JUMPING BUG

DESCRIPTION

This unit describes how to make a fun novelty *JUMPING BUG* using a simple clockwork mechanism with an eccentric cam. It also allows you to practice your soldering skills.
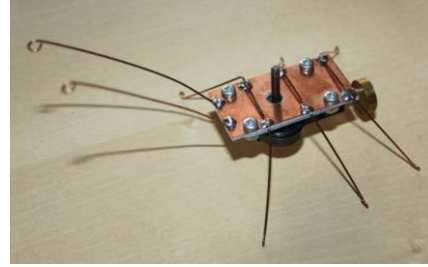
SECTION 1: COMPONENTS & MATERIAL REQUIRED

1.1 COMPONENTS SUPPLIED

The following components are supplied in the kit - before starting this project it is suggested that all the components are checked against the checklist below.

HINT: the kit is supplied in a snap lock bag. We suggest that you write your name on the bag and use it to keep all the loose parts in while you are working on this project.

☐ 1 x Clockwork mechanism + key	(BUGBX)
☐ 750mm length of MIG welding wire	(WIREMIG)
☐ 4 x M3x8mm Bolt	(BOLT8)
☐ 4 x M3 Nut	(NUTM3)
☐ 1 x Copper plate - 75mm x 50mm	(PLTOUC)
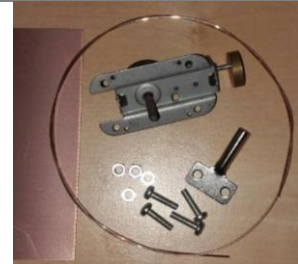
1.2 ADDITIONAL REQUIREMENTS

The following items are required:
☐ Material for making the "body"

1.3 TOOLS REQUIRED

The following tools are required. Several are available from Scorpio Technology, and can be ordered separately if required (item codes in brackets):

☐ Assorted hand tools and cutting tools – depending on the choice of materials to be used, such as:
  o A small hand saw or tin snips to cut the base board
  o Ruler / square (SQUARE100) and pen / marker
  o Scriber or pin punch
  o Sanding block and sandpaper or a file
☐ Small needle nose pliers
☐ Soldering Iron: a good quality soldering iron, with a fine tip (SOLDIRN) and Soldering Iron Stand (SOLDIRNSTD) or Soldering Station (SOLDSTN)
☐ Solder: the use of 0.71mm 60/40 solder is recommended (SOLD500)

☐ An electric drill, plus:
  o A 5mm drill bit (for the key)
  o A 3mm drill bit (to enlarge the holes for the bolts)
☐ Phillips screwdriver #1 point (SCREWDRPH1/80)
☐ Small spanner (MULTITOOL) or pliers to hold the 3mm nuts while tightening.

SECTION 2:   DESIGN

The prototype *JUMPING BUG* we built is shown at the start, but the concept has scope for variation.
☐ Consider the suitability of various materials for the vehicle (Aluminium, PVC, plywood, Perspex, etc.).
☐ Do you have access to other manufacturing equipment, such as 3D printers?

THE BASE PLATE, LEGS AND ANTENNAS
The kit contains a Copper plate - 75mm x 50mm that can be used for a simple design, and is for soldering the legs and feelers to. This base plate can be cut down if desired – 30mm x 50mm is the minimum size to cover the clockwork mechanism.

A 750mm length of MIG welding wire has been supplied, for cutting and forming into 3 legs and 2 feelers.

Before starting the size of the base plate and the lengths of the legs and wires needs to be worked out – the larger the plate, the shorter the legs will have to be, so as not to run out of wire.

Some of the questions to consider include:
☐ The aesthetics / proportions of the base plate to the leg lengths
☐ the legs will take a pounding when the *JUMPING BUG* starts jumping. Will longer or shorter legs absorb that pounding better?

OUR PROTOTYPE
Our prototype used:
☐ one piece of the supplied copper plate, cut down to 30mm x 50mm
☐ two feelers, each 60 mm long (allow additional for curling both ends)
☐ three leg pairs – each leg being 45mm long (the leg pair consisted of one piece of wire 140mm long – allowing for a 45mm leg + 30mm base + 45mm leg + 10mm for the ends)

MAKE A BODY FOR THE *JUMPING BUG:*
• Access to a 3D printer would allow you to make an interesting body and head for the bug (just remember to leave a hole for the key!
• it can be made (carved) out of styrene foam or balsa wood.
• Re-use materials, for example a mint tin, which can then be painted
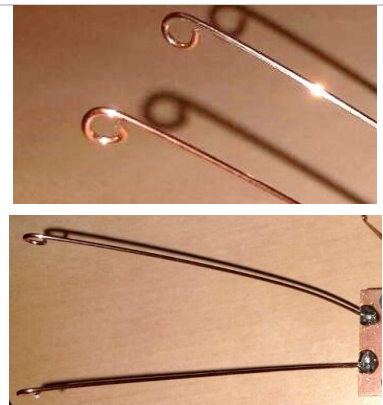
For example, this *JUMPING BUG* was 3D printed – the *.stl* files are available upon request.

SECTION 3: MAKING THE *JUMPING BUG*

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MAKING THE FEELERS ☐ Use the needle nose pliers to cut 2 pieces of wire for the feelers, and then bend one end of each to form a circle about 4mm in diameter (the feelers). ☐ The other end will be soldered onto the base. To give the wire a larger surface to solder, that end can also be bent into a circle, that can sit flat on the base.	
MAKING THE BASE ☐ Cut the plate to the desired size and shape ☐ Drill a 5mm hole for the key ☐ Drill 4 holes for bolting the base onto the mechanism.	
MAKING THE LEGS ☐ Use the needle nose pliers to cut 3 off pieces for the legs, and then bend both ends of each to form a 3-4mm circle (as you did for the feelers).	
ASSEMBLY OF THE BODY ☐ Enlarge the mounting holes in the mechanism using the 3mm drill bit ☐ Insert the bolts through the base and the clockwork mechanism. ☐ Turn it over, put on the nuts and fasten them.	
SOLDERING ON THE LEGS AND FEELERS ☐ Solder both feelers onto the front of the base. ☐ Solder the 3 legs on to the base.	
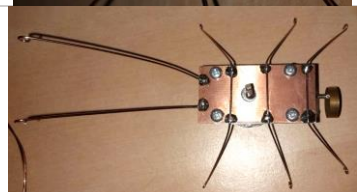
HINT:
1. Mark the spots where you are going to solder and tin those spots on the base.
2. Hold the legs over the tinned spots on the PCB. Mark where the wire will be soldered to the PCB. Tin the wires.

3.   Hold the wires above where they will be soldered. Heat the solder on the wire and the solder on the PCB. They will both melt and join together.
4.   Use a pair of pliers and carefully bend the wires into their leg shape as seen above.
5.   Use lots of solder to ensure that the legs are firmly attached.

SECTION 4: NEXT – TESTING THE *JUMPING BUG*

Hold the *JUMPING BUG* in your hand.
☐ Wind the clockwork mechanism with the key.
☐ Remove the key.

Put the *JUMPING BUG* on the table and watch him jump around! - the legs will take a pounding when the *JUMPING BUG* starts jumping!

SECTION 5: WHAT ELSE CAN I DO?

EXPERIMENTATION:
Experiment with the adjustment of the legs (forward / rearward, or the angles of the legs) to see what movement patterns can be obtained.

SOME IDEAS TO INVESTIGATE.
If you're interested in how this works, some ideas to investigate could be:
•   How does a clockwork mechanism work?
•   What different uses are there for clockwork mechanisms?
•   What makes the Jumping Bug jump? (Hint: look into the use of off-centre cams)
•   Why is there little use of clockwork mechanisms in today's society?