BELT GRINDER DESIGN & CONSTRUCTION

By Otto Bluntzer- Genesee Forge

THIS ARTICLE With a keen interest in designing, building and making things work and at the request of several members of the Genesee Forge, this article describing an approach to building a "Belt Grinder," comes about. Some of you are aware that my primary interest is that of "Bladesmithing" not to lessen the rewards derived from forging articles as fashioned by our current and Ancestral Smiths. On October 15th 2001 I began a very beneficial class at the **American Bladesmith School** in Washington, Arkansas called, "Intro to Bladesmithing". At this two week class I had repeatedly made use of "**Bader Grinders**" and became very comfortable with how they functioned. Prior to this I had converted a "Craftsman" belt grinder by adding a third pulley to allow for "Slack Belt Grinding". This third wheel had a rubber boot to allow a smoother grind. The modification proved useful, but the overall machine had serious limitations. Soon thereafter an opportunity to visit "Centaur Forge" in Burlington, Wisconsin resulted in the purchase of an "**Ickler** Grinder". This machine has only a cushioned contact wheel driven by a 1/2 HP AC motor and an idler wheel which also serves as the belt tracking mechanism. A good machine, it too needed a heavier motor.

RATIONALE Several reasons for constructing my own grinder were: (1) The need to make use of many grinding techniques, (2) Cost, and (3) The need to select different sizes of contact wheels. In order to execute this project it would be necessary to have what might represent more than average shop tools. It should also be mentioned that many articles and several books written by Wayne Goddard provided ideas of importance in the initial design phase.

PREPARATION Over a period of many months, sketches, drawings and a number of CADD designs made me feel comfortable that the necessary information was in place. A collection of metal stock earmarked for the different assemblies then proceeded. Along the way I had come into possession of a metal lathe & mill which made possible the construction of pulleys and other parts.

SPECIFICATIONS The Grinder must make use of: 2" X 72" belts, A 110V. DC Motor rated at 1.5 HP minimum, A belt speed, SFM (Surface Feet per Minute capable of reaching a maximum of 3,500 SFM, Speed to be adjusted by either a touch pad or potentiometer, Contact wheels to be easily and rapidly changed, and finally it was determined that parts of the machine were assembled in a manner allowing for removal and modification if that became necessary.

MATERIALS ON HAND Cost of all materials purchased were under $50.00 due to availability of parts which came from a commercial grade Treadmill. The Baldor 1.5 HP DC Motor, the motor rectifier and control panel, and most of metal stock came from the same treadmill. All ball bearing assemblies came from similar machines. Basically the only cost was that of aluminum stock purchased from surplus and for a 5/8" high quality drill bit needed to bore holes in the pulleys. A small amount of bar stock was purchased.

WHERE TO BEGIN As sketches were being made it was realized that the project could not be completed if the necessary materials or tools to shape these materials were not in hand. An inventory of materials collected, the quantity and size of materials was made. Page 12 begins with the materials list. On page 12 is a list of tools used.

MATERIALS LIST

Item	Size/Quantity/Amount
(1) Base Plate	1/4" T X 12" W X 19" L (has a 2" lip at 90 degree angle on one end)
(2) Upright Support	Shaped with Plasma Cutter from a 1/8" X 18" X 14-1/2" Plate.
(3) Drive Pulley on Motor	Aluminum billet, 5-1/4" D X 3" W. (5/8" bored for motor shaft)
(4) Idler or Tracking Pulley	Aluminum billet, 4/I/2" D X 3" W. (5/8" bored for 6" L idler shaft)
(5) Idler Shaft	5/8" D X 6" L (Mild steel OK if ball bearings are used)
(6) Mounting Brackets	For Contact Wheel Arms - 1" X 1" Angle Iron. 3 Foot needed
(7) Contact Wheel Arms	1" X 1" Square Stock - 8 Foot required (needed for other parts also)
(8) Contact Wheels	
(A) 8" D X 2" W	Made of a Rubber Wheel taken from industrial size Cart.
(B) 3/4" D X 2-1/2"	Made from a Steel Tube, incorporates two small ball bearing assemblies)
(C) 2-1/4" X 2" W	Made of two Rubber Rollers with Bearings mounted side by side on shaft
(D) 14" X 2" W	Same as in item "D" (Neither of these last two wheels are easily balanced)
(E) Flat Platen	(Not yet built as the Ickler grinder is used in place of until completion)
(9) Belt Tensioner Lever	1/4" X 3/4" Stock, 18" L (Forged to shape as will be shown)
(10) 15", Additional Stock	Same as above 1/4" X 3/4" (Used for tracking mechanism & brace)
(11)1.5 HP. DC Motor	Baldor - Commercial application use
(12)Controller Assembly	Includes rectifier and digital touch panel (Taking from Trotter Tread Mill)
(13)Ball Bearings	Matched Pairs for Contact Wheels (Size determined by application)
(14)Valve Spring	From B & S or Tecumseh 3-1/2 HP to 6 HP (for tracking mechanism)
(15)Bolts & Nuts	2- Head Bolts from B & S or Tecumseh engine for locking mechanisms)
(16)Bolts & Nuts	Generous Assortment of 1/4 X 20. (Used for assembling parts)
(17)Round Rod	1/4" X 6" L for making three, T - handles for item above.
(18)3/8" X 1-1/2" X 6"	Stock to be drilled, tapped and welded to Contact Arm Brackets

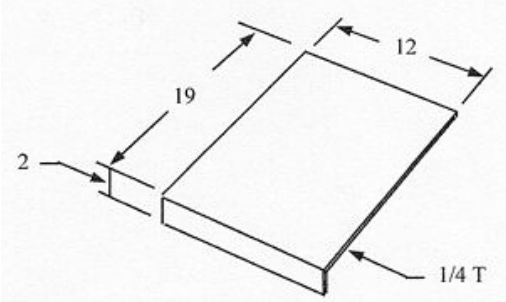
TOOLS USED

(1)Metal Lathe	Extensively used for turning and boring Idler and Drive wheels.
(2)Metal Band Saw	Extensively used for cutting stock to desired length.
(3)MIG Welder	Used for welding up brackets and small parts as needed
(4)Bench Drill Press	Used for drilling holes prior to assembly of frame.
(5)Hand Drill	Used for drilling holes after basic metal frame is completed.
(6)Bench Grinder	Used periodically for bringing parts to rough tolerance.
(7)Belt Grinder	Frequently used for creating smooth operating surfaces.
(8)Angle Grinder	Used to touch up edges of frame and parts assembled to frame.
(9)Forge, Anvil etc.	Used to shape handle used for installation & removal of belts.
(10)Bench Vise	Useful when draw filing.
(11)Tap & Die Set	Used at locations indicated on drawings.
(12)Dial Calipers	Frequently used for general as well as lathe work.
(13)General Tools	Commonly used for basic metal work.

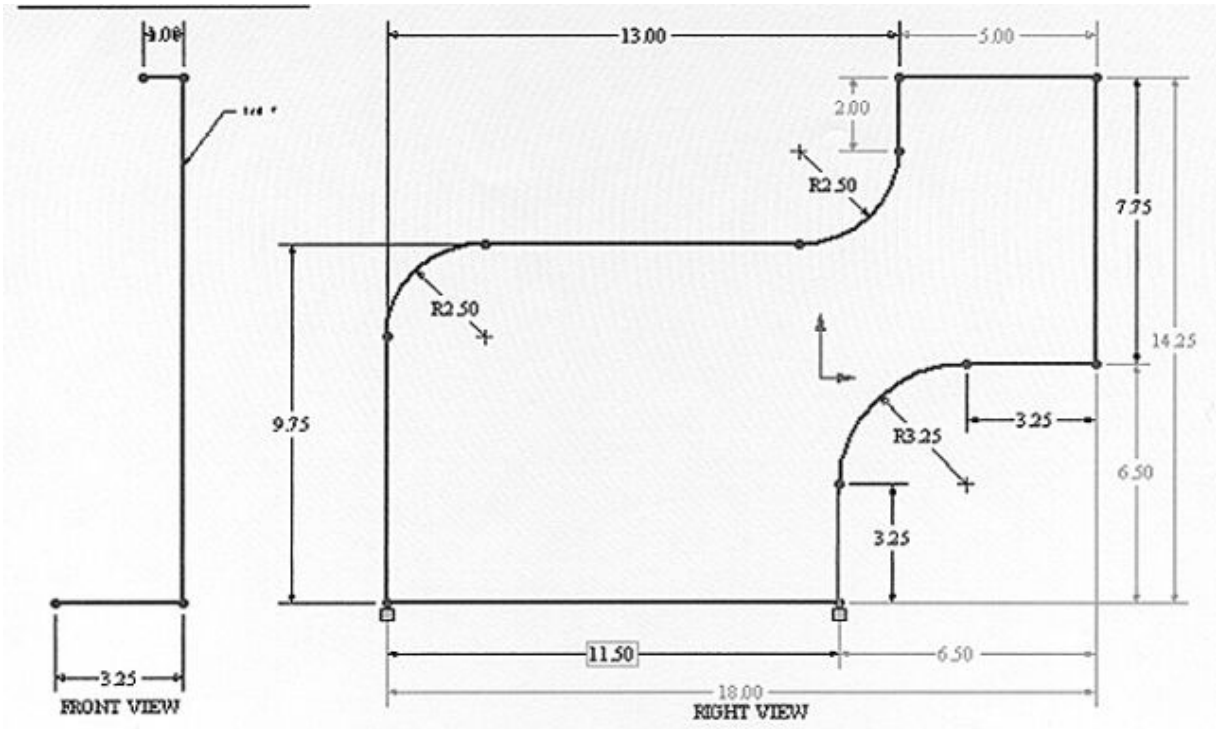
ASSEMBLY SEQUENCE & ILLUSTRATIONS

1) BASE PLATE

NOTE: All dimensions given are in inches unless otherwise noted. As per most parts, the exact dimension of the Base Plate is only incidental! It's what I had in stock!



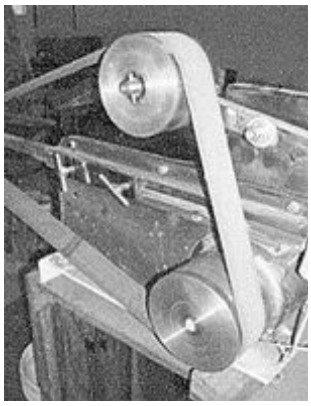
(2) UPRIGHT SUPPORT



This "Upright Support" is made from 1/8" plate. By itself, it is much too weak to support the idler and contact wheels. It is recommended that a thicker plate be used. The scrap from which this plate is made has a 3-1/4" bend at the bottom which extends as shown in the front view. This was used to bolt the "Upright Support" to the base. There was also a right angle, 1" bend at the top.

(3) MOTOR MOUNTING

The motor is bolted to the rear of the "Base Plate". The motor shaft is located at the focus point of the 3.25" radius of the "Upright Support as shown in # 2 above. The drive wheel will extend over the edge of the " Base Plate".

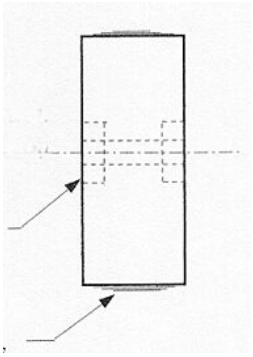


(4) DRIVE PULLEY (Lower right comer of picture)

Make the "Drive Pulley" approximately 6" D X 3" wide. The maximum RPM of the motor along with the diameter of this drive pulley determines the maximum SFM of the belt. This arrangement produced 3,400 SFM. The motor shaft is 5/8" D. The pulley was turned on a shaft for precision balance. A keyway was cut into the pulley to match the keyway on the motor shaft.

(4a) IDLER or TRACKING PULLEY

This pulley can be the same diameter and width as the drive pulley described in step # 4. Ball bearing assemblies are included for free rotation on a fixed shaft. The face of the "Idler Pulley" must have a slight crown such as a typical balloon tire, but not as pronounced. The crown is 1/6", although 1/8" might be better

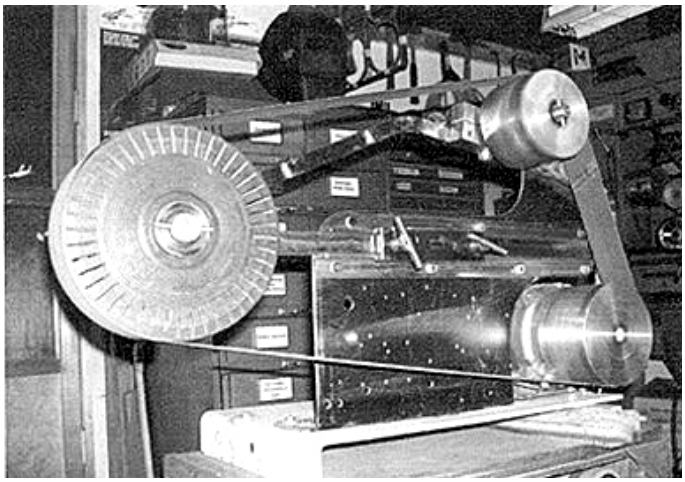


(5) IDLER SHAFT

This shaft was chosen to be 5/8" D X 5" long. It will be secured at one end of a 6" length of 1" square stock.

(6) CONTACT WHEELS

At present there are four contact wheels in use. An 8" wheel with a 2" width is most often used. This wheel was taken from a typical industrial cart. New recesses were turned into the rubber wheel to retrofit the original. The wheel face was trued on a lathe.
Next, a 3/4" diameter wheel is used for finishing radii less than a couple inches. This is made of a metal tube with bearings inserted. Because of its size, no provision was made for a rubber boot over the metal surface. A rubber sleeve to fit over this contact wheel is anticipated.
Then a 2-1/4" D wheel is used for curves larger than 2".. This wheel has a rubber boot.
Finally there is a 14" D wheel. Because of its size it is difficult to balance. It is generally used for creating "Hollow Grinds" on knife blades. The surface is made of a plastic composite. It should have a rubber boot on it. Later drawings will show mounting details of the above "Contact Wheels". (The 8" "Contact Wheel" is pictured at lower right)
Not yet made is a "Platen Grinding Attachment". The Ickler Grinder currently in use has a good platen grinding arrangement. The 1/2 HP motor it driving that grinder is grossly inadequate.

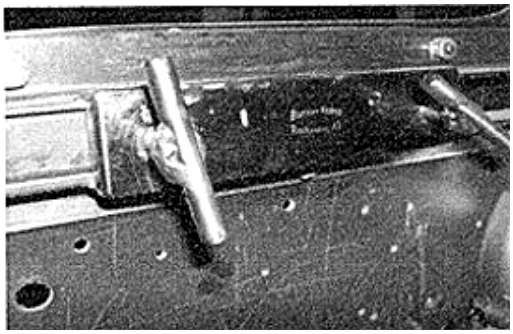


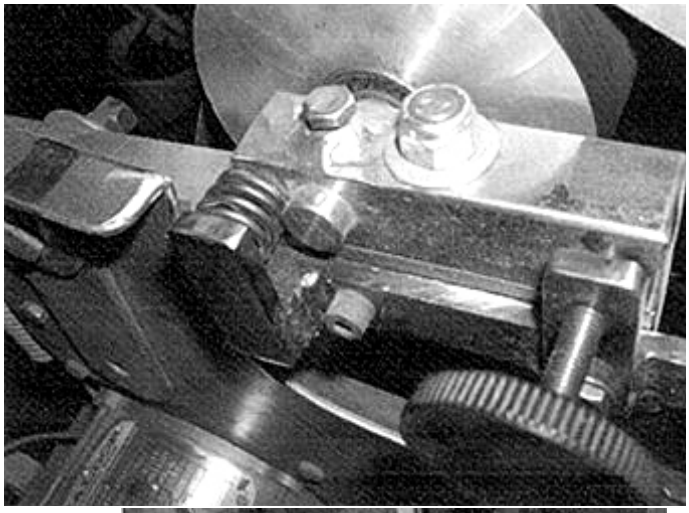
(7) MOUNTING BRACKETS

Two pieces of angle iron, 1 X 1 X 18" are bolted to the "Upright Support" to allow insertion and removal of the "Contact Wheel Arms". These arms are made of 1" X 1" Square Stock. The brackets may be welded, however, bolts allow for adjustment should that become necessary.

(8) CONTACT WHEEL ARM LOCK

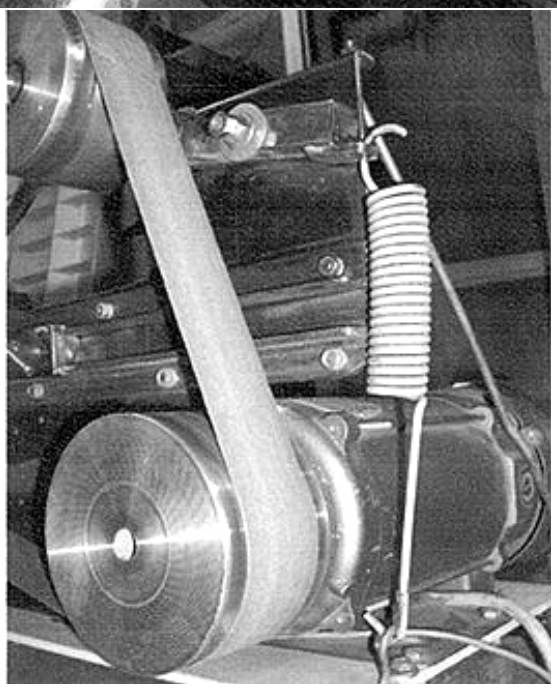
This is made of a 1/4" thick plate measuring 1-1/2" X 6", welded to the two "Mounting Brackets". As shown at right, there are two bolts used to secure the "Contact Arm". Bolts used are taken from a B&S small engine. Rods measuring 2-1/2" long X 1/4" D are welded to the heads of the bolts to serve as handles. The bolts were cut off to a length of one inch. "Really pleased with how well this mechanism functions!"





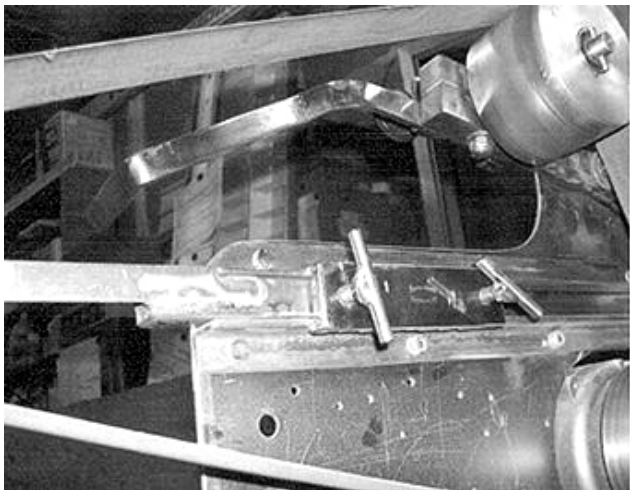
(9) IDLER WHEEL TRACKING MECHANISM

The "Idler Wheel" or "Tracking Wheel" is adjustable. Its position can be slightly rotated on an horizontal plane which causes the belt to ride properly on the contact wheel. The large thumb screw seen in the picture to the right is rotated in order to properly position the "Idler Wheel". To the left of the mechanism is a Briggs & Stratton valve spring which counteracts the pressure of the large thumb screw. The "Idler Wheel Shaft" appears immediately



(10) SPRING TENSIONER FOR BELT

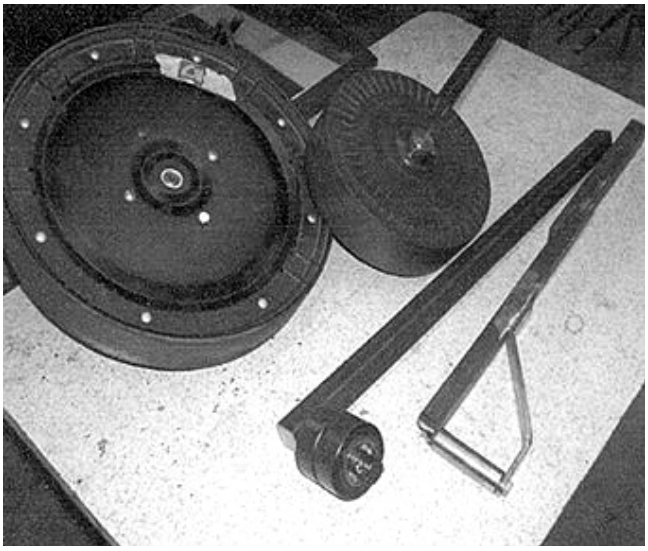
Pictured at right is the spring which applies pressure to the sanding belt. With this arrangement there is no tendency for anything to fly off or away from the winder in the event that a belt breaks. Belt tension is adjusted by how much of the "Contact Arm" is allowed to extend from the "Contact Arm Guides". The "Drive Wheel" is at the bottom of this picture. Mounted behind the drive wheel (not visible in any view) is a speed sensor which causes the DC motor to maintain the RPM to which the control panel has been adjusted. The smaller of the two wires at the lower right comer of this view is the cable which returns to the control circuitry providing the necessary feedback. Consider this feature the same as "Cruise Control" on an automobile. Under heaviest of loads I have not been able to slow the motor. This is true from the lowest RPM to full 3,400 SFM.



(11) TENSIONER ARM

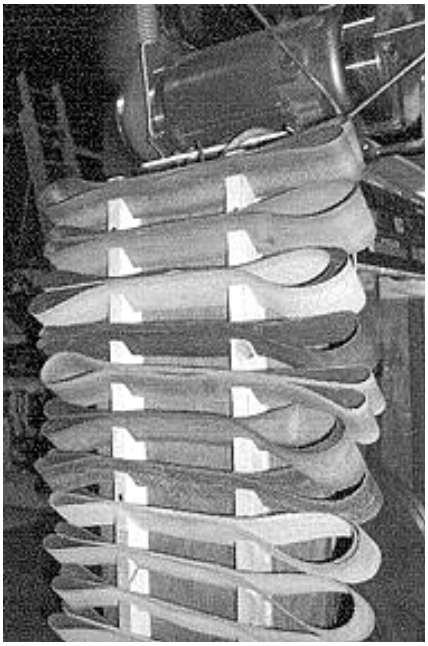
In order to remove or install belts on the grinder, the "Tensioner Arm" is depressed. Then the belt may be easily slipped on or off. This arm is attached to and pivoted at the "Upper Support" at the rear. In order to prevent the belt from wandering off the contact wheel, as heavy pressure is applied, the entire mechanism should be stoutly designed. This picture also shows a view of the two "Contact Arm Guides" along with the "Arm Locking Mechanism". Bolts are used to secure the angle iron guides to the "Upright".

(12) CONTACT WHEEL CONSTRUCTION



Four "Contact Wheels" were described earlier. At the lower right is the smallest, a 3/4" X 2-1/2" wide wheel. Note the angled bracket on that is included to provide rigidity. All four wheels have mounting arms as earlier described, made of 1" X 1" stock. It should be noted that a high quality set of bearings which are designed for high RPMs should be used for the very small contact wheels. Their RPM is very high even at moderate motor speeds. Pressures applied to these smaller wheels are much less than the larger contact wheels. It should be noted that the axel shafts for these rollers must maintain true right angles referenced to the mounting arms to avoid belt tracking problems.

(13) SANDING BELT and CONTACT WHEEL STORAGE



A slotted rack was built to store the 2" X 72" belts. At the rear of the stand. The stand is open on both left and right sides allowing for mounting of the "Rectifier Circuit" and "Control Panel". Racks for storage of the four contact wheels are included.

(14) ADDITIONAL COMMENTS

(A) The "Upright Support" should be made of heavier plate than what is used here. Note that a reinforcement bar has been added from the top of the "Upright Plate", angling down to a point behind the motor where it is attached to the "Base Plate". The 14" Contact Wheel may require additional bracing as the wheel has some vibration at medium RPM. A gusset plate may be welded to the "Upright Support" at the front to provide additional rigidity.

(B) The addition of a "Disc Grinder" attachment was included as the Baldor Motor came with a heavy flywheel which was precision balanced. By gluing on a sanding disc and constructing an adjustable table, the need for a separate disc sander no longer exists.

(C) DC Motor controllers are now available which are not nearly expensive as those in the past. A "Variac" along with a "Full Wave Rectifier" (high current rating) with the use of a couple of spike protection capacitors will also provide an excellent means of DC motor speed control.

(D) A considerable quantity of articles and illustrations are on file relating to belt sanders. For further information: hezzy@eznet.net

This article is reprinted from and courtesy of the NYSOB Newsletter

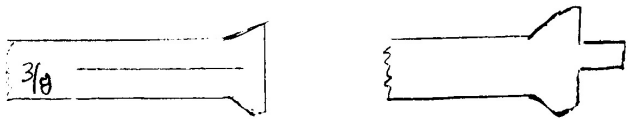
A Colonial Chandelier

By Kit Wattenbarger

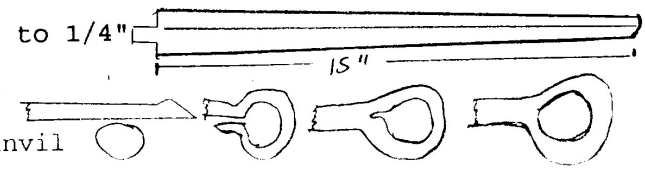
Four Light Williamsburg Chandelier

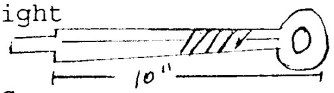
as done by Jerry Darnell

Upright
Material: 3/8" square x 12"



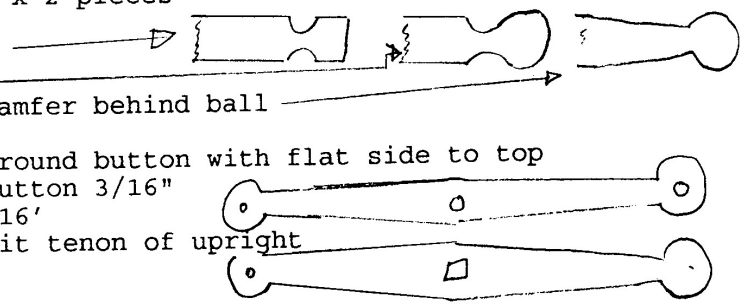
Upset base
form square tenon
Draw long taper on upright to 1/4"
Cut to 14-15" long
Weld eye in top of upright
Scarf end
Roll around horn of anvil
Flux & weld eye
Round up eye
Twist approximately 1/3 down upright





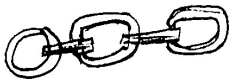
Arms
Material: 3/4 x 3/16 x 8" x 2 pieces

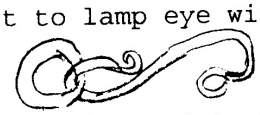
Fuller 3/4" from end
Form ball on end
Draw taper and chamfer behind ball
Duplicate on other end
Hammer ends out to 1" round button with flat side to top
Drill center of button 3/16"
Drill Center of arm 3/16'
Drift square to fit tenon of upright



Chain
Material: 3/16 round 4" x 5

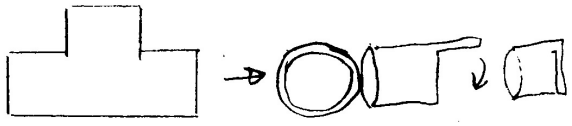
Form 4 links and connect to lamp eye with ring
or
Ring with extender(s)



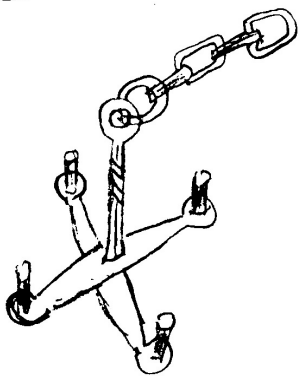


*Chain making will be discussed in article by Marlin Arnold

Candle Cups
16 guage sheet metal
heat and roll around mandrell
close over end
drill center of cup 3/16"



Assembly
Forge weld ring and chain or extenders to upright
Rivet candle cups (4) to cross arms with 3/16 rivet
Rivet upright to cross arms
Finish with wax or paint as desired



Good Luck. Kit Wattenbarger

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Look around and see what you have to donate.
Contact; Dave Macauley, Directors list, Page 2

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Jayesh Shah Architectural Iron Design
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jay@archirondesign.com

Open Forges

We are looking for members who are interested in opening their forges up to members as a open forge. This does not have to be a weekly forge as is Marshall's the others can meet once or twice a month. Please contact, Larry Brown, Editor.

We want to encourage all to join us at:

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The Ashokan campus is located in Olivebridge, N.Y., several miles west of Kingston, N.Y. The meets are held the first weekend in May and in the first weekend in October every year. The main demonstration is in the blacksmith shop and there is a "Hands On" workshop for beginners. A main demonstrator is brought in for each meet, food and bunk-house style lodging are provided as part of the cost of the weekend long meet.

Contact : Tim Neu
to register for hammer-ins
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_____
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Please mail checks to:
NJBA, P.O. Box 761, Mt. Laurel, NJ 08054

Please include payment with the information listed below. You will receive a postcard confirmation of your membership, and will receive a newsletter within a month. NJBA's "year" runs from June to June. If you join mid-year, the postcard will offer a prorated dues option which will then allow you to extend your membership till the following June. The following information will be listed in a roster available to other members.

Name _____ Home Phone_____
Address _____ Day Phone _____
City _____
State _____ Zip _____
E-Mail _____ Skill Level (optional)_____
Comments _____