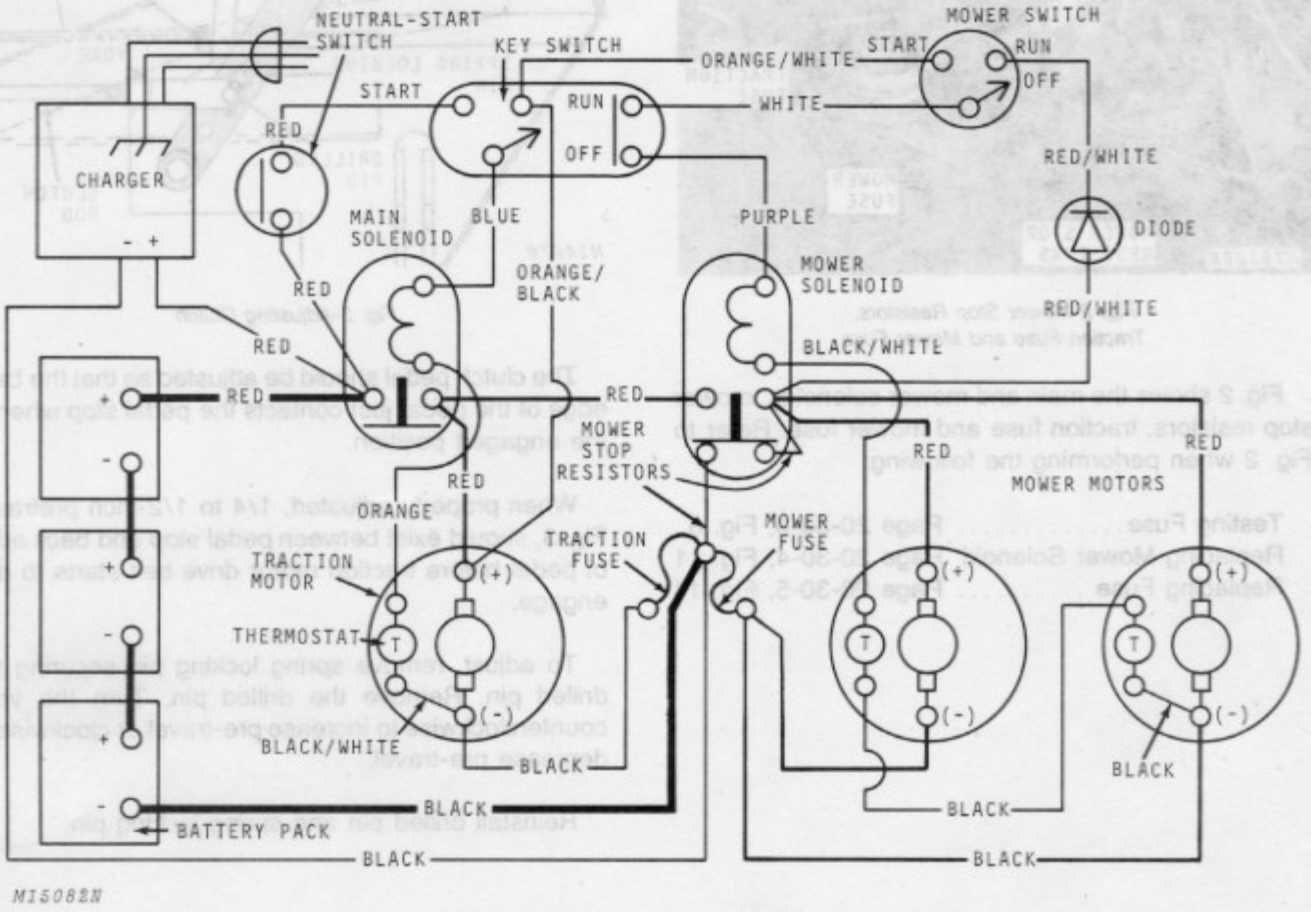


Fig. 1-Wiring Diagram for Electric 90 Mower (Serial No. 11,705-)

When servicing the mowers, use the wiring diagram, Fig. 1, with the existing information shown at the right.

NOTE: This diagram differs from all the other diagrams in the manual because of a second mower stop resistor and separate fuses for the traction and mower motors, Fig. 1 and 2.

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FUSES AND RESISTORS

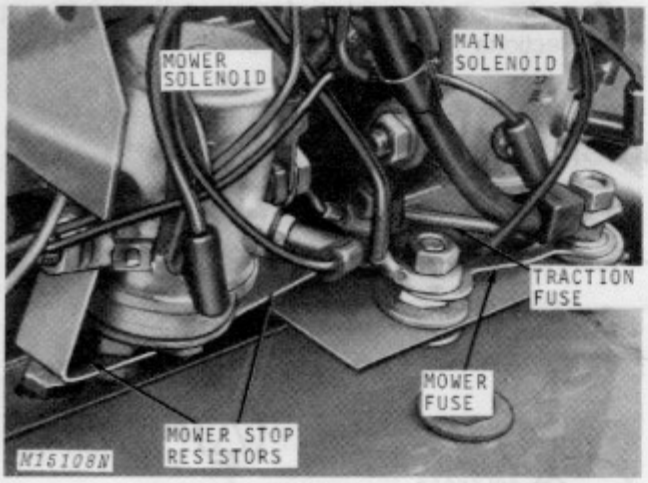

Fig. 2-Mower Stop Resistors, Traction Fuse and Mower Fuse

Fig. 2 shows the main and mower solenoids, mower stop resistors, traction fuse and mower fuse. Refer to Fig. 2 when performing the following:

ADJUSTING CLUTCH

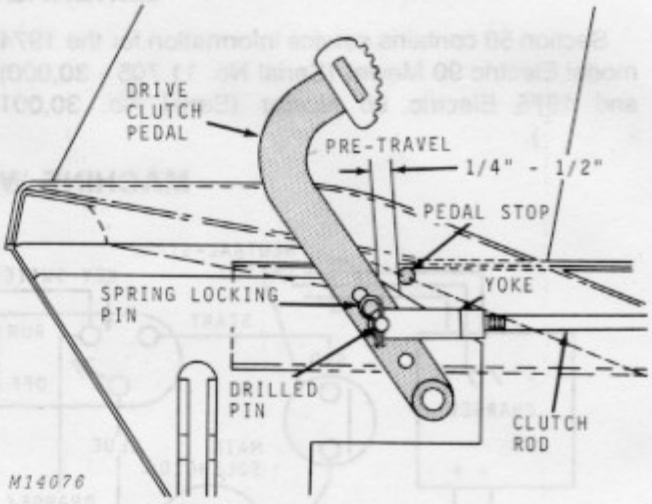

Fig. 3-Adjusting Clutch

The clutch pedal should be adjusted so that the back edge of the pedal just contacts the pedal stop when in the engaged position.

When properly adjusted, 1/4 to 1/2-inch pretravel, Fig. 3, should exist between pedal stop and back edge of pedal before traction motor drive belt starts to disengage.

To adjust, remove spring locking pin securing the drilled pin. Remove the drilled pin. Turn the yoke counterclockwise to increase pre-travel or clockwise to decrease pre-travel.

Reinstall drilled pin and spring locking pin.

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CHARGER

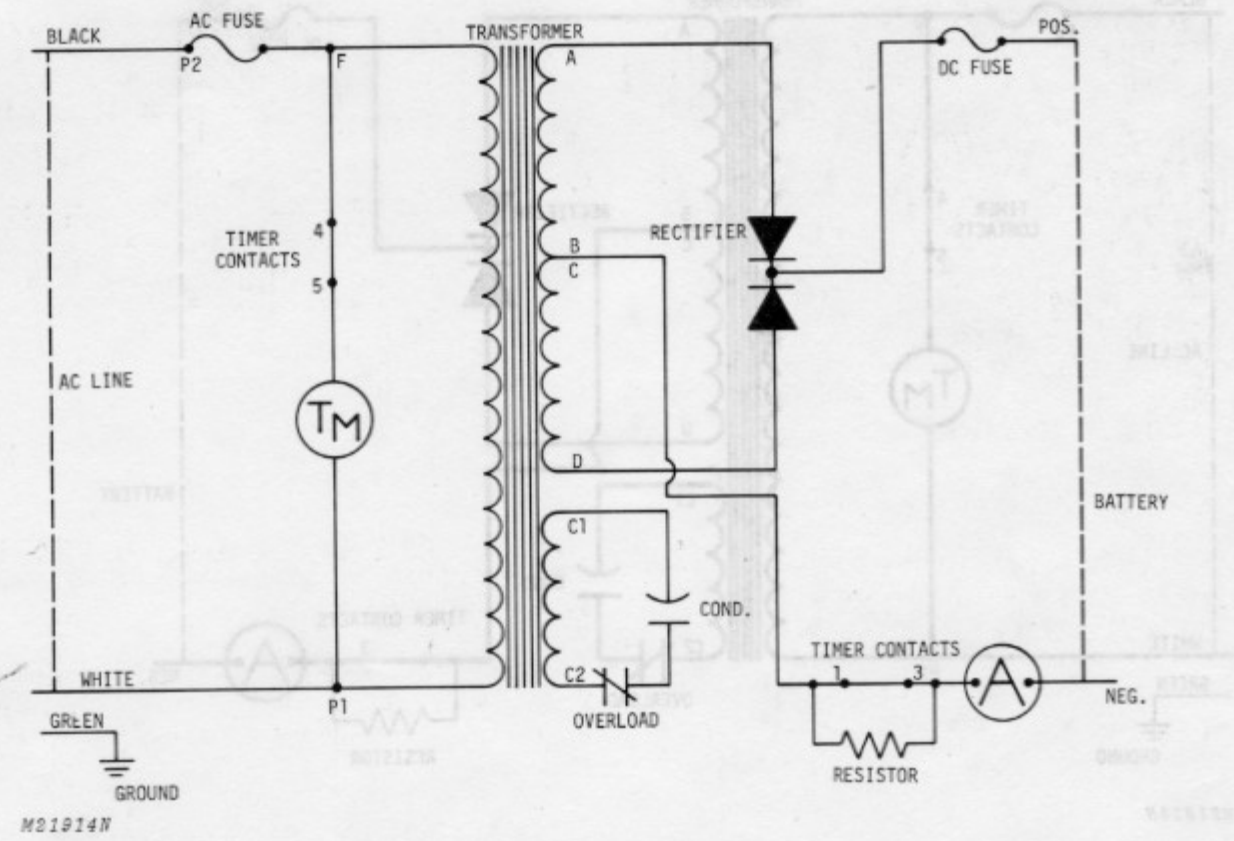

Fig. 4-Schematic Wiring Diagram

There are two basic differences between the Gould and Prestolite chargers. The indicator light has been replaced by an ammeter and the boost timer has been replaced by a maintenance charge resistor, Fig. 4.

The ammeter works as an independent unit and reads the current flow from the charger to the batteries. It does not sense battery voltage or condition.

The maintenance charge resistor allows approximately .05 amps current to the batteries to keep the batteries fully charged, when the charger is plugged in and the timer knob is in the "STORE" position.

The ferro-resonant battery charger will maintain a nearly constant voltage to the batteries even if the power supply voltage varies. The charger has a charging circuit, a storage circuit and a resonant circuit.

CHARGING CIRCUIT

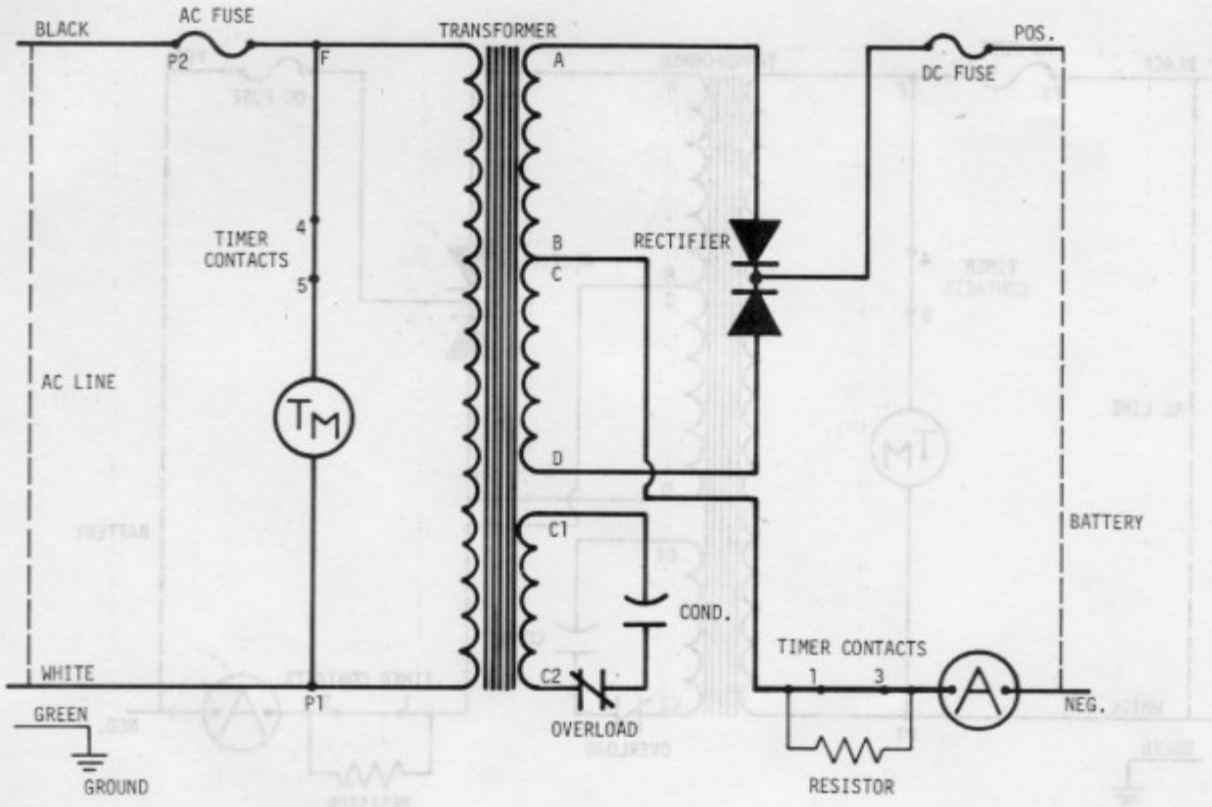

Fig. 5-Charging Circuit

The charging circuit, Fig. 5, has a rate of 1.5 to 8 amps for charging the batteries and the storage circuit has a rate of approximately .05 amps to maintain the batteries.

Turning the timer knob clockwise closes contacts 1 and 3 and 4 and 5 and starts the timer motor. AC alternating current flows through the fuse and coil windings, inducing an alternating magnetic field in the transformer coil.

Two secondary coils convert the magnetic energy from the transformer core into a lower alternating voltage. This AC voltage is converted by the rectifier to DC voltage to charge the batteries.

At the beginning of the battery charge the battery voltage is low. Low battery voltage causes high amperage and low voltage output from the charger.

As the batteries charge, the voltage increases and the amperage decreases. Voltage will continue to increase and the amperage will decrease until the charger goes to the "STORE" position.

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STORE CIRCUIT

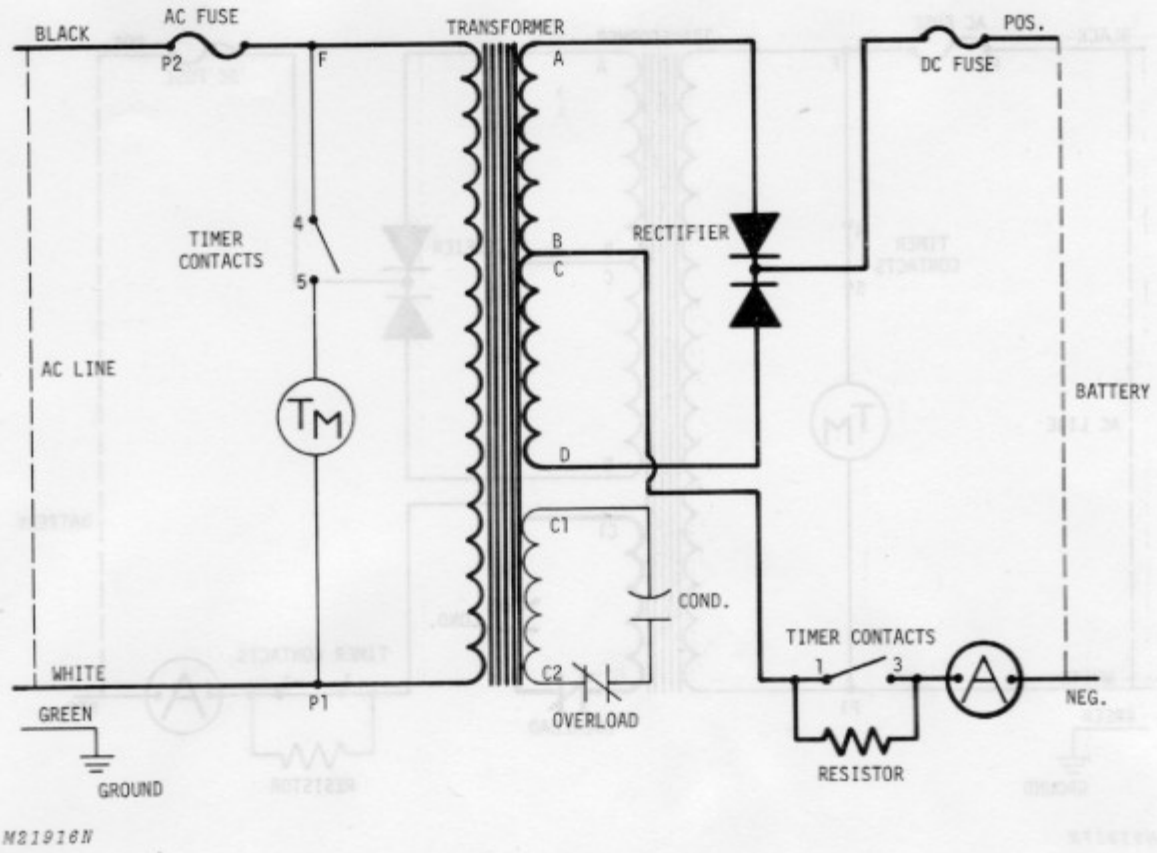

Fig. 6-Store Circuit

It takes approximately 12 hours for the timer knob to return to the "STORE" position, Fig. 6. This opens contacts 1 and 3 and 4 and 5. All charger output must now pass through the maintenance charge resistor, reducing charger output to .05 amps to maintain the batteries at full charge.

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RESONANT CIRCUIT

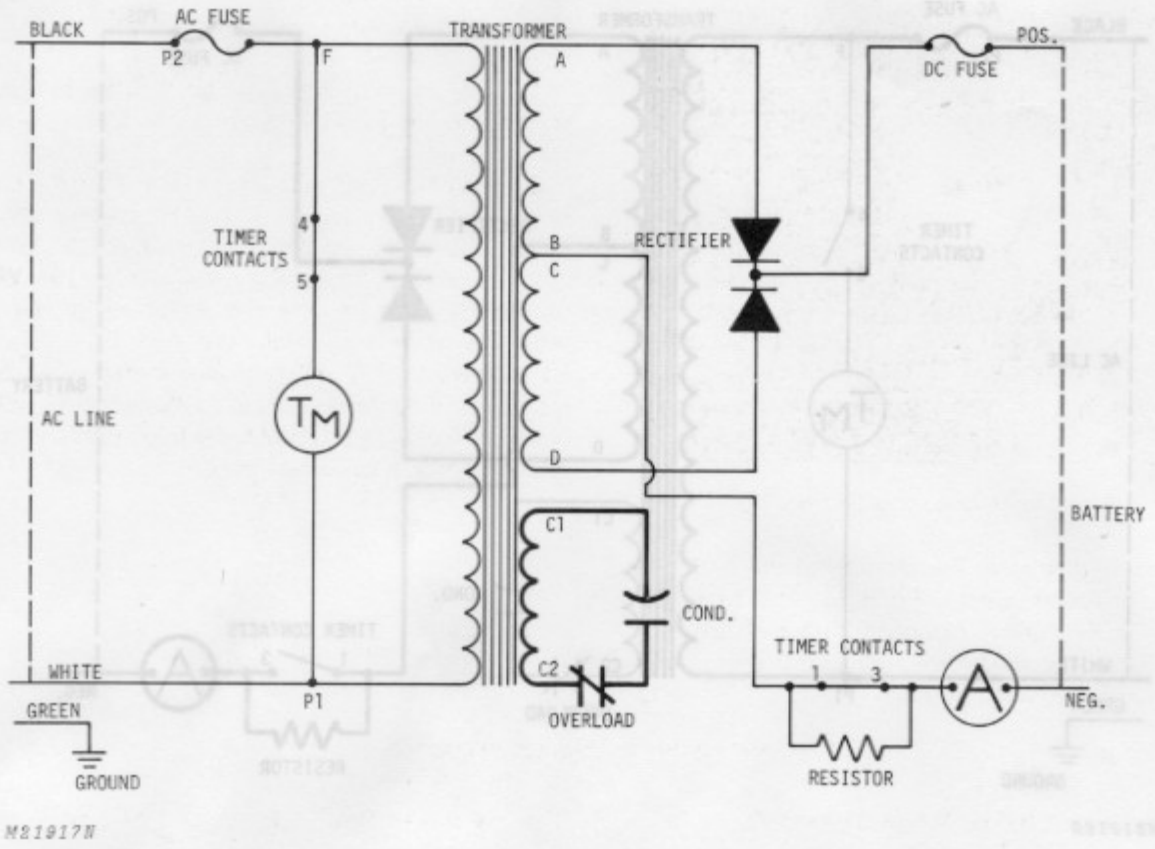


Fig. 7-Resonant Circuit

The resonant circuit, Fig. 7, limits voltage output to the batteries and consists of C1 and C2 windings, condenser and the overload switch. The overload switch is heat sensitive and if the charger becomes too hot, the overload switch opens and reduces charger output until the charger cools sufficiently to allow the overload switch to close.

There are two additional protective devices for the charger; an AC fuse on the inlet side and a DC fuse on the outlet side.

CHARGE INDICATOR (AMMETER) OPERATION

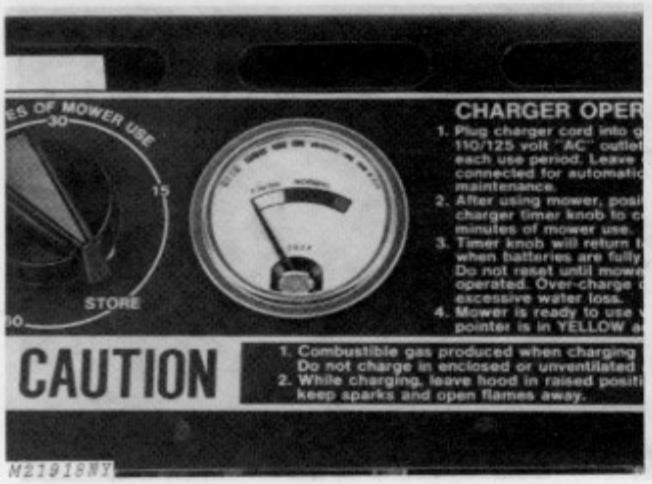


Fig. 8-Charge Indicator (Ammeter)

High current flow from the charger to the batteries causes the ammeter needle, Fig. 8, to move to the far right of the yellow area. When the batteries are fully charged, current flow decreases, and the ammeter needle moves into the green area.

NOTE: The following are things to remember when reading the ammeter.

1. Charger must be plugged in and the control timer knob turned to the "ON" position before the ammeter can be read.
2. The ammeter reads current flow from the charger to the batteries. It does not indicate battery condition.
3. To determine if batteries are ready for use, turn the control timer knob to approximately "10". WAIT 5 MINUTES. If the ammeter needle moves into the green area, the batteries are fully charged. Turn the control timer knob to "STORE". If the ammeter needle remains in the yellow area, batteries are not fully charged. Reset the control timer knob to the amount of time the mower was last used.

TROUBLE SHOOTING

Charger Fails to Charge When Turned On

Check the following:

1. AC power source.
2. Physical damage.
3. Both the AC and DC fuses.
4. Timer connections for continuity.
5. All connections including the DC output terminal.
6. Ammeter continuity.
7. DC terminal for correct continuity - red lead is positive.

Charger Fails to Charge Full Charging Current

Check the following:

1. Rectifier diodes.
2. Transformer for damage.
3. Capacitor.
4. All connections.

Timer Fails to Return to Store Position

Check the following:

1. AC power source.
2. AC fuse.
3. All charger connections.

Charger Does Not Charge Batteries in 12 Hours of Operation

Check the following:

1. AC power supply.
2. AC and DC fuses.
3. Battery connections.
4. Batteries for defective calls.

CHECKING CHARGER COMPONENTS

Checking Transformer

NOTE: Use an AC voltmeter to perform the following tests. Connect voltmeter between the points as indicated.

1. Disconnect AC power supply.

2. Disconnect one lead from the condenser.

Short condenser using screwdriver with an insulated handle, Fig. 9.

⚠ CAUTION: Condenser may be charged to 300 volts. Be sure screwdriver has an insulated handle.

3. Reconnect AC power supply.

4. Turn timer knob to "ON" position.

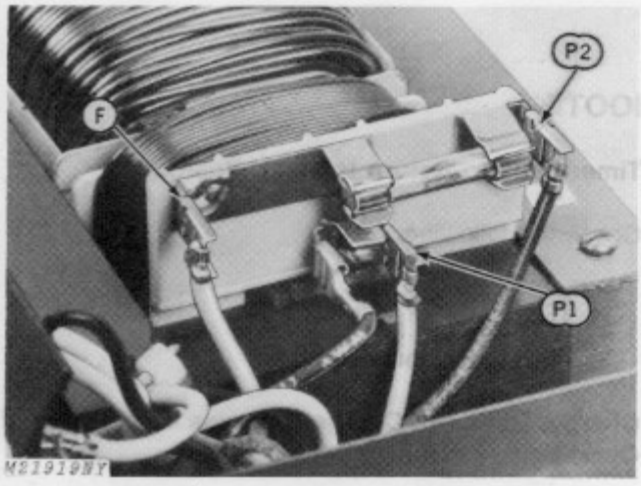


Fig. 9-Checking AC Power Supply and Fuse

5. P1 and P2, Fig. 9 should read approximately 120 volts AC.

6. P1 and F should read approximately 120 volts AC which indicates AC fuse is good.

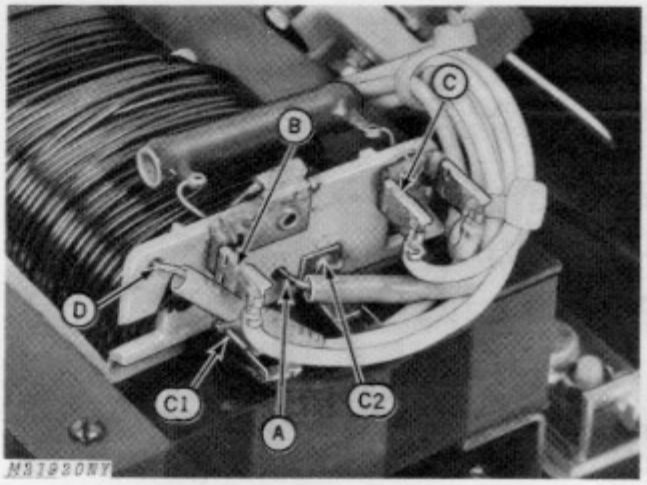


Fig. 10-Checking Charger Output

7. C1 and C2, Fig. 10 should read approximately 300 volts AC.

8. A and B - should read approximately 34 volts AC.

9. C and D - should read approximately 34 volts AC.

10. A and D - should read approximately 68 volts AC.

Checking Rectifier Diodes

NOTE: Use an ohmmeter to make the following checks.

1. Disconnect AC power supply.

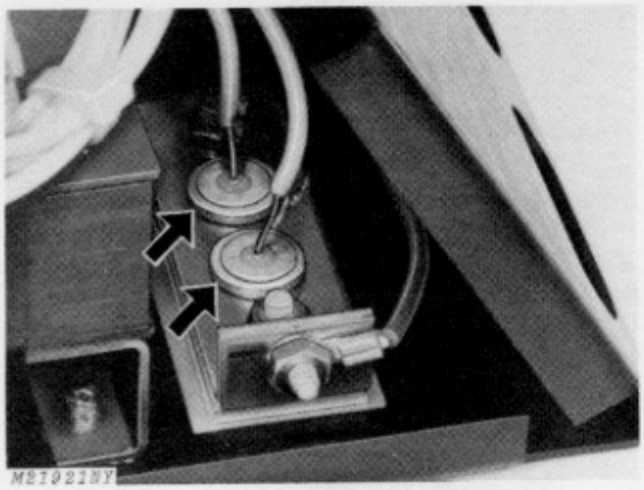


Fig. 11-Checking Diodes

2. Place ohmmeter probes across the diode, Fig. 11. Reverse probes.

3. Ohmmeter should show continuity in one direction, but not the other.

4. If ohmmeter shows continuity in both positions, diode is shorted and must be replaced.

5. If continuity does not exist in either position, diode is open and must be replaced.

Checking Condenser (Capacitor)

NOTE: Use an ohmmeter with a scale of RX10,000 to check the condenser.

1. Disconnect AC power supply.

2. Disconnect one lead from the condenser.

3. Touch ohmmeter probes to condenser terminals, Fig. 12. Ohmmeter needle should deflect and move toward the original position. This indicates condenser is good.

NOTE: It may be necessary to reverse ohmmeter probes to obtain deflection.

4. If ohmmeter needle deflects but does not return toward original position, condenser is shorted and must be replaced.

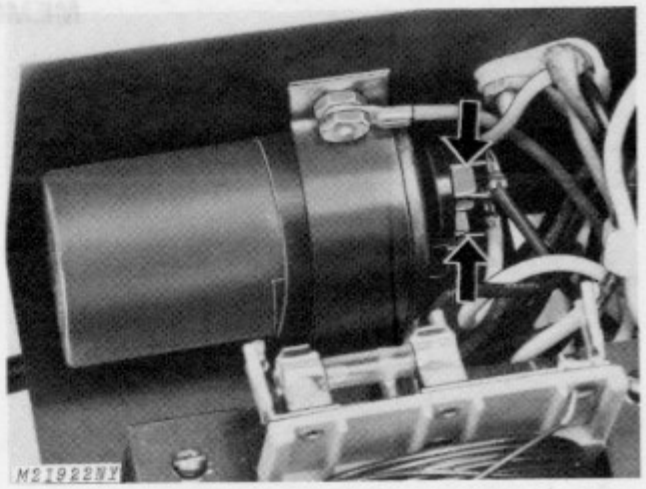


Fig. 12-Checking Condenser (Capacitor)

5. If ohmmeter needle does not deflect with probes in either position, condenser is open and must be replaced.

Checking Ammeter

NOTE: Ammeter may be checked with a continuity light or an ohmmeter.

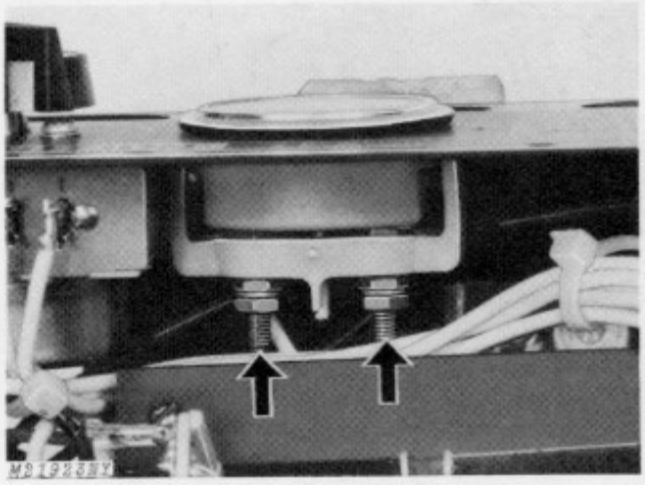


Fig. 13-Checking Ammeter

1. Disconnect AC power supply.

2. Touch ohmmeter probes to terminals of ammeter, Fig. 13.

3. Replace ammeter if it does not show continuity.

Checking Timer

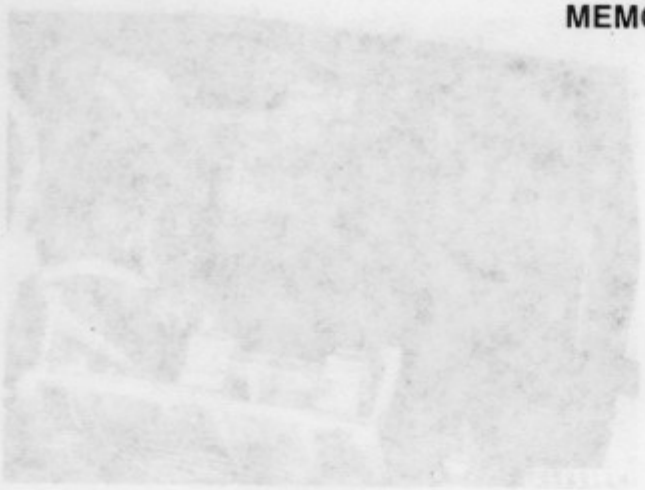
1. Connect charger to AC power supply.

2. Turn timer knob to "ON" position.

3. Wait at least one hour. If timer knob has not moved, timer must be replaced.

Litho in U.S.A.

MEMORANDA



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