

INTRODUCTION

Ben Pearson Tubemaster Corporation has exercised every care in the design and selection of materials and building of your pipe bending machine. We feel the Ben Pearson benders combine the most desirable features that can be built into a machine to enable you to bend tail pipe and exhaust pipes accurately and efficiently with a minimum of training. The machines are designed and built for long-term dependable use. With proper care and servicing, it will provide you with a high return on your investment.

This manual is provided to help you understand the general operation of your bender, as well as how to perform the many functions it is capable of.

GENERAL OPERATION OF MACHINE

Ben Pearson pipe benders utilize as standard a 230-volt, AC, 60 hertz, single-phase motor. Three-phase motors and other voltages are available, as well as options with either 50 or 60 hertz current.

OPERATION OF MB97

MB97 machines have the convenience of an automatic reverse of the ram die and automatic motor shut-off. A magnetic motor start switch is incorporated inside the control box with the main power switch on the right side of the box. There is a red indicator light in the switch that will indicate when the power is "ON". The motor will then start automatically simply by pressing the RAM-OUT side of the knee control.

The automatic retraction of the radius die is initiated when the limit switch on the side of the machine is activated either by the depth-of-bend pointer (as the selected depth-of-bend is reached) or alternately pressed by the operator's finger. The knee must be removed from the knee control to allow the ram die to automatically retract.

The motor will automatically shut-off when the ram die has retracted to its initial position. The ram die can be stopped at any point during its return by "jogging" either side of the knee control. This is normally desirable to avoid cutting the motor off when the entire bending operation is completed.

A rear power switch is also provided on the MB97 machines, which enables the operator to turn the motor on from the rear of the machine for performing end-of-pipe operations. NOTE: The main power switch must be "ON" before the rear power switch will start the motor.

BENDING DIES

The bending dies are made of precision-formed ductile iron and heat-treated for long life and wearability. If the tubing is prelubricated, it is unnecessary to lubricate the 3" and 4" radius dies – especially around the rails or extreme outside of the die where it contacts the back shoes.

The dies are color-coded (see color code chart) and have size numbers embossed on the dies that indicate pipe diameter and radius. Example: 214-4 is a 4" radius die for a 2-1/4" diameter pipe.

The radius dies have three holes for easy mounting on the matching pins on top of the die carriage. No locking or bolting is necessary. **ALWAYS PLACE THE DIE WITH THE SIZE NUMBER FACING UP.**

The back shoes, three quarter shoes, and half shoes are simply slid onto the pins extending from the pivot arm. One half shoe is supplied for each diameter pipe. All the shoes are reversible for use on either side of the machine.

COLOR CODE CHART FOR SELECTING DIES AND TOOLS

DIAMETER PIPE/COLOR

1-1/2" RED 1-3/4" - BLUE 1-7/8" - YELLOW 2" - WHITE 1-1/4" - ORANGE

2-1/2" - GREEN 3" - GOLD 1-1/4" - VIOLET 1-3/8" - PINK 1 5/8" - BROWN

Goerlich 64625	Old Goerlich	Supreme 344125	Walker 46366	Bend #	Symbols	Length Marks	Rotation Angle	Depth Setting
Maremont T5-3276	New Maremont 45087	IPC 6T5564	Year 74-76	1	F	7-3/4	0	78
Diameter In. 2-1/4	Hayes	Side		2	+ *	13-1/8	94	28
Make: BUICK OLDSMOBILE PONTIAC				3	#	22	199	149
Application: 8 CYL - SINGLE EXHAUST SEE CATALOG FOR APPLICATION				4	+ #	33	315	101
Program Instructions/Symbol Interpretation: USE 4 IN. RADIUS * USE HALF SHOE # USE 3/4 SHOE + REVERSE PIPE CUT 3 IN. OFF F AFTER BENDING				5	+	43	212	90
				6		78-1/2	308	15
				7	R			
				8	CUT	88-1/2		
				9				
				10				

Date: 7/80 CA

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89N

TUBEMASTER PROGRAM CARDS

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Symbols F & R: F = Front of Pipe

R = Rear of Pipe

The Tubemaster card system is sequenced numerically by either the Goerlich, Maremont, Walker or Supreme numerical catalog system. For your convenience, crossover numbers are shown on the card.

USING THE PROGRAM CARDS

1. Look up the automobile to be fitted in the catalog. It will appear in the catalog according to make, model and year. The exhaust pipe, muffler and tail pipe numbers will be indicated on the illustration and/or in a list shown with the illustration.
2. Take down the number of the pipe to be bent and look up that number in the card deck. The cards are filed in numerical order with the card number located in the upper left-hand corner of the card.

Also shown in the upper left section of the card is the year of the vehicle, the pipe diameter and the side of the vehicle that the pipe fits (for dual exhaust). Immediately below is the make of the vehicle (Chevy, Dodge, etc.) and the vehicle model (Blazer, Challenger, etc.). The program instructions at the bottom left corner give the instructions on tooling, end-of-pipe operations and special information, and also gives the meaning of any symbol appearing in the column marked "symbols" on the car. All bend data is tabulated on the right side of the card.

3. Install the correct size radius die as called for on the card and the corresponding back shoes having the same color code. **NOTE:** The part numbers on the long back shoes have the suffix "1" (as 214-1), three quarter shoes have the suffix "0" (as 214-0), and half shoes have the suffix "H" (as 214-H). Two back shoes are required unless otherwise specified.
4. Select the proper size tubing for the application. **NOTE:** Use only fresh, good quality aluminum kilned tubing. The wall thickness should be a minimum of 16 gauge for 2" diameter pipe and below and 14 gauge for 2-1/4", 2-1/2" and 3" diameter pipe.
5. Refer to the column marked LENGTH MARKS for the corresponding bend under the BEND NUMBER column. Using the weld seam as a reference, measure the distance called for and make a mark across the seam with either a scribe or a dark felt tip pen. Always refer to the weld seam after each bend to make sure all marks are picked up and no bends are missed.

NOTE: All marks are measured from the end of the pipe

6. Once the pipe has been marked, place it into the back shoes with an equal amount of pipe extending out both sides of the machine. Move the valve handle to the right to bring the radius die forward until the die almost contacts the pipe. Slide the pipe to the right until the first mark is between the back shoes with the weld seam turned up. Move the RAM-OUT until the die contacts the pipe and the spring in the die carriage is compressed. The die carriage is spring loaded so that the pipe will not lock immediately upon contact with the radius die. This allows for each rotation of the pipe by hand so that the rotation angle can be easily set.

7. The DEPTH-OF-BEND scale is located on the right side of the machine below the pivot arm. The knob moves the pointer to the desired position on the scale. Refer to the card for the setting required. Set the pointer to the corresponding setting on the OUTSIDE SCALE when card bending.

For the MB97 – Press the RAM-OUT side of the knee control until the pointer indicates the desired degree of bend. To reverse the ram and free the pipe, press RAM-IN and hold until the ram retracts sufficiently to remove or move the pipe to the next bend location.

8. Slide the rotation dial over the right end of the pipe and move it down to a position approximately 18 INCHES PAST THE LAST BEND MARK. To clamp the dial on the pipe, HOLD UP ON THE DIAL, SET THE BALL ON ZERO (using the outside scale) and tighten the threaded pointer (Fig. #1). The dial will be left in this position until the pipe is ready to be cut off.

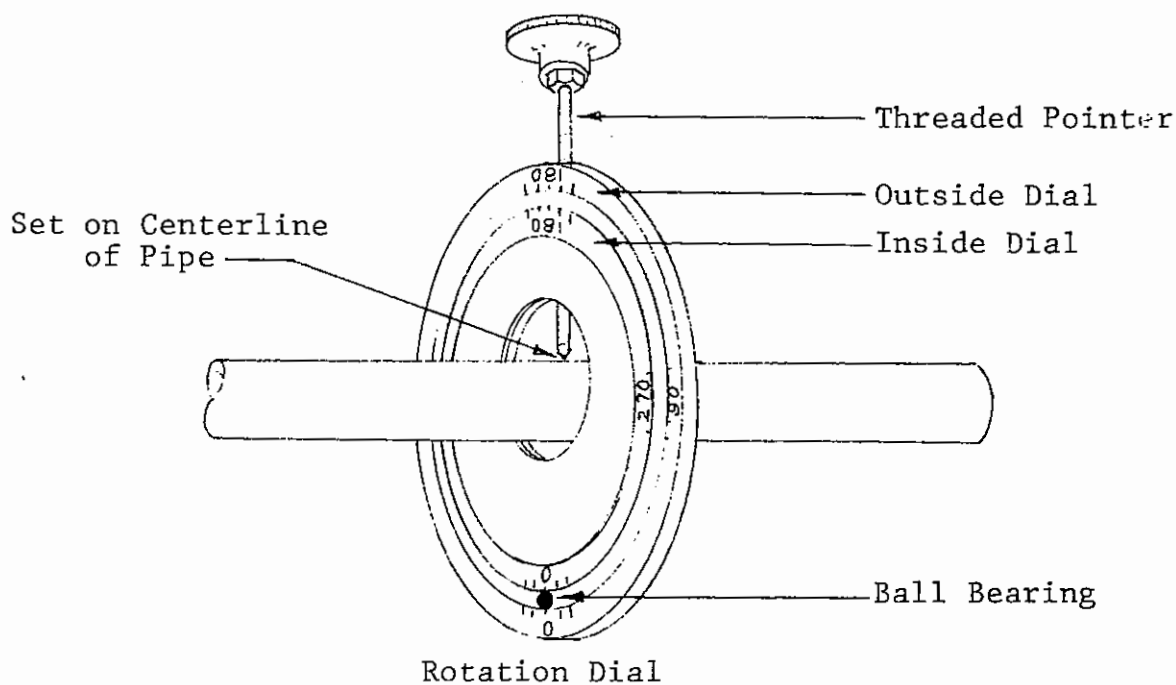


Figure 1

NOTE: The rotational dial is equipped with two scales – the standard scale is to the outside of the dial. The inside scale is used for bending a “mirror image” or opposite hand pipe. This is desired when making custom duals. To bend an opposite pipe from the one called for on the card, set the ball bearing on the angle on the inside scale rather than the outside scale. **CAUTION:** Before bending the opposite pipe, make sure there are no obstacles that might prevent using the custom pipe. Examples: emergency brake cables, shock mounts, etc.

9. For the second bend, move the pipe to the left and align the bend mark between the back shoes. Engage the ram die until the spring in the die carriage begins to compress, but do not start bending. Refer to the card and select the desired depth-of-bend setting for the second bend. Select the rotation angle for the second bend on the card and rotate the pipe until the ball is aligned with the desired angle on the outside scale of the rotational dial. Move valve handle again until the second bend is complete. Continue the same procedure for the third, fourth bend, etc., until all the bends are completed. Cut the pipe off at the final mark only after you have checked the pipe for proper fit underneath the automobile.
10. When one or more symbols appear, it is very important to follow the instructions at that symbol during that bend only. If the symbol disappears on the following bend, go back to the original set up. For instance, if bend number two calls for a half shoe (reference * in the symbol column) then a half shoe must be placed on the machine in order to miss bend number one. If the same symbol does not appear on bend number three, then the long back shoe must be placed back on the machine.

Similarly, if the symbol calls for a REVERSE, the pipe must be removed from the machine and flipped over so that the straight section with the rotation dial is now on the left side of the machine. If the reverse symbol does not appear on the next bend, the pipe should be reversed to the original position.
11. The backpressure as shown on the gauge in the front of the machine, is factory set to register 675 PSI during the bending cycle only. This setting should not be adjusted except for special instructions.

COPY BENDING

If a bending card is not available for a particular automobile and its tail pipe or exhaust pipe is intact after removing from the car, then a new pipe can be duplicated or copied as follows:

1. Select the size diameter pipe as removed from the car and match the radius of the bends on the old pipe with the selection of the radius dies.
2. Install the respective die on the machine and place the new pipe in the dies feeding from right to left.

NOTE: Blank program cards are provided in your file box to create your own custom cards. If you are going to record the bending data, then it is best to accurately measure the length of the pipe on the machine.

The best method for measuring the distance between bends is to mark a circle around the pipe at the exact center of each of the bends. Do not attempt to measure around the bend as this will result in inaccurate measurements because of the stretch in the pipe during bending.

Accumulate the rotation and depth-of-bend angles during the bending. After the pipe has been reproduced, transfer the data to the blank Tubemaster card and fill in the other pertinent information such as diameter of pipe, make and model, etc.

3. Place the old pipe to be copied flat on top of the radius die with the center of the first bend aligned with the center of the radius die and split between the two back shoes. (Fig. #2)

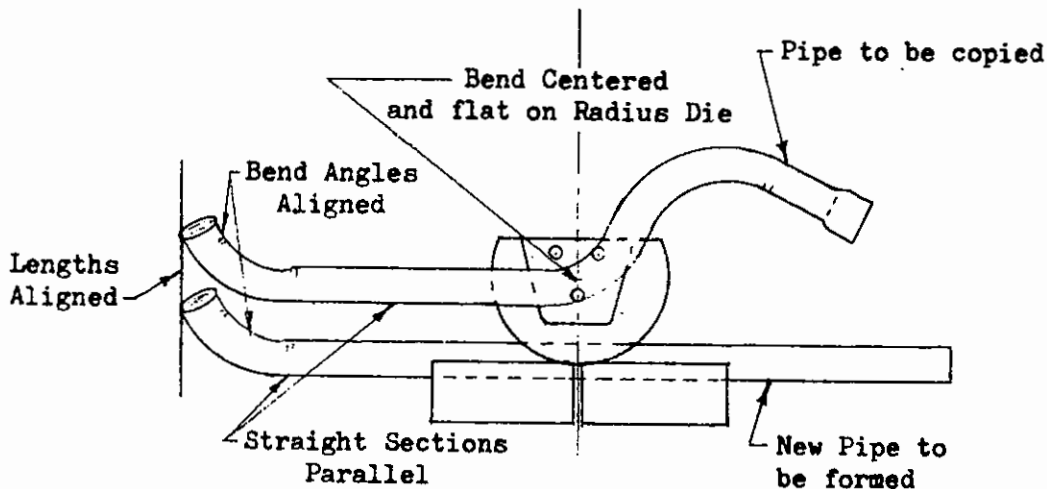


Figure 2

If recording card data, slide rotation dial on the new pipe and set at zero degrees with the centerline of the pipe.

4. Move valve handle to extend radius die until the new pipe is bent to the same angle as the old tail pipe for that bend. **DO NOT OVER BEND.**

Record the depth setting angles as shown where the pointer stops on the inside scale. When using your custom card for bending pipe in the future, the pointer will be set on the outside scale (same as on all card bending) for the angle you recorded on the inside scale during copy bending.

5. For the second bend, slide the new pipe to the next mark on the centerline and move the master pattern to its second bend. Rotate new pipe until the bend just completed matches the position of the old as it is being held flat on the radius die.

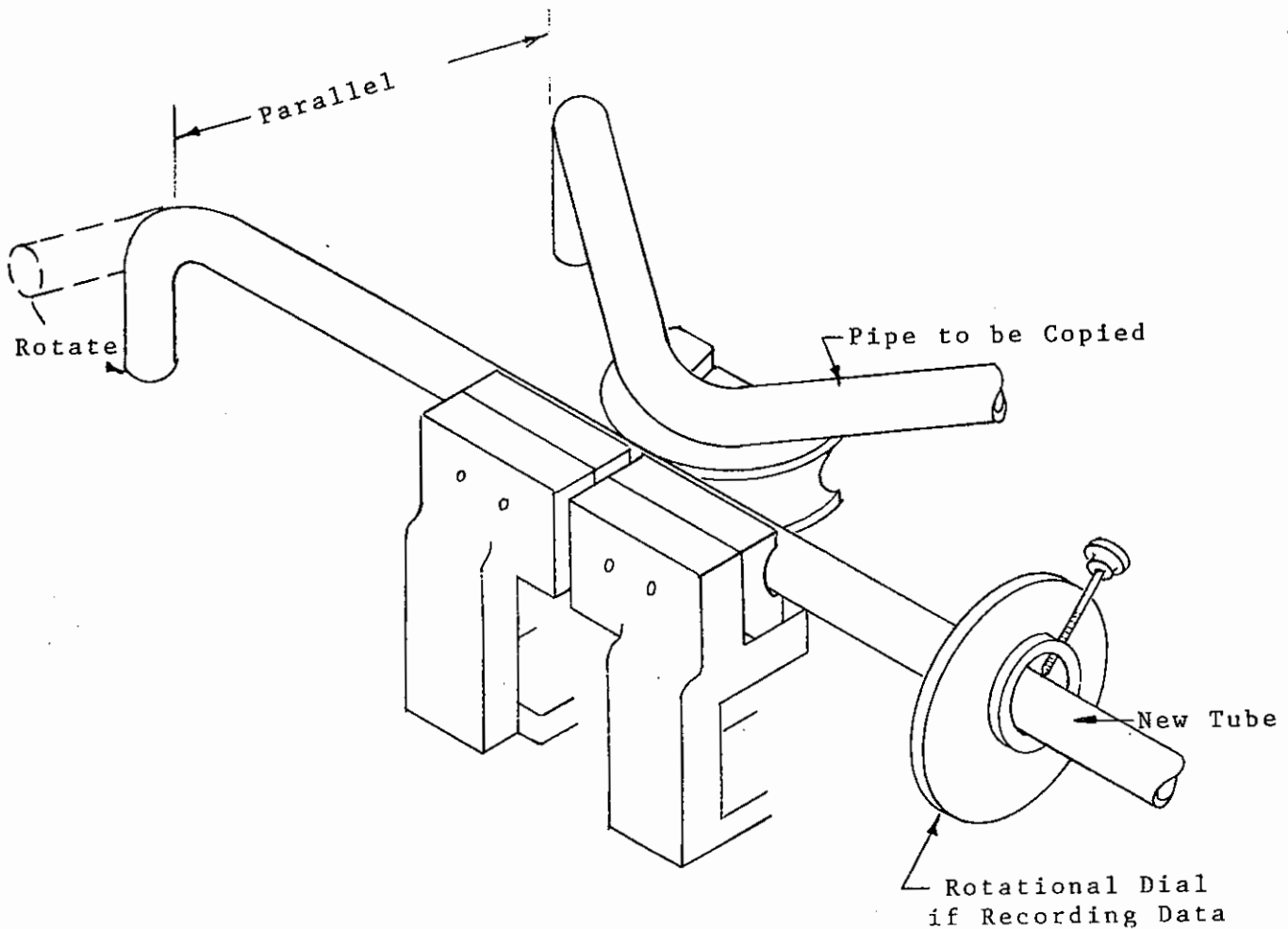


Figure 3

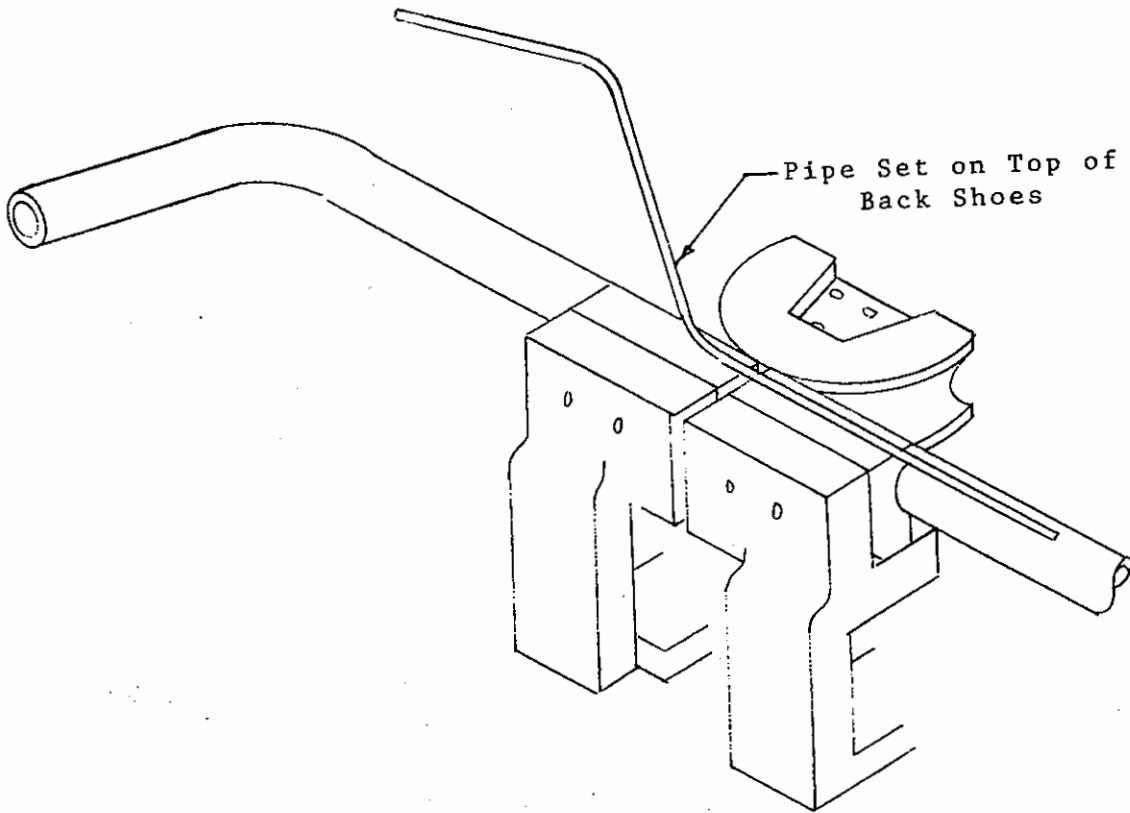
Record the rotation angle (degree mark aligned with ball bearings) from the rotation dial before bending and the depth-of-bend angle (inside scale) after bending.

3. Repeat steps four and five until all bends are duplicated. Make final length cut after bends are made.

PATTERN BENDING – OLD PIPE NOT AVAILABLE

When the old pipe is not available to use as a master, using a wire pattern made of soft iron wire (3/32" diameter) can create the new pipe. Welding rods work well.

1. Hand form wire to desired shape, keeping the bends sharp. Hand forming can be done under the car, under and around the frame, around and over the axle.
2. Lay the wire on top of the back shoe dies after placing the proper straight tubing in the machine. (Fig. #4)



Pattern Bending With Wire or Rod Pattern
Figure 4

3. Immediately after starting the bend, move the wire pattern to the rear behind the pivot arms. Then bend the pipe until the pivot arms and the pattern are parallel and flush together.

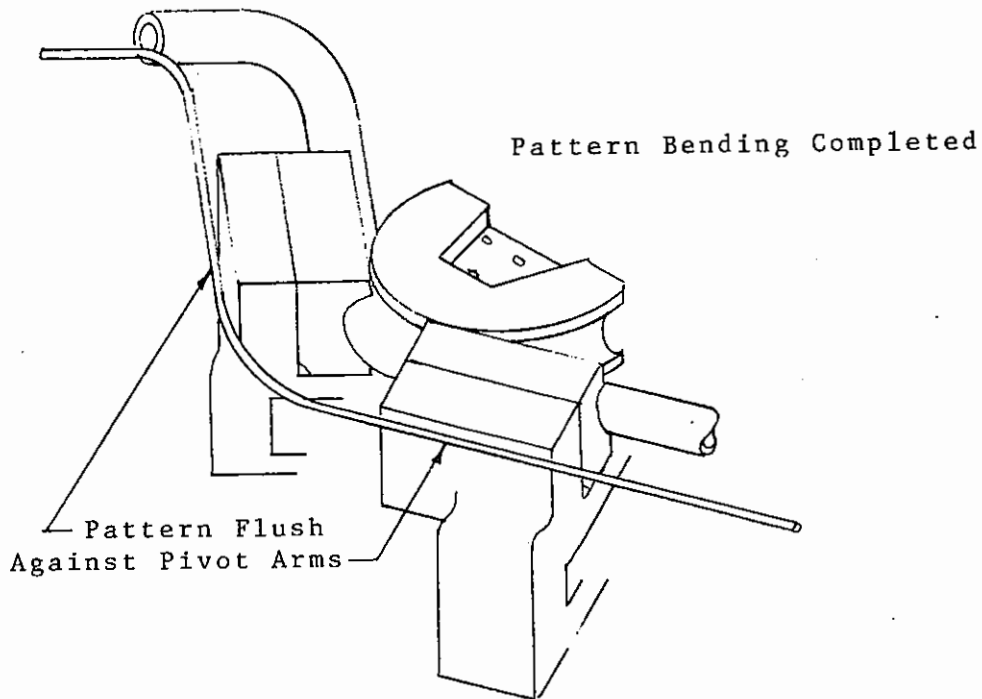


Figure 5

4. For the second and successive bends, keep the wire pattern on the top of the back shoes and rotate pipe until it is parallel to the wire pattern. Repeat step number three during bending.

3" DIAMETER PIPE BENDING

1. As noted on page 3, it is recommended that 14 gauge AK pipe be used for 3" diameter pipe bending. Bending with standard cold rolled pipe that has not been aluminum kilned, as well as lighter gauge tubing, will normally result in moderate to severe crinkling of the pipe depending on how deep the bend is.
2. Normally, if the pipe is fresh 14 gauge AK, a bend up to 90 degrees may be made without reducing the backpressure (gauge setting at 675 PSI). However, even AK tubing will harden after it has been in stock for an extended period of time (the amount of carbon in the pipe will also affect the degree of hardening) resulting in the machine stalling if you attempt to bend a full 90 degrees at the 675 PSI back pressure setting. If this should happen, **YOU MUST REDUCE THE BACKPRESSURE** at the point the machine began to stall in order to complete the bend. **NEVER TRY TO FORCE THE MACHINE TO BEND AFTER THE MOTOR HAS BEGUN TO LUG DOWN.**
3. To reduce the backpressure turn the adjusting knob (located next to the pressure gauge in the front of the machine); counter-clockwise until the backpressure is 200 PSI or less. For example, to bend a particular pipe to 60 degrees without reducing the back pressure always start at the 675 PSI to finish bending the pipe to a full 90 degrees.

When necessary to reduce the backpressure, always remember to reset the pressure to 675 PSI before starting the next bend or before you bend other diameter pipes. **NEVER INCREASE THE BACKPRESSURE ABOVE 700 PSI, UNLESS SPECIFICALLY INSTRUCTED BY THE FACTORY FOR SPECIAL APPLICATIONS.**

**END OF PIPE OPERATIONS
CLAMP DOWN SWAGER (ALL MODELS MC59, MB97 & BP79)**

TOOLS



2" Swager



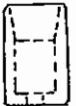
Swager



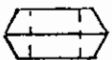
Flare



Female Ball
Joint



Reducer



Collet

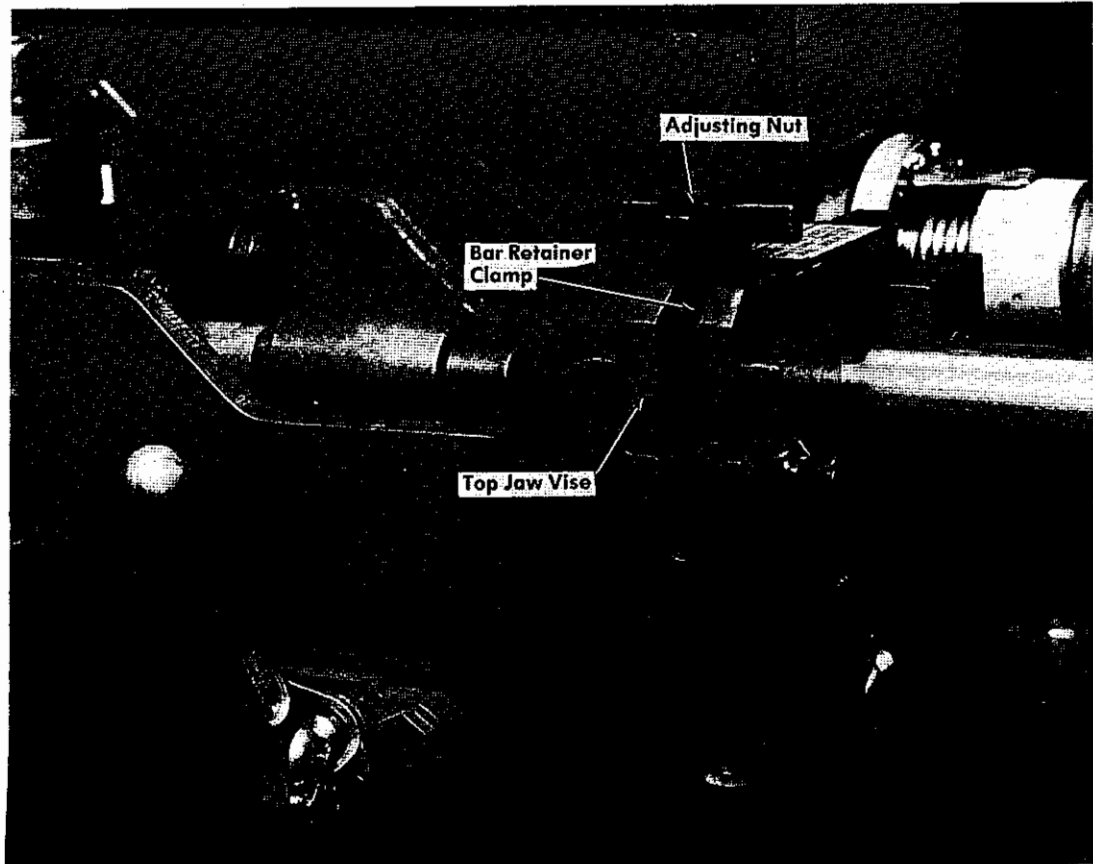


Figure 6

The MB97 utilizes one double-ended cylinder and one manually operated hydraulic valve to do both swaging with clamp down swager and expansions with the segmented tooling and arbor bolt.

If the cylinder rod is either extended or retracted fully, the pump will go on relief and a squealing noise will be heard from the pump. Do not hold the pump on relief for an extended length of time. This will create heat and put unnecessary strain on the electric motor.

Select the proper tool or combination of tools to perform the operation desired. **NOTE:** The flaring tool (Fig. #6) and the female ball joint tools are used in combination with the 2" swager by slipping them onto the boss on the front end of the swager tool.)

For 45-degree flares, use the tapered end of the tool and only one stroke. For 90-degree flares, make a 45-degree flare, and then reverse the flaring tool so that the flat side is toward the vise. With a second stroke, form the 90-degree flare.

The ball joints are formed with one stroke using the end of the tool marked for the diameter pipe being used. The diameters of the swagers are stamped on the end of each tool.

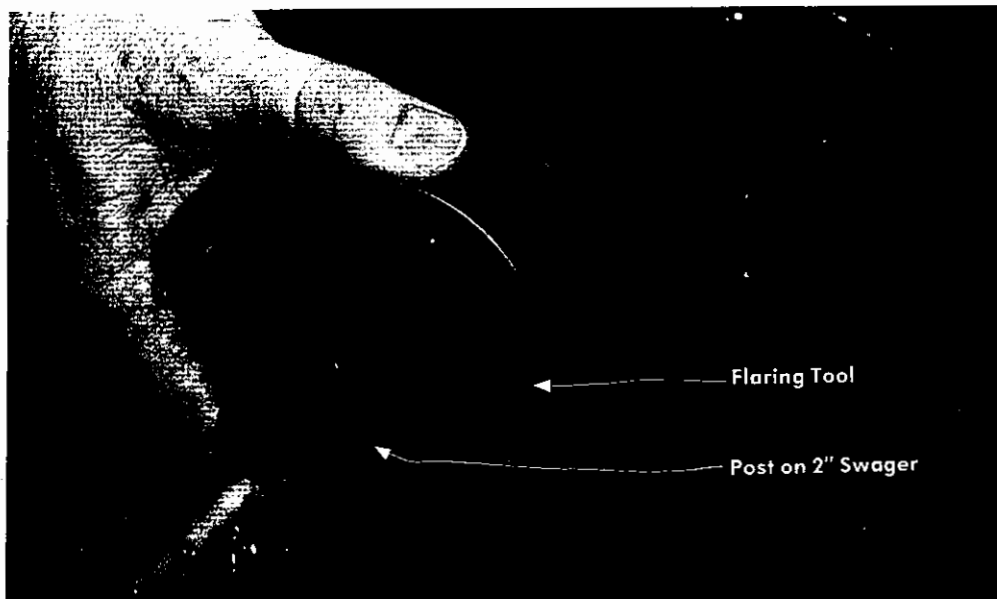


Figure 7

"Quick Release" Feature

All swagers and reducers are designed to be positioned on the swager cylinder rod by a unique "Quick release" system. This saves valuable time over a system that requires threading the tools on the cylinder rod. Instructions for installing and releasing tools are shown. (Fig. #8 on next page)

- Place tooling onto adapter, aligning pin side of tooling with flat side of adapter.
- Grasp tooling and rotate clockwise until rotation stops.
- Tooling is now ready to use.
- To remove, turn tool counter clockwise and pull off.

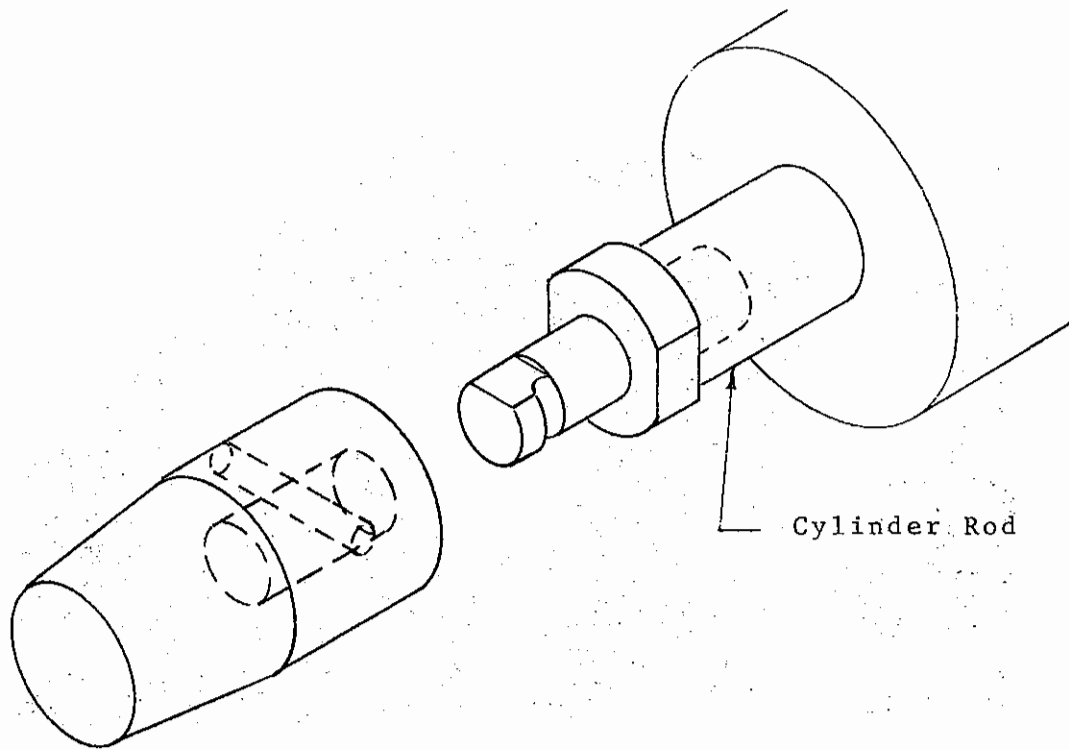


Figure 8

Select the collets for the diameter of pipe used. The diameter is stamped on the end of the collet. Collets are available for the selected pipe sizes from 1-1/4" to 3". Place one of the collets in the lower jaw of the vise. Place the pipe in the collet leaving the desired amount of pipe (Fig #9). Place one collet on top of the pipe so that either the front edge or the rear edges line up on both halves.



Figure 9

To clamp the pipe, swing the top jaw of the vise over until the top collet seats in the jaw. Lift the clamp-retaining bolt until the clamp-adjusting nut can be swung and caught by the lip on the clamp lever. Tighten adjusting nut to secure and clamp pipe into vise. (Fig. #10). If a tighter clamp is needed, turn the adjusting nut clockwise until the necessary clamping force is obtained. To reduce the clamping force, turn the adjusting nut in the opposite direction. **NOTE:** Clamping of vise works best if the clamp is left slightly loose.

Below is a list of operations and recommended lengths for extended pipe into the box:

<u>Operation</u>	<u>Extend</u>
Swage	2" min.
45 & 90 degree flare	1/2" min.
Ball Flare	1" min.
Reduce	4" min.



Figure 10

To extend the cylinder rod, pull up on the control lever. The speed of the operation may be controlled by how far up the control lever is pressed. When the operation is complete, push down on the lever to retract the tool. The control lever is spring centered for safety and convenience. The lever must be held in place during extending or retracting the rod and returns to the neutral position when released. To release the pipe, loosen adjusting nut and swing clamp retaining bolt down. Then lift the top jaw of the vise and remove the pipe.

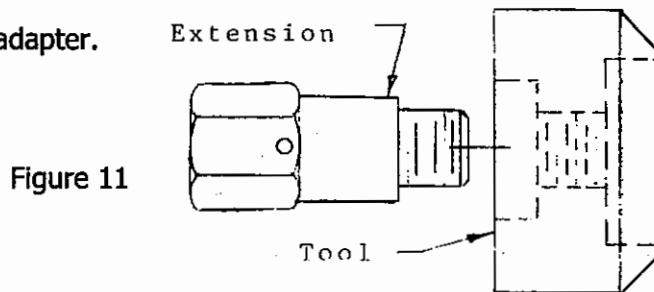
THE SUPER FLANGE TOOL

The 1-1/2" – 2 Super Flange Tools are a specially designed dual-purpose tool. One end of the tool is designed to produce a 45 degree crimp flare with 2" tubing and the other end produces a 90 degree crimp flare (Toyota Flange) with 1-1/2" tubing.

The 1-3/4" – 2-1/4" Super Flange Tools will produce a 45 degree crimp flare on either 1-3/4" or 2-1/4" tubing depending on which end is used. Proper procedures for using the tool are shown below:

A.) Thread the tool on the extension as far as possible with the end of the selected operation toward the vise. (Fig.#11)

B.) Place onto quick disconnect adapter.



C.) **Make sure the end of the pipe is cut off square.** Using a pipe cutter gives the best results.

D.) Measure the proper distance from the end of the pipe. (1-1/2" for 2" x 45-degree crimp and 1-1/8" for 1-1/2" x 90 degree crimp). These dimensions may vary slightly; therefore, it is recommended that the operator experiment with the tool on a scrap piece of pipe until the desired results are obtained. (Fig. #11).

E.) Select the proper size when collet and clamp the pipe securely in the vise. **NOTE:** When forming the 1-3/4", 2" and 2-1/4" x 45 degree crimp, make certain the deep chamfered inside edge of the collet is toward the tool). (See Fig. 12#).

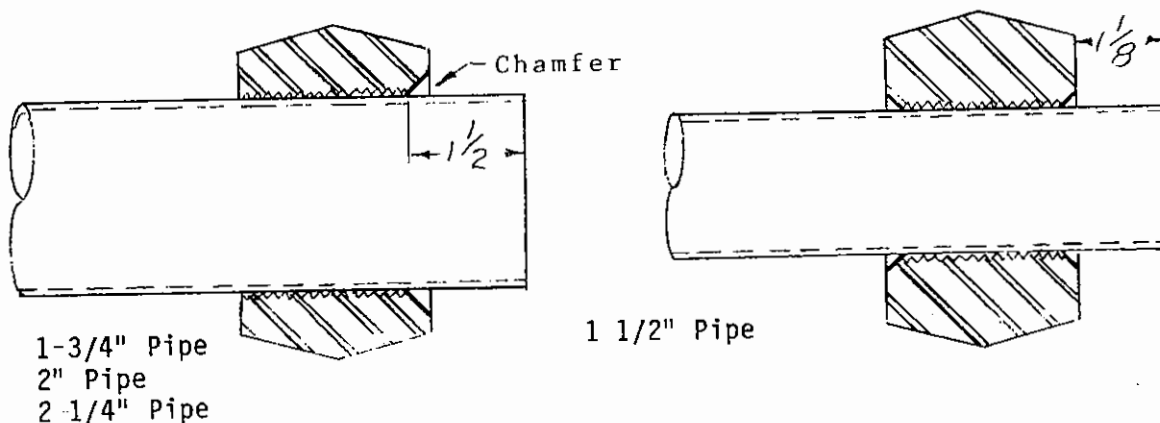


Figure 12

F.) Move the tool slowly toward the pipe until the tool begins to slip up on the pipe. **NOTE:** The tool is designed to perform the operation in one step with the "clamped in" position. If the tool does not engage the pipe properly, check the cylinder alignment on the swager box.

G.) Run the cylinder out until the tool completely crimps the pipe against the collets. Retract the cylinder and remove the pipe.

END-OF-PIPE OPERATIONS

SEGMENT EXPANDER UNIT

The Ben Pearson bender is equipped to make EXPANSIONS for 1-1/2" through 3" diameter pipe or with optional tooling and small arbor expansions, can be made down to 1-1/4" I.D., 45 degree FLARES for 1-3/4" through 2-1/2" diameter pipe and male and female Buick Balls for 2", 2-1/4" and 2-1/2" diameter pipe. The following are instructions for operating the segment unit:

- 1.) To operate the expander, the motor must be running. (See General Operation).

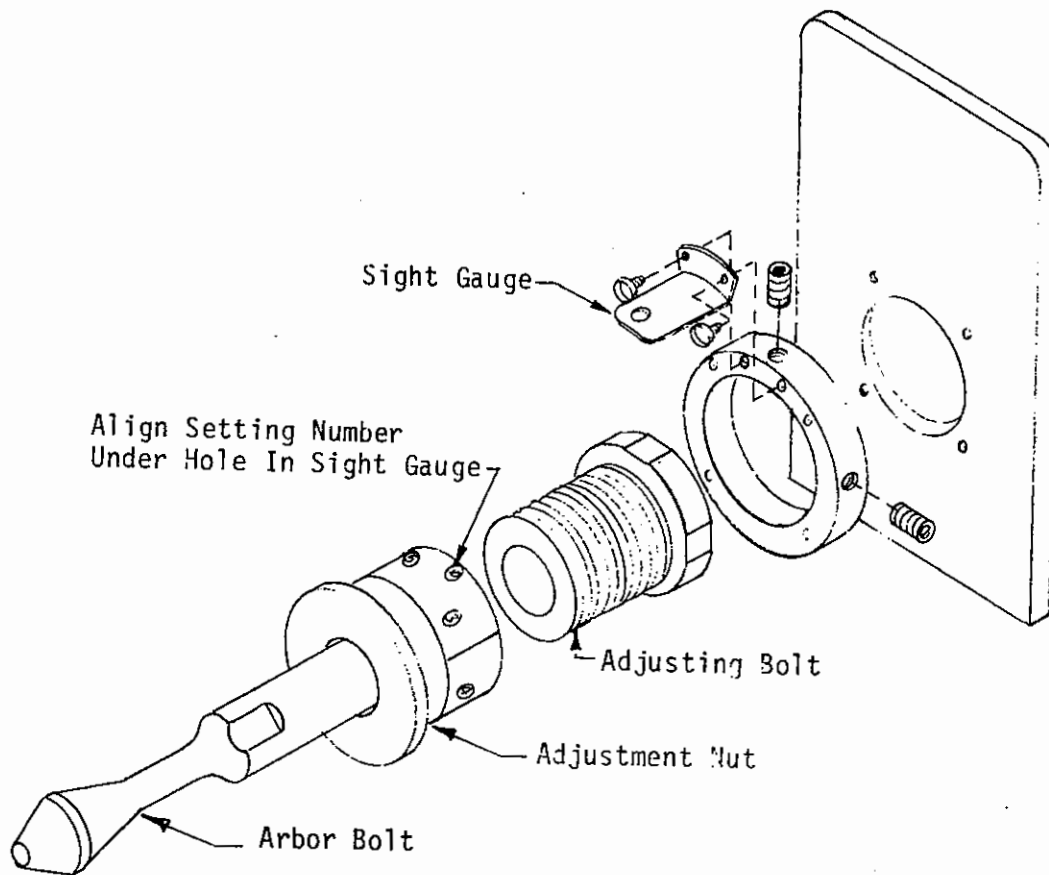


Figure 13

Select the desired tool and slip it onto the mandrel head. **Note:** The tools are color coded on the top of the tool, according to the color code chart for selecting the dies. For example, the tool for 1-3/4" diameter pipe will be painted blue on the top, etc. Combination tools will have two colors denoting that the tool is used for two different diameter pipes. Check to insure that all segments are in the tools and are held and aligned properly by the o-rings before performing any operations.

- 2.) Adjust the ACME adjusting nut to the desired setting of the operation to be performed. The various settings are shown below the hole in sight.

SETTING CHART																		
INSTRUCTIONS:																		
(A) SELECT TOOL USING COLOR CODE CHART																		
(B) DETERMINE CORRECT SETTING NUMBER FROM CHART BELOW																		
(C) SLIP TOOL OVER ARBOR HEAD AND TURN ADJUSTING COLLAR UNTIL THE SELECTED SETTING NUMBER IS CENTERED IN THE SIGHT GAUGE																		
EXPANDERS												FLARES			MALE BUICK BALL		FEMALE BUICK BALL	
I D						O D												
2 1/8	1 1/2	1 5/8	1 1/4	2	1 3/8	2 1/4 (14 GA)	1 3/4	1 13/16	1 5/8	2 1/2	2	1 3/4	1 7/8	2	2 1/2	2	2 1/2	2
2 3/8	1 3/4	1 3/8		2 1/2		2 1/4		1 7/8	(14 GA)	2 1/2		2 1/4	2 3/8	2 1/2		2 1/4		2 1/4
	2 1/4	2 3/8		3														
2 3/4	2 7/8																	
* USE 1 1/4" - 2" TOOL						SETTING NUMBERS												
①	②	③	④	⑤	⑦	①	②	③	④	⑤	⑥	⑥	⑧	⑨	③	⑥	⑤	⑧

Figure 14

I.D. settings of the 1-1/4" and 1-3/8" require the use of a small arbor to obtain these dimensions.

OD Settings:

If an OD setting requires going from one expansion tools range into another tool range, this will require a two-step expansion. Example: To expand 2" OD tubing to 2-1/4" OD, first expand the 2" OD tubing to 2" I.D. with the 2" expander. Then using the 2-1/4" expander, expand the tubing to 2-1/4" OD

SETTINGS THAT REQUIRE TWO-STEP EXPANSIONS ARE:

1-3/4" OD, 1-13/16" OD, 2-1/4" OD and 1-7/8" OD expanded from 1-5/8" OD

SPECIAL NOTES:

Several cards call for expanding 1-7/8" OD pipe to 1-13/16" ID. Expand tube to 1-13/16" OD and turn adjusting bolt counter-clockwise approximately one half turn and expand

again. Adjust and expand until desired fit is obtained. Mark location on decal with ballpoint pen.

Using the combination Buick Ball and combination 45 degree flare tools will require two expansions be made for most tubing. Note: Do not retract cylinder fully on the first expansion. Rotate tubing to eliminate marks and fully expand the second expansion. This first partial expansion allows the tool to grip better than if fully expanding the first time. With a little practice, you will obtain satisfactory flare.

Press lever arm (with knee or hand) to the right to perform the desired operation – and then left to loosen the tool and remove pipe.

NOTE: The arbor and mandrel shipped with your machine have been calibrated to give a "line-on-line" fit on standard expansions, (e.g., 2" OD expanded to 2" ID). If a looser fit is desired, then the adjusting nut should be adjusted to the right (clockwise) of the setting number for that size operation.

** To recalibrate arbor, see page 18.

When using the 45-degree flaring tools, be sure to slide the pipe all the way over the two grooves in the raised position of the tool to ensure a quality flare. For a larger flare, repeat operation a second time.

"CHEVROLET FLANGE"

When a Chevrolet flange is called for one of the Tubemaster cards, it can be made four ways.

1. As follows:
 - a. Cut off a 1-1/2" length of pipe with a diameter 1/8" smaller than the exhaust pipe you are bending. For example, if the exhaust pipe is 2" OD use 1-7/8" pipe for the 1-1/2" long piece.
 - b. Slide regular manifold gasket material around pipe section and expand slightly until gasket is tight on pipe.
 - c. Flare exhaust pipe to 45-degrees.
 - d. Drop 1-1/2" piece of pipe gasket into flared end of exhaust pipe onto manifold.
 - e. Slide original flange up to flared portion of exhaust pipe and tighten down onto the manifold.
2. Use super Chevy expander tool.
3. Use solid die super flange tool.
4. Use vise to press same diameter pipe into flared pipe.

MACHINE MAINTENANCE

Your Ben Pearson bender was factory shipped with four gallons of Chevron 46 AW (or equivalent) hydraulic oil. Hydraulic oil that can be used or added are those that meet the specifications of the Chevron 46 AW hydraulic oil.

To check the reservoir oil level, remove the round pipe cap on the rear of the machine. The correct oil level is to the bottom of the sloping fill tube. If the oil level falls below the minimum allowed, the machine should be checked thoroughly to determine the cause of the leak.

DAILY MAINTENANCE

1. Keep machine clean – remove dirt and grime from between ways.
2. Keep dies and shoes clean.
3. Do not operate machine without dies.
4. Be sure radius die, back shoes and tubing are the same diameter
5. Keep round ways (on which radius die carriage travels) lightly lubricated using LPS, WD40, etc. **DO NOT USE GREASE.**

WEEKLY

1. Lubricate all grease fittings with Moly based grease or equivalent.
2. Lubricate pivot arm chains with lightweight oil to prevent stiffening of chains and cracking noise during bending.

YEARLY

1. It is recommended that the hydraulic oil be changed after 1,500 hours of operation. The strainer should be checked and cleaned at that time.

BENDING DIE MAINTENANCE

Minor damage to dies, such as dents or nicks on the lip area should be repaired before dies are used again. For repairing the inside of the die lip, use a round or half-round file.

TOOLING DIE MAINTENANCE

Keep all expander tools clean and properly aligned by o-rings. Keep mandrel head greased with Moly based grease. Keep swager tools lightly oiled to reduce wear and prevent corrosion.

ARBOR BOLT CALIBRATION

1. Set adjusting bolt to an ID setting and expand pipe to this setting.
2. Determine if expander size is large or small.

3. Extend arbor fully and loosen arbor bolt with proper size wrench while holding pump on relief by maintaining pressure on valve handle.
4. Loosen small setscrew locking large setscrew into arbor. There will be a 7/8" jam nut that must be loosened.
5. To increase expanded pipe size, tighten large setscrew. Loosen hex jam nut and screw arbor into cylinder and then retighten jam nut to secure.
6. To decrease expanded pipe size, loosen large setscrew. Unscrew arbor from cylinder, and then retighten jam nut to secure.
7. Pipe with 1/64" (.015) larger or smaller OD requires setscrew or arbor to be moved twice that distance or 1/32" (.03).
8. Re-adjust as necessary until proper expansion is achieved.

TO REPLACE ACME NUT SETTING DECAL

1. Expand a piece of 2" OD tubing to 2" ID. Adjust nut and re-expand until proper fit is obtained.
2. Remove expander tool leaving adjusting nut at proper setting.
3. Extend arbor bolt until large diameter is extended through the adjusting nut.
4. Using a felt tip marker or scribe, draw a line down face of adjusting nut onto arbor bolt.
5. Remove adjusting nut and clean off old decal and grease.
6. Carefully align lines on arbor bolt and adjusting nut.
7. Remove backing from half of decal under setting 5 and carefully position setting 5 on decal underneath sight gauge hole.
8. Wrap half of decal around adjusting nut carefully keeping edge of decal parallel to edge of nut.
9. Remove backing from other half and repeat step 8.
10. Carefully rub air bubbles from correctly installed decal in which ends meet squarely.
11. Machine is now ready to use.

BENDER MAINTENANCE

The Ben Pearson pipe bender is designed and built for long-term dependable use. With proper care and maintenance, it will provide years of service and a high return on your investment. The following lubrication and preventive maintenance schedule has been formulated to assist the operator in achieving satisfactory performance and longevity from the bender. Reasonable care and observation from daily use will supplement operator's schedule and result in prolonged life.

HYDRAULIC OIL

Your bender was factory shipped with four gallons of Chevron 46 AW hydraulic oil. Hydraulic oils that can be used or added are those that meet the specifications of the Chevron 46 AW hydraulic oil. Ford type F or Dextron B automotive transmission fluids are excellent substitutes.

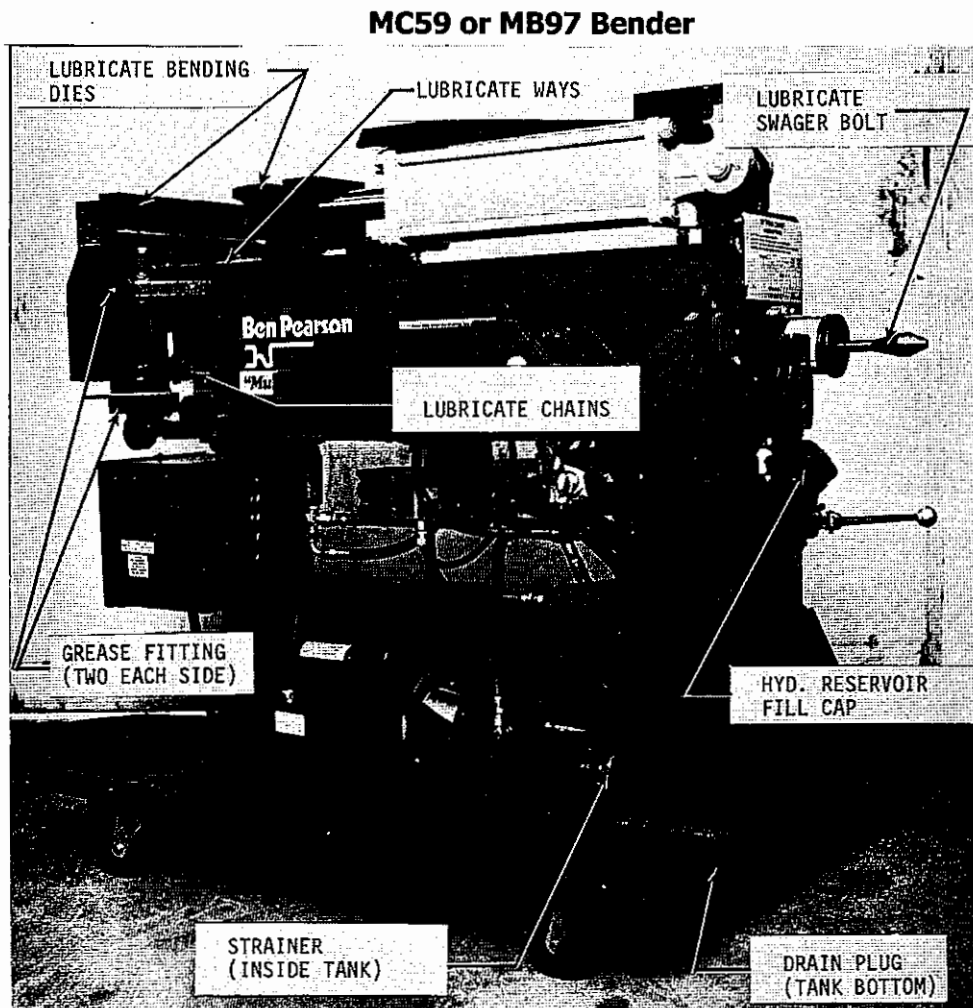
To check the reservoir oil level, remove the round pipe cap on the rear of the machine. The correct oil level is to the bottom of sloping fill tube. Should the oil level fall below the minimum, the machine should be checked thoroughly to determine the cause of the leak.

Hydraulic oil should be changed after 1,500 hours of operation or yearly. The strainer should also be removed and cleaned at that time.

BENDER MAINTENANCE

LUBRICATION GUIDE

1. Grease four main bearings weekly using a Moly based grease or equivalent.
2. Grease swager bolt as required with a Moly based grease or equivalent.
3. Lubricate round ways daily with a light spray (LPS, WD-40, etc.) **DO NOT USE GREASE.**
4. Lubricate pivot arm chains as required to prevent rust and stiffness using a light spray (LPS, WD-40, etc.)
5. Lubricate radius dies, back shoes, and solid swager tools daily with a light spray (LPS, WD-40, etc.)



PREVENTIVE MAINTENANCE

1. Keep machine clean – remove build-up from between round ways.
2. Keep dies, tooling and their mounting surfaces clean.
3. Never operate machine without dies.
4. Do not clutter machine with pieces of tubing or tooling not being used.
5. Inspect round ways regularly for damage caused by dropped dies or other objects. To prevent excess wear to die carrier bushings, repair any damaged ways using a file or sandpaper.
6. Inspect die carrier bushings for excess wear by using a flat screwdriver to pry up and down on carrier. Over 1/8" movement will normally allow poor quality bends. All four bronze bushings should be replaced if necessary.
7. Inspect mounting surfaces for radius dies and back shoes regularly for damage caused by dropping of dies or other objects. Repair any damage with a file.
8. Inspect all hydraulic hoses regularly for wear or cuts. Replace any hose that appears damaged.
9. Inspect regularly for hydraulic leaks. Repair any leaks immediately.

NOTE: ALL HYDRAULIC CYLINDERS WILL SEEP A SMALL AMOUNT OF FLUID AROUND THE RAM.

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TECHNICAL MANUAL

Bending Problems

Bending problems can usually be broken into three categories.

1. Flattening or collapsing of pipe on outside of bend (see Fig. 1).
2. Dimpling of pipe on inside of bend (see Fig. 2).
3. Crimping or wrinkling of pipe on inside of bend (see Figure 3).

Causes and solution to these problems are as follows:

Flattening of Pipe

Cause: Back pressure too low.

Solution: Adjust back pressure to factory recommended pressures -- (675 PSI for Serial #1046 and above). Reference Page 3 for instructions on adjusting back pressure.

Cause: Diameter of tubing is smaller than diameter of bending dies.

Solution: Select proper bending dies.

Cause: Tubing is not aluminum killed (AK) -- or alternately tubing has too thin a wall thickness (gauge) for diameter of tubing being bent.

Solution: Make sure tubing is AK*. Gauge thickness should be a minimum of 16 gauge for 2" diameter and below and a recommended minimum of 15 gauge for 2¼" and 2½" diameter pipe.



Figure 1

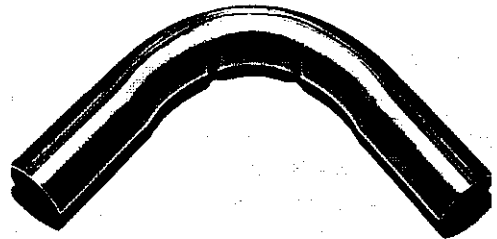


Figure 2

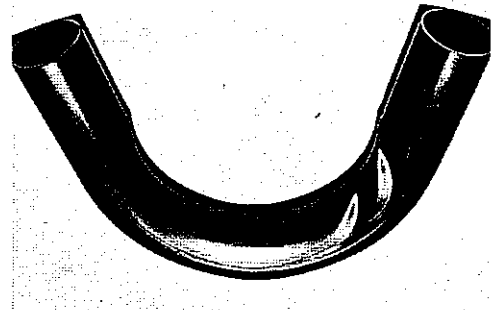


Figure 3

Flattening of Pipe -- Continued

Good quality 16 gauge tubing can be used on 2½" and 2½" diameter pipe although not on all radius dies. For good bends on the 214-3" radius and the 212-4" radius dies, a minimum of 15 gauge or sometimes even 14 gauge tubing is required. For bending 3" diameter pipe the tubing must be 14 gauge AK.

*Fresh cold rolled tubing may work for a short period of time on 2" diameter and below.

Dimpling of Pipe on Inside of Bend

Cause: Back pressure is too low.

Solution: Adjust back pressure. Reference Page 3 for instructions.

Cause: Pipe may be of low quality or too thin a gauge.

Solution: Use recommended gauge thickness and purchase good quality AK tubing.

Crimping, Wrinkling or Cutting of Pipe on Inside of Bend

Cause: Bronze bushing in die carriage may be worn causing radius die to become misaligned with back shoes. Check for this by placing a screw driver under the die carriage to see if there is "up and down" motion in the die carriage. (See Fig. 4). If there is more than 1/16" "up and down" motion the bushings need to be replaced.

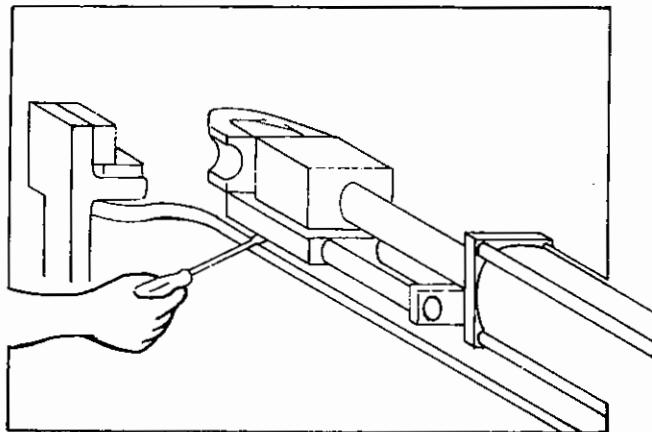


Figure 4

Solution: Replace die carriage bushings per instructions on Page 6.

Cause: Die Misalignment -- the back shoes and the radius dies have become misaligned with respect to each other causing the pipe to crimp or wrinkle on the inside of the bend. The wrinkling could occur at the top or the bottom of the pipe and on the left or right hand side.

Solution: Follow instructions for aligning radius die as noted on Page 4.

Placing Pivot Arms in Open Position --- placing pivot arms in open position is the first step in several service operations including changing die carriage bushings and change-out of the back pressure cylinder.

The first step in opening the pivot arms is to remove the back pressure. This is done by turning the adjustment knob (shown next to the back pressure gauge in Fig. 5) all the way counterclockwise. (The jammed nut will have to be loosened first.)

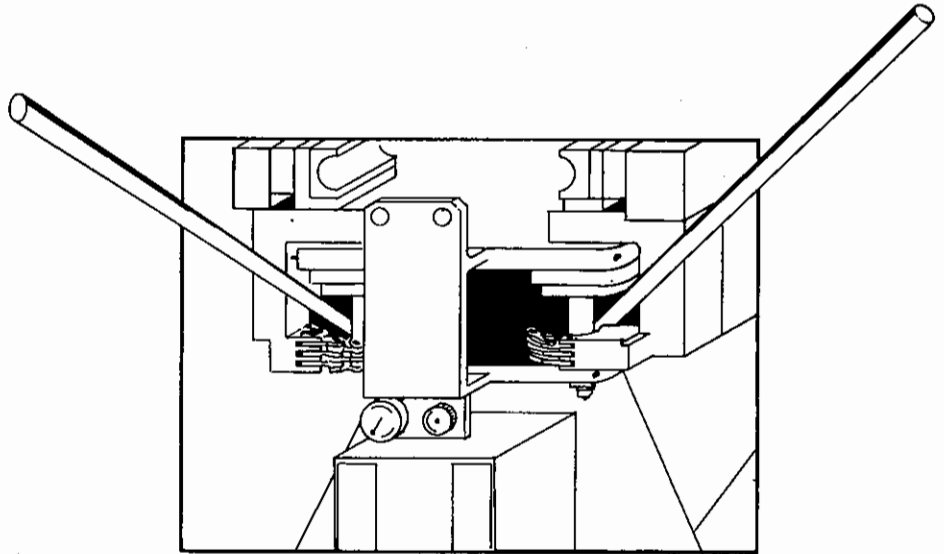


Figure 5

The next step is to place a 5" radius die and matching back shoes on the machine. With the power "On" the die carriage must be extended to its full out position as in making 180° bends. You will note the back pressure gauge should read approximately zero.

The third step is to retract the ram die while holding the pivot arms open. Two lengths of tubing approximately 4' long positioned as shown in Fig. 5 can be used to hold the pivot arms while the ram die retracts.

The machine is now ready for servicing the pivot arms, die carriage and back pressure cylinder.

Replacing (and Adjusting) Back Pressure --- pressing the "ram out" switch will bring the radius dies forward and return the pivot arms back to the closed position after the service procedures are completed.

In order to bring the back pressure up to recommended pressure (675 PSI on Serial Nos. 1046 and above) force the radius die forward into the back shoes and start quickly turning the adjustment knob clockwise watching the back pressure increase as you continue to turn. Keep turning the adjustment knob clockwise and moving the radius forward until the recommended back pressure has been restored. Once the jammed nut has been tightened behind the adjustment knob, the machine is ready for operation.

If the back pressure is too high turn the adjustable knob counterclockwise until the recommended pressure setting is achieved.

ALIGNMENT OF RADIUS DIE

Once a bending problem has been diagnosed as being caused by die misalignment the operator must determine which side of the radius die must be adjusted -- and in which direction, up or down. The following will give you an indication of which way the radius die needs to be moved (reference Fig. 6 for definition of the problem areas).

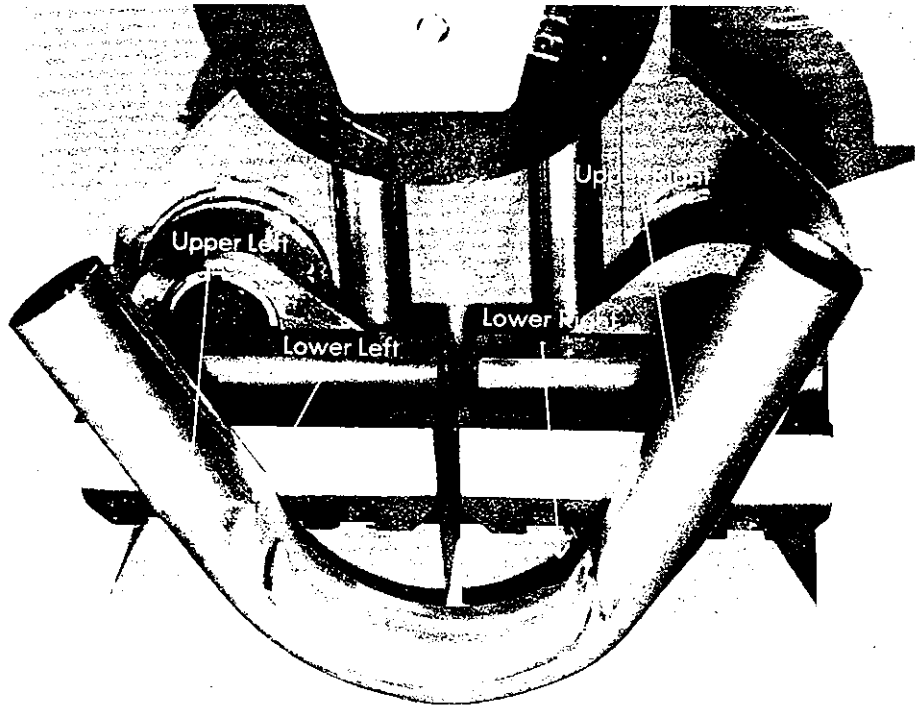


Figure 6

Wrinkling in Upper Left Quadrant:

Move left side of radius die - up.

Wrinkling in Lower Left Quadrant:

Move left side of radius die - down.

Wrinkling in Upper Right Quadrant:

Move right side of radius die - up.

Wrinkling in Lower Right Quadrant:

Move right side of radius die - down.

Before making any adjustments to the radius die, check the pivot arm shafts for end play. (Fig. 7) The pivot arms should move up and down $1/32$ " (.031"). If there is more than $1/32$ " travel, the split collar should be moved upward on the pivot arm shaft until the proper travel is obtained.

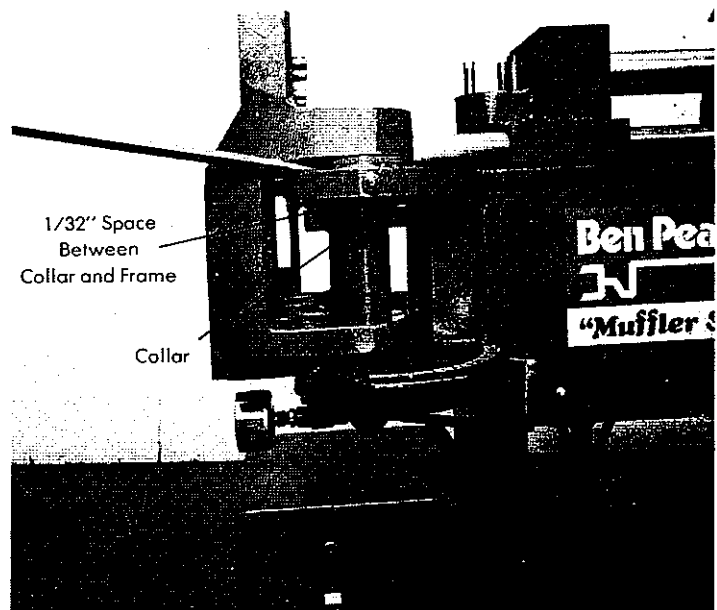


Figure 7

Before any adjustment can be made to the radius die, all 4 screws shown in Figure 8 must be loosened. The adjustments are made by adding or removing shims* from around these 4 screws. (Figure 9) The shim thickness under the left side may differ from that of the right side, however, the shim thickness of the front way retainer must be identical to that of the rear way retainer. For example, if there is .020" shims under the left front screw, there should also be .020" shims under the left rear screw.

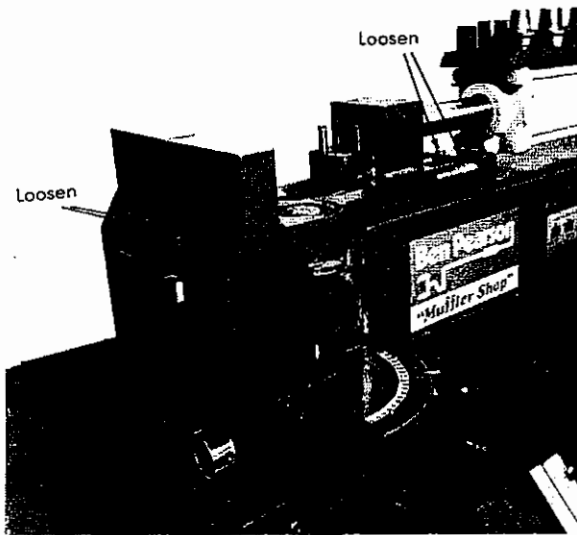


Figure 8

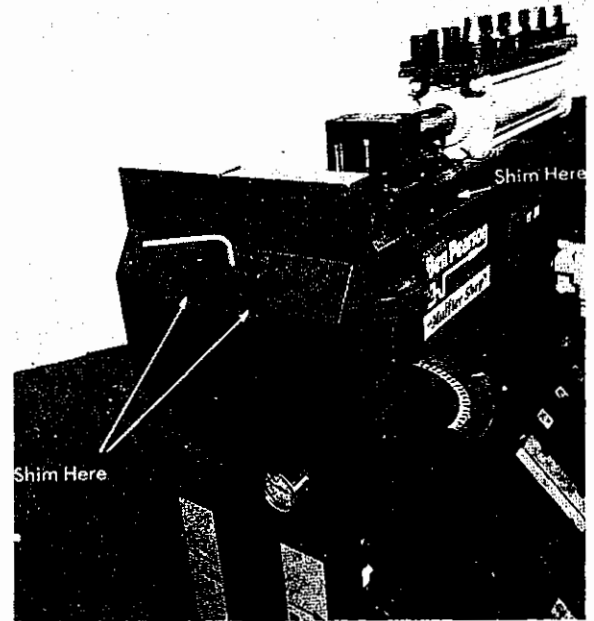


Figure 9

To move the left side of the radius die up:

Add shims around the left screw of both the front and rear way retainer.

To move the left side of the radius die down:

Remove shims from the left screw of both the front and rear way retainer.

To move the right side of the radius die up:

Add shims around the right screw of both the front and rear way retainer.

To move the right side of the radius die down:

Remove shims from the right screw of both the front and rear way retainer.

*The shims installed during assembly of the bender are U-shaped to fit around the screws. You may use other types of material or different shapes of shims as long as they fit around both sides of the screws.

It may take several adjustments of the pivot arms to get the radius dies and back shoes to perfectly align.

It should be noted that trying to align the pivot arms by matching the lips of the back shoes with lips of the radius die, without bending pipe, may or may not lend to good alignment.

The only true alignment test is to bend tubing and note the results per the above descriptions and then adjust accordingly.

REMOVING DIE CARRIAGE

To remove the die carriage from the machine follow the steps listed below:

1. Place pivot arms in open position (see Page 3 for instructions) and move die carriage to the half-way position. (Figure 10)

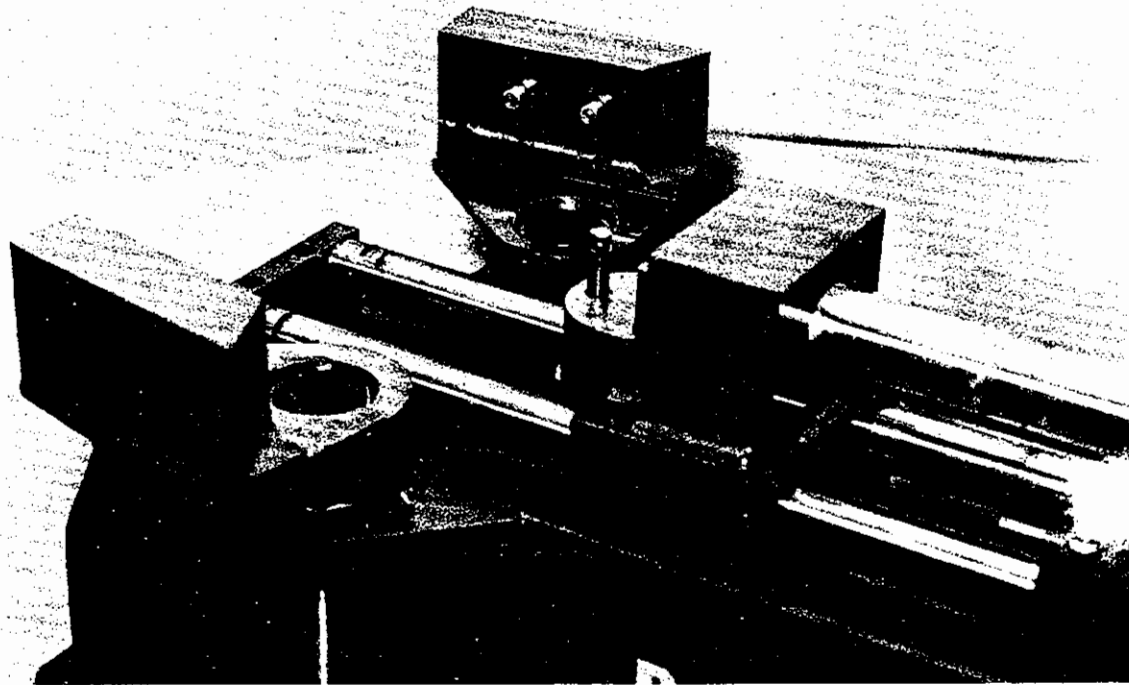


Figure 10

2. Place a short section of $1\frac{1}{2}$ " tubing under the front end of the main cylinder.

3. Remove the screw that connects the die carriage to the end of the cylinder ram and slide die carriage forward. (Figure 11)
NOTE: Do not lose die spring which is located between end of ram and carrier.

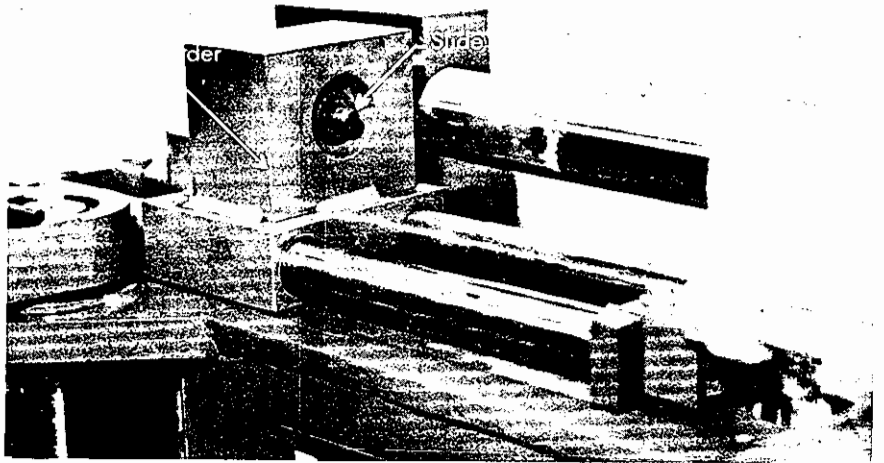


Figure 11

4. Remove the two bolts holding the "cover" over the micro switch. (Serial #1046 and above). (Figure 12) Then remove cover and also micro switch from bracket. NOTE: Wires do not have to be disconnected from switch. Just pull switch clear of bracket and allow it to hang free.

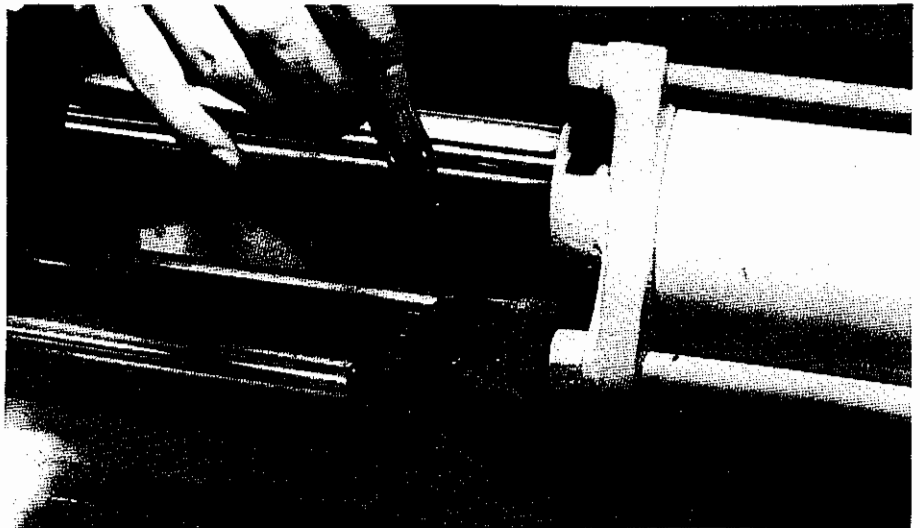


Figure 12

5. Using a 9/16" wrench remove the two bolts that hold the rear way retainer.

6. Remove "way retainer" from ways (it may be necessary to tap with hammer) and pull the ways from the front of the machine frame which will free the die carriage. (Figure 13)

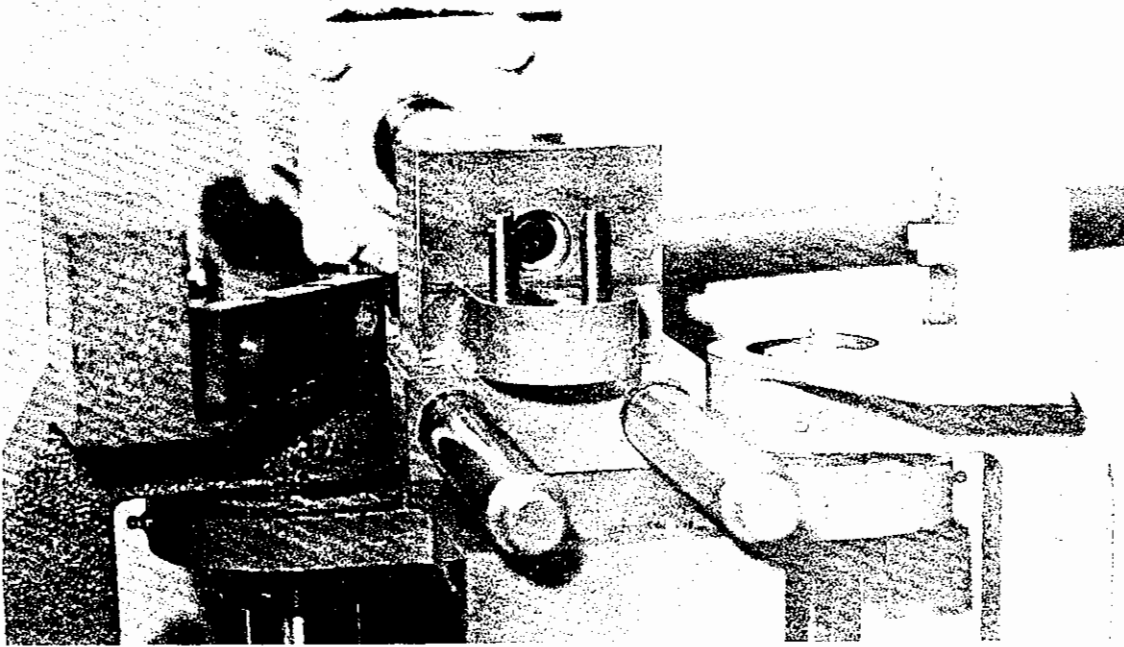
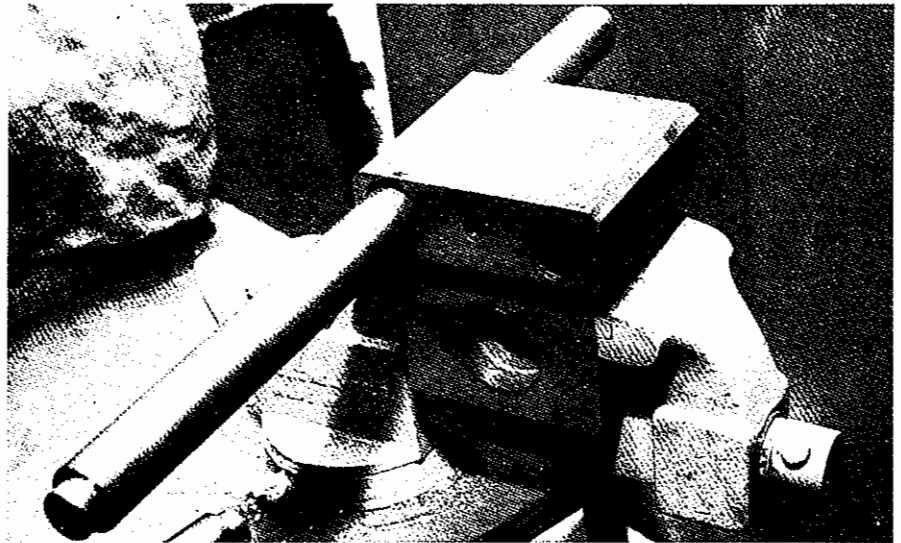


Figure 13

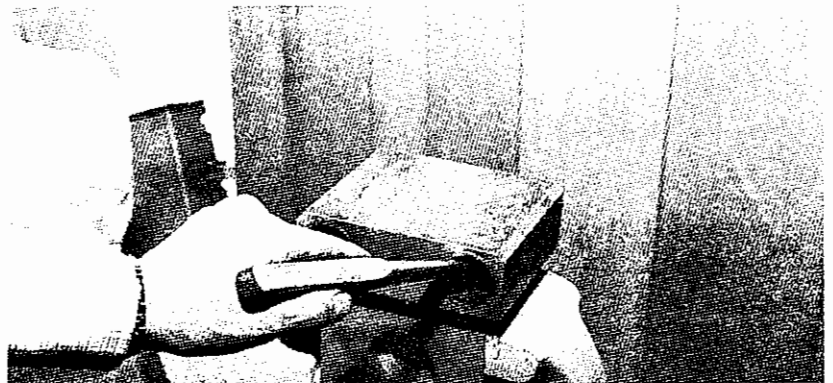
REMOVING AND REPLACING BUSHINGS IN DIE CARRIAGE

1. Remove round ways from die carriage (a vice is recommended to hold carriage rigid). (Figure 14)

Figure 14



2. Using a hammer and punch, remove all 4 bushings from die carriage. NOTE: Punch should be cylindrical, flat on the end, and about $\frac{1}{2}$ " in diameter. (Figure 15)



3. Check for any damage that may have occurred while driving old bushings out of carriage. If necessary file off any burrs which may have been produced around edge of bushing holes.

4. Insert new bushings in die carriage. NOTE: Bushings should be started into hole by "LIGHTLY" tapping with hammer. (Figure 16) After bushings are started place a block of wood against bushing to prevent damage when driving them in. (Figure 17) If bushings are damaged use a round or half-round file to remove burrs from bushings.



Figure 16

5. Replace round ways and install carriage to machine reversing the steps used for removing carrier.

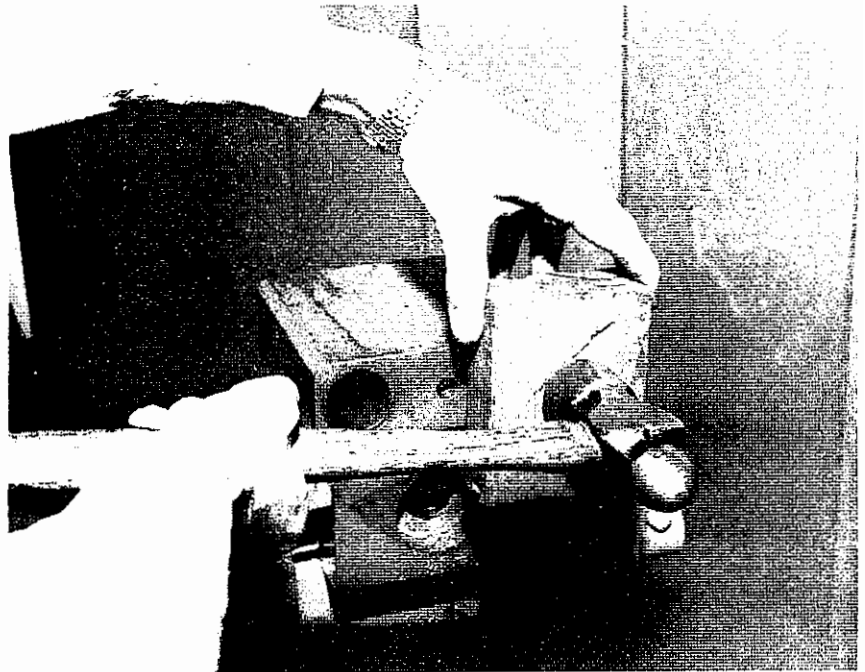


Figure 17

