Making #6 Battery Replicas

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The practical #6 cell (in the USA) dates from 1896. The "Columbia".

- Used in gasoline engine ignition systems.
- Telephones.
- Electric lanterns.
- Door Bells.
- "Electrotherapy" machines.
- Toy motors.
- Small spark wireless outfits before 1920.

What vintage to make?

- Radios using #6 batteries most prevalent from introduction (in the USA) of the UV-199 triode in 1923. Nominal 3 Volt – 0.06 Amp. – And WD-11 in 1922. Nominal 1.1 Volt – 0.25 Amp.
- Considerable drop in usage in home receivers from 1927. By 1933/34 better alternatives.
- Only other usage, in portable radios and that was only a tiny fraction of the market.

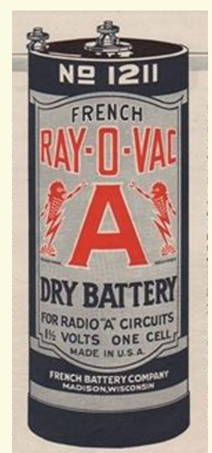
UV-199

RCA took the lead in dry cell powered radios.

- Radiola Grand, IV, III and III-A, etc. from late 1922 into 1924.
- Radiola Superhetrodyne variants from 1924 to 1926.
- In TRFs, Radiola 20 from 1925 to Radiola 21 in 1929.
- All using the #6 size dry cell.

Who was selling #6 cells to the radio market?

- Largest advertiser: The National Carbon Company with their ***Eveready*** brand.
- Burgess Battery Co.
- French Battery Co. (***Ray-O-Vac***)
- Several smaller manufacturers.



Which brand to replicate?

- It seem like the Burgess graphics would be the easiest to duplicate. BUT there are no known early (1925 or before) examples in collections for me to scan or photograph.
- Eveready being the largest manufacturer, there are a few 1925 vintage examples in collections.

I really, really want to document this circa 1922/24 graphic.

- While there are a number of advertisements showing earlier graphics, I have yet to find actual cells in collections.
- You cannot rely on advertising literature of this period to accurately determine the graphics.
  - No accurate color information.
  - It is well known that advertising art was commissioned to look good when printed in B&W.

Here is a typical example of the color representation problem. Red is shown as white, blue as black & white text is shown as black in B&W advertising cuts.

True color.

Gray scale version.

Advertising cut.

Corporate records are housed at the Rutherford B. Hayes Presidential library in Fremont, Ohio. Index of holdings do not seem to indicate much information existing from the early 1920s.

My choices as of 2015.

- The Eveready / Columbia No. 6 - ©1925
- The Eveready No. 7111

  Radio ‘A’ - ©1929.

Creation of replica graphics is outlined in my article on creating replica batteries for the RCA Radiola II.

Available for download at this link: http://kd4hsh.homestead.com/Battery-Art-index.html

What is the difference?

- Unknown if there are technical differences.
- Could be just a marketing strategy. Saying it is a Radio ‘A’ battery might impart a notion that it is preferred over other #6 batteries in the market.
- References to radio usage could confuse public on whether it was appropriate for earlier applications such as telephones, ignition, doorbells, etc.
- Most likely: Different distributor channels. Probably many traditional hardware stores did not want to stock the growing number of ‘B’ battery sizes or have to include them in their local advertising.

What does a replica need to do?

- **#1 – Do not attract attention!** – The goal is to present a better understanding of all that was necessary to make a radio outfit operational. Not to sidetrack conversation towards how cleverly or deficient the replica has been fabricated.
- Brand new looking and/or crudely made replicas will contrast with the vintage equipment and detract from your presentation goal.

Would be nice for a replica to work.

- Although static museum displays don’t need working replicas, there are certainly some percentage of exhibits where functionality can enhance the learning experience.

What does it need to deliver?
A worst case example…

- The ***Radiola 28*** Superhetrodyne uses 7 – UX-199s and 1- UX-120 as the audio output tube. Total filament current 550 ma.
- Two alkaline 'D' cells in <u>parallel</u> will deliver 50 to 60 hours of operation at this load. That is a LOT of demonstration time!
- These same two cells more than equal the rated maximum continuous load rating of any 1920s vintage carbon/zinc

  #6 dry cell of 1 Amp.
- #6 cells are rated at 300 ma. for best total energy delivery. So the Radiola 28 used six (or nine) #6 cells in series-parallel to deliver maximum total power over time.

What does it need to look like?

- Good enough to be placed next to an original and not be instantly recognized as a reproduction.
- This means terminals in the same place with properly scaled dimensions.
- Potting compound appearance virtually identical.
- Actual body diameter between 2.5 & 2.625”
- Crisp graphic but toned down so as to not appear brand new using pigmented laser toners known to remain colorfast for decades.
- Bottom cap present as is on the originals.

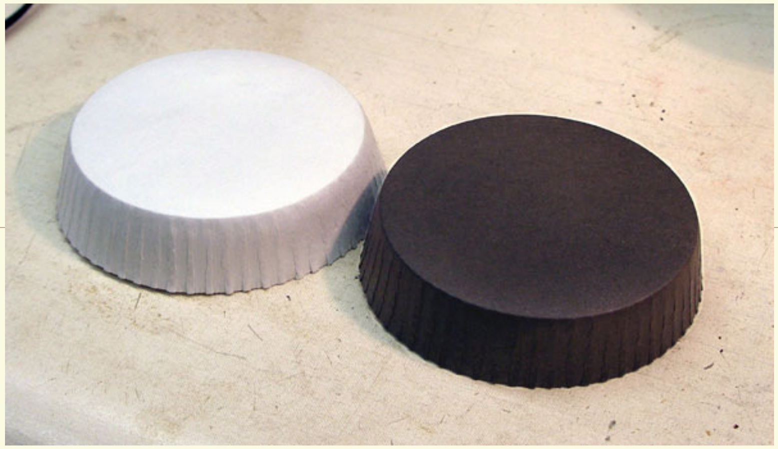
Batteries easy to replace.

- My solution is to have the bottom cap twist off to reveal loading port for battery cage.
- The robust nature of the replica housing insures dimensional stability for a very long time.

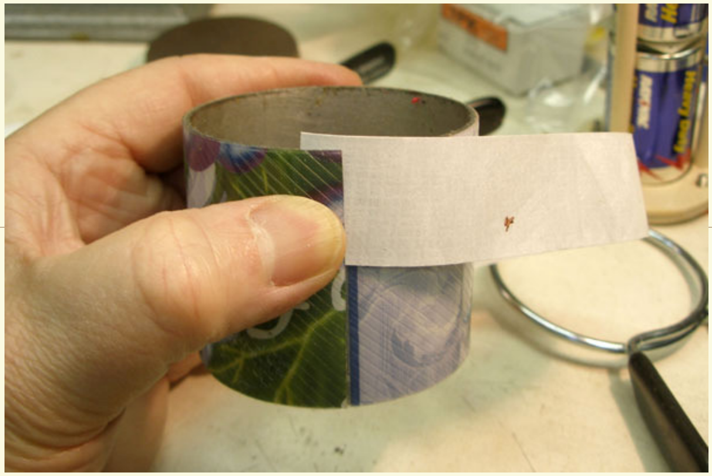
(Cage remains sealed in steel body.)

Most difficult challenge.

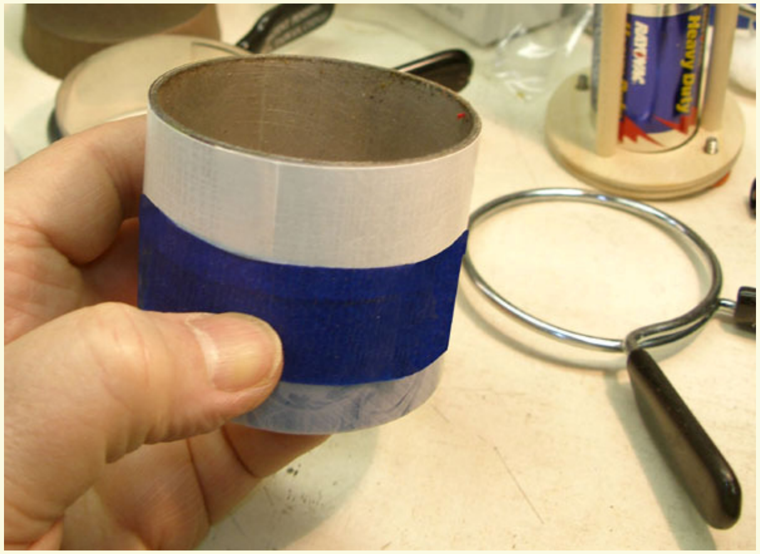
- Fabricating an end cap that will be stable over time even in high humidity conditions.
- Solution requires a multi-step process.
- Basic end cap is a sanitary glass cover made by SONOCO Paper Products – ‘Stancap’ 65mm.
- This paper cap is crimped to form its shape and will not retain its shape over time.
- Solution is to glue a ring of TYVEK synthetic paper to the inside of the crimped area. This material is extremely resistant to stretching.



Spray stock cap with aniline wood dye.



Wrap Tyvek strip around form.

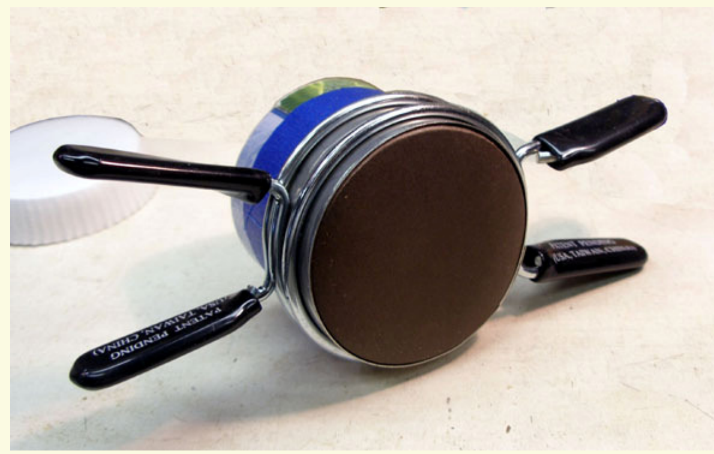


Secure Tyvek with a wrap of blue tape.

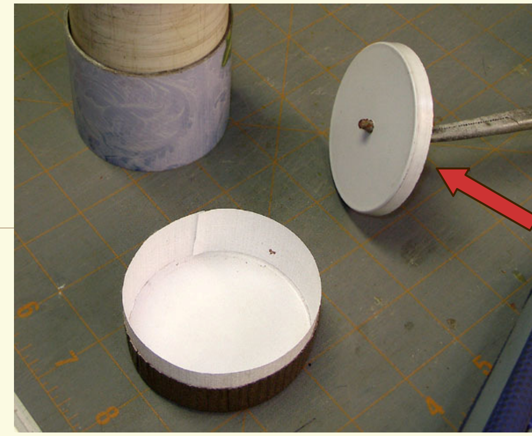
Spray masking jig.

Tyvek is covered with spray contact adhesive.

Form with Tyvek strip is immediately placed in paper cap.



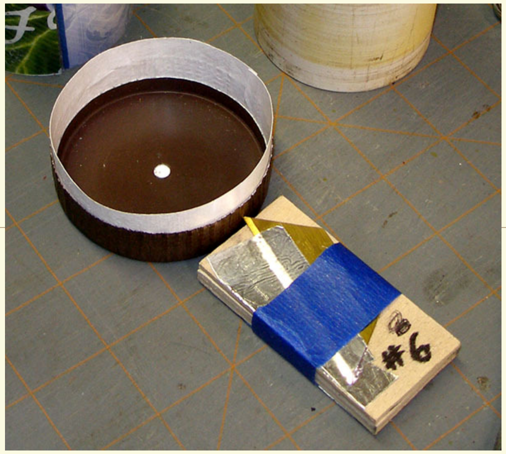
Assembly is immediately forced into thin stainless steel strip secured with spring hose clamps to cause the strip to collapse tightly around paper cap.



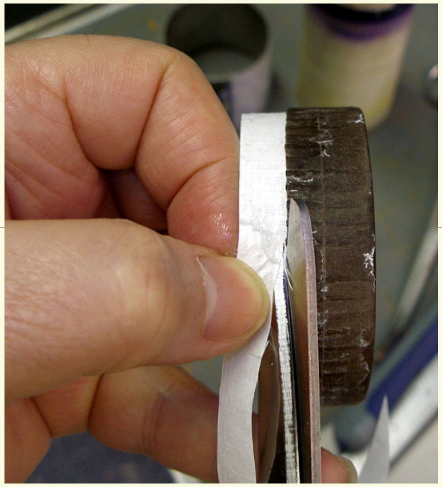
Heat required to bake out the adhesive spray volatiles.

Spun aluminum flanged disc is sprayed with adhesive and forced into paper cap.

For long term stability, crimped area of paper cap is saturated with water thin CA adhesive to form a rigid matrix unaffected by moisture & easy to paint.



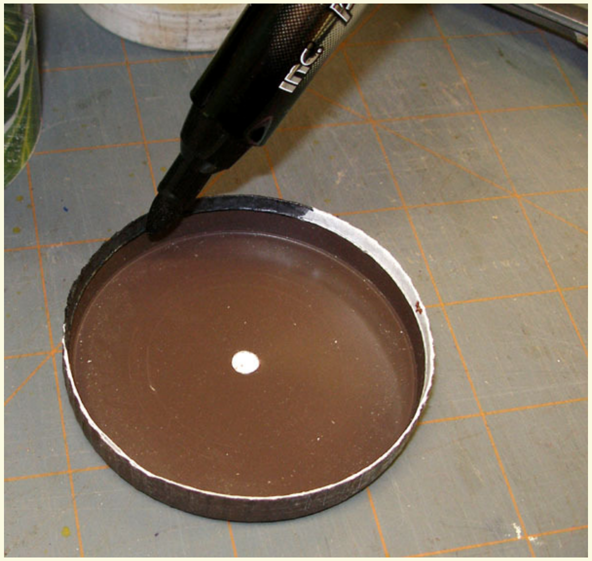
Scribe a cut line for finished cap height.



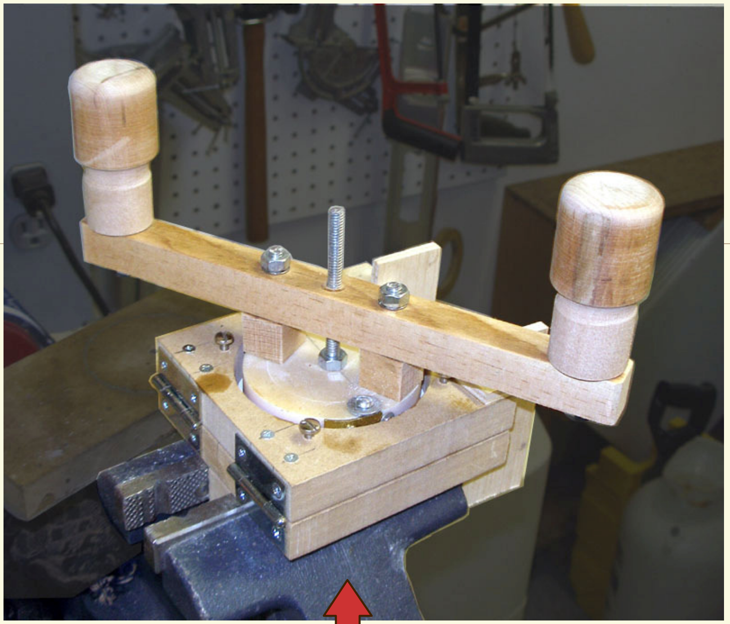
Cut away excess Tyvek.

Use tin snips to cut paper/Tyvek matrix to finished size.

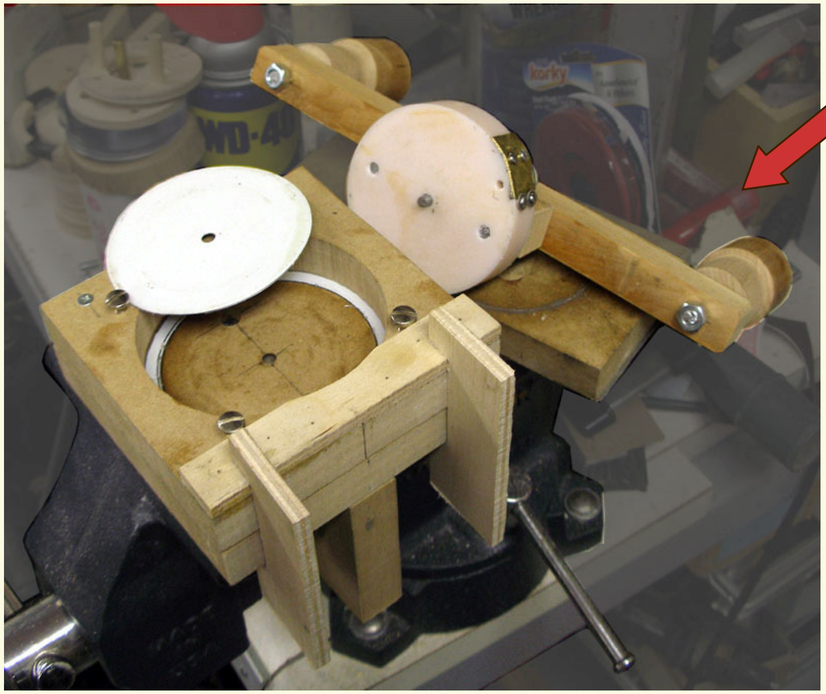
Black permanent marker masks cut edge.

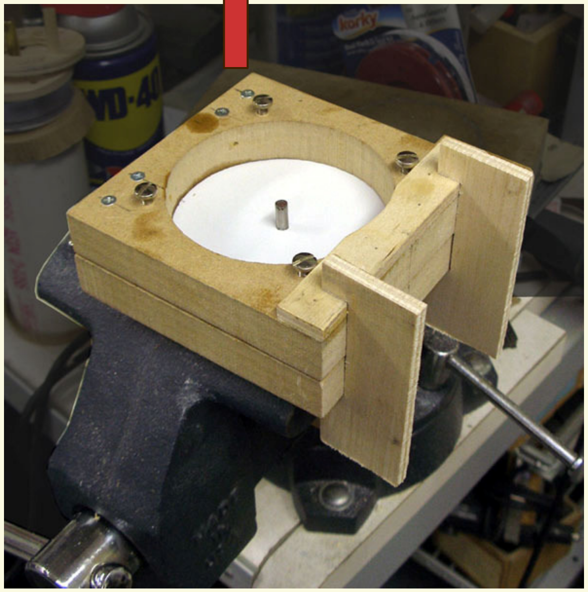


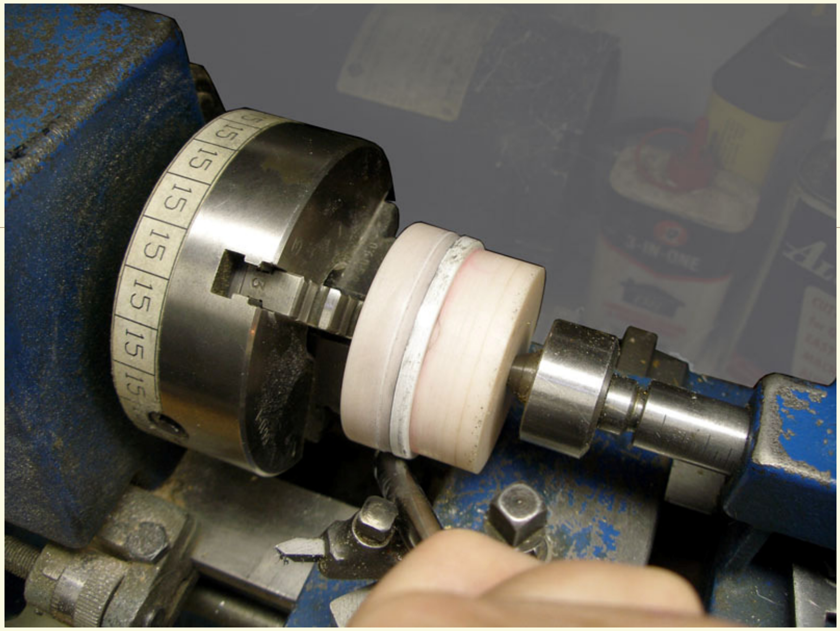
Making the spun aluminum disc.



Made from seamless gutter stock.



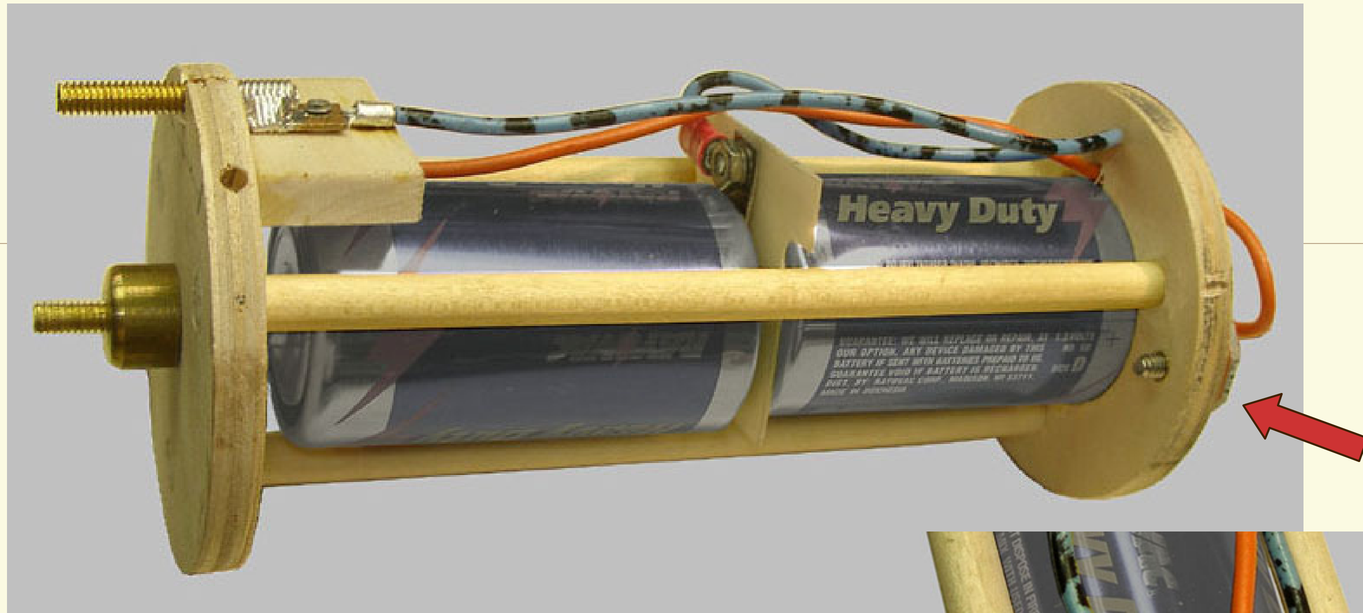




The dead soft aluminum disc is spun around simple mandrel using a handheld steel bar working on a pivot point.

All it takes is brute force and a little skill. You are done in a few seconds.

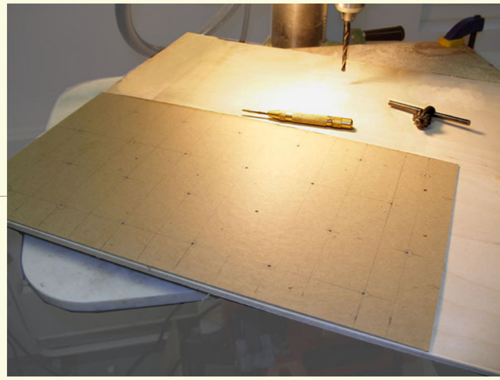
Finished cap is sprayed any color using acrylic paints.

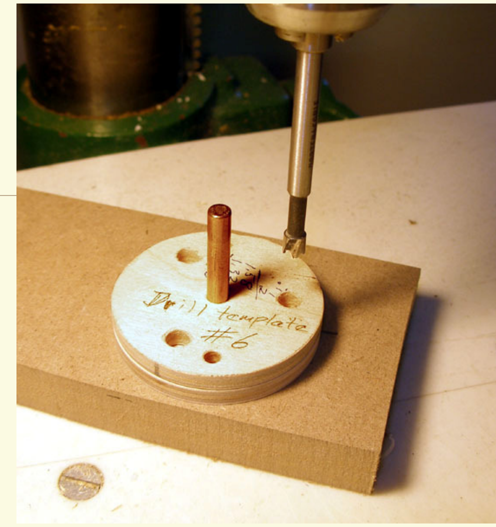


Making the battery cage is pretty much straight forward woodworking.

1/4” 5 Ply Birch discs, ¼” Dia. Poplar dowels & Poplar block. Press fit 6x32 brass inserts in bottom disc to retain positive battery contact.

Dowels pinned in discs using 23 gauge pneumatic nailer.



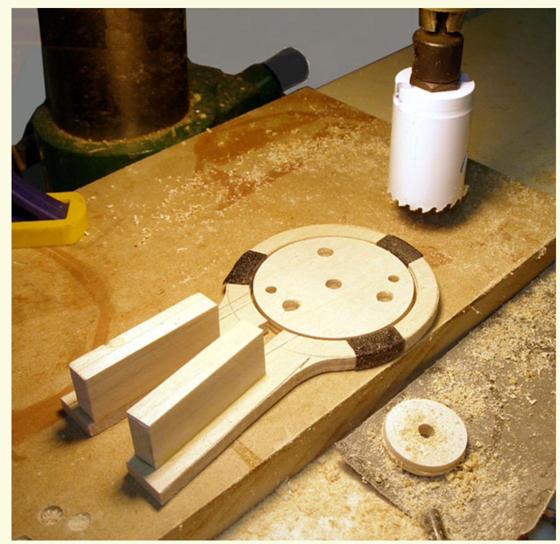


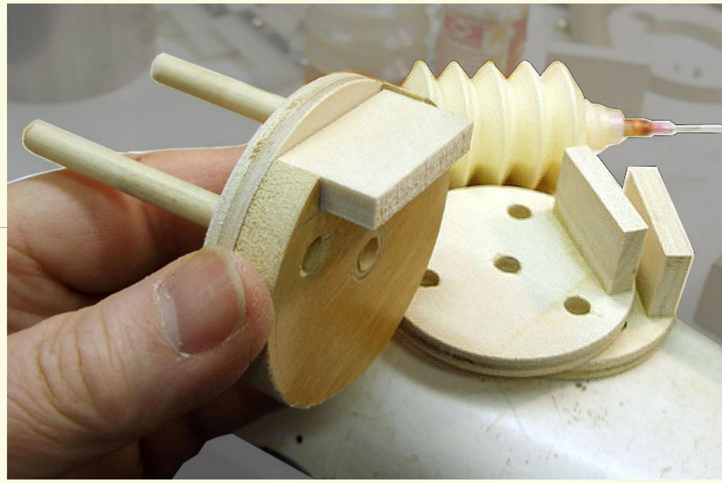
Punch and drill pilot holes for the hole saw.

Hole saw cuts half way thru the wood, then the panel is turned over for completion of the sawing.

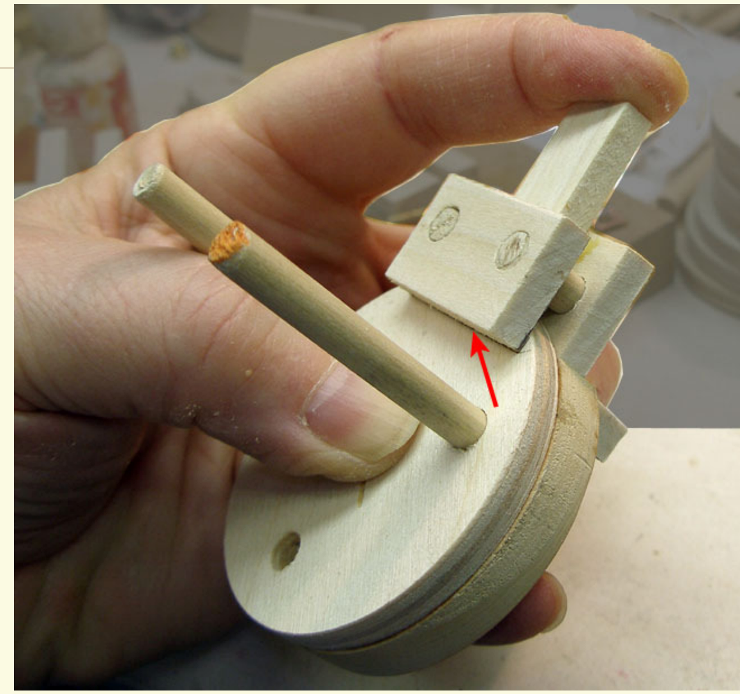
A template disc is used to locate 1/4” & 3/16” holes.

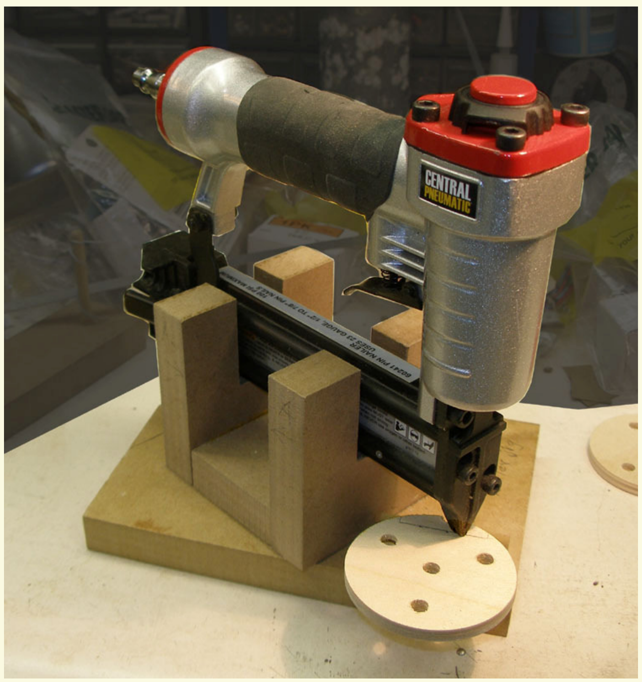
Simple plywood ring clamp holds disc safely for sawing out the 1- 5/16” battery access port.





Jig locates negative terminal mounting block that is glued and pinned.

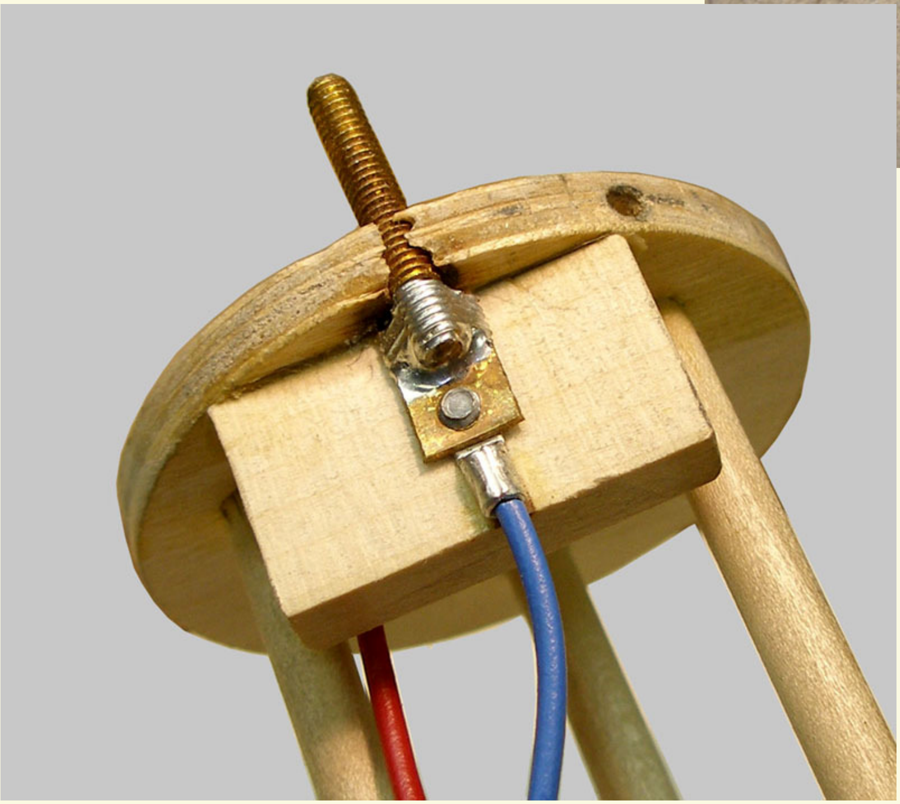




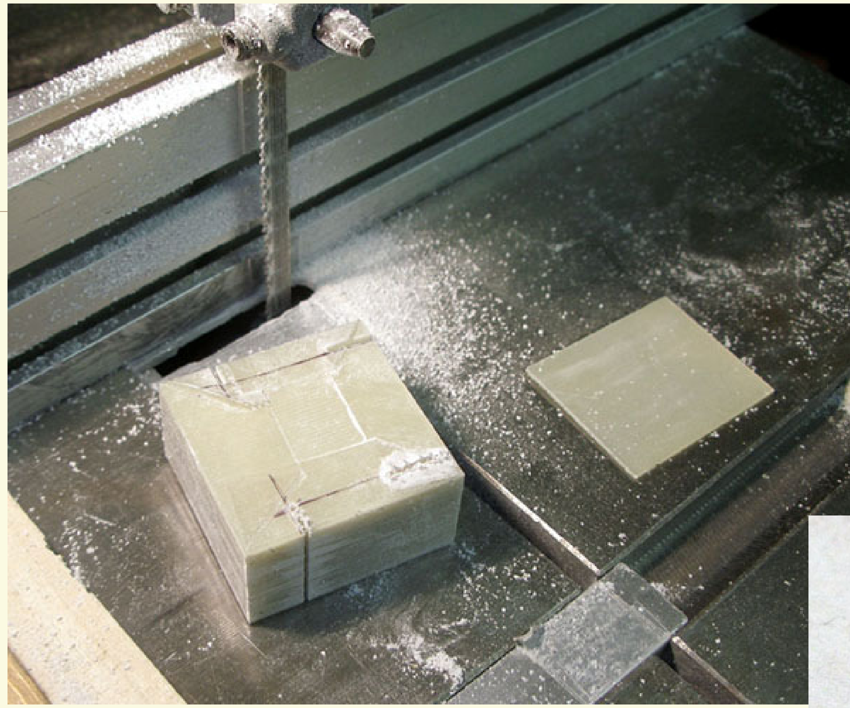
Jig allows you to scribe a line for 23 gauge pin nails to fasten negative terminal mount block.

When nailing small parts, a jig is necessary to drive pins at true right angles to your work piece.

My way to place the negative stud within a millimeter or two of the correct radial distance from the center positive electrode.



Hard silver soldered joint.

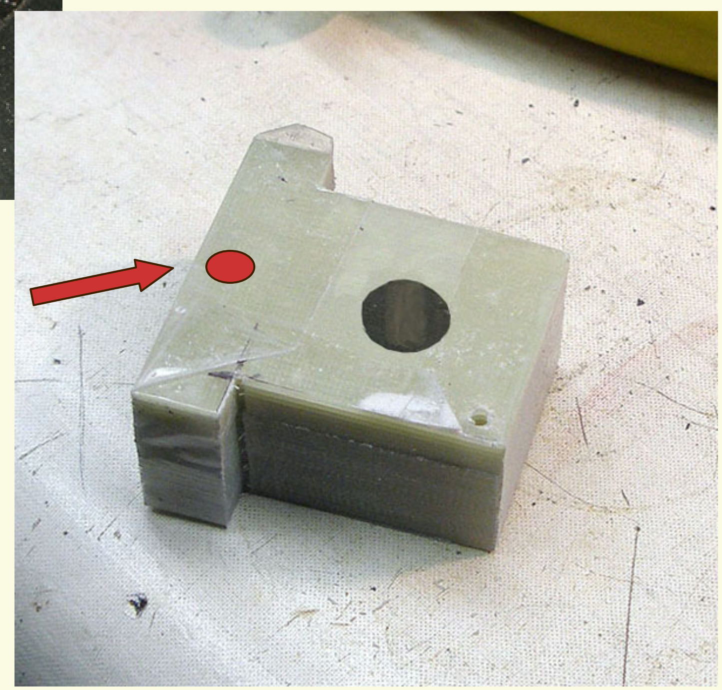


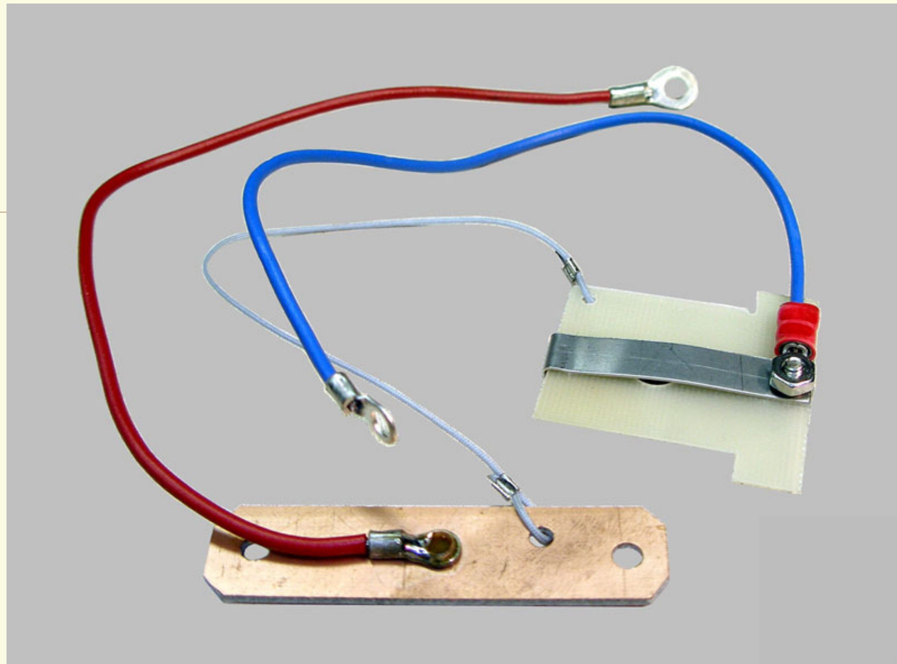
Negative contact 0.032” fiberglass base.

Easy to cut to size if you simply tape up a stack for sawing.

Drill 9/32” hole and 1/16” string hole.

(A 1/8” hole is punched at the time the stainless steel contact is wrapped around this base.)

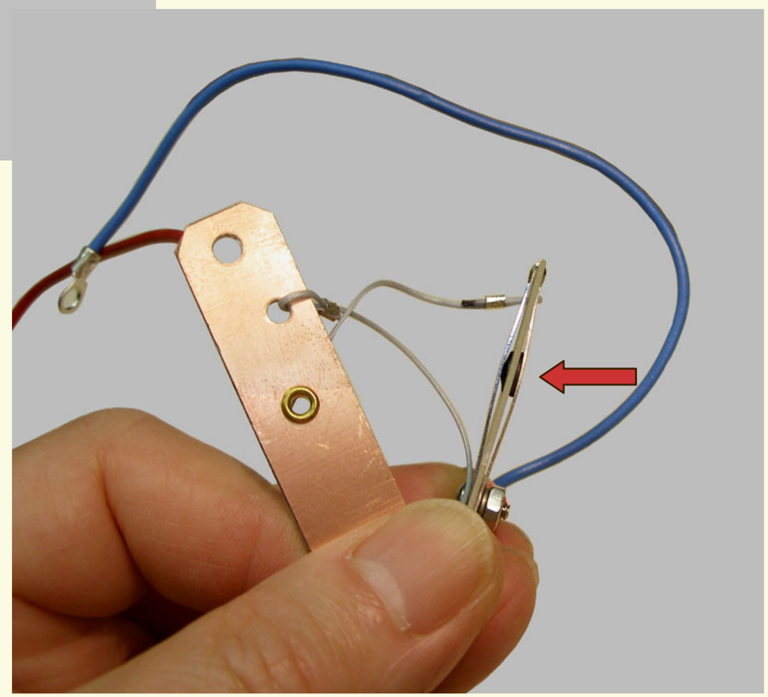




Wire harness assembly.

Stainless steel strip forms negative ‘D’ cell contacts.

Positive contact is on 0.063” PC board material that provides spring tension.



SS strip is wrapped around fiberglass base and 1/8” dia. hole is punched for attachment of #4 ring terminal.

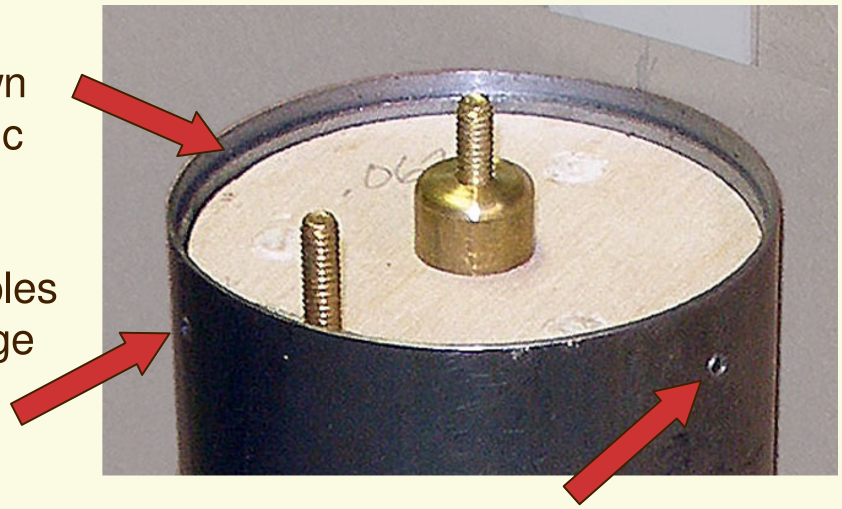
A little slug of plastic is captured by the stainless steel strip to create high contact point at center of the battery negative electrodes.

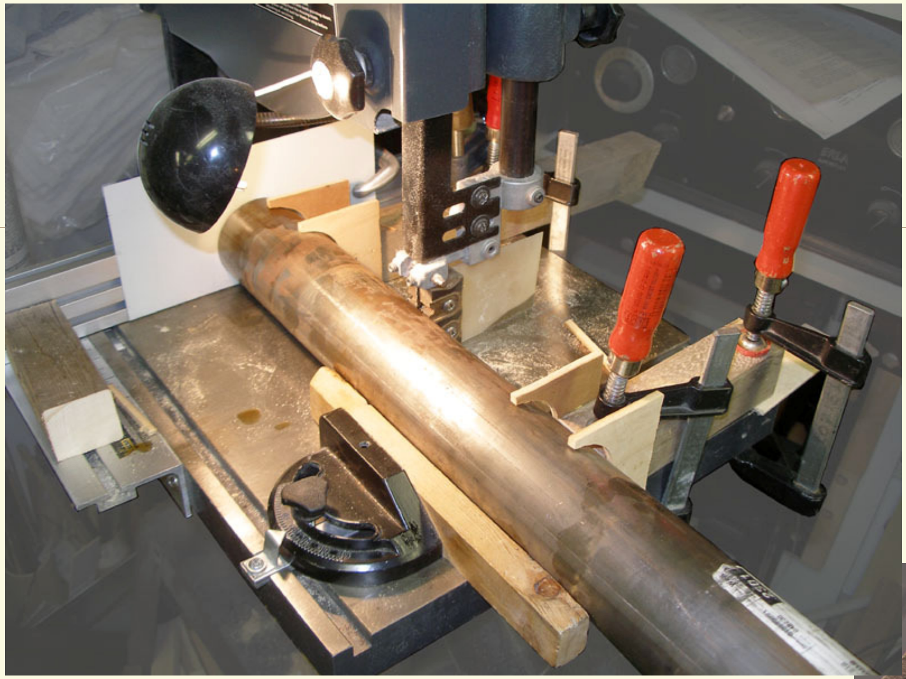
Why a steel body?

- Nominal outside diameter of a #6 cell zinc can is 2.5”. The added paper label & end cap must not cause the diameter to exceed 2.625”
- No known plastic pipe or paper tubing exists that will meet those requirements.
- The easiest metal tubing to purchase in small quantities that will meet those requirements is 17 Gauge – 2.5” O.D. automotive exhaust pipe. (0.063” wall)

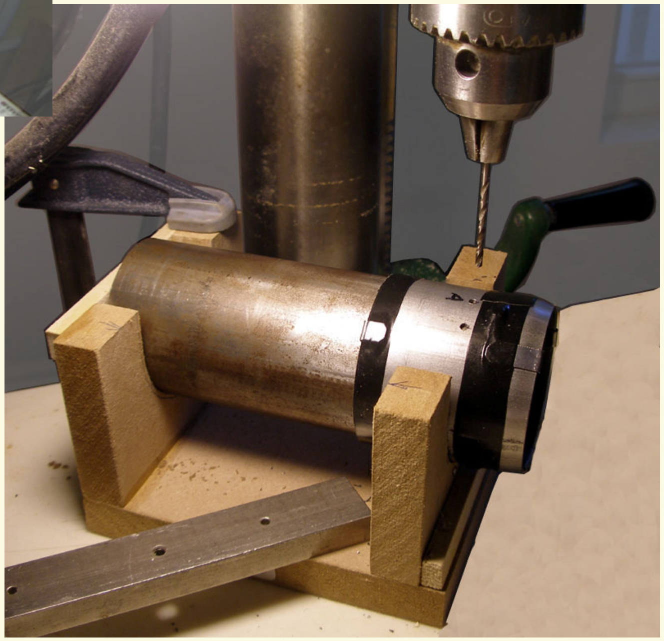
Steel body permits machining down one end to the thickness of the zinc can wall at the top of the cell.

Wall thickness supports tapped holes used to anchor internal battery cage with set screws.

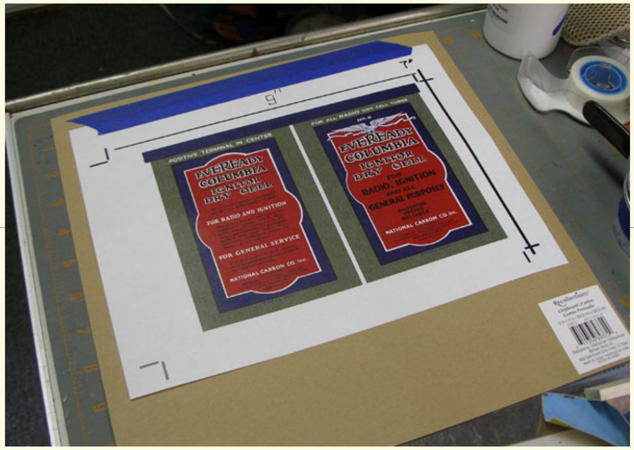




A slip-on jig guides drilling of radial holes for three set screws that anchor the wood battery cage.



Sawing this 2.5” Dia. steel pipe is a very slow process on my modified band saw. Definitely a job I would like to farm out.

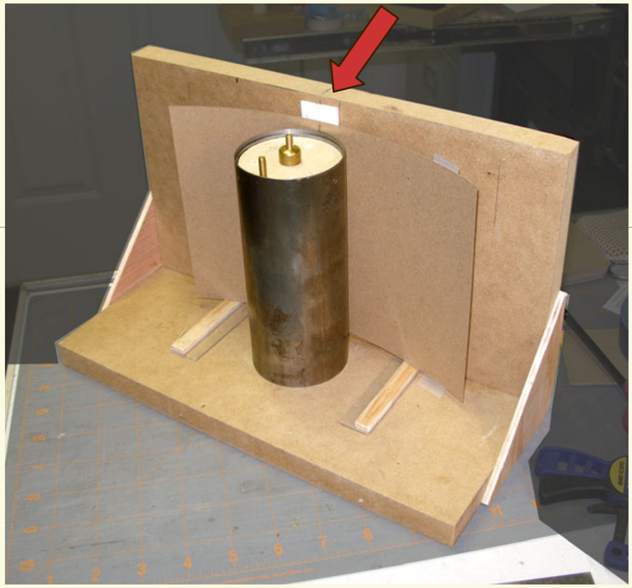


Graphic is laminated to 0.025" chipboard.

Spray contact adhesive is used for bonding.

Graphic is precision cut to size.

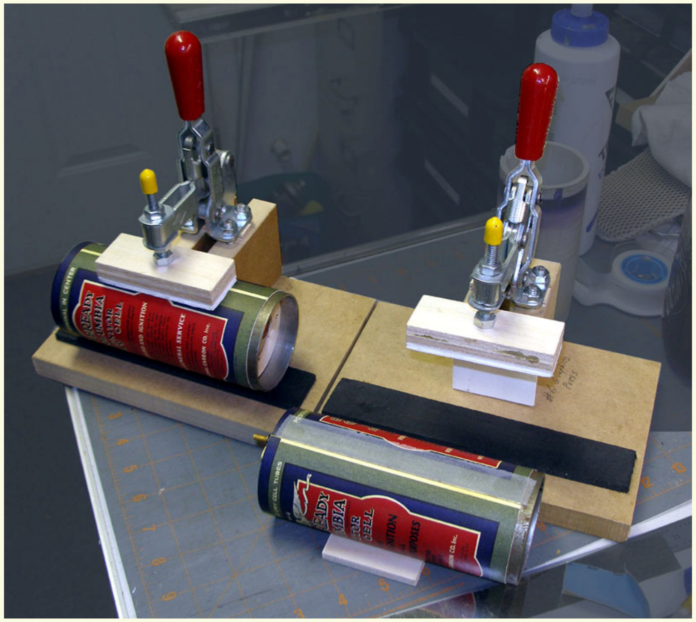
Removable tape applied at glue line to protect graphic.



•Contact adhesive is sprayed on about 85% of the graphic leaving the glue joint area clear to be bonded later with waterproof wood glue.

•Jig holds graphic absolutely parallel to steel body base so it can be pressed into white rubber pad to guarantee the start point for rolling a perfect wrap.

•Wood glue is brushed onto the graphic joint, closed, wiped of excess glue and clamped in cushioned fixture for drying.



Many batteries of the 1920s used a red or brown compound on top. What is it?

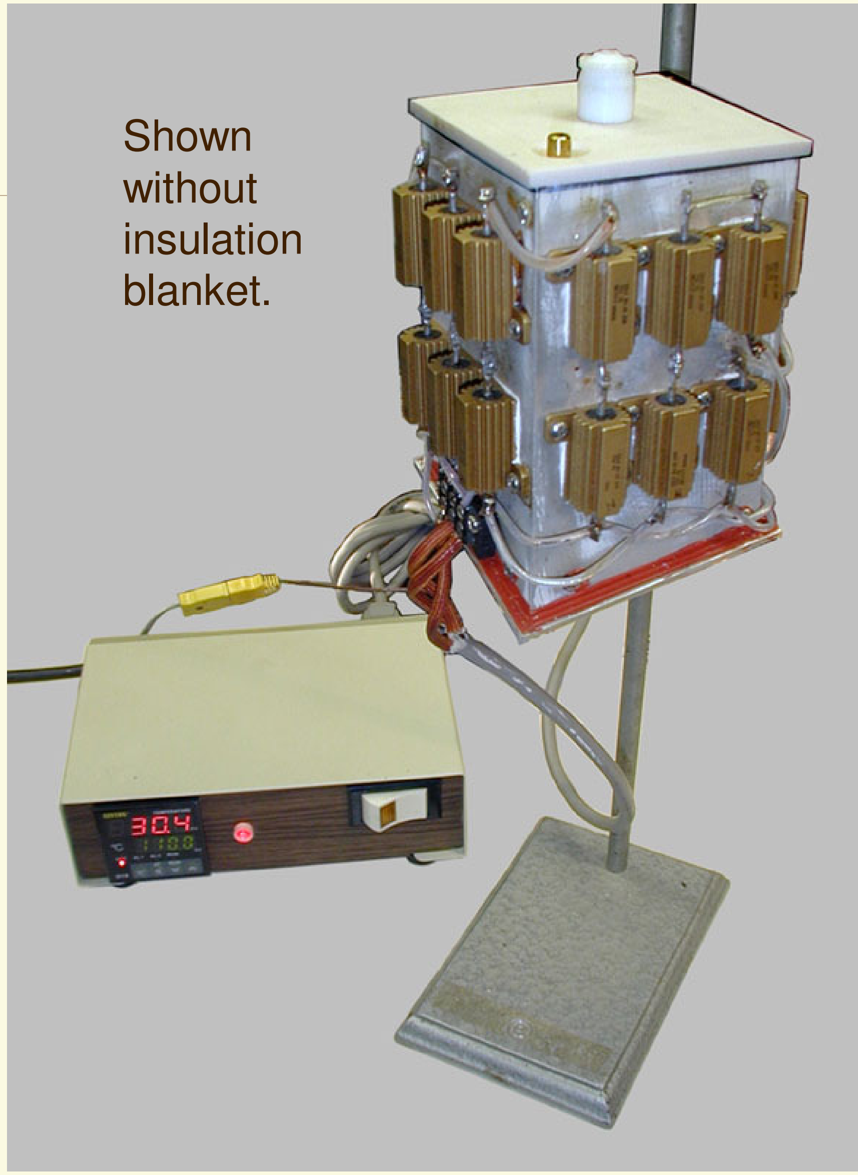
The name of this stuff is Red Pitch.

Pitch (a.k.a. bitumen or asphalt) is a heavy fraction of petroleum or coal. It is always Black.

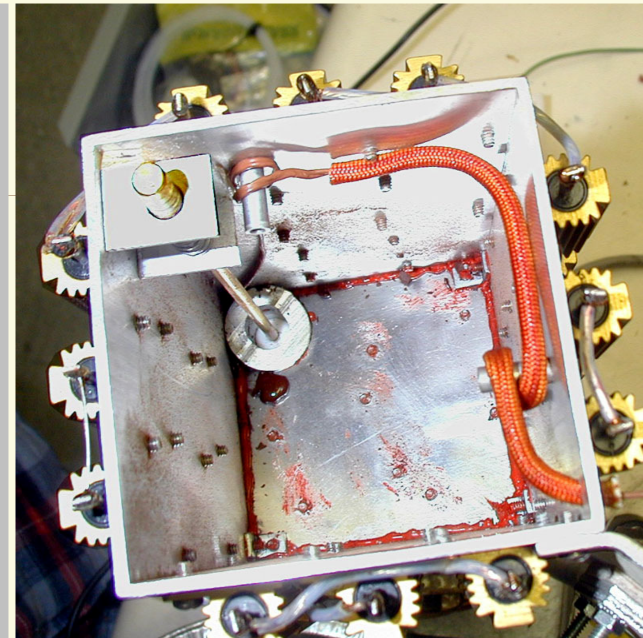
Red Pitch is a misnomer because it is made of coniferous tree resin (amber), tallow (white) and finely ground old brick (red). It was cheap at the time but since it is only used in the artisan metalworking trades now, it is expensive. More than $5.00 worth to fill the top of this medium sized battery. (At least $2.00 worth to fill the top of a #6 dry cell.

First attempts to heat red pitch in a double boiler. It worked but made a terrible mess and was way too slow to use in production.

- Red pitch is best heated in custom built dispenser.
- Consist of 28 – 25 Watt – 75 Ohm heat sink mounted power resistors distributed across five surfaces of a 3” square aluminum extrusion. (About 350 W dissipation.)
- Heating is controlled by a $30 programmable controller using thermocouple data inside the exit valve.



Shown without insulation blanket.



Filling battery replicas with red pitch can only be accomplished practically by using a purpose-built heated dispenser. The pitch must be maintained at 110 to 115° C for proper flow.

Fill area must be preheated to about 120℃.

On cooling of the pitch, many tiny bubbles appear on the surface. They are easily popped and leveled in about 10 seconds by a moderate blast of hot air (150℃) played on the surface.

The covered body is air brushed with a clear lacquer solution containing a small percentage of light oak aniline wood dye to give the look of ‘kind aging’.

Fresh off the printer.

You don’t want to see a strong contrast between an old artifact and a new replica.

After about **65**

process steps,

a finished replica!

About $11.00 in parts and consumables per unit.

(In lots of 25 units.)

Just over 1 hour of skilled labor per unit using current fixtures and jigs.

Results: Accurate enough to serve in a museum display environment.

This PowerPoint presentation is available for download at a link posted on this web page: http://kd4hsh.homestead.com/Battery-Art-index.html

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