JUMPING BEANS MAGNETIC

Fred Astaire, even at his best, never pulled the moves you'll see this project do!

By Stan Czarnik

IMAGINE DOING THE FOLLOWING: PLACE A SMALL METALlic chunk in a glass vial. Seal the vial. Place the vial on a black box, and the chunk vibrates wildly with no visible means of propulsion.

The chunk is a magnet, the box emits an alternating magnetic field, and so the magnet vibrates. Even to those who know exactly what's going on, this simple trick seems strangely amusing. With a small power transformer, some magnet wire, and a few other parts, you can create your own "jumping bean simulator" in two or three hours.

Step One

First, you need to wind an electromagnet and make a mounting bracket. Obtain a fairly stiff strip of non-ferrous metal about ½- or ¾-inch wide. The material in the photos is brass; but aluminum or copper will work too. The length of the strip will depend on the size and shape of the cabinet; more on that later. Drill a hole in the center of the strip that is just large enough to accommodate a steel screw from your hardware collection. The screw should be 1½- to 2-inches long. If possible, use a flathead screw. Push the screw through the hole, fit a perforated fiber washer onto the opposite end, and secure it with a nut.

You're now ready to make the electromagnet. Plan on winding at least 8 or 10 layers of #20 magnet wire around the screw. You will need between ¼ and ½ pound of wire, depending on how large a coil you wish to make, so make sure to get enough. Nothing is worse than realizing that you don't have enough wire to finish the job when it's too late to do anything about it.

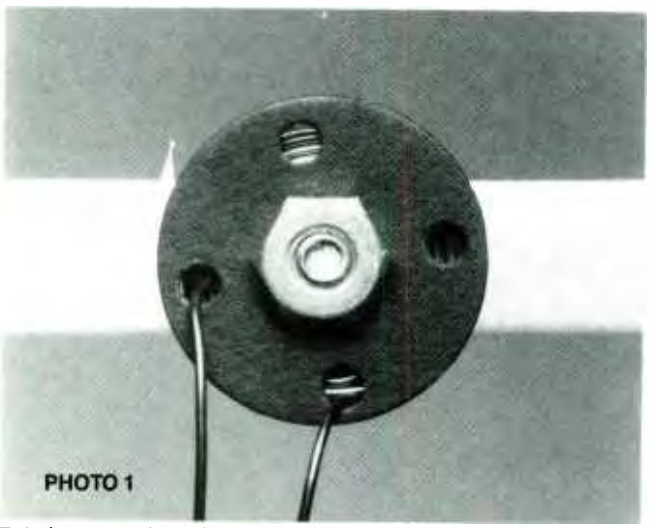


PHOTO 1

This is a rear view of the electromagnet. Note how the leads have been drawn through two of the holes in the perforated washer to prevent the coil from unraveling.

Begin the electromagnet by threading a few inches of wire through one of the off-center holes in the washer. That helps keep the windings from becoming undone. The windings needn't be perfectly even, but do your best. Give yourself plenty of time to wind the coil, it may take a while. When you're done, the windings should be tight enough to hold the metal strip firmly against the head of the screw and the fiber washer against the nut. Terminate the winding in the way you began, by threading a few inches of wire through one of the off-center holes, as shown in Photo 1. The leads coming off the coil should be long enough to work with easily once the assembly is mounted.

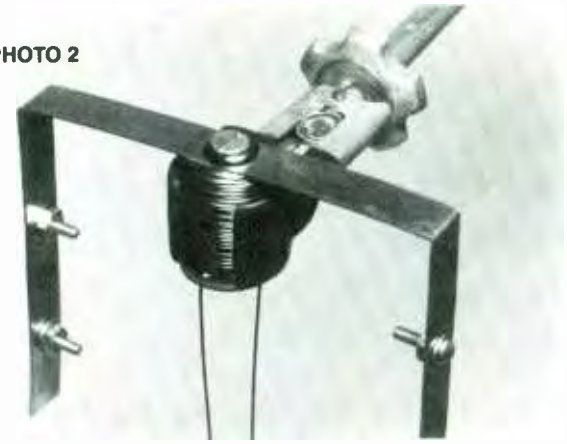
The Cabinet

The cabinet can be made of wood or plastic. The top, or what will be the top, of the box should be no more than about ¼-inch thick. Very heavy material may put too much distance between the electromagnet and top surface of the cabinet. The case in the photos is a wooden knick-knack box, painted black, the top of which is about ⅛-inch thick. Also, **do not** choose a cabinet that is too small. The unit heats up very rapidly and the components need as much air around them as possible.

Now is the time to decide how you will mount the coil bracket inside the box you have chosen to use. The important part is to make sure the end of the electromagnet fits tightly against the inside top of the cabinet. One way, but not the only way, of doing that involves bending the metal strip into the form of a "U," as shown in Photo 2. The *base* of the "U" should match the inside dimensions of the box along which you will be placing the bracket. If the ends of the strip extend past the bottom of the cabinet, they must be bent or cut. The bracket can be mounted before anything further is done.

The circuit is very simple, as you can see in Fig. 1. The electromagnet is connected to the secondary of a small power transformer. The transformer the author used (a Radio Shack

PHOTO 2



Here's the electromagnetic coil mounted on the bracket. The hardware has been inserted to show the position of the holes used for mounting the unit in the cabinet.

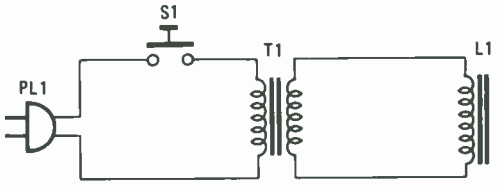


Fig. 1—This is all it takes to build the Electronic Jumping Bean project. This is one project that takes little time to build, but many days to kick the habit of playing with it.

When the coil bracket is secured inside the cabinet, you should make sure the coil is right up against the top of the cabinet. A good, snug fit along the sides is also desirable.

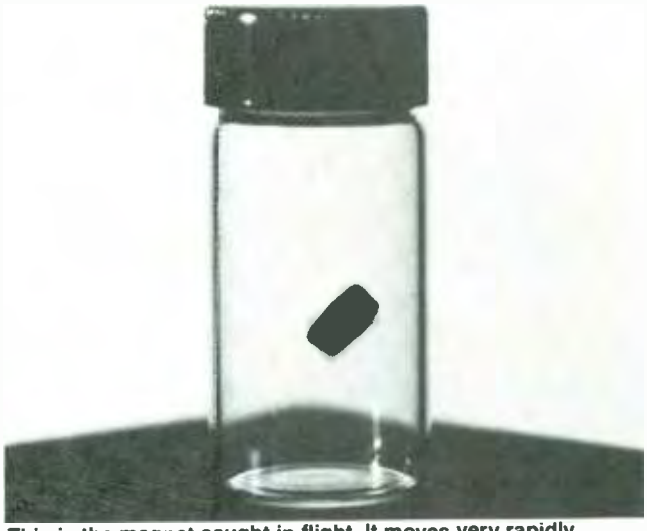
PARTS LIST
FOR THE ELECTRONIC JUMPING BEAN

L1—Electromagnet (see text)
PL1—AC plug with line cord
S1—Momentary-contact pushbutton switch
T1—Any 6- or 12-volt power transformer (such as Radio Shack 273-1352)

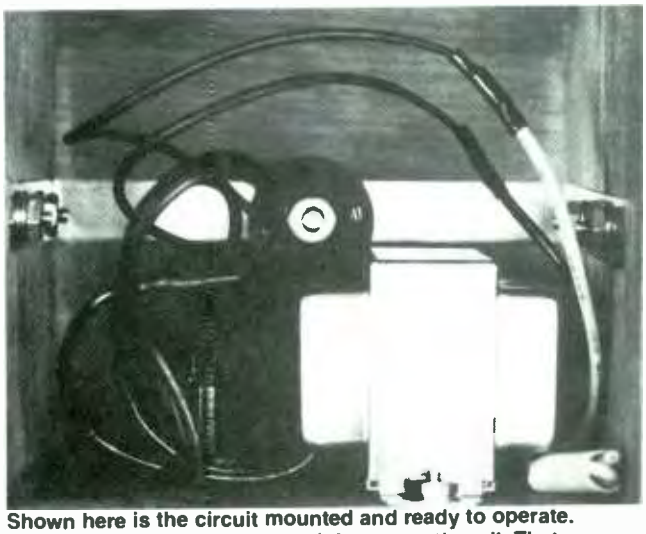
Project box (see text); perforated fiber washer; steel screw, 1-½- to 2-inch; magnet (see text); magnet wire, 20 gauge, ½ pound spool; brass strip; clear glass or plastic vial; line cord; heat-shrink tubing; hardware; solder, etc.

unit) was a center-tapped, 12-volt secondary type. Using either the 6- or 12-volt output did not seem to make much of a difference. The author used the 6-volt arrangement. The primary of the transformer is connected to a 117 VAC line cord and a momentary-contact pushbutton switch. A neon lamp may be added to the circuit (parallel to the transformer primary) to indicate that the unit is on.

A momentary-contact switch is used for a good reason. Be sure to use one to avoid overheating the coil through overuse.



This is the magnet caught in flight. It moves very rapidly inside the vial in a helter-skelter fashion.



Shown here is the circuit mounted and ready to operate. Note the large air space around the magnetic coil. That helps keep it cool. Do not use a cabinet that is too small.

The electromagnetic coil becomes *very* hot *very* quickly and the momentary switch prevents the unit from being left on unattended. Also, resist the temptation to operate the unit for more than 20 or 30 seconds at a time.

The connections between the transformer and the coil can be soldered and insulated before the transformer is mounted. The rest of the work may have to wait until everything is in place. If the line cord does not fit tightly in the grommet, tie a knot (such as an underwriter's knot) in it, or consider using a strain relief. Attach a plug to the cord, turn the box right side up, and you're done.

You may have a little trouble finding a magnet small enough (as well as strong enough) to jump with any degree of energy. The one in the photos is only ⅜-inch long. If you do not wish to use the supplier mentioned in the Parts List, then you can make a small magnet from a larger one you may already have. Wrap it in cloth or paper, and break it into smaller pieces with a pair of pliers and a vice. Do not bang on the magnet as that reduces its strength.

Do not use a magnet that you might want to use for some other purpose. What you have built is very similar to a bulk tape eraser or degausser. The alternating field will weaken and eventually neutralize the power of the magnet. ■