

By  
**GAYLORD WELKER**



**SPARKY**

This is the first of two articles describing the construction of Sparky the Robot Pup. Sparky will be an interesting project for the advanced gadgeteer. Next month Sparky's "brain" construction will be given. Readers with a well-equipped workbench and relay circuit experience should find Sparky both novel and challenging.

—The Editors

**SPARKY**  
*the*  
**Robot**  
**Pup**

**"R**OBOT" is still something of a catchword in this age of technology, carrying with it a hint of terrible power and a suggestion of the implacable machine. Yet robots are already with us, doing their jobs quietly and efficiently in our factories and homes.

Not everyone agrees on what a robot "is," but a good idea is given in Edmund C. Berkeley's definition: "A robot is a machine made out of hardware, wire, etc., which can receive or "sense" information from its environment using its sense organs, perform actions or display behavior using its acting organs, and perform

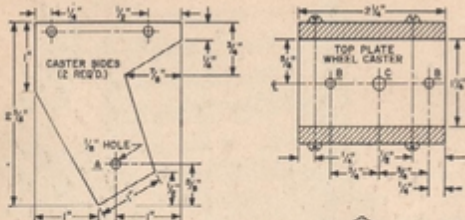


Fig. 1. Caster sides and top should be screwed together. Resultant caster assembly should be rigged.

logical or arithmetical operations correlating the sense impressions and actions, using its thinking organs for a brain."

This article, the first of two, tells how to construct a simple robot. Since Sparky only has three brain cells to think with, he isn't very bright. But there are other things to recommend him aside from his good disposition. He is the "gadgeteer's dream." And when he's running busily around the floor, he may remind you of an inquisitive puppy, skittering from one attraction to the next. That's the only thing he's been "trained" to do . . . so far.

**Platform Details.** Basically, the robot pup is composed of a 10"x12" tricycle platform of an approximately oval shape. The platform should be fairly rigid and built of 1/4" Plexiglas, Masonite, plywood or heavy sheet metal.

The hole for the drive unit should be cut so that the wheel and motor will have room to turn. Supporting members for the various components are fabricated of Plexiglas or aluminum and can be mounted on

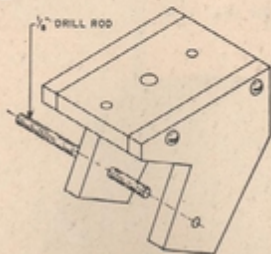
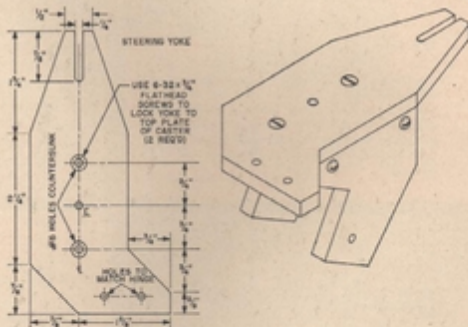


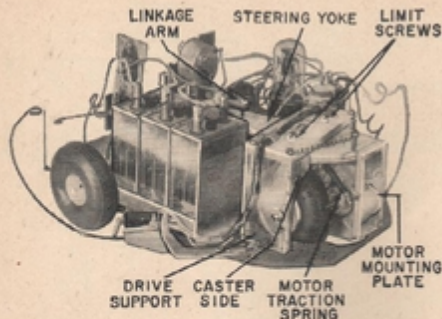
Fig. 2. Carefully cut steering yoke to exact size (below, left). Secure the finished piece to the caster assembly top (below).



the platform with sheet metal screws or nuts and bolts.

**Drive Motor Assembly.** After shaping the platform, start construction of the drive motor assembly. This installation will determine the position of the other components.

Cut out three rear-wheel caster pieces as per Fig. 1, clamp the two side pieces together in a vise, and drill a 1/8" axle hole at "A." Assemble the caster unit, using washers to space the rear drive wheel in the center of the shaft. The wheel should



Here is a picture of Sparky upon completion. The constructed assemblies are shown in their required locations.

### PARTS LIST

- B1—Three 2-volt wet cells (Aristo Type 23)
- C1—50- $\mu$ fd., 25-volt d.c. electrolytic capacitor
- H1—Electric horn (Aristo Edu Kit B 1-35)
- L1, L2—6-8 volt blinker light
- L3—6-8 volt #47 pilot light
- M1—Steering motor (Aristo No. 3 PM motor)\*
- M2—Drive motor (Aristo No. 4 PM motor)\*
- RL1, RL2—4-p., d.l., 6-volt d.c. relay
- RL3—Thermal delay relay (Amperite 8C3)
- S1—3-p.s.t. toggle switch
- S2, S3—5-p.s.t. feeler switch (V3 Microswitch)
- S4—5-p.s.t. cam-operated leaf switch
- 3—3" wheels with 1" aluminum hub,  $\frac{1}{4}$ " bore (Perfect)
- 1—12" length of  $\frac{1}{8}$ " drill rod (axles)
- 1—1" cabinet hinge\*
- 1—Shell (any container which conforms to robot shape—author used 14" thin aluminum dishpan)
- 3—Dial light sockets
- 1—Octal socket
- 1—5-pin male and female socket for interconnection of shell and robot's innards
- Misc.  $\frac{1}{4}$ "-thick Plexiglas scraps (see Figs. 1 to 5); screws; springs; washers; hardware; and plastic metal or cement

\* Only these parts are required for the construction details given this month.

Parts can be supplied by:

- Berton Plastics, 79 5th Ave., New York, N. Y.
- Cyrol Electronics Co., 36 Walker St., N. Y., N. Y.
- Microswitch Div., Minneapolis-Honeywell, 24-30 Skiffman Ave., Long Island City, N. Y.
- Folk Hobbies, 314 5th Ave., N. Y., N. Y.

must be made with two opposing low-tension coil springs which will act to re-center the caster assembly when the steering motor is off. Otherwise, the rear wheel will continue to steer in the same direction given it by the last impulse of the steering motor.

**Steering Construction.** Cut out the steering motor support, support braces and

linkage arm from  $\frac{1}{4}$ " Plexiglas as per Fig. 5. Install a 1"-long #4 screw in hole G, and mount the linkage arm on the long shaft of the motor with a setscrew. The #4 screw

should project down towards the motor body. This steering motor, incidentally, will not be free to rotate fully as it is being used as a "torque motor" to turn the steering yoke.

Mount the steering motor on the steering motor support with the long shaft up. Install the whole assembly in the center of the platform in such a way that the #4 screw in hole G, and mount the linkage arm on the long shaft of the motor with a setscrew. The #4 screw should project down towards the motor body. This steering motor, incidentally, will not be free to rotate fully as it is being used as a "torque motor" to turn the steering yoke.

**Front Wheels.** The front wheels are mounted on separate  $\frac{1}{4}$ " axles and are locked to the axles by a setscrew or a blob of plastic metal. The platform is hung from these axles by Plexiglas or metal bearings.

A sufficient number of washers to keep the wheels from rubbing the side of the platform are installed between the wheel and the bearing. Two washers and a blob of plastic metal are used to anchor the inner end of the axle.

**Batteries.** Power is furnished by three 2-volt wet cells in series which are rated for 3 ampere-hours. The cells are clamped together and mounted firmly to the platform with a metal strap.

There is a certain amount of bumping around as the little fellow goes his way, and we don't want his power supply tearing loose. The batteries can be connected directly to the drive motor leads for testing purposes. Switch leads to reverse motor direction.



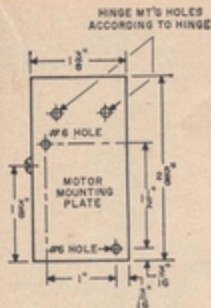
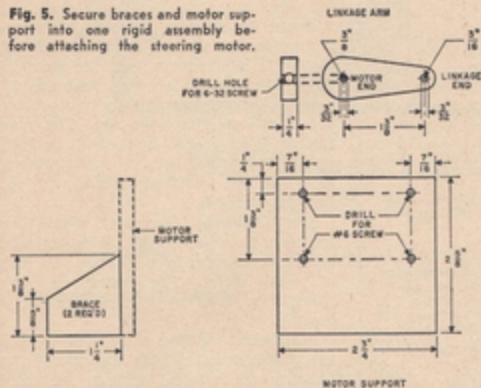


Fig. 3. Mount motor to motor mounting plate. Then attach assembly to steering yoke by means of a hinge.

Fig. 5. Secure braces and motor support into one rigid assembly before attaching the steering motor.



turn freely on 1/8" axle rod but should not "walk" from side to side.

Cut out the steering yoke as per Fig. 2. Place flat-head screws through holes *D* in the steering yoke, and bolt it to the top of the caster assembly through holes *B*. Now drill the pivot bolt hole (*E* in yoke and *C* in caster) and tap for the 10-32 pivot bolt.

Next, install the Aristo #4 permanent magnet motor on the motor mounting plate (Fig. 3) so that the long shaft of the motor will bear against the rear wheel tread. Suspend this motor assembly on the rear

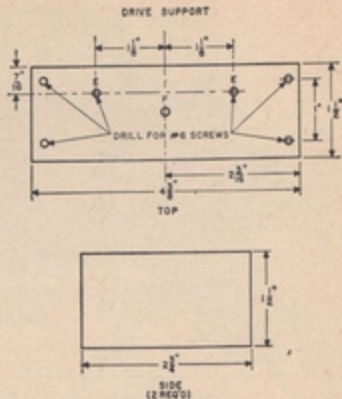


Fig. 4. Drill drive support holes at their exact locations.

of the steering yoke with a small hinge, taking care that the wheel does not rub against the motor body.

The motor mount should be loaded with a small coil spring so that the motor shaft bears against the wheel firmly.

Assemble the U-shaped drive support bracket (Fig. 4), and install "limit" screws in top plate holes *E*.

Mount the previously assembled drive unit within the drive support with the 10-32 pivot bolt through *F* and into tapped hole *C* (Fig. 1) and *E* (Fig. 2). Tighten screw, then back it off to allow free swiveling. Place nut on screw end and tighten to lock it. Then mount this whole assembly on the platform so that the wheel assembly can swivel freely between limit screws.

A centering device for the steering yoke

By  
GAYLORD WELKER



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# SPARKY

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**L**AST MONTH we described Sparky's basic mechanical construction. Here are more details of his mechanics and instructions on how to assemble his "brain."

**Thinking Mechanism.** The chassis for Sparky's brain-works is shown in the overall view of Sparky's innards. A 3"x3¼" piece of aluminum will serve or you may wish to leave extra space for additional "brain cells."

The two 4-p.d.t., 6-volt d.c. relays (*RL1*, *RL2*) have two mounting screws on ½" centers, and are 1¼" high. The Amperite relay tube (*RL3*) uses a standard octal socket, or if a

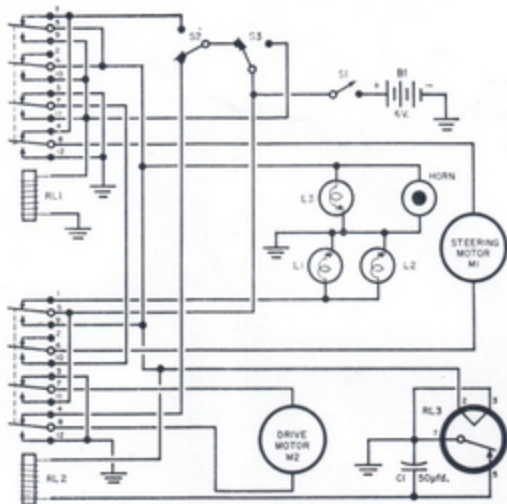
The coding of Sparky's brain relays RL1 and RL2 corresponds to the relay contact pictorial shown in mechanical breakdown view on opposite page.

miniature relay is used, a novel socket is mounted on the brain chassis.

Mount the chassis on 1" standoffs to leave room for miscellaneous connections and parts. Be sure to allow adequate slack in the drive motor leads so it can swivel freely.

**Body Shell.** The robot's shell can be constructed of practically any material that can be shaped to fit. A large aluminum pan was warped into shape for Sparky. Holes for his "eyes" (L1, L2) and tail light (L3) were drilled slightly oversize and fitted with grommets.

The dial lamp sockets with leads soldered to them were then inserted in the grommets. The screw thread contacts of the sockets are connected to a common ground. Center contacts of L1 and L2 are connected



to contact 1 of RL2. The remaining lug of L3 is connected to contact 9 of RL2.

Main switch S1 is installed on the top for easy access. The shell can now be mounted to the platform by three angle brackets.

**Sparky Takes Off.** With everything connected up properly, and the batteries fully charged, flip S1 on. If drive motor polarity is correct, Sparky should take off for the nearest table leg.

Arriving at full tilt, one of his feelers will close Microswitch S2 or S3 and Sparky will immediately go into reverse, honking like a small bullfrog. His tail (L3) lights up and filament current is sent to RL3. When RL3 opens, Sparky immediately goes about his business in some other direction, until he hits something else. Note that the batteries may not operate RL3 unless they are at full charge.

One of the fascinating aspects of building this small robotic unit is the consideration of all the many ways that it can be put to use—both practically and for sheer fun. Body styles can be altered to fit the need, decoration can suit any fancy, and structural material can be anything at all that fills the bill.

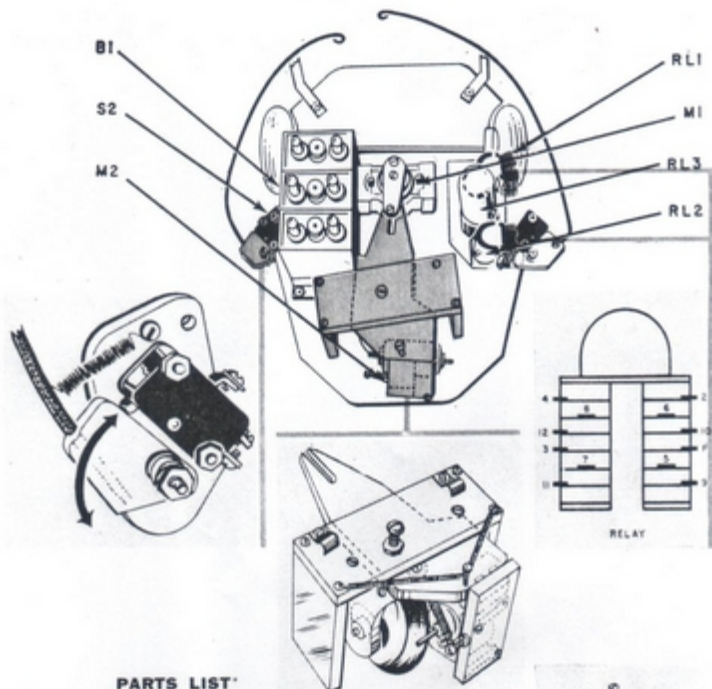
#### HOW IT WORKS

When main switch S1 is closed, all relays stay in their unactivated position and power is supplied only to the drive motor (M2) and "eye" lights. The robot moves forward until one of the feelers contacts something with enough pressure to close switch S2 or S3.

When the left feeler closes S2, the following sequence is initiated. RL2 is energized and electrically locks in. Contacts 7 and 8 of RL2 reverse drive motor M2 and energize steering motor M1. The latter is polarized to turn away from direction of contact as Sparky rolls backward. RL2 also disconnects L1 and L2, turns on L3, and supplies heater current to RL3.

The other pole of M1 is supplied from contact 4 of RL1. After three seconds, RL3 opens, releasing RL2, so that the circuit reverts to the normal forward running condition.

When the other feeler arm closes S3, both relays are energized, causing M1 to swing in a direction opposite to that of the S2 closed condition. All of the other reversing operations are similar. Movement of the robot is really a random path determined by the heating time of RL3. If RL3 is warm, turns and backing cycles are of shorter duration.



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\* This parts list supersedes the list which was included with the "Sparky" article last month.

