GOLF CART- RUNABOUT

PART II

By Tom Riley

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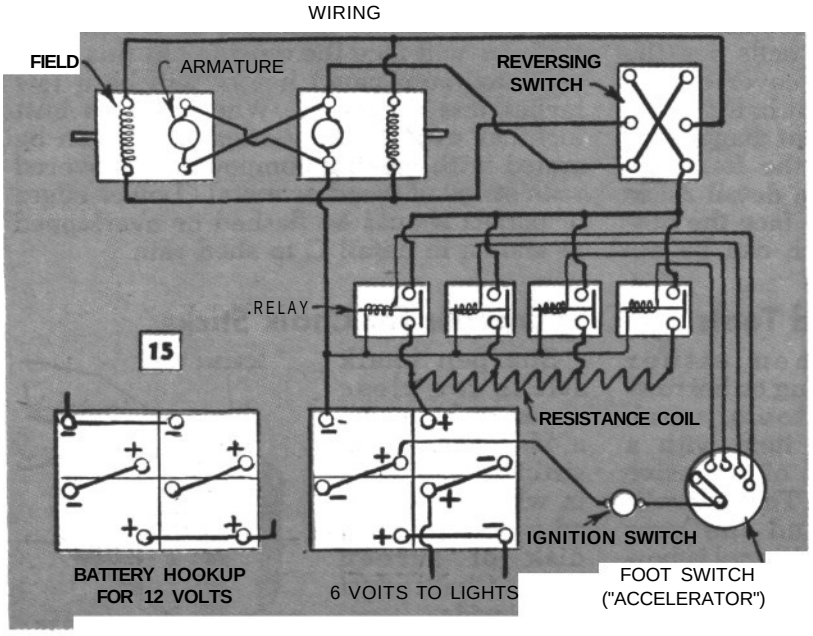
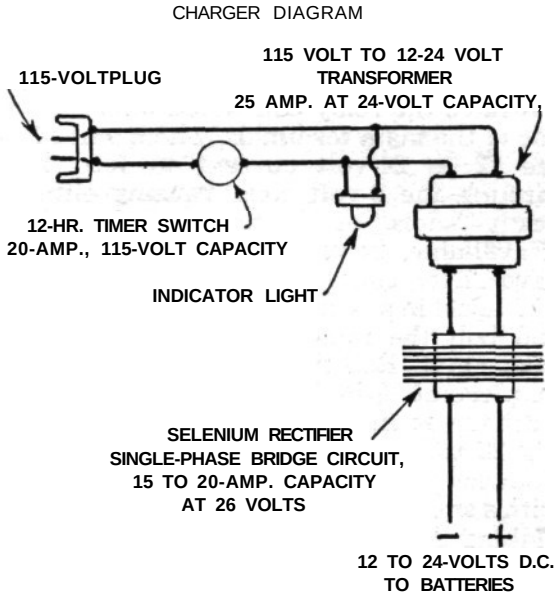
A FTER COMPLETING the main frame, drive-unit frame and all other work described in Part I last month, the next step in construction of the cart is installation of the batteries. Heavy-duty, 6-volt batteries rated at 170-amp. hours or better should be used to assure maximum performance. Batteries having bolt-on connecting posts are the best for installation in the cart, as they allow interconnection of the batteries with inexpensive "bus bars" of 1/8 x 3/4-in. aluminum flats, Fig. 19. Screw strips of 3/4 x 3/4-in. hardwood to the floorboard around the batteries to keep them in place. Batteries shown in Fig. 19 are standard-sized, grouped in a rectangle and centered in the cart. If long, narrow batteries are used, place them four in a row across the center of the seat space. Weld a frame of 3/4-in. steel angles for a hold-down and secure this frame on two ends by means of long 5/16-in. bolts passed through the floorboard. This arrangement is similar to that used to hold the battery in an automobile. The lower, left-hand detail in Fig. 15 shows how four 6-volt batteries can be hooked together for 12 volts, the detail to the right shows a 24-volt hookup. Note the 6-volt take-off for lights. If the cart is used on the street, it will require a horn and lights as well as a license. When extra accessories are installed, tap each unit from a different battery. This distributes the electrical drain so that one battery is not overtaxed. Because the batteries are charged as a unit, when the other three were fully charged, the battery from which all the accessories were draining still would not be up to standard.

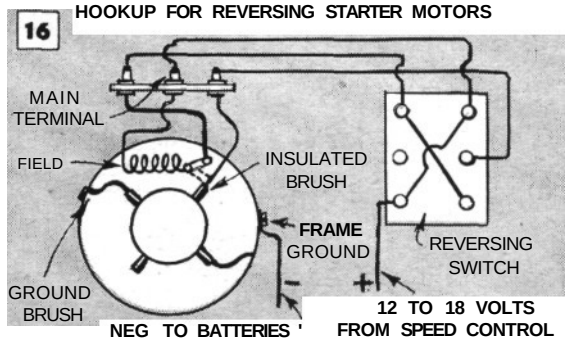


Next, it is necessary to determine the method to

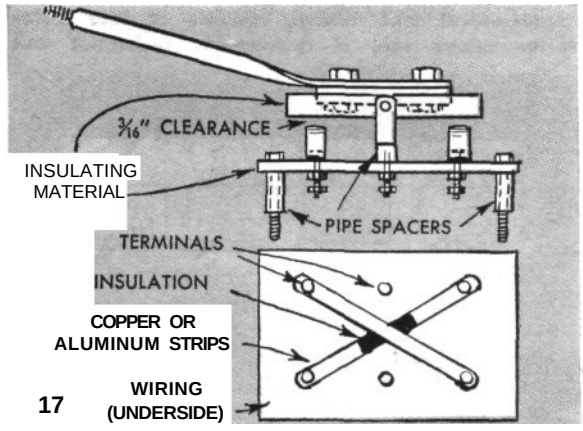
use for reversing the motors you are going to use. Most traction motors have 3 or 4 terminals on the outside, with a diagram printed on the motor or terminal box, so no changes are necessary in this type of motor. Most surplus aircraft motors will require that short leads be run through the brush cover to extra terminals on an insulated base outside the motor, as shown in Fig. 16. Reversing diagrams sometimes are supplied with these surplus motors, but it is best to have an electrician check to make sure it is right. A diagram supplied with motors used on the original cart was incorrect; it recommended reversing the polarity of the brushes, resulting in a dead short, because these particular motors had grounded armatures. Fig. 16 shows how these were correctly reversed. It still is best to check with an electrician before connecting your motors.

The heavy-duty reversing switch required, Figs. 17 and 21, is obtained inexpensively by rebuilding an old-style 50 to 100-amp. double-pole, double-throw service entrance switch. They can be obtained at some electricians' shops because they are being replaced in homes today with less exposed disconnects. Raise the two center, or hinge, jaws of the switch about 3/4 in. on pipe spacers, so the blades will clear the end jaws by 3/16 in. when they are level, Fig. 17. Replace the two blades and handle with two 5-in.-long copper blades, pivoted at the middle. Bolt a block of insulating material between the blades at the center, then attach a new handle. If necessary, reposition the four outer jaws on the base plate so they fit under the new blades. Bolts securing all six jaws to the base should extend about 3/4 in. below it, so they



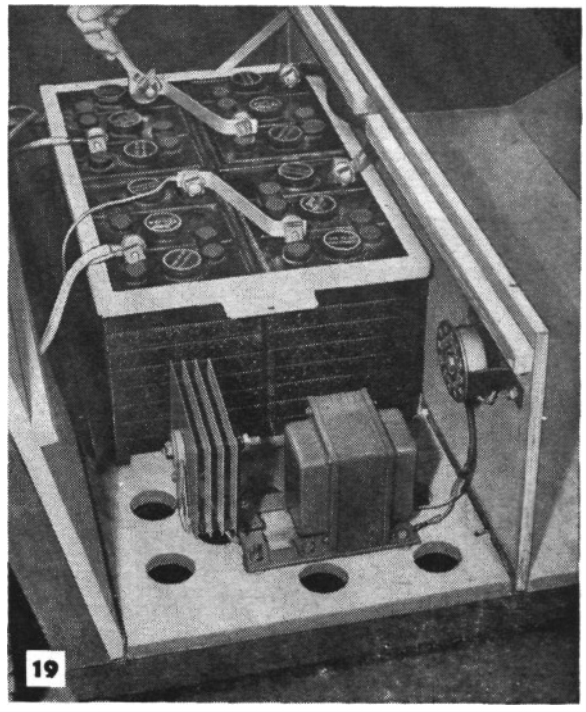


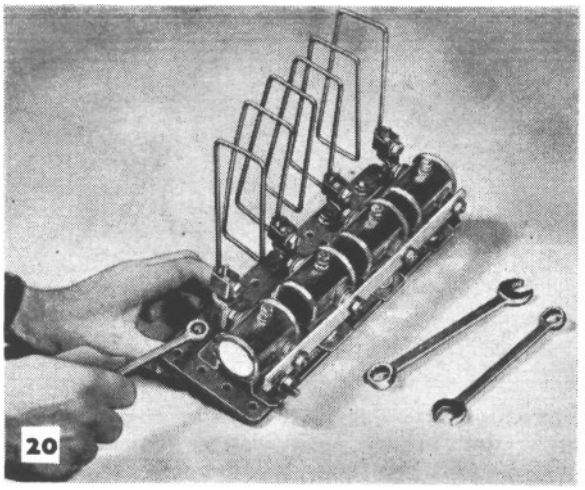
Above, wiring diagram for reversing aircraft starter motors as corrected by builder of original cart. Jt still is best to have electrician check motors



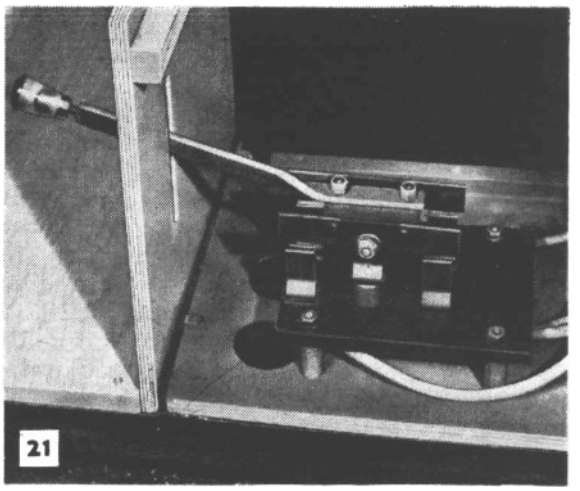
Reversing switch for cart, above, is made by modifying switch used originally in house wiring. They sometimes can be obtained at an electrician's shop

Photo, below, shows installation of four, 6-volt batteries, with hold-down frame. Charger and timer are in foreground. Wiring diagram is shown at left

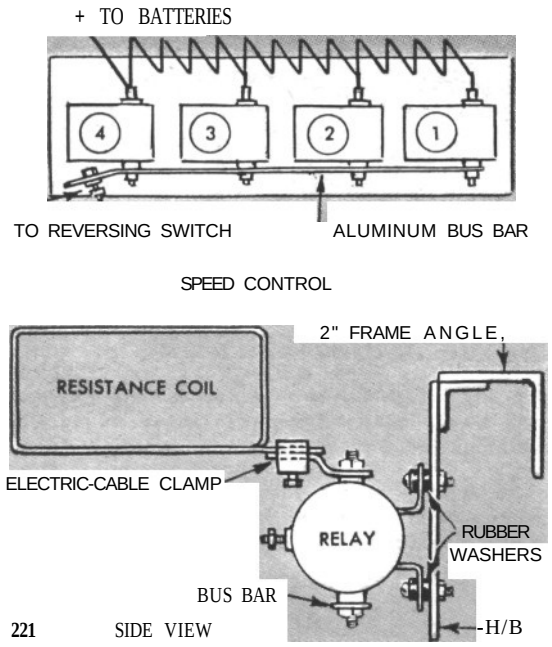




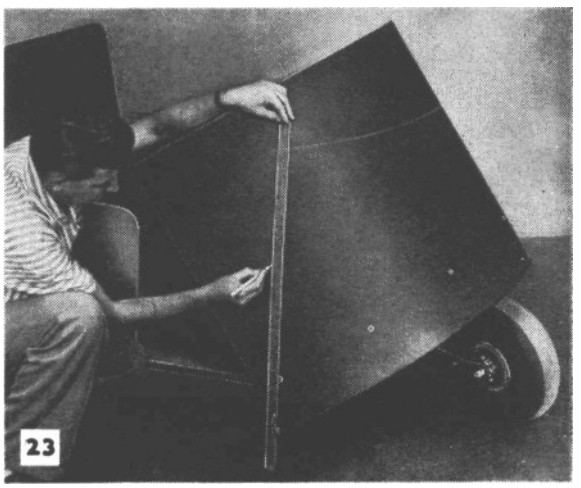
Speed-control unit, above, consists of four auto-starter relays and a rectangular resistance coil



Reversing switch, above, is raised on pipe spacers so that wiring can be run in the space beneath it



Above, wiring diagram and layout of speed control shows how resistance coil is offset to keep it well below rear deck. Below, hood is marked for cutting

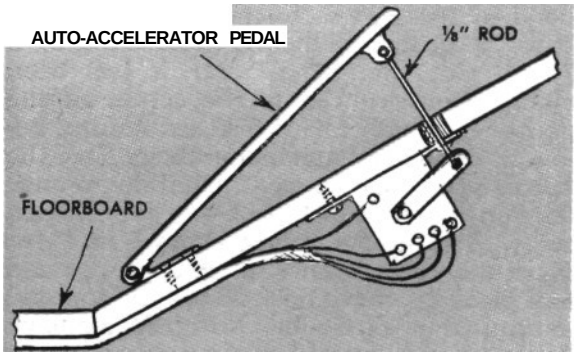


can accommodate two nuts and cable terminals. On the underside of the switch base, cross-connect the four outer terminals as indicated in Fig. 17, using copper or aluminum strips. The switch handle is a 1/4 x 1/2 x 10-in. steel flat, twisted 90 deg. just beyond the insulating block to which it is bolted. The end is ground down and threaded to accept a small gear-shift knob from an automobile steering-column lever.

To vary the speed of the cart motors, a speed control is assembled from four 6-volt auto-starter relays, which pass the electric current through a varying length of chrome-nickel resistance wire, Figs. 20 and 22. In operation—see Fig. 22—closing relay No. 1 causes the current to pass through the full length of the resistance coil, resulting in low speed. Closing relays 2, 3 and 4 give constantly higher speeds, with No. 4 producing full speed because it allows the current to bypass the resistance coil. Use auto relays that have no connection between the relay coil and its main terminals, such as for a 1946 to 1954 Plymouth. Most Ford relays, for example, look the same, but have the relay coil wired internally to one of the main terminals, which will cause the 12 to 24-volt current to feed back through the 6-volt coils, causing either a heavy "short" or chattering of the relays. If available, 24-volt aircraft relays, which have silver contacts, are best. Drill holes 3 in. apart in a 1/8 x 3/4 x 11-in. aluminum bar and bolt the motor-side terminals of the relays to it. Bolt the four relays to a 4 x 12-in. piece of 1/4-in. hardboard, using rubber washers as indicated in the lower detail, Fig. 22, to quiet the click when they operate. Connect the four relay housings together with a small wire to provide a 6-volt ground. Making the resistance coil is a cut-and-try matter, depending on the wire, motor type and voltage used. Try about 10 ft. of

1/8-in.-dia. chrome-nickel resistance wire, wrapped around a 2 x 6 to form a rectangular coil. Because the wire gets hot when the cart is running, mount the coil above the relays, and extending out from them as in Fig. 22. For the same reason, connect the coil to the relays with electric service-entrance cable clamps, rather than by looping the wire around the relay terminals. The clamps also allow you to tap off anywhere along the coil. Connect the clamps so there is more coil between relays 1 and 2, than between the others. If this produces too slow a first speed, cut down on the length, if too fast, add more resistance wire between the first two relays. The speed control is bolted to the center of the 2-in.-angle crossframe with two pieces of steel angle, Fig. 22.

The 6-volt wire from the batteries and the four wires from the relays to the "accelerator pedal" need be only 18-ga. stranded wire, secured to the underside of the floorboards. On the original cart, the accelerator switch, Fig. 24, was a long-wearing, silver-contact type made especially for this purpose by one of the larger golf-cart manufacturers. Some heavy-duty surplus radio switches also can be used. They are a "shorting type" switch. The wiper arm of the switch contacts each following terminals before disconnecting from the preceding terminal, providing a smooth action. The heavy wiring from the batteries to the speed control, reversing switch and motors, Fig. 15, should be 6 ga. or heavier. Auto-battery cable is excellent but expensive. House-service cable can be used, but is less satisfactory because it is difficult to bend at sharp angles.



"ACCELERATOR" SWITCH
(SHORTING-TYPE SWITCH)

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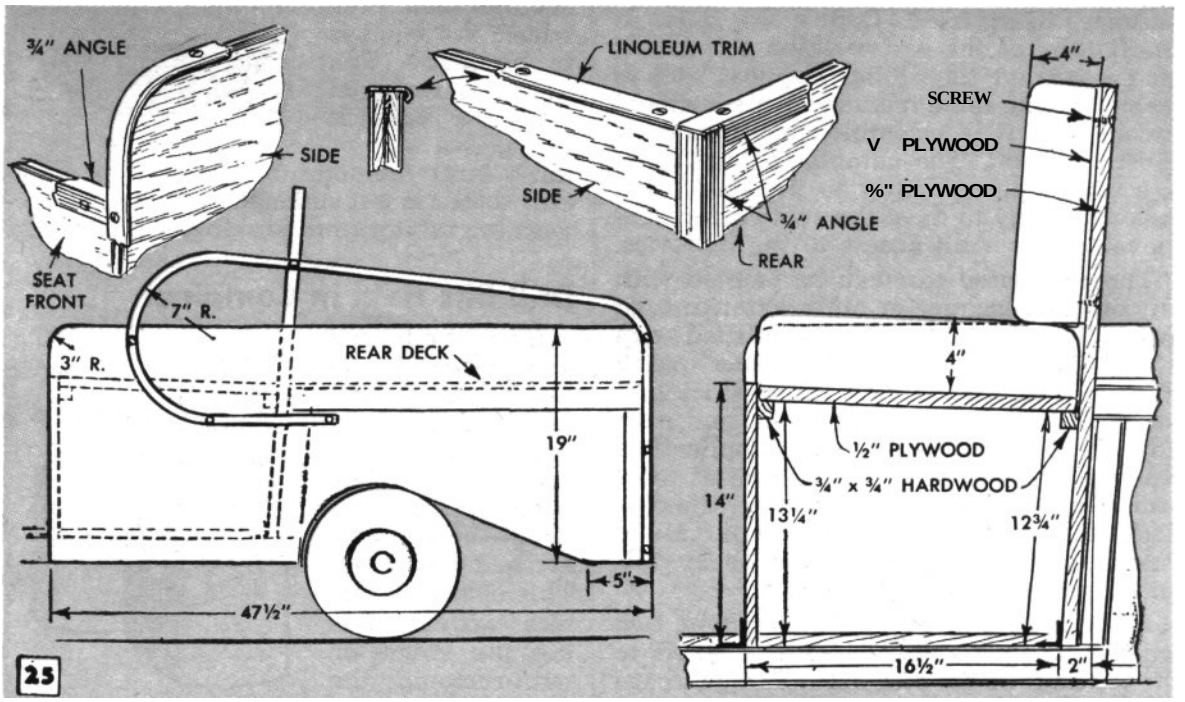
The built-in charger is an optional feature, but it definitely simplifies servicing. The charger shown in Fig. 19 produces more than 20 amps, at 24 volts, and has both a 12 and 24-volt output. An 18-volt transformer would have to be used, if that current were used in your cart. Mount the transformer on brackets about 1/2 in. above the floorboard, so wiring can be located beneath it. A 12-hour, spring-wound timer switch, such as used for large fans, is mounted under the seat. The wiring diagram is shown in Fig. 18.

Figs. 14 and 25 show how the two sides, rear panel and rear deck, cut from 1/2-in. plywood are attached and trimmed with linoleum trim strips and steel angles. The side rails on the rear of the cart are bent



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from 1/2-in. Thin-Wall electrical tubing. The hood of the cart is formed from a single sheet of 1/8-in. hardboard, measuring 24 x 76 in. Cut this panel after it has been clamped or screwed to the center of the floorboard, with about 5 in. extending below it. Then bend and clamp the ends of the hardboard to the frame. Push it down until the top end assumes an even curve, then screw it to the floorboard every 8 in. Now, mark the vertical lines of the doorway and any pleasing curve desired for the top and bottom edges of the hood; Fig. 23. Remove the hood and cut it with a bandsaw, or cut it in place with a handsaw. The glove, or package, shelf, shown in the photos in Part I of this article, is cut from 1/2 or 3/4-in. plywood and screwed to the inside of the hood at a convenient height. An instrument panel is screwed to the glove shelf at about a 10-deg. angle. Install a keyed "ignition" switch and any other accessories desired on the panel. The hand-brake lever is fastened to the underside of the glove shelf with a metal bracket.

Upholstering of the seat cushion and back may be done by a professional, or at home, if a heavy-duty sewing machine is available. The cover material of the seat should be weather-resistant plastic, and the filling should be two 2-in. layers of foam rubber cemented together. The seat cushion is assembled around a sheet of 1/2-in. plywood, the completed cushion resting on hardwood strips, right-hand detail, Fig. 25.

Note that the seat cushion is slanted slightly, to provide more comfortable seating. The degree of slant will vary, depending on the necessary clearance above the batteries being used. Drill a few holes in the bottom of the seat cushion to provide air escapes for the filling. The seat back is formed in the same manner as the cushion, except that it is assembled on a sheet of 1/4-in. plywood. The completed back then is screwed permanently to the seat back. It is necessary to have the seat cushion removable to permit access to the batteries.

The completed cart can be painted with any enamel, lacquer or other exterior-type finish. The original cart was finished with a vinyl-lacquer, two-color "spatter" paint, that has the advantage of producing a tough, heavy finish in one coat, and does not require a spray gun for application. Rubber floor matting, obtainable at most auto-supply stores, is used to cover the rear deck, floorboards and glove shelf. Metal enamel should be used on the wheels, rails and steering column of the cart.

If the cart is to be used for golfing, two lengths of web strapping are screwed to the top edge of the seat back. The golf bags then can be strapped in place. * * *