CLARK

Service School Topic.....

SST-14
Ref. Group No. 50

August 28, 1975

Subject: Electrical Troubleshooting Guide
All Model Machines

Attached is an electrical troubleshooting guide covering "A" Circuit Generators, "B" Circuit Generators, Alternator systems and different styles of voltage regulators.

Basic Facts:

1. The most common electrical problems are caused by dirty and loose connections, faulty batteries stemming from poor maintenance and damage caused by improper installation and troubleshooting methods.

2. Never trust an indicator light or ammeter – check for charge with a test meter to be certain a system is not charging.

3. Nine times out of ten a dead battery is caused by an ignition switch left on or lights left on.

4. All electrical components must have a complete circuit – a "hot" lead and a good ground.

5. All electrical problems are one of three types: opens, shorts, or grounds.

   Open – No electrical connection, i.e. cut wire.
   Short – Partial connection – some current to accessories, some current to ground.
   Ground – All current flow to ground, none to accessories.

6. Know the rules: – Think.
   – What are the symptoms?
   – Take time to plan your attack.
   – Use a careful systematic approach.
   – Never skip any item.
   – Find out what caused the problem.

7. Safety rules:
   – Always disconnect ground side of battery first.
   – Be sure all items are always connected properly. (positive to positive – negative to negative)
   – Be sure any charger or tester is turned "off" before connecting or disconnecting cables to batteries.

   BATTERIES CAN BLOW UP!

   Caution: Do not smoke where batteries are being charged or tested!

8. If any component in the charging system is found to be faulty, all other charging system components must be tested.

TOOLS NEEDED: Hydrometer, Voltmeter and Jumper Wires.

I. "Current" is defined as a movement of electrons through a conductor. It is measured and expressed as amperage. When 6.28 billion billion electrons pass a certain point in a conductor in one second, it is equal to one ampere.

II. The force which causes the electrons to flow is called "voltage".

III. The resistance to electrical current flow is measured in OHM's. It takes one volt to push one ampere through one OHM of resistance.

IV. The conventional theory of current flow is positive to negative. One must always remember that current must have a complete path to travel, i.e. from positive post of battery through a light and back to the negative post of the battery. In most applications, the frame is used as ground or negative circuit.

V. Charging system components: Alternator, Regulator, Relays & Battery

VI. BATTERIES

A. When Troubleshooting any electrical system, one must remember that there has to be an adequate power supply. The battery must be at a minimum of 75% of full charge before troubleshooting the system. The condition of the battery can be simply checked with a hydrometer.

SPECIFIC GRAVITY OF A BATTERY

*Checked at 80^{o} F.

Full Charge	1.275 - 1.290	*NOTE: When checking battery at temperature other than 80^{o} F, for every 10^{o} above 80^{o} – Add .004 to reading.
75%	1.250 - 1.275	
50%	1.225 - 1.250	
25%	1.190 - 1.225	For every 10^{o} below 80^{o} – Subtract .004 from reading.
Very Low Charge	1.160 - 1.190	
Bad Cell or Dead	1.130 - 1.160	

When checking the specific gravity of a battery, there should be no more than .050 specific gravity points difference between any two cells.

If there are any two readings greater than .050 points apart, it is possible that the battery has a shorted cell, badly damaged cell, or the electrolite has been lost.

B. Battery Care. Overfilling of a battery can cause poor performance, short life and excessive corrosion.

If battery is underfilled, permanent damage may result to plates or connectors.

Excessive water usage indicates battery is being overcharged or is being subjected to high operating temperature. Normal water usage is one to two ounces per month, per cell. If dirt is allowed to accumulate on top of the battery, it will allow current flow between battery terminals and slowly discharge the battery. A solution of baking soda and water should be used to clean the battery.

If batteries do not hold 75% charge, they must be replaced before any further testing can be done.

VII. USING A VOLTMETER FOR TROUBLESHOOTING

A Voltmeter is preferred over an ammeter because it is easier to connect than an ammeter. The ammeter must be connected in a series which means a connection must be broken and the meter inserted into the circuit. See Fig. 1. The volt-meter may be used in parallel to read voltage drop in the circuit, i.e. voltmeter connected from positive battery post to positive starter terminal. If connections are good, a zero reading will be obtained. See Figure 2. NOTE: A voltmeter which reads 0-3 volts must be used for this test. Also a voltmeter may be connected across the circuit which will read total circuit voltage, See Figure 3, i.e. connect meter from positive side of light to ground. This reading should be compared to battery voltage. If circuit voltage is lower than battery voltage, there is a voltage drop in the system which can be caused by a poor connection, too small a wire, etc. NOTE: Some circuits may normally have a voltage drop but it should be very low. Use voltmeter in parallel to find the problem area.

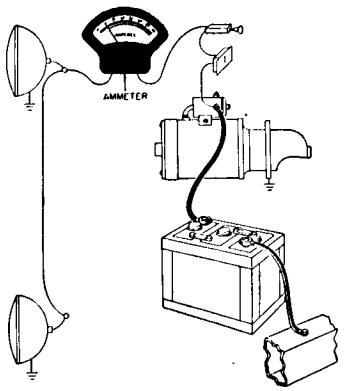

Fig. 1 – An ammeter must always be connected in a circuit in series

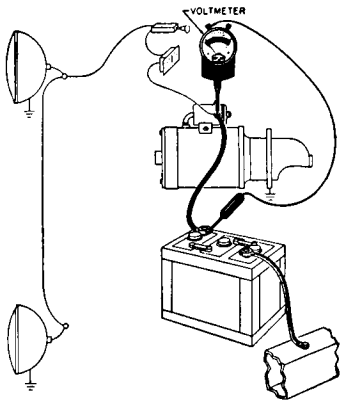

Fig. 2 – A voltmeter connected in parallel with a circuit measures the resistance in the circuit expressed in terms of voltage drop

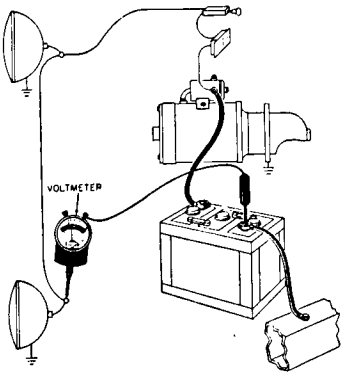

Fig. 3 – A voltmeter connected across a circuit measures the total voltage in a circuit

CHECKING GENERATOR OUTPUT

Step 1. Start engine and run at 1500 RPM with voltmeter connected as shown. See Fig. 1. Be sure all electrical items are off. The approximate reading for the voltmeter is 13 to 16 volts for a 12-Volt System and 25 to 28 volts for a 24-Volt System. If the voltmeter reads battery voltage during this test, the charging system is not working.

ISOLATING FIELD CIRCUIT PROBLEM

Step 1. Leave voltmeter connected as shown in Fig. 1. NOTE: See Fig. 3 & 4 for "B" circuit connections.

Step 2. Disconnect the field wire at the voltage regulator and ground it to the generator case. See Fig. 2. for "A" circuit.

For "B" circuit connect jumper from "F" terminal to "A" terminal and "A" terminal to the "Bat." of regulator.

Step 3. Start engine and run at about 1500 RPM. If voltmeter reads approximately 2 volts over battery voltage now, the field circuit in the voltage regulator is bad. The voltage regulator must either be repaired or replaced. If the voltmeter reads some voltage but less than battery voltage during this test, it indicates that the reverse current cut-out relay points are not contacting in the voltage regulator or the field windings in the generator are shorted.

If regulator or generator is removed or replaced it will be necessary to polarize the system. NOTE: This should be done before starting the engine after a repair is made. To polarize the system use the following steps:

"A" Circuit – Connect a jumper wire to a battery source and touch it momentarily to the "A" terminal of the generator.

"B" Circuit – Disconnect the field wire at the voltage regulator and momentarily touch it to a battery source.

If it is unknown whether you have an "A" circuit or a "B" circuit generator, always follow the procedure listed for "A" circuit first. If the voltmeter still shows zero voltage after following the procedure for "A" circuit, then proceed with the "B" circuit procedure.

If after polarizing the generator the voltmeter still reads zero voltage, the generator is inoperative and must be either repaired or replaced.

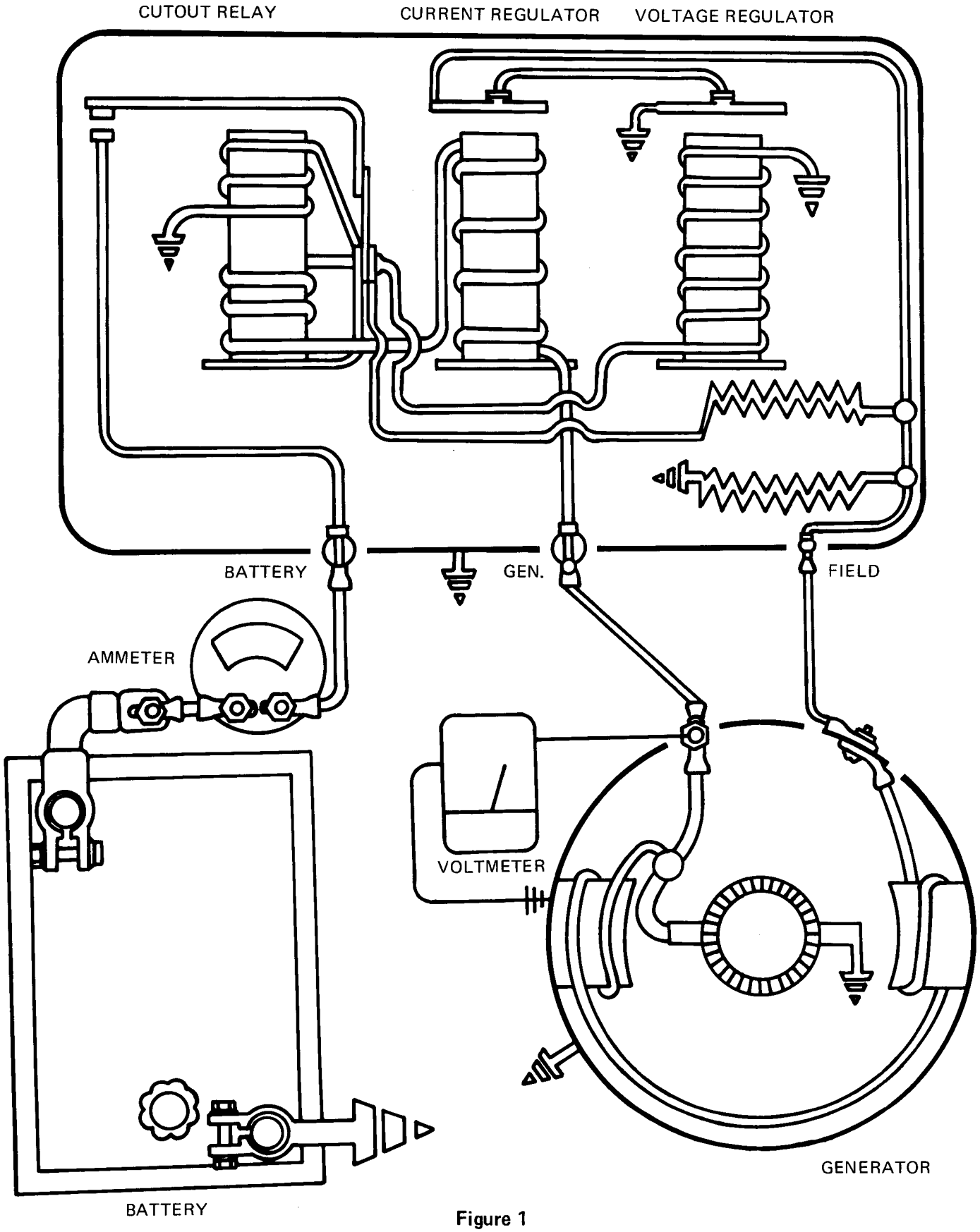

Figure 1
"A" Circuit Voltmeter Connection

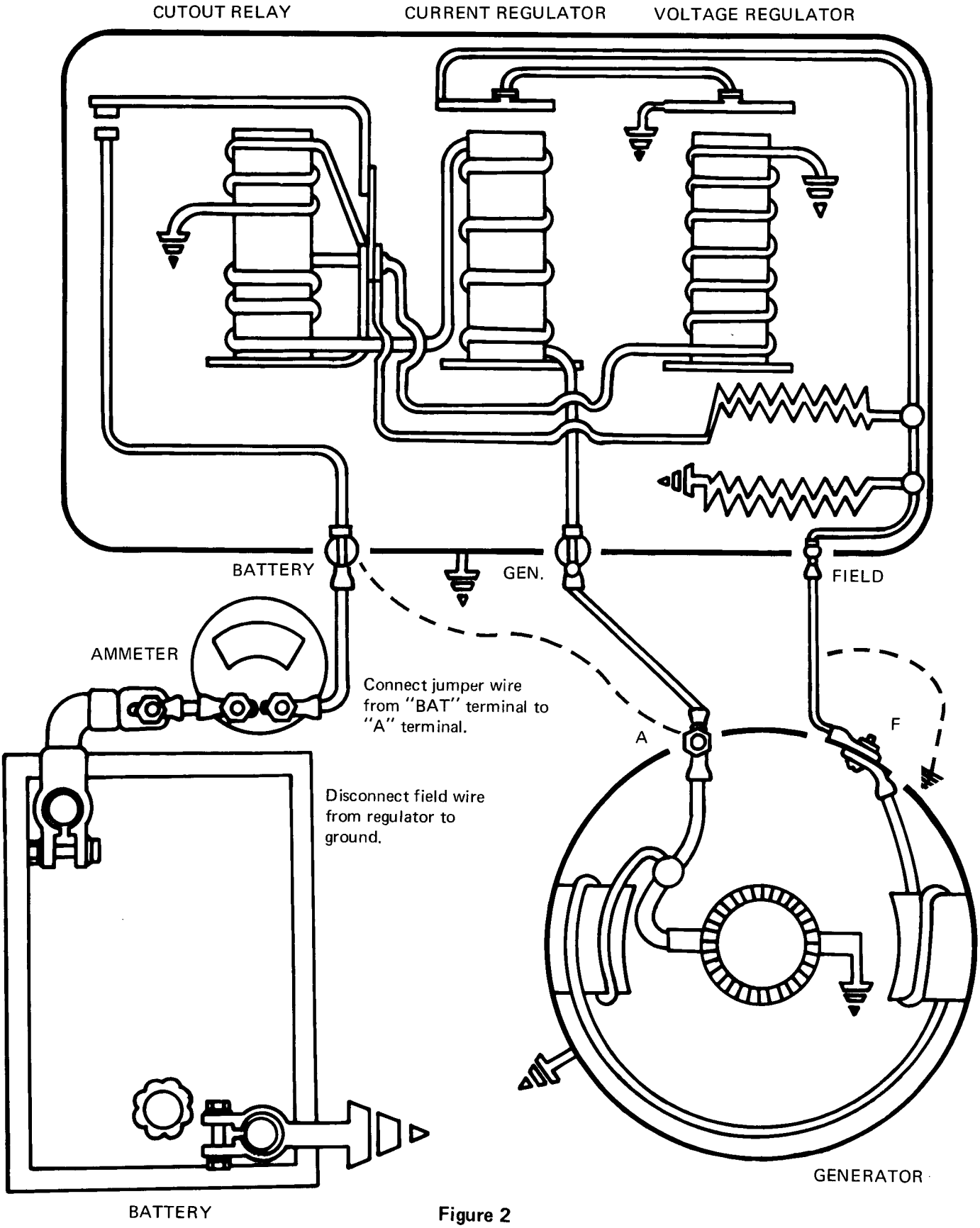

Figure 2
"A" Circuit

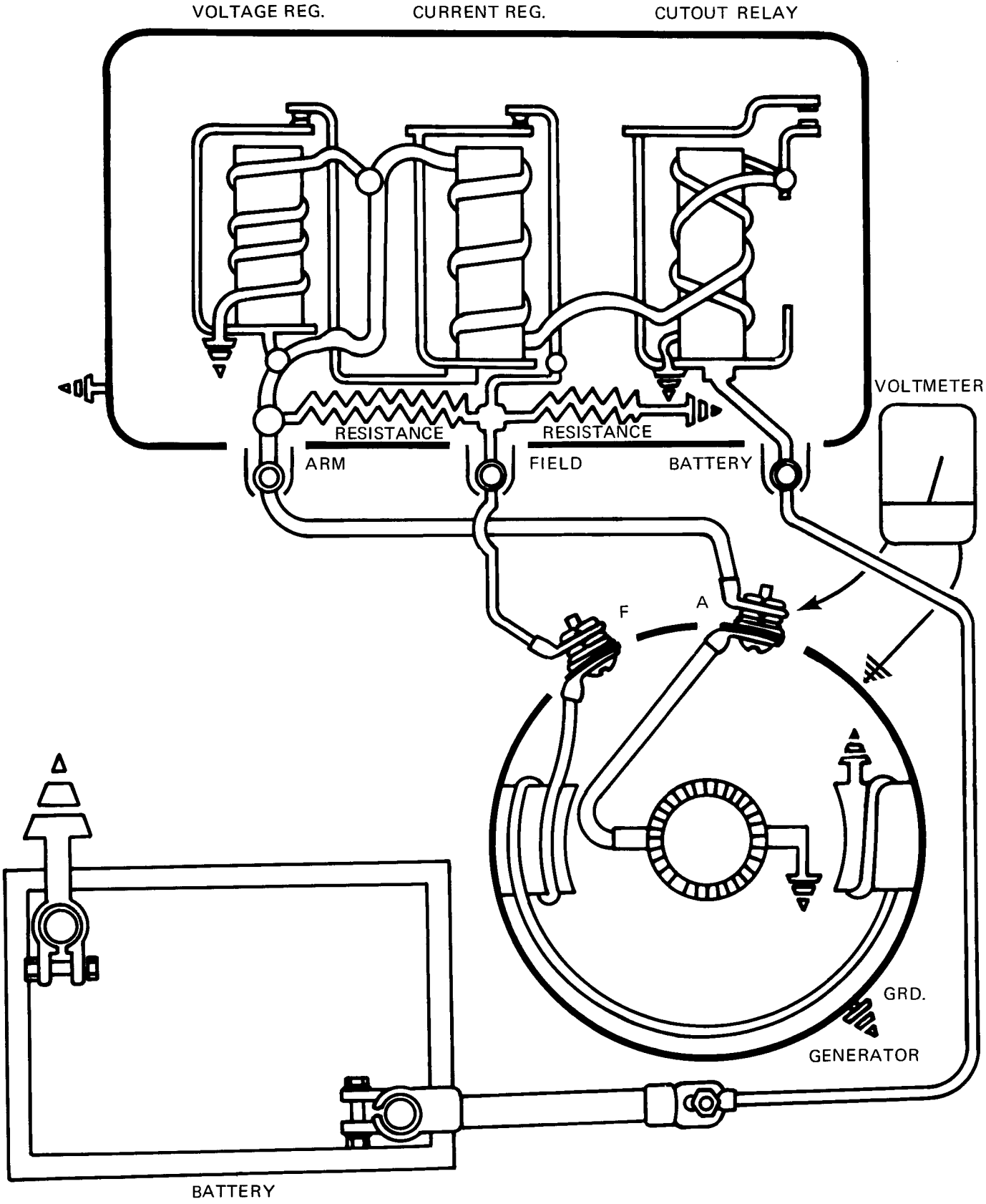

Figure 3
"B" Circuit Voltmeter Connection

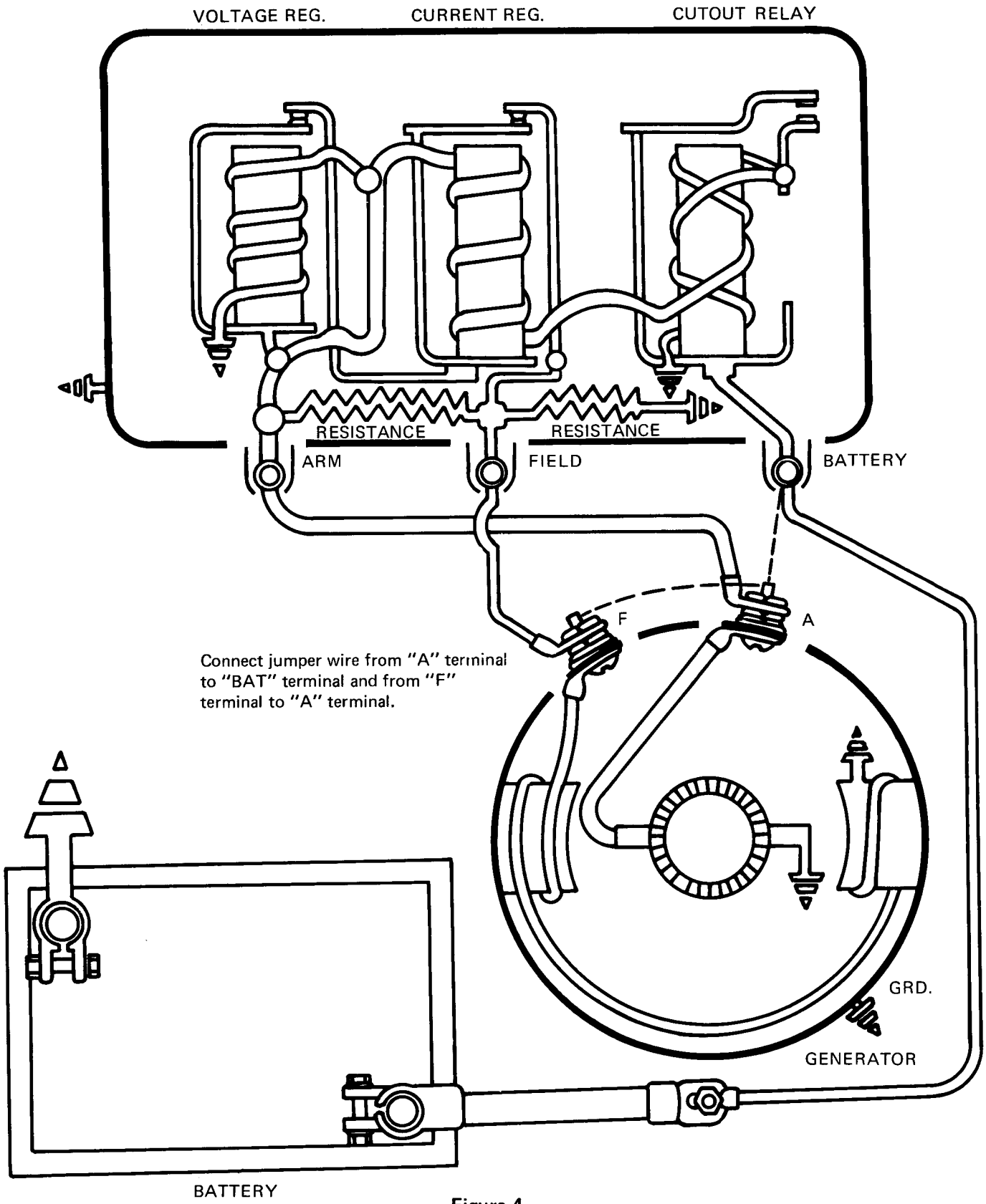

Figure 4
"B" Circuit

I. DELCO-REMY SYSTEM (DELCOTRON) WITH EXTERNAL REGULATOR. (See Fig. 1)

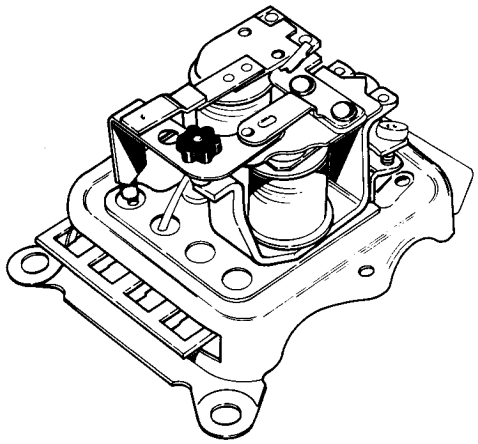

Fig. 1

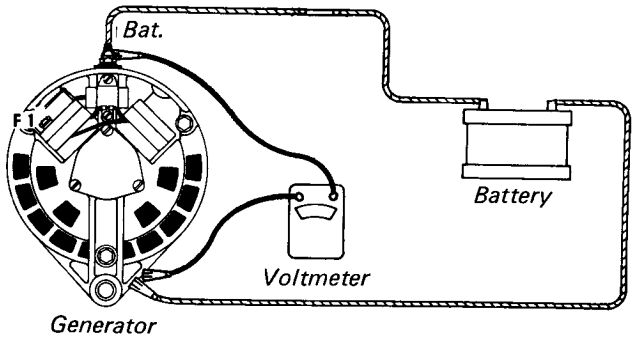

Fig. 2

Step 1. Key off.

Step 2. Connect voltmeter from battery terminal to alternator case. See Fig. 2. Battery voltage should be seen on the voltmeter. If battery voltage is not seen there may be a wiring problem from battery to alternator.

Step 3. Start engine and run at idle RPM. Voltage reading should be above battery voltage 13 volts to 16 volts on 12-Volt Systems, 25 volts to 28 volts on 24-Volt Systems. If voltage does not read above battery voltage raise engine RPM to 1500.

Step 4. If voltage does not read above battery, voltage now, shut down engine, connect voltmeter from the field terminal to ground. Fig. 3.

Step 5. Turn on ignition switch on.

Step 6. If voltmeter reads about 1-2 volts less than battery voltage, proceed to output test.

Step 7. If voltmeter reads zero, wiring, field relay, indicator light relay, or regulator may be defective and must be replaced. NOTE: If regulator is found to be defective, it may have been caused by a faulty field winding, check alt. before replacing regulator.

Step 8. Output test: Disconnect field wire from alternator ("F" terminal) and connect a jumper wire from battery terminal to the field terminal. See Fig. 4. Run engine at idle RPM. If voltage does not read above battery voltage, alternator is defective and must be repaired or replaced.

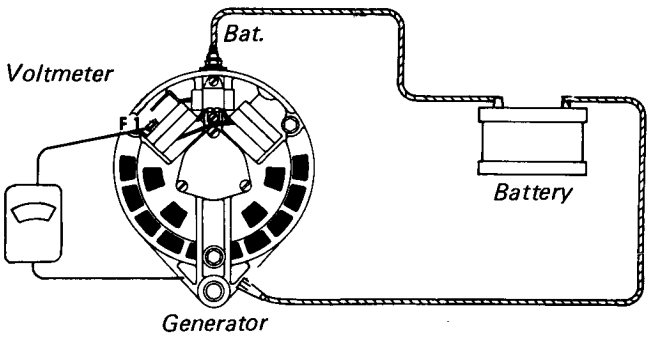

Fig. 3

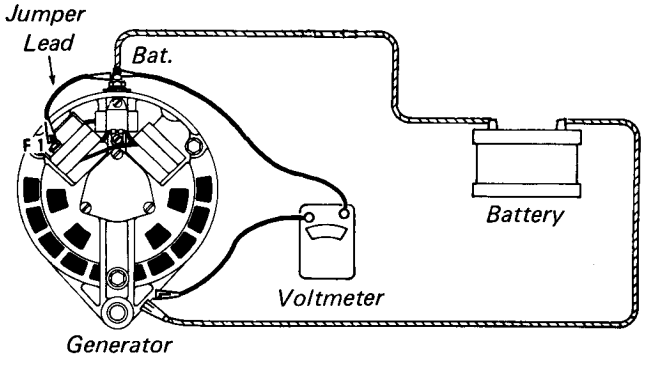

Fig. 4

II. DELCO-REMY (DELCOTRON) EXTERNAL TRANSISTOR REGULATOR.

See Fig. 1

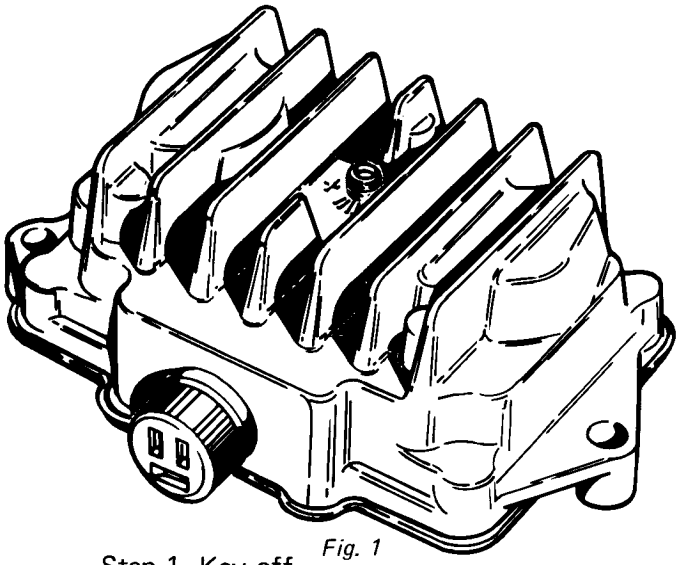

Fig. 1

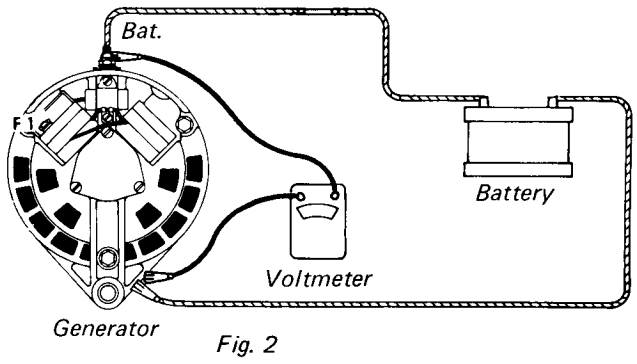

Fig. 2

Step 1. Key off.

Step 2. Connect voltmeter from battery terminal to alternator case. See Fig. 2. Battery voltage should be seen on the voltmeter. If battery voltage is not seen, there may be a wiring problem from battery to alternator.

Step 3. Start engine and run at idle RPM. Voltage reading should be above battery voltage 13 volts to 16 volts on 12-Volt Systems, 25 volts to 28 volts on 24-Volt Systems. If voltage does not read above battery voltage raise engine RPM to 1500.

Step 4. If voltage does not read above battery voltage now, shut down engine, connect voltmeter from the field terminal to ground. Fig. 3

Step 5. Turn on ignition switch.

Step 6. If voltmeter reads about 1-2 volts less than battery voltage, proceed to output test.

Step 7. If voltmeter reads zero, wiring, field relay, indicator light relay or regulator may be defective and must be replaced. If transistor regulator is used, it must be determined which type of wiring circuit is used to proceed with troubleshooting. NOTE: If regulator is found to be defective, it may have been caused by a faulty field winding, check alt. before replacing regulator.

Step 8. Output test: Disconnect field wire from alternator ("F" terminal) and connect a jumper wire from battery terminal to the field terminal. See Fig. 4. Start engine and run at idle RPM. If voltmeter reads higher than battery voltage, alternator is o.k. If voltage does not read above battery voltage, the alternator is defective and must be repaired or replaced.

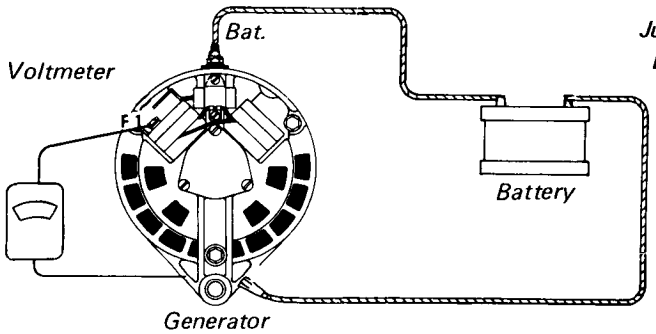

Fig. 3

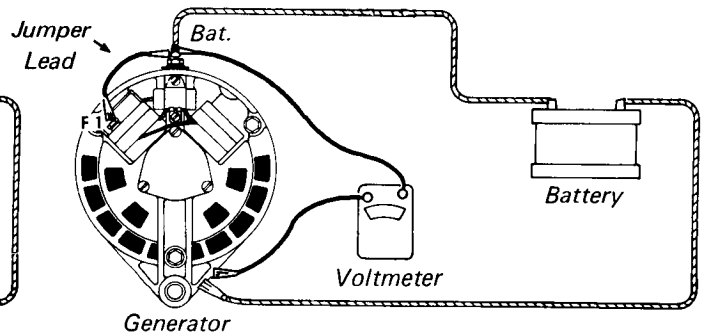

Fig. 4

CLARK

Type No. 1 (See Fig. 1)

Type No. 1 has two separate relays, one field relay and one indicator light relay. This system can be recognized by looking at the rear of the alternator. If there is no wire connected to the "R" terminal of the alternator, the system must be tested in the manner described below:

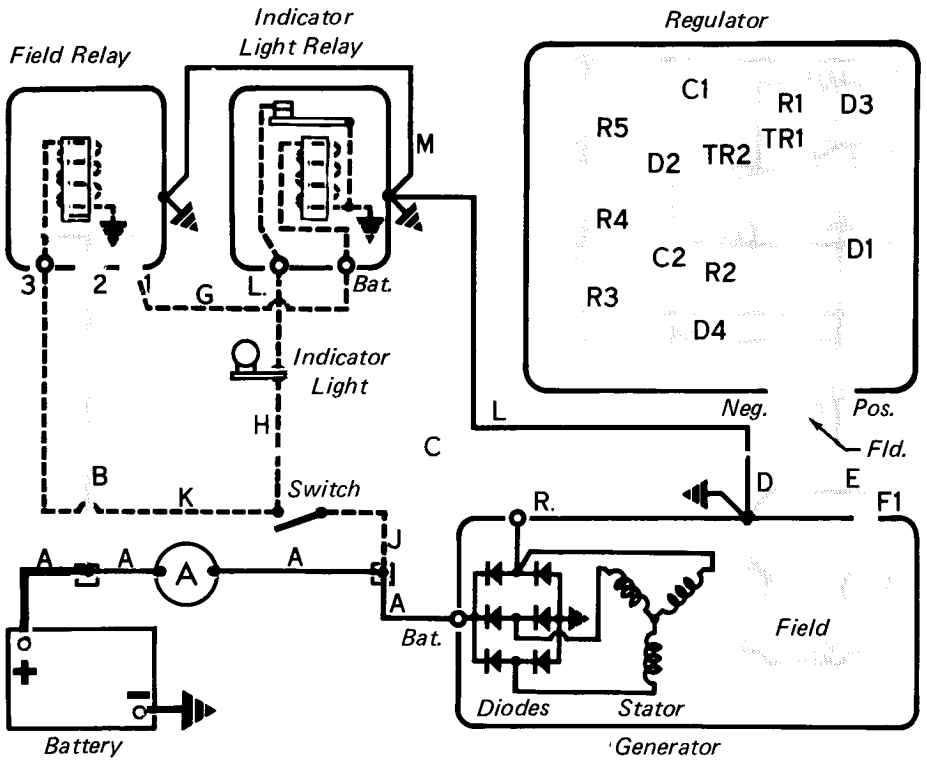

Fig. 1

Negative ground circuit with light relay winding connected to battery when switch is closed.

NOTE: The field relay has three (3) wires. The indicator relay has only two (2).

Field Relay Test Procedure:

Step 1. With ignition switch off, the number 2 terminal of field relay should read battery voltage. If there is no voltage at this terminal, check wiring. No other terminal on the field relay or indicator light relay should show any voltage with the ignition switch off.

Step 2. Turn ignition switch on. Battery voltage should be seen at all terminals of the field relay and indicator light relay, also indicator light should be on. If there is no voltage at terminal number 3 of the field relay, check ignition switch and wiring. If there is voltage at terminal number 3, but not at terminal number 1, check for proper ground. If grounded properly but still shows no voltage at terminal No. 1 replace field relay.

Indicator Light Relay Test Procedure:

NOTE: Field Relay testing must be done and found in working order before Indicator Light Relay can be tested.

Step 1. Switch on, battery voltage should be seen at the "BAT" terminal of the indicator light relay. If battery voltage is not seen check the wiring. Indicator light should also be on at this time. If it is not, check for battery voltage at the "L" terminal of the relay. If there is no voltage at the "L" terminal and light does not work, check light bulb, connectors and wiring. If both relays and alternator check o.k. but charging system does not, replace or repair voltage regulator.

Type No. 2 (See Fig. 2)

This system is very similar to the aforementioned system. The only change is in the way the indicator light relay is wired. The indicator light relay is connected to the "R" terminal of the alternator. The only change in test procedure from Type No. 1 is the checking of the indicator light relay.

Step 1. Turn switch on. Indicator light should come on. If it does not, connect a jumper wire from the "L" terminal of the relay to ground. If the light still is not on, check the bulb, wiring and connectors.

Step 2. If the light does come on, check the relay for proper ground. If the relay is grounded properly, the relay must be replaced.

Step 3. The "R" terminal on the relay should not have any voltage until the engine is started. If there is voltage at the "R" terminal, there is a shorted diode in the alternator. The alternator must be either repaired or replaced.

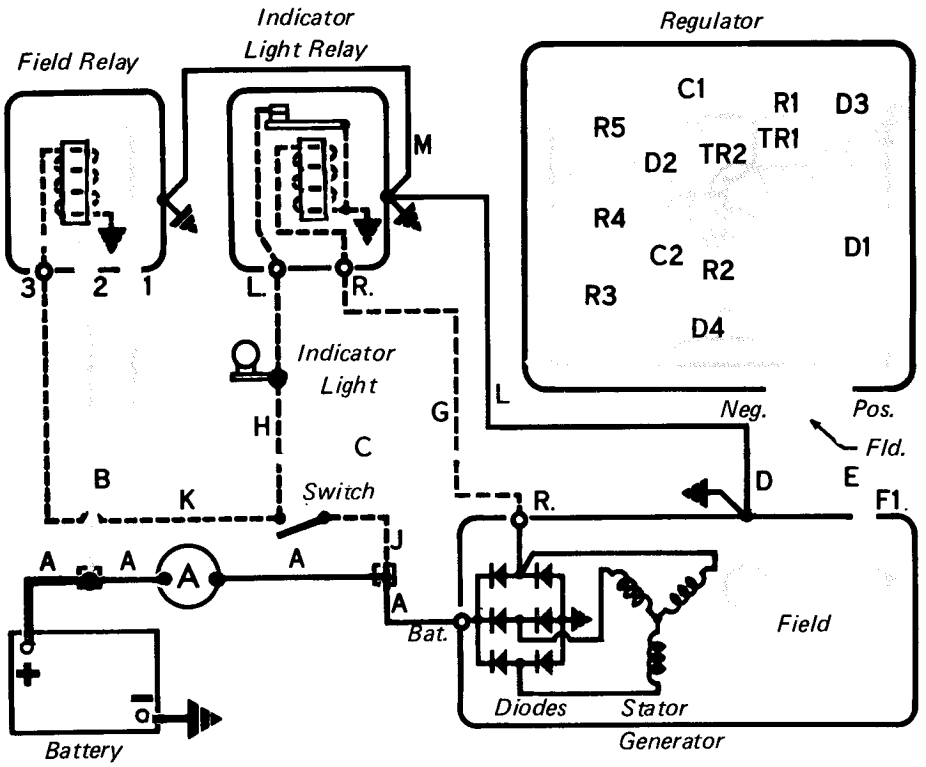

Fig. 2

Negative ground circuit with light relay winding connected to the "R" terminal on generator.

Type No. 3 (See Fig. 3)

In this system check procedure is the same for all components as in Types 1 & 2, except for the field relay and light relay which are housed as one unit.

Step 1. Key off, terminal number 3 should have voltage at all times, if it does not, check wiring and connectors.

Step 2. Key on, terminal number 1 should have voltage; also, indicator light should be on. If there is no voltage at terminal number 1, check ignition switch, wiring, bulb and resistor. If there is voltage at terminal number 1, but indicator light does not work, check bulb and wiring. Terminal number 2 should not have voltage until engine is started.

Step 3. Remove cover from light and field relay. Start engine. Check to see that contact points are closing. If they are not, check for voltage at terminal number 2. If there is not, check wiring from alternator to relay. If the voltage is there, but contacts are not closed, replace relay.

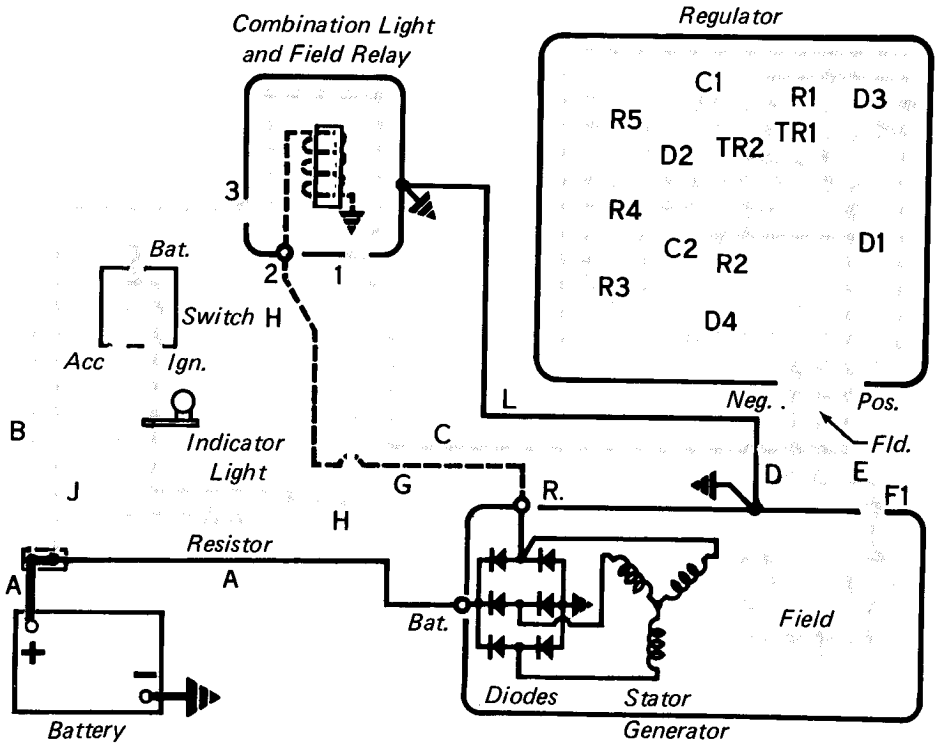

Fig. 3
Negative ground circuit with combination light and field relay.

Step 1. Key off, connect voltmeter from output terminal to ground on case. NOTE: Hex cap screw is insulated, no voltage can be obtained by connecting to the hex head. Battery voltage should be seen at this time. If there is anything less than battery voltage, check the wiring and connectors.

Step 2. Start engine, run at 1500 RPM. Voltmeter should read above battery voltage. If it does not, repair or replace alternator.

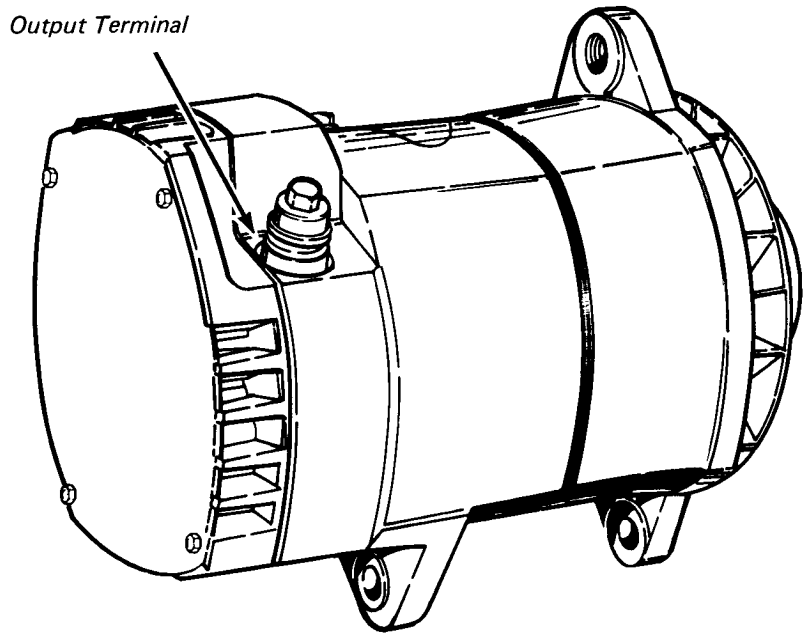

Fig. 1
Internal Transistor Regulator

Step 1. Switch off. Connect voltmeter from positive output terminal to ground at negative output terminal. See Fig. 1. Voltmeter should read battery voltage. If the voltmeter reads less than battery voltage, check wiring and connections.

Step 2. Start engine and run at 1500 RPM. Voltmeter should read above battery voltage. If it does not, go to step 3.

Step 3. Disconnect field wire at the alternator. See Fig. 2, and connect jumper wire from output terminal to field terminal. Start engine and run at 1500 RPM. Voltmeter should read above battery voltage. If it does, replace voltage regulator. If it does not, repair or replace alternator.

Step 4. Check for open isolation diode. Leave the jumper wire connected between the output terminal and the field terminal. Connect one wire on the voltmeter to the auxiliary terminal and the other to ground. Start the engine and run at 1500 RPM. If voltmeter now reads above battery voltage, when it did not in step 2, the isolation diode is open and must be replaced. NOTE: If at this time you have not been able to read a charge from your alternator, there is something wrong internally. Repair or replace.

Step 5. Check for a shorting isolation diode. If the charging system checks to be working properly, but the battery runs down overnight, check for a shorting isolation diode. Connect the voltmeter as described in step 4. With the key off, there should be zero volts at the auxiliary terminal. If voltmeter reads battery voltage, the isolation diode is shorting and must be replaced. If you have this problem, but the isolation diode checks to be all right, there is a short in machine wiring.

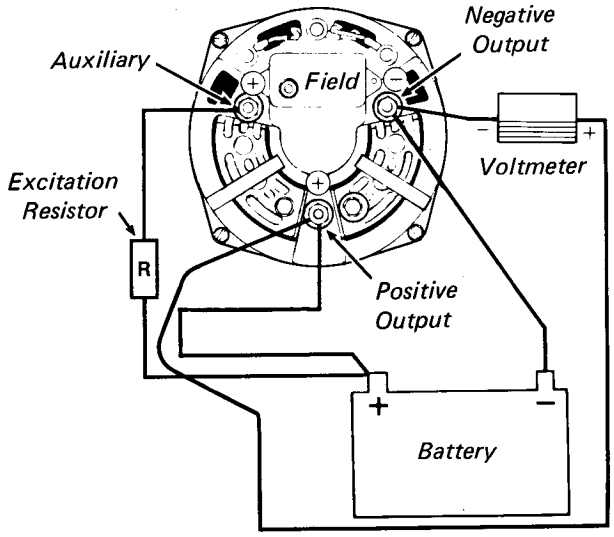

Fig. 1

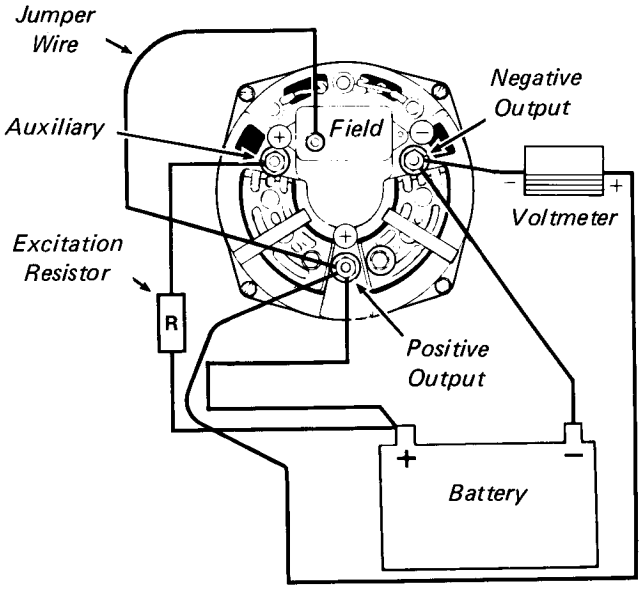

Fig. 2

Voltage at Auxiliary Terminal should be approx. 1.0 volt higher than output voltage.

R-75 OHM, 12 Volt Units
R-150 OHM, 24 Volt Units

Evaluation Test (12 & 24 Volt Models with Isolation Diode)

Step 1. Connect one lead of voltmeter to positive output terminal of alternator and other lead to ground at the negative output terminal. See Fig. 1. Battery voltage should be seen at this time. If battery voltage is not seen check wiring and connections.

Step 2. Start engine, run at 1500 RPM. Voltmeter should read above battery voltage. If it does not, connect jumper wire from output terminal to "REG" terminal. See Fig. 2. If voltmeter now reads above battery voltage, check wiring from battery to regulator terminal (I.E. ignition switch, wiring etc).

Step 3. To bypass regulator, the regulator must be removed from the alternator. It is then necessary to connect two jumper wires, one from the negative brush wire to negative output terminal, the second from the positive brush wire to the positive output terminal. Start engine, voltmeter should now read above battery voltage. If it does not, alternator is defective and must be repaired.

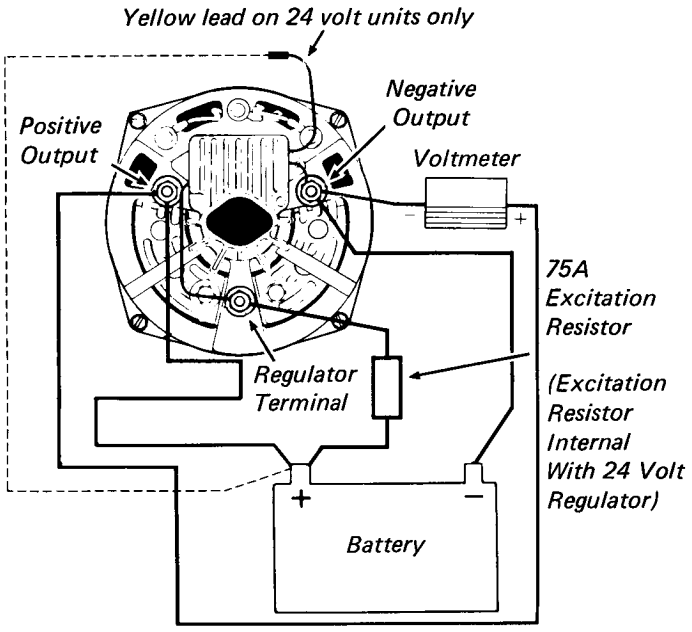

Fig. 1

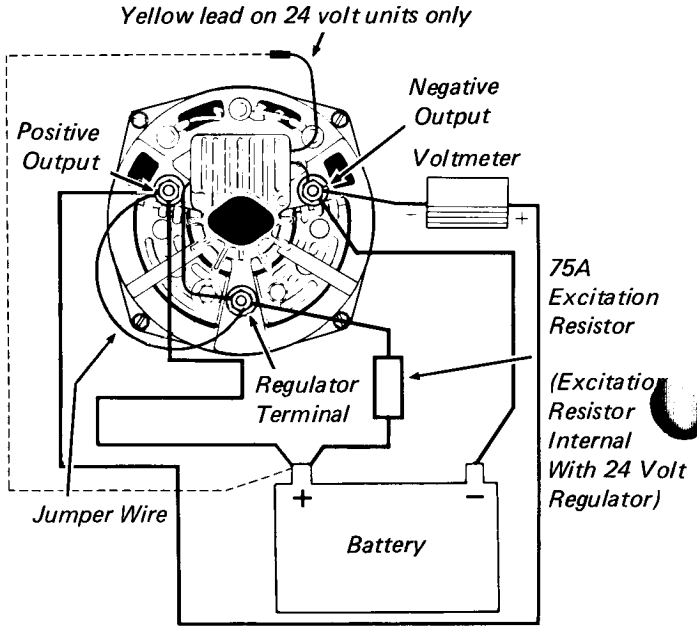

Fig. 2

Voltage at Regulator Terminal should be approx. same as charging voltage

Evaluation test (12 & 24 Volt Models with Integral Regulator)

Service School Topic.....

SST-14 A

Ref. Group Number 50

October 15, 1975

SUBJECT: Electrical Troubleshooting Guide Supplement
All Model Tractor Shovels With Indicator Lights

Attached is an electrical troubleshooting guide covering the different types of indicator lights currently used on Clark Tractor Shovels.

WARNING LIGHT CIRCUIT - "B" SERIES MACHINES

Warning lights are now standard on several machine models replacing the conventional gauges. Lights indicate the following:

Engine System

1. Low oil pressure
2. High coolant temperature

Brake System

1. Low service brake air pressure (in some cases this light is used to show both low air pressure and low fluid level in the master cylinder)
2. Parking brake "on"

Electrical System

1. Alternator not charging

Transmission & Torque Converter System

1. High torque converter oil temperature

Trabon Lubrication System (Standard on 475-675)

1. Lube system cycling (green)
2. System high pressure (red)

Each circuit consists of a warning light and a sender switch. The lights are interchangeable except for title on lens, if there is a title on the lens. A "press to test" button or a rotary tap switch and a warning buzzer are common to the entire circuit.

The following are some basic facts that need to be known to understand the warning light circuitry.

1. A diode is a one-way check valve that allows current to flow in one direction but not the other. The following is the symbol used to show the location of a diode:

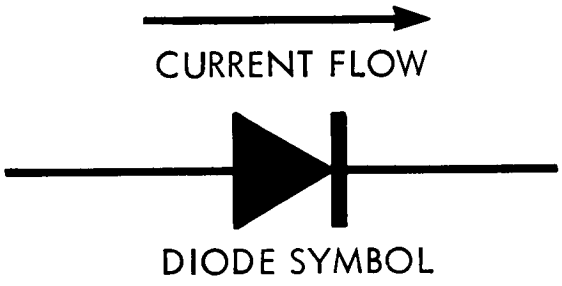

Fig. 1

Common troubleshooting terms are "open diode" or "shorted diode". An open diode will not allow current to flow through it in either direction. A shorted diode will allow current to flow both directions.

2. Sender switches are devices that either open or close through pressure sensing or heat sensing to complete an electrical circuit.

There are three (3) different warning light circuits used in the Michigan equipment. The basic differences are as follows:

1. Use of lights with internal diodes and Press-to-Test switch.
2. Use of a single external diode block and a Rotary Tap test switch.
3. Use of two external diode blocks and a Press-to-Test switch.

It must be determined which type of circuit is used before any troubleshooting procedures are attempted.

To determine if the machine is equipped with the circuit using the lights with internal diodes, the lens of the lights will have lettering on them indicating which circuit each light is for. The circuits using diode blocks instead of lights with internal diodes, have the lettering for the circuits on the dash panel instead of on the lens of the light. The measurements of the lens of the lights with internal diodes are approximate 9/16" x 1 1/2". The lights without internal diodes are approximately 1/2 as large.

The warning light circuit for units using indicator lights with internal diodes is sketched below:

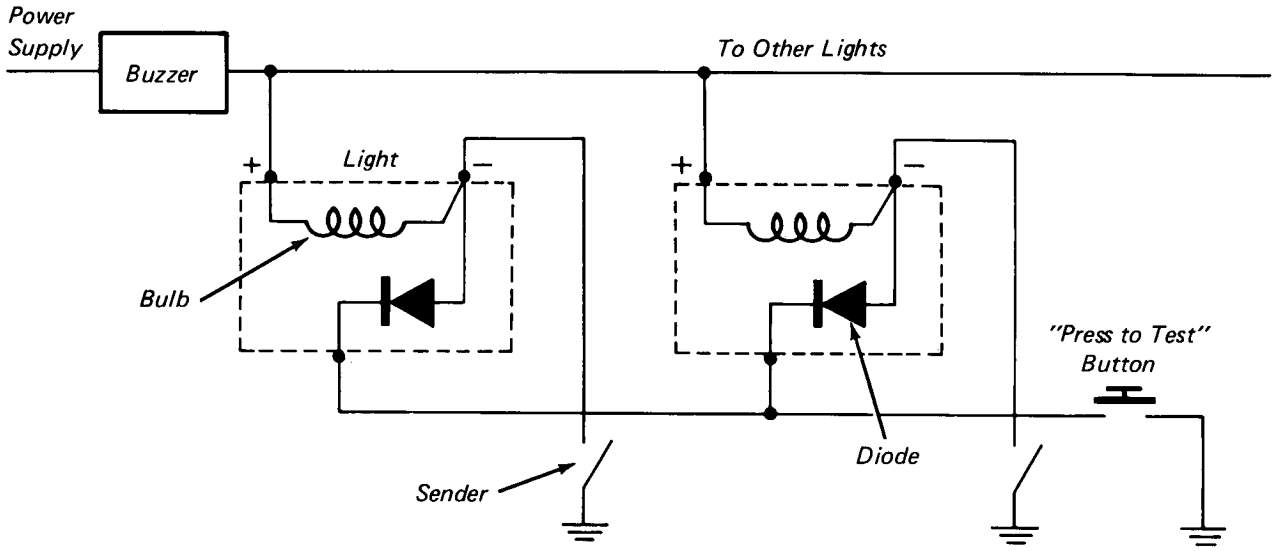

Fig. 2

This is the circuit with the single external diode block and rotary tap switch.

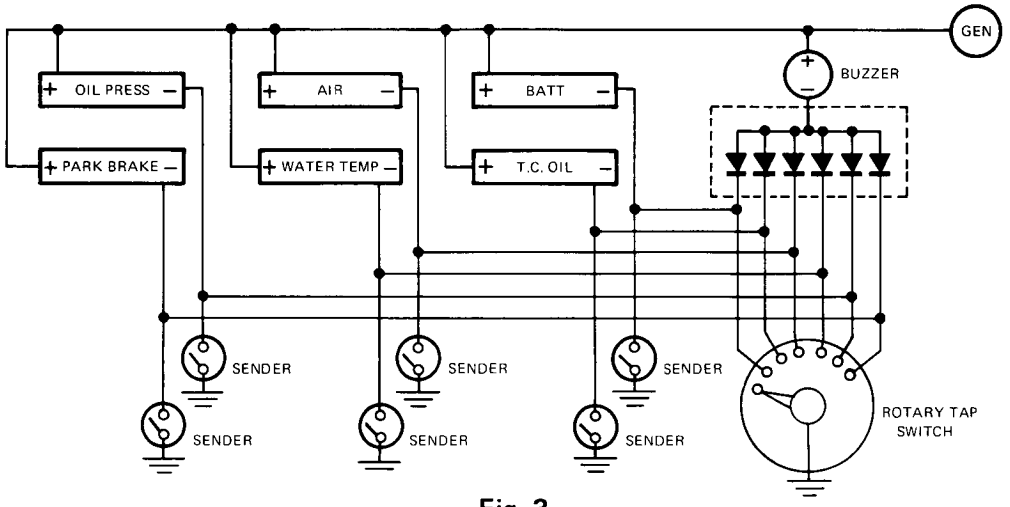

Fig. 3

This one has the two external diode blocks and "press to test" switch.

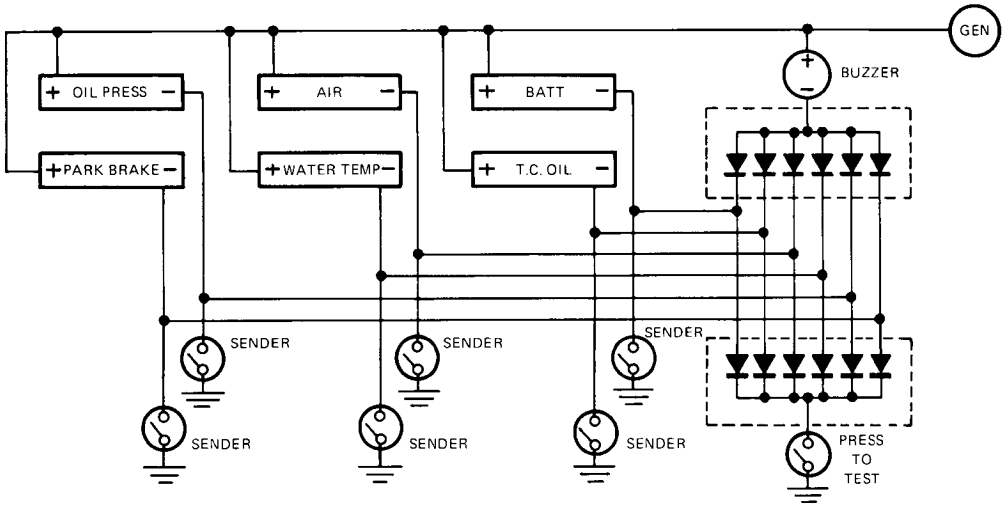

Fig. 4

The warning system operates as follows: (see figures 2, 3, & 4)

If a problem develops in any of the circuits, the sender switch completes the circuit to ground. The power supply flows into the positive (+) terminal of the warning light, through the light, through the wire, to the sender, to ground. This causes the light to light up denoting a problem.

When the sender switch closes the circuit, power also flows through the buzzer. The current flowing through the buzzer causes the buzzer to operate. The buzzer is an additional warning device to draw the operator's attention to a problem area if he fails to see the light.

The "press to test" button or rotary tap switch replaces the sender switch to complete the circuit to ground. When the button is pushed or switch is rotated, the power supply flows into the positive (+) terminal of the warning lights, through the diodes, through the "press to test" button or rotary tap switch to ground causing all of the lights to light up and the buzzer to operate. The purpose of the diodes is to prevent current passing through one light from lighting a second light, during normal operation, and to allow the use of a "press to test" button or rotary tap test switch.

The following troubleshooting guides are designed to find and correct problems in the indicator light circuits. It must be understood that any problems found in the systems served by the indicator lights must also be corrected before the machine is returned to its operation.

The following is a list of possible problems, causes, and remedies for circuits using lights with internal diodes:

PROBLEM 1 One warning light on, buzzer not operating.

POSSIBLE CAUSE 1. Inoperative buzzer.

CHECK OR REMEDY 1. Replace buzzer.

PROBLEM 2 Buzzer on, no lights on.

POSSIBLE CAUSE 1. Light bulb failed.

CHECK OR REMEDY 1. Press "press to test" button to check lights.

PROBLEM 3 All warning lights on and buzzer on.

POSSIBLE CAUSE 1. Diode in one light unit shorted. (Probably one light will be bright, other lights will be dim.)
2. "Press to test" button or wiring to button grounded.
3. (-) wire to sender and test wire connected to opposite terminal.

CHECK OR REMEDY 1. Remove the wire connected to the terminal marked "test" from the brightest light. All lights other than circuit with problem should go out. Light bulb must be replaced and system problem corrected.
2. Disconnect wire from "press to test" button to warning lights.
3. Check connections. Correct wiring and system problems.

PROBLEM 4 More than one light, but not all lights on, buzzer on (45B only).

POSSIBLE CAUSE 1. Shorted diode in buzzer.

CHECK OR REMEDY 1. Check to see which system or circuit has a problem. Correct problem and replace buzzer.

PROBLEM 5 Light and buzzer on with no malfunction as indicated.

POSSIBLE CAUSE 1. Shorted sender, or wiring.

CHECK OR REMEDY 1a. Disconnect sender. If this corrects problem, replace sender.
1b. If sender does not correct problem, check wiring.

PROBLEM 6 "Press to test" button pushed, one light does not come on.

POSSIBLE CAUSE 1. Faulty wiring or bad connections.
2. Diode is open or bulb is burned out.

CHECK OR REMEDY 1. Switch the wires (all three) from a light that is working to one that is not. If light comes on, wiring or connection is at fault.
2. If light does not come on, replace light.

PROBLEM 7 "Press to test" button pushed, buzzer does not work.

POSSIBLE CAUSE 1. Defective buzzer.

CHECK OR REMEDY 1. Replace buzzer.

PROBLEM 8 Light comes on and gets brighter and brighter. (This problem could show up on any of the three systems.)

POSSIBLE CAUSE 1. A gauge sender has been installed instead of a light sender.

CHECK OR REMEDY 1. Replace sender.

CIRCUIT WITH ROTARY TAP SWITCH

PROBLEM 1 One warning light on, buzzer not operating.

POSSIBLE CAUSE
1. Open diode in diode block.
2. Faulty wiring.
3. Inoperative buzzer.

CHECK OR REMEDY
1. Rotate rotary tap switch to see if buzzer will work with other circuits. If it does, check wiring between the light and the diode block. If the wiring is correct, replace diode block.
2. If buzzer does not operate when rotary tap switch is rotated, check wiring from the power supply to the buzzer. Then from the buzzer to the diode block.
3. If none of the above correct the problem, replace buzzer.

PROBLEM 2 Buzzer on, no lights on.

POSSIBLE CAUSE
1. Light bulb failed.
2. Faulty wiring.
3. Buzzer grounded.

CHECK OR REMEDY
1. Turn rotary tap switch to find light which does not work. Install a new bulb, or switch the inoperative bulb with one of the others to see if this corrects the problem.
2. If this does not correct the problem, check the wiring to and from the bulb.
3. If all of the lights operate with the rotary tap switch, check the wiring from the buzzer to the diode block for a ground.

PROBLEM 3 All warning lights on and buzzer on.

POSSIBLE CAUSE
1. Faulty rotary tap switch.

CHECK OR REMEDY
1. Repair or replace rotary tap switch.

PROBLEM 4 More than one light, but not all lights on; buzzer on.

POSSIBLE CAUSE
1. Shorted rotary tap switch.
2. Shorted diode.

CHECK OR REMEDY
1. Determine which system has a malfunction or which light should be on. Disconnect the wire that connects that light to the rotary tap switch at the switch. If all other lights go out, except the one that should be on, there is a short in the rotary tap switch.
2. If the extra lights do not go out when the wire is disconnected from the rotary tap switch, there is probably a shorted diode in the diode block. Disconnect the wire that connects the light that should be lit to the diode block. All other lights should go out. Replace diode block.

PROBLEM 5 Light and buzzer on with no malfunction as indicated.

POSSIBLE CAUSE
1. Shorted sender, or wiring.
2. Shorted rotary switch.

CHECK OR REMEDY
1a. Disconnect sender. If this corrects problem, replace sender.
1b. If sender does not correct problem, check wiring.
2. If the above does not correct the problem, disconnect wire from diode block to rotary switch. If this corrects the problem, replace rotary switch.

PROBLEM 6 Rotary switch turned to test each circuit and one or more lights do not come on and buzzer works.

POSSIBLE CAUSE
1. Faulty wiring or bad connections.
2. Bulb is burned out.

CHECK OR REMEDY
1. Switch wires from a light that is working to the one that is not. If light comes on, check wiring, connections, or terminal in rotary tap switch.
2. If the light does not come on when the wires are switched, replace bulb.

PROBLEM 7 Rotary switch turned to test each circuit, lights work, buzzer does not work in some of the positions.

POSSIBLE CAUSE
1. Faulty wiring.
2. Open diode.

CHECK OR REMEDY
1. Check wiring.
2. Replace diode block.

PROBLEM 8 Rotary switch in all positions and buzzer does not work with lights working properly.

POSSIBLE CAUSE
1. Defective buzzer or wiring.

CHECK OR REMEDY
1. Check wiring. If there is no wiring problem, replace buzzer.

PROBLEM 9 Light comes on and gets brighter and brighter.

POSSIBLE CAUSE
1. A gauge sender has been installed instead of a light sender.

CHECK OR REMEDY
1. Replace sender.

CIRCUIT WITH TWIN DIODE BLOCKS

PROBLEM 1 One warning light on, buzzer not operating.

POSSIBLE CAUSE
1. Open diode in buzzer diode block.
2. Faulty wiring.
3. Inoperative buzzer.

CHECK OR REMEDY
1. Press the "press to test" button. If the buzzer operates now, check the wiring between the light that came on and the buzzer diode block. If the wiring is correct, replace the buzzer diode block.
2. If the buzzer does not operate when the "press to test" is depressed, check the wiring from the power supply to the buzzer and from the buzzer to the diode block.
3. If wiring is correct, change buzzer.

PROBLEM 2 Buzzer on, no lights on.

POSSIBLE CAUSE
1. Light bulb failed.
2. Faulty wiring.
3. Buzzer grounded.

CHECK OR REMEDY
1. Press the "press to test" button to determine which light is not working. Install a new light bulb or switch the inoperative bulb with one that is working.
2. If this does not correct the problem, check the wiring to and from the bulb.
3. If all of the lights operate when the "press to test" button is pushed, check the wiring from the buzzer to the buzzer diode block for a ground.

PROBLEM 3 All warning lights on and buzzer on.

POSSIBLE CAUSE
1. Faulty wiring.
2. Shorted diode in "press to test" diode block.
3. Faulty "press to test" switch.

CHECK OR REMEDY
1. Check wire for grounding from diode block to "press to test" button.
2. If wiring is satisfactory, disconnect the wires connecting the lights to the diode blocks one at a time. If the lights all go out with any one wire disconnected, the "press to test" diode block has a shorted diode. Replace diode block.
3. If neither of the above corrects the problem, replace the "press to test" button.

PROBLEM 4 More than one light, but not all lights on, with buzzer on.

POSSIBLE CAUSE
1. Shorted diode in buzzer diode block.

CHECK OR REMEDY
1. Determine which light should be one. Disconnect the wire from the diode block to this light. All other lights should go out. Replace buzzer diode block.

PROBLEM 5 Light & buzzer on with no malfunction as indicated.

POSSIBLE CAUSE 1. Shorted sender, or wiring.

CHECK OR REMEDY 1. Disconnect sender. If this corrects problem, replace sender.
2. If sender does not correct problem, check wiring.

PROBLEM 6 "Press to test" button pushed, one light does not come on.

POSSIBLE CAUSE 1. Faulty wiring, bad connections, or open diode in the "press to test" diode block.
2. Light bulb failed.

CHECK OR REMEDY 1. Switch both wires from a light that is working to the one that is not. If light comes on, check the wiring to and from the light. If wiring is ok, "press to test" diode block has an open diode. Replace diode block.
2. If light does not come on, bulb is burned out. Replace light.

PROBLEM 7 "Press to test" button pushed, buzzer does not work.

POSSIBLE CAUSE 1. Defective wiring.
2. Defective buzzer.
3. Defective buzzer diode block.

CHECK OR REMEDY 1. Check wiring to and from buzzer.
2. If wiring is alright, replace buzzer.
3. If the above does not correct the problem, replace buzzer diode block.

PROBLEM 8 One light on, buzzer does not sound.

POSSIBLE CAUSE 1. Defective wiring.
2. Open diode in buzzer diode block.
3. Defective buzzer.

CHECK OR REMEDY 1. Press "press to test" button. If buzzer operates now, check wiring from buzzer diode block to light.
2. If wiring is correct, replace buzzer diode block.
3. If buzzer does not work when "press to test" button is pushed and wiring is correct, replace buzzer.

PROBLEM 9 Light comes on and gets brighter and brighter.

POSSIBLE CAUSE 1. A gauge sender has been installed instead of a light sender.

CHECK OR REMEDY 1. Replace sender.

CLARK Service gram

July 17, 1964 SG-243

SUBJECT: Delcotron Alternators
Model 125A, 175A, 275A Series II
Tractor Shovels and 480 Tractor Dozers

The purpose of this bulletin is to list and emphasize certain precautions that must be observed when servicing or repairing subject models equipped with alternators.

The alternator is a continuous - output diode rectified alternating current (a.c.) generator that develops a continuous output of electrical energy at all engine operating speeds (high, low and idle). The trade name for this unit manufactured by Delco-Remy is "Delcotron". The output of the alternator is controlled by a transistorized voltage regulator.

When working on a "Delcotron" charging system, it is important to keep in mind that the "Delcotron" and regulator are designed for use on only one polarity system. The following precautions must, therefore,be observed when working on or troubleshooting the charging circuit and failure to observe these precautions will result in serious damage to the electrical system components.

1. When installing a battery, always make absolutely sure the ground polarity of the battery and the ground polarity of the "Delcotron" are the same. If a battery of the wrong polarity is connected into the charging system or if the battery is reversed when installing it, the battery is directly shorted through the diodes. Consequently, the diodes and machine wiring are endangered by high current flow. Burned wiring harness and burned "open" diodes probably will result.

2. When connecting a booster or "slave" battery, make certain to connect the negative battery terminals together and the positive battery terminals together. Failure to observe this precaution will result in the same damage as just described above.

3. When connecting a charger to the battery, connect the charger positive lead to the battery positive terminal and the charger negative lead to the battery negative terminal. Failure to follow this procedure will result in the same damage as described in the first precaution.

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4. Never operate the "Delcotron" on open circuit. With no battery or electric load in the circuit (open circuit), the "Delcotron" can build up high voltages which could be extremely dangerous to anyone who might accidentally touch the "Delcotron" battery terminal. Before making tests or "on-the machine" checks, it is prudent to make sure that all connections in the circuit are tight and secure.

5. Do not short across or ground any of the terminals on the "Delcotron" or regulator. Any artificial circuit set up by purposely grounding or shorting any of the "Delcotron" or regulator terminals can cause serious electrical malfunctions that might endanger components of the electrical system.

6. Do not attempt to polarize the "Delcotron". Polarizing the d. c. type of generator is necessary to insure that generator and battery polarity are the same. "Delcotron" polarizing, however, is not necessary since the voltage developed within the "Delcotron" is of both polarities and the diode rectifier automatically controls the direction of current flow. It is of vital importance, as discussed in the first precaution, that the battery ground and the "Delcotron" ground be of the same polarity for diode protection.

7. Before doing any welding on machines equipped with an alternator, disconnect the ground cable from the battery and the electrical lead from the battery terminal on the alternator.

CLARK Service gram

March 9, 1966 SG-260

SUBJECT: Transistorized Regulator used in conjuction with Delco-Remy "Delcotron" alternator

The purpose of this bulletin is to recommend certain service procedures prior to replacing inoperative transistorized regulators used in conjuction with the Delco-Remy "Delcotron" Alternator (a continuous-output diode-rectified alternating-current generator).

When working or troubleshooting on a "Delcotron" charging system, it is important to observe the precautions specified in Service Gram 243, dated July 17, 1964.

In addition to performing the tests and adjustments specified in the applicable Delco-Remy Service and Maintenance Instructions, it is recommended that the Wiring circuit be checked for proper hook-up and good contact.

Figure 1 illustrates the correct alternator to regulator wire routing. Wiring harnesses that do not match the wire routing illustrated by Figure 1 will necessitate replacement or rework to agree with the illustration in order to prevent further damage to electrical system components.

HJS

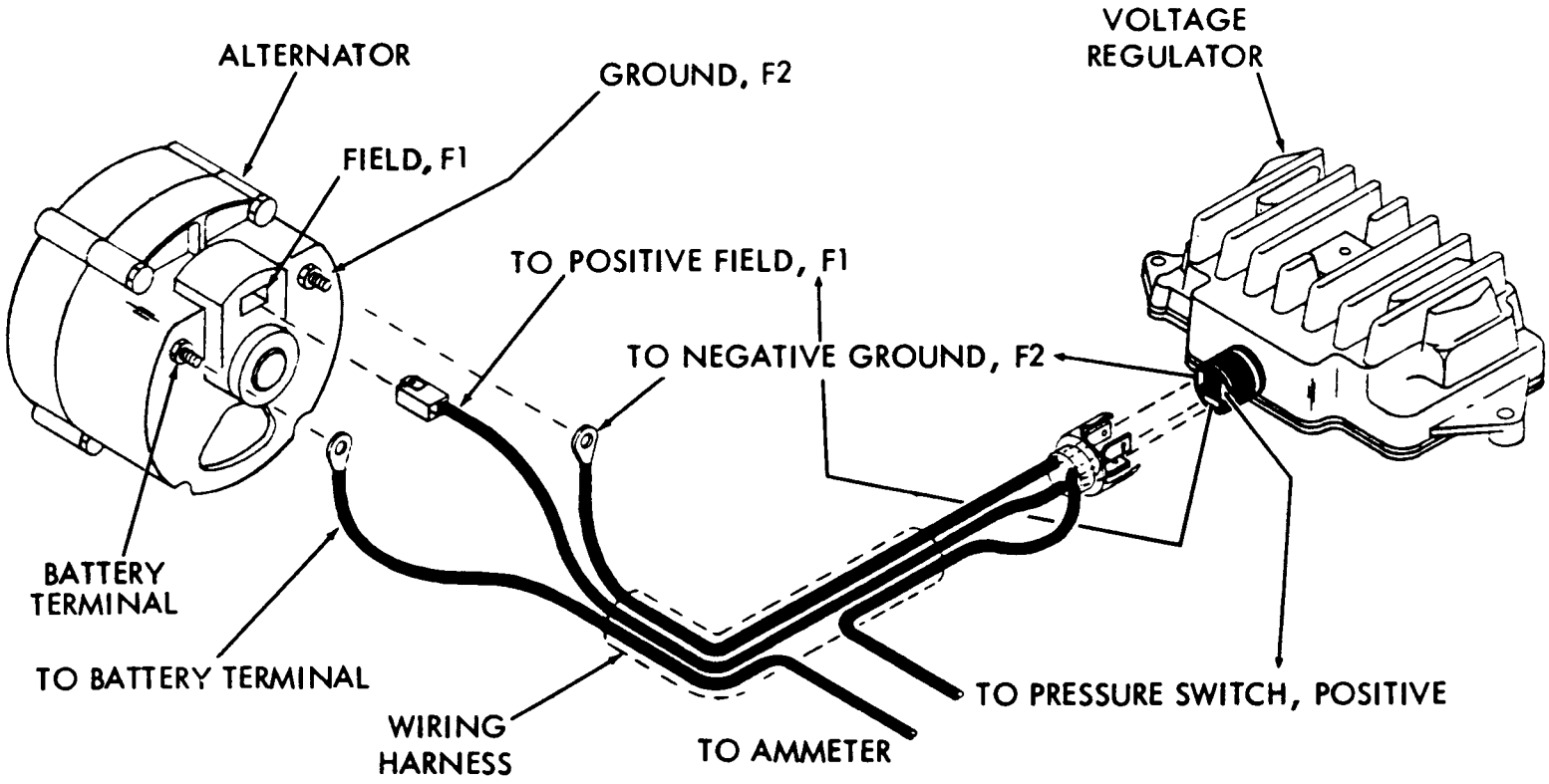

FIGURE 1 ALTERNATOR REGULATOR DIAGRAM

TS-6903

CLARK Service gram

December 6, 1972

MICHIGAN SG-458
Group Ref. No. 1500

SUBJECT: Blower Wheels, Blower Housings & Blower Motors as Individual Service Parts for Heater Assemblies 1510660 (12V) & 1510661 (24V) - Series III & IIIA Model Machines

This is to announce that the blower wheels, housings, motors, foils and plates previously available only in the form of complete blower assemblies, for the subject heater assemblies, are now available as individual service parts from the Central Parts Division. Part number data is as follows:

*Item No.	Description	For 1510660 Heater (12V)	For 1510661 Heater (24V)
-	Blower Assy (Inc. 4, 5, 7, 8, 9)	948957	948958
4	Plate, Blower	949521	949521
5	Wheel, Blower	948992	948992
7	Housing, Blower	949522	949522
8	Foil, Blower	947978	947978
9	Motor, Blower	948977	948978

*Refer to Fig. 1

NOTE: When replacing blower motors, wheels or housings in old style heater assemblies 1505845 (12V) or 1505844 (12V), as outlined in Service Gram SG-376, it is still necessary to replace the entire blower assembly using 948957 blower assy. for 12V heaters & 948958 blower assy. for 24V heaters. After such replacement, individual components may be serviced separately.

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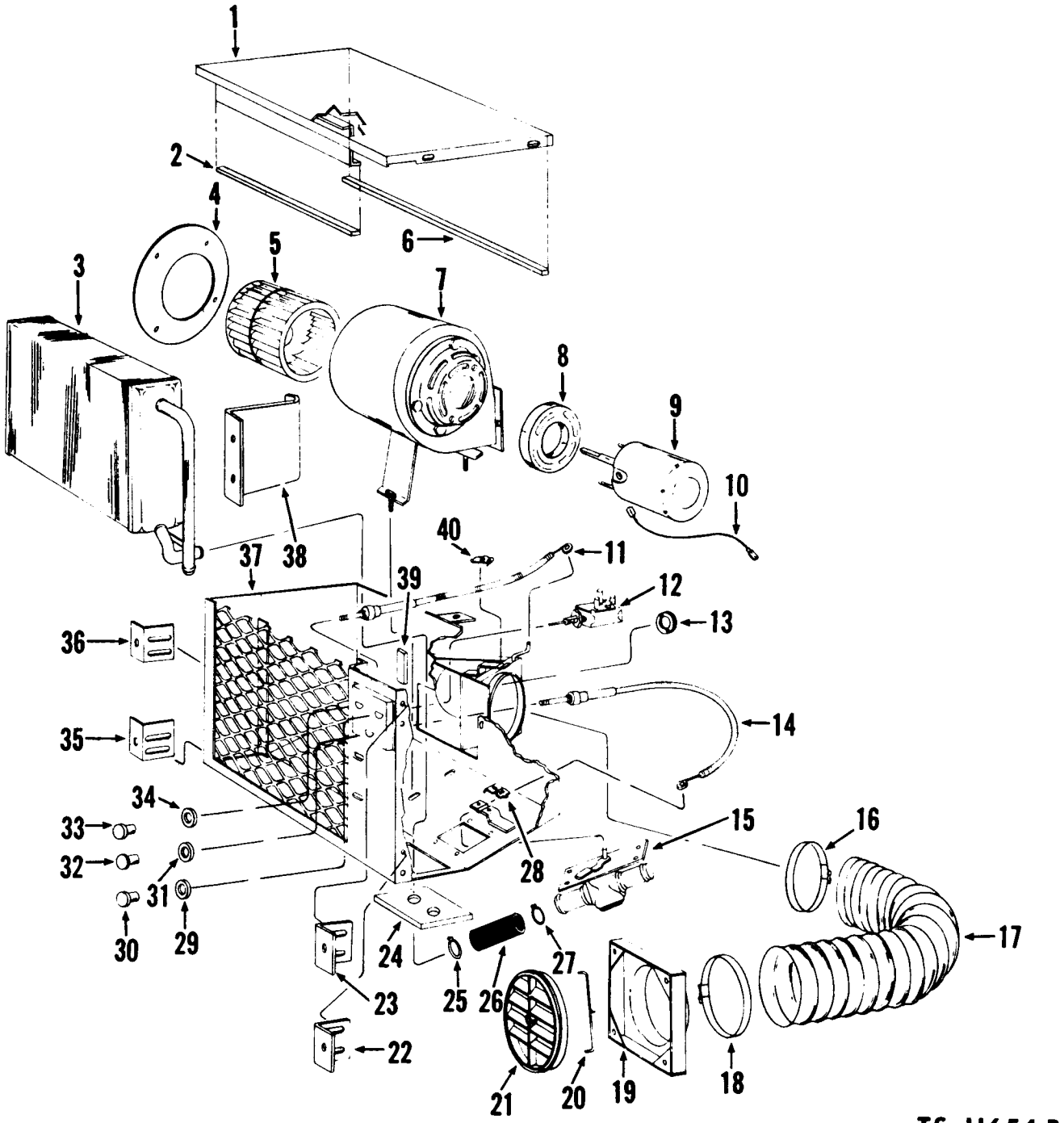
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CLARK Service gram

25 July 1973

MICHIGAN SG - 482
Group Ref. No. 800
1500

SUBJECT: Boom Detent Release
Model 175 B & 275 B

An electric boom detent release is available for use on Model 175 B & 275 B Tractor Shovels. This feature makes it possible to manually by-pass the action of the boom kickout and may be installed, if desired, on subject model machines in the field by using parts listed below and installing them in accordance with the following instructions. These parts may be ordered from the Central Parts Division.

PARTS REQUIRED (Per machine):

1 - 1501478 Switch, Toggle
1 - 2502936 Wire Assy.
1 - 2502937 Wire Assy.

INSTALLATION:

1. Refer to Figure 1 and disconnect unfused wire from boom kick-out solenoid valve.

2. Connect 2502937 Wire Assembly between terminals disconnected in Step 1.

3. Install 1501478 Toggle Switch on left hand instrument panel as shown in Figure 2.

4. Connect 2502937 Wire Assembly to toggle switch as shown in Figure 1.

5. Connect 2502936 Wire Assembly to toggle switch and resistor hold down screw for ground as shown in Figure 1.

R/N 20573

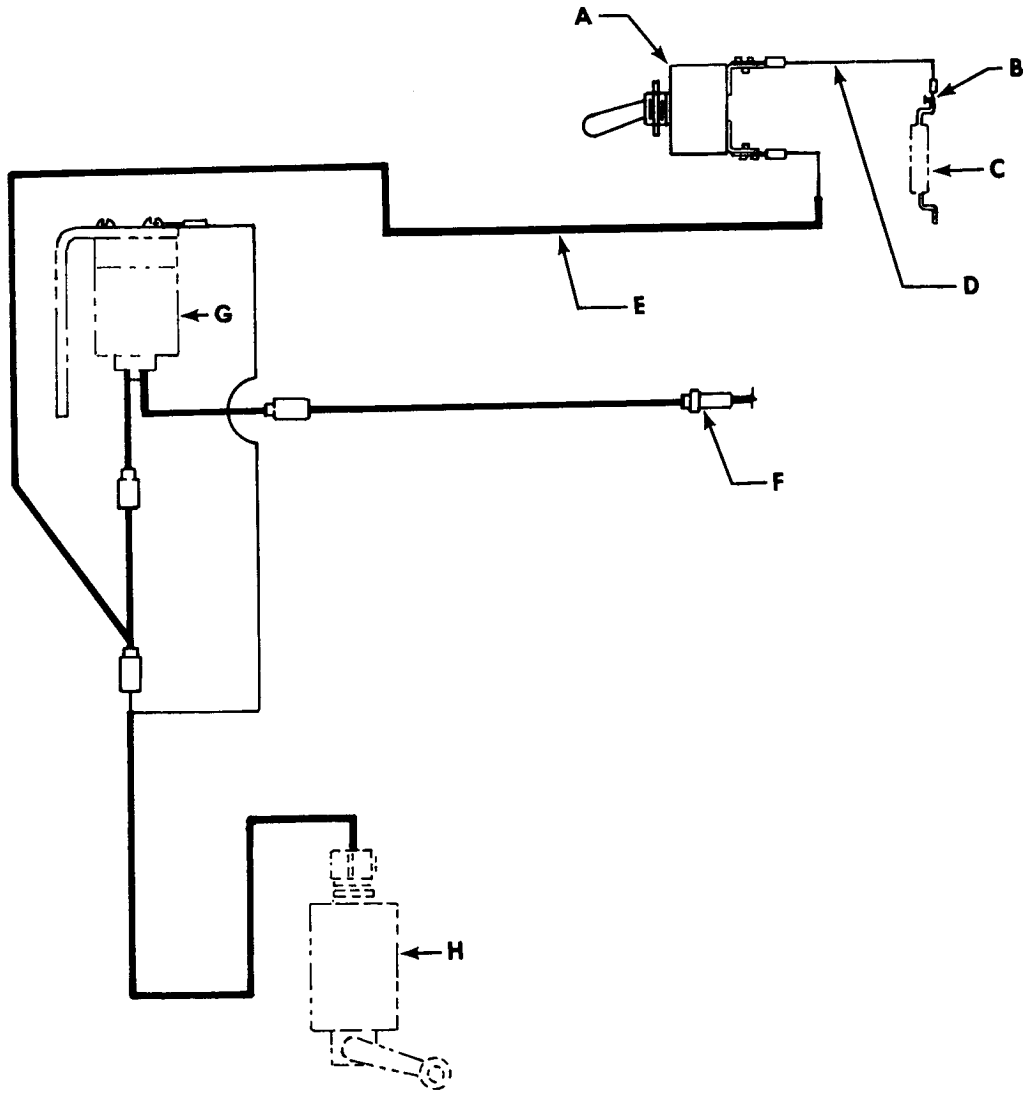

Figure 1. Wiring Diagram

A. 1501478 Toggle Switch
B. Ground
C. Resistor ref.
D. 2502936
E. 2502937 Wire Assy.
F. Fuse ref.
G. Boom Kickout Solenoid Valve
H. Boom Kickout Limit Switch

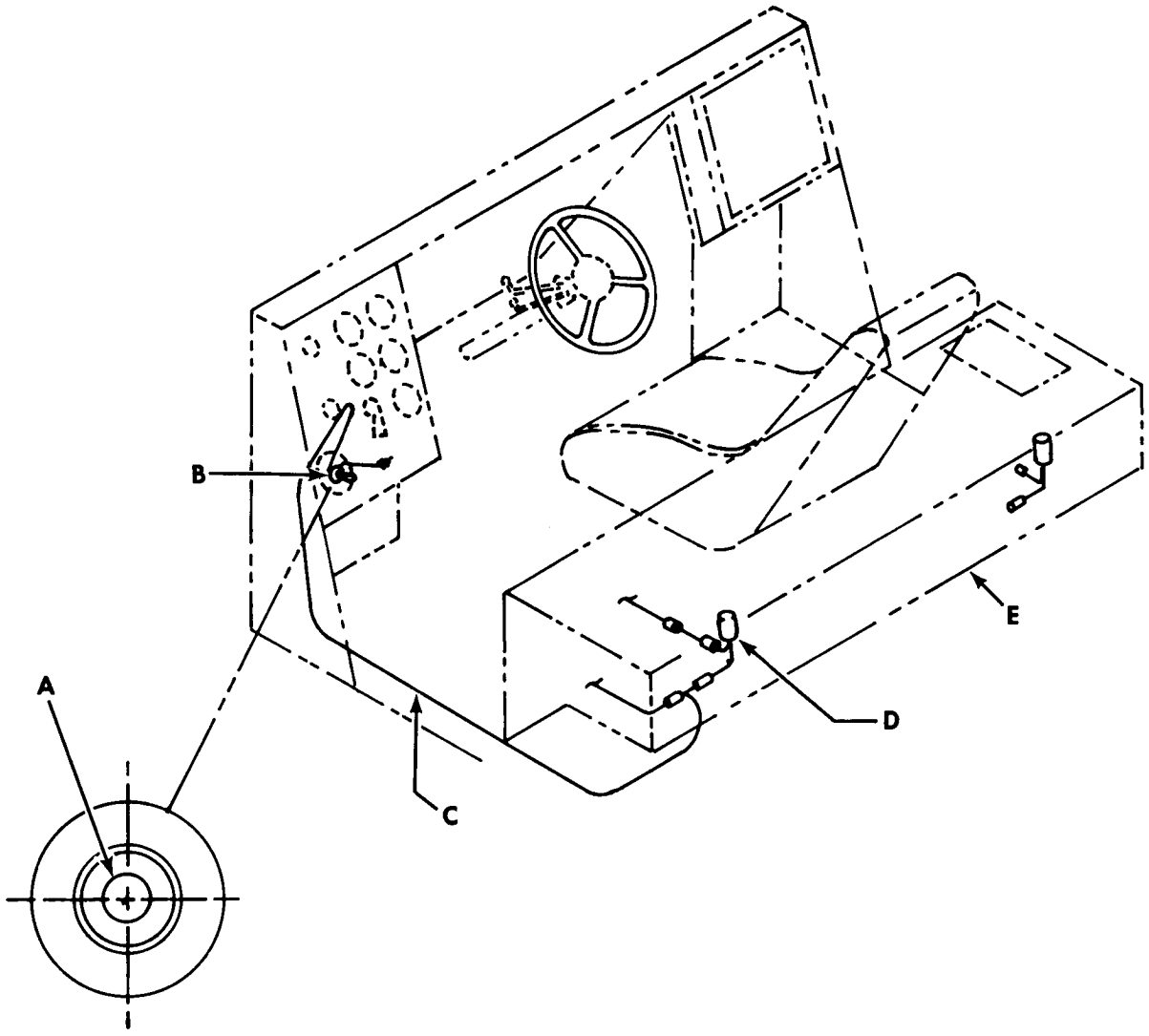

Figure 2.

A. Drill .50 (12,7) diameter hole in knock-out
B. 1501478 Toggle Switch
C. Clip wire as req'd to existing clips
D. Boom Kickout Solenoid Valve
E. Cockpit ref.

CLARK Service gram

19 December 1973

MICHIGAN SG-493
Group Rev. No. 800

SUBJECT: 1512688 Circuit Breaker (50 Amp.) used on Models 175B, 275B, 475-111A & 280-111A
6001501 Circuit Breaker (70 Amp.) used on Models 45B, 75B, 125B, 475B & 675B

The subject circuit breakers are utilized in the electrical systems of the machine models enumerated above. The reset button of these circuit breakers is normally a MAROON color.

Due to a shortage situation of the petrochemical based material used in molding these reset buttons, caused by the existant petroleum shortage, it has become necessary to employ alternative materials for an indefinite period of time in the production of these circuit breakers. As a result, you will encounter machines in the field with these circuit breakers having reset buttons of a BLACK or SCARLET RED color. This color change will result in no change in the performance specifications of these circuit breakers.

The purpose of this bulletin is to inform you of this situation, in order that there will be no cause for question or alarm as a result of same.

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CLARK Service gram

12 March 1975

MICHIGAN SG-535
Group Ref. No. 800
1500

SUBJECT: Replacement of Windshield Wiper Motors, Applicable to All Models of MICHIGAN Tractor Shovels and Dozers

The original "K Series" wiper motors are no longer produced by the vendor and have been replaced by a later series of wiper motors. Wiper motors are broken down into two catagories for service purposes. Catogory 1 includes machines equipped with 12 volt electrical systems and Catagory 2 includes the machines equipped with 24 volt electrical systems.

Catagory 1 (12 volt electrical systems):

1 - 960096 Wiper Motor plus 1 - 2501082 Switch plus 1 - 733611 Wire Terminal will service existing 568969 or 1544501 Wiper Motor on all machines equipped with a 12 volt electrical system.

Catagory 2 (24 volt electrical systems):

1 - 1580724 Wiper Motor plus 1 - 2318002 Switch plus 1 - 733611 Wire Terminal will service exist ng 560163, 545168 or 1544502 Wiper Motor on all machines equipped with a 24 volt electrical system except models 475B, 125B and 75B (S/N 443A & 447A), which require 1 - 1580724 Wiper Motor plus 1 - 2318002 Switch plus 1 - 949806 Wire Assembly and 1 - 1513547 Circuit Breaker (2 Amp.) in place of the previously used 5 Amp. Circuit Breaker.

In all of the previous cases where the 733611 Wire Terminal is required, rework the existing wire assembly to accommodate the new series of wiper motors.

When service replacement of wiper switch only is required, service old with old and new with new.

SPR-60773, 09175
SPC-77373
ECN 42173, 63173, 48173

CLARK Service gram

10 March 1976

MICHIGAN SG-561B
Group Ref. No. 800
1300

(This bulletin supersedes and replaces SG-561A dated 14 January 1976, and SG-561 dated 8 October 1975. REASON: Updated to provide latest pressure switch and wiring rework).

SUBJECT: Back-Up Alarm Pressure Switch Replacement
Applicable to All Models with Back-Up Alarm

An improved back-up alarm pressure switch has been released for use on all models under Part Number 2516008. The improved 2516008 Pressure Switch is designed to withstand high pressure surges, in excess of those encountered in normal operation.

The 2516008 Pressure Switch supersedes the 2506758 Pressure Switch and replaces the 620313 for use as a back-up alarm switch. The 620313 is still used in other applications.

EFFECTIVE IMMEDIATELY, use ONLY 2516008 as a back-up alarm pressure switch.

Since the 2516008 Switch has pin type terminals for wiring connectors, it will be necessary to rework the wiring leads by adding two (2) 2516092 Terminals (Female crimp-on type), and two (2) 614142 Sleeves for insulating purposes, as shown in Figure 1.

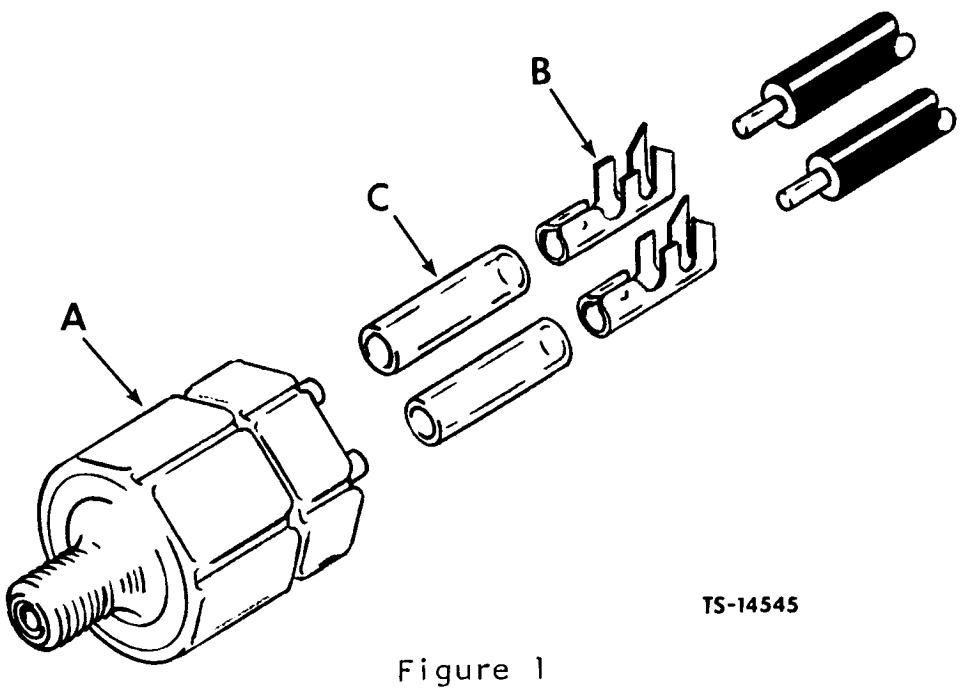

Figure 1

A. 2516008 Switch B. 2516092 Terminal C. 614142 Sleeve

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CLARK Service gram

May 1980

MICHIGAN SG-811
Group Ref. No. 800

SUBJECT: Hourmeter Replacement

An improved hourmeter has been installed on the following Tractor Shovels:

Model 175B Tractor Shovel with S/N: **Cummins 438C431C and after, 438C376CAC and after**
GM 427C107C, 417C, 419C and after, 427C289CAC and after

Model 475B Tractor Shovel with S/N: **Cummins 421J374C and after, 421J136CAC and after**
GM 420B138CAC and after

The improved hourmeters can be installed on all models of tractor shovels and dozers with either 12 or 24 volt electrical systems.

To make this change, order the parts from the parts list below and follow the installation instructions.

PARTS LIST FOR ONE MACHINE:

1 – 2524589	Hourmeter (12 volt)	
1 – 2524590	Hourmeter (24 volt)	
1 – 2524789	Plate	
1 – 2515307	Face Plate (Instrument panel mounted hourmeters only)	
3 – 85G608	Screw	– (For hood mounted hourmeters only)
3 – 50D6	Nut	

INSTALLATION:

1. Put the machine on a level surface.

2. Put the machine in the 'service' position: Bucket or blade on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on steering wheel, safety link connected, wheels blocked.

3. Disconnect the negative battery cable from the batteries.

4. FOR MACHINES WITH INSTRUMENT PANEL MOUNTED HOURMETERS (See Figure 1)

   A. Disconnect any existing outside wiring harness (such as a cab wiring harness, etc) from the connection at the instrument panel.

   B. Remove the instrument panel mounting hardware.

   C. Raise the rear of the instrument panel. Disconnect the wiring harnesses and wires.

   D. Remove the wires from the existing hourmeter. Remove the hourmeter attaching hardware and the face plate. Remove the hourmeter. Discard the hourmeter and face plate. Keep the hardware for re-use.

E. Install 1 – new 2524589 (12 volt) Hourmeter or 1 – new 2524590 (24 volt) Hourmeter, 1 – new 2524789 Plate and 1 – new 2515307 Face Plate into the instrument panel using the existing hardware.

F. Connect the existing wires to the new hourmeter. Connect the wires and wiring harnesses to the instrument panel wiring harnesses.

G. Put the instrument panel in position on the cockpit. Install the instrument panel mounting hardware. Tighten the bolts.

H. Connect the outside wiring harnesses (if any) to the connection at the instrument panel.

5. FOR MACHINES WITH HOOD MOUNTED HOURMETERS (See Figure 2).

A. Disconnect the wiring from the existing hourmeter.

B. Remove the existing hardware from the hourmeter. Remove the hourmeter. Discard the mounting hardware and the hourmeter.

C. Install 1 – new 2524589 (12 volt) Hourmeter or 1 – new 2524590 (24 volt) Hourmeter, 1 – new 2524789 Plate, 3 – new 85G608 Screws, 3 – new 50D6 Nuts and the existing vibration dampener into the hood assembly.

D. Connect the existing wires to the new hourmeter.

6. Connect the negative battery cable to the batteries.

7. Start the engine. Check hourmeter for proper operation.

8. Remove warning tag from steering wheel. Disconnect safety links. Remove blocks from wheels.

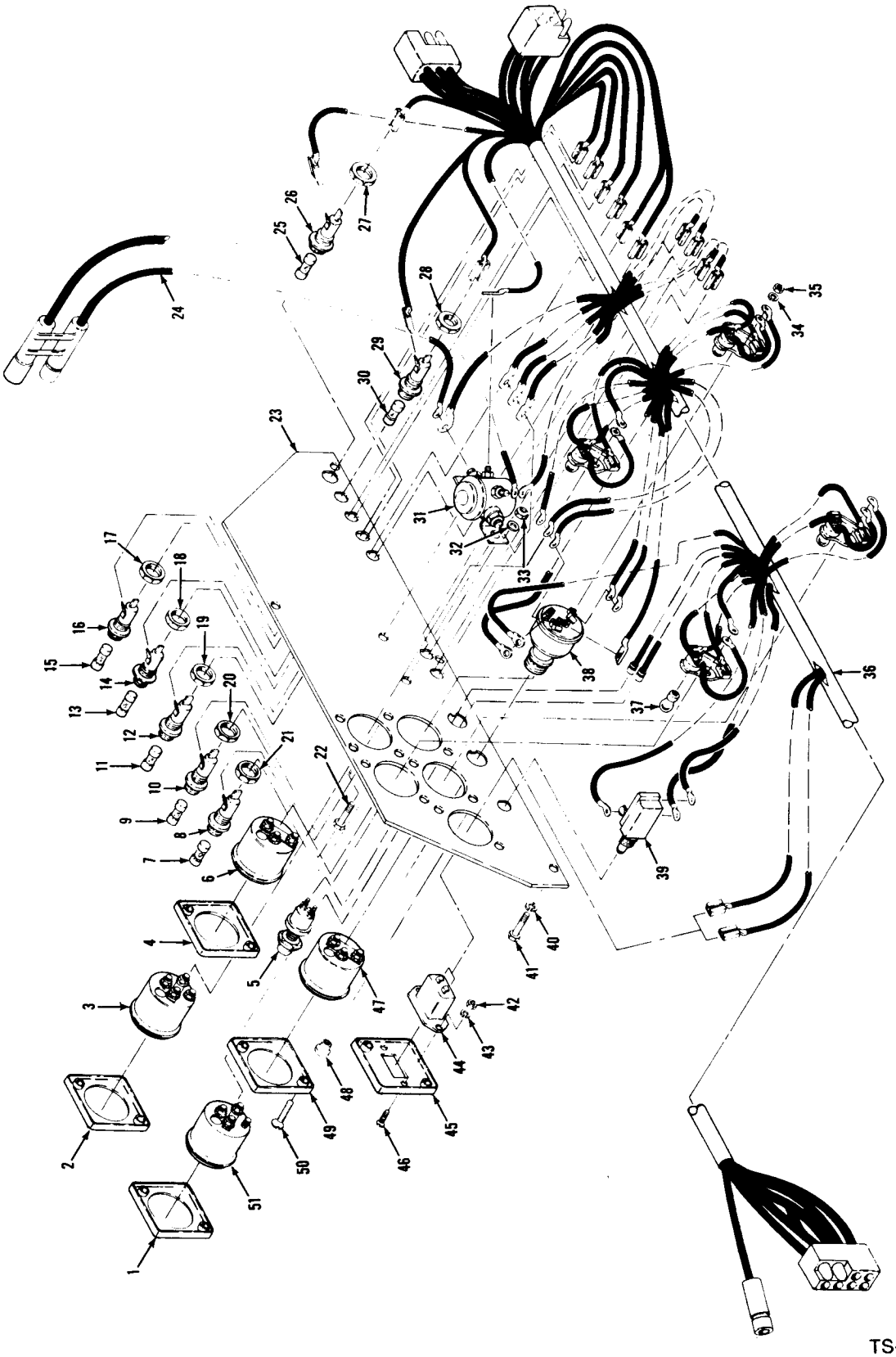


Figure 1 (Typical)

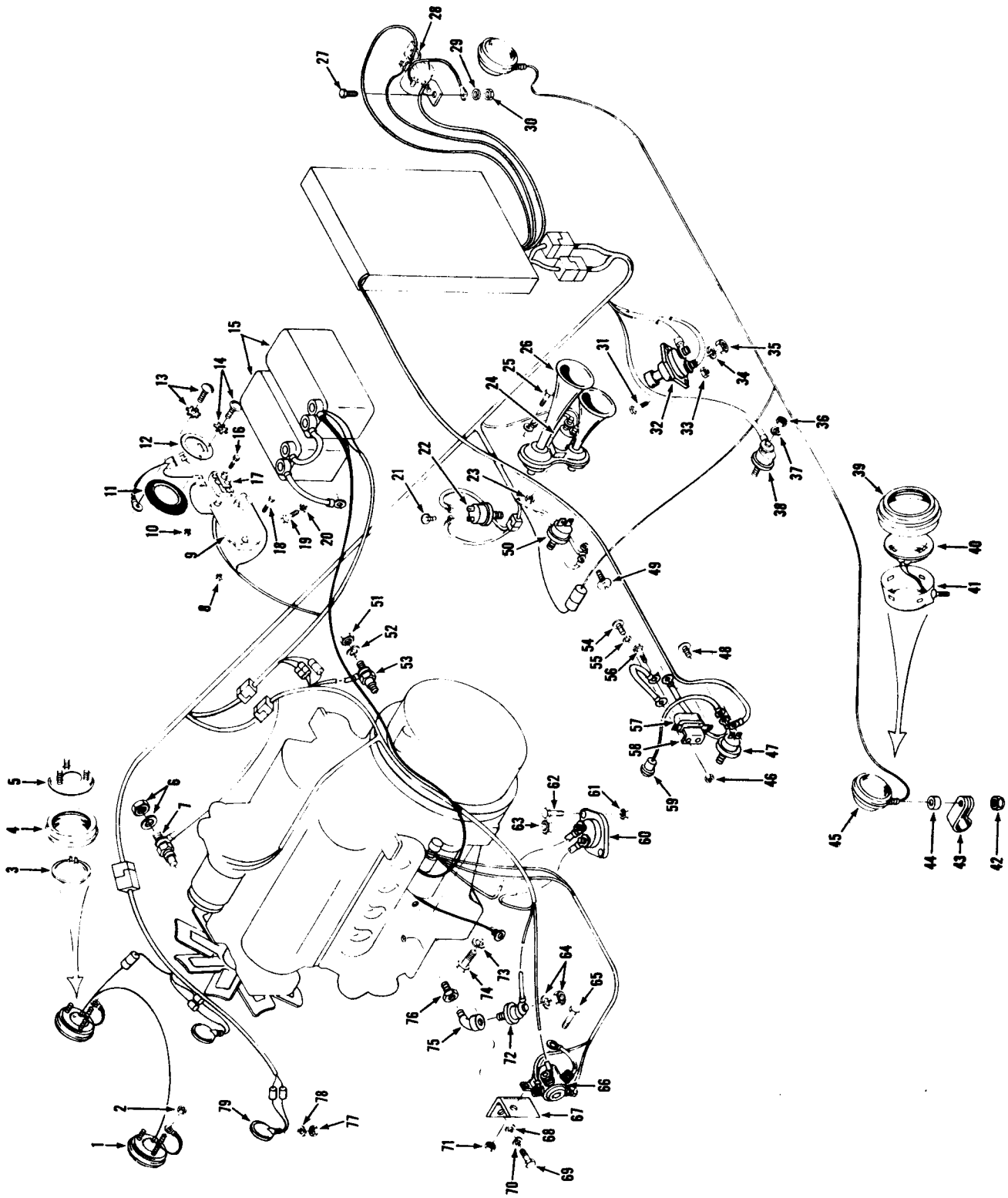


Figure 2 (Typical)

TS-15547

CLARK Service gram

March 1981

MICHIGAN SG-834
Group Ref. No. 800

SUBJECT: Engine Oil Pressure Gauge Revision
Models 75B, 125B, 175B, 275B, 475B & C, 675B Tractor Shovels with S/N:

75B	Cummins	443C, D, E
	GM	447C, D, E
125B	Cummins	439B, C, D
	GM	441B, C, D
175B	Cummins	438D
	GM	427D
275B	Cummins	425D, 482A
	GM	479A
475B	Cummins	421J
	GM	420B
475C	Cummins	487A
	GM	488A
675B	Cummins	436C108L and after

A color coded numerical oil pressure gauge can now be used to replace the color coded only type oil pressure gauge presently used on machines with serial numbers listed above.

The new gauge is more accurate and easier to read.

To make this change, order the parts from the parts list below and follow the installation instructions.

PARTS LIST FOR ONE MACHINE:

1 – 2533310 Gauge (For Cummins Powered Machines)
1 – 2533311 Gauge (For GM Powered Machines)
1 – 6000171 Switch

INSTALLATION:

1. Put the machine on a level surface.
2. Put the machine in the 'service' position: Bucket on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on steering wheel, safety link connected, wheels blocked.
3. Disconnect the negative battery cable from the batteries.

4. See Figures 1 or 2, depending upon which instrument panel is used. Remove the 2 attaching screws from the face plate on the existing oil gauge. Remove the face plate from the instrument panel. Keep the face plate and screws for re-use.

5. See Figures 1 or 2 and remove the instrument panel mounting bolts, washers and lockwashers. Keep the bolts, washers and lockwashers for re-use.

6. Raise the instrument panel. Disconnect the wires from the existing oil pressure gauge. Remove the gauge from the instrument panel. Discard the gauge.

7. See Figures 1 or 2 and install 1 – new 2533310 or 2533311 Oil Pressure Gauge into the instrument panel. Connect the existing wires to the gauge.

8. Put the instrument panel in position on the cockpit. Install the instrument panel mounting bolts, washers and lockwashers. (See Figures 1 or 2).

9. See Figures 1 or 2 and install the existing gauge face plate and attaching hardware to the new oil pressure gauge on the instrument panel.

10. On GM powered machines, a new oil pressure sending switch (Part Number 6000171) must be used with the new gauge. Remove the existing switch and install the new 6000171 Switch on the engine (Item 85, Figure 3).

    NOTE: Cummins powered machines will use the existing oil pressure sending switch.

11. Connect the negative battery cable to the batteries.

12. Make sure that all connections are tight. Start the engine. Check all systems for proper operation. Stop the engine. Remove warning flag from steering wheel. Disconnect safety links. Remove blocks from wheels.

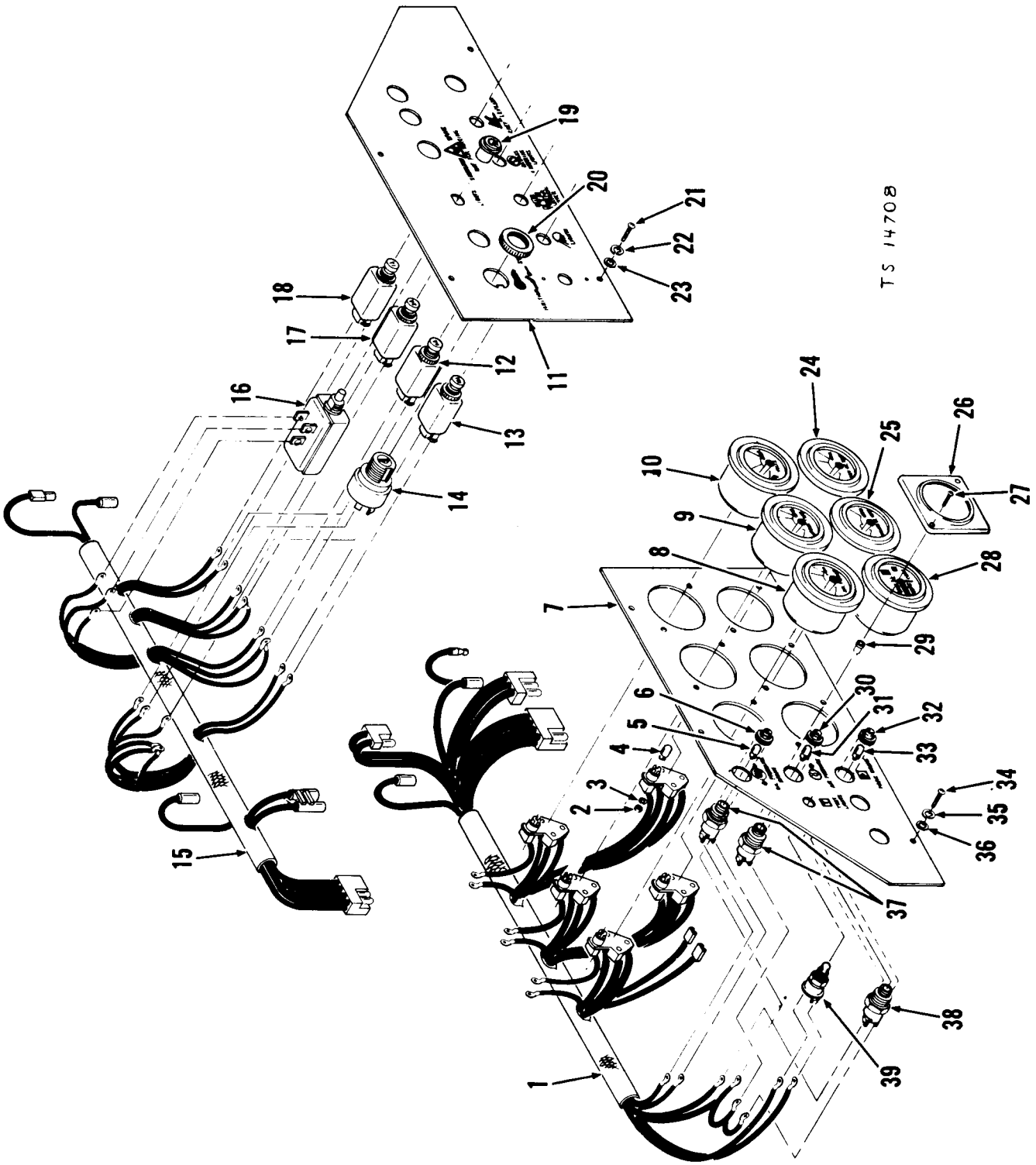


Figure 1 (Typical)

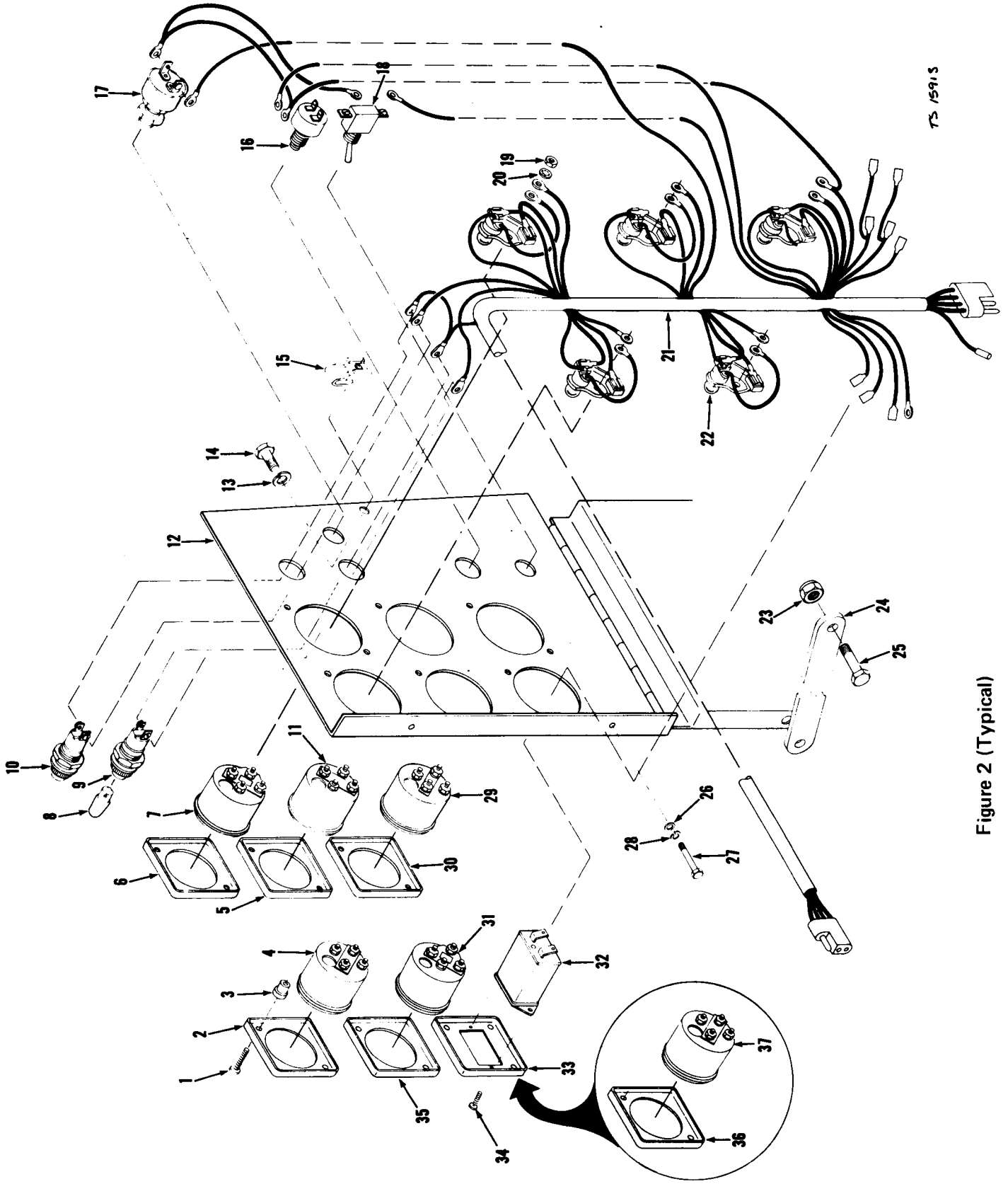


Figure 2 (Typical)

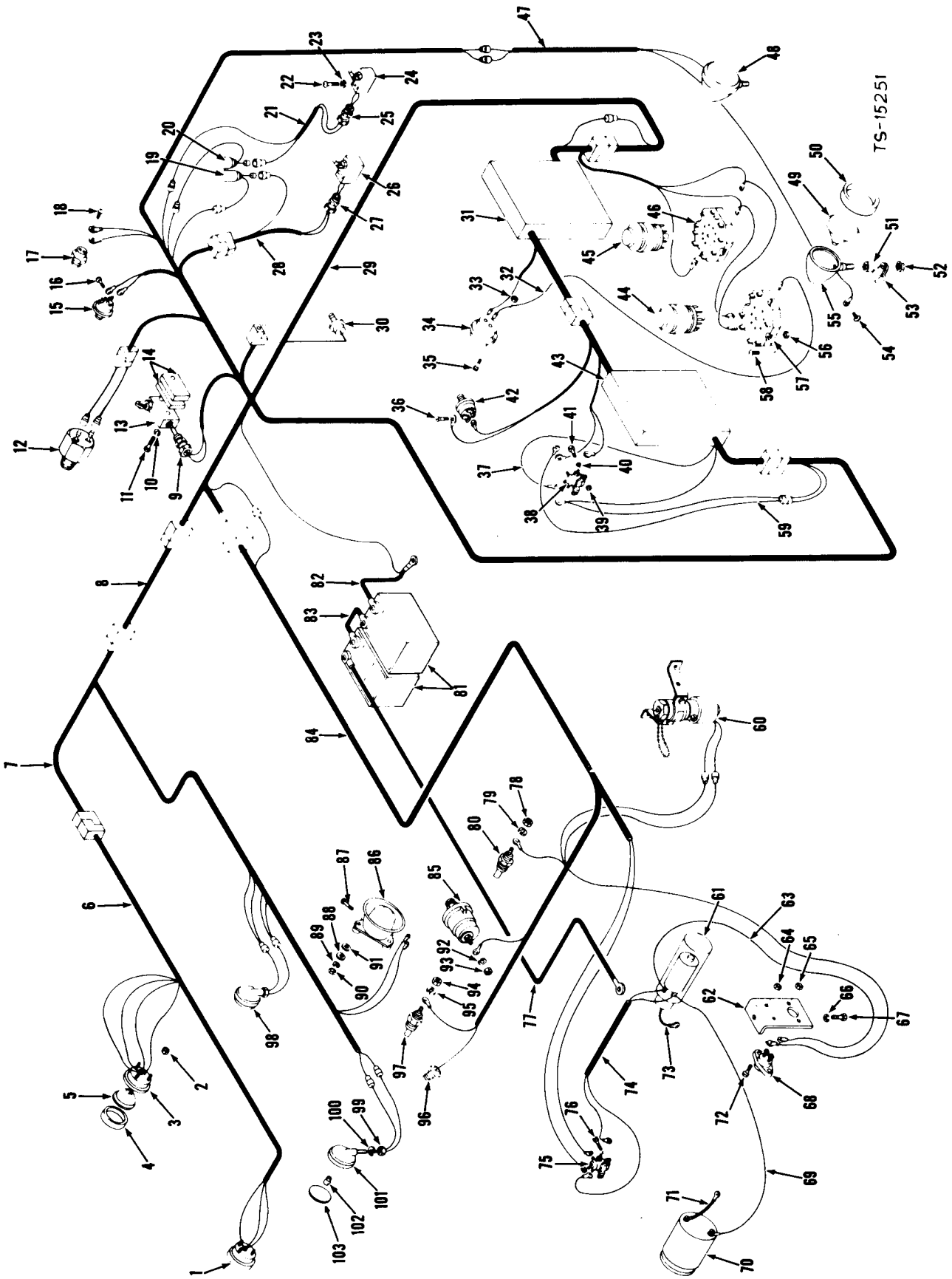


Figure 3 (Typical)

CLARK Service gram

November 1980

MICHIGAN SG-851
Group Ref. No. 2500

SUBJECT: **Electrical Wiring Corrosion Protection**
All Models of Tractor Shovels and Dozers

Information on different types of protective treatment for electrical systems is needed occasionally.

Machines that are operated in corrosive conditions such as working with fertilizer, phosphate mining, etc., need special protection.

Two products that are designed for these applications are:

1. Spray kote (Clark part number 886784, available in cases of twelve only) will seal electrical wiring, while allowing the wires to stay pliable. It also resists extreme heat or cold.

2. GRAFO 112-X (Made by Grafo-Colloids Corp.). Available in 1 quart cans. This is a grease type protective treatment for connectors.

CLARK Service gram

April 1981

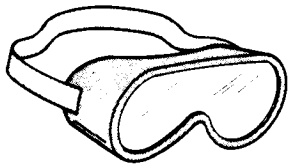
MICHIGAN SG-870
Group Ref. No. 2500

SUBJECT: CHARGING MAINTENANCE FREE BATTERIES

BATTERY SAFETY PRECAUTIONS

Charging batteries generate explosive gases.

Protect your eyes with safety goggles.

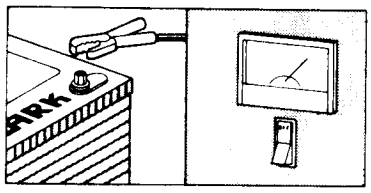


TS20785

Keep sparks, flames, burning cigarettes or other ignition sources away at all times.

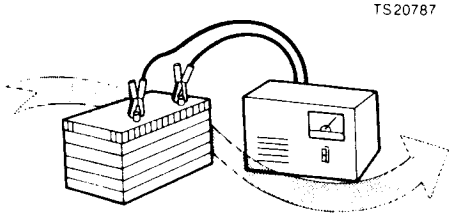
TS20786

Do not connect or disconnect live circuits. Turn the charger "OFF" before connecting leads to the battery or disconnecting leads from the battery. Always disconnect the neg. lead first.



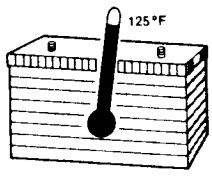
TS20787

Make sure there is good ventilation in the area when charging batteries.



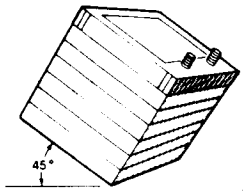
TS20788

When charging, never let electrolyte be pushed out of the battery or the temperature of the battery go above 51.7°C (125°F). If the battery case feels hot, stop charging for 20 minutes then start charger at a lower amperage rate. High temperature will ruin a battery. Do not try to charge a battery with ice in it. Let the temperature of the battery increase to 15.6°C (60°F) before charging.



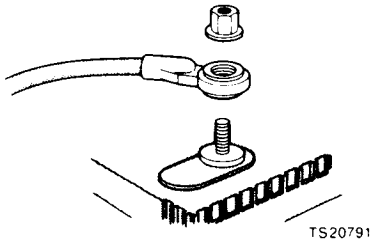
TS20789

Do not tilt the battery to an angle of more than 45° in any direction or electrolyte may leak out of the vent.



TS20790

Disconnect the ground cable first when removing a battery. Connect the ground cable last when installing a battery.



TS20791

CHARGING MAINTENANCE FREE BATTERIES

Put the machine in the SERVICE POSITION

1. To make the voltage stable, operate the lights or a 15 amp load for 15 seconds and then wait for 15 seconds. Make sure the ignition switch and all accessories are "OFF". There must be no flow of electric current from the batteries.
2. Check the voltage from one terminal to the other on the same battery. Do not connect the voltmeter to the battery cables.

VOLTAGE	PERCENT CHARGED
12.6 VOLTS OR MORE	100%
12.4	75%
12.2	50%
12.0	25%
11.7 OR LESS	0%

Delco Maintenance Free batteries have a hydrometer in the top. If the hydrometer is clear or light yellow, discard the battery. Do not check or charge it.

3. Follow the instructions of the battery charger manufacturer.

Make sure the battery charger is "OFF". Connect the positive (+) charger lead to the positive (+) terminal on the battery first. Connect the negative (−) charger lead to the negative (−) terminal on the battery.

Voltage of 12.4 or above		Voltage between 11.7 and 12.4		Voltage 11.7 or below	
Amps of Recharge	Hours of Recharge	Amps of Recharge	Hours of Recharge	Amps of Recharge	Hours of Recharge
5	5	5	14	5	27
10	2.5	10	7	10	14
15	1.5	15	4.5		

If the temperature of the battery becomes higher than 51.7 C (125 F) or if electrolyte is pushed out the vent, stop the charger for 20 minutes then start the charger at a lower charging rate.

TS-16047

Note: *If the electrolyte level in CLARK MAINTENANCE FREE batteries is low, distilled water can be added. Cut the center section out of the plaque. Remove this section. Remove the plug from each cell. Add distilled water as needed. Install the caps and plaque. Delco Maintenance Free batteries do not have this feature!*

Printed in U.S.A.

CLARK

SERVICE GRAM

February 1983

SUBJECT: 24 Volt To 12 Volt Power Converter Installation

CLARK SG - 970
Group Ref. No. 800

Correct installation of 12 volt accessories on 24 volt systems will insure proper charging of batteries, therefore increasing battery life.

TWO POWER CONVERTERS ARE AVAILABLE:

2553254 (Fig 1) is a 2 Amp continous power converter for use with AM/FM radios, CB radios, tape players, etc.

2553255 (Fig 2) is a 6 Amp continous power converter for use with beacon lights,2 way radios, two or more low current draw accessories totaling 6 Amps or less.

Note: *The power converters cannot be used on machines with Positive (+) grounded electrical systems.*

INSTALLATION:

1. Put the machine on a level surface.

2. Put the machine in the "SERVICE" position: Bucket on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on steering wheel, steering frame lock connected, wheels blocked.

3. Disconnect the Negative (-) cable from the batteries.

4. Determine suitable location for power converter, preferbably cockpit wall. Do not mount on ROPS structure or ROPS/Cab . Remove paint so converter has good metal contact for heat dissipation. Use power converter for mounting hole locations. Drill holes and attach with necessary hardware.

5a. Connect the (input) 24 volt Positive (+) terminal to the accessory terminal on the ignition switch for the 2 Amp converter and ground the (input) 24 volt Negative (-) terminal to any unpainted surface.

5b. The 6 Amp converter (input) 24 volt Positive (+) terminal should be connected to the No. 4 terminal on the accessory solenoid . Ground the (input) 24 Volt Negative (-) terminal to an unpainted surface. On older machines that do not have an accessory solenoid ,a 14 gauge wire should be connected to the battery terminal on the starter.

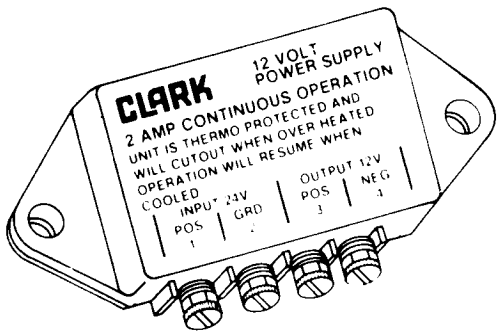
(12I10)

6. Connect (output) 12 volt Positive (+) terminal to the Positive (+) lead of the radio or accessory, usually a red wire. Connect the (output) 12 volt Negative (-) terminal to the accessory Negative (-) lead, usually a black wire. If the accessory is internally grounded ,connect the Negative (-) wire to one of the accessory mounting bolts.

7. Make sure all connections are tight. Connect the Negative (-) cable to the batteries. Turn ignition switch to accessory position and check operation of accessory. Turn ignition switch to off position.

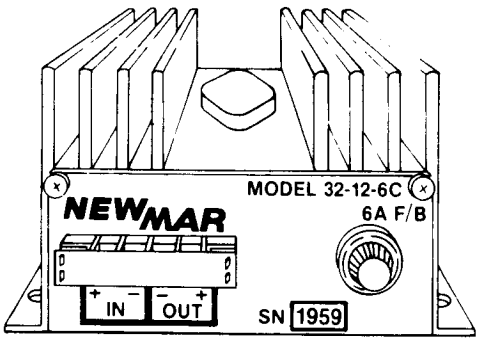
8. Remove warning flag from steering wheel. Disconnect steering frame lock. Remove blocks from wheels.

2 AMP POWER SUPPLY



(Fig 1)

6 AMP POWER SUPPLY



(Fig 2)