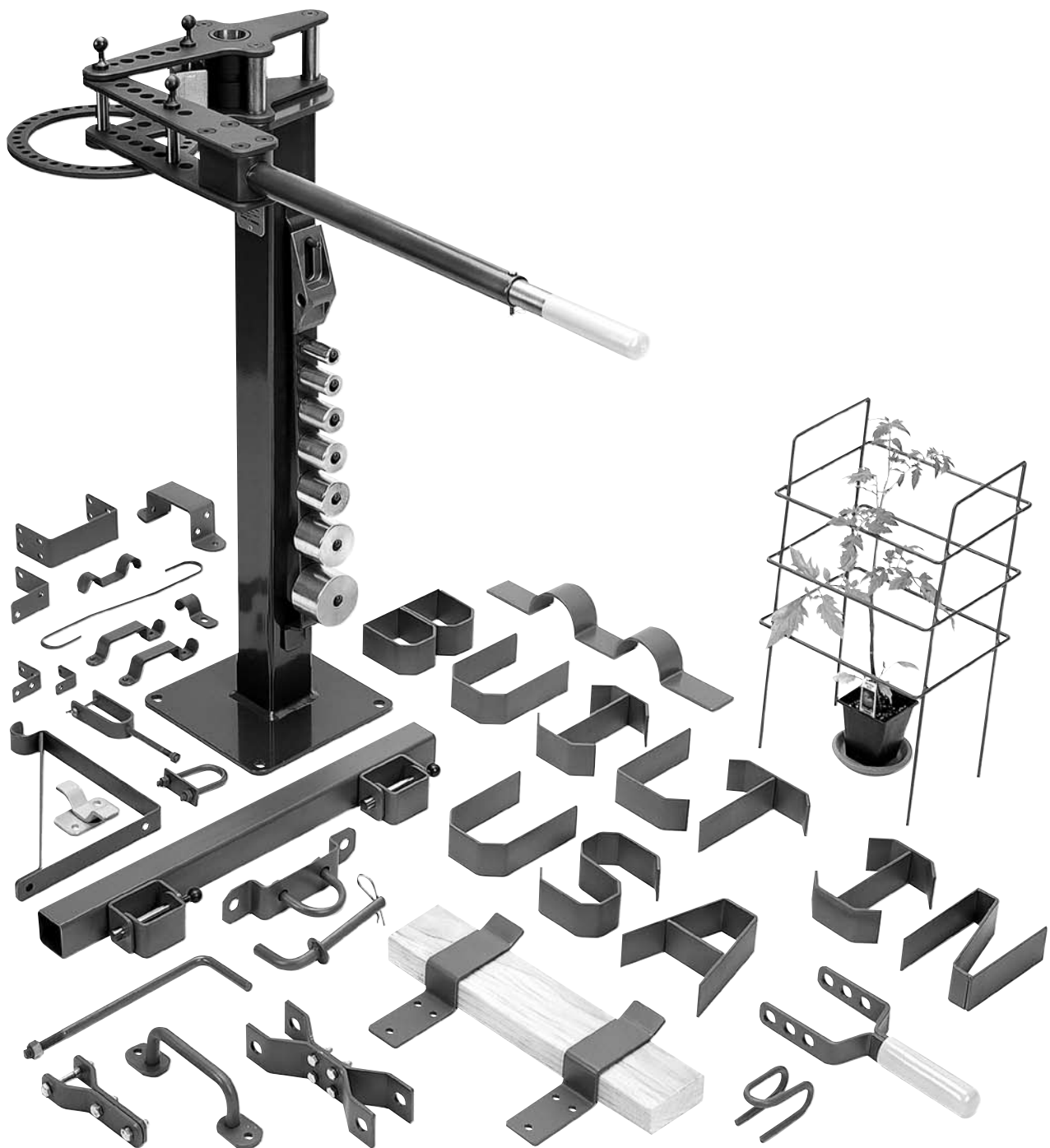


INSTRUCTION MANUAL

for the
20/20 Compact Bender





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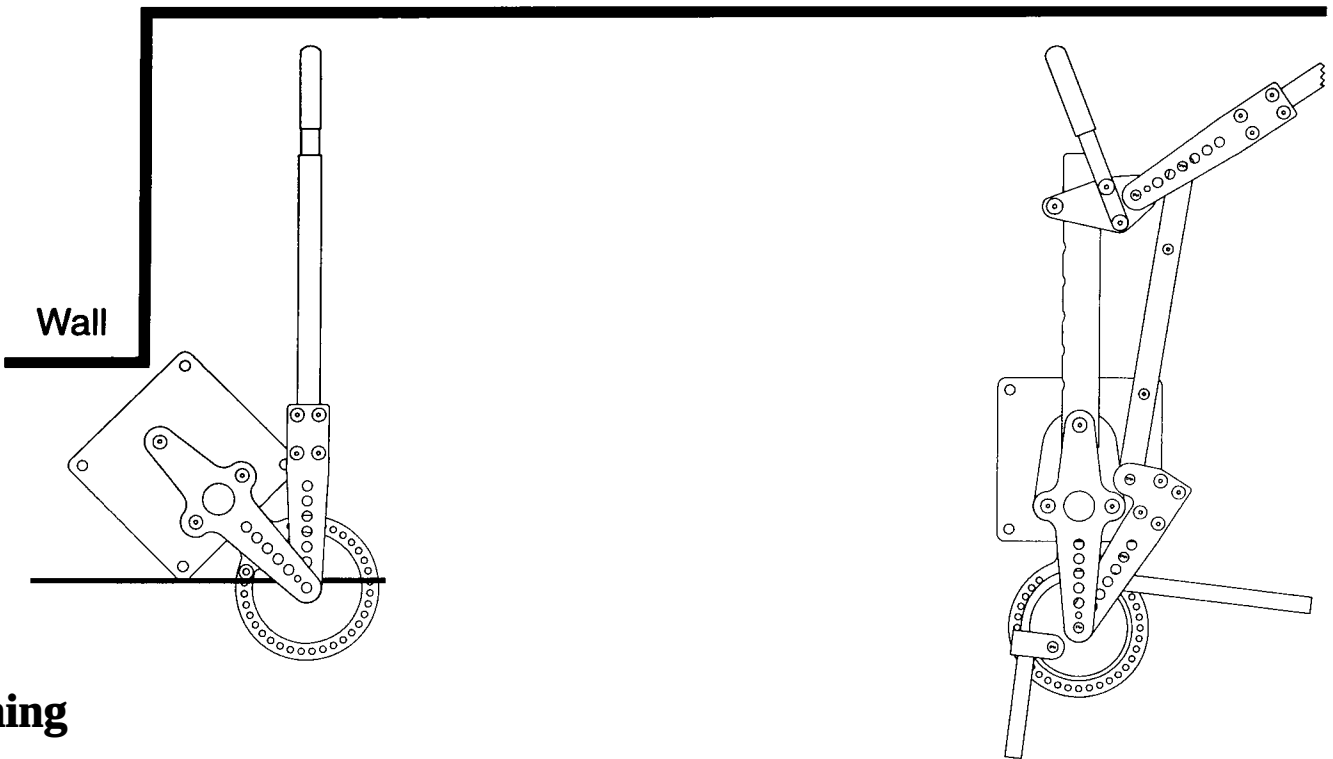
Designed to make a variety of bends on flat, square or solid round stock, the Compact Bender is the economic solution to achieving most needed bends. Furthermore, the Compact Bender is lightweight enough for use as a portable bender on field service trucks.

This Manual has been prepared for use by our customers who have purchased the 20/20 Compact Bender (which includes the Right Angle Bending Attachment). Following the instructions should simplify efforts to make the projects that are covered in this manual. As you become familiar with the Compact Bender, you will discover many ways in which it will make your work easier. We welcome your comments or suggestions.

Photography by Ron Dehn
Technical Drawings by Shawn Bulle

Assembling and Mounting the Compact Bender

1. Secure the ring assembly to the stand (see drawings on pages 3 and 4).
2. With the handle fully extended allow the bender arm to swing in as wide of an arc as possible, making certain that no obstacles will interfere with the bender or the operator.
3. Make sure adequate room is available behind the bender for the purpose of inserting longer bars. If practical, the bender may be positioned at an angle to a wall before it is mounted (shown at lower left), or mounted six feet away from all obstacles. If you ever plan to use other attachments such as the Multiplier or the Picket Twister, you should have at least 32" between the back of the ring and the wall (shown at lower right is the Compact Bender equipped with the Leverage Multiplier).

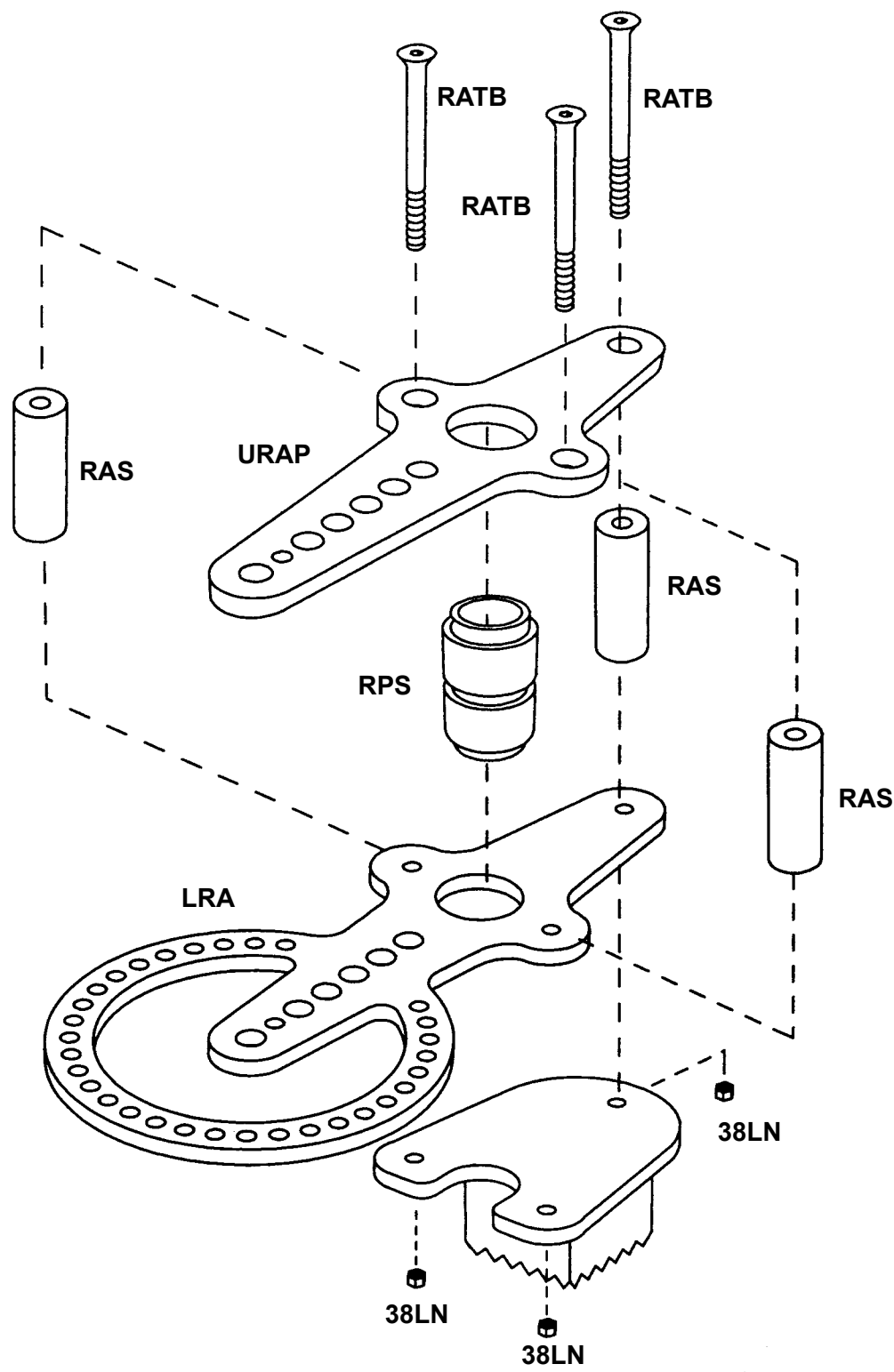


Warning

- Make certain that the stand is securely mounted to a floor.
- Keep the work area free of all obstacles that an operator could run into or trip over.
- Do not add handle extensions or otherwise modify the bender.
- Wear safety goggles at all times.
- When making bends, verify that all pins are fully inserted.
- Sufficient material must protrude past both the stop block and the forming die when bends are made. Otherwise, material may slip off of either the stop block, or the forming die and cause an accident or injury.
- Do not attempt to bend any solid material harder than hot-rolled, mild steel up to 5/16" x 2", 5/8" round or square.
- Use the right angle bending attachment only to bend hot-rolled mild steel up to 3/16" x 2" or 1/4" x 1 1/4". Do not attempt to bend round stock with the right angle bending attachment.
- Do not bend material thicker than 1/4" around the center pin, use the 1" die instead to avoid breaking the center pin.

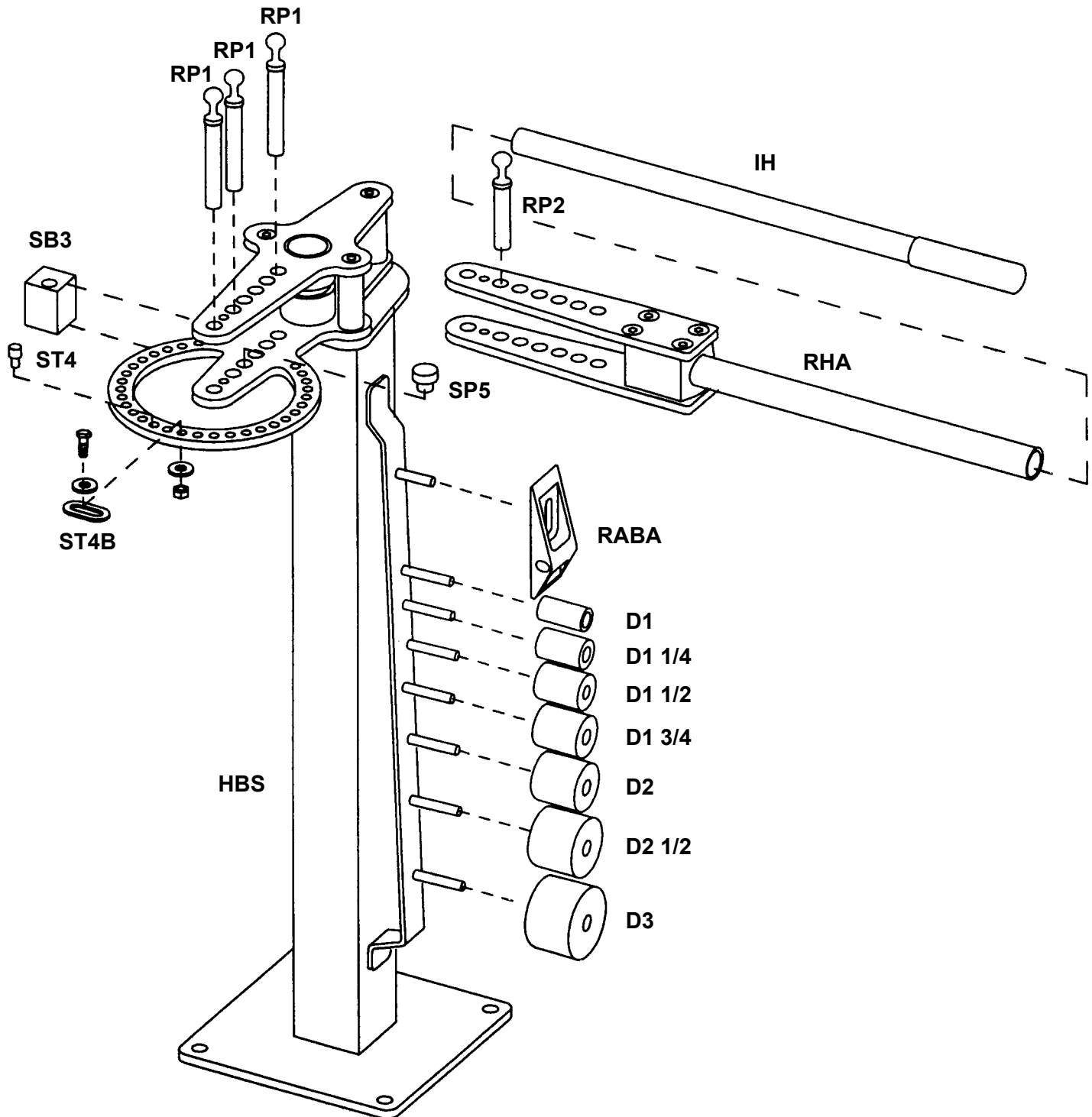
Failure to heed these warnings may result in serious injury.

**Mounting Ring
Assembly to Stand**



Identifying Parts

Refer to part numbers shown below and on the previous page when ordering any new parts. (The purpose of this drawing is to show parts and their corresponding part numbers, not the positions at which they should be located during bends).

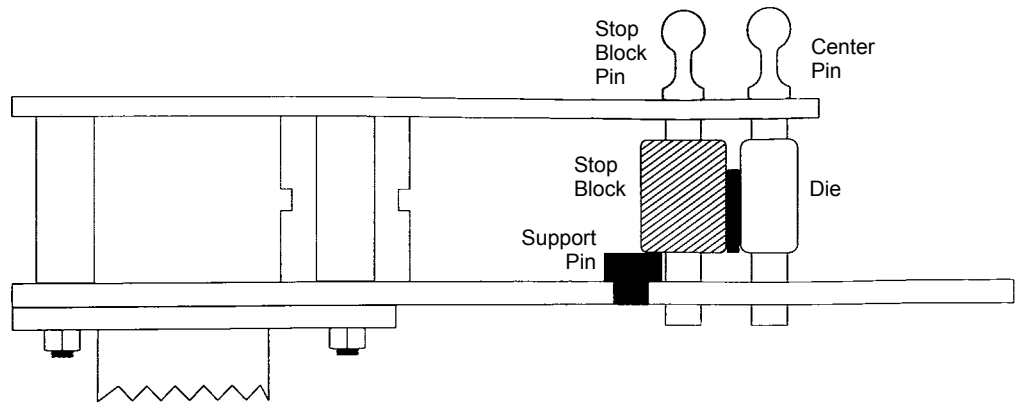
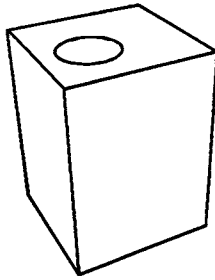


PARTS LIST

Part Number	Diameter of Die	Quantity per Bender
RP1	Long Round-headed Pin	3
RP2	Short Round-headed Pin	1
SB3	Square Stop Block	1
ST4	Stop Block	1
ST4B	Adjustable Stop	1
SP5	Support Pin	1
RAS	Ring Assembly Spacer	3
RPS	Rotating Pocket Spacer	1
RATB	Ring Assembly Tie Bolts	3
38LN	3/8 Lock Nuts	3
URAP	Upper Ring Assembly Plate	1
RHA	Rotating Handle Assembly	1
IH	Inner Handle	1
HBS	Heavy Duty Base Stand	1
RABA	Right Angle Bending Attachment	1
LRA	Lower Ring Assembly	1

Die Number	Diameter of Die	Quantity per Bender
D1	1"	1
D1 1/4	1 1/4"	1
D1 1/2	1 1/2"	1
D1 3/4	1 3/4"	1
D2	2"	1
D2 1/2	2 1/2"	1
D3	3"	1

Using the Stop Block

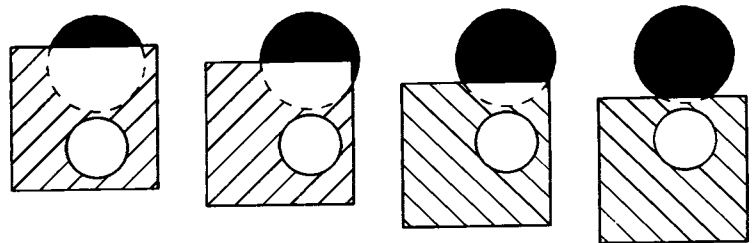


The stop block secures material while the forming die of the handle assembly bends it around the center die (or center pin). The stop block can be positioned in only four possible correct positions. Always use the position that places a face of the stop block as close to the center die as possible. However, the gap between the stop block and center die must still be wide enough to allow insertion of the material.

When viewed from the front of the machine, the hole in the stop block should always be shifted to the right side of the stop block, no matter which face of the stop block is used. Therefore, the stop block must be flipped upside-down before it can be used for two of the correct positions. If the stop block's hole is shifted to the left, the stop block will rotate during bending, causing the material to slip. If precise bends are required, a pair of locking pliers (such as a Vice Grip) may be clamped onto the material to prevent it from slipping.

When larger dies are used on the center pin, both the stop block and the support pin must be relocated one or more holes back from the center to compensate for the larger center die. Remember to position the stop block as closely as possible to the center die, allowing room for material to be inserted. If too much space lies between the stop block and the center die, choose another one of the four stop block positions or move the stop block and its support pin closer to the center.

The support pin raises the stop block to the level of the material and center die (as shown above).



The four correct positions of the stop block are shown above. When viewed from the front of the machine, the stop block's hole is always shifted to the right of the block's center, regardless of which face contacts the material.

In most cases, the stop block can be correctly positioned to hold material in place. When special bends or precise measurements are required, a pair of locking pliers will prevent the material from slipping if it is clamped onto the material along the edge of the stop block.

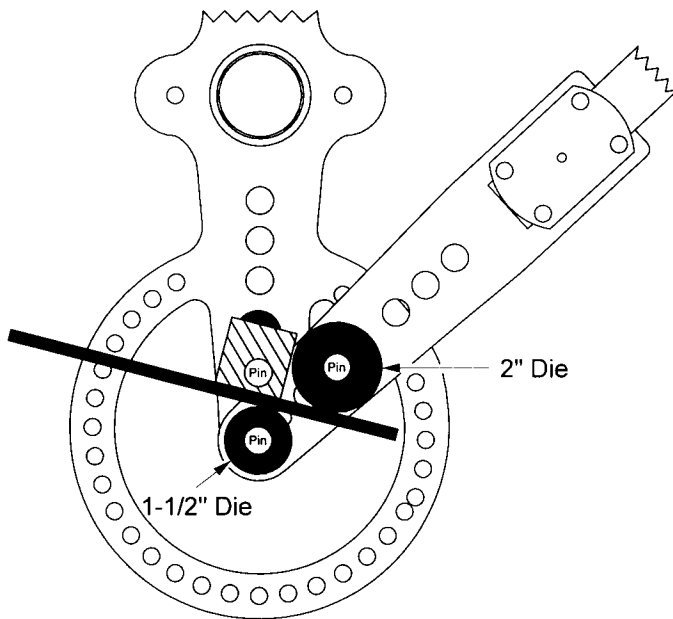


Examples of the Stop Block Used in Each of its Four Correct Positions

Note: Both the stop block and its support pin must be moved toward or away from the center die to different holes along the ring assembly in order to accommodate different die and material sizes. However, the stop block must always be oriented in the same manner as any of the examples shown below.

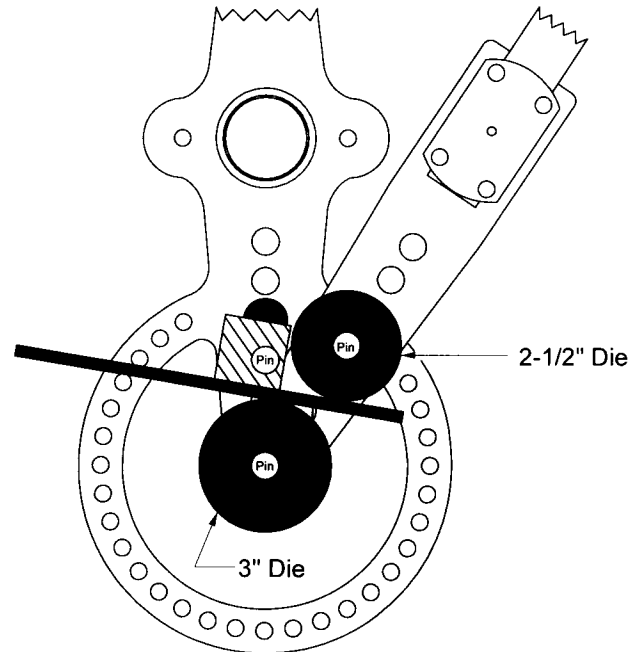
Position 1

1/4" flat, round or square being formed around the 1 1/2" die



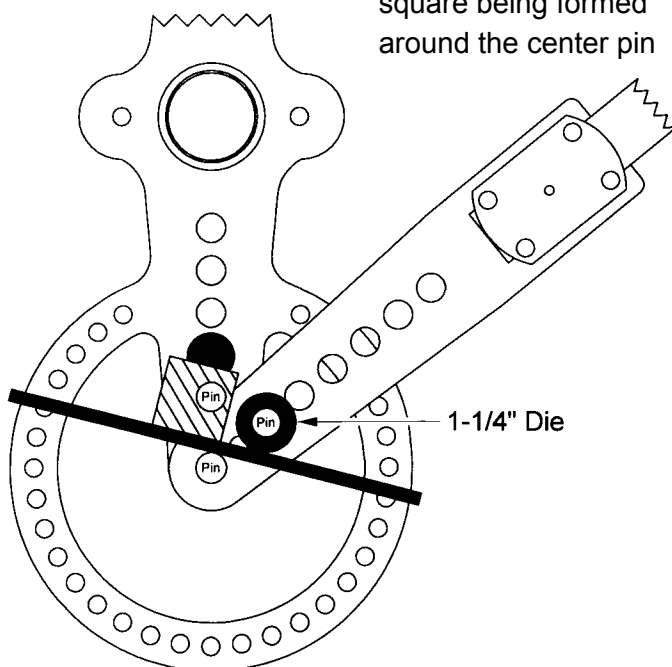
Position 2

1/4" flat, round or square being formed around the 3" die



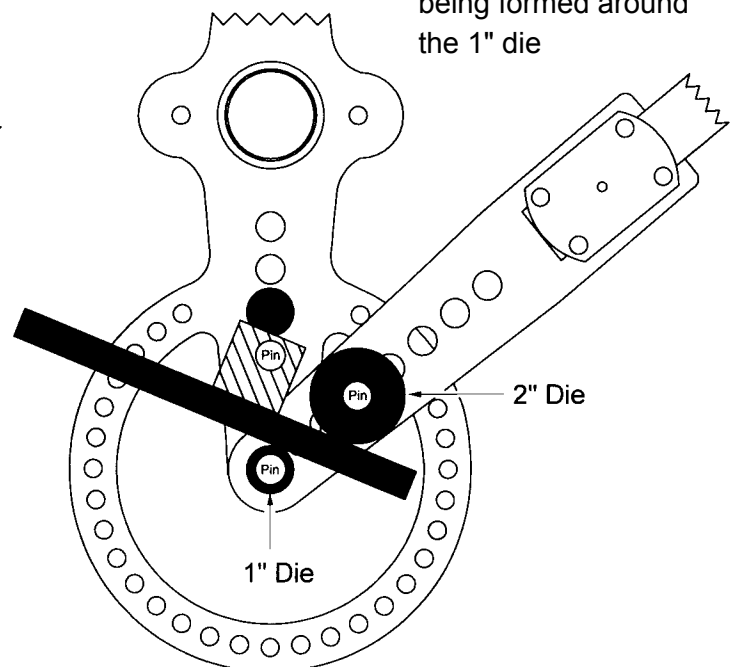
Position 3

1/4" flat, round or square being formed around the center pin

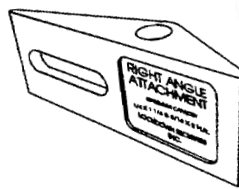


Position 4

5/8" round or square being formed around the 1" die



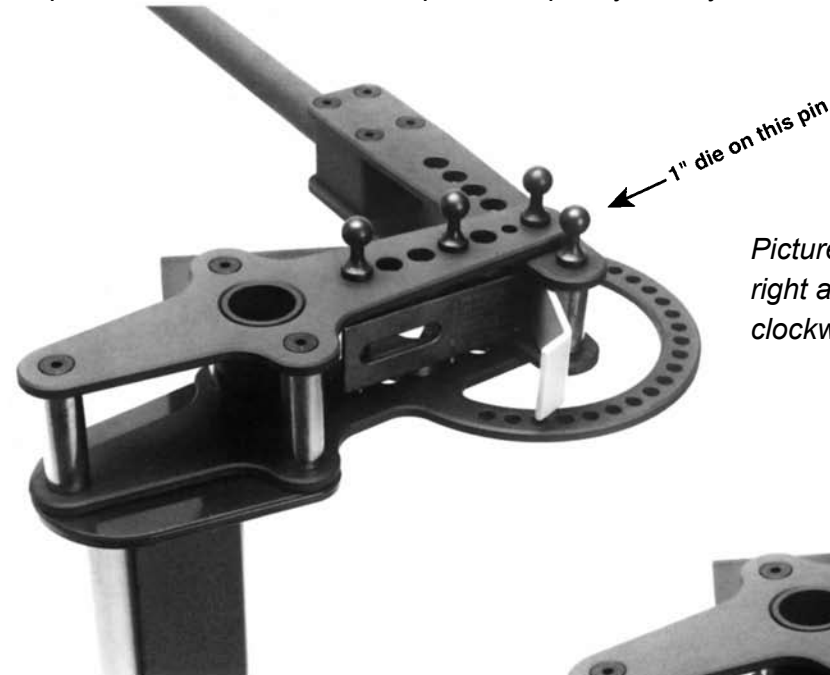
Using the Right Angle Bending Attachment



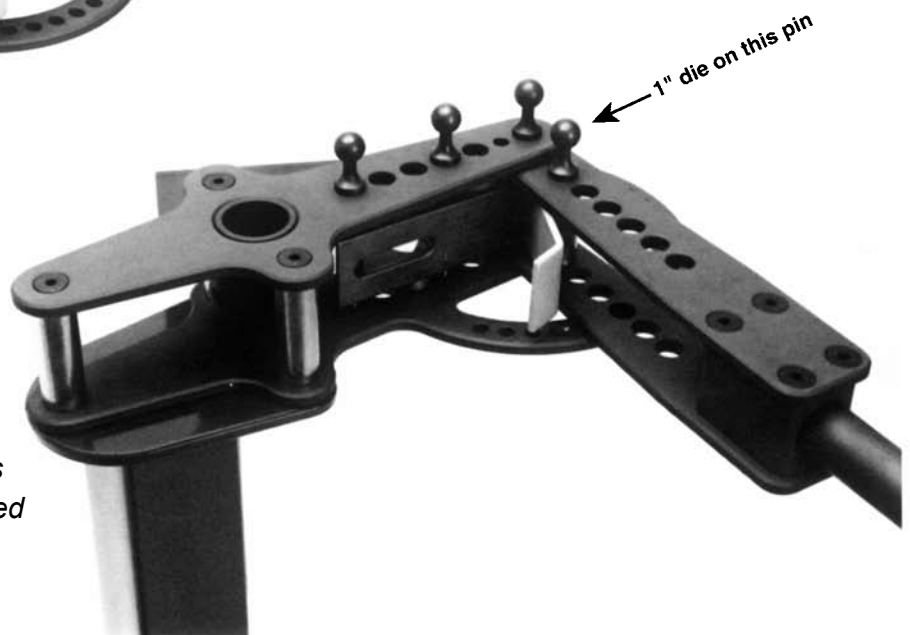
Before making sharp right-angled bends, draw thin, clear chalk lines across your flat stock at each point along which you want the bend formed. Once the flat stock has been positioned in the bender, only one half of the chalk line should be visible (see Online Video, <http://www.shopoutfitters.com/CompactBender2.html>), since the other half is covered by the bending edge of the right angle attachment.

If two right-angled bends are to be made along the same side of the flat stock, the chalk marks need to be placed approximately 1/8" farther apart than the desired inside dimension of the finished part. If extremely precise measurements are required, a test piece should be made before multiple parts are bent. Rather than using more expensive material such as 3/16" x 2" for testing bends, use a less expensive material, like 3/16" x 1/2".

Specific dimensions for bending letters are provided in this manual. If you are uncertain about how the dimensions will affect the outcome of any part, you should first make a test part from a less expensive material of the same thickness before bending more expensive material or multiple parts. Once dimensions and bending sequences are determined for a particular part, you may want to record them in a notebook for future reference.



Picture to left shows the normal position of the right angle attachment (handle is pulled in the clockwise direction)



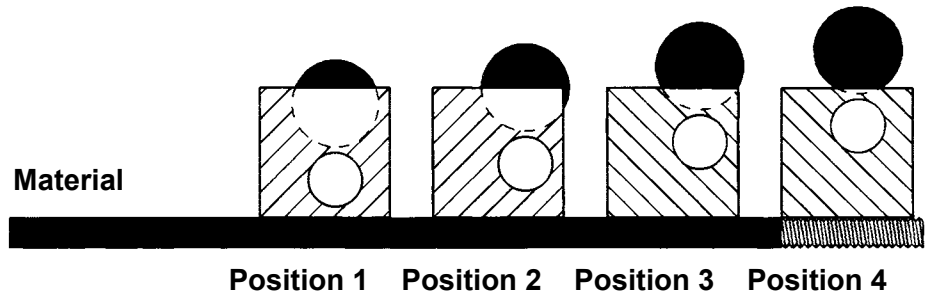
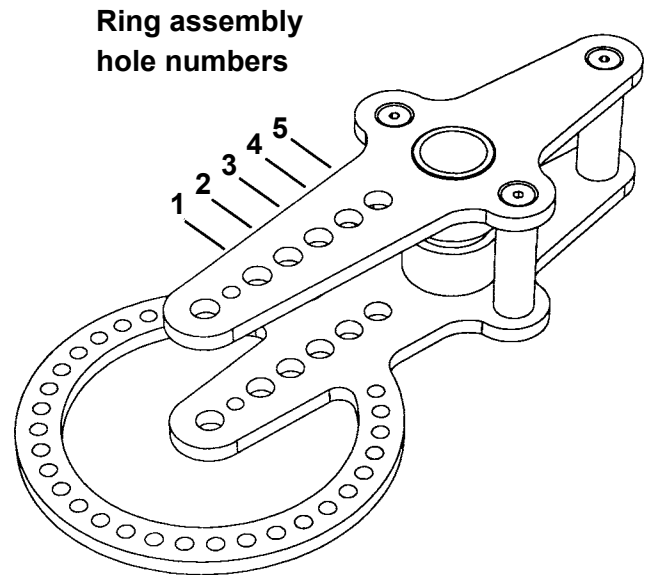
If the material is too long and hits the handle during the normal setup, use this setup shown to right. (handle is still pulled in the clockwise direction)

Defining Terms

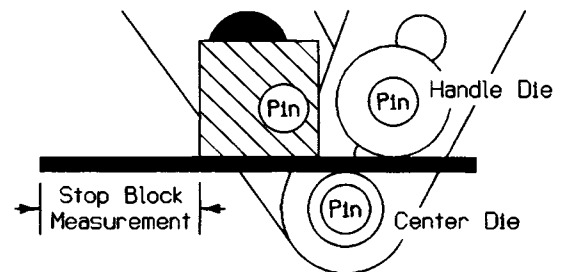
Blank Length - length to which stock must be cut when making U-bolts and letters

Ring Assembly Hole # - number of hole through which stop block pin will be inserted for securing stop block

Stop Block Position - position of stop block relative to side of material against which it applies force



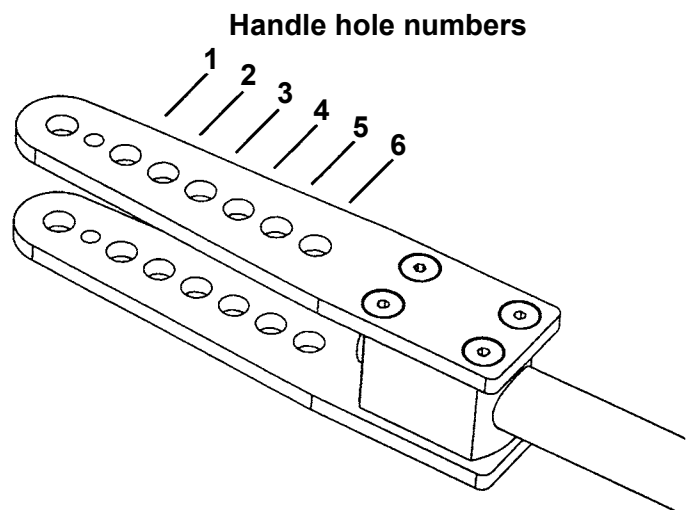
Stop Block Measurement - length of stock that protrudes past stop block before bends are made



Center Pin Die Size - diameter of die to be used on center pin

Handle Die Size - diameter of the die to be used in handle

Handle Hole Number - number of the hole through which the short hitch pin should be inserted for securing the handle die



Bending Handles

Round Stock

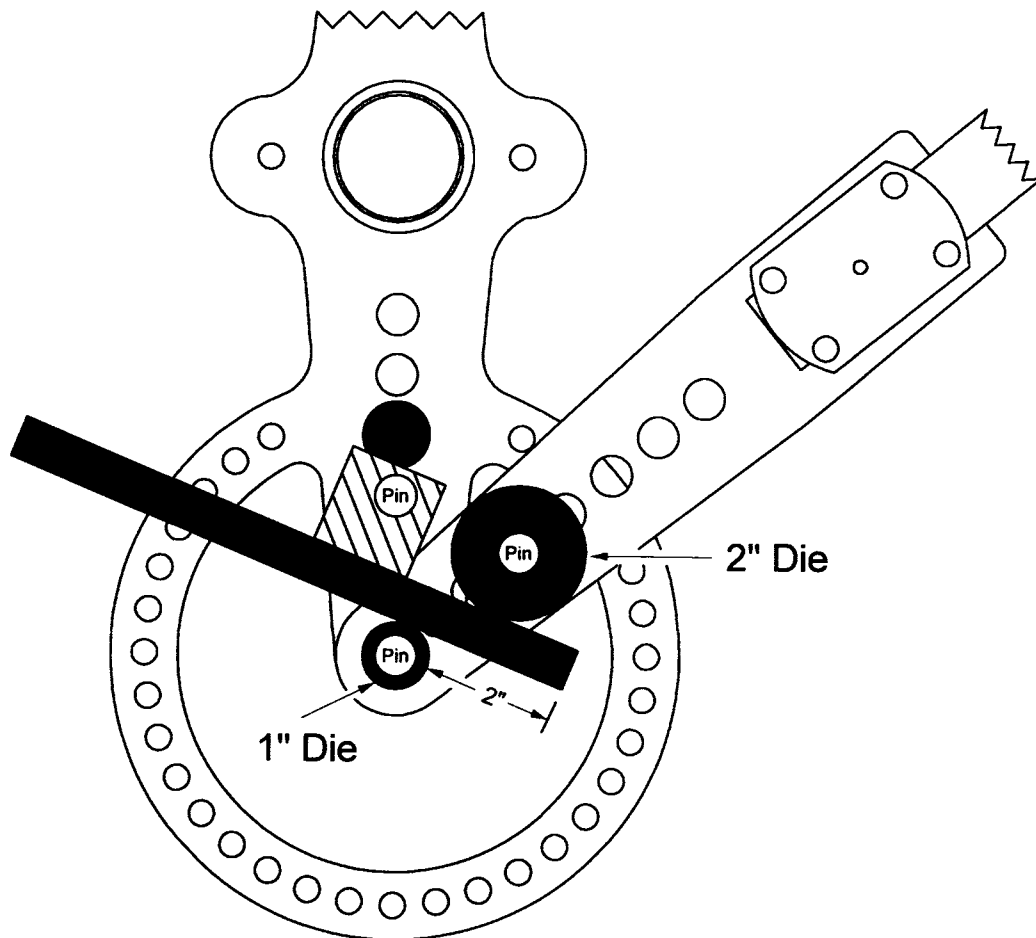
Handles of various sizes and designs are easily formed on the Compact Bender. Each of the three types of handles shown are made from a 9" length of 5/8" round stock.

After bending the round stock, drill 5/8" holes through the mounting plate and insert the handle partway, leaving the hole half empty. Weld into the hole from the back, and grind any protruding welds flush. When using different sizes of round stock, be sure that the holes in the mounting plates are of the same diameter as the round stock.



Material Needed

One 9" length of 5/8" round bar stock
Two pieces of flat bar stock (for mounting plates)



Flat Stock



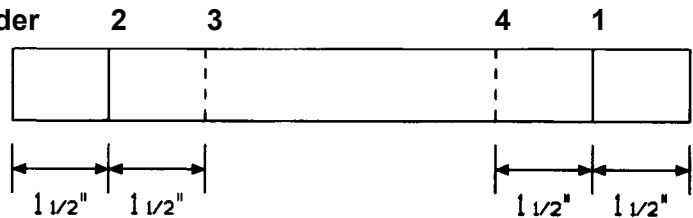
Position chalk marks as shown. The two outermost marks must be drawn on the side of the stock opposite the two inner marks.

Note: Other sizes of flat stock may be substituted for the listed dimensions, such as 1/4" x 1" or 3/16" x 1". Many other types of handles can be made after a little experimentation.

Material Needed

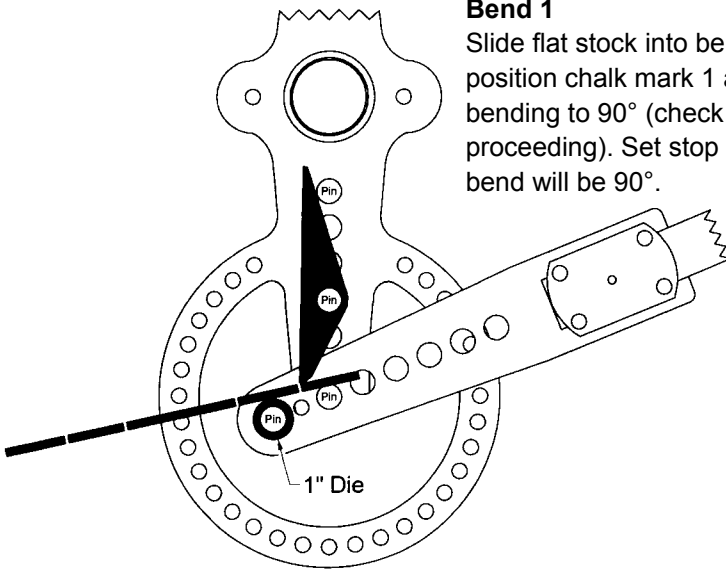
One 11" length of 3/16" x 1" hot rolled flat stock

Bend Order



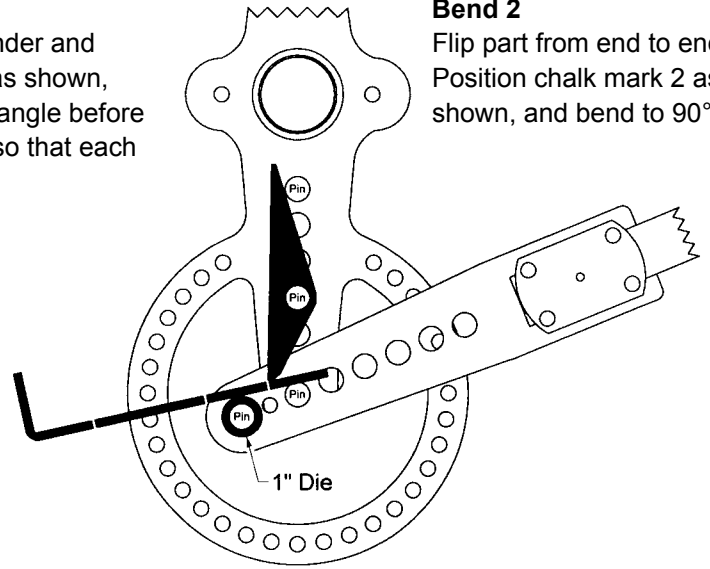
Bend 1

Slide flat stock into bender and position chalk mark 1 as shown, bending to 90° (check angle before proceeding). Set stop so that each bend will be 90°.



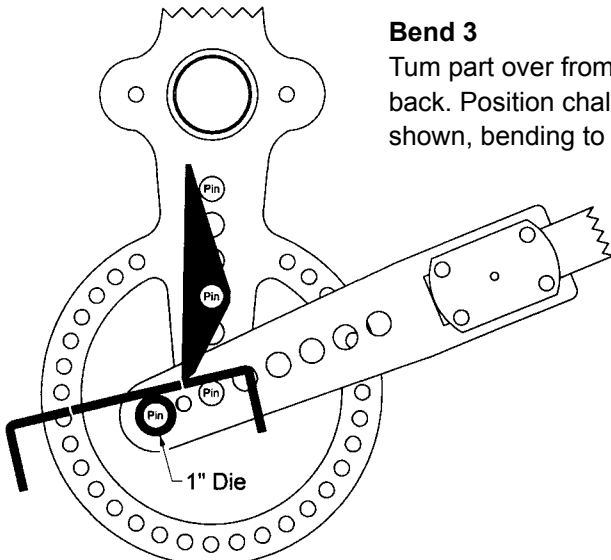
Bend 2

Flip part from end to end. Position chalk mark 2 as shown, and bend to 90°.



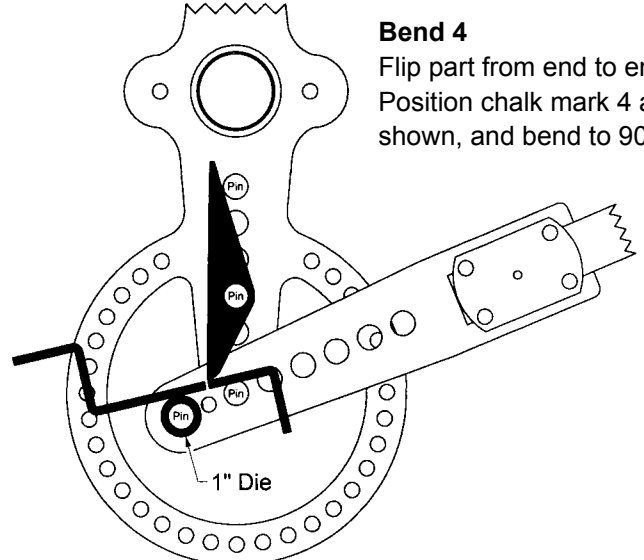
Bend 3

Turn part over from front to back. Position chalk mark 3 as shown, bending to 90°.

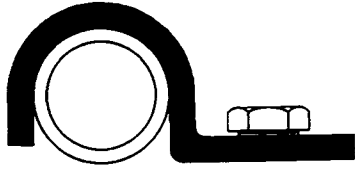


Bend 4

Flip part from end to end. Position chalk mark 4 as shown, and bend to 90°.



Making Pipe Clamps

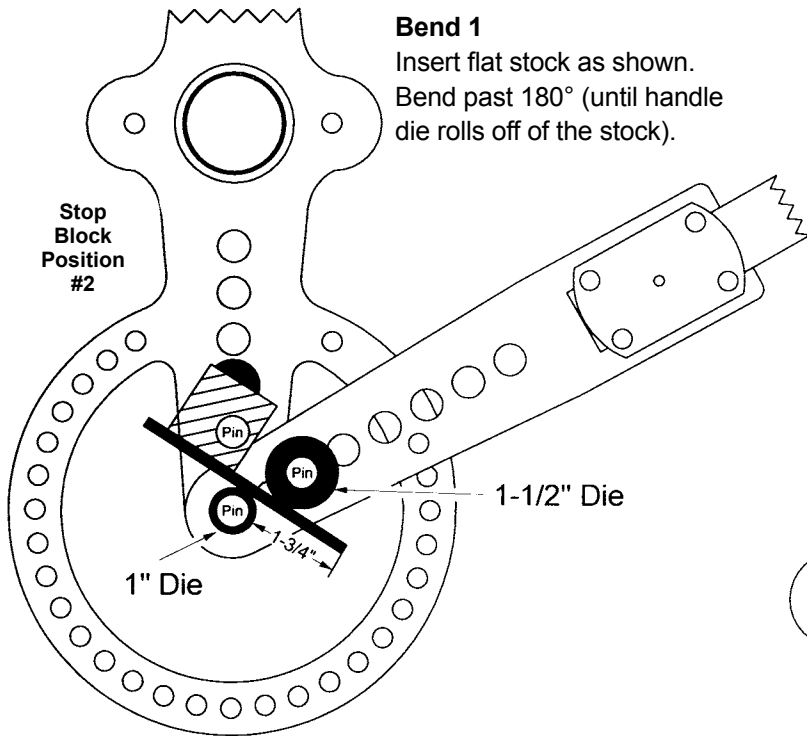


1" I.D. single tube clamp (material to be clamped is 1" O.D.)

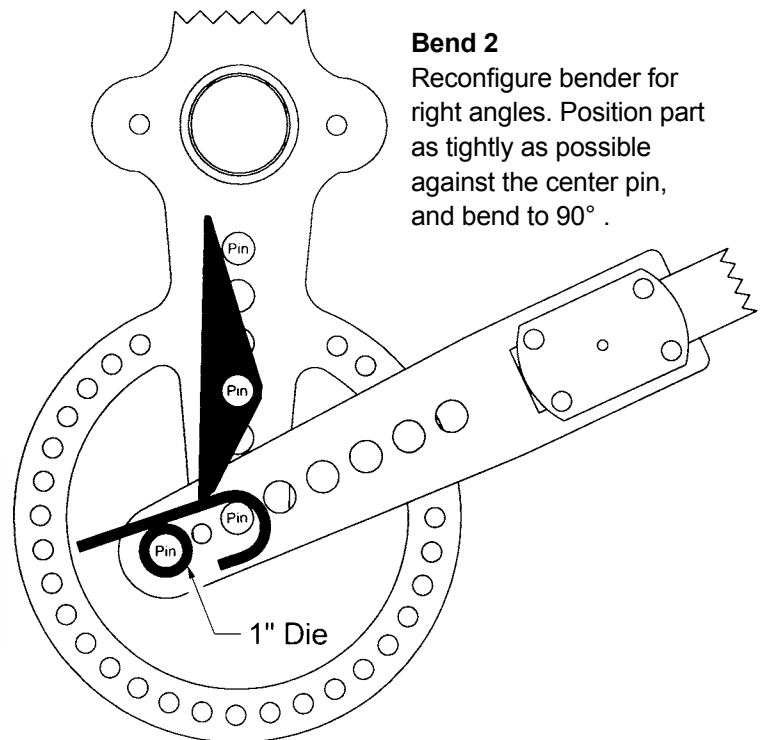


Material Needed

One 3/16" x 1" piece of hot-rolled flat stock, 4 1/2" in blank length



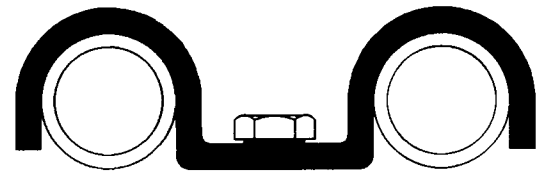
Clamp a pair of locking pliers onto the stock and against the stop block to prevent stock from slipping.



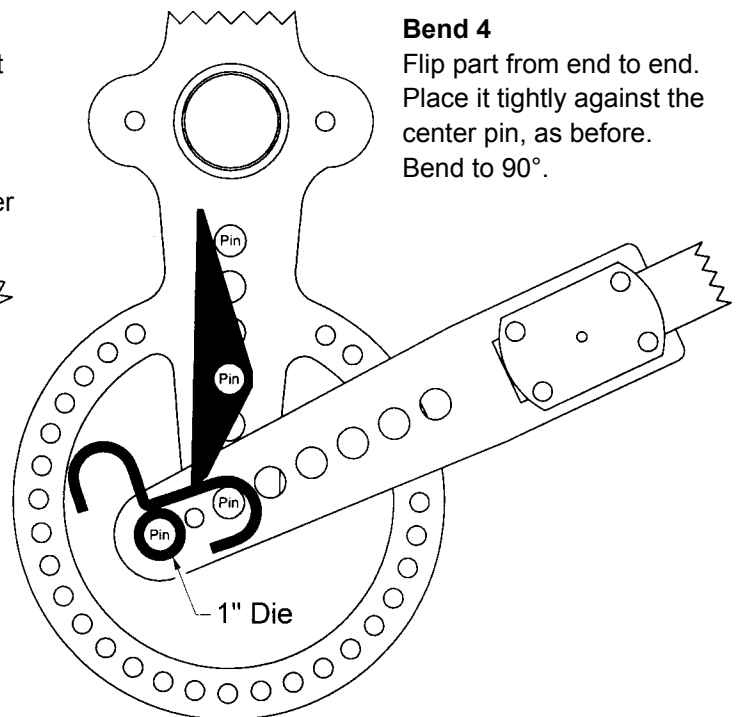
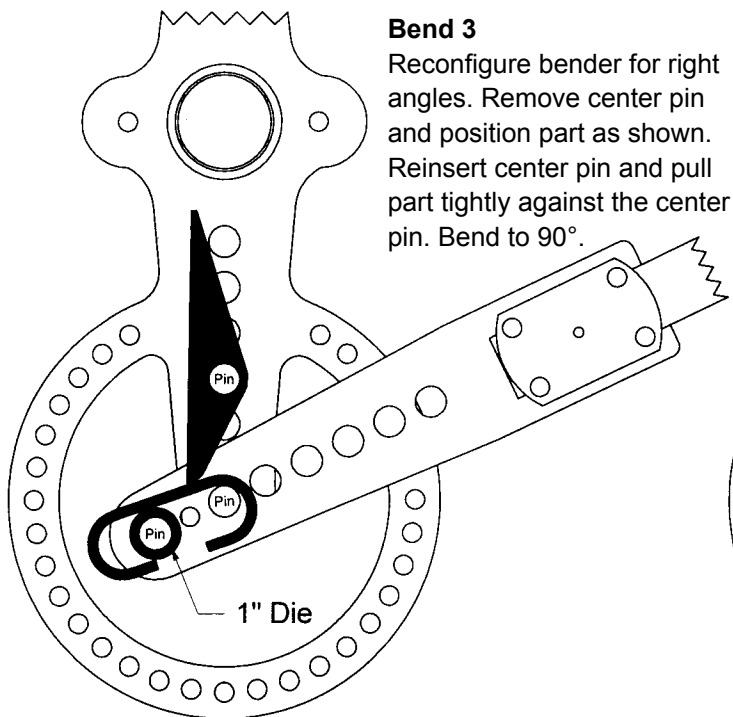
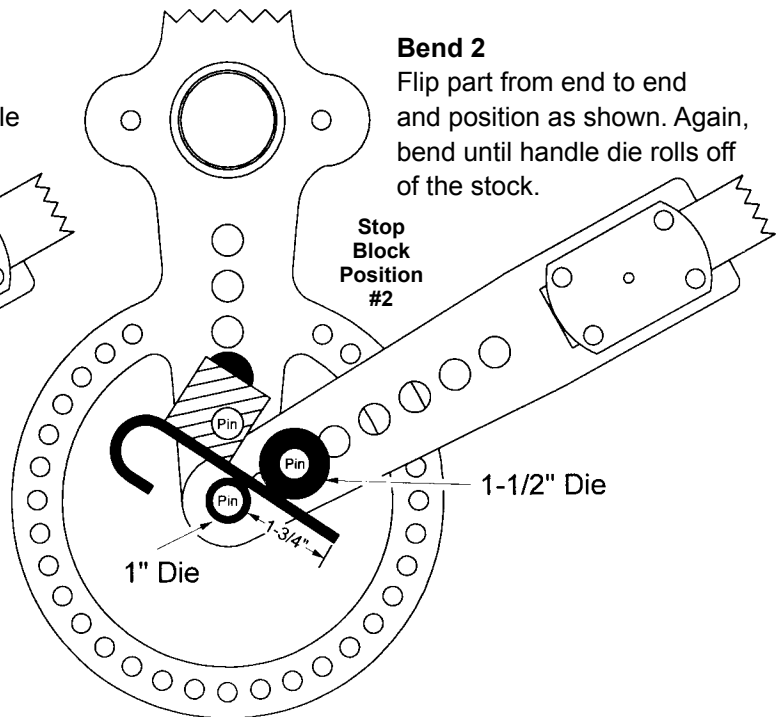
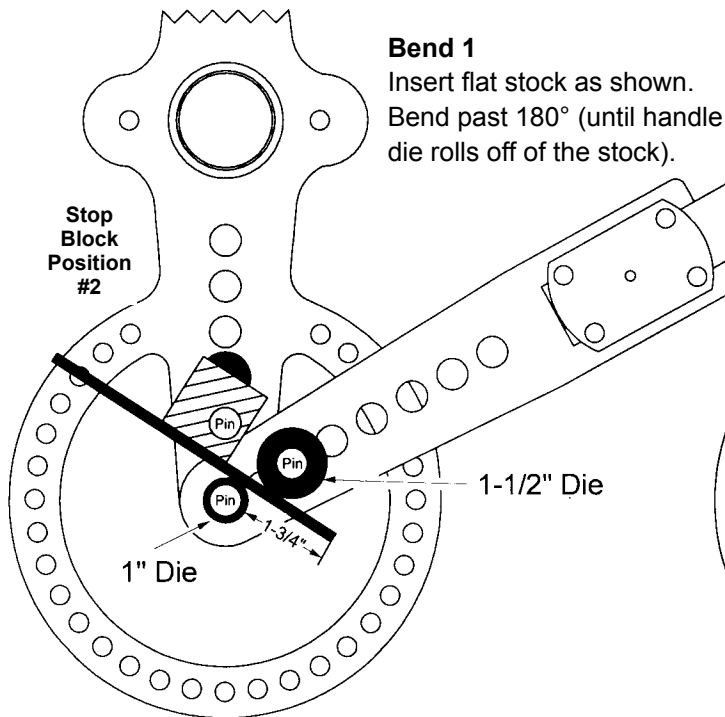
Many other sizes of clamps can be made other than the examples shown. When experimenting with various sizes of clamps, keep records of dimensions.

Material Needed

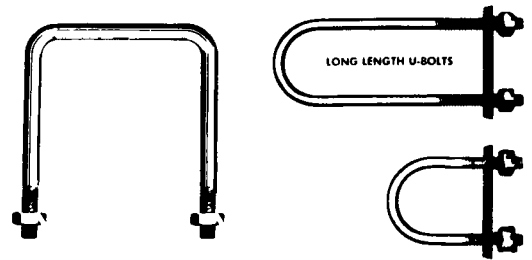
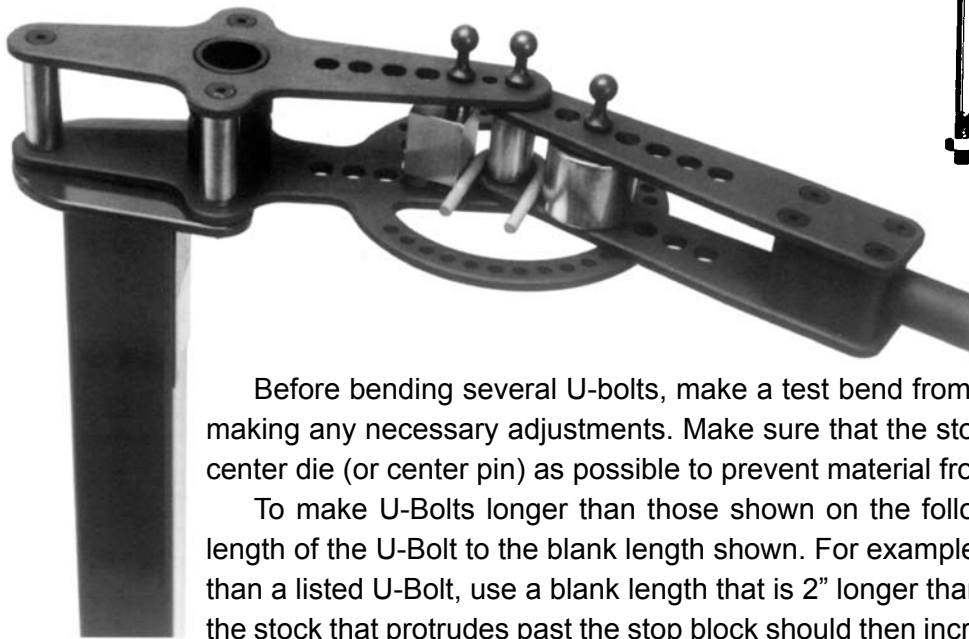
One 3/16" x 1" piece of hot-rolled flat stock, 6 1/2" in blank length



1" I.D. double tube clamp (material to be clamped is 1" O.D.)

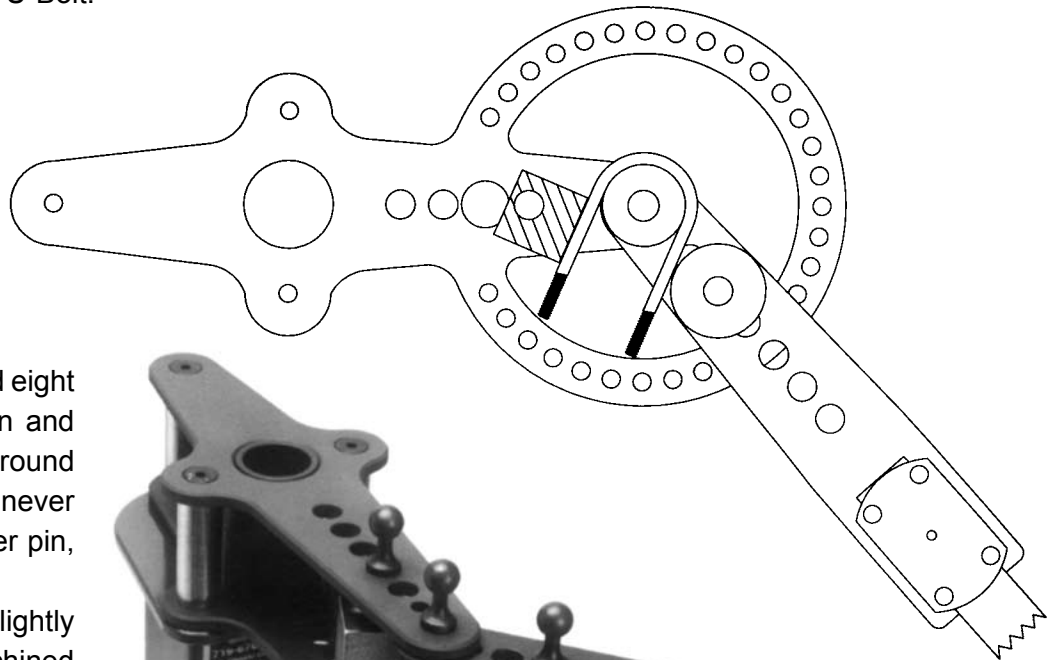


Bending U-Bolts and Anchor Bolts



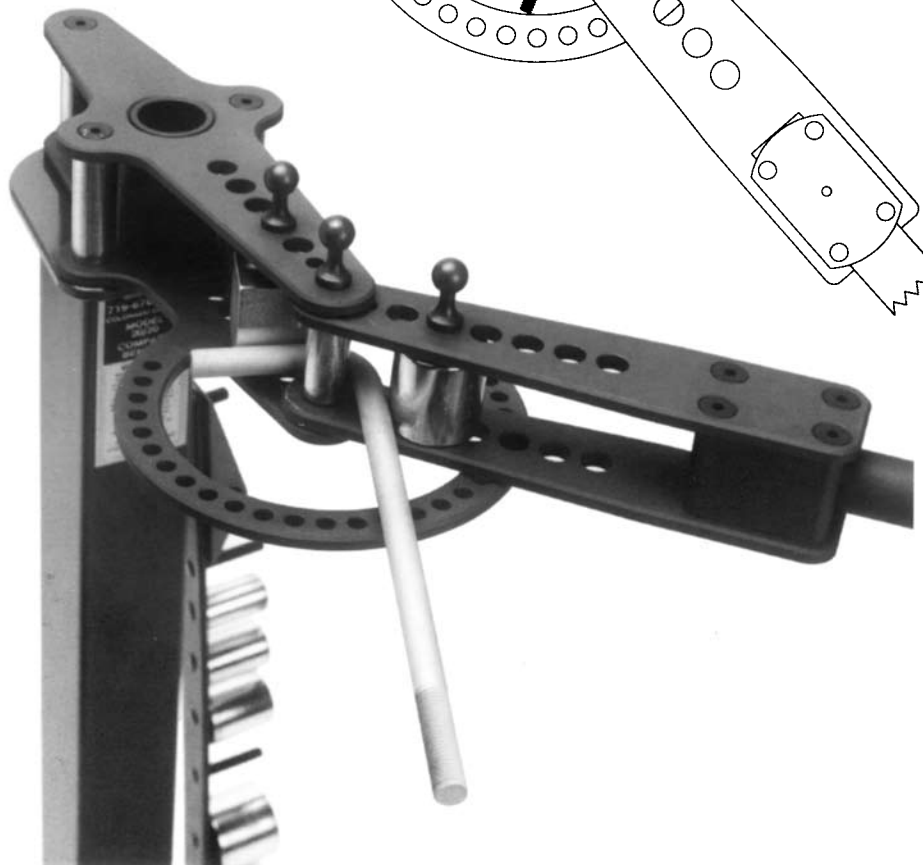
Before bending several U-bolts, make a test bend from unthreaded stock. Verify dimensions, making any necessary adjustments. Make sure that the stop block is positioned as closely to the center die (or center pin) as possible to prevent material from slipping.

To make U-Bolts longer than those shown on the following pages, add twice the additional length of the U-Bolt to the blank length shown. For example, if you need a U-Bolt that is 1" longer than a listed U-Bolt, use a blank length that is 2" longer than the listed blank length. The length of the stock that protrudes past the stop block should then increase by 1", since the other 1" is added to the other leg of the U-Bolt.



The bender is equipped to bend eight different radii, using the center pin and the seven dies. When bending round stock greater than 3/8" in diameter, never bend the material across the center pin, since it may break.

Because the material springs slightly after it is bent, each die is machined to approximately 1/16" undersize. The spring of the steel varies slightly among steel from different mills; a test-piece should usually be bent even when following the instructions of this manual. If notes are kept on die positions and measurements, they can be referenced for repeated jobs.



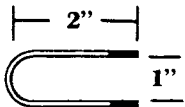
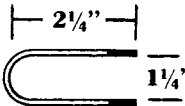
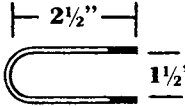
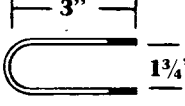
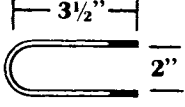
BENDING U-BOLTS

1/4" Round Stock



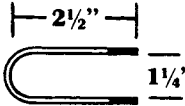
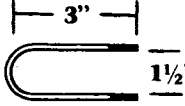
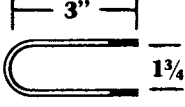
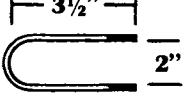
Dimension Tables

Finished Length - measurement from inside center of U-Bolt to the end of the two legs.

Finished Length & Inside Diameter	Blank Length	Ring Assembly Hole #	Stop Block Position	Stop Block Measurement	Center Pin Die Size	Handle Die Size	Handle Hole #
	5"	1	#2	Flush	1"	2"	2
	5 3/4"	1	#2	1/4"	1 1/4"	2"	2
	6 3/8"	1	#1	3/8"	1 1/2"	2"	2
	7 1/2"	2	#4	1/4"	1 3/4"	2"	2
	8 5/8"	2	#4	7/8"	2"	1 3/4"	2

BENDING U-BOLTS

5/16" Round Stock

	6 1/4"	1	#1	5/16"	1 1/4"	2"	2
	7 3/8"	2	#4	1/4"	1 1/2"	2"	2
	7 5/8"	2	#4	3/8"	1 3/4"	2"	2
	8 3/4"	2	#4	15/16"	2"	2"	2

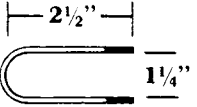
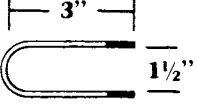
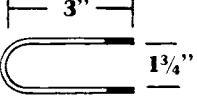
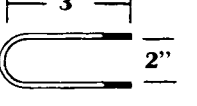
BENDING U-BOLTS

3/8" Round Stock



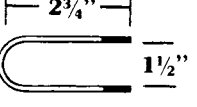
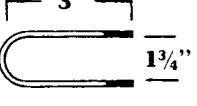
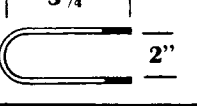
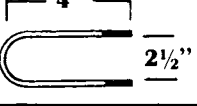
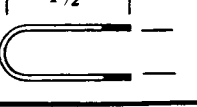
Dimension Tables

Finished Length - measurement from inside center of U-Bolt to the end of the two legs.

Finished Length & Inside Diameter	Blank Length	Ring Assembly Hole #	Stop Block Position	Stop Block Measurement	Center Pin Die Size	Handle Die Size	Handle Hole #
	6 1/2"	1	#1	5/8"	1 1/4"	2"	2
	7 1/2"	2	#4	7/16"	1 1/2"	3"	3
	7 3/4"	2	#4	9/16"	1 3/4"	3"	3
	8"	2	#3	1/4"	2"	3"	3

BENDING U-BOLTS

1/2" Round Stock

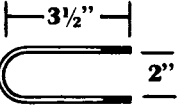
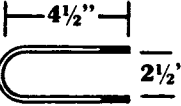
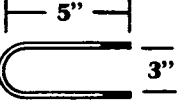
	7 1/4"	2	#4	7/16"	1 1/2"	3"	3
	8"	2	#4	15/16"	1 3/4"	3"	3
	8 3/4"	2	#3	3/4"	2"	2 1/2"	3
	10 1/8"	2	#2	1"	2 1/2"	2"	3
	11 5/8"	3	#4	1"	3"	2"	3

BENDING U-BOLTS

5/8" Round stock

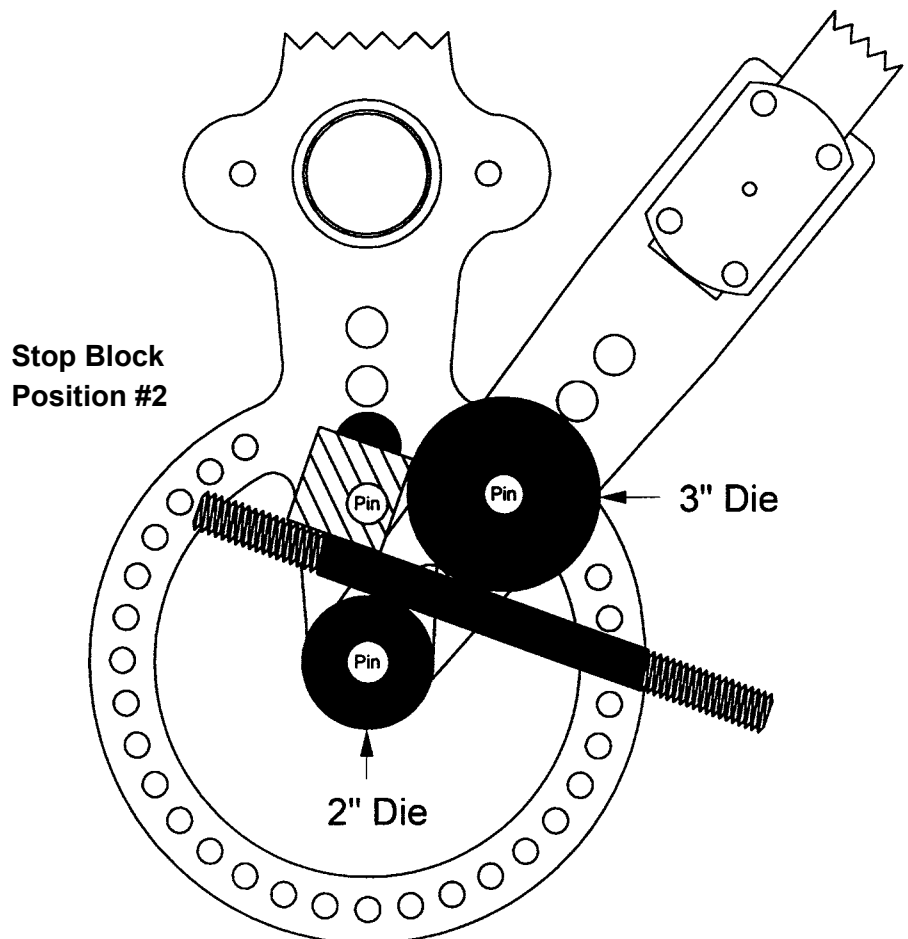
Dimension Tables

Finished Length - measurement from inside center of U-Bolt to the end of the two legs.

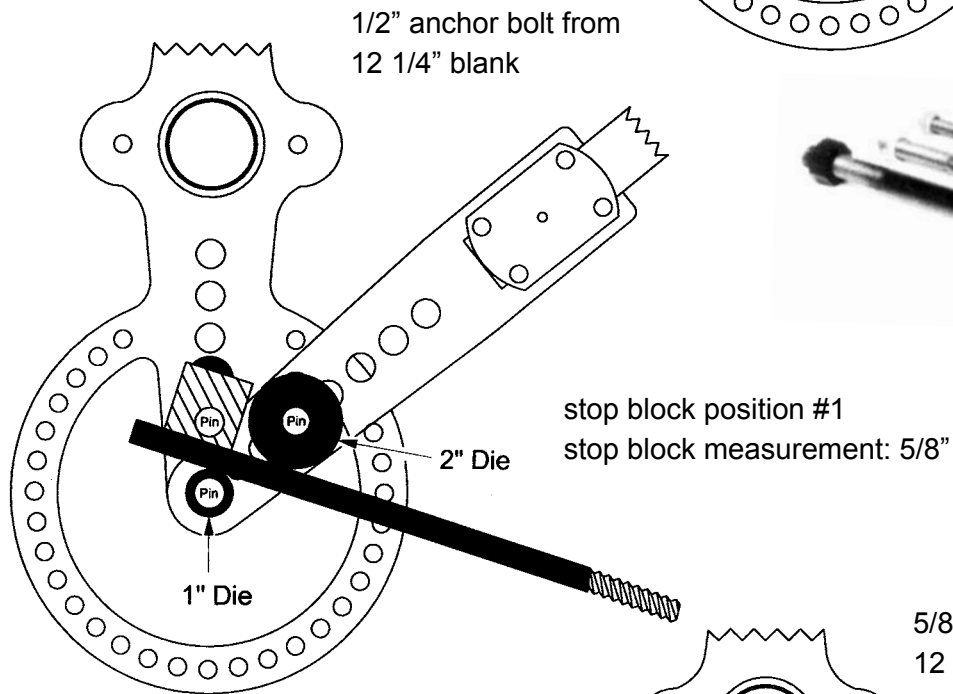
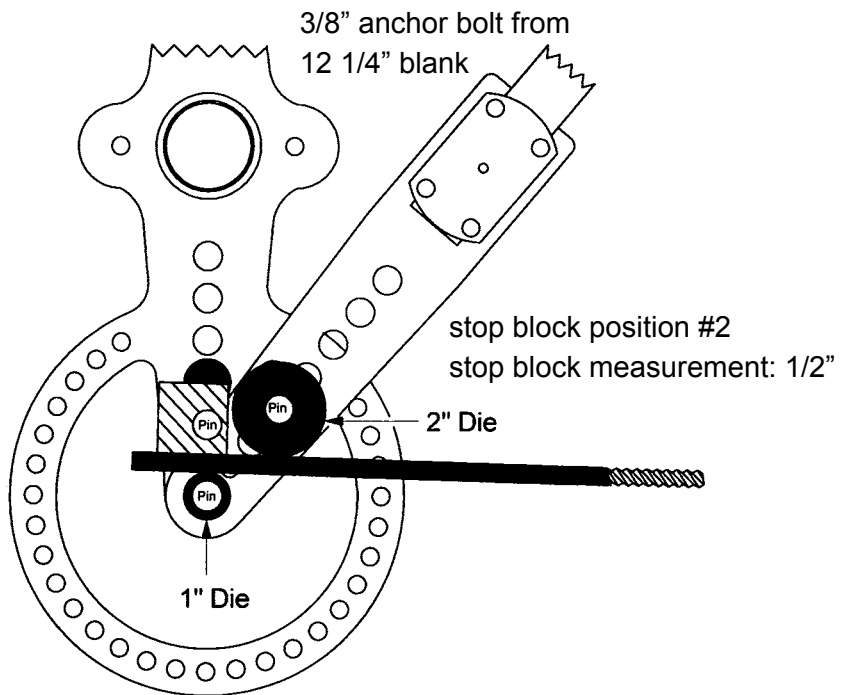
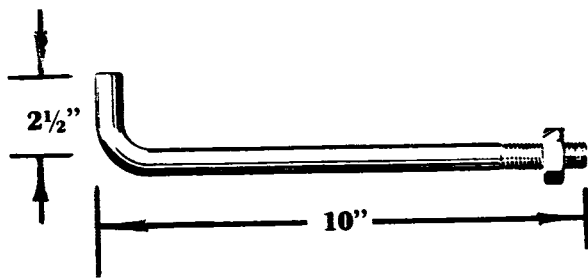
Finished Length & Inside Diameter	Blank Length	Ring Assembly Hole #	Stop Block Position	Stop Block Measurement	Center Pin Die Size	Handle Die Size	Handle Hole #
	9 1/4"	2	#2	1"	2"	3"	3
	11 1/2"	2	#1	1 5/8"	2 1/2"	2"	3
	12 3/4"	3	#4	1 7/8"	3"	2"	3



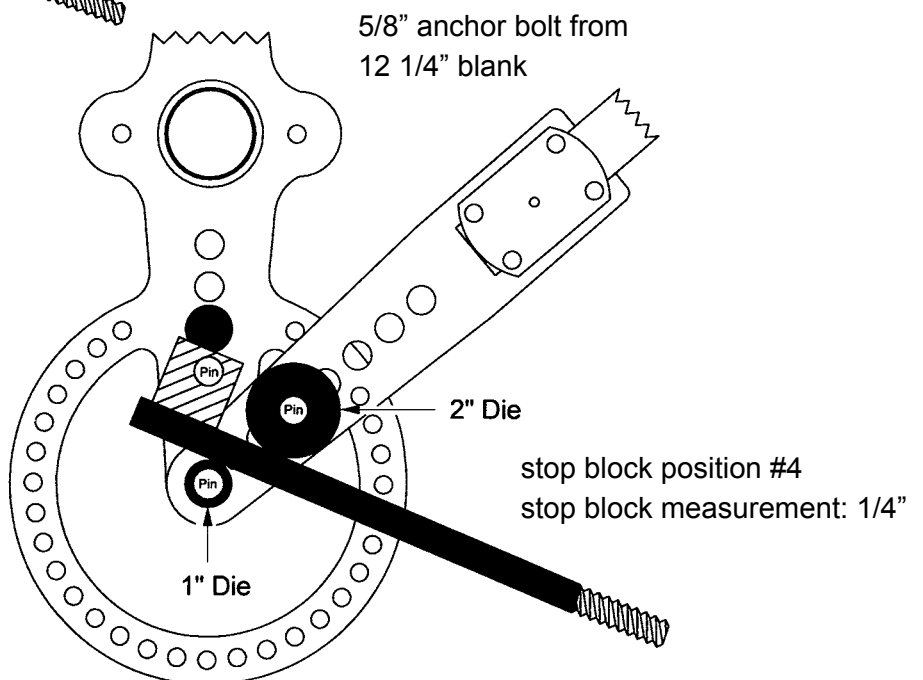
The correct setup for bending a 5/8" U-bolt with an inside diameter of 2" and a length of 3 1/2" is shown at right.



Bending Anchor Bolts



The dimensions shown are for making $10"$ long anchor bolts. To make anchor bolts of other lengths, simply change the blank length. The length of the legs can also be changed by adding to or subtracting from the stop block measurements. Verify that adequate material catches the stop block if the legs are decreased in length.



Making Letter of the Alphabet



Ornamental signs require elegant letters of uniform sizes and shapes. Making letters may seem tricky, but with a little practice you will master the technique. You can then incorporate letters for your own creative design.

This manual covers all of the alphabet's 26 letters. The instructions are for making 6" high letters from 3/16" x 2" hot-rolled mild steel or even narrower material, such as 3/16" x 1". Often, you will find that the wider 2" letters give your sign a lavish look. However, the project itself will have to determine the letter width.

Following these procedures for making letters can save you many hours of work. You must follow each step exactly, making bends in proper sequence. Continually compare the illustrations for each letter to the part you are forming. Since the "S" is the most difficult letter to make, you must follow the listed procedures precisely. Once you master the "S", you will find that the other letters are relatively simple to make. If you have never made letters before, practice making some from 1/2" x 3/16" before bending the wider material that may be needed for your sign.

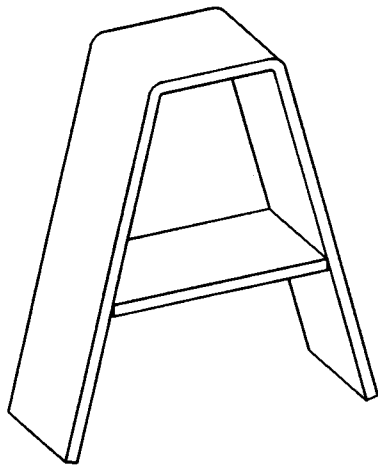
Never attempt to bend any brittle material that may snap during a bend and injure the operator. Use only hot-rolled mild steel in this machine. When constructing a sign, make all of the repeated letters at the same time. For example, if the sign requires four "E"s, make all four "E"s before starting another letter.



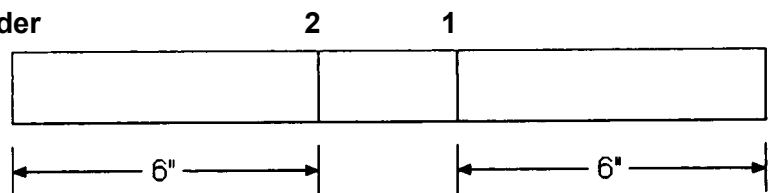
Material Needed

One 3/16" x 2" (maximum width) bar of flat stock, 14" in blank length
 One 3 1/2" piece of flat stock (of same material)

Draw chalk marks on one side of the 14" piece as shown.

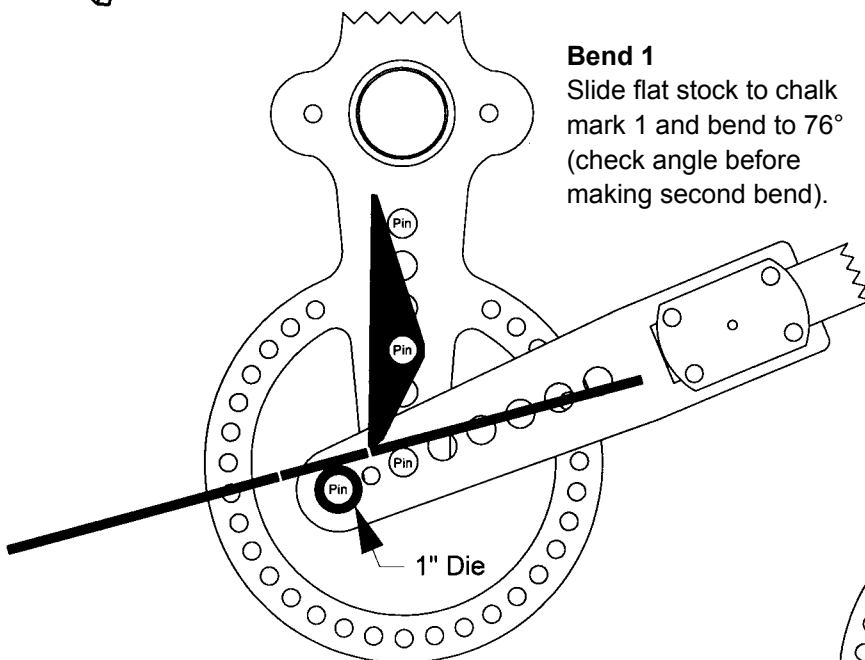


Bend Order



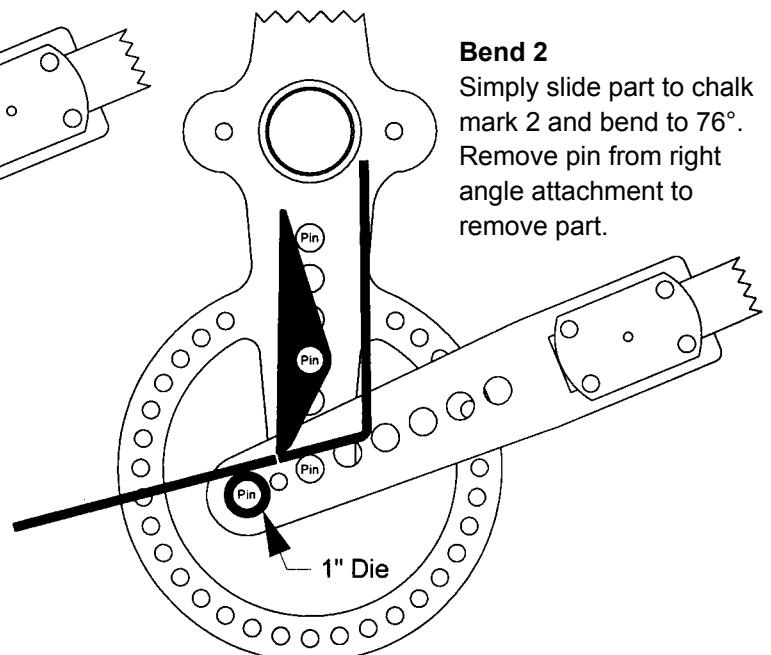
Bend 1

Slide flat stock to chalk mark 1 and bend to 76° (check angle before making second bend).

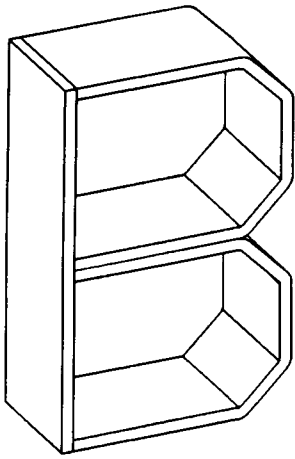


Bend 2

Simply slide part to chalk mark 2 and bend to 76°. Remove pin from right angle attachment to remove part.



Check angles and tack weld pieces together as shown.

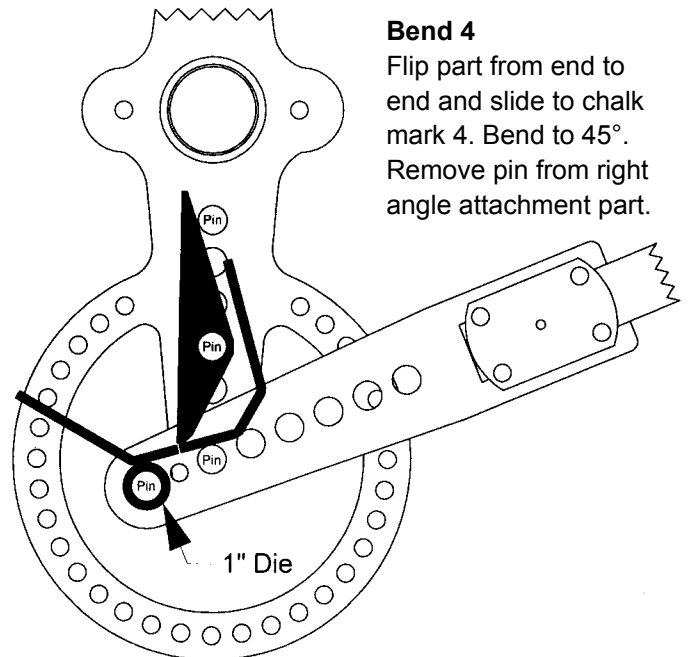
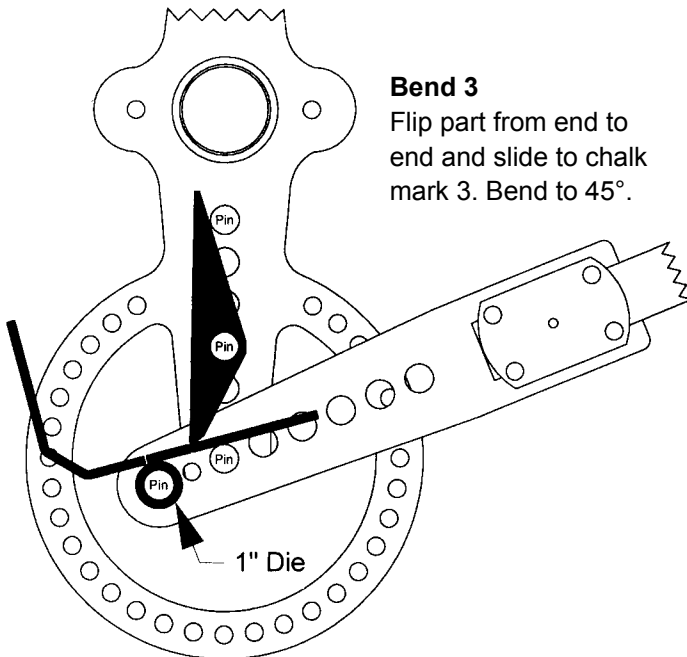
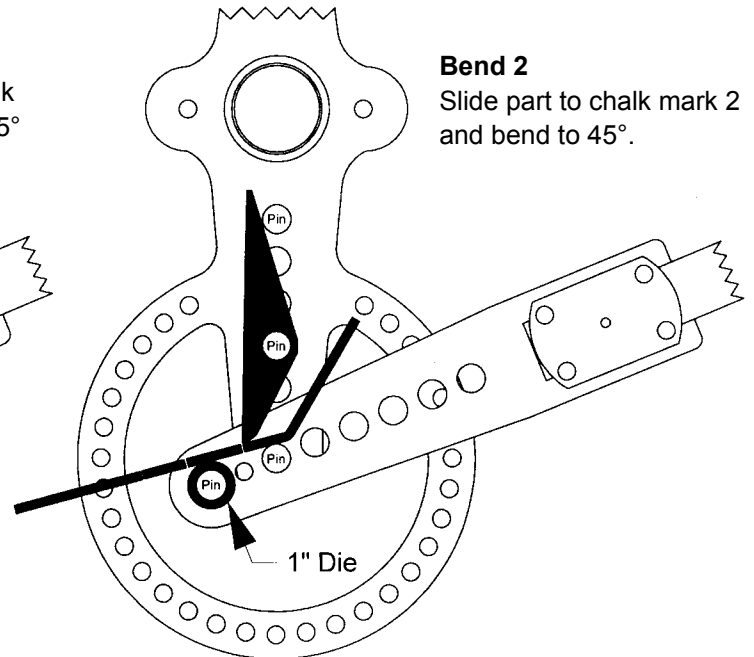
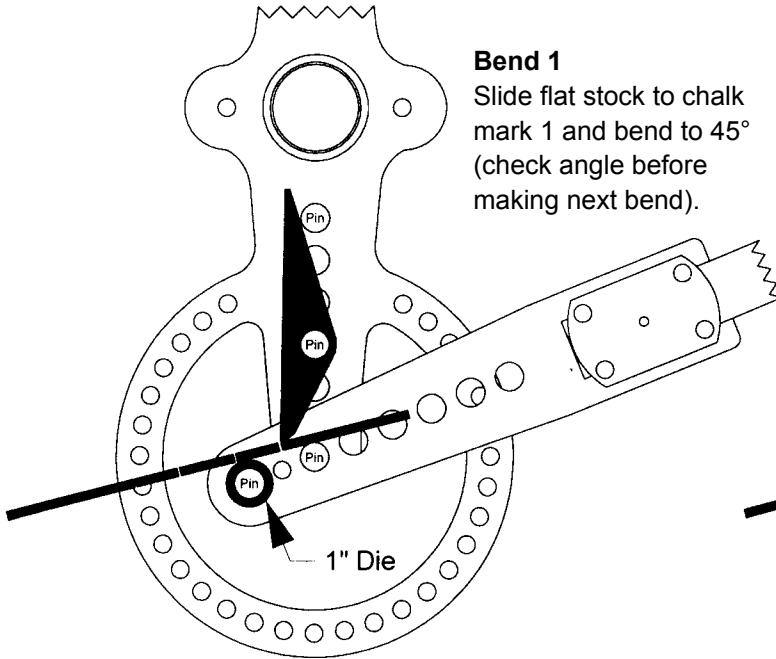
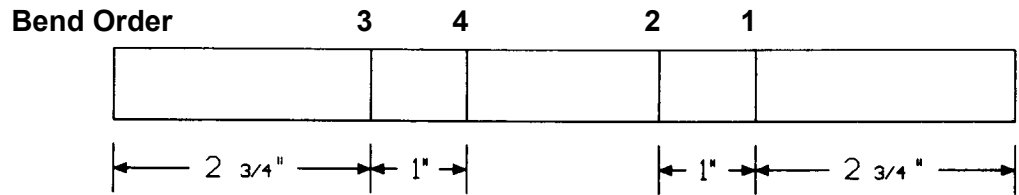


Material Needed

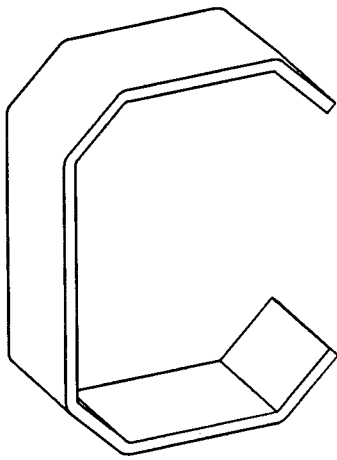
Two 3/16" x 2" (maximum width) pieces of flat stock, 8 7/8" in blank length

One 6" piece of flat stock (of same material)

Draw chalk marks on one side of both 8 7/8" pieces as shown.



After both 8 7/8" pieces have been bent, tack weld both to the 6" piece as shown.

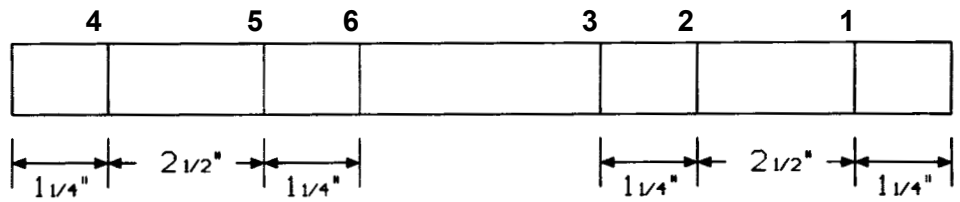


Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 14" in blank length

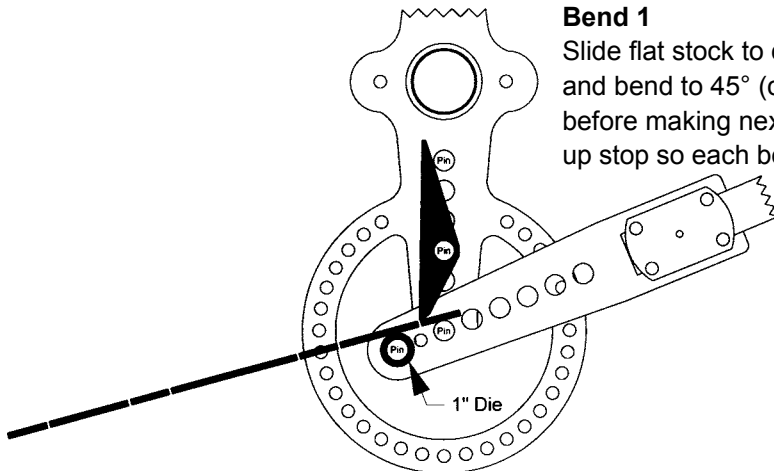
Draw chalk marks on one side of the 14" piece as shown.

Bend Order



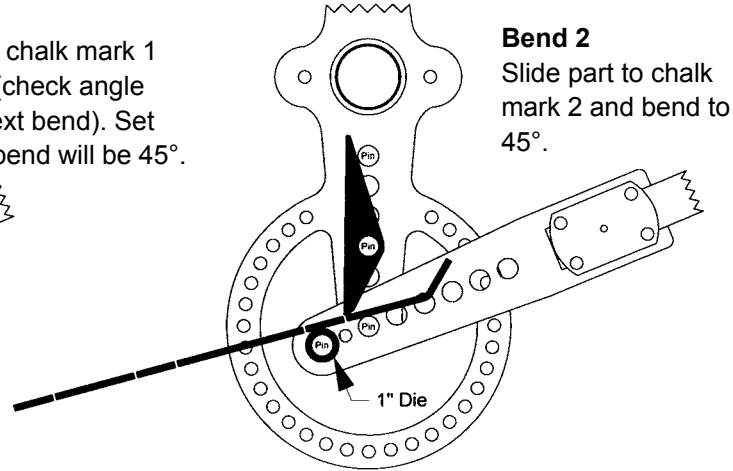
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle before making next bend). Set up stop so each bend will be 45°.



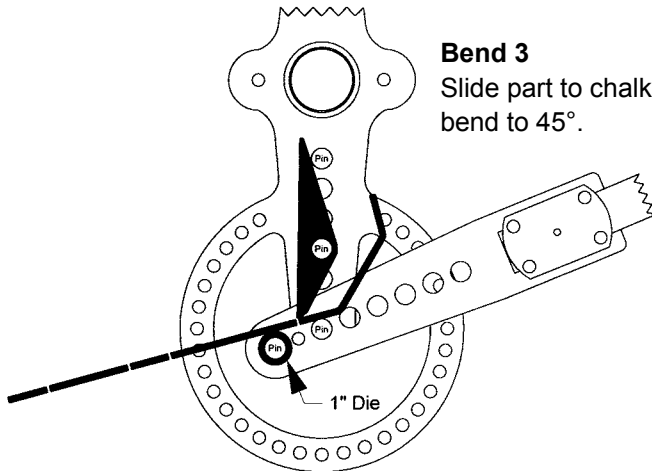
Bend 2

Slide part to chalk mark 2 and bend to 45°.



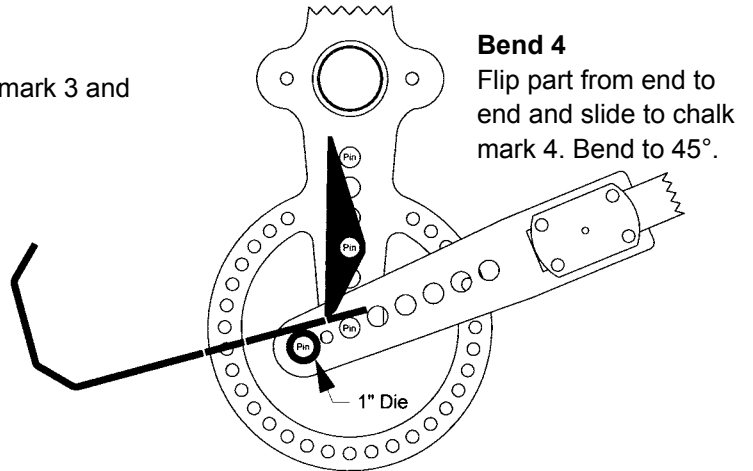
Bend 3

Slide part to chalk mark 3 and bend to 45°.



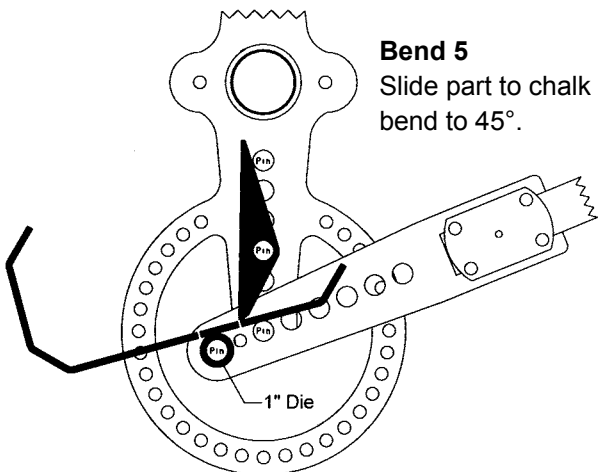
Bend 4

Flip part from end to end and slide to chalk mark 4. Bend to 45°.



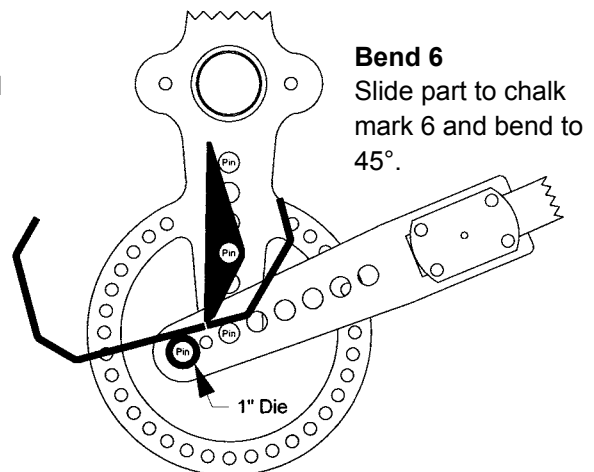
Bend 5

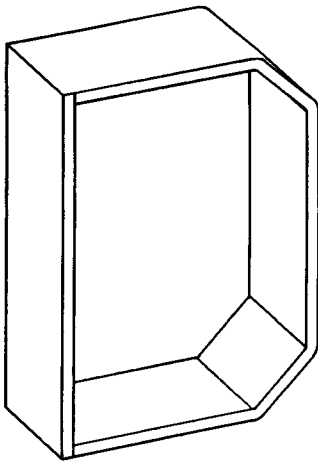
Slide part to chalk mark 5 and bend to 45°.



Bend 6

Slide part to chalk mark 6 and bend to 45°.



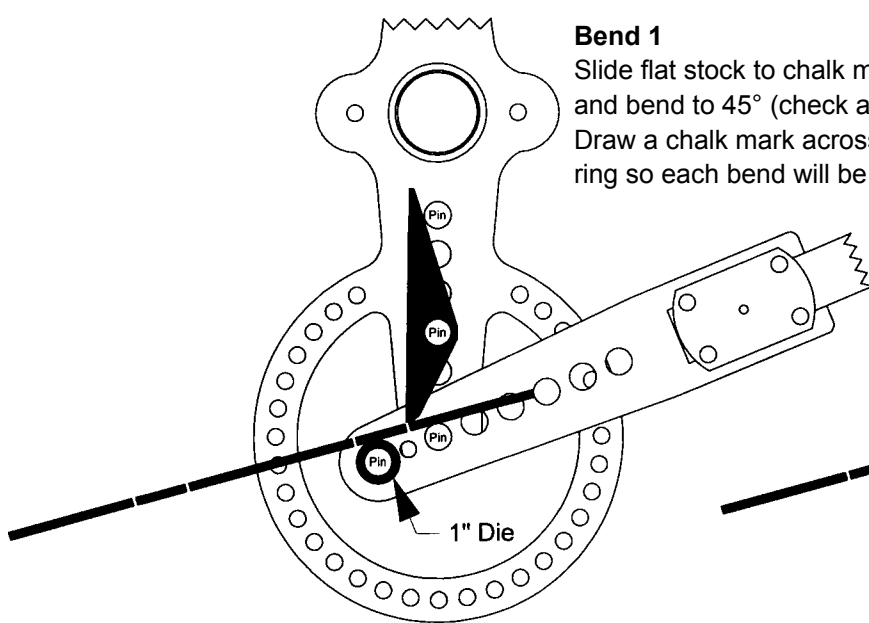
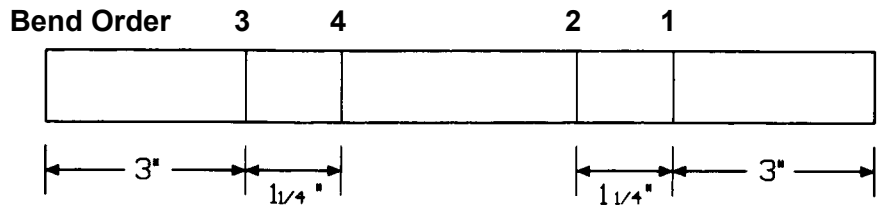


Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 12 1/2" in blank length

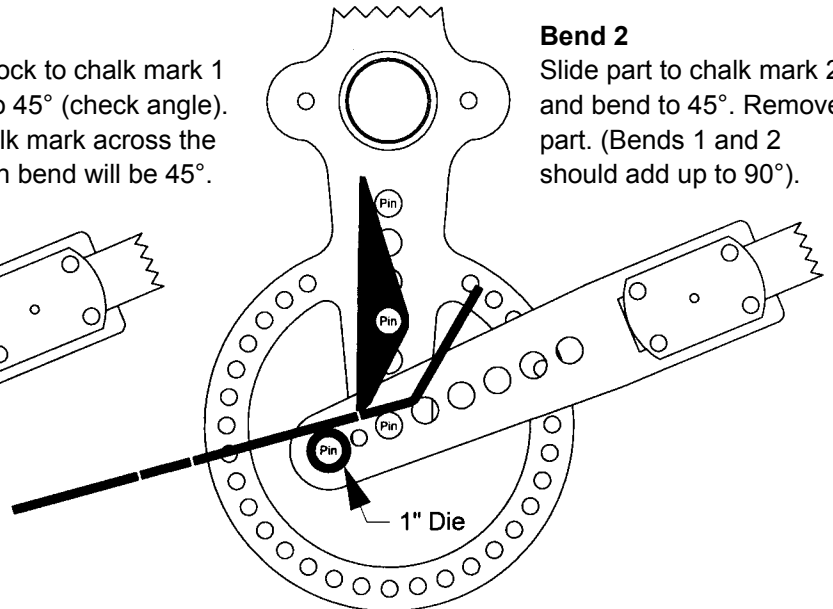
One 6" piece of flat stock (same material)

Draw chalk marks on one side of the 12 1/2" piece as shown.



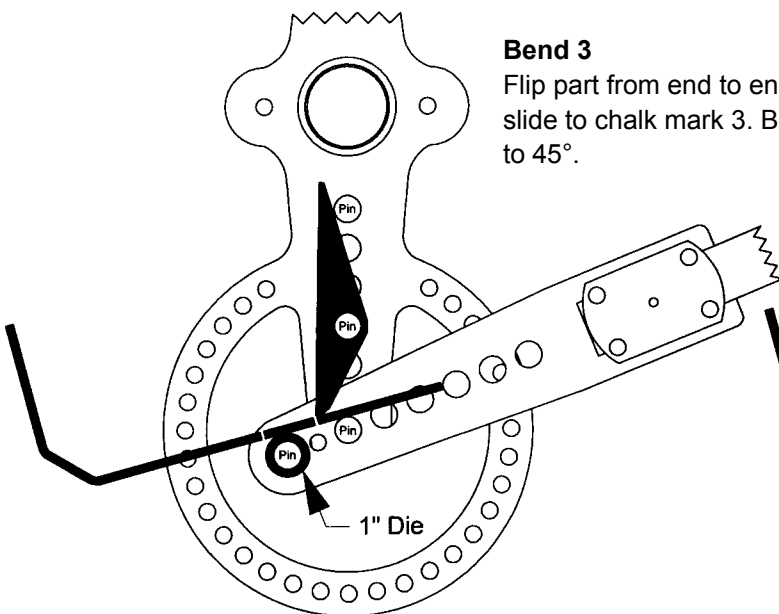
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle). Draw a chalk mark across the ring so each bend will be 45°.



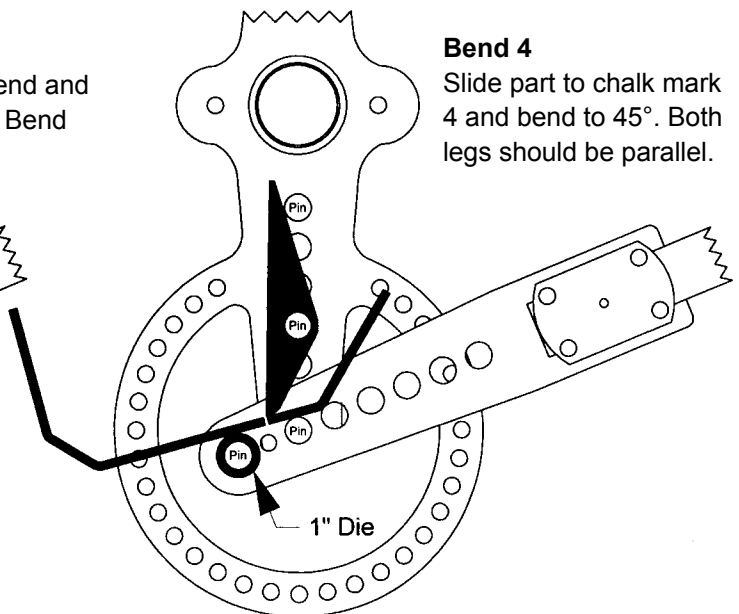
Bend 2

Slide part to chalk mark 2 and bend to 45°. Remove part. (Bends 1 and 2 should add up to 90°).



Bend 3

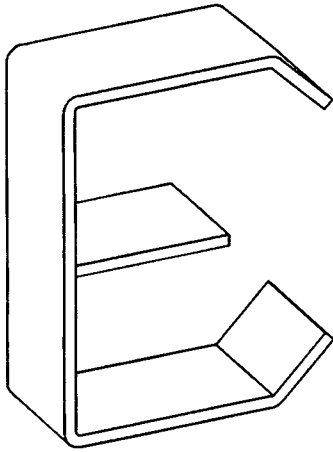
Flip part from end to end and slide to chalk mark 3. Bend to 45°.



Bend 4

Slide part to chalk mark 4 and bend to 45°. Both legs should be parallel.

Tack weld 6" insert to the top and bottom of the bent piece.

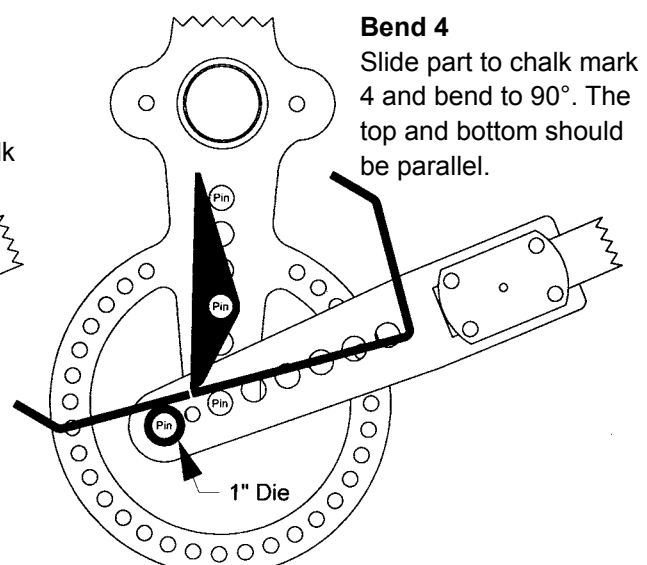
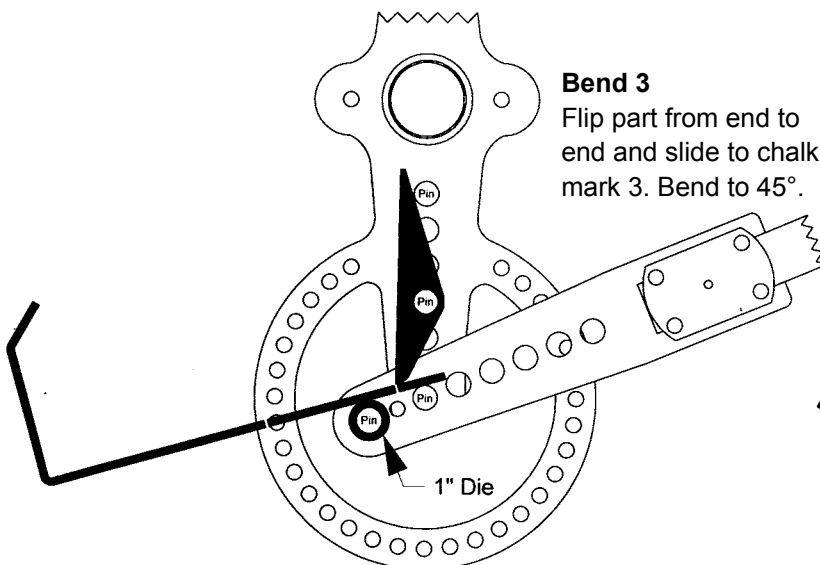
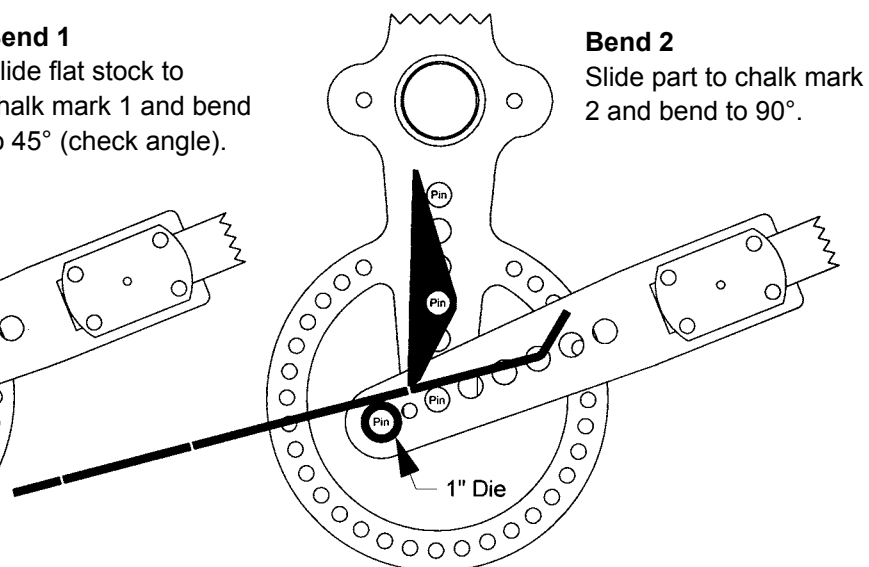
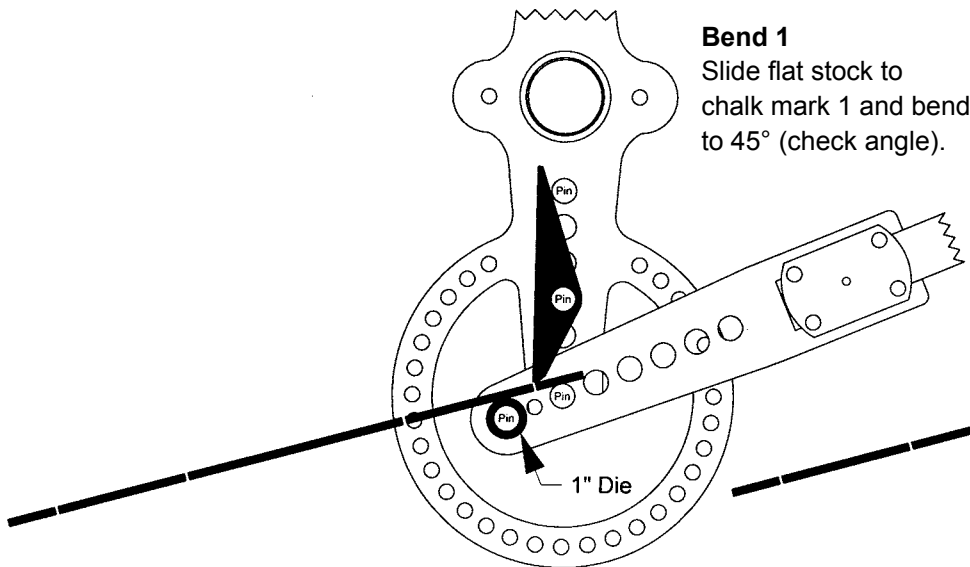
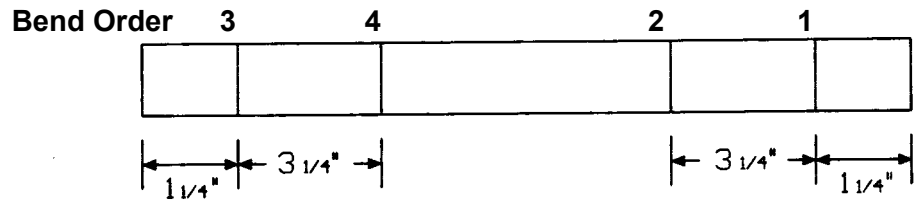


Material Needed

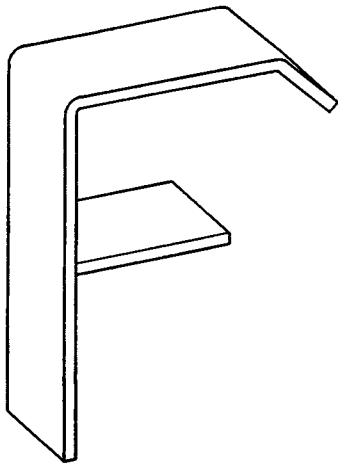
One 3/16" x 2" (maximum width) piece of flat stock, 14 9/16" in blank length

One 2 1/2" piece of flat stock (of same material)

Draw chalk marks on one side of the 14 9/16" piece as shown.



Tack weld 2 1/2" insert to the top and bottom of the bent piece.

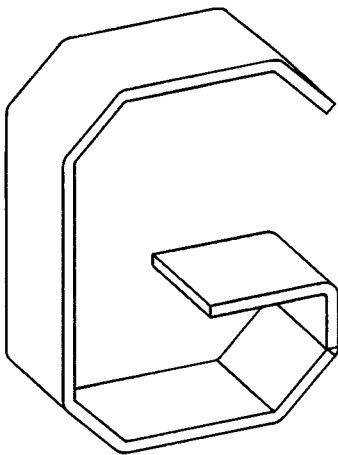
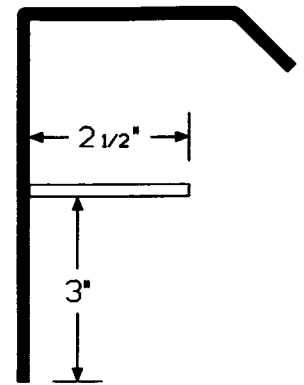


Material Needed

One completed "L"

One 2 1/2" piece of flat stock (of same material)

Flip the "L" upside down and weld the 2 1/2" piece in place as shown to complete the "F".

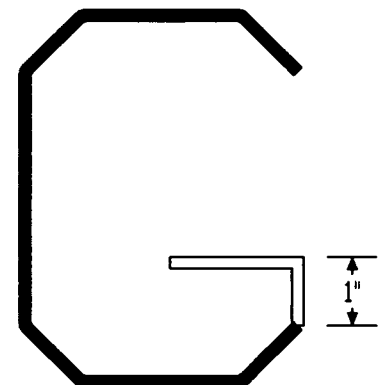
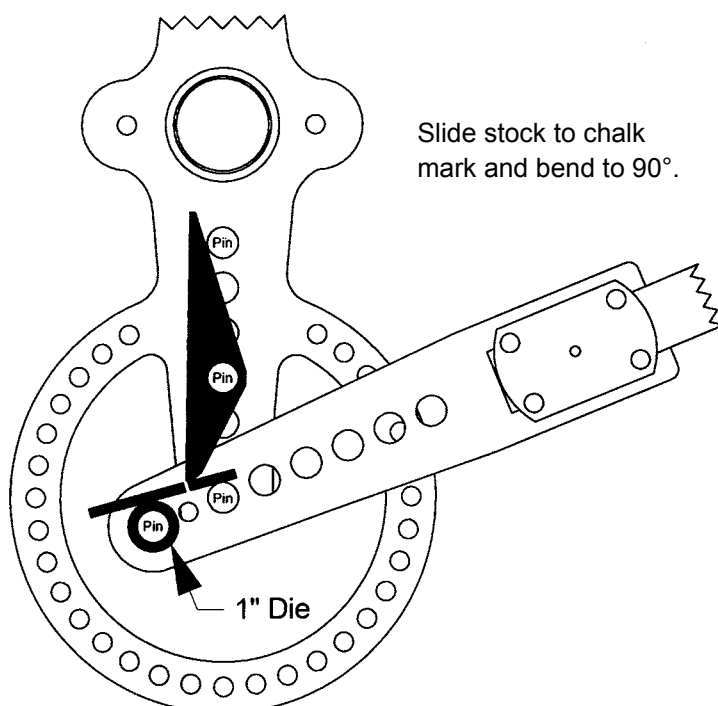
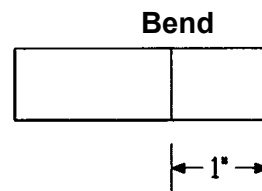


Material Needed

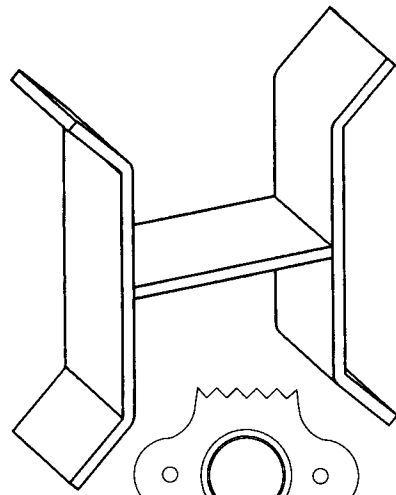
One completed "C"

One 3" piece of flat stock (of same material)

Draw a chalk mark on the 3" piece as shown.



Weld pieces together as shown.



Material Needed

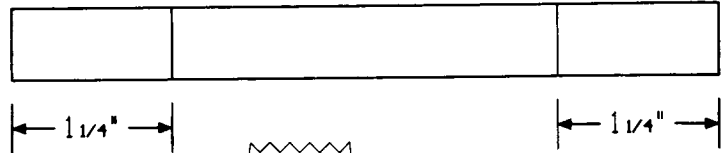
Two $\frac{3}{16}$ " x 2" (maximum width) pieces of flat stock, 6 $\frac{5}{8}$ " in blank length
One 3 $\frac{1}{4}$ " length of flat stock (of same material)

Draw chalk marks on both 6 $\frac{5}{8}$ " pieces as shown.

Bend Order

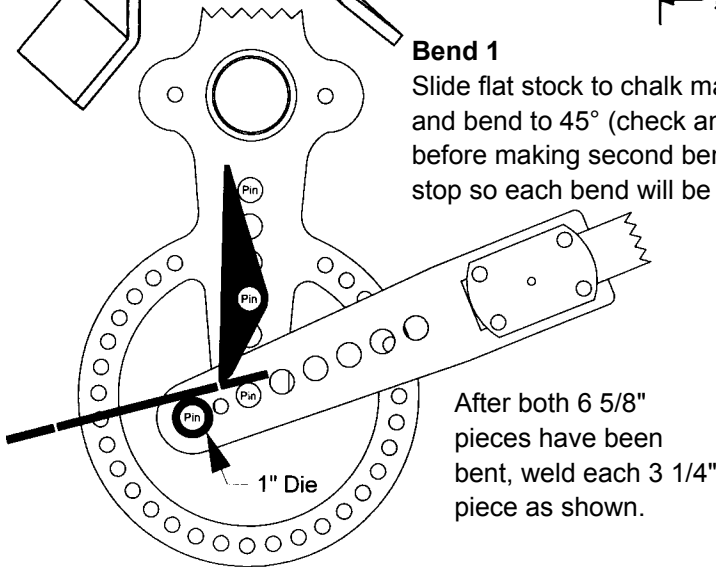
2

1



Bend 1

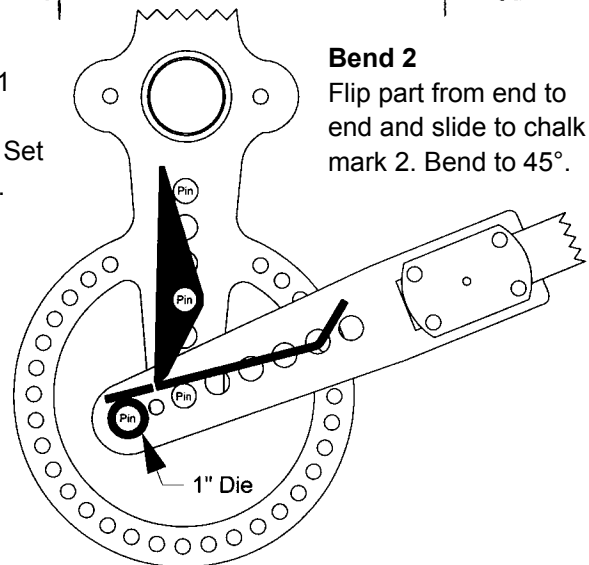
Slide flat stock to chalk mark 1 and bend to 45° (check angle before making second bend). Set stop so each bend will be 45°.



After both 6 $\frac{5}{8}$ " pieces have been bent, weld each 3 $\frac{1}{4}$ " piece as shown.

Bend 2

Flip part from end to end and slide to chalk mark 2. Bend to 45°.



Material Needed

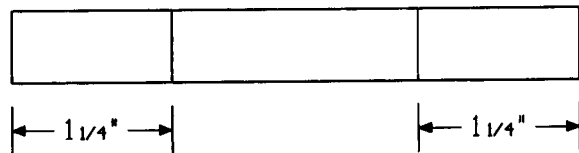
Two $\frac{3}{16}$ " x 2" (maximum width) pieces of flat stock, 5" in blank length
One 5 $\frac{5}{8}$ " piece of flat stock (of same material)

Draw chalk marks on one side of both 5" pieces as shown.

Bend Order

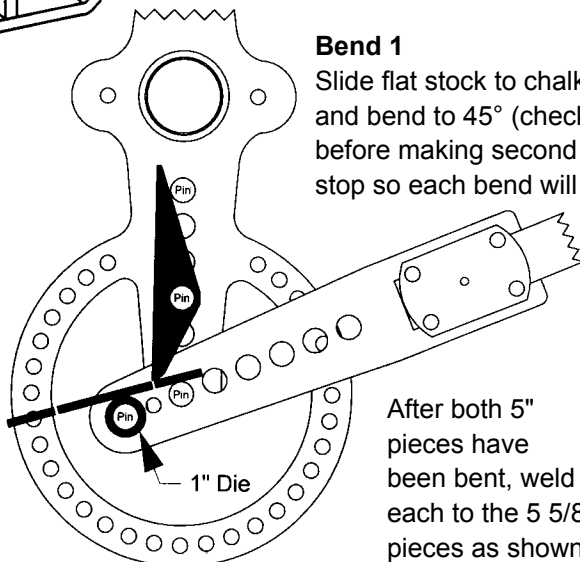
2

1



Bend 1

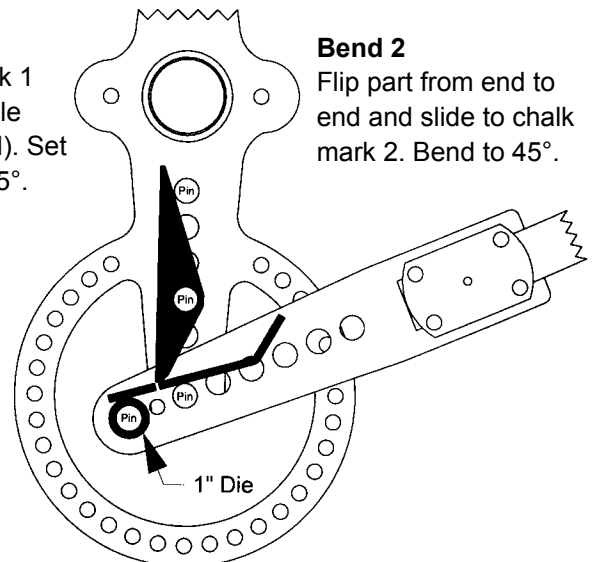
Slide flat stock to chalk mark 1 and bend to 45° (check angle before making second bend). Set stop so each bend will be 45°.



After both 5" pieces have been bent, weld each to the 5 $\frac{5}{8}$ " pieces as shown.

Bend 2

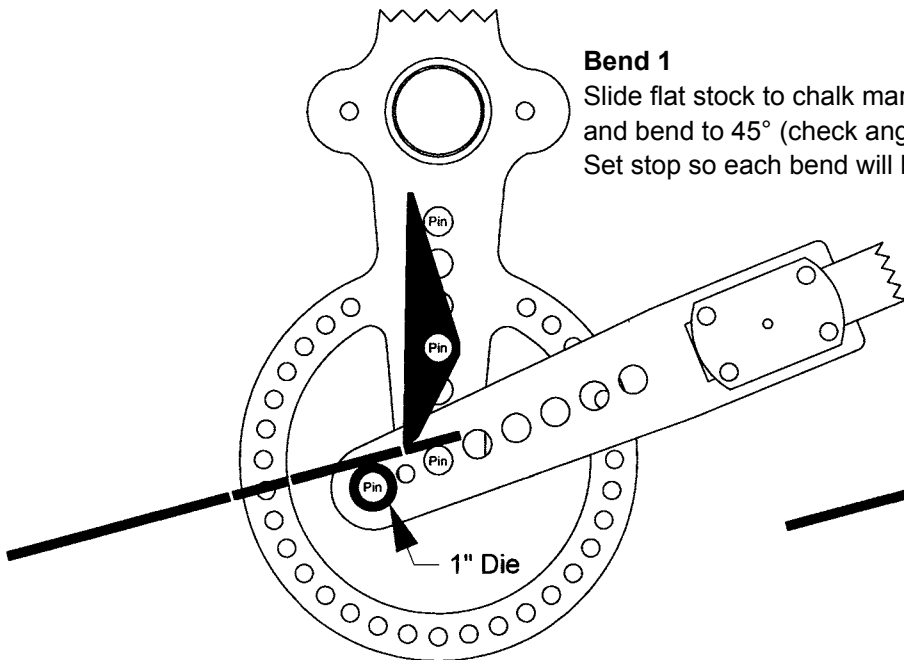
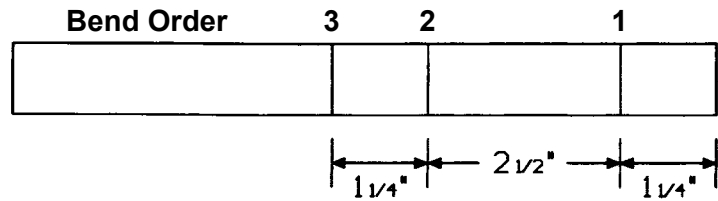
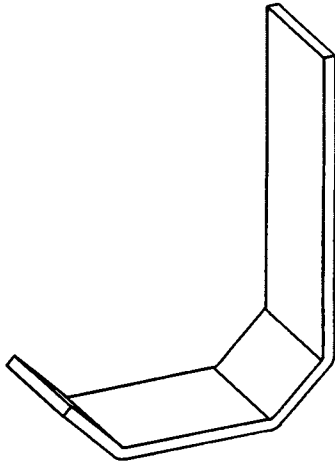
Flip part from end to end and slide to chalk mark 2. Bend to 45°.



Material Needed

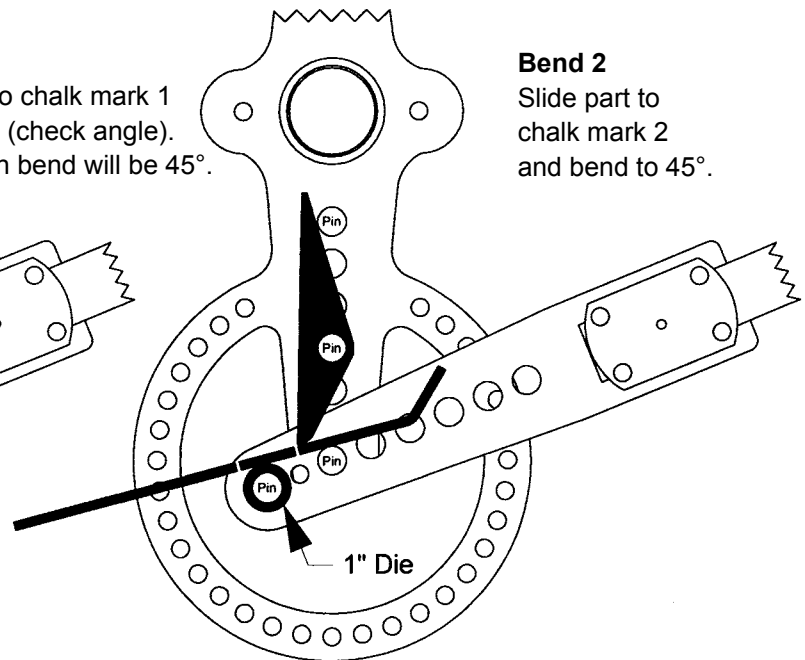
One 3/16" x 2" (maximum width) piece of flat stock, 10" in blank length

Draw chalk marks on one side of the material as shown.



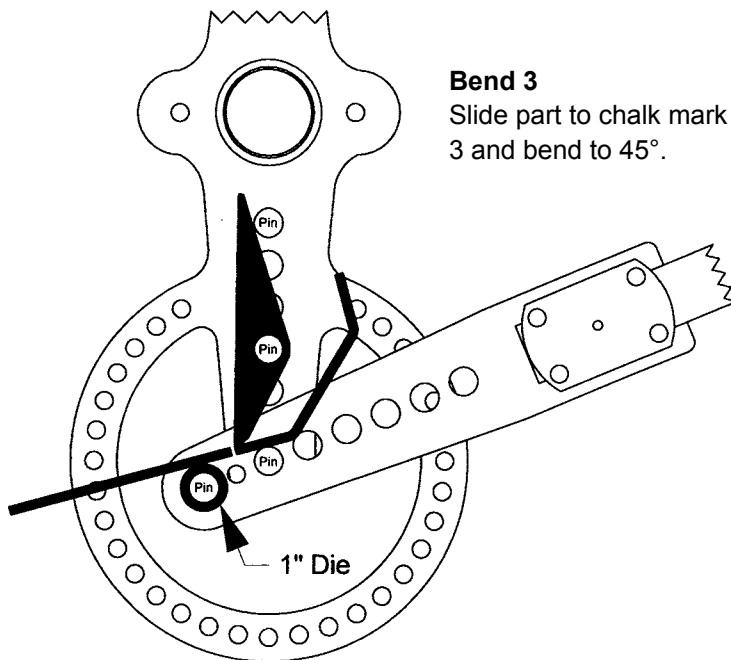
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle). Set stop so each bend will be 45°.



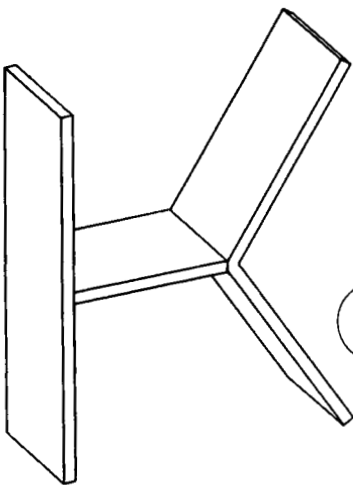
Bend 2

Slide part to chalk mark 2 and bend to 45°.



Bend 3

Slide part to chalk mark 3 and bend to 45°.



Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 7" in blank length

One 6" piece of flat stock (of same material)

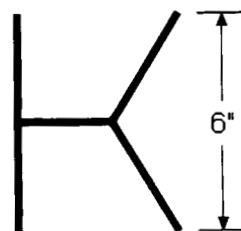
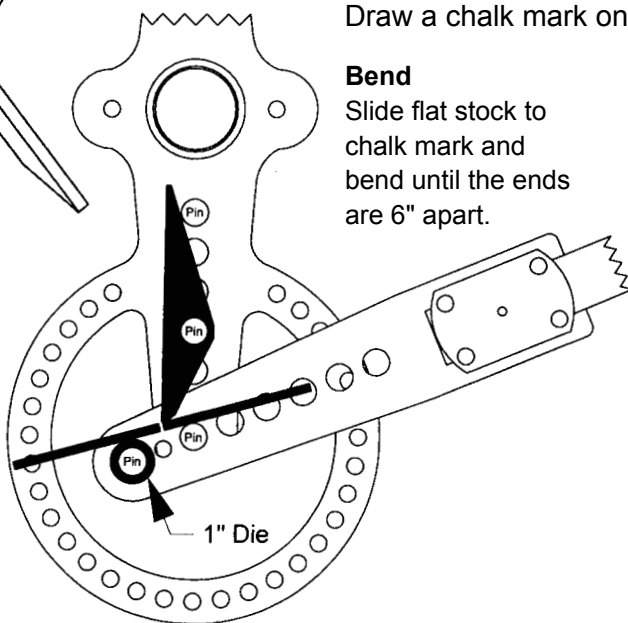
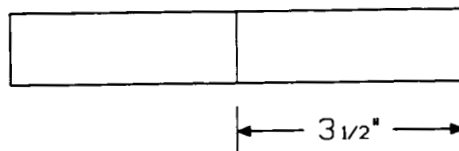
One 2 1/2" piece of flat stock (of same material)

Draw a chalk mark on the 7" piece as shown.

Bend

Slide flat stock to chalk mark and bend until the ends are 6" apart.

Bend

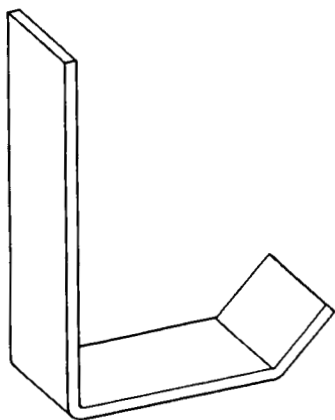


Center 2 1/2" insert between back front of 'K' and weld into position as shown.

Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 10 3/8" in blank length

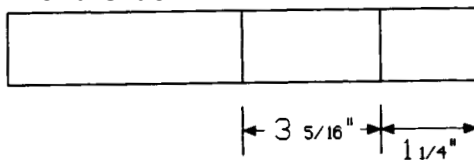
Draw chalk marks on one side of the material as shown.



Bend Order

2

1

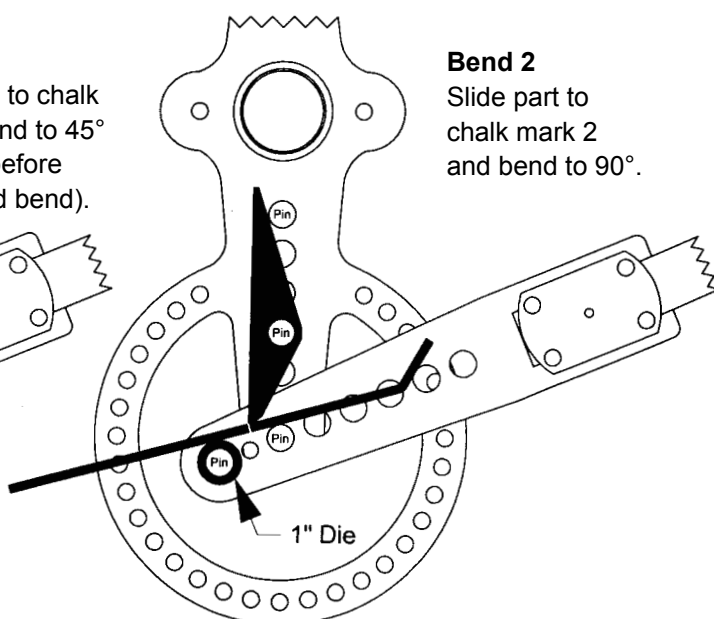
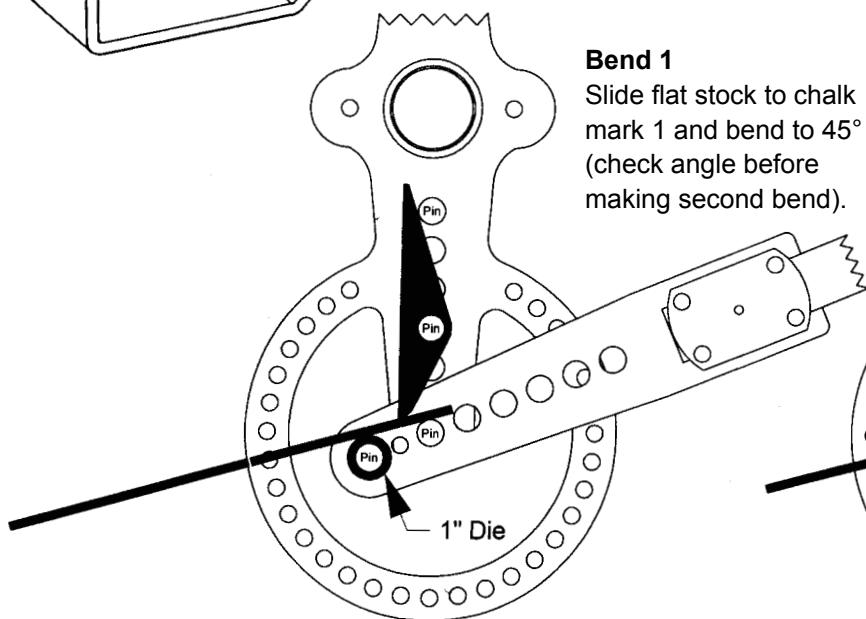


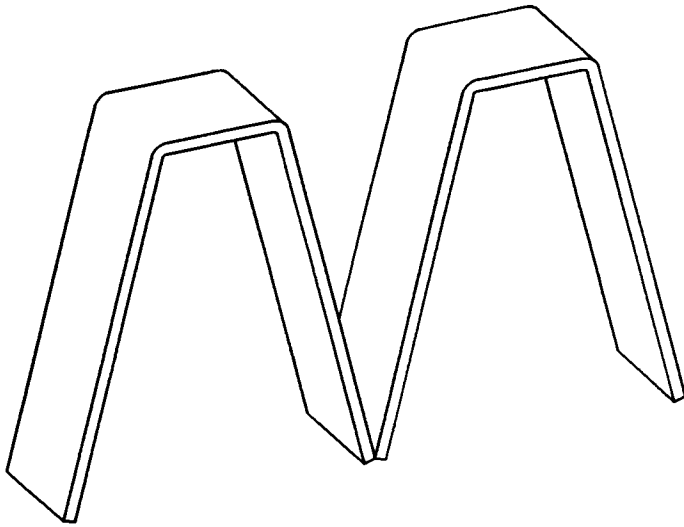
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle before making second bend).

Bend 2

Slide part to chalk mark 2 and bend to 90°.

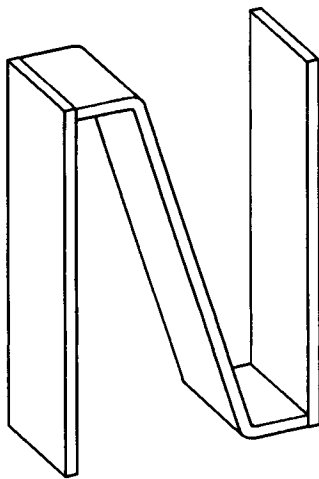




Material Needed

Two completed 'V's

Flip the 'V's upside down and weld them together at the ends as shown to complete the 'M'.

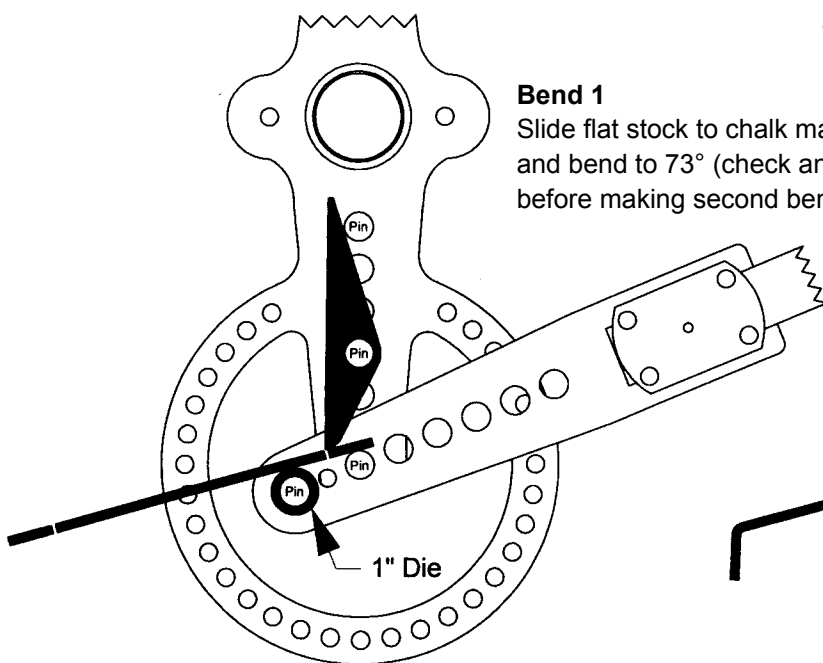
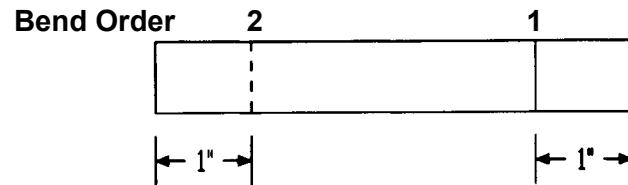


Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 8 1/16" in blank length

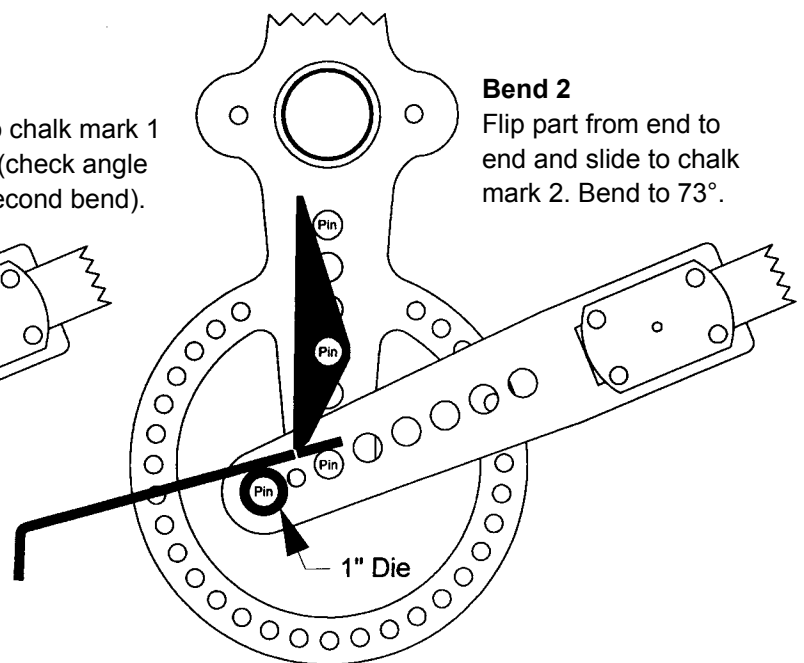
Two 6" pieces of flat stock (of same material)

Draw chalk marks on opposing sides of the 8 1/16" piece as shown.



Bend 1

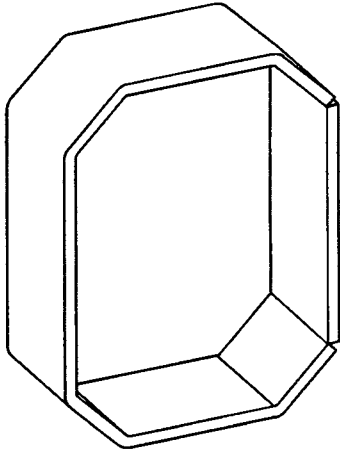
Slide flat stock to chalk mark 1 and bend to 73° (check angle before making second bend).



Bend 2

Flip part from end to end and slide to chalk mark 2. Bend to 73°.

Tack weld pieces together as shown.

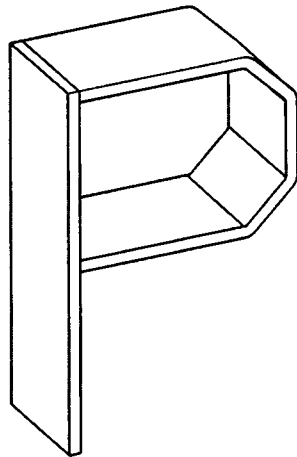
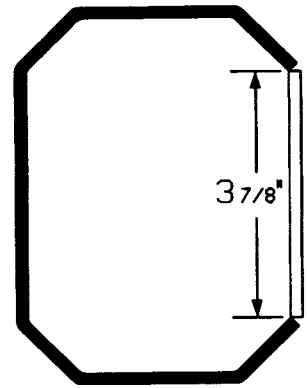


Material Needed

One completed "C"

One 3 7/8" piece of flat stock (of same material)

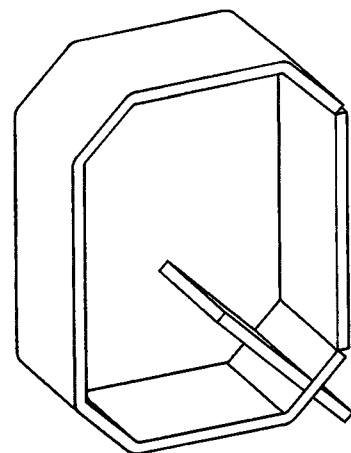
Tack weld the 3 7/8" piece into the jaws of the "C" as shown to complete the "O".



Material Needed

One half of an incomplete "B"

Follow the directions for making a "B", but only bend up one piece of 8 7/8" long flat stock. Tack weld it to the 6" piece as shown.



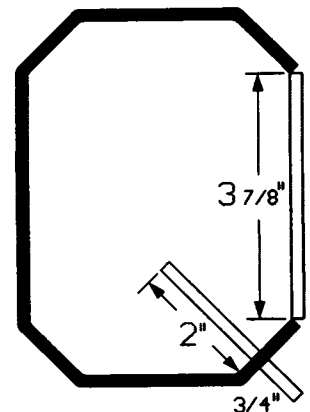
Material Needed

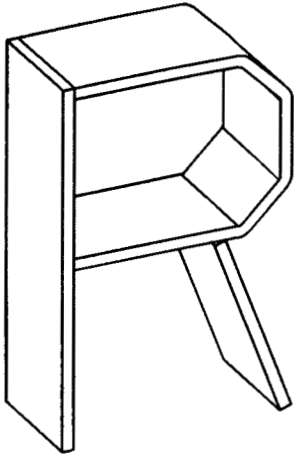
One completed "O"

One 3/4" piece of flat stock (of same material)

One 2" piece of flat stock (of same material)

Tack weld pieces together as shown.



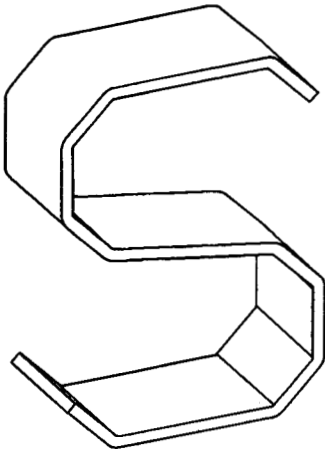
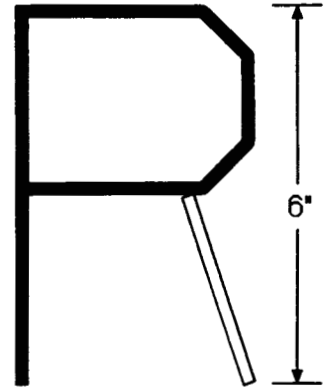


Material Needed

One completed "P"

One 3 1/8" piece of stock (of same material)

Tack weld pieces together as shown.

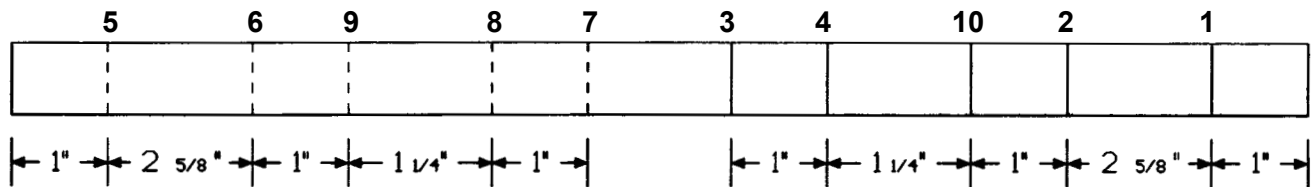


Material Needed

One 3/16" x 2" (maximum width) piece of flat stock, 16 1/2" in blank length

Draw chalk marks on material as shown. After drawing five marks on one end of the flat stock, draw the five marks for the other end on the opposite side (represented by the dashed lines). Use sharp chalk and draw narrow lines for best results. The "S" is the most difficult letter to make; its construction requires the strictest adherence to the procedures. Practice making the "S" with a piece of 3/16" x 1/2" hot-rolled mild steel. Once you master the "S", all of the other letters will seem simple.

Bend Order



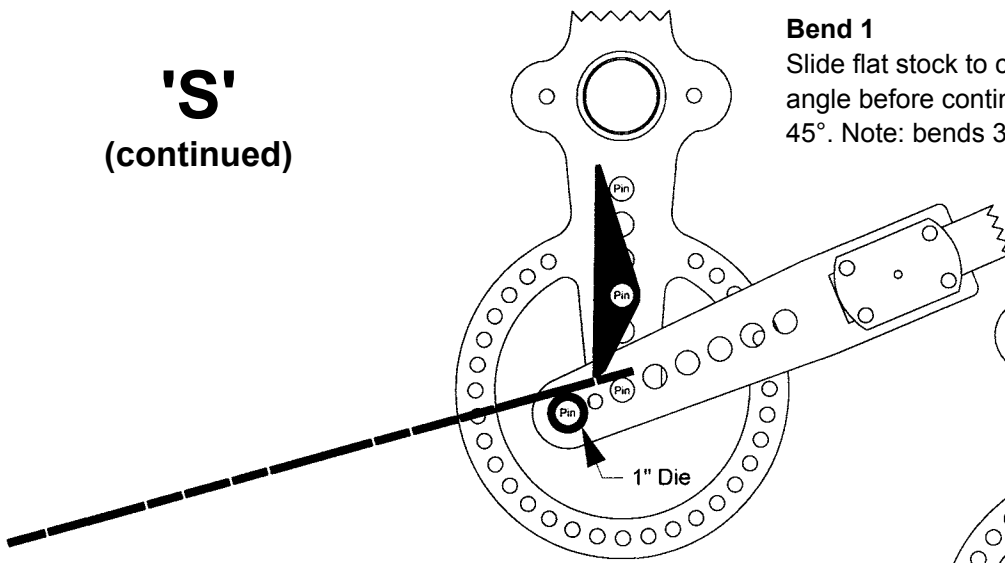
Follow the instructions and illustrations presented on the following pages.

'S'

(continued)

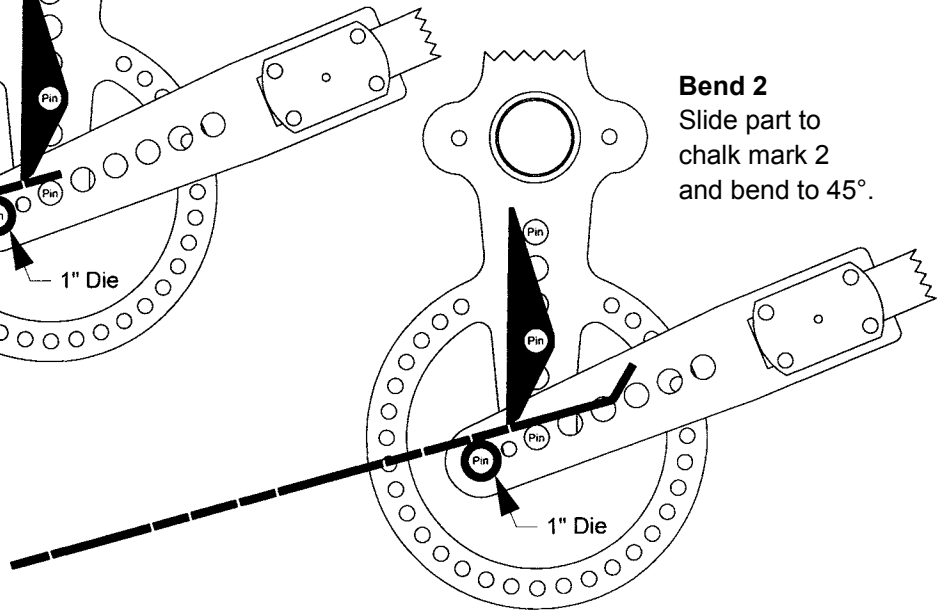
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle before continuing). Set stop so each bend will be 45°. Note: bends 3 and 7 will measure 41°.



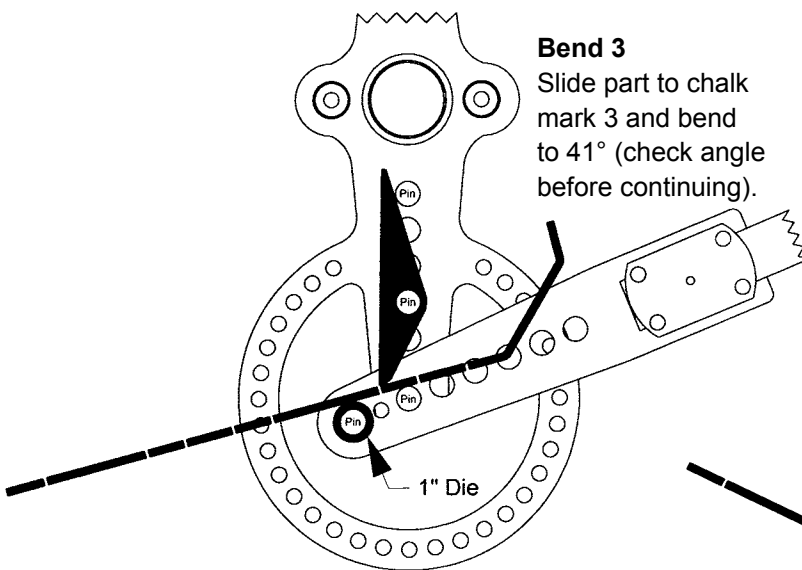
Bend 2

Slide part to chalk mark 2 and bend to 45°.



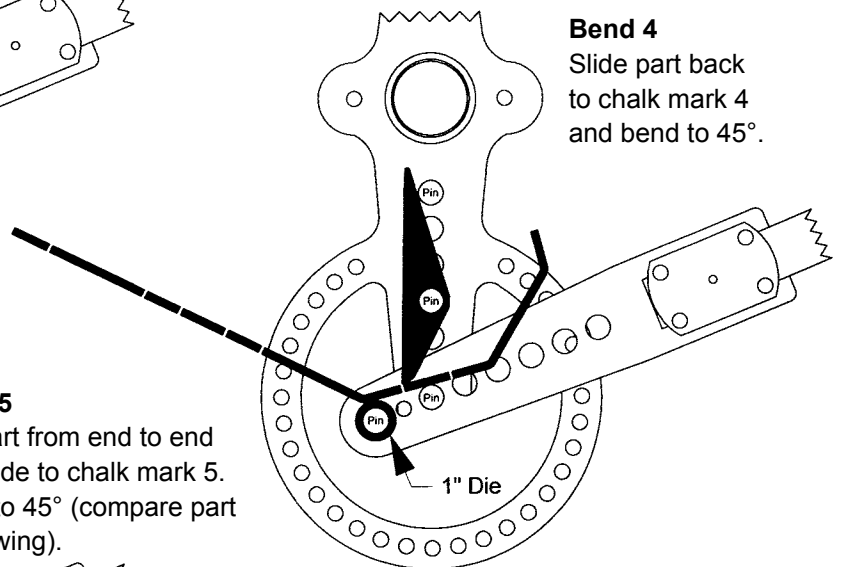
Bend 3

Slide part to chalk mark 3 and bend to 41° (check angle before continuing).



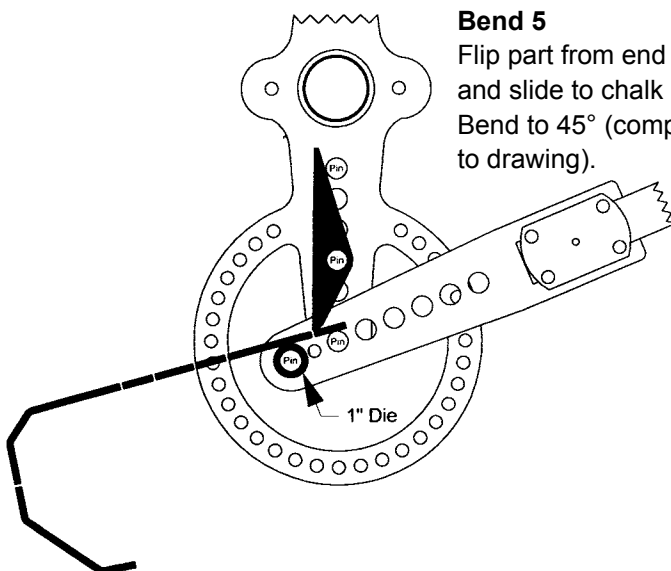
Bend 4

Slide part back to chalk mark 4 and bend to 45°.



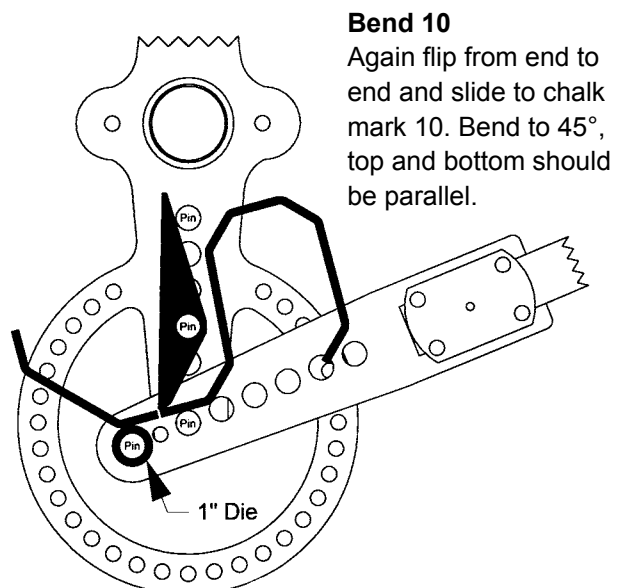
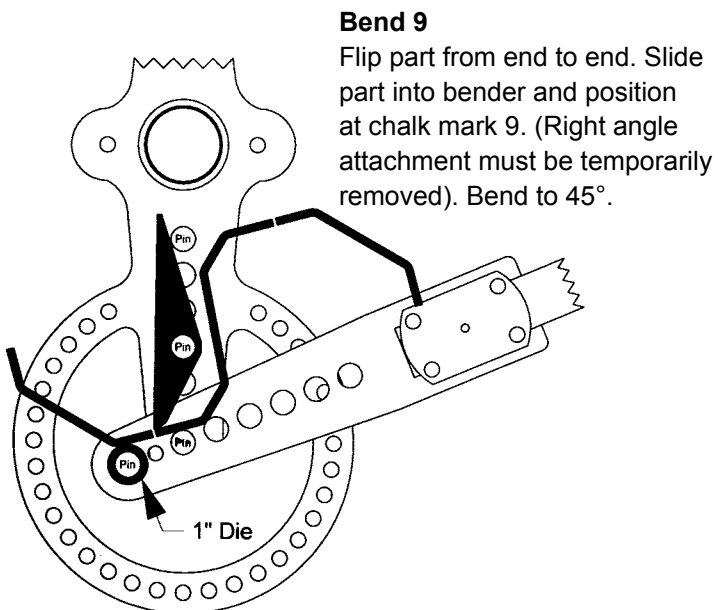
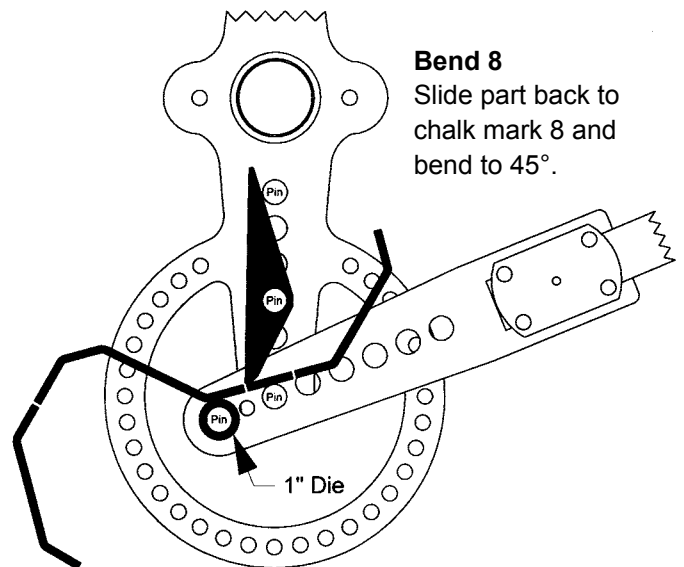
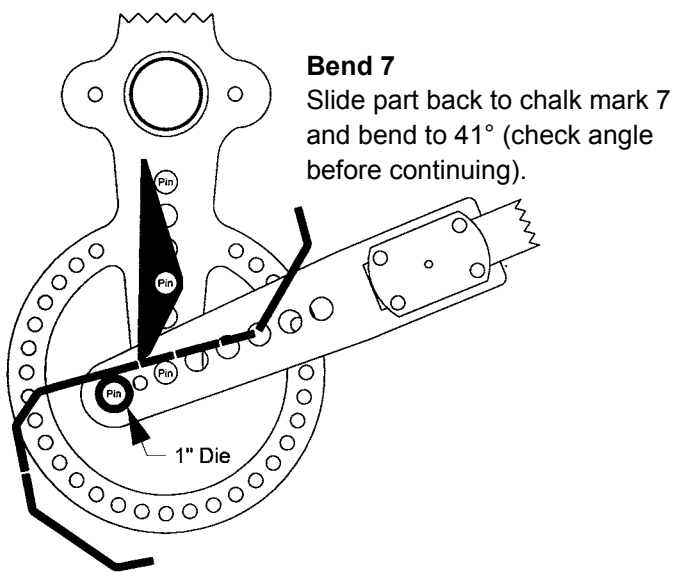
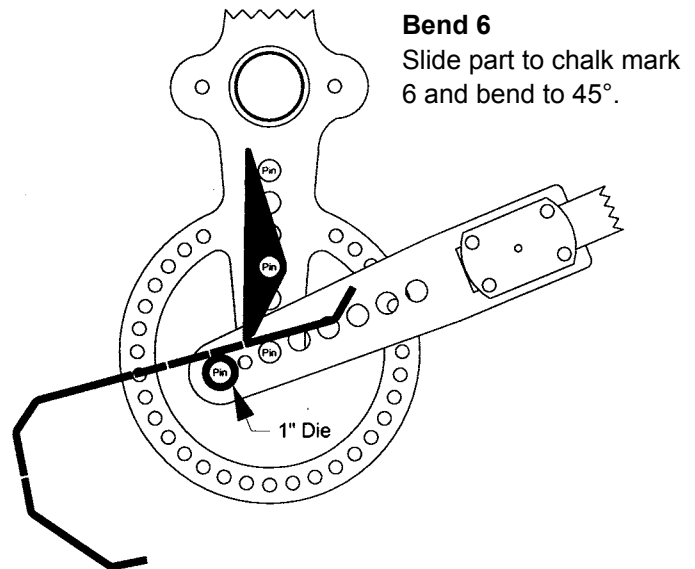
Bend 5

Flip part from end to end and slide to chalk mark 5. Bend to 45° (compare part to drawing).



'S'

(continued)



One 5 13/16" piece of flat stock (of same material

[illegible]

Bend 1
Slide flat stock to chalk mark 1 and bend to 45°.

Bend 2
Flip part from end to end and slide to chalk mark 2. Bend to 45°.

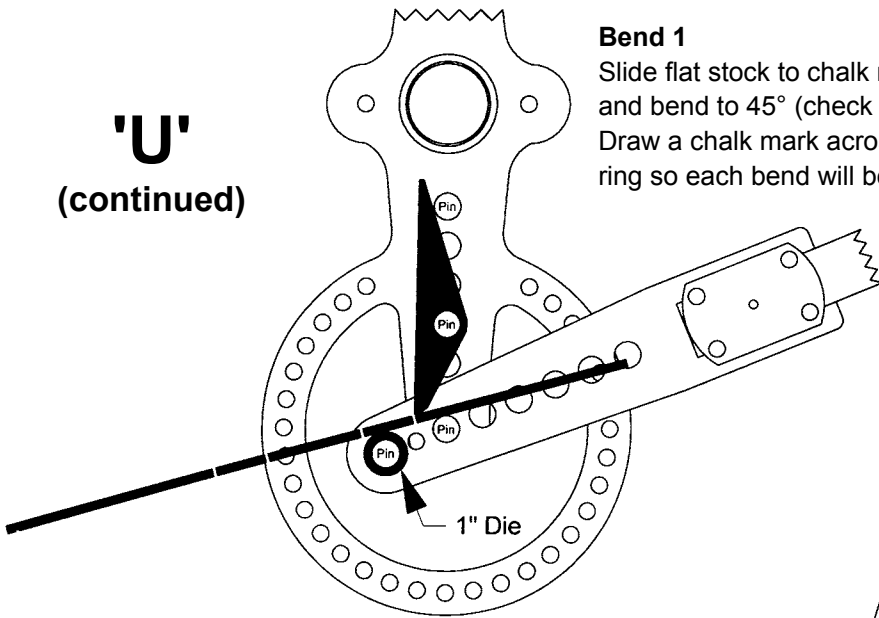
Draw chalk marks on one side of the 14 3/4" piece as .shown.

34

'U' (continued)

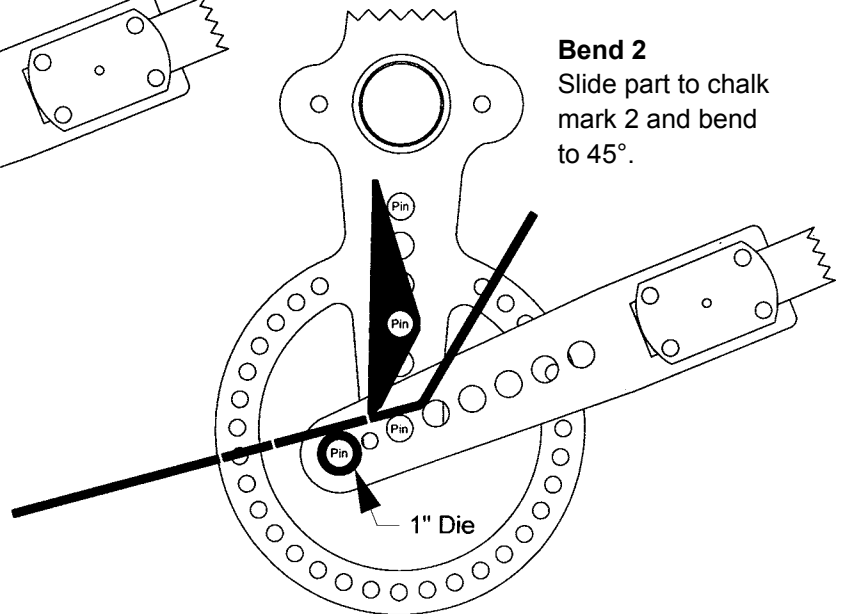
Bend 1

Slide flat stock to chalk mark 1 and bend to 45° (check angle). Draw a chalk mark across the ring so each bend will be 45°.



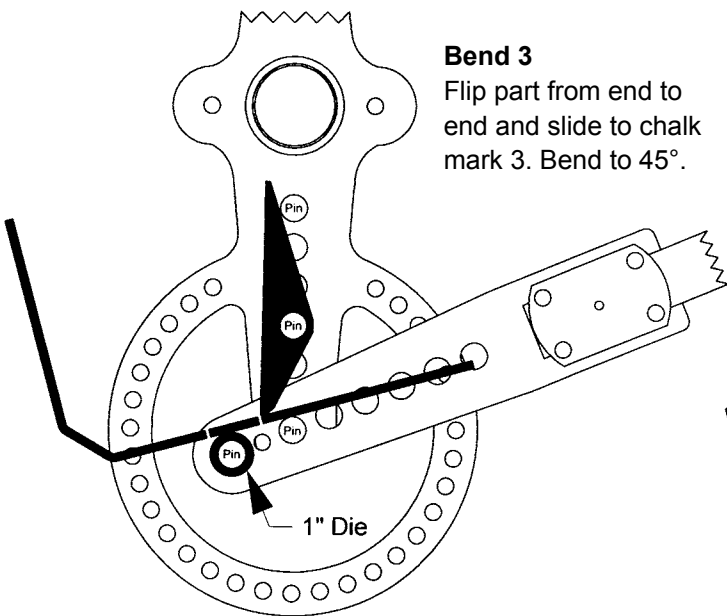
Bend 2

Slide part to chalk mark 2 and bend to 45°.



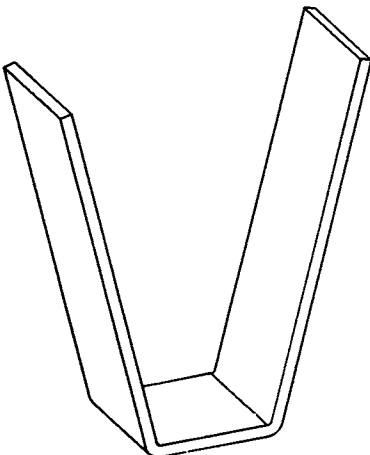
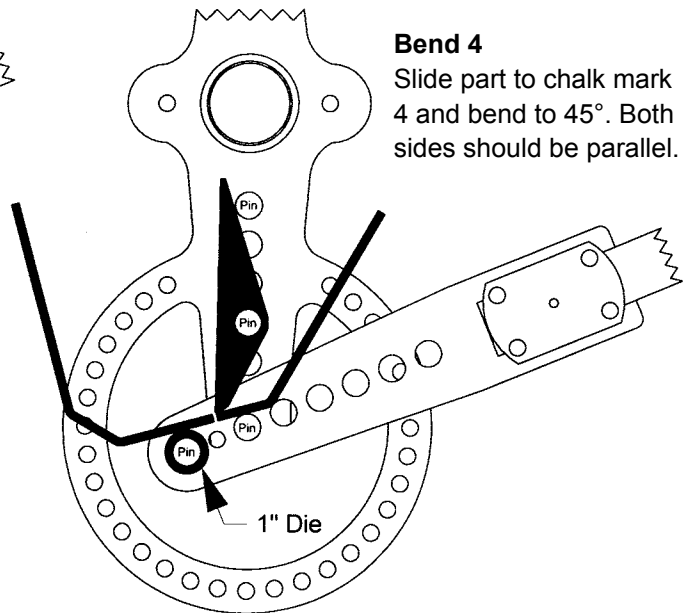
Bend 3

Flip part from end to end and slide to chalk mark 3. Bend to 45°.



Bend 4

Slide part to chalk mark 4 and bend to 45°. Both sides should be parallel.



Material Needed

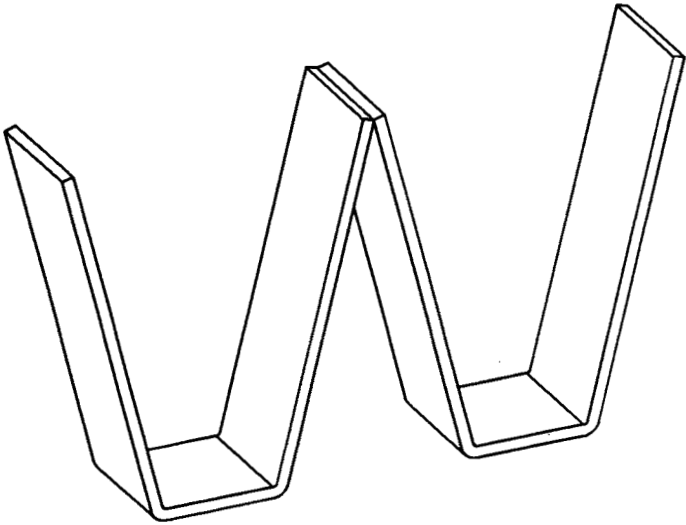
One 'A' without the 3 1/2" insert

This 'V' is simply the partial 'A' flipped upside-down.

Material Needed

Two completed 'V's
(two 'A's without inserts)

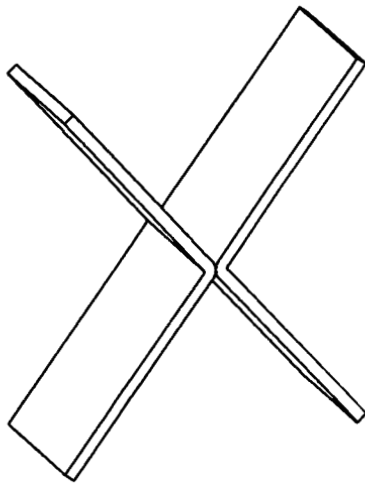
Tack weld ends of the 'V's together as shown to form the 'W'. (The 'W' is made in the same way as the 'M').



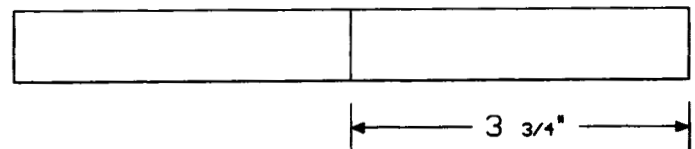
Material Needed

Two 3/16" x 2" (maximum width) pieces of flat stock,
7 1/2" in blank length.

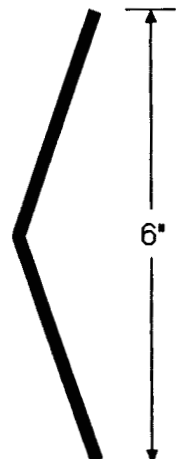
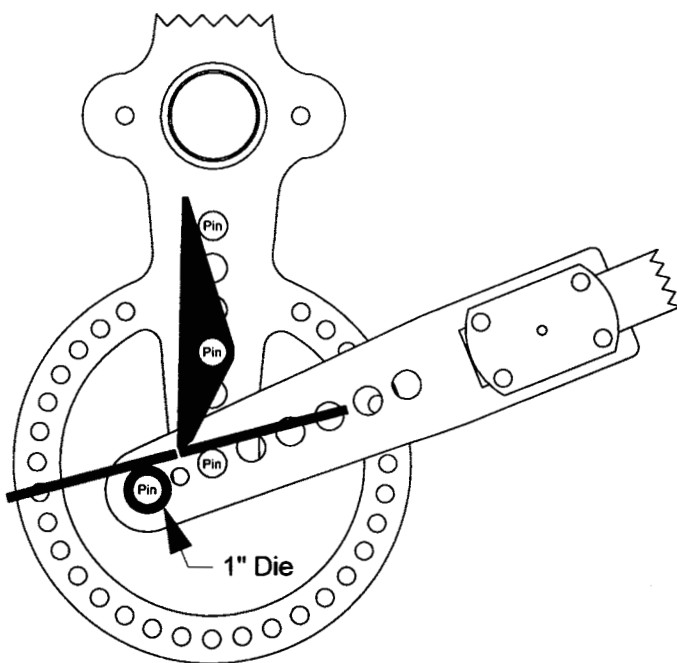
Draw a chalk mark on each piece as shown.

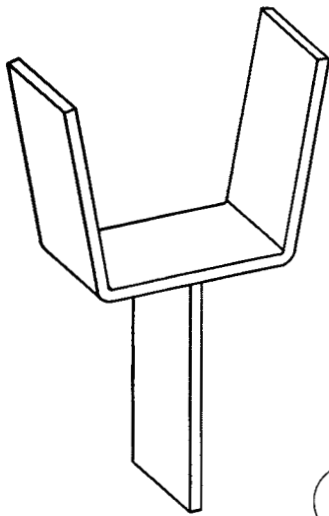


Bend



After both pieces are bent,
join their middle and tack
weld them together as
shown above left.





Material Needed

One 3/16" x 2" (maximum width) bar of flat stock, 9 1/2" in blank length

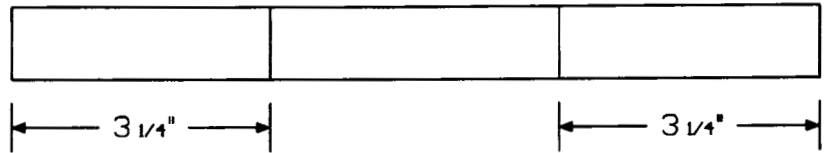
One 3 3/4" piece of flat stock (of same material)

Draw chalk marks on one side of the 9 1/2" piece as shown.

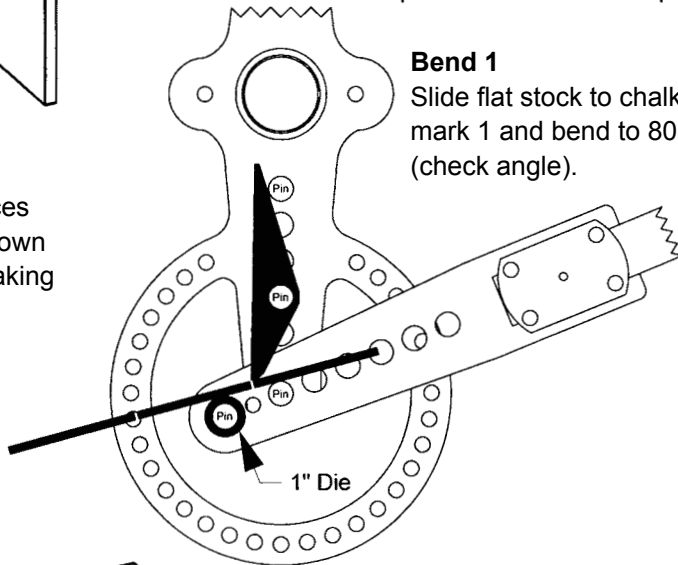
Bend Order

2

1

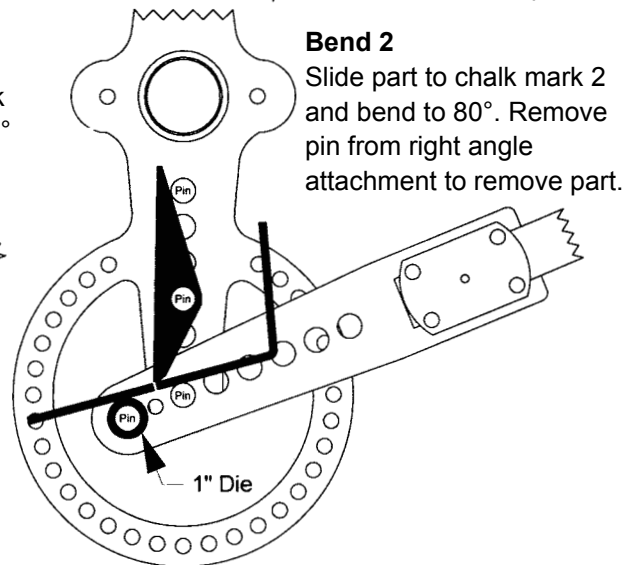


Tack weld pieces together as shown above after making bends.



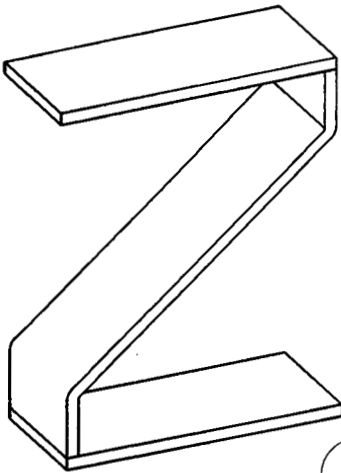
Bend 1

Slide flat stock to chalk mark 1 and bend to 80° (check angle).



Bend 2

Slide part to chalk mark 2 and bend to 80°. Remove pin from right angle attachment to remove part.



Material Needed

One 3/16" x 2" (maximum width) bar of flat stock, 9 1/2" in blank length

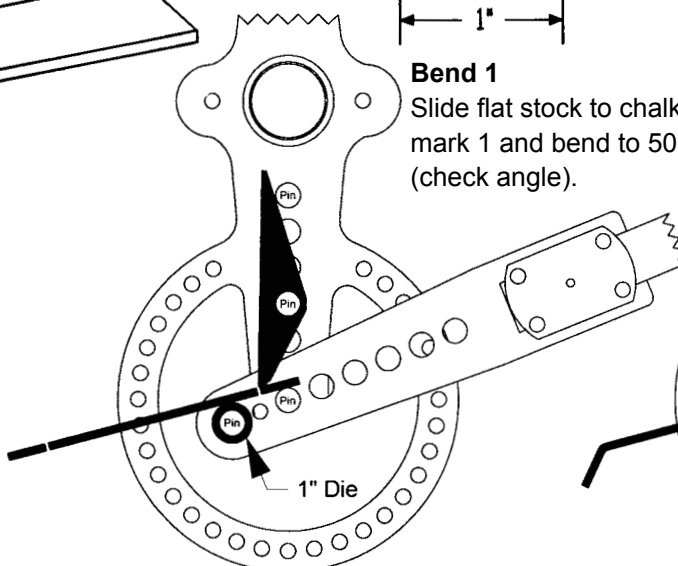
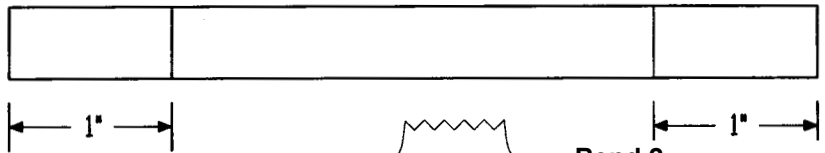
One 3 3/4" piece of flat stock (of same material)

Draw chalk marks on one side of the 9 1/2" piece as shown.

Bend Order

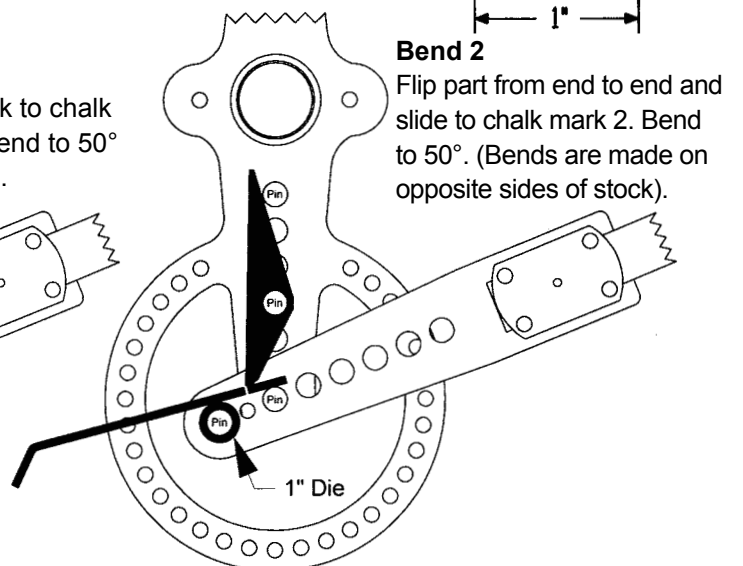
1

2



Bend 1

Slide flat stock to chalk mark 1 and bend to 50° (check angle).



Bend 2

Flip part from end to end and slide to chalk mark 2. Bend to 50°. (Bends are made on opposite sides of stock).

Space 4 1/2" inserts 6" apart and tack weld bent piece in place as shown.

Bending Round Tubing

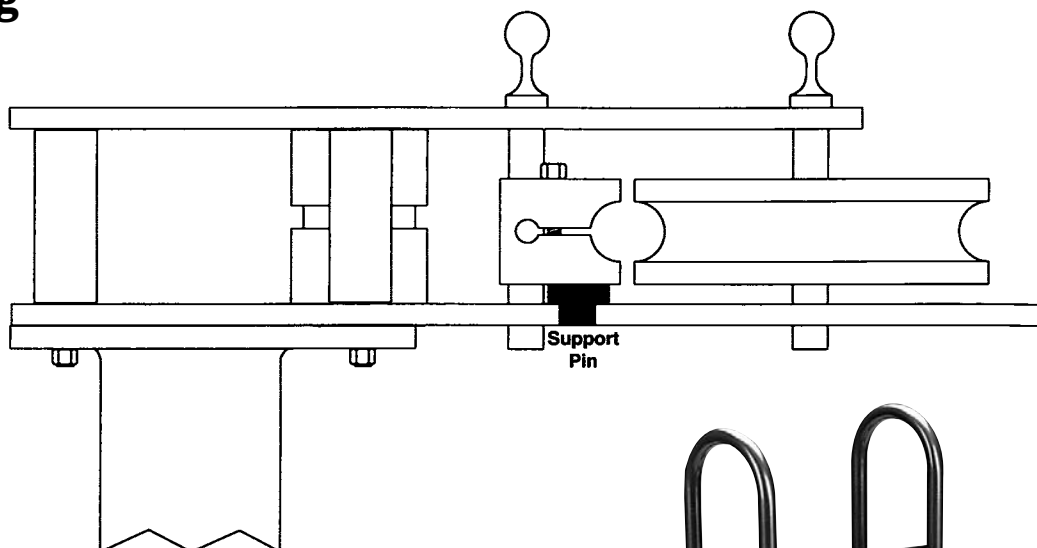
Be sure that the support pin is under the clamp block before using tubing dies.

For a Video Demonstration please go to <http://www.shopoutfitters.com/TubeBender2.html>.

The Clamp Block

The clamp block is used to secure the tubing, preventing it from slipping as the handle die bends it around the center die. The tubing must be securely fastened in the clamp block by tightening the 3/8" bolt, as shown below. Use one hand to hold the tubing firmly into the clamp block, and tighten the bolt with a boxed end wrench. Do not over tighten this bolt or attempt to clamp an improper size of tubing.

Cut the tubing to an oversized length before you bend it and trim the ends after the bend is made. As a reference for future bends, record the distance from the clamp block to the end of the tubing before a bend. You can use this information to predict the lengths of tubing that you will need. **The clamp block is used only for smaller sizes of round tubing from 1/2" to 7/8".** For larger sizes of tubing (which require the optional Multiplier), tube clamp brackets are used. The illustration on page 41 shows a tube clamp and how it attaches to the tube die.



Bending Square Tubing

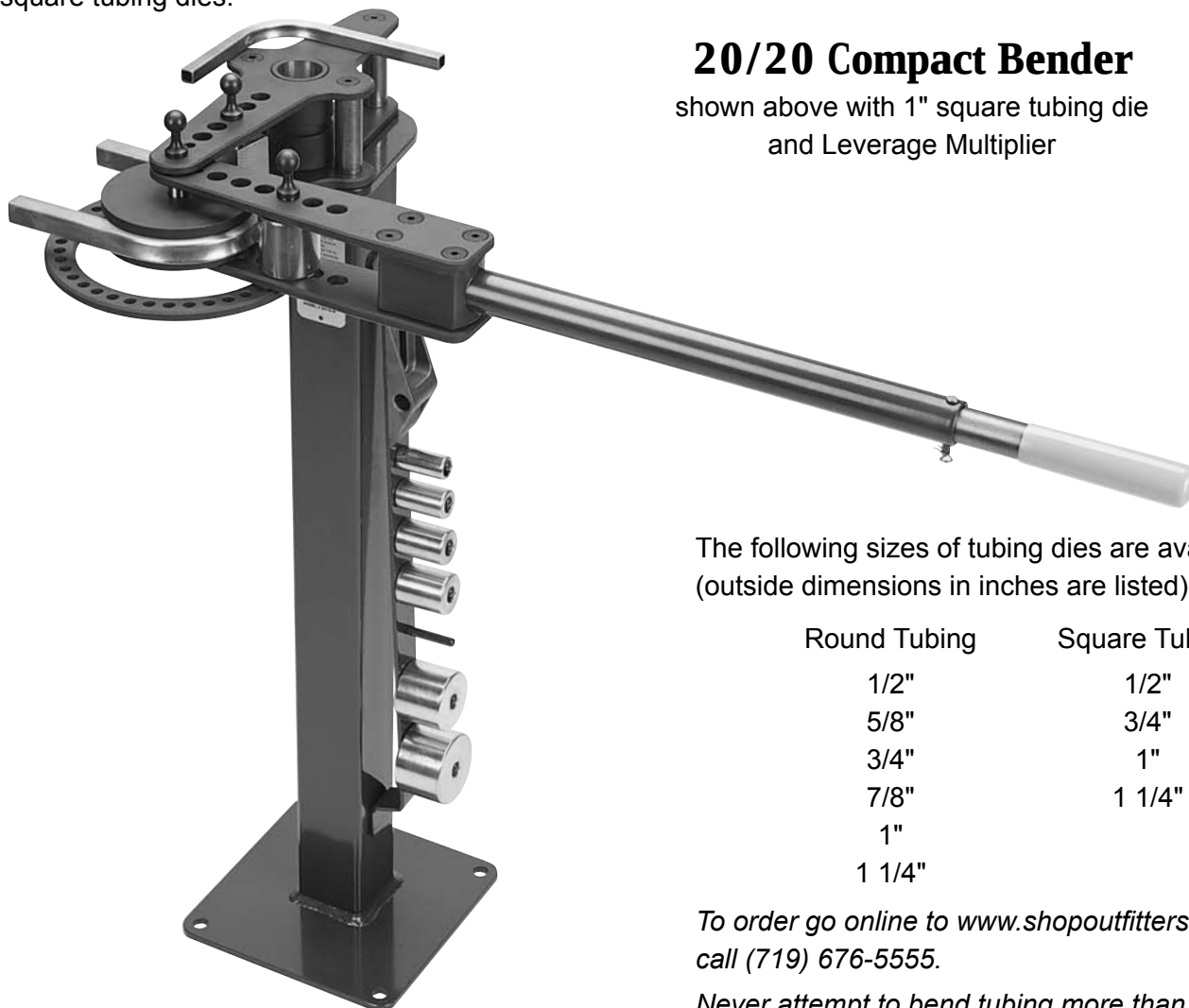
The 1" and 1 1/4" square tubing dies have a unique slip apart and rotate split design which forms bends in square tubing without kinking the material.

Smaller sizes of square tubing are bent on the bender as shown using a tubing die, a roller die, and the square block which is provided with the Compact Bender. Before placing square tubing into the dies for bending, you should **oil the insides of the upper and lower flanges** to aid in removal of the finished part. Larger sizes of both round and square tubing are bent using the optional Multiplier as described on pages 41–47. The Multiplier increases the leverage of the bender, making it possible to bend much heavier tubing. No oil is required on 1" and 1 1/4" square tubing dies.



20/20 Compact Bender

shown above with 1" square tubing die
and Leverage Multiplier



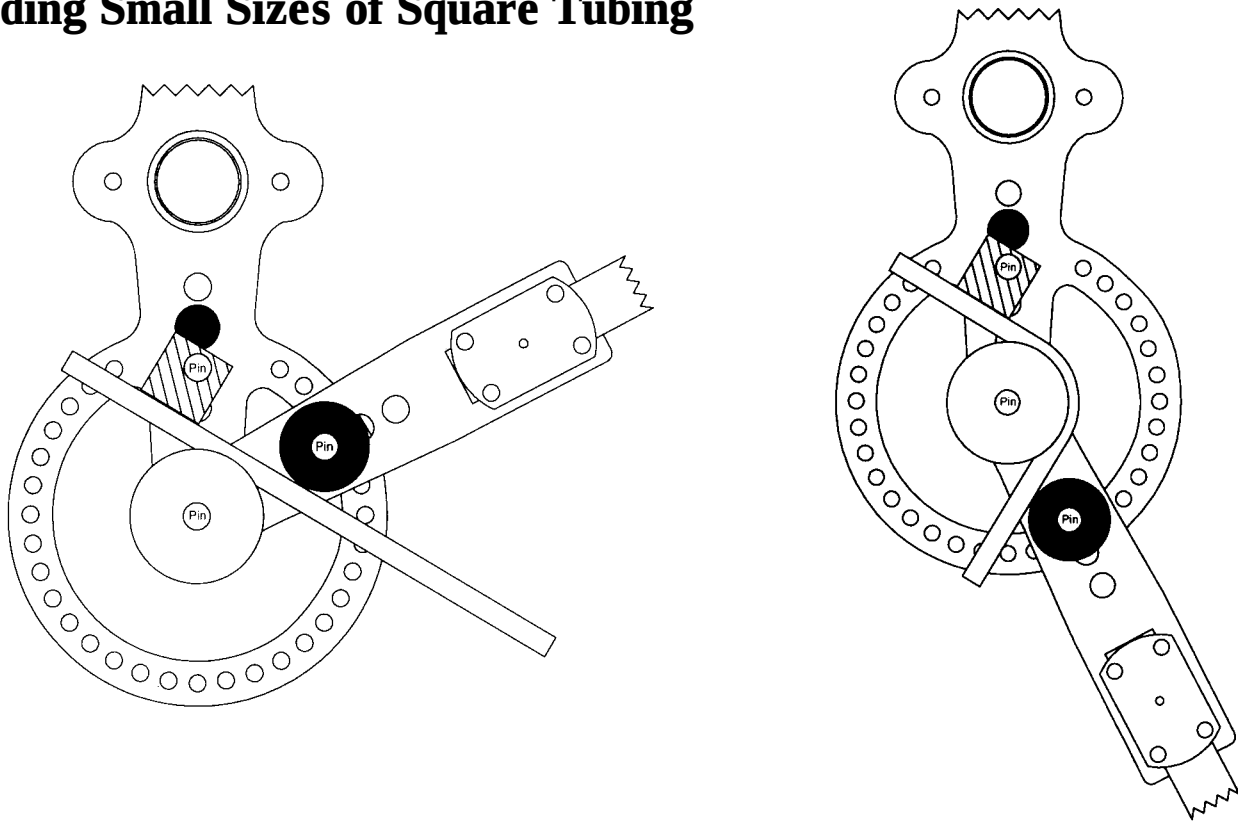
The following sizes of tubing dies are available
(outside dimensions in inches are listed):

Round Tubing	Square Tubing
1/2"	1/2"
5/8"	3/4"
3/4"	1"
7/8"	1 1/4"
1"	
1 1/4"	

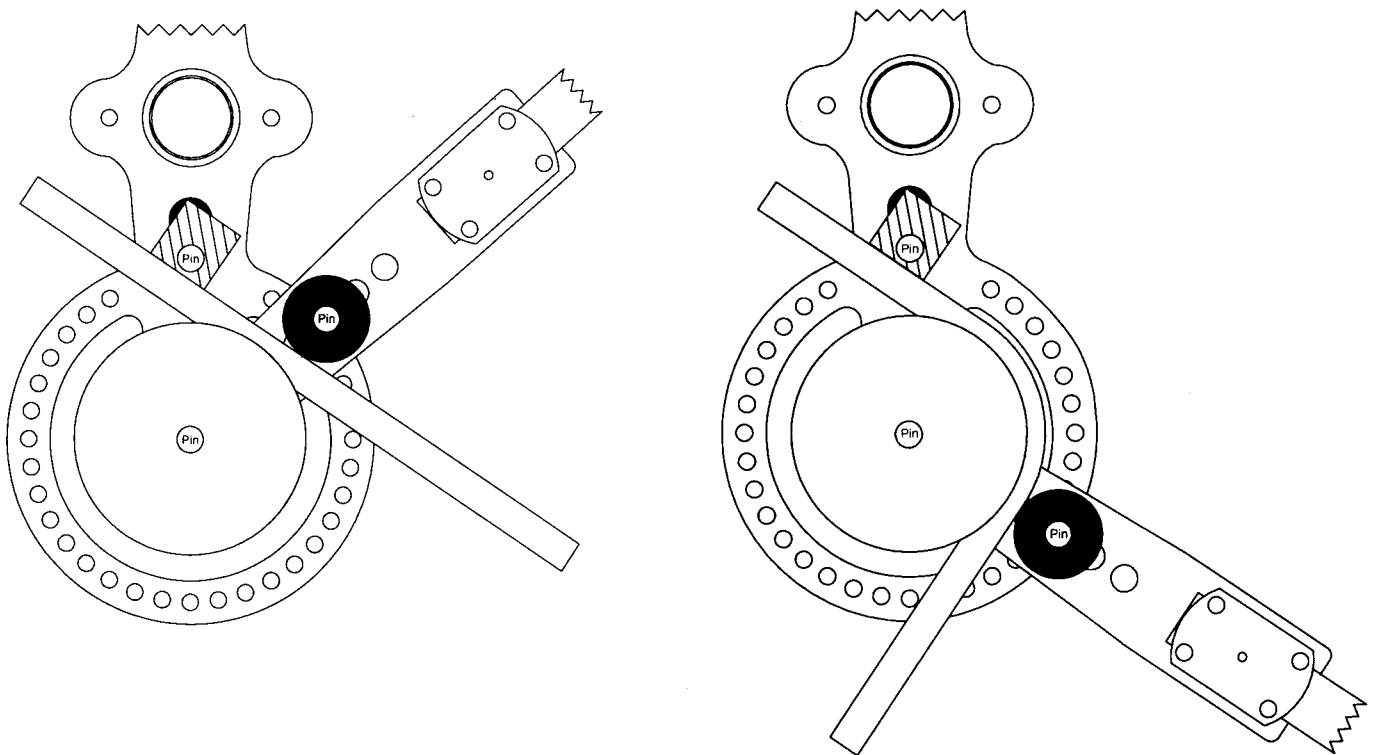
To order go online to www.shopoutfitters.com or
call (719) 676-5555.

*Never attempt to bend tubing more than 180°,
since it will be extremely difficult to remove from
the center die. The part shown at left was bent to
the maximum angle of 90°.*

Bending Small Sizes of Square Tubing

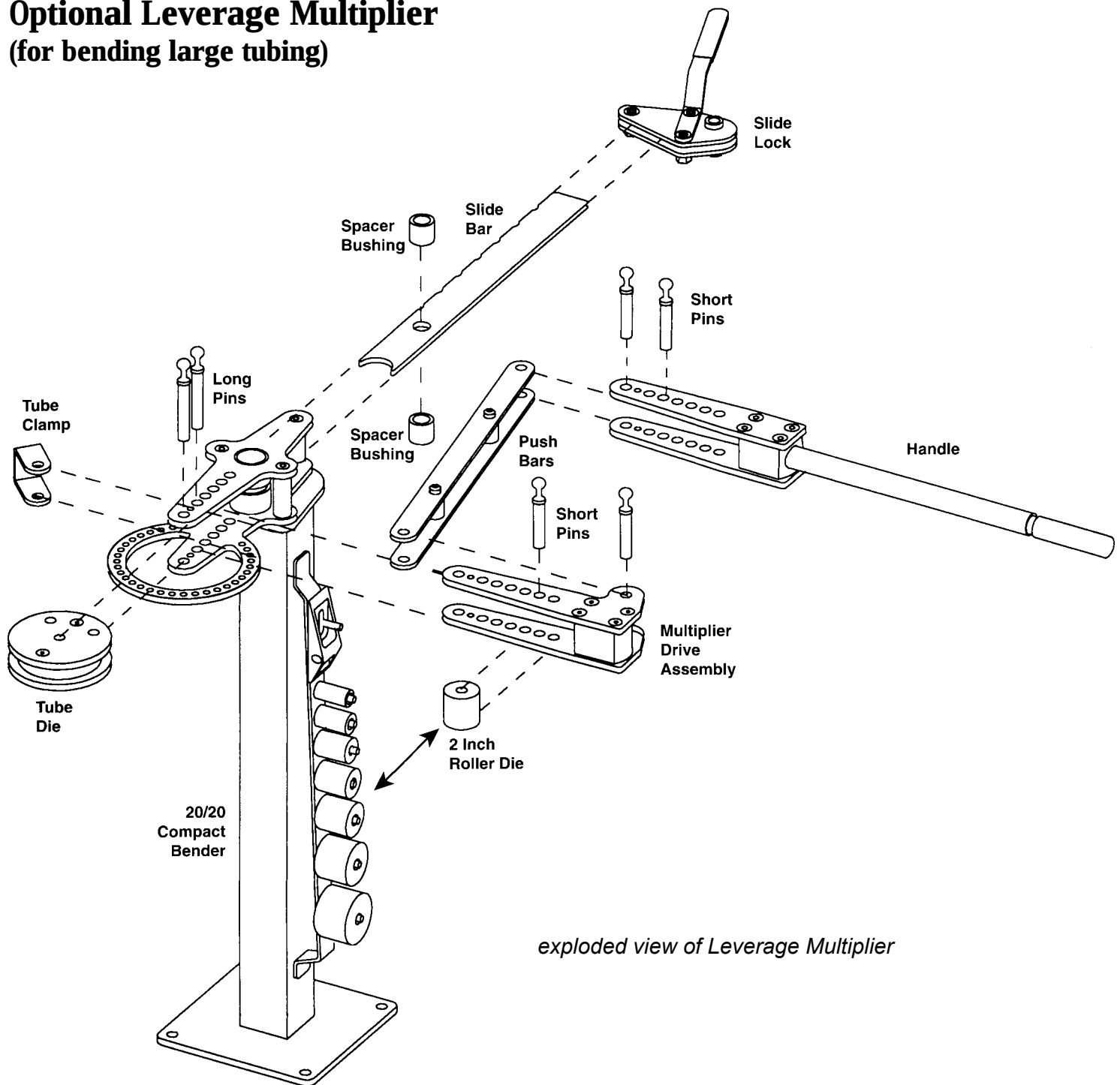


The stop block is easier to use because one doesn't have to tighten and loosen a bolt each time a bend is set up. Shown above is a length of 1/2" square tubing before and after it is bent. Place the stop block in hole 3 of the ring; it should be in block position 4 as shown (see page 9 in manual for more information on positions). The 2" die provided is used to form the tubing around the center die and should be placed in hole 3 of the handle.



Shown above is the arrangement for bending 3/4" square tubing. The stop block goes in hole 3 of the ring and is in block position 1 (see page 9 in manual). The 2" die is used as the forming die and is located in hole 4 of the handle. Square tubing can be bent up to 180 degrees. If you try to bend tubing more than 180 degrees, you will find that it will not come off of the center die.

Optional Leverage Multiplier (for bending large tubing)



Refer to the parts and their names on this page when setting up the Multiplier, when using the instructions found on the following pages, and for ordering any new parts. The Multiplier is designed for bending large sizes of square and round tubing (1" and up) which would be difficult or impossible to bend without the added mechanical advantage offered by the Multiplier. It is not intended for bending larger sizes of flat and solid stock. Shown above are dies for bending 1 1/4" square tubing. For round tubing, be sure to use the round tubing roller die for the correct tubing diameter.

Assembly View of Leverage Multiplier



Part #	Tube Size (O.D.)	Wall Thickness	Bend Radius
TDR1	1" round	14-10 ga.	2 ¹⁵ / ₁₆ " centerline
TDS1	1" square	16-11 ga.	2 ³ / ₈ " inside
TDR114	1 ¹ / ₄ " round	14-11 ga.	3 ¹⁵ / ₁₆ " centerline
TDS114	1 ¹ / ₄ " square	16-14 ga.	3 ¹ / ₁₆ " inside

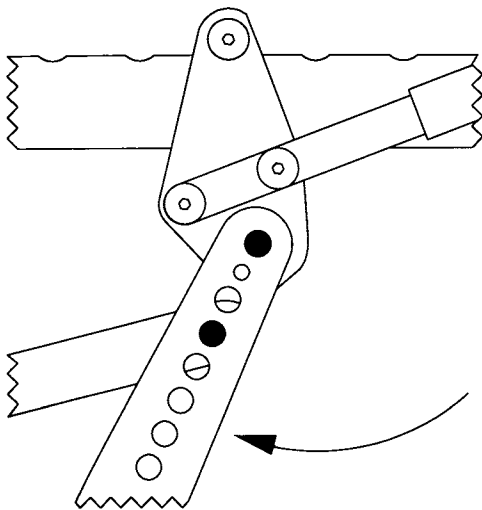
This photo shows the correct configuration of the Compact Bender outfitted with the Leverage Multiplier. Before the multiplier can be used, the slide bar must be bolted to the back of the bender (refer to the exploded view and assembly view drawings for clarification). In this photo the push bars are located at the second hole position of the handle. This position gives the largest mechanical advantage, but other hole positions can be used for faster bending of tubing.

Ratings

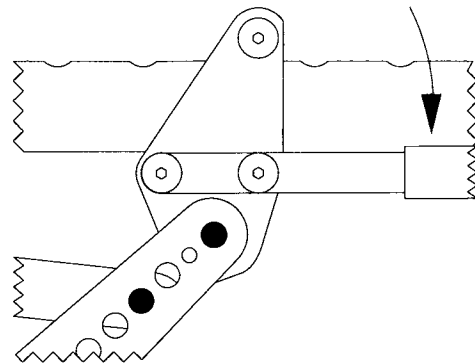
Using the Multiplier to bend heavy solid stock can damage the bender and is not recommended. The Leverage Multiplier is used with the 20/20 Compact Bender to bend 1" and 1 1/4" round and square tubing within specifications shown on page 42.

Operation

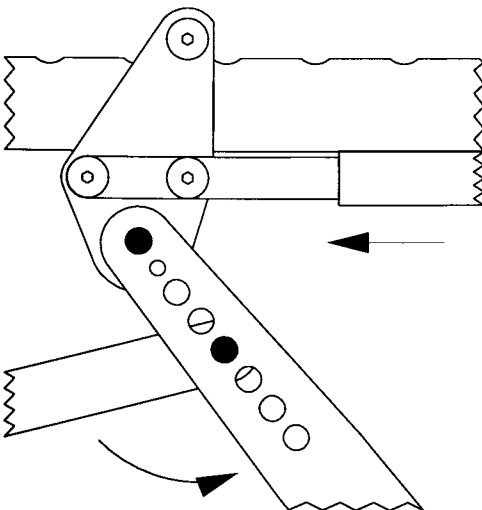
The illustrations below show how the Multiplier works. In these drawings, the push bars are located at the second hole position of the handle. This position gives the largest mechanical advantage, but other hold positions can be used for faster bending. Make certain bushing on slide plate is locked in notch in slide bar before applying pressure to handle to make any bends.



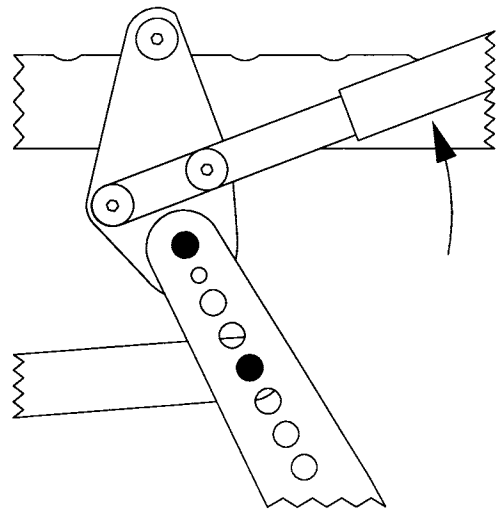
Step 1: The handle is pulled toward the bender to bend the tubing



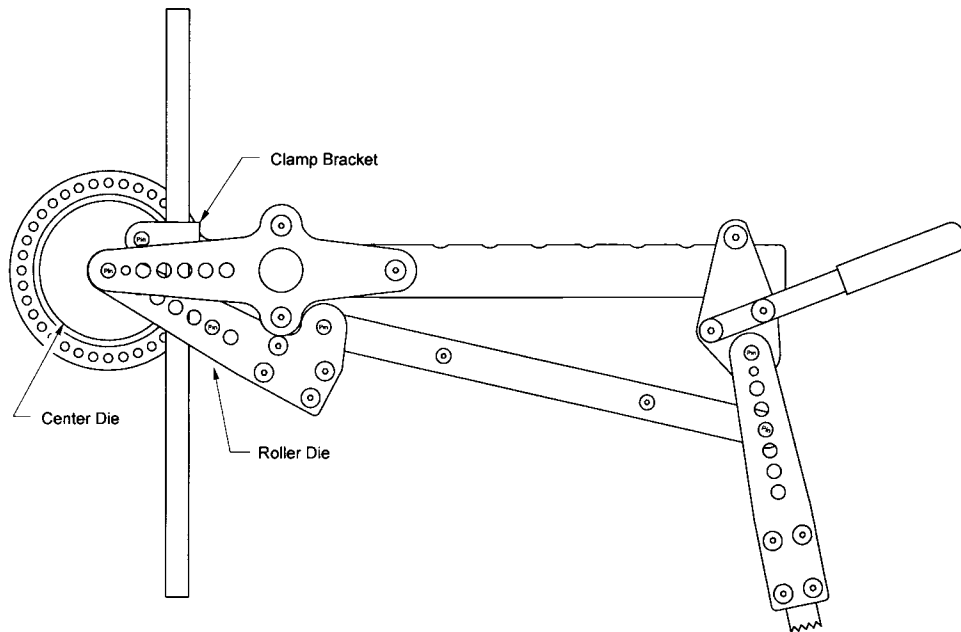
Step 2: The slide lock is released from the slide bar.



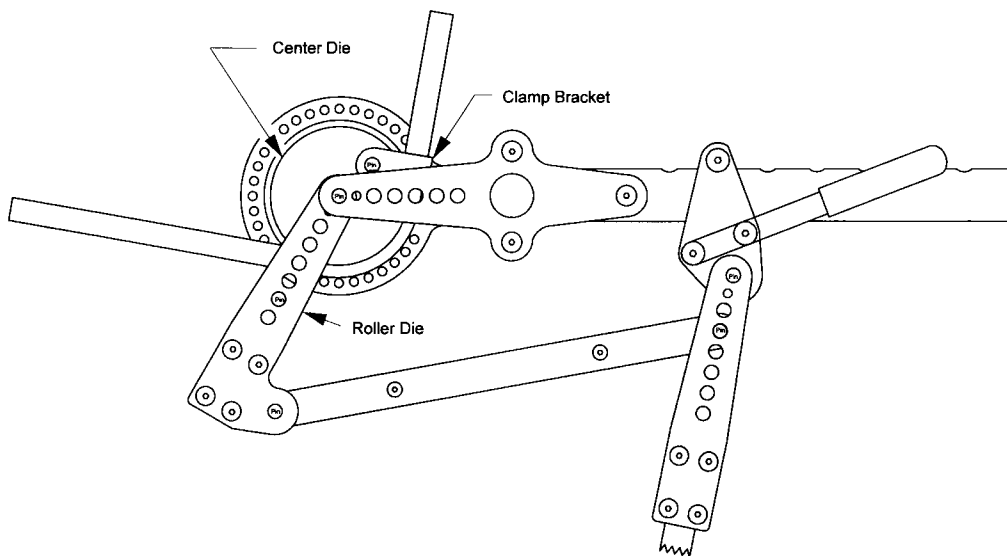
Step 3: The slide lock is advanced forward along the slide bar while the handle swings back away from the bender.



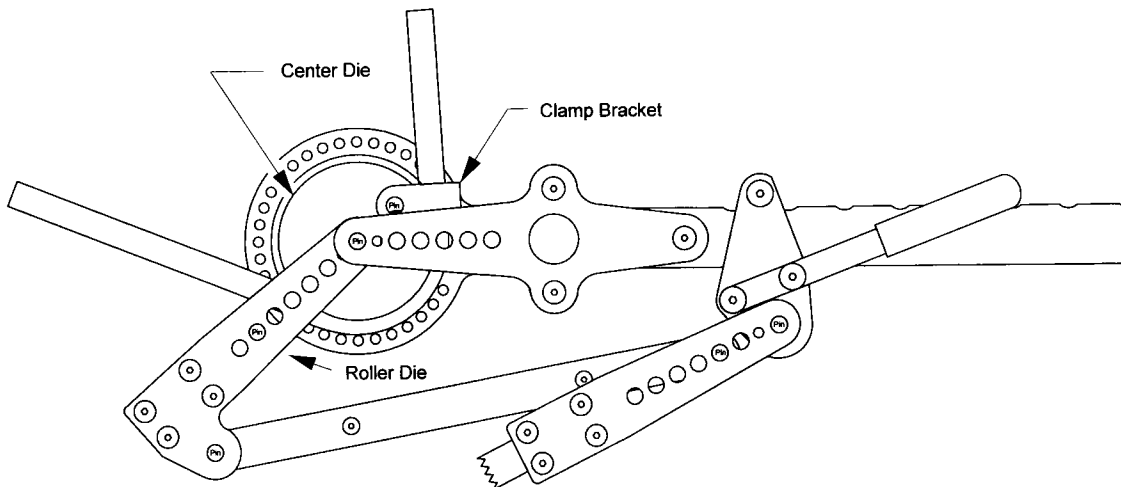
Step 4: The slide lock is locked to the slide bar in preparation for further bending.

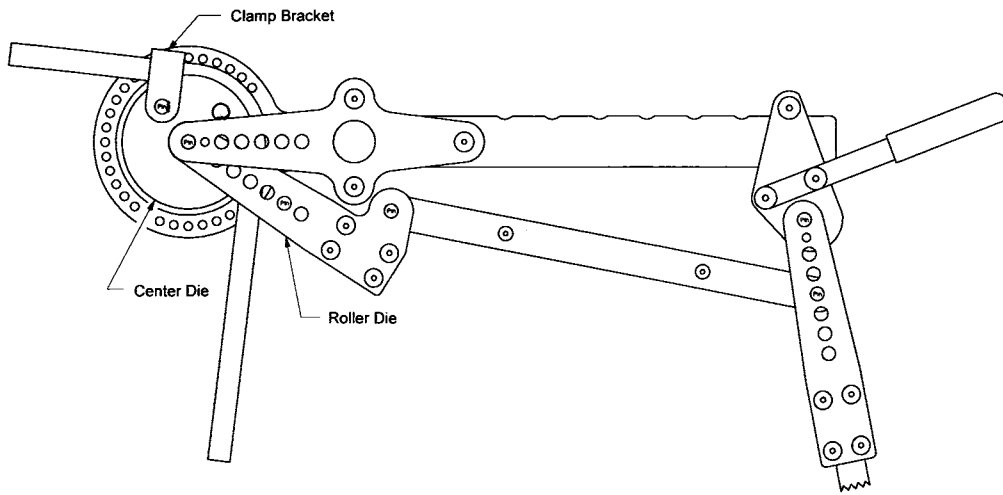


The drawing shown above illustrates how to position the tubing for bending. The tube clamp is held to the tubing die by a short flat sided pin. The flat side of the pin pushes against the side of the bender ring assembly. When bending round tubing (as in this illustration) be sure to use a roller die of the correct size. Failure to do so will cause the tubing to collapse during bending.

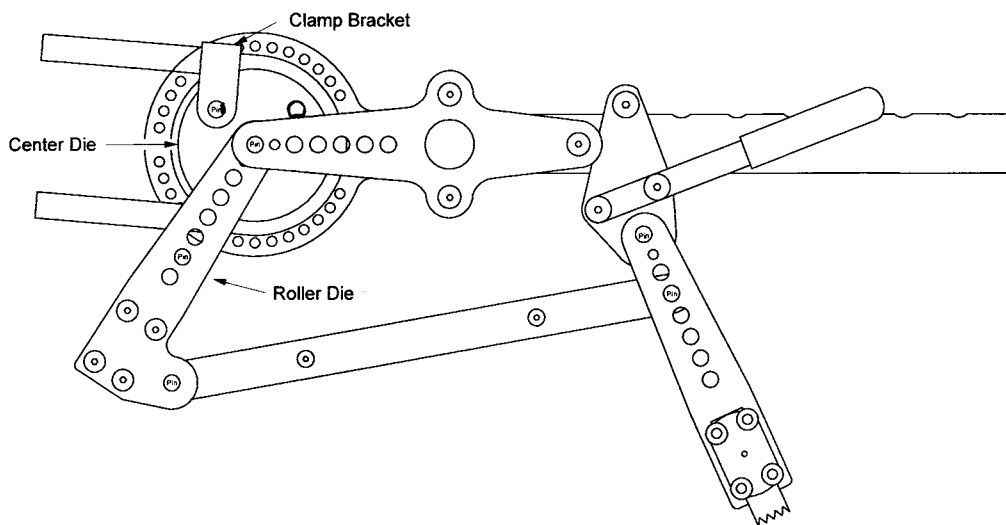


The above drawing shows the same tubing after it has been bent 90 degrees. The tubing can actually be bent further than 90 degrees without changing the first setup, as in the example shown below. However, for bending the tubing to 180 degrees, you need only to bend the tubing at least 90 degrees in this setup.

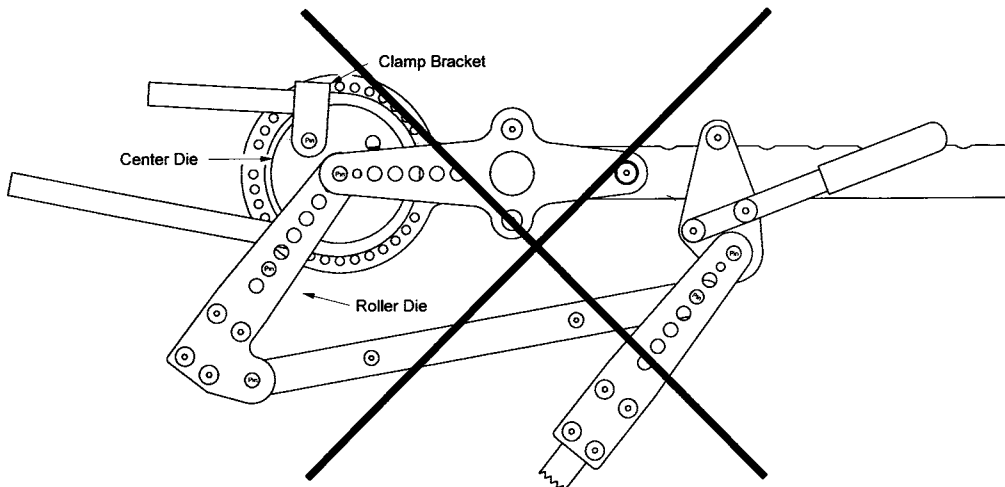




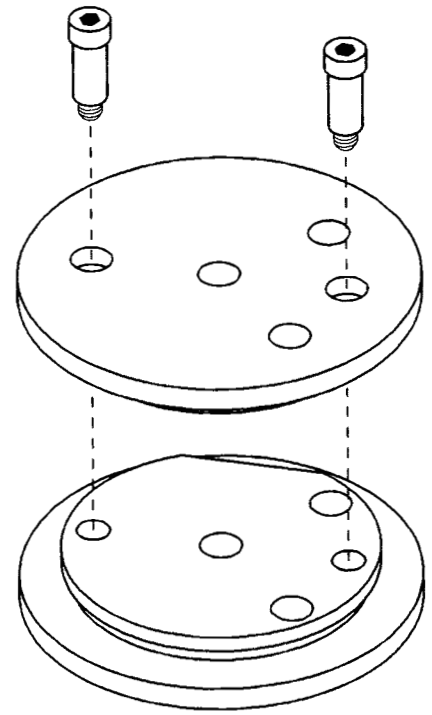
If you plan to bend the tubing to 180 degrees, the tubing must be set up as shown above-after it has been bent at least 90 degrees. The most important thing to remember during this step is to make sure that the tubing is level with the tubing die before you begin the second bend. If it is not, the final bend will not be straight. To level the tubing, you can sight it along the tubing die, but using a level on the tubing gives the best results. When making several bends, set an adjustable stand to support the tubing as it is bent.



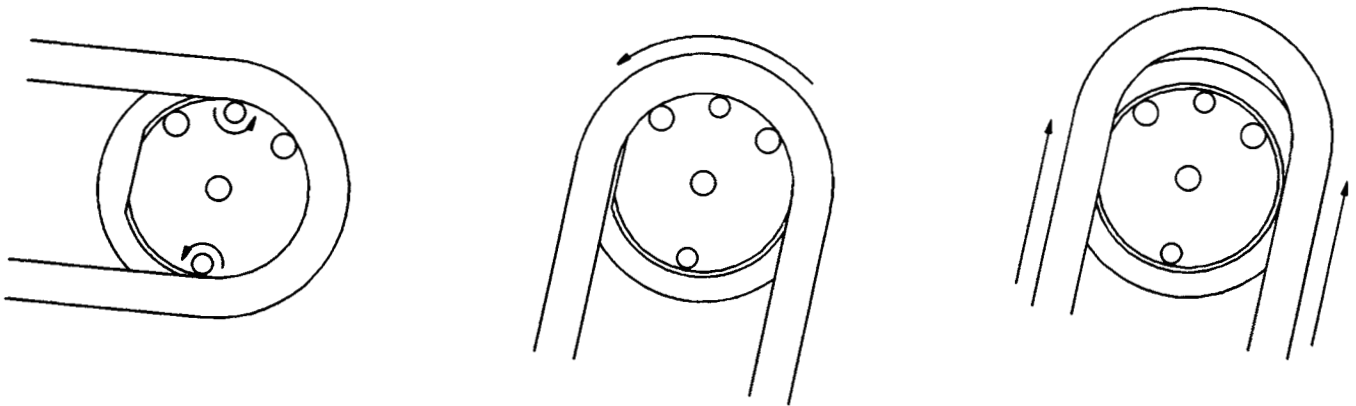
The above drawing shows the tubing after it has been bent 180 degrees. **Do not bend the tubing past 180 degrees** under any circumstances, or it will not slide out of the tubing die (as shown below).



Split Dies for Square Tubing



The 1" square tubing die is shown above. The die actually consists of two halves which are held together by shoulder bolts. The bolts can be loosened for easy removal of the tubing after bending. Notice that the square tubing dies have a flat section along the inside surface. This flat section is located on the side of the die around which the tubing is never bent. The flat section allows you to remove tubing from the die after it has been bent to 180 degrees.



The above drawings illustrate how to remove tubing bent to 180 degrees. (For better illustration, the top half of the tubing die is not shown. However, you should not have to actually disassemble the tubing die during normal use.) First, loosen the shoulder bolts. The tubing can then rotate around the die until the flat section of the die lies parallel with a leg of the tubing. Finally, the tubing slides freely off the die.

#238 Pedestal Ring Roller



Roll circles and arches from 8" diameter and larger out of hot rolled mild steel up to a maximum capacity of 3/8" x 2" flat and up to 1/2" square. Optional Dies for rolling round stock are also available (www.shopoutfitters.com). The 30" hand wheel drives the heat treated drive roller which in turn forces the material over the hydraulically adjustable die rollers to form an almost infinite number of ring sizes. All working parts are precision machined and are fully replaceable. Ships UPS in three boxes and comes with instruction manual.

Optional Picket Twister

The optional Picket Twister works with the 20/20 Compact Bender to twist 3/16" x 1" and 1/2" square pickets from hot rolled stock. Your 20/20 Compact Bender already has the picket twister receiver built into it's design ready for use with the picket twister attachment. The twisted section of the picket (not including the untwisted flat left on both ends) can be twisted up to 36" in length. You can vary the appearance of the pickets by how tightly you twist them and by how much untwisted flat is left on each end of the picket. The adjustable stop allows you to set how much flat remains on each end.

For a Video Demonstration go to <http://www.shopoutfitters.com/PicketTwisting2.html>



NOTE:
20/20 COMPACT BENDER
already has receiver built
in for rotating head.



While twisting a picket, you must keep a firm grip on the handle. Otherwise, the spring that remains in the picket while it is under torque can be a hazard. Contrary to what some think, the length of the picket does not shorten while it is twisted.

Another advantage of the Picket Twister over hand-operated benchmounted twisters is that you can put more force into twisting the pickets because you actually walk around the machine during twisting.



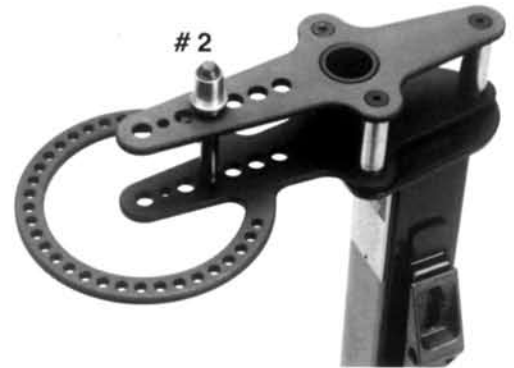
Scroll Bending Attachment



The scroll bending attachment is designed for bending 3/16" x 1/2" up to 3/16" x 1" hot rolled mild flat stock as well as 1/4" round. The bushing supplied with the scroll attachment keeps the scroll flat as it is formed. To form scrolls out of 1/4" round the bushing is turned upside down. The new scroll attachment shown here has letters embedded in its surface to allow you to make repetitive size scrolls. When forming a particular scroll size such as a 'B' scroll simply turn the crank handle until the material just touches the 'B' mark on the side of the scroll attachment. Chalk marks can also be used for scroll sizes in between the designated scroll sizes.

For 1/8" flat bar scrolls a shim will be needed to keep the material in place.





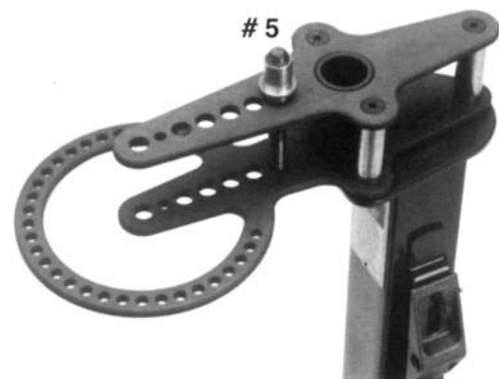
Regardless of the desired scroll size, always begin the scroll by placing the pin and bushing into #2 hole as shown above.

Make certain that the scroll remains rested on the flange of the roller bushing during all scroll bending operations.



Continue bending the scroll across the entire bending surface of the scroll attachment's center-piece. **Do not** bend the scroll past the end of the centerpiece, or the scroll will be distorted.

Turn the crank handle until the material just touches the letter size mark on scroll attachment side to make that particular scroll letter size.



When bending larger scrolls, move the pin and bushing to hole #5 after the first stage (bending of the scroll around the centerpiece) has been completed. Never try to start a scroll with the pin and bushing positioned in hole #5 as shown above.

For a Video demonstration go to <http://www.shopoutfitters.com/Scrollbender2.html>



Shown to the left is an outdoor flowerpot holder. The legs were first twisted using the PT Picket Twister (Pg. 48). After the twists the 3/16" x 1" Hot Rolled Flat Stock was inserted into the SA Scroll Attachment (Pg. 50) and scrolled on each end. Then the legs were welded to rings rolled on the 238 Pedestal Ring Roller (pg 47). Additional scrolls were added for decorative and structural support.

This is a great simple project that will incorporate many facets of your compact bender. In the future look for more projects and ideas at:
www.industrialartsprojects.com.

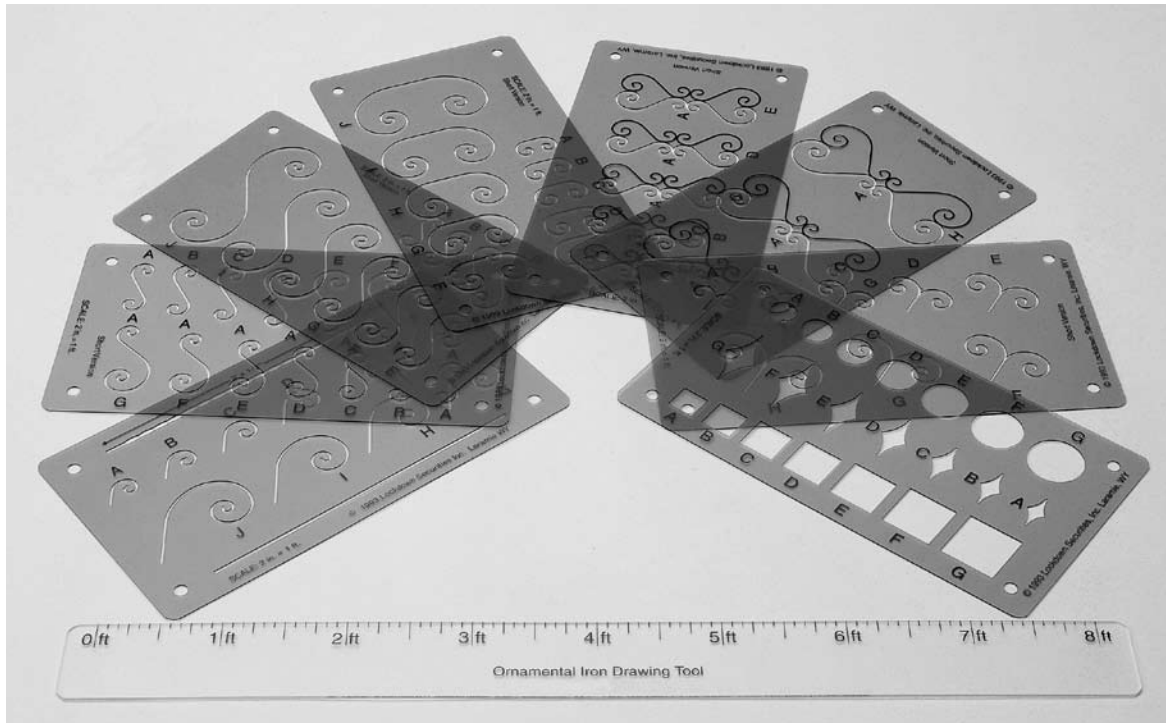
Ornamental Coffee Table

Shown below is a decorative coffee table which was formed using the bender. The outside scrolls were made using 3/16"x1" Hot Rolled Mild flat stock. The hearts were also fashioned using the Scroll Attachment this time with 3/16"x1/2" Hot Rolled Mild flat stock. The ring on the bottom was rolled using the 238 Pedestal Ring Roller, however the smaller ring on the top can be cut from a piece of pipe using our EV-996 Industrial Bandsaw. The metal clips you see adorning different joints was created using the WA Wrap Attachment. For more information on the Band Saw and Wrap Attachment please go to www.shopoutfitters.com or call (719) 676-5555.

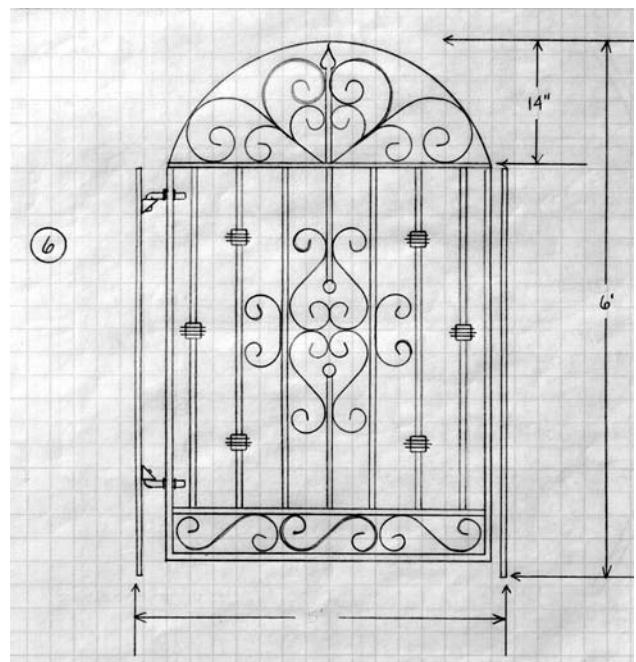


Making Detailed Ornamental Iron Drawings

The specialized ornamental iron drawing system allows you to draw ornamental iron designs to scale before you attempt construction of a project. The system includes a scaled ruler and an assortment of 8 drawing templates. A wide variety of scrolls can be effortlessly drawn, as well as pickets and other essential parts of ornamental iron. Little drawing talent is required to make the drawings, which are all drawn to the scale of 2" = 1' (or 1/6th). To draw scrolls, a sharp wooden pencil or mechanical pencil is inserted into the slot of the scroll size you desire. The scroll is then traced out. With the ornamental iron drawing system, you layout your plans on paper rather than making several potential scrap scrolls when using the old "bend it to see if it fits" method.

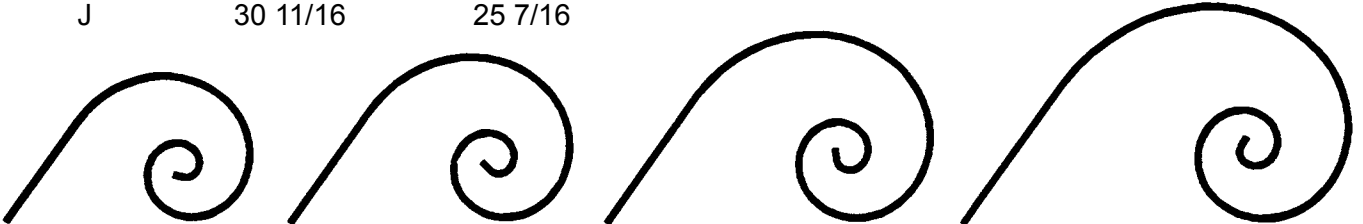


Shown to the right is a sample drawing drawn with the drawing tools. Above is shown the set of eight rugged plastic drawing templates and the 2" = 1' scale ruler. To order go to www.shopoutfitters.com

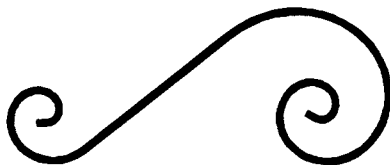


Bending Different Sizes of Scrolls

The scrolls on the drawing templates are categorized by ten different sizes, designated as sizes A to J. Instructions for making the scroll sizes are shown in the table below. The table shows the scroll size and the blank length (length that stock should be cut to before bending begins). When bending the scroll, insert the end farthest away from the chalk mark into the scroll attachment. Bend the scroll until the chalk mark touches the side of the scroll attachment. In other words, the bend in the scroll will end at the chalk mark, leaving the remaining material flat.

Scroll Name	Blank Length (inches)	Length of material used up in bent part of scroll (inches)	
A	8 5/16	6 3/8	
B	9 11/16	7 5/8	
C	11 3/16	8 13/16	
D	12 15/16	10 3/8	
E	14 15/16	11 7/8	
F	17 1/8	13 15/16	
G	19 3/4	16 1/8	
H	22 3/4	18 11/16	
I	26 5/16	21 7/16	
J	30 11/16	25 7/16	

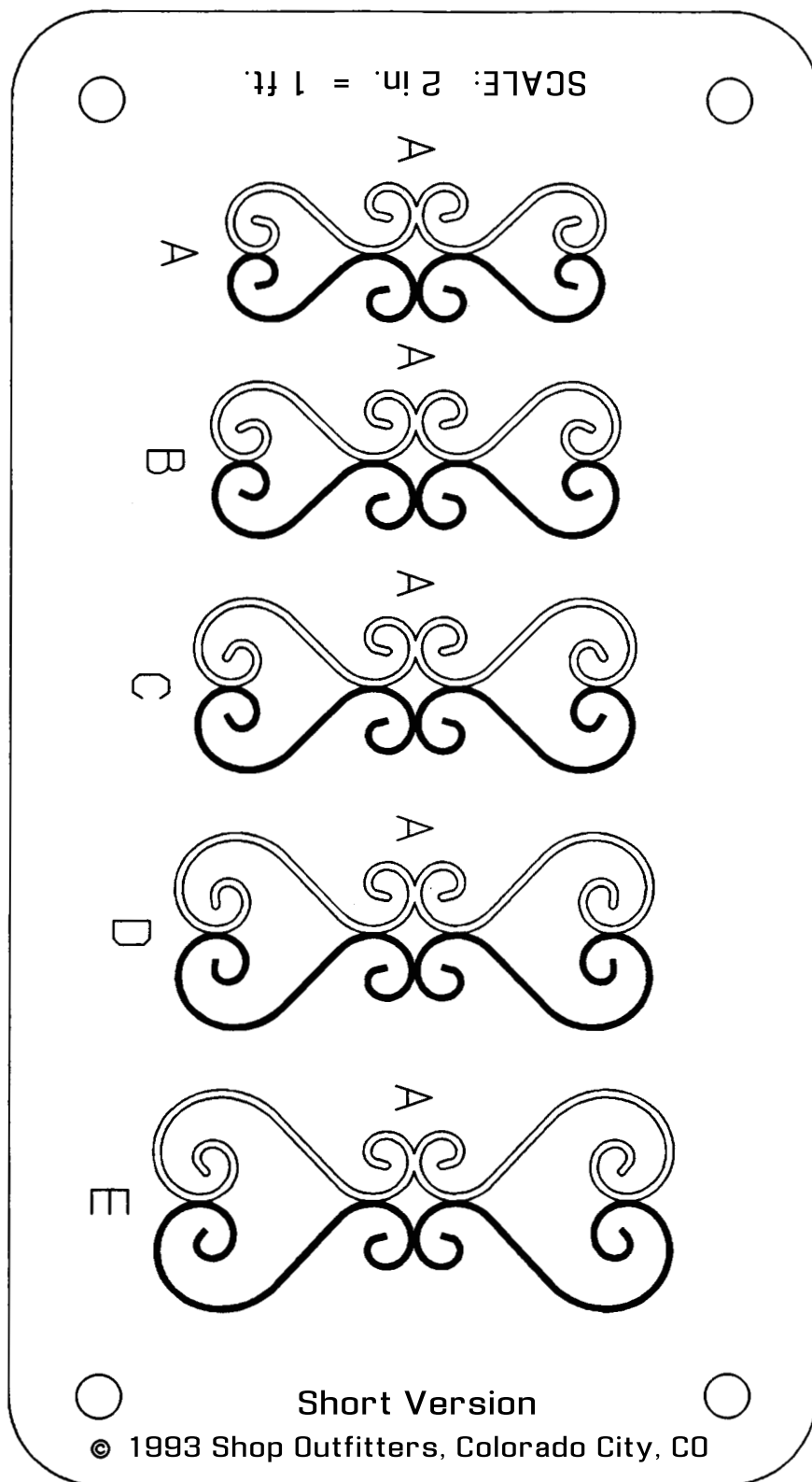
The scrolls shown above can be drawn with one of the drawing templates to their scale of 2" = 1'.



Two scrolls can be coupled to form more complex scrolls, which have no connecting joints. For the 'S' shaped scroll shown above, the blank length of the 'A' scroll was added to the blank length of the 'G' scroll, giving a total blank length of 28 1/6". Finally, both ends of the scroll are bent without flipping over the scroll.



For the 'C' shaped scroll, the length of material used up in bent part of the 'E' scroll is added to the blank length of the 'E' scroll, giving a total blank length of 26 13/16". (If both blank lengths were added, the length of the flat section would be too long and would make the scroll cumbersome.) The scroll is flipped over between bends so that the scrolls face in opposite directions.



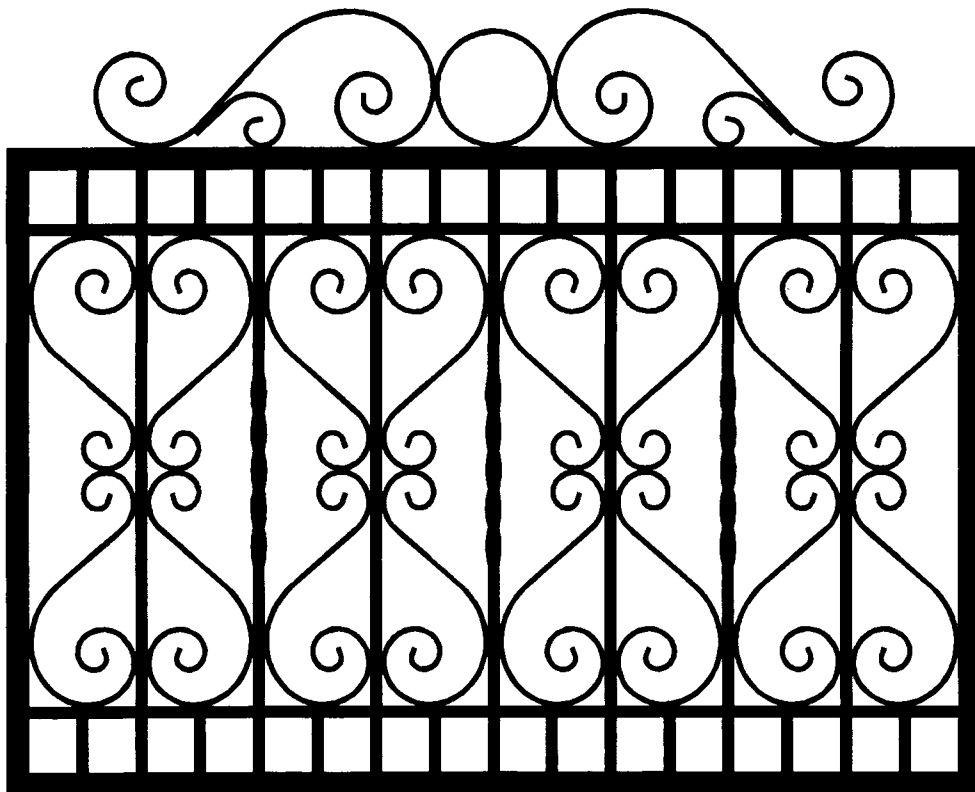
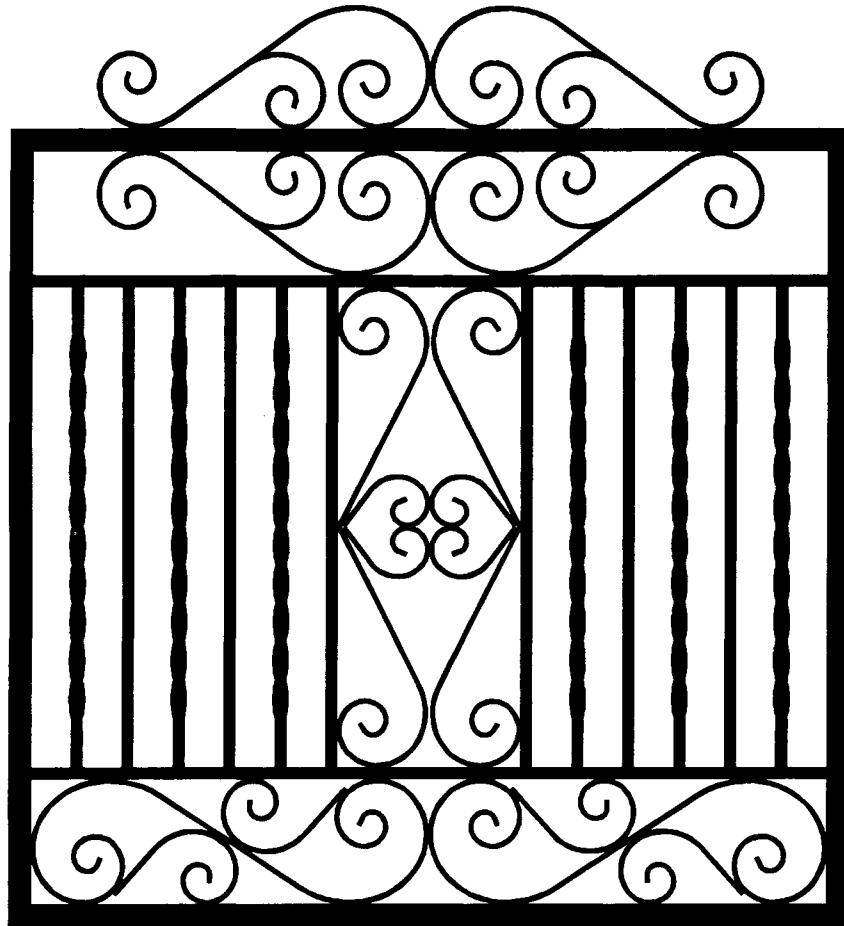
To the left is shown card 5 at its actual size.

The drawings shown on the right were originally designed and drawn with the ornamental iron drawing system by Al Bulle. Al has many years of experience building ornamental iron but almost no experience drawing it.

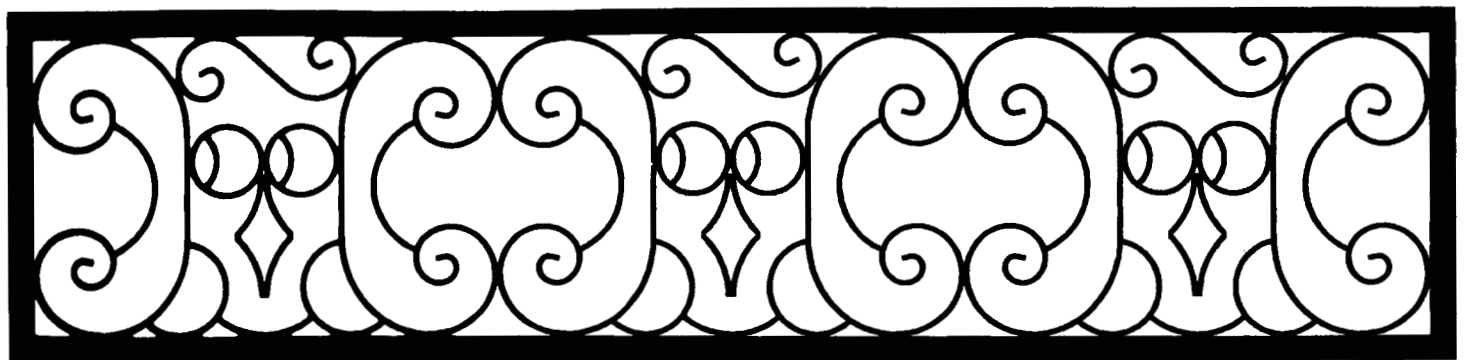
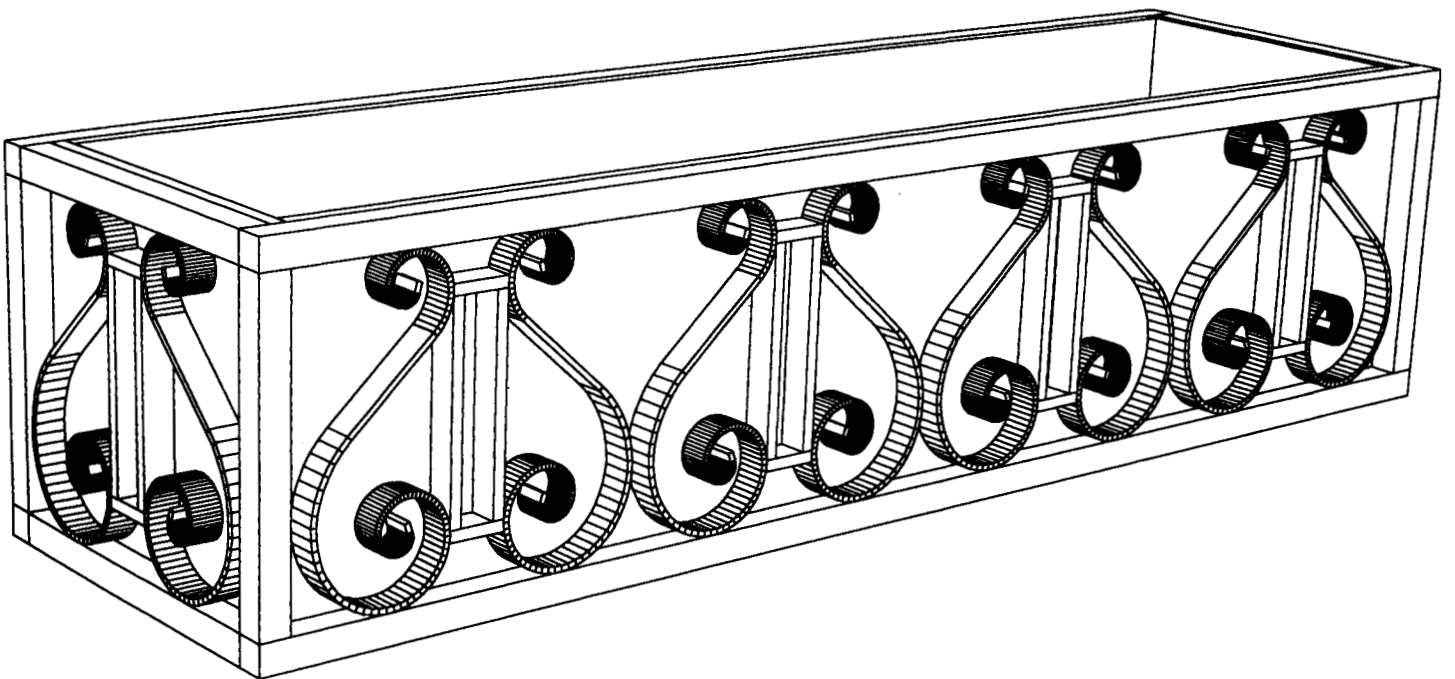
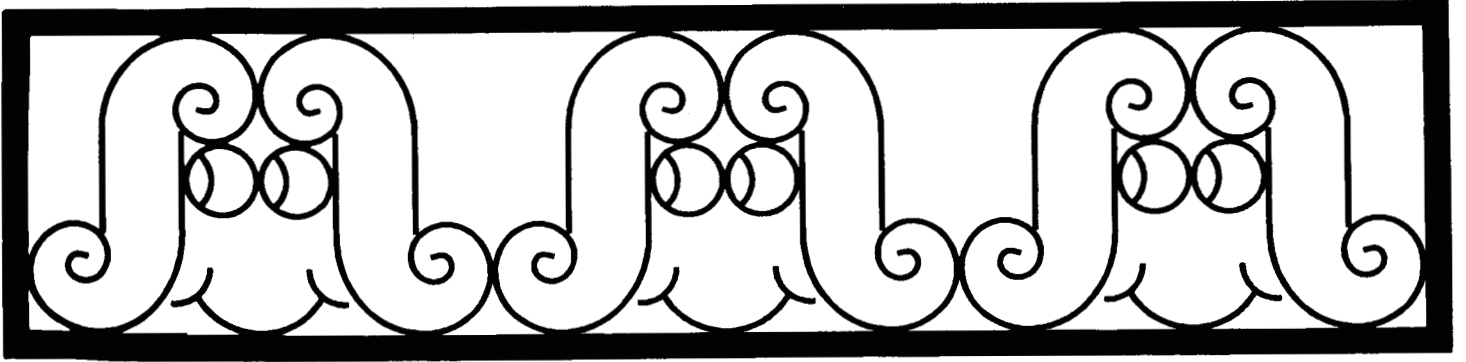
If you enjoy making ornamental scroll work, you will find the Ornamental Iron Drawing Tools well worth the investment.

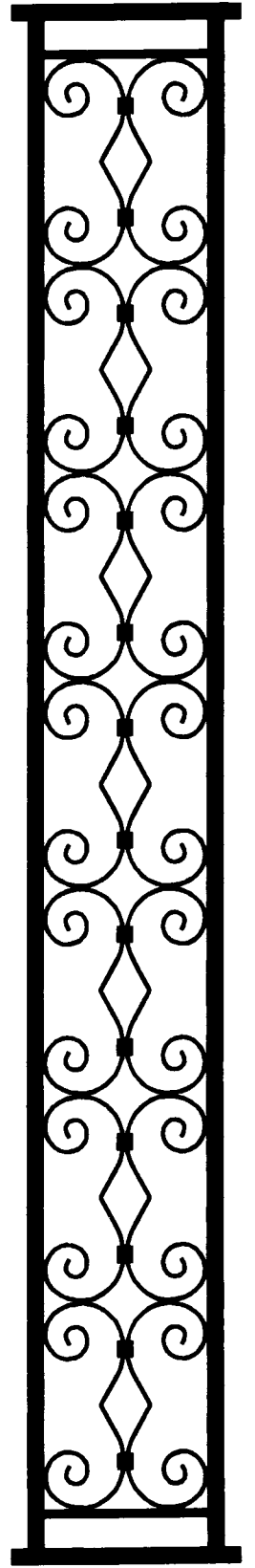
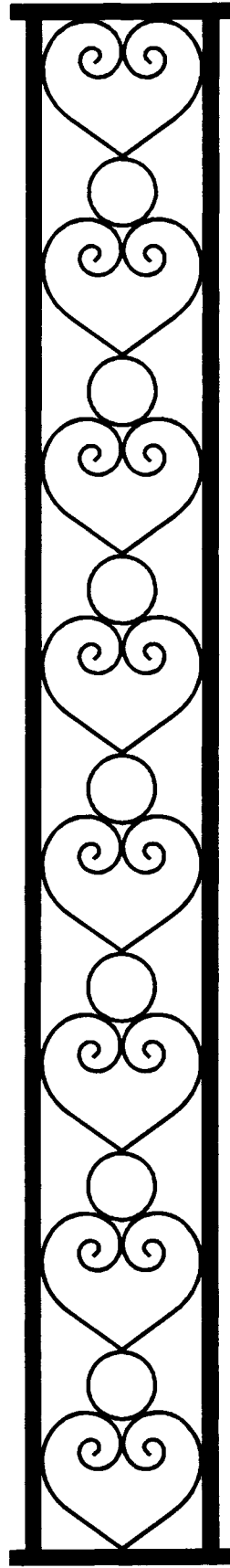
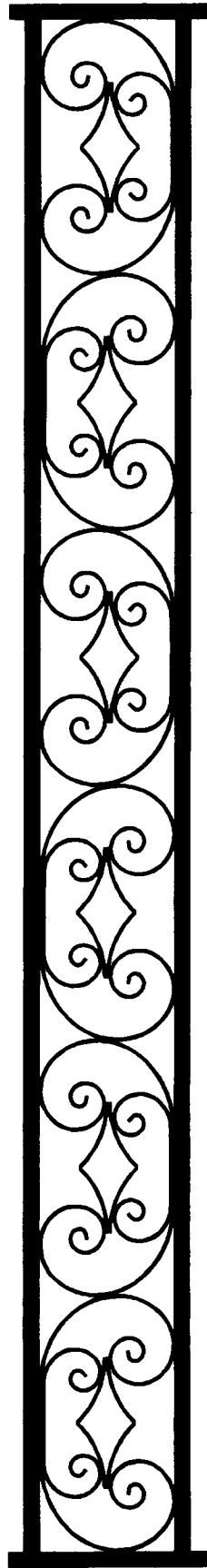
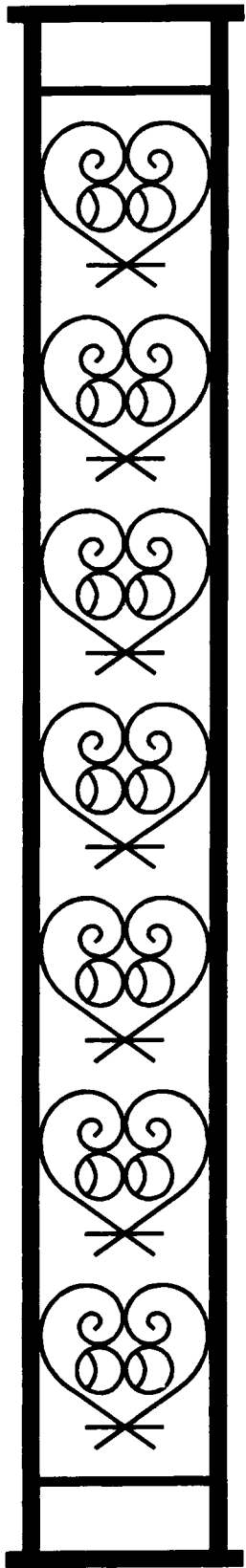
The Ornamental Iron Drawing Tools are eight plastic templates and a 2" = 1' scale ruler, all of which are shown on page 54. The designs on each template are marked with letters which are used to reference their sizes.

Specifications for all scroll designs are listed in the Drawing Template Manual. All objects are drawn to the scale of 2" = 1'.











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WWW.SHOPOUTFITTERS.COM

P.O. Box 20106

4932 GRANEROS Rd

COLORADO CITY, CO 81019

(719) 676-5555 • FAX: (719) 676-5554

SALES@SHOPOUTFITTERS.COM

