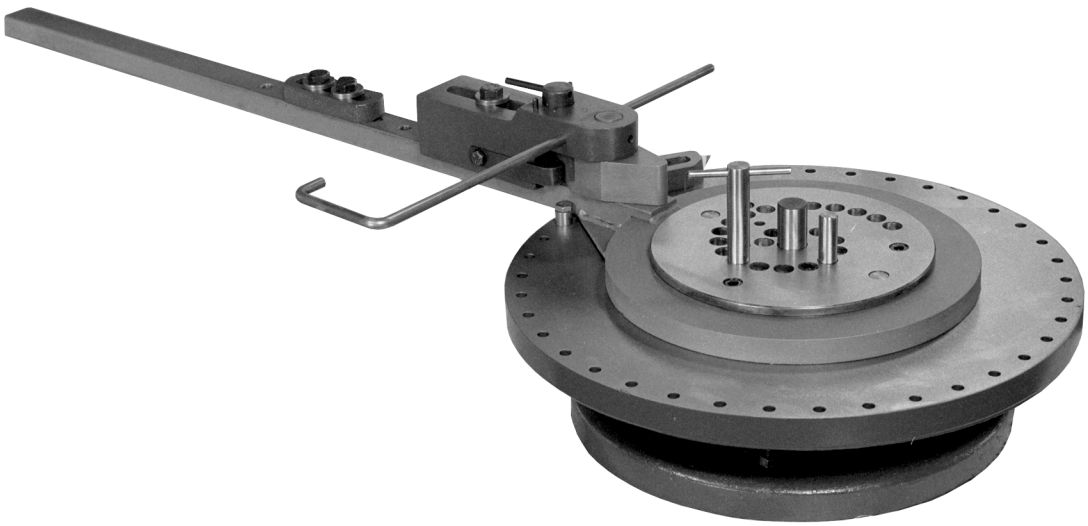
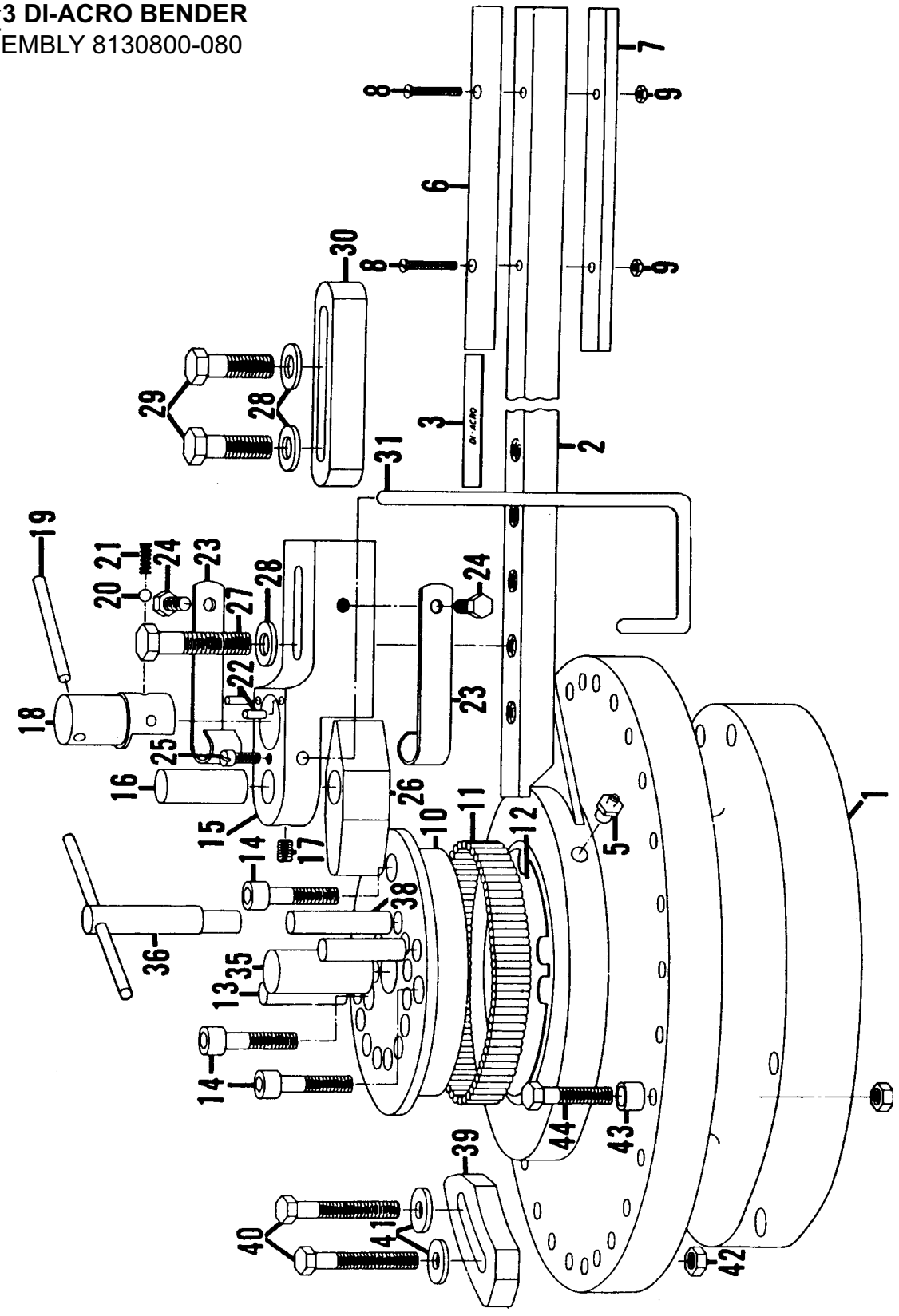
OPERATOR'S MANUAL & INSTRUCTIONS

NUMBER 3 Di-Acro Hand Bender



Di-Acro, Incorporated
PO Box 9700
Canton, Ohio 44711
3713 Progress Street N.E.
Canton, Ohio 44705
330-455-1942
330-455-0220 (fax)
Revised 01/02

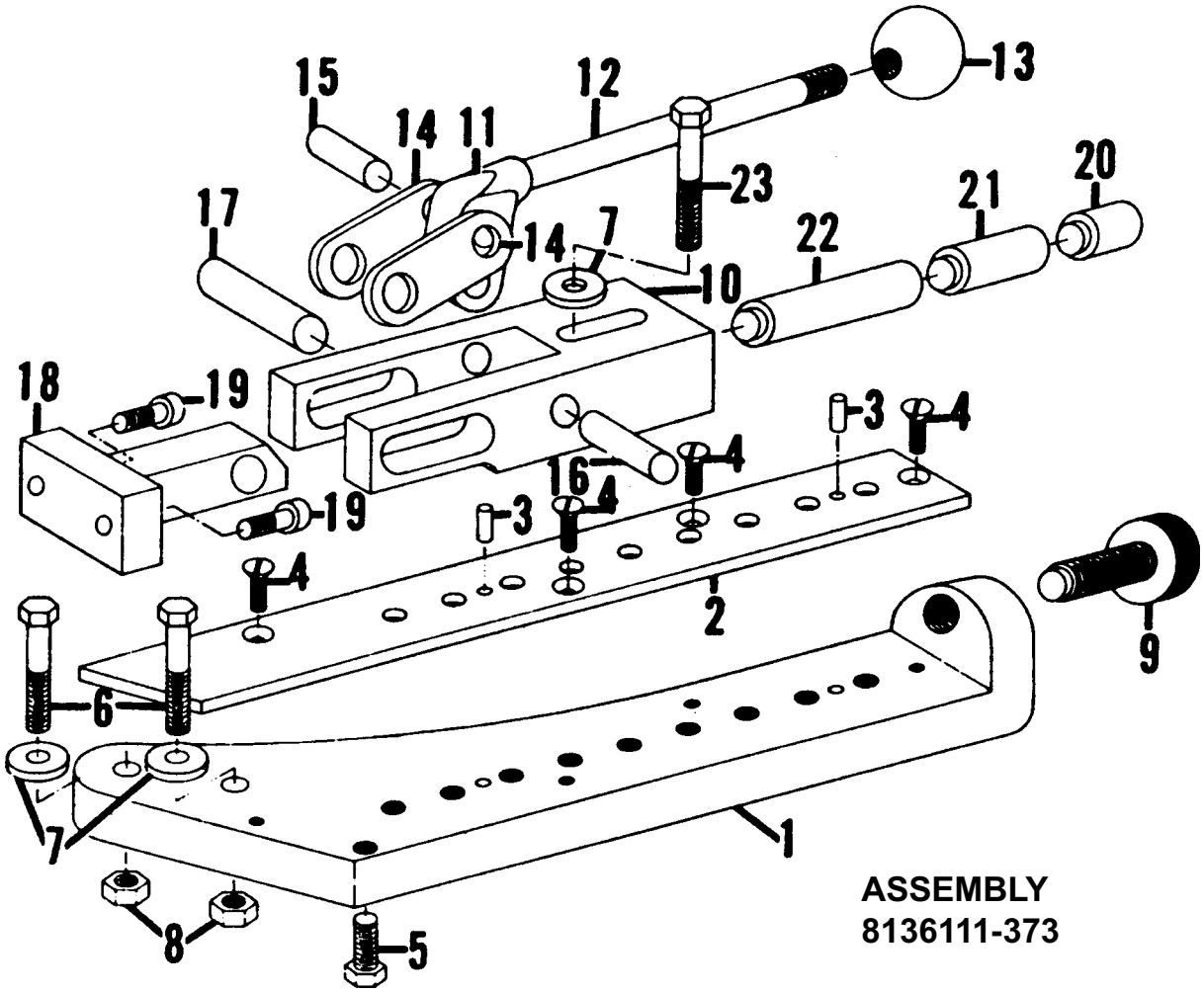
NO. 3 DI-ACRO BENDER
ASSEMBLY 8130800-080



#3 BENDER PARTS

ITEM	DESCRIPTION	PART NUMBER	QTY
	BENDER #3	**8130800-080**	
1	BASE	8130110-100	1
2	HANDLE ARM WELDMENT	8100120-800	1
3	NAME PLATE	8130650-110	1
5	GREASE FITTINGS	8901004-000	1
6	HANDLE UPPER	8130120-800	1
7	HANDLE LOWER	8000120-800	1
8	SCREW	22CXX08C1304	2
9	NUT	31XX08S	2
10	MOUNTING PLATE	8130110-501	1
11	ROLLER	8310300-200	109
12	SHIMS	8130570-203	6
13	PIN	8130120-301	2
14	SCREW	20A0308C102	3
15	NOSE HOLDER	8200121-701	1
16	NOSE PIN	8000120-301	1
17	SCREW	20A0516C0102	1
18	TRIGGER	8158121-702	1
19	PIN	19A0104X2102	1
20	STEEL BALL	0010461-000	1
21	SPRING	8120510-202	1
22	NEEDLE ROLLER	8310301-200	2
23	NOSE SPRING	8120510-401	2
24	SCREW	21A0516C0102	2
25	SCREW	20A0104F0508	1
26	FORMING NOSE	8130121-701	1
27	SCREW	21A0102F2102	1
28	WASHER	61X0102	4
29	SCREW	21A0102F2000	2
30	NOSE HOLDER SUPPORT	8120121-701	1
31	BEND LOCATING GAUGE	0134352-100	1
35	RADIUS PIN	8130016-970	1
36	LOCKING PIN ASSEMBLY	8130120-371	1
38	PIN	8130120-303	1
39	ANGLE GAUGE	8120142-001	1
40	SCREW	21A0104F0508	2
41	WASHER	61X0308	2
42	NUT	30X0308C	3
43	RETURN STOP	8100142-001	1
44	SCREW	21A0308C2104	1

#3 BENDER
QUIK-LOK ASSEMBLY



ASSEMBLY
8136111-373

CAUTION

TO PREVENT SERIOUS BODILY INJURY AND DAMAGE TO THE MACHINE

BOLT THE MACHINE TO THE STAND AND THE STAND TO THE FLOOR

THE ART OF BENDING

FOR A COMPLETE DESCRIPTION OF 20 BENDING OPERATIONS WITH CLEAR STEP-BY-STEP ILLUSTRATIONS OF EACH, ORDER THE 20-PAGE DI-ACRO “ART OF BENDING” CATALOG WITH OVER 90 DIAGRAMS AND CHARTS TOGETHER WITH VALUABLE TOOLING SUGGESTIONS.

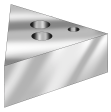
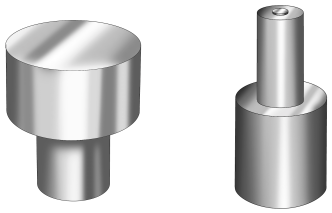
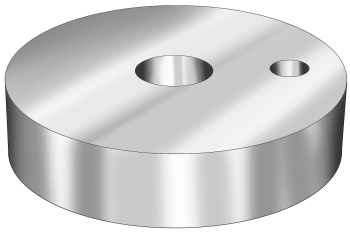
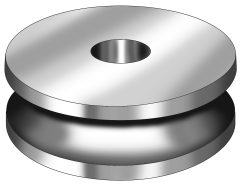
#3 BENDER QUIK-LOK PARTS

ITEM	DESCRIPTION	PART NUMBER	QTY
	QUIK-LOK #3 BENDER	**8136111-373**	
1	BASE	8136111-300	1
2	SLIDE	8600111-300	1
3	PIN	19A0104X1000	2
4	SCREW	22C0104F0304	4
5	SCREW	21A0308C2104	1
6	SCREW	21A0308C2304	2
7	WASHER	61X0308C1332	3
8	NUT	30X0308C	2
9	KNR HEAD SCREW	8500111-301	1
10	HANGER	8126111-302	1
11	HANDLE BLOCK	8400111-300	1
12	HANDLE ROD	8500111-300	1
13	PLASTIC KNOB	8120810-700	1
14	LINK	8930111-300	2
15	LINK PIN	8156120-301	1
16	PIN	19A0102X2102	1
17	PIN	19A0508X2102	1
18	NOSE ASSEMBLY	8920111-300	1
19	SCREW	20A0516C0508	2
20	SPACER ROD A	8156111-301	1
21	SPACER ROD B	8300111-301	1
22	SPACER ROD C	8400111-301	1
23	SCREW	21A0308C3000	1

SPECIFICATIONS

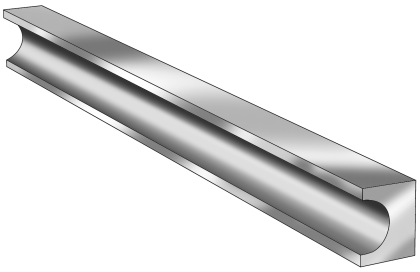
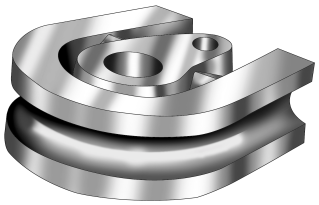
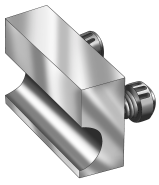
	No. 1A		No. 2		No. 3		No. 4	
Model	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**
Max. Radius Capacity	6	152.4	9	228.6	12	304.8	12	304.8
Height of Standard Forming Nose	3/4	19.1	1	25.4	1-1/2	38.1	1-1/2	38.1
Center Pin Hole—Diameter	1/2	12.7	1	25.4	1	25.4	1	25.4
Operating Leverage	16	406.4	29	736.6	40	1016	40	1016
Material Capacities								
Round Mild Steel Bar	5/16	7.9	1/2	12.7	5/8	15.9	1	25.4
Square Mild Steel Bar	1/4	6.4	3/8	9.5	1/2	12.7	3/4	19.1
Steel Tubing—16 gauge	1/2	12.7	3/4	19.1	1	25.4	1-1/4	31.8
Standard Iron Pipe	—	—	3/8 IPS	9.5	1/2 IPS	12.7	1 IPS	25.4
Flat Steel Bar (easy way)	3/16 x 1,4.8 x 25.4		1/4 x 1-1/2,6.4 x 38.1		1/4 x 2,6.4 x 50.8		3/8 x 4,9.5 x 101.6	
Flat Steel Bar (hard way)	1/8 x 1/2,3.2 x 12.7		1/8 x 3/4,3.2 x 19.1		1/8 x 1,3.2 x 25.4		1/4 x 1,6.4 x 25.4	

#3 BENDER TOOLING

DESCRIPTION	PART NUMBER	SIZE
BUILT-UP NOSE 	8130250-000	4” HT.
FORMING ROLLER 	8130690-000	3” DIA.
RADIUS BLOCK 	8130000-920	0” RAD.
 **RADIUS PIN**	8130004-970 8130006-970 8130008-970 8130010-970 8130012-970 8130014-970 8130016-970 8130020-970 8130024-970 8130028-970	1/8” RAD. 3/16” RAD. 1/4” RAD. 5/16” RAD. 3/8” RAD. 7/16” RAD. 1/2” RAD. 5/8” RAD. 3/4” RAD. 7/8” RAD.
 **RADIUS COLLAR**	8130100-930 8130108-930 8130116-930 8130124-930 8130200-930 8130208-930 8130216-930 8130224-930 8130300-930	1” RAD. 1-1/4” RAD. 1-1/2” RAD. 1-3/4” RAD. 2” RAD. 2-1/4” RAD. 2-1/2” RAD. 2-3/4” RAD. 3” RAD.
 **GROOVED ROLLER**	8130016-790 8130020-790 8130024-790 8130028-790 8130100-790	**TUBE DIA.** 1/2” 5/8” 3/4” 7/8” 1”

SPECIAL TOOLING IS AVAILABLE FOR SIZES NOT SHOWN

#3 BENDER TOOLING

DESCRIPTION	PART NUMBER	SIZE	
 **FOLLOW BLOCK**		**LENGTH**	**TUBE DIA.**
	8136016-622	6”	1/2”
	8136016-623	9”	1/2”
	8136016-624	12”	1/2”
	8136020-622	6”	5/8”
	8136024-623	9”	3/4”
	8136024-624	12”	3/4”
	8100024-625	15”	3/4”
	8136028-623	9”	7/8”
	8136028-625	15”	7/8”
	8136028-627	21”	7/8”
	8136100-624	12”	1”
	8000100-625	15”	1”
	8136100-627	21”	1”
 **GROOVED RADIUS COLLAR STYLE A** (USE WITH QUIK-LOK CLAMP)		**C/L RADIUS**	**TUBE DIA.**
	8136108-016	1-1/4”	1/2”
	8136200-016	2”	1/2”
	8136300-016	3”	1/2”
	8136124-020	1-3/4”	5/8”
	8136200-024	2”	3/4”
	8136300-024	3”	3/4”
	8136400-024	4”	3/4”
	8136216-028	2-1/2”	7/8”
	8136400-028	4”	7/8”
	8136600-028	6”	7/8”
	8136300-100	3”	1”
	8136400-100	4”	1”
	8136600-100	6”	1”
 **CLAMP BLOCK** (USE WITH QUIK-LOK CLAMP)		**TUBE DIA.**	
	8136016-320	1/2”	
	8136020-320	5/8”	
	8136024-320	3/4”	
	8136028-320	7/8”	
	8136100-320	1”	

SPECIAL TOOLING IS AVAILABLE FOR SIZES NOT SHOWN

BENDER TOOLING

SPECIAL TOOLING FOR YOUR SPECIAL BENDING NEEDS

When you have a bending problem in production or design, Di-Acro can aid you at no obligation. Just send blueprints, dimensioned sketches, or the part you wish to produce to our Applications Engineering Department and your plans will receive prompt attention.
Special tooling? Here is some tooling we have available: Crush-bend tooling, automatic follow-bar return, wiper dies and ball mandrels for thin-walled tight radius tube bending, power clamping for high speed application, pneumatic mandrel extractor.

SPRING BACK - When determining the size of the Radius Pin or Collar, spring-back should be compensated for. A frequent way is by overbending slightly beyond the required angle. After the amount of spring-back has been determined, the Angle Gauge can be set so that all bends will be duplicated. In addition to overbending, it may be necessary, in some cases, to form the material around a Radius Pin or Radius Collar of smaller radius than the desired bend. The actual size of th Radius Pin or Collar can best be determined by experiment for the material and conditions.

FORMING ROLLER - To eliminate work marking and reduce operator effort, it is often desirable to replace the Forming Nose (furnished as standard equipment), with a Forming Roller.

BUILT-UP FORMING NOSE - This is used to increase the material width range of Di-Acro Benders. Must be used with wider or stacked radius collars.

There are two tube bending methods:
1. The “Forming Roller” method is recommended for (a) all large bends where centerline radius is at least 4 times the outside diameter (O.D.) of the tube, (b) pipe and heavy wall tubing, and (c) very small diameter tubing.
2. The “Follow Block” method, which allows forming thin wall tubing to a centerline radius as small as 2-1/2 times the O.D. without using inside madrels or fillers.

Guard against spring-back (see above). To prevent the tube form slipping during forming, the Quik-Lok Clamp is recommended, used with Type A Radius Collar. For locking smaller size tubing the Clevis and Swivel Clamps with Type B Radius Collars are used on No. 1 and No. 1A Benders.

PARTS REQUIRED FOR “FORMING ROLLER” BENDING METHOD Grooved Radius Collar - one for every radius and tube size. Grooved Forming Roller - one for each tube size only. Clamp Block - for use with Quik-Lok Clamp on all Di-Acro Benders. One for each tube size. Swivel and Clevis Clamps - for No. 1 and No. 1A Benders. One for each tube size.

PARTS REQUIRED FOR “FOLLOW-BLOCK” BENDING METHOD Grooved Radius Collar - one for every radius and tube size. Forming Roller - one covers all “Follow Block” operations. Follow Block - one for each tube size only. Listed length will accommodate a 180 degree bend. Clamp Block - for use with Quik-Lok Clamp on all Di-Acro Benders. One for each tube size. Swivel and Clevis Clamps - for No. 1 and No. 1A Benders. One for each tube size. Style B collars only.

IT'S EASY TO BEND

Increased knowledge of the cold bending of metal and improvements in bending machines during the past decade have opened new horizons in the manufacturing field as many forming operations not considered practical some years ago can now be readily performed.

Technically metal bending is rather involved due to the physical change that occurs within the material during the bending operation and also because the numerous types of alloys available each react differently when formed.

Rather that discuss these technical problems, the purpose of this booklet is to illustrate and describe the multitude of bending operations that can easily be accomplished without special engineering knowledge provided a few elementary principles are observed.

PRODUCT DESIGN

Design of the formed parts in a product generally determines whether or not they can be efficiently and economically produced. Give careful consideration to these suggestions.

Selection of material is of first importance as it must be sufficiently ductile to produce a satisfactory bend of the smallest radius required and still be strong enough to provide the rigidity which the product demands.

It is usually desirable to designate the largest practical radius as this gives wider latitude in choice of material and often assures a better bend in both strength and appearance.

By using the same size material and designating identical radii for each bend whenever possible, the tooling of the bending machine can be simplified and the highest possible production obtained as a number of successive bends can then be progressively made in a part, thereby completing it before it is removed form the machine.

Compound bends or adjacent bends in different planes should be avoided if possible because of confliction that may occur between the bends which might necessitate special tooling. This is especially true in tubing but also holds for solid materials.

Generally the smallest recommended radius for tubing, measured to the exact center of the tube, is 1-1/2 times the outside diameter of the tube provided an inside mandrel is used when bending. This minimum centerline radius should be increased to at least 2-1/2 times the outside diameter of the tube if the bend is to be made without an inside madrel.

In making a bend near the end of a tube, a straight length equal to at least the diameter of the tube should extend beyond the bend. If a bend is required to the very end of the tube, a straight length should be allowed and trimmed after forming.

SELECTION OF MATERIAL

From the numerous types of material available in tubing, extrusions, mouldings, channel and solid bars, the most suitabel material for produciton of a part can usually be chosen.

In making this selection the ductility of the material should be given prime consideration and before a decison is made a sample should be formed to the smallest required radius or assurance obtained from the supplier that the bend can be satisfactorily made.

Elasticity of the material, which causes it to spring back after it has been bent, must also be considered as it may be impossible to form a closed eye or a complete circle is some alloys.

If tubing is to be bent without an inside mandrel the heaviest practical wall should be used. As a rule, in non-ferrous metals, one quarter to half hard tubing provides best results.

When bending channels, angles, mouldings, and extrusions the centerline radius of the bend should usually be at least three times the width of the flange to be formed edgewise.

CHOICE OF BENDING MACHINE

A number of bending machines are offered on the market today and your choice of the most suitable bender can largely be determined by the range of your bending requirements.

These machines are available in both small and large manually operated models as well as power driven units; some designed for one specific application and otheres capable of performing a wide variety of operations.

Should your work consist only of one specialized operation such as the bending of thin wall tubing on a high speed basis, obviously a completely automatic bender is the answer.

If, on the other hand, your jobs are so varied that you are called on to form a variety of materials such as tubing, angle, channel, extrusions, mouldings, and bus bars in addition to solid materials, a universal all-purpose bender will best serve your needs.

Oftentimes small parts can be formed faster and cheaper with manually operated benders provided production quantities do not warrant completely automatic equipment.

Careful study of specifications, capacities and working range of the various benders under consideration will enable you to choose the most logical unit for your own operations.

TOOLING THE BENDER

All bending machines merely provide a means of applying power either manually or mechanically to perform the bending operation and supply mountings for the bending tools.

These tools consist of a form or radius collar having the same shape as the desired bend, a clamping block or locking pin that securely grips the material during the bending operation and a forming roller or follow block which moves around the bending form.

When bending materials of open cross section such as tubing, channel, angle and extrusions, the bending form should exactly fit the contour of the material to provide support during ther forming operation. This is also true of the clamping block and forming roller, as only by completely confining the material can a perfect bend be obtained.

Since all metals are somewhat elastic, they will spring back more or less after they are formed and for that reason the bending form must usually have a smaller radius than the required bend. The amount of springback is dependent upon the type of material, its size and hardness, as well as the radius of the bend and it is usually necessary to experiment somewhat to determine the exact size of the bending form.

Bending is no different than any machining operation in that the results obtained will be in direct proportion to the care taken in properly tooling the bender for the job to be done.