Another Most Useless Machine Ever

by techhobbit on May 24, 2011

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Intro: Another Most Useless Machine Ever

If this is your first time seeing a Most Useless Machine Ever (MUME), it is a machine that, when turned on, instantly turns itself off. If you're thinking about building one, I encourage you to look at others on Instructables (after you've studied mine thoroughly!), and check out the video below. There are two different electrical versions of these, they operate exactly the same. I'm using the simplified one - switches only, no 555 timer chips.

These are a lot of fun to have sitting around and see how people respond to them. Sometimes, when I'm feeling a little bored, or melancholy, I'll clear a small corner on my workbench, pull out my MUME and play with it. After some unscheduled maintenance, or disassembly-reassembly, I'm feeling better in no time! I can spend hours doing this! But remember, it is nice to share your MUME with others!

In this, my first Instructable, I will demonstrate *how I approached designing & building my own* Most Useless Machine Ever-box. It is not intended to be a blow-by blow how-to-do-every-step instructable. There are a lot of variables involved in what materials you have on hand, can acquire locally or even online. This makes it difficult to give specific steps, but I hope I can give you some guidance in (1) gathering acceptable materials, (2) designing (engineering!) the parts to fit together and work in your box, and (3) assembling, wiring and tweaking your MUME. I hope (1) you'll be inspired to build your own, or (2) this info might be helpful, or (3) you are entertained for two minutes before continuing surfing Instructables.com.

Video of my MUME:
http://youtu.be/erIC3vSxwz4

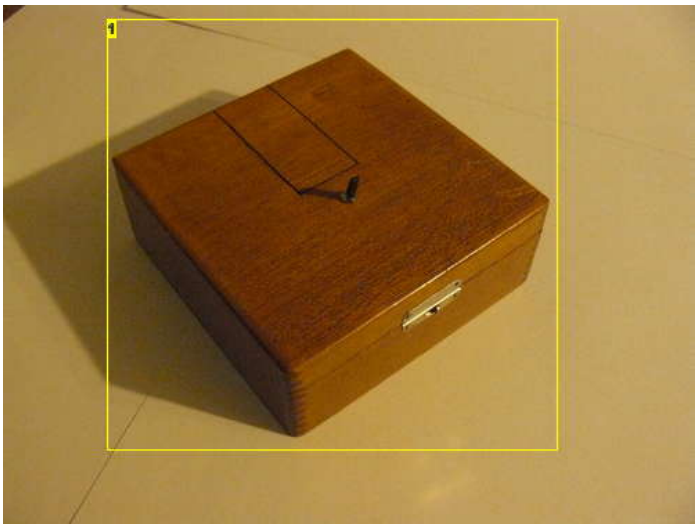


Image Notes
1. Most Useless Machine Ever - picture only, video is below.

Step 1: Materials - The Box

Here are some box candidates I was considering: a cedar cigar box (approx. 6.5"x6.75"x2.5"), a keepsake box with a glass picture frame in the lid, and a smaller box with a slightly curved lid. The package (in the pic) contains small brass hinges which I did end up using.
If I wanted to use the picture-frame-in-the-lid box, I would have removed the glass and replaced it with thin plywood, stiff plastic sheeting, or thin metal sheeting. Or possibly a picture mounted on cardboard that would have accentuated the placement of the switch... maybe a picture of a cat with it's mouth open, the switch on the mouth, and the lever is a goldfish or mouse!
Your choice of box may be your highest priority - you have a perfect box and you're going to make it work! But then you might have some difficulty in finding the right components to fit inside and make it work properly. Maybe you end up setting aside your perfect box and make your first edition out of less than perfect components, get the experience, then build your own premium family heirloom edition. You can always give the first one away to someone who will truly cherish it - just don't let them see how superior your personal model is!
The small box, well, I decided it was just too small for my first build. Although, I get very excited thinking about the challenge of building a MUME the size of a matchbox or Zippo lighter! (...I'm collecting tiny motors & gearheads!) There is nothing that says the box has to be wood; you might be able to adapt a metal or plastic box, maybe even a book, plastic Easter egg, or a milk jug into a MUME!
I did end up using the cigar box, but I had not made the decision at this point. I went on to look at motor/gearhead options first... the guts!

Image Notes
1. Cedar cigar box approx. 6.5"x6.75"x2.5"
2. picture-frame-in-the-lid box
3. small chest box with curved lid
4. small brass hinges may be needed later

Step 2: Materials - the geared motor

I have a ton of junk to choose from for his project. I first pulled out several possible motor/gearhead combinations. You need a motor mated with a gear reduction unit. A motor alone won't work. Although there are some out there who will have the tenacity to collect all kinds of tiny gears and methodically find those that will fit the motor, or even scratch build them out of whatever materials are available...(sounds challenging! ...I'm getting very excited!), it's far easier to scrounge or purchase one. Some of my geared motors were from: small battery operated toy trucks, Polaroid (or other) cameras, rc hobby servos, cassette, VCR, or cd players, old typewriters, copier machines....
(Would that be a good Instructable - "How to extract the motor and working gearhead from a Polaroid Camera"?)
Things to consider when choosing a motor:
(1) AC or DC, and voltage level: You will likely end up using a low voltage, 3-9 volt, dc (direct current) motor. Current draw depends on how efficient your motor is. It's really not critical to have a super efficient motor, but if you take your box to a party, bring extra batteries! If your MUME box is going to sit on your desk, a wall-wart or low voltage transformer would eliminate batteries and maybe the cord would discourage others from walking off with it. Ideally, one could have a box with batteries and a power cord that by-passes, or charges, the batteries whenever power is available.
Testing... I set up my variable power supply and ran voltage to each of my potential motors. Most dc motors will work in a range of voltages from where it first starts to rotate, to full voltage. You can make it go slower with lower voltage and faster with higher voltage but if you exceed its designed peak voltage it will likely burn out sooner.
(2) Rotation speed of output shaft: I put a piece of tape on the output shaft and slowly turn up the voltage while watching the speed of the tape twirling around, which depends mainly on the gearing. You will want to find a speed that works with a voltage of 1.5, 3, 4.5, 6, 7.5, or 9 volts - so you can match a battery pack to it. It will slow down as batteries drain, but again, nothing is really too critical here.
Through experimenting, I decided a rotation speed of about 1-2 seconds per rotation would be about right. I eventually did a paper cut out of my finger/lever and taped it on the motor shaft to see how fast the full size piece would move. But when I got my box completed, you can only see the finger/lever for a brief period because it is mostly inside the box - so it appears to move much faster than when I was watching the full view of it on the motor. So, I think the best speed is about a 3-4 second rotation, unless you like a very fast action - which can be a lot of fun, also!
(3) Torque, force of the motor: The motor will have to have enough torque, or rotational force, to push the toggle switch you use on top of the MUME box. There are simple ways to do this testing but I don't think its justified here - I didn't do torque testing. I just held the motor while running, grabbed the shaft and tried to stop it. Be careful, you might break up the gear train or burn out the motor. You are just trying to get a sense of the torque. To get an idea of how much torque you need, try pushing several different toggle switches. I checked a few I had in my switch selection box, then went to Radio Shack and tried every single DPDT switch in their parts drawers.

I ended up using a gearhead motor unit that comes in a hobby grade, smallish-standard sized servo case, but it came without the electronic circuit board in it.
(I got this from Solarbotics: Gear Motor 4, $13.95 but currently sold out). It is possible to convert a standard servo into this configuration (search Instructables - anyone want to offer the link?).

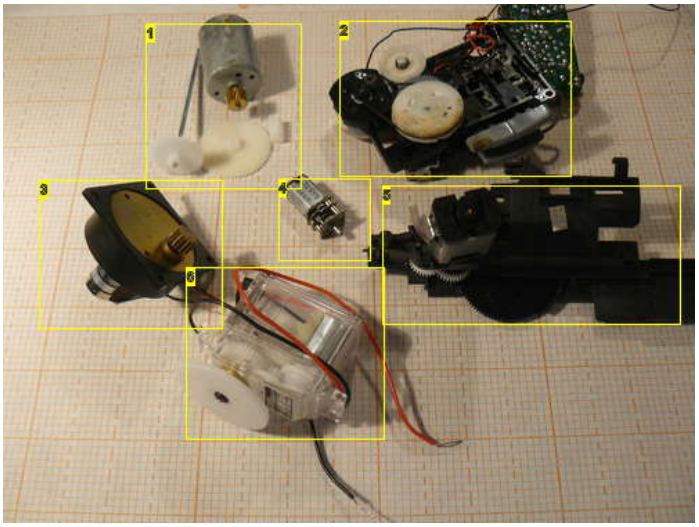


Image Notes
1. raw motor and gears, build your own - difficult.
2. cassette tape mechanism, belt drive... hard to adapt to a MUME.
3. from a copier - powerful, slow... maybe too slow.
4. nice little motor-gearhead... save it for my matchbox MUME! (from Solarbotics)
5. motor & gear drive from a Polaroid camera... moderately difficult to adapt.
6. servo without the internal feedback circuit - perfect speed and torque, easy to adapt.

Step 3: More materials - the guts, and tools

You will also need:
(1) micro or small limit switch, SPST, or a SPDT will work, it will have 2 or 3 wire contacts, respectively.
(1) toggle switch, DPDT - feel the action and try to find one that is easier to push/activate, this will have 6 wire contacts.
(1) battery holder sized for your motor.
about 20-24" of wire, I used wire stripped from phone or CAT-5 cable.

Optional:
I used wood - custom cut to fit my motor case, you could probably stick it together with cardboard and hot glue.
Terminal strip and a few cable ties makes wiring easy and gives it a nice industrial strength appearance.
I'll explain the strip of brass and adjustment screw later.

Second micro switch: I ended up using a second micro switch as a safety lock out. If someone triggers the start switch on top when the lid is opened, the finger/lever will activate, swing around to turn itself off, but the switch is nowhere around so the finger/lever just keeps on going and mangles itself, breaks loose from inside the box and just keeps twisting all the wires and guts into a mess!
So, the second micro switch is in the power line from the battery and when the lid opens, it breaks the power thereby averting the above scenario.

Tools:
Nothing special for this kind of job, the regular electronic workbench stuff...
needle nose pliers, wire cutter/stripper or pocket knife(be careful!), soldering iron, screw drivers as needed, drill and a set of small drill bits, a few small wood screws.

I mentioned using a small variable dc power supply to test motors with, but it's not critical - you can get by with a few batteries.

Whatever type of box you choose to use, you will likely have to do some cutting for the opening that the lever will extend and retract from. I have a small scroll-saw... I think even a coping saw could give a pretty clean job if you are careful.

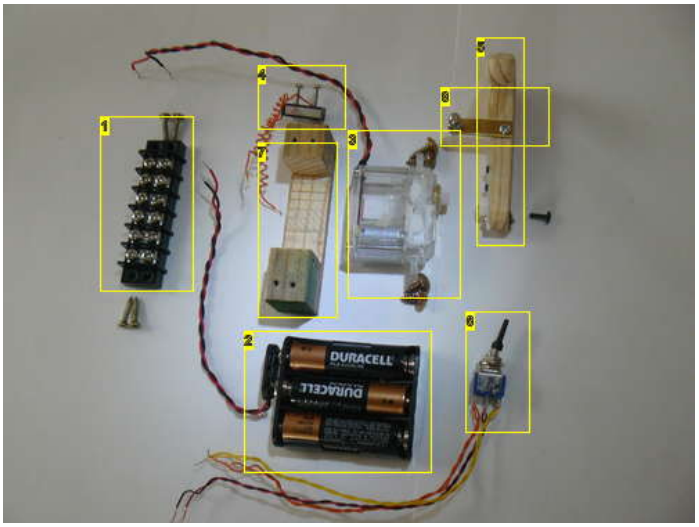


Image Notes
1. terminal strip - handy but not absolutely required
2. battery pack sized to your motor
3. motor with gearhead
4. micro switch - SPST, limit switch for retracted position
5. finger/lever - carved from wood
6. switch, DPDT, for top of box
7. wood block - sized to hold... everything!
8. strip of brass and adjustment screw

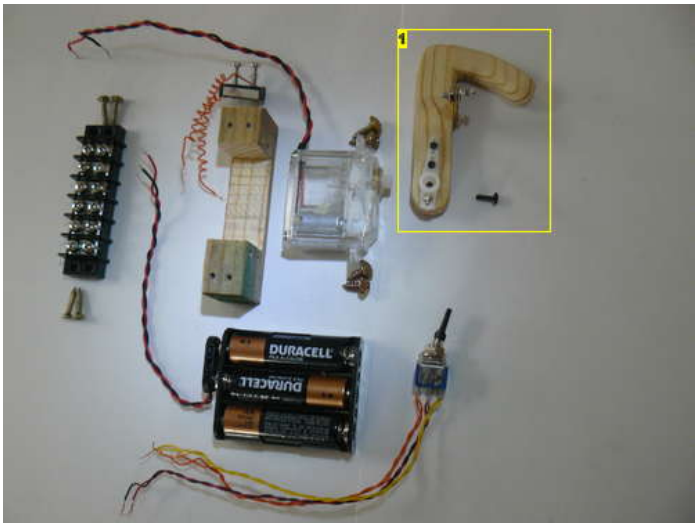


Image Notes
1. finger/lever side view showing servo horn mounting

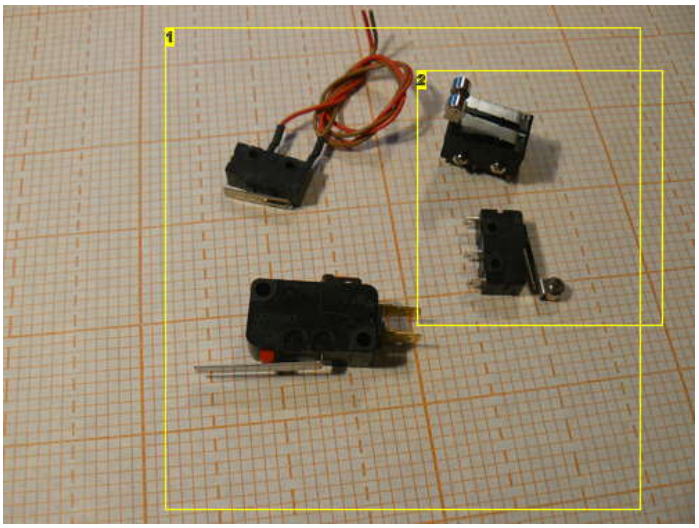
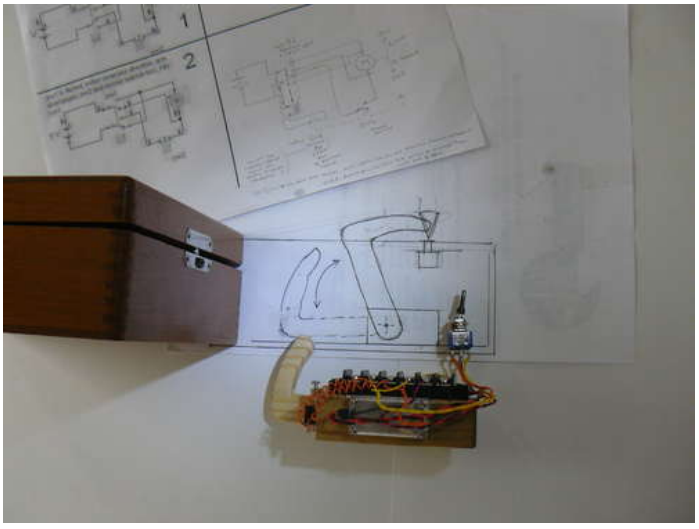
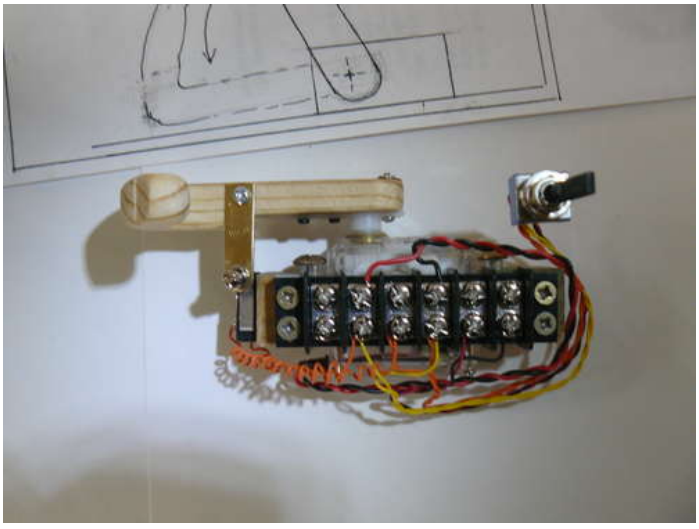


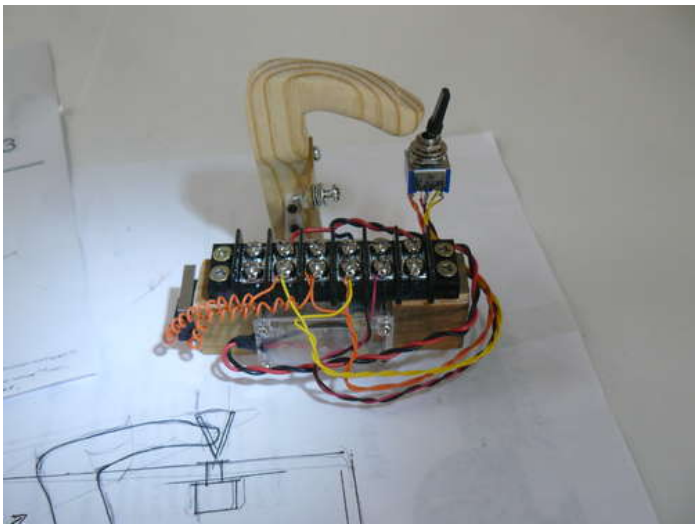
Image Notes
1. better pic of various micro switches...
2. this style has rollers, but either style will work.

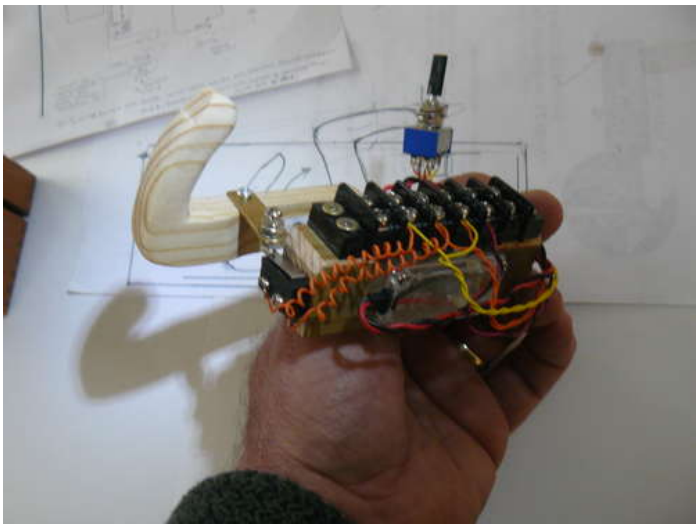
Step 4: Engineering: Thoughts on How I built my MUME

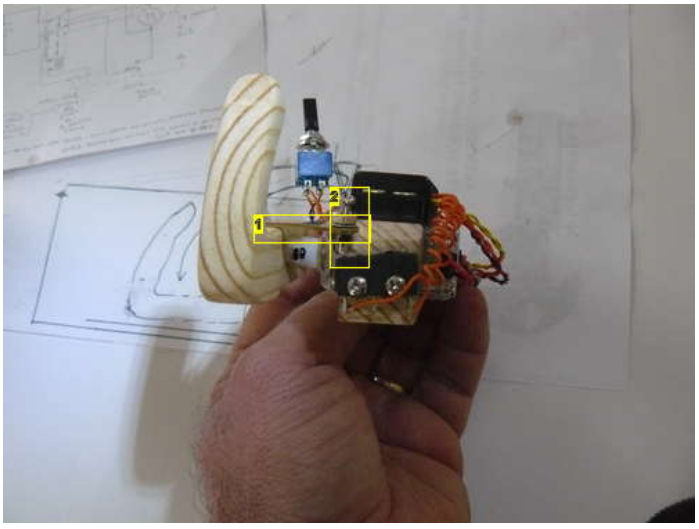
I'll try to keep this succinct as possible, and describe the logical process my little brain went through to make my unique set of parts fit together and work properly.
I'll spread this over the next two steps with several pics from different angles.
Trying to make accurate measurements and drawings:
1. I started with a cross-sectional drawing of my box, especially internal depth (inside top to bottom) and thickness of the lid.
2. I made a paper cutout of the motor and the first idea of the shape of my finger/lever.
(Right from the start I wanted to make my lever in the shape of a finger, but all other MUMEs I've seen just use a lever, not a "finger".)
3. I moved these pieces around inside the box, and just laid the top switch on the drawing as needed to find an adequate location. Keep in mind how the lid may be cut to accommodate the lever moving in and out smoothly. There are many possibilities that could work, try to stay flexible in your thinking process.
4. Once I thought I had the layout and sizing right I cut out the finger shaped lever and whittled, sanded it to shape, very close to my concept drawing. I had to look at it and my motor and figure out how to mount it. Servos have a screw through the center of the output shaft and a variety of armatures to choose from - see the pics to see how I secured my finger/lever to my motor.
5. At this point I decided to try and put all the components on one modular unit, which should fit into the box I chose, or any other box, because it's (almost) all in one piece! This decision might have come after determining that I needed to raise the bottom of my motor off the bottom of the box by about 3/16 inch. So I thought I'd use a strip of wood. But the motor (in a servo case) has mounting supports up around the top. So instead of making multiple little blocks that need to be screwed or glued together, I'll just cut one piece that will meet all the needs: hold the motor to the base of the box at the right height, and hold the terminal strip on top which helps condense all the wiring (okay, not necessarily...), and hold the micro switch on one end. The top mounting switch just kinda floats up there by its own wires. (It won't fully function in this condition - the finger/lever just pushes the switch out of the way, and... kinda crashes and burns.)











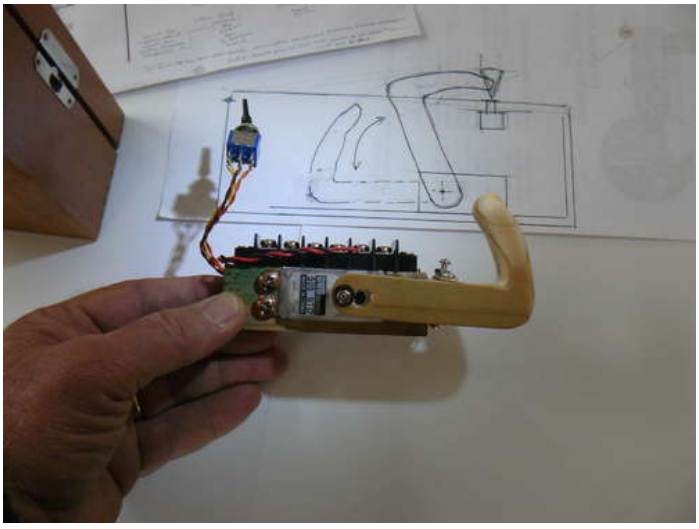


Image Notes
1. strip of stiff brass, secured to wood finger/lever
2. small bolt and two nuts make an adjustable set for depressing the micro switch.

Step 5:

6. Once I got the pieces together I started wiring the components:
See the schematic. "sungam3D", on Instructables, offers a nice flash/schematic/analysis of this circuit; here is another link to the same drawing:
http://9x20lathe.blogspot.com/2010/01/components-and-schematic-for-useless.html
I won't do it here but, I would suggest you study the wiring, learn and understand how the circuit operates.

You may have to reverse the motor leads to get it to rotate the lever the right direction out, then back in.
I think its easiest if you strip and tin six, 5-6 inch wires and solder them all onto the DPDT switch, then take each one to its place on the terminal strip. This takes a lot of looking back and forth from the schematic to the switch, to make sure you've got it wired right.
7. I would recommend cutting the hatch in the lid before drilling the hole for the switch. If you need to make adjustments you can place the hole a little bit in any direction to assure the lever will contact it at just the right point. Or, drill and mount the top switch and then plan your motor mount to be slightly adjustable, by using wood screws put in thru the bottom. I cut a small hatch out of my box top rather than have half the top open like some MUMEs. My design required I add a hinge for that middle piece, otherwise it would just fall out because the original two hinges were outside of the cut hatch.
I then discovered the curf (gap left from the cut) was wide enough that the hatch would fall into the box further than I liked, rather aesthetically displeasing. So I finally decided on cutting a pattern out of thin black plastic from a fast food salad tray. This got glued inside to the top lid, an supports the hatch level with the lid.
8. I didn't have the piece of ribbon cable I had envisioned for transitioning the wires from the lid into the box. These wires get bent every time the lid is opened to admire the ingenious industrial innards! I used an 8-pin DIP socket as a mini terminal strip - but I don't like it.... gotta find that ribbon cable...
9. When the finger/lever retracts, it must hit the inner micro switch which breaks the power to the motor and stops the lever from continuing right on threw the bottom of the box. I tried using a paperclip at first but found it to be too weak. After a few cycles of the lever the clip was bending and not stopping the lever before it hit bottom.
Solution: digging into the metal scrap box, I found a stiff strap of brass, approximately 1/16 x 1/4 inch. Cut to appropriate length, about one inch, hole drilled a both ends. It got mounted to the lever and a small machine screw and two nuts on the other end allow it to be adjusted. By adjusting the bolt length, you control the stop point of the lever.
10. I mounted the safety lock out micro switch towards the front right side, on the main box, with its lever just above the lip of the box. At the matching point on the lid, I secured three thin rubber washers. After a little tinkering with it, it works.

Is anybody still with me? Or is this just a lot of techno-psycho-babel?

Things I would do differently, and still might:
Use ribbon cable.
Add a wall wart for power.

...and, if you are still with me, let me know what you think of these ideas!
Next:
(1)I would like to try a double MUME, a MUMEMUME? in which two finger/levers come out and set/reset the stop switch from both sides... like a never ending MUME! I am very excited about this! But why stop at two, why not three or four that do a round robbin of turning each other on and off?
(2) I am working on a series of MUME switches that can be put on/over wall light switches, appliances, and even automobile ignition switches - these will be MGMEs, Most Greenest Machines Ever. Think of the energy we could save, how environmentally friendly we could all be if we have these on all our energy guzzling devices: as soon as you turn anything on, the MGME instantly turns it off!
Needless to say, I am getting very excited!

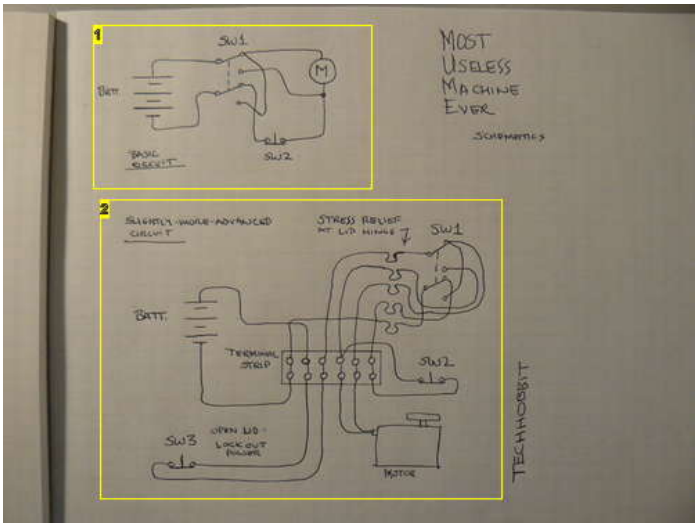


Image Notes
1. the basic circuit
2. same circuit but added a power cut out switch if lid is raised, and a terminal strip.

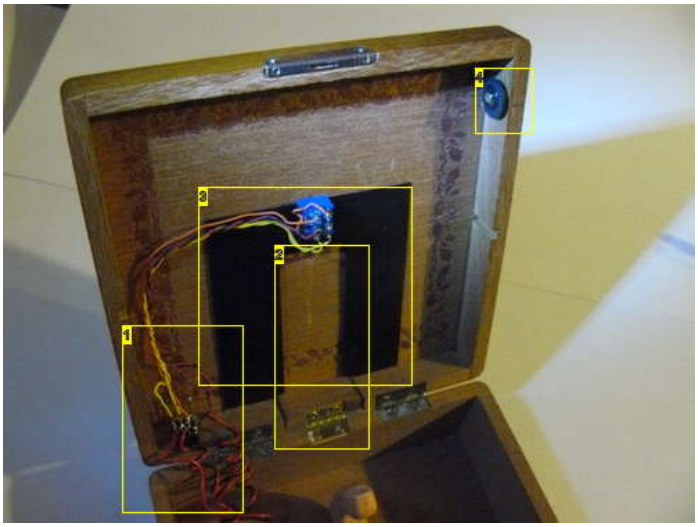


Image Notes
1. where I used IC socket instead of ribbon cable for wire bending when box is opened.
2. lid cutout area that lifts up when lever moves out; added hinge on bottom.
3. black thin plastic glued to lid to hold cut hinged lid level with top.
4. rubber washer meets micro switch when closed. When opened, micro switch disables circuit from working and self-destructing.

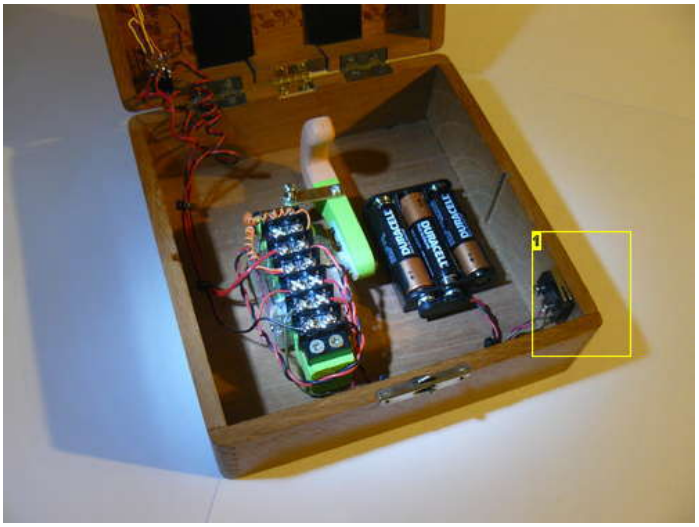


Image Notes
1. safety micro switch - to prevent self-destruct, cuts power when box is open.

Related Instructables

My Useless Machine (Photos) by randofo

Most Useless Machine (video) by macobt

DS cardboard arcade stand by Duobix

My useless box project (video) by IW5 Industries

Project N (Knex Ball Machine) - The Smallest and Most Pointless Ball Machine Ever

Call of Duty 5 Nazi Zombies by Liberty Prime

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