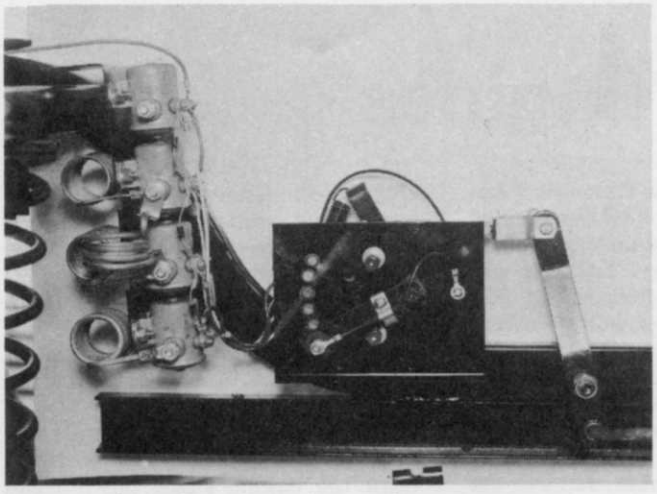
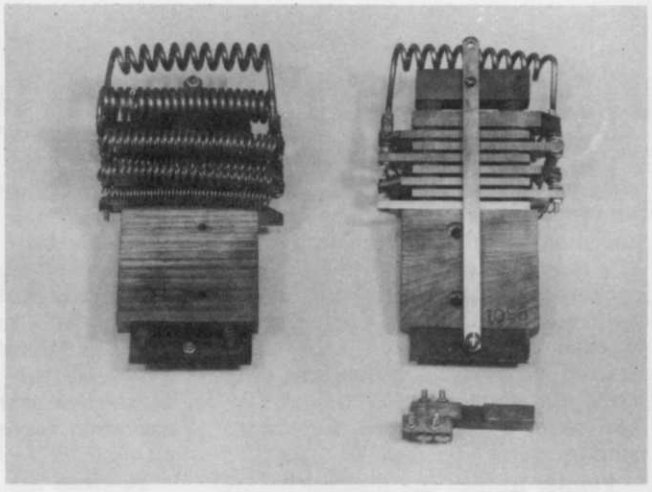


Version of a solenoid speed control arrangement. Contacts on face plate activate the solenoid holding coils as the foot pedal is depressed.



Typical sliding bar speed control. Resistor coils mounted on the back side of switch are at the left. At right stationary bass is shown. Item in lower right is the brush on sliding bar.

Golf Car Trouble-Shooting

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BEFORE getting into a diagnostic malfunction study of the electric system of the golf car, maybe it would be better to digress a little into fundamentals of the system and describe briefly how it works.

The electrics can be divided into four main component areas, i.e., the batteries, the charger, speed control and the motor. Each area has its own specific task to perform and is subjected to its own peculiar malfunctions.

The batteries can be considered as the fuel tank of the vehicle and as such they have to be initially filled up with energy before the vehicle can be made to perform. And in the process of performing, obviously, they become empty again. In the case of electric storage batteries the re-energizing is accomplished by passing an electric direct current through the batteries. Actually in one end and out the other. This may sound strange, but the electricity is not stored in the battery at all but by passing a current through the battery, internal changes take place which enable electricity to flow from the battery at a later time.

What happens when an external electrical source is applied to the battery is a chemical action between the negative and positive place in each battery cell This action is aided and in fact couldn't take place without the presence of the electrolite, which is a solution of water and sulfuric acid. Later, when an electrical demand is placed on the battery, this chemical action reverses itself and causes electrons or electricity as we know **it** to flow from the battery.

It is the condition of the electrolite which indicates the state of this chemical action and hence the state of charge of the battery.

The tool used to test the electrolite is called a hydrometer and no electric vehicle repair or mainte-

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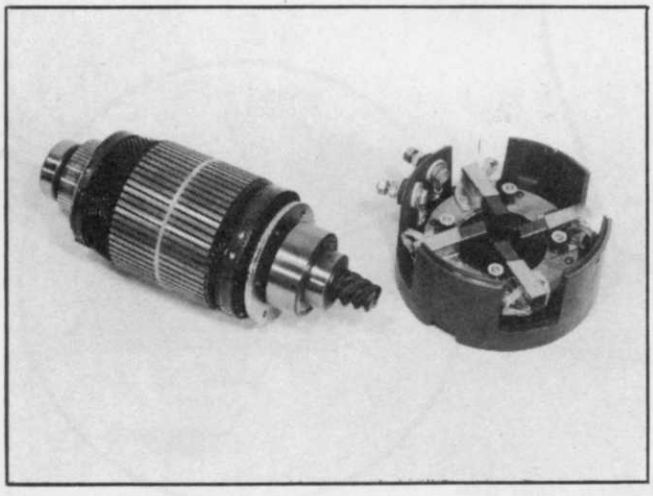
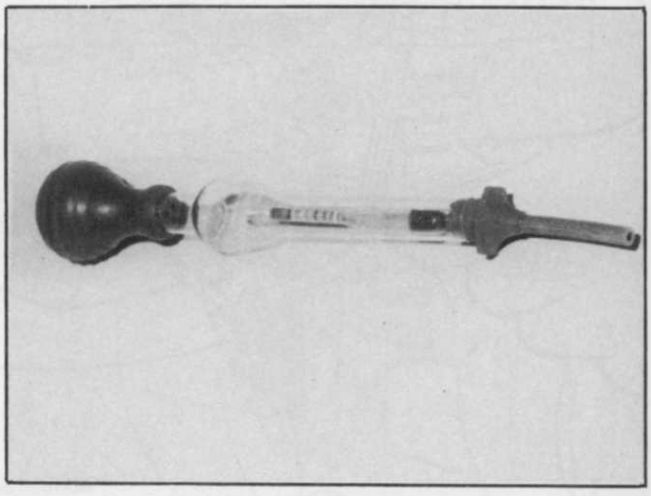


This is a typical motor armature assembly and brush rigging assembly. The commutator section of the armature is at the left side.



Above is a Hydrometer. The inner float indicates specified gravity of the electrolite.

GOLF CAR TROUBLE-SHOOTING

(from page HH)

nance shop should be without one. The hydrometer measures the specific gravity (sp. gr.) of the electrolite which is approximately 1.26 when the batteries are charged or the complete chemical charging action has taken place. When the batteries are completely discharged or a complete chemical reversal has occurred, the sp. gr. is about 1.18.

Don't let the term specific gravity throw you, it simply means "times the weight of water." Hence, an electrolite with a 1.26 sp. gr. is 1.26 times heavier than water. Therefore, the lower the sp. gr. number the closer the electrolite is to water, and the battery less able to perform.

It would be very convenient if we could simply plug or connect the batteries to the nearest electrical wall socket receptacle for some period of time in order to recharge the batteries. Unfortunately, this cannot be done for two very good reasons.

First, the electricity delivered by the utility companies is of the type called alternating current which would not create the required internal chemical action of the battery.

Secondly, the supply current is usually at a potential of 110 volts. Most golf car electric systems run on a 36 volt battery pack and the recharging voltage should only be slightly higher to avoid battery damage.

This then dictates the need for a charging system which in essence does two things; steps the supplied voltage down to a more acceptable level and changes the alternating current to a direct current. Another necessary feature is a timer switch which shuts off the charging operation after a predetermined time period.

The next aspect of the electrical system is the speed control device. As the name implies, this enables the operator to manipulate the vehicle at various speeds as desired. The type of speed control most often encountered in golf cars is of the stepped resistor method.

The resistors, usually four, are connected in series into the battery power supply circuit and are bypassed individually by advancing the speed control foot pedal.

The by-passing can be accomplished by a copper sliding bar arrangement or by other more sophisticated methods. Usually solenoid contractor units.

The function of the resistors is to create a voltage loss in the supply line from the batteries to the motor. Therefore, as each resistor is bypassed, the voltage to the motor increases until all resistors are bypassed and the motor is receiving full battery voltage and so can perform at maximum power.

Finally, the motor which converts the electrical power into useful, mechanical work is again usually of the series-wound traction type. This means that the coil windings on the rotating armature shaft are connected in series in the battery power circuit with the coil windings of the stationary motor field.

This is achieved by means of the stationary carbon brushes and the rotating commutator section of the armature shaft, which enables current to pass through the rotating armature coils.

One other necessary requirement is the ability to reverse the rotational direction of the motor. This is done by changing the polarity of either the motor armature coils or the field coils. To accomplish this a heavy-duty contact manual switch is employed.

That then briefly outlines the basics of the system, so if a cry for help is received from an irate golfer on the 5th tee whose car has pooped out, what do we do.

In trouble shooting malfunctions in any piece of equipment, always start with the simplest possibilities. In this case, if the car will not run, assume that the electrical energy from the batteries is not reaching the motor. This then could mean:

1. A loose terminal connection in the power circuit at any one of the connecting points, i.e., the batteries, motor, speed control, or the forward reverse switch.
2. A broken power cable, unlikely, but possible.
3. Poor or no electrical contact in the forward/reverse switch.
4. Poor or no electrical contact in the speed control system or a broken resistor coil.
5. Poor or no electrical contact between motor brushes and the commutator.

Looking for loose or broken leads in the field should not be difficult to do or fix on the spot. Checking the forward/reverse switch for good continuity maybe possible in the field, depending on the construction of the switch. Similarly with the speed control. If it is a simple, sliding-bar type then a visible inspection should tell if it is making good or bad contact. If a solenoid switch is employed, place the forward/reverse switch in neutral, then manipulate the foot pedal. All solenoids should close with definite clicks if working properly. If not, the problem could be in the activating circuit or the solenoid contacts. This then would lead to more difficult and complicated trouble shooting and would require repair shop work.

Checklist For Golf Car Trouble Shooting

Problem	Check Points				
Car will not run	Check battery for charge	Check for loose or broken leads & connections	Check forward/ reverse for good connections	Check speed control for good contact	Check motor brushes for good contact
Car runs slow	Check battery for charge	Check brakes & mechanicals	Check speed control	Check motor brushes	
Car runs slowly then stops	Check battery for charge	Check speed control	Check motor brushes		
Car takes off suddenly	Check speed control				
Battery not accepting charge		Check charger fuse, leads and connections	Check AC supply for voltage		Suspect sulfated battery; Replace

♦ For More Details On Preceding Page Circle (135) On Reply Card

If contacts, sliding bars, connections and wires all seem to be correct, then the motor should be checked. The brush cover should be removed and the brushes then inspected for positive pressure against the commutator and free movement in the brush holder. To do this, pull on the brush pigtail then release the brush. The brush should snap back positively against the commutator.

For a car with fully charged batteries but will not run, the cause has to be due to an incomplete electrical connection in one of the areas described above. Depending on the nature of the failure will dictate whether the car will have to be returned for more extensive analysis and repair.

Another type of malfunction is the "sudden take off" of the car. This is almost always experienced in solenoid systems and indicates that either one solenoid is permanantly closed or more than one solenoid is closing at a time when the foot pedal is pressed. Listening to the clicks of the solenoids will give a definite clue to the offending solenoid, or solenoids, in this instance. If diodes are used in the solenoid activating circuit, then they should also be suspect.

A car that runs slowly could also be experiencing malfunctions in the speed control system. This could be caused by solenoids not pulling in when required. Again, check out the solenoids as described above. Also, check the motor brushes for wear and contact with the commutator. Worn down or broken brushes should be replaced. In addition, check the commutator for appearance. It should be fairly clean and only faintly scarred by brush wear. Badly marked and scarred commutator should be cleaned.

Last, but by all means not least, is the charge condition of the batteries. Battery failure is by far the most common cause of vehicles not performing properly.

This type of problem opens up a whole Pandora's box of complexities since it includes as well as the batteries, the charging systems, the maintenance aspect of the vehicle and the way the vehicles are used.

Good care of the batteries is essential if maximum performance and life is to be realized. This comprises of making sure that batteries are fully charged before sending the cars out for 36 holes of play. This avoids deep discharge cycling of the batteries which is detrimental to the battery. Also maintain an adequate level of distilled water in the batteries. The cell plates should never be exposed to the atmosphere. This causes oxidation and renders the area exposed as useless. The vehicle should be in good mechanical order, check particularly tire inflation pressure, wheel bearings and brake adjustment. This is to eliminate unnecessary rolling friction from the vehicle and, thereby, reduce the electrical load on the battery.

Finally, poor battery performance could be attributed to inadequate or failed charging systems. This can easily be ascertained by checking the batteries with a hydrometer after recharging the batteries for the recommended time period. If a recharging problem is experienced, rotate the charger to other cars. If the problem still persists, then the chances are the charger is at fault. If the problem only persists with one particular car then the batteries are suspect, possible sulfated and will not recharge.

The above thus describes broadly the functions and generalities of golf car electrical problems most commonly encountered.□