

**SMT-PULLMAX**  
KUMLA

Kumla Mekaniska  
Verkstads AB  
Kumla, Sweden

Z-52		Maskin nr. Machine No. Maschine Nr. Machine No. Máquina No.	4556
Lev. år Delivery year Lieferung Jahr Livrée en Ano de entrega	82.02	Maskinvikt Machine weight Maschinengewicht Machine poids Peso de la máquina	19.800 lbs

On inquiries and orders for spare parts, please state the above mentioned machine No.

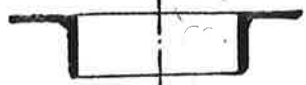
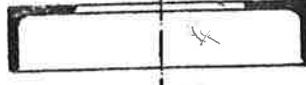

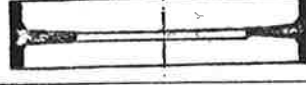
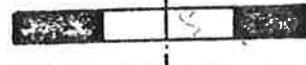
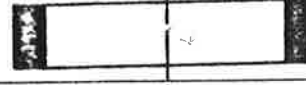
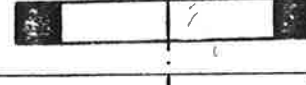
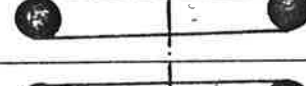
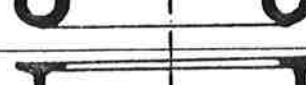
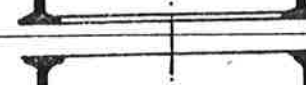
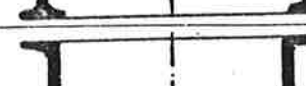
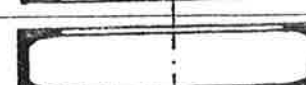
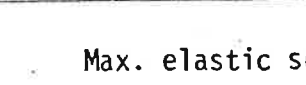
Please hand over these instructions to the operator in charge of the machine.

**N.B.!** Before the machine is started, please carefully read this instruction book. If the given instructions are followed, the life of the machine will come up to the demands you have the right to put on a high-quality product at the same time as the work result will be the best possible.

RING BENDING MACHINE Z-52.

Capacity chart.

Min. diameter <sup>1)</sup>

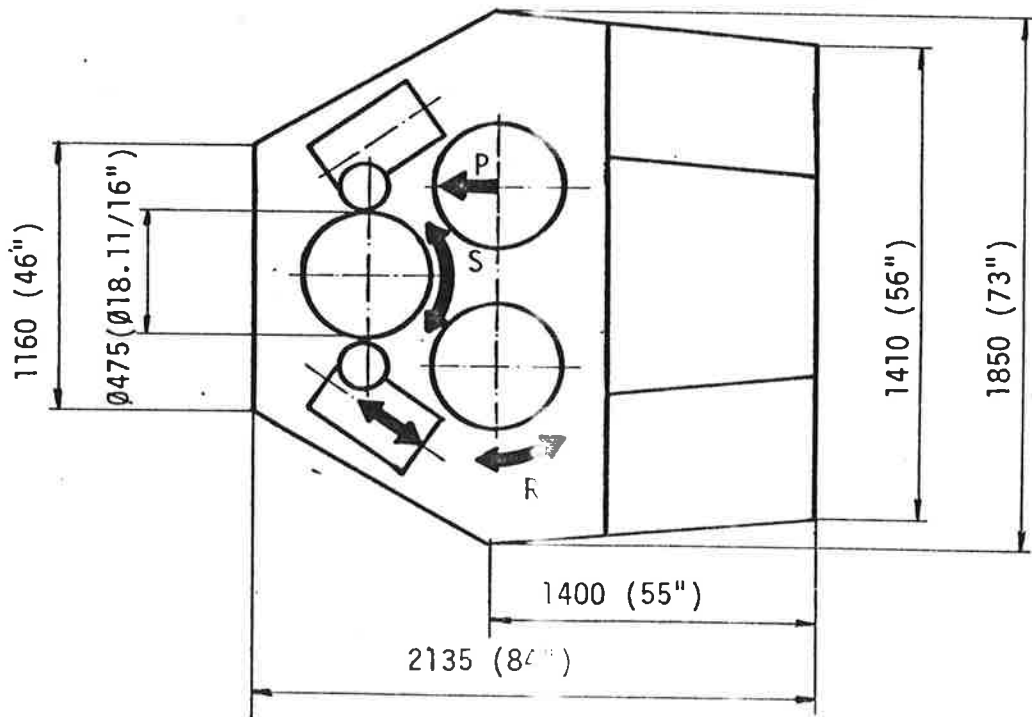
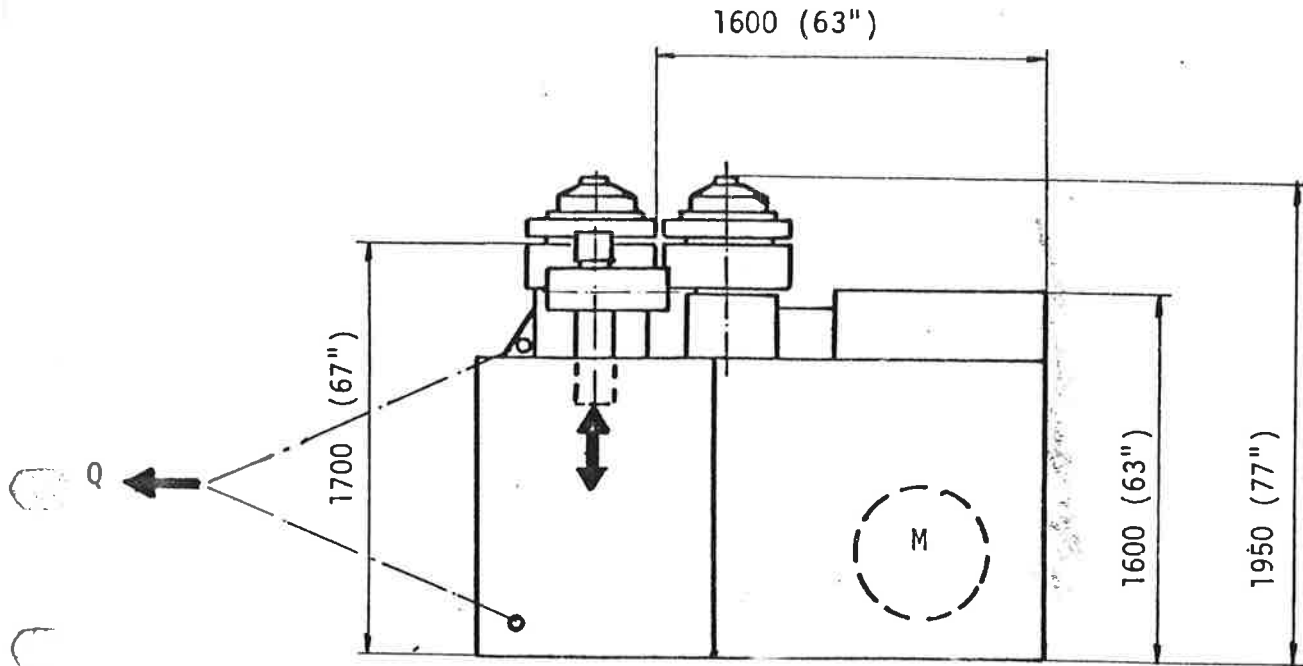
	max. min. min. <sup>2</sup>	5.1/2"x5.1/2"x1" <sup>3)</sup> 3" x 3" x 5/16" 2" x 2" x 3/16"	71" 35" 22"
	max. min. min. <sup>2</sup>	6" x 6" x 3/4" 3" x 3" x 5/16" 2" x 2" x 3/16"	87" 39" 22"
	max. min.	6" x 6" x 5/8"	59" 24"
	max. min.	6" x 6" x 5/8"	79" 24"
	max. min.	6" x 1.1/4"	63" 24"
	max. min.	8" x 2.3/8"	35" 24"
	max. min.	3.1/2" x 3.1/2"	51" 24"
	max. <sup>2</sup> min. <sup>2</sup>	Ø 4"	43" 24"
	max. <sup>2</sup> min. <sup>2</sup>	Ø 6.1/4"	75" 24"
	max. <sup>2</sup> min. <sup>2</sup>	11" x 5.1/2" 3" x 1.3/4"	71" 24"
	max. <sup>2</sup> min. <sup>2</sup>	11" x 4.3/4" 3" x 1.3/4"	71" 24"
	max. <sup>2</sup> min. <sup>2</sup>	11" x 4" 3" x 1.3/4"	71" 24"
	max. <sup>2</sup> min. <sup>2</sup>	11" x 4" 3" x 1.3/4"	71" 24"

Max. elastic section modulus  $W = 7.32 \text{ in}^3$

The figures refer to mild steel with tensile strength 56000 PSI.

- 1) Minimum diameter obtainable in one pass with standard rolls. Smaller diameters with several passages.
- 2) With extra equipment.

TECHNICAL DATA Z-52.



- M = 22 kW
- P = 580 kN (132000 lbs)
- S = 0-4 r/min. (0-4RPM)
- R = 0-2,5 m/min. (0-8,2 fpm)
- Q = 88 kN (19800 lbs)

### Adjusting of the top roll sliding clutch.

The top roller is provided with a sliding clutch to compensate the speed difference between outer and inner diameter of the profile.

After some time of operation it might be necessary to readjust the sliding clutch. If the top roller is not driven when the machine is running idle, this is an indication of the necessity of readjustment.

Adjusting is done in the following way:

1. Dismantle the cover on the top side of the frame. Tighten the allen screws as much as the friction lining has been worn, yet one turn for each adjustment at the most.

Z - 52 ANGLE ROLLS*Claude*

## Adjustment procedures:

To adjust pressures: Note.. To be able to adjust all pressures a ampmeter 0 - 2000 ma must be used!

STEP 1: - Disconnect all electrical connections for the valves on valve plate. ALL except V-13 ( Located on pump - tank-)

STEP 2: - Remove relay board and adjust all pots R-I0, R-II, R-I3, R-I4, & R-24 to minimum. ( Were it reads the highest number on the meter eg.



A- read across 1 & 3 note number

B- read across 2 & 3 and adjust to ' A '

STEP 3: - Turn the potentiometer on AMP-I & AMP-2 to minimum. (If you look at the printed circuit board from above with the component side towards you, and the attachment strip to the right. AMP-I will be at the right and AMP-2 will be at the left.

STEP 4: - Connect the ampmeter in series with V-I3 at panel P-202

STEP 5: - Start the machine and actuate lever SP-I max. Adjust pot MA (R-5) AMP-I to 600ma. Release SP-I and actuate SP-4 (Guide rollers) and adjust pot R-24 to 225ma. ( Increase if not enough to start flow)-CCW-

STEP 6: - Re-connect V-I3 & move ampmeter to V-I2. Mount the electrical connection to V-I2. Actuate SP-I (approx 25-30 %) and adjust MA (R-5) AMP-2 to about 700ma. Release SP-I. Adjust MI (R-2/AMP-2) maximum CW. (Max res 65) Then adjust R-I0 to 300ma --- ( on fluke it only read 718ma.) ---

STEP 7: - Actuate SP-5, adjust R-I4 to 630ma, release SP-5

STEP 8: - Actuate SP-2 (25%) Adjust R-I3 to 565ma. Release SP-5

STEP 9: - Actuate SP-I (25%) Adjust R-II to 685ma. Release SP-I

STEP 10.- Reassemble all electrical connections to the valves.

STEP 11.- Test run and check (And if necessary adjust pot MI (R-8) AMP-I so that the pump does not turn out to much at only a slight movement of SP-I

### INSTALLATION

The machine can be operated in horizontal as well as vertical position. A special base plate is not necessary.

The outer measurements of the machine are given on sheet 4-18211/E.

### CONNECTING

Electric cable to be connected to the electric cubicle on the left side of the machine. Connecting is done to terminals R, S, T and O. Test run the machine and check that the direction of rotation agrees with the symbols on the machine plate. If not, switch two of the cable connections in the electric cubicle.

The motor is protected only by overload relays of thermal type, and therefore overcurrent protection (fuses) should be switched in on the feeder.

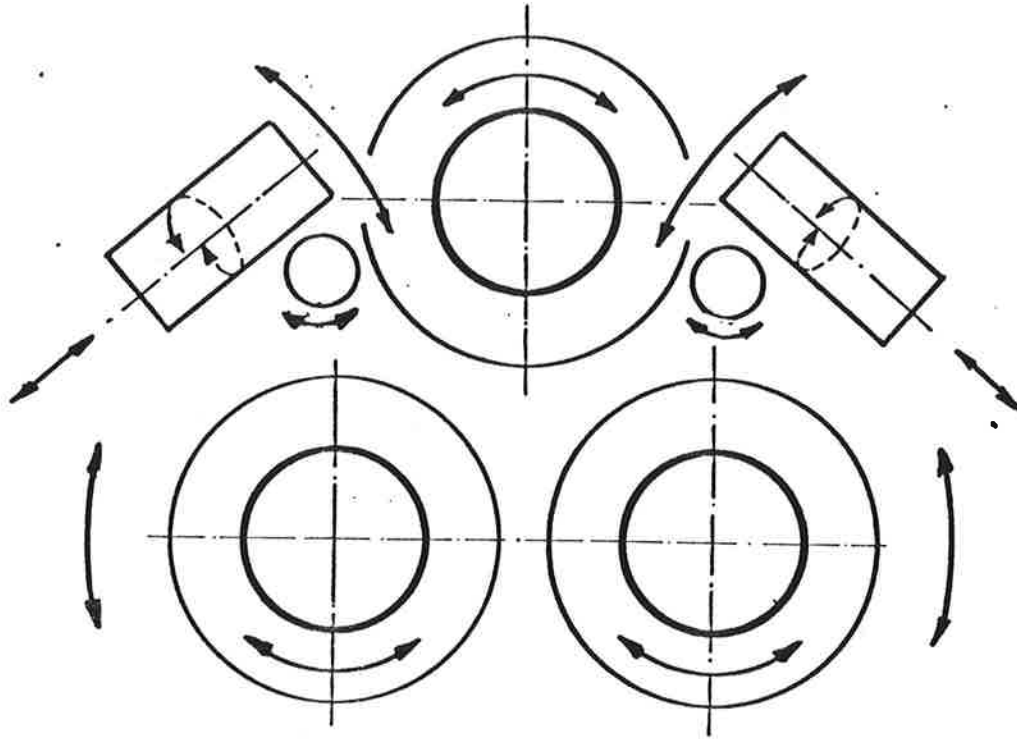
### CLEANING

The bright parts of the machine are furnished with rust protection coating, which is eliminated by means of crystal oil or a similar agent. (N.B.! Thinner or the like must not be used.)

### GREASING

After cleaning greasing of the machine should follow according to lubrication chart 2-17631.

## GENERAL DESCRIPTION.

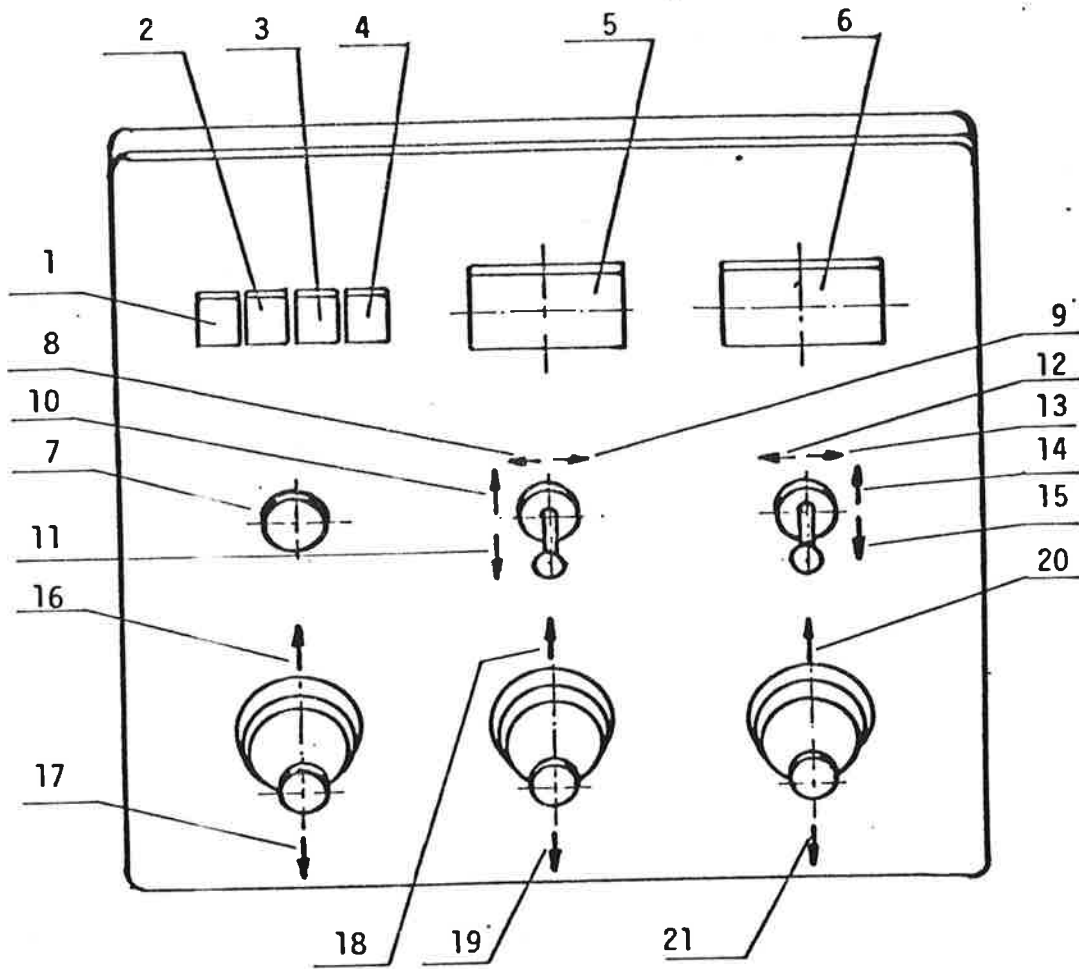


The upper bending roller of the machine has a fixed position. Both the lower rollers are made to swivel. All three rollers are driven by gear wheel transmission by a hydraulic motor. In order to eliminate skidding against the profile, the upper roller is driven through a sliding clutch. The drive for the lower rollers is made by wedge joints.

The lower rollers are placed as closely together as possible. This roller arrangement not only enables prebending to be carried out, but also allows each roller to be adjusted independently.

All functions on the machine are operated by hydraulic power, and are protected against overload by relief valves.

Control panel Z-52.



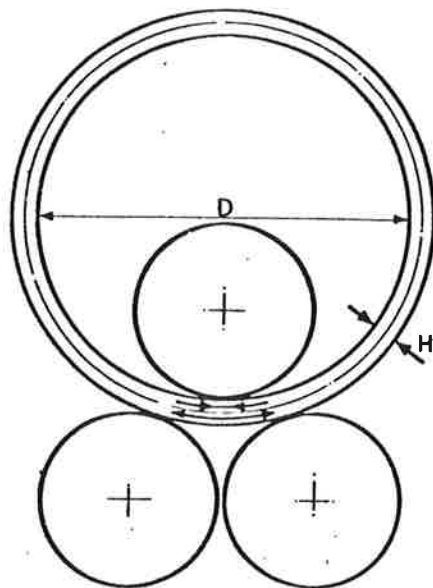
1. Line on.
- ✓ 2. On-off. *select*
3. Machine ready.
4. Indication for change of filter.
- ✓ 5. Position indication for left bending roller.
- ✓ 6. Position indication for right bending roller.
- ✓ 7. Emergency stop.
- ✓ 8. Left support roller, outwards.
- ✓ 9. Left support roller, inwards.
- ✓ 10. Left support roller, upwards.
- ✓ 11. Left support roller, downwards.
- ✓ 12. Right support roller, inwards.
- ✓ 13. Right support roller, outwards.
- ✓ 14. Right support roller, upwards.
- ✓ 15. Right support roller, downwards.
- ✓ 16. Feeding clock-wise.
- ✓ 17. Feeding anti clock-wise.
- ✓ 18. Left bending roller, upwards.
- ✓ 19. Left bending roller, downwards.
- ✓ 20. Right bending roller, upwards.
- ✓ 21. Right bending roller, downwards.



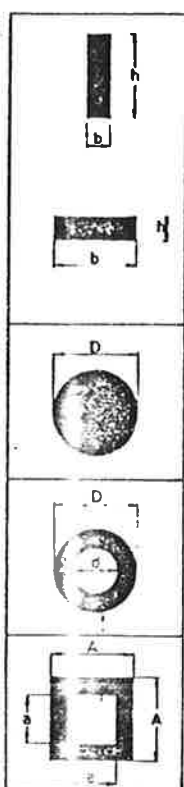
## GENERAL PRINCIPLES OF RING BENDING.

When bending a profile, the material outside the central axis will undergo tension, and the material inside will undergo compression. The allowance, which can be made in this respect, depends on the properties of the material being used. Because of this, the smallest possible bending diameter is limited to four to six times the height of the section for steel of normal structure.

As will be seen from the capacity chart, the elastic section modulus is a limiting factor. Formulas for calculating simple sections are shown below. The elastic modulus of roller structural profiles are, as a general rule, to be found in manufacturer's catalogues.



$$D_{min} = 4-6 \cdot H$$

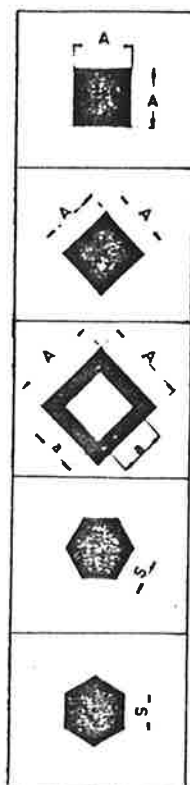


$$W = \frac{b \cdot h^2}{6}$$

$$W = \frac{\pi \cdot D^3}{32}$$

$$W = \frac{\pi}{32} \cdot \frac{D^4 - d^4}{D}$$

$$W = \frac{1}{6} \cdot \frac{A^4 - a^4}{A}$$



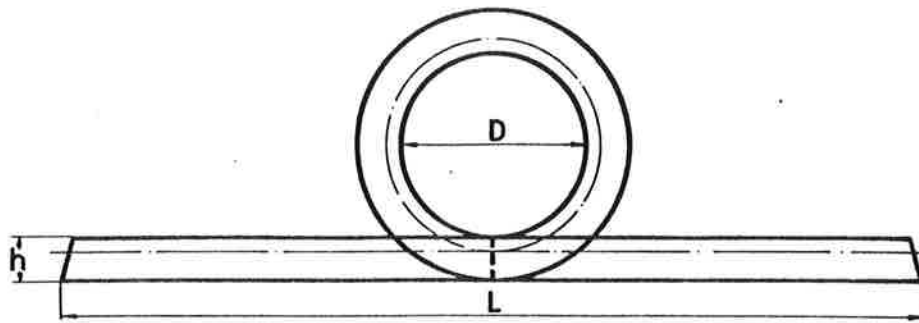
$$W = \frac{A^3}{6}$$

$$W = \frac{A^3 \sqrt{2}}{12}$$

$$W = \frac{A^4 - a^4}{12A \sqrt{2}}$$

$$W = \frac{5}{8} S^3$$

$$W = \frac{5\sqrt{3}}{16} S^3$$



### Calculating of length of blank

Necessary length of blank is generally considered to be identical with the length of the neutral axis (centre of gravity). Owing to the thickening of the wall in the compressed zone and the thinning in the stretched, the neutral axis will move toward the inside of the bend. This relocation will complicate the calculations. In practical bending, however, this movement can be estimated to be about 5 per cent of the height of the profile if the section is heavy and the bending radius large. For very light sections bent to very small radii, a movement of the neutral axis of approximately 25 per cent will occur.

For rough calculations the following empirical equation can be used:

$$L = \pi \cdot D + 2 \cdot 3 \cdot h$$

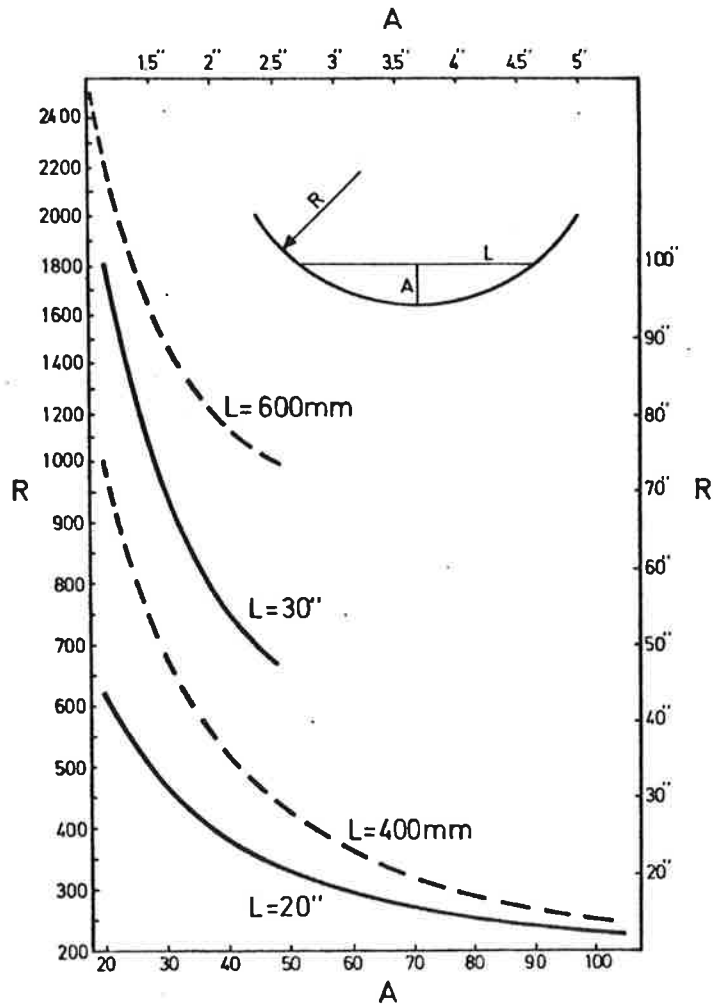
Compare figure above.

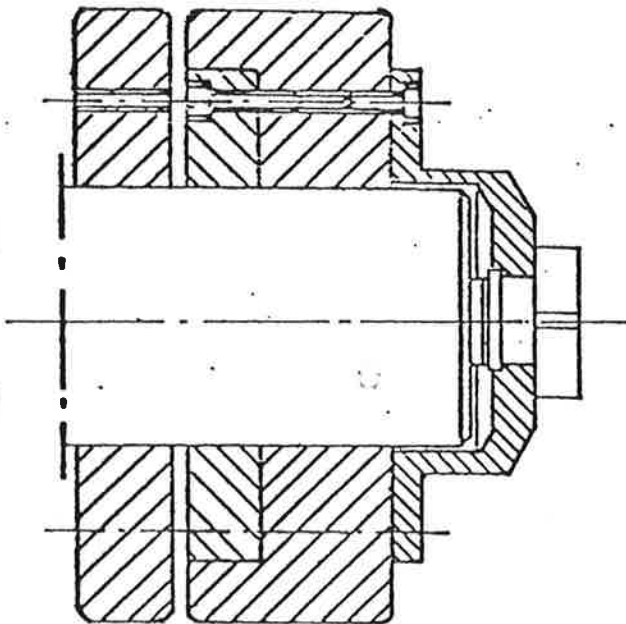
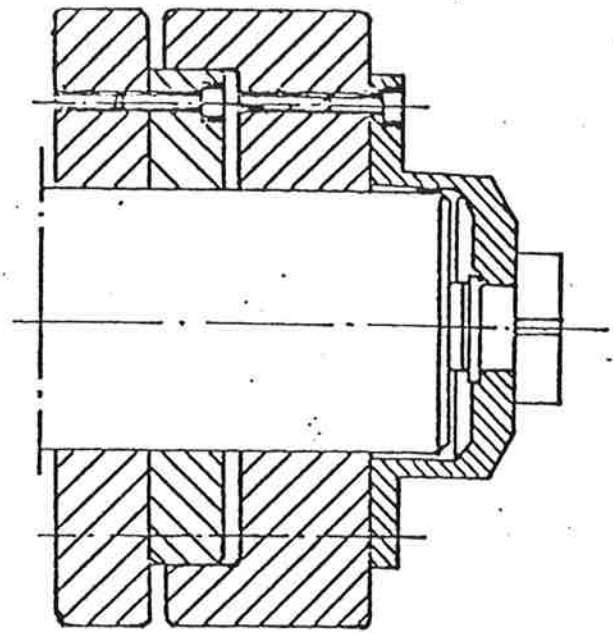
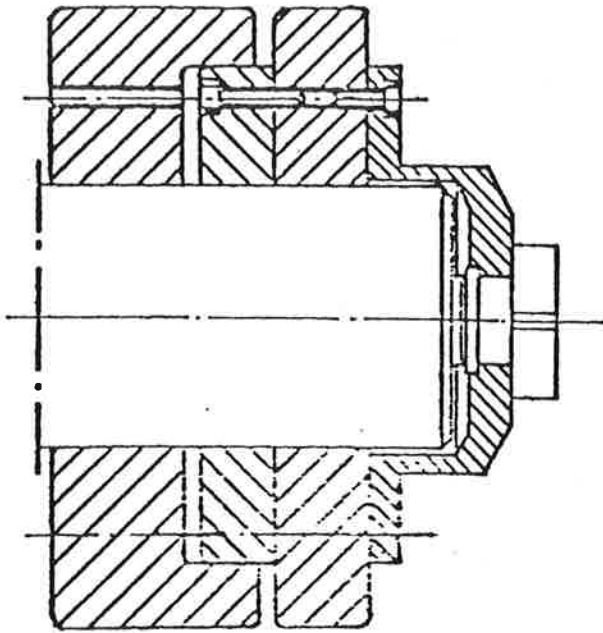
### Measuring of bending radius

A simple method for measuring the bending radius of uncompleted rings is to place a straight rule of certain length (L) against the inside of bend. Measure the chord rise, e.g. the distance between the straight rule and the inside of bend. Then the following equation can be used for calculating the bending radius.

$$R = \frac{L^2 + 4A^2}{8A}$$

Use the diagram below if the ruler is 400 or 600 mm respectively 20" or 30" in length.





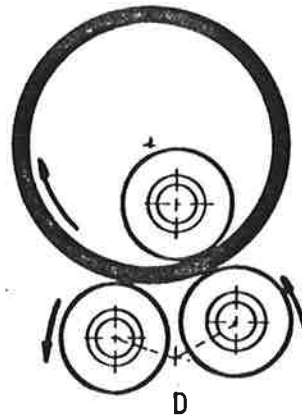
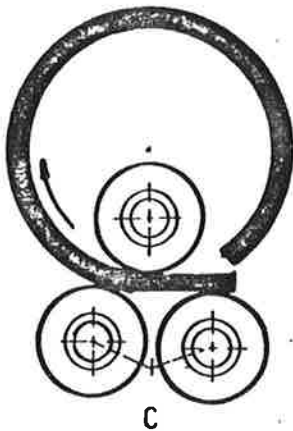
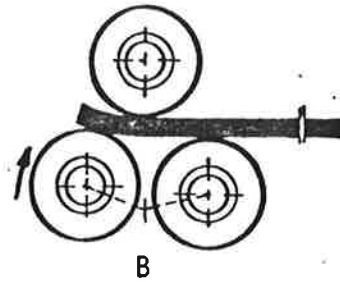
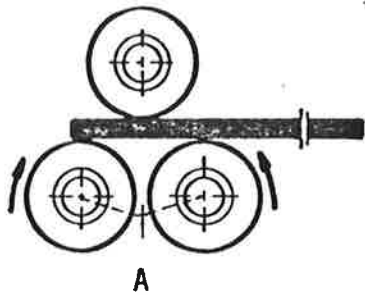
### Bending Rollers

As standard, the machine is equipped with bending rollers divided into two, with one section twice the width of the other. With these standard rollers most profiles can be bent. All the rollers are hardened and have the same diameter.

The fitting of the rollers is illustrated by pictures on this page.

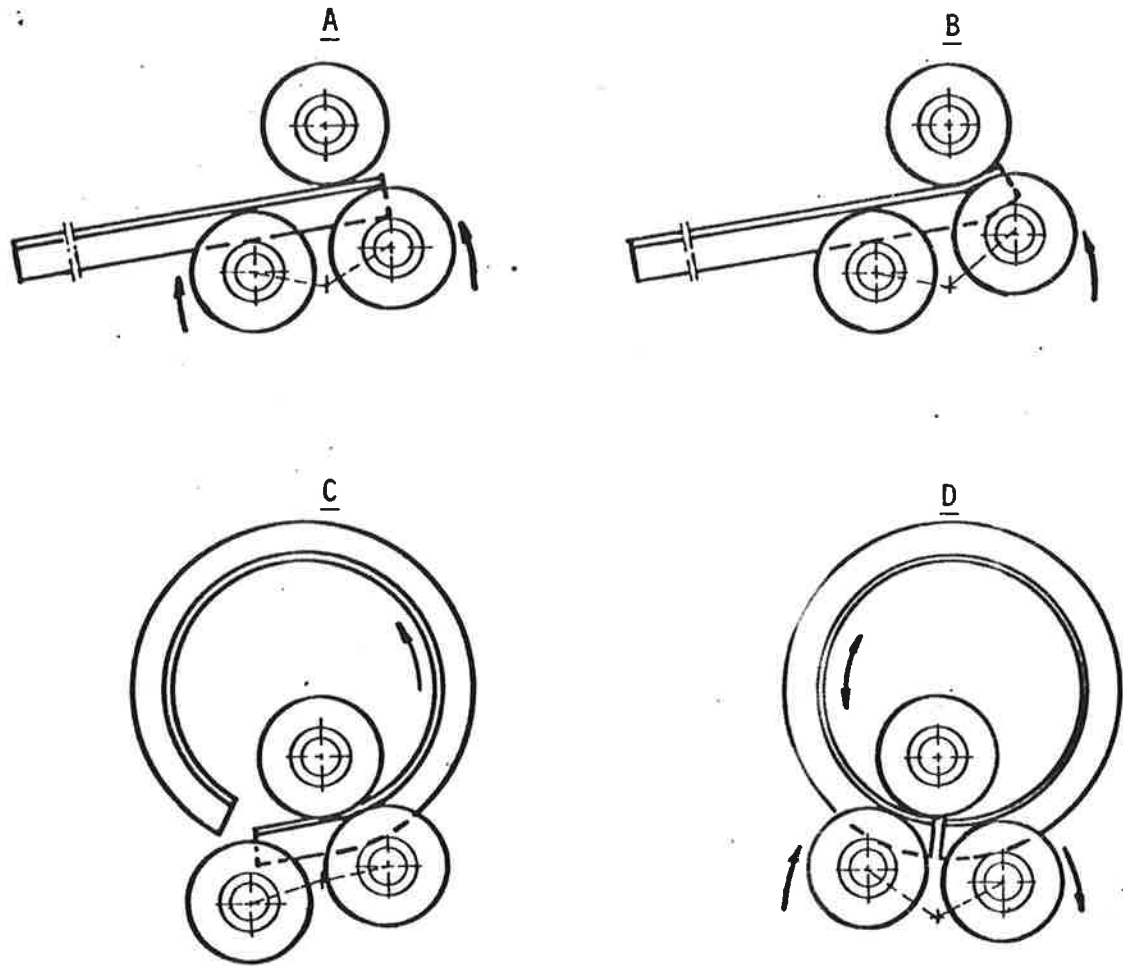
The rollers can be turned.

## Adjustment of Bending Rollers



- A. Set both lower rollers symmetrically against the profile in such a way that the material being formed rests against the upper roller with light pressure.
- B. Raise the lower left-hand roller to a position in accordance with the desired radius, using the adjusting scale. Start the drive motor and feed in a clock-wise direction. Please note the increasing sensitiveness the larger the diameter of rings is to be bent. The shape of the curve varies with the section to be bent.
- C. Feed the entire length of the material through the machine with the rollers in a fixed position.
- D. If necessary, finish forming the diameter by reversing the setting of the lower rollers, i.e. lower the left roller to the same level as the right and then raise the right roller to form the desired bending radius.

Adjustment of Bending Rollers for unsymmetrical sections.



- A. Raise both lower rollers against the profile in such a way that they will press against the upper roller with a light force. Please observe that the lower right roller is to be raised considerably more than the left one.
- B. Raise further the right roller to position in accordance with the bending radius desired. Use the adjusting scale. Start the drive motor for counter clock-wise feeding.
- C. Feed the profile in its entire length through the machine with fixed setting of the rollers.
- D. If necessary, calibrate the other end of the profile by reversing the setting of the lower rollers - lower the right roller to the same level as the left one, then raise the left roller for the desired bending radius. Feed the profile through the machine in clock-wise as well as counter clock-wise direction thus having the joint pass the bending rollers several times.

## Pre-bending

Through pre-bending the edges of the profile there will be a minimum of straight edges.

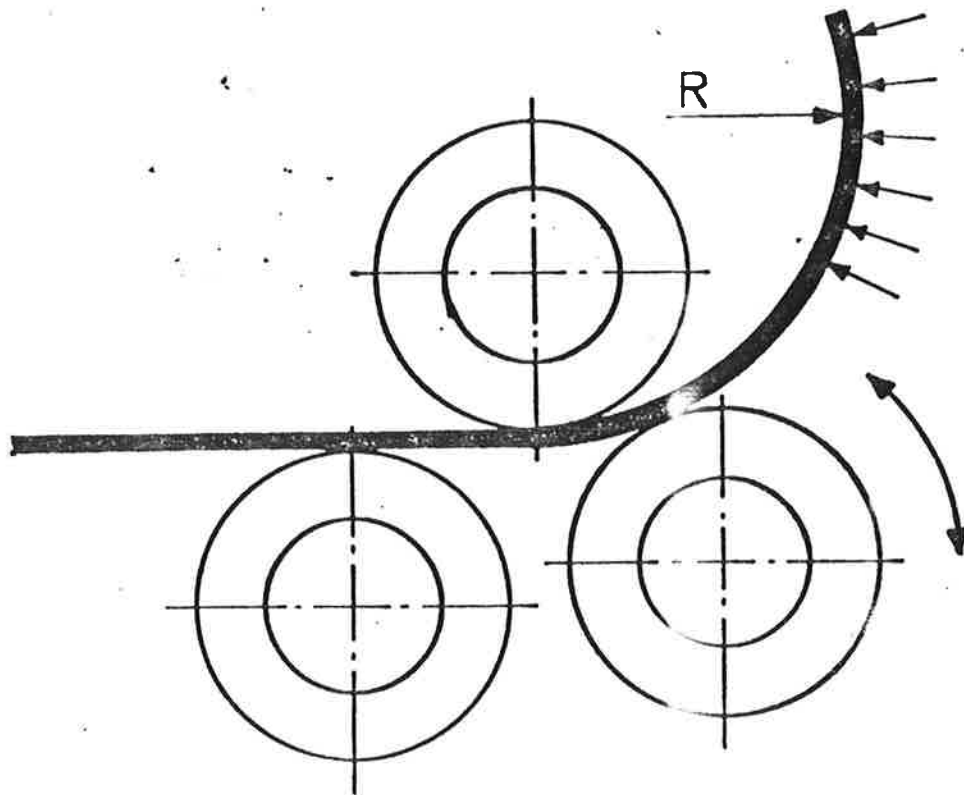
Bend first one end with one of the bending rollers considerably more raised than the other one, then bend the other end of the profile by reversing the setting of the lower rollers.

Pre-bending also is important when bending coarse profiles to small diameters in one single pass through the machine.

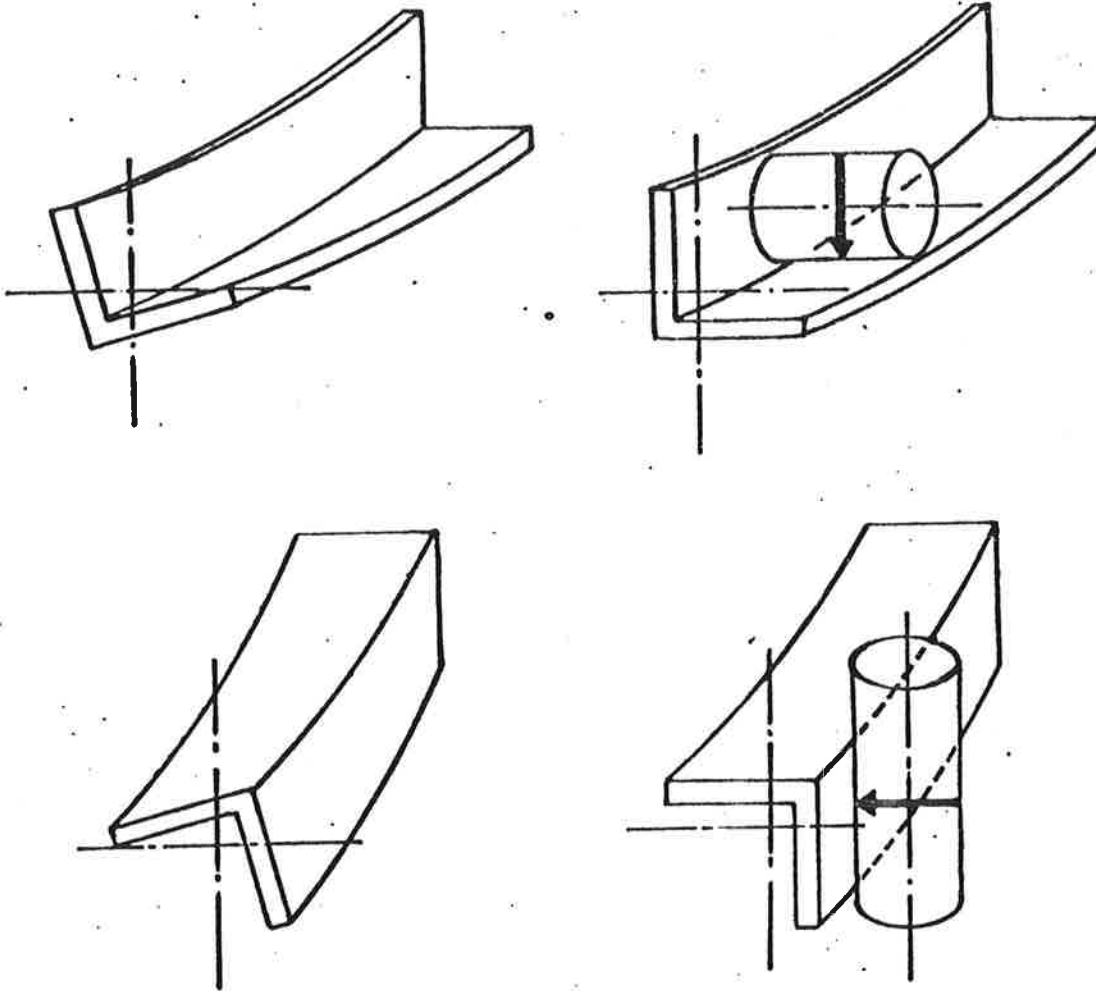
Pre-bend in following way:

Raise one of the bending rollers hard in the end of the profile, then lower the roller and feed the material a smaller distance, raise the roller again. Bend in this way in small steps until the right radius  $R$  is obtained, check with template. Feed the material through the machine with the rollers in a fixed position.

Compare figure below.



## Adjustment of Guiding Rollers.



When bending, the profile tends to twist round its centre gravity-line. If this is unsymmetric, the result will be a distortion of certain parts of the section.

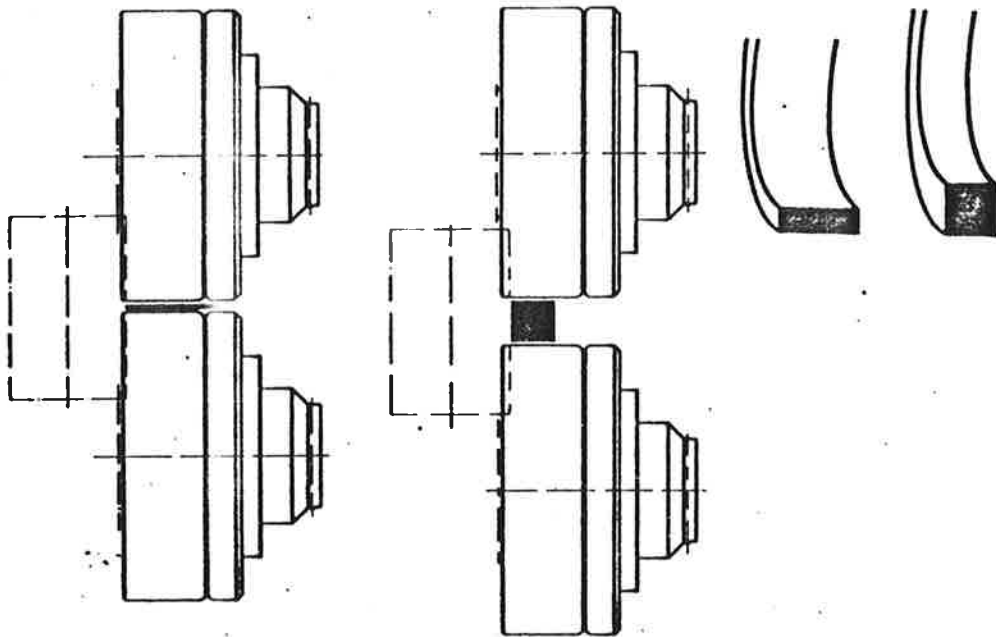
When distortions occur, the guiding rollers have to be set against the profile and an over-bending of about  $7/32''$  to  $13/32''$  is necessary to compensate for the normal back-spring of the profile.

The centre axis of the guiding roller should be in line with the centre point of the ring being bent.

Adjustment "in and out" of the guiding roller is carried out hydraulically from the control panel by guidance from position indicator. Both right and left guiding rollers have to be adjusted equally.

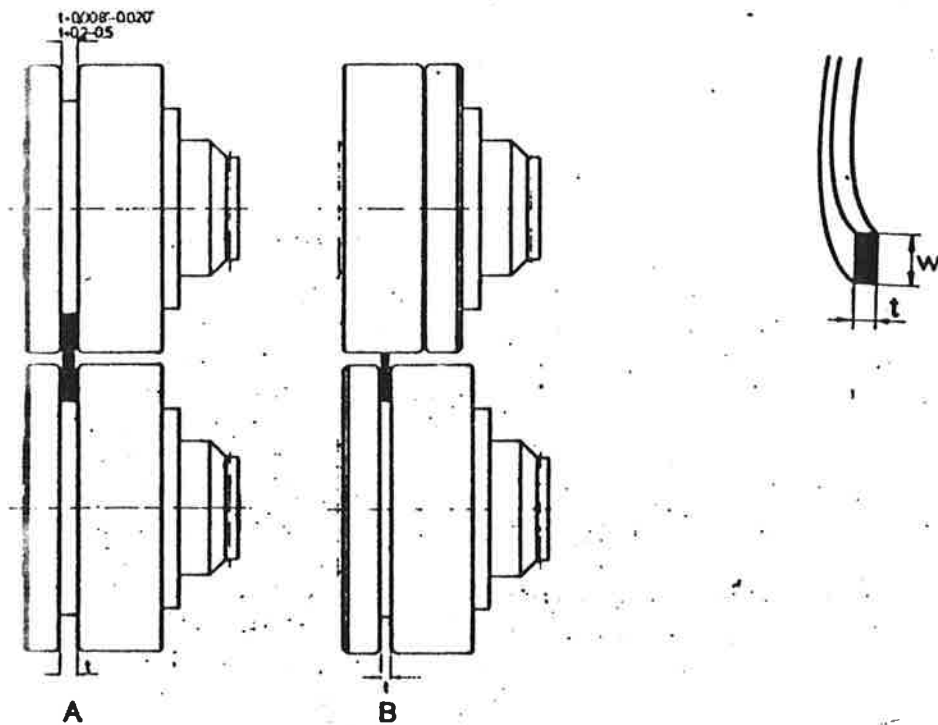


Bending of horizontal Rectangular and Square section.



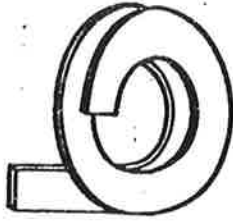
The roller sections on all shafts are screwed close to each other. Both guiding rollers should be adjusted to be the same distance from the machine. Operate in accordance with instructions on sheet 4-18218/E.

Bending of vertical Rectangular section



The standard setting for the rollers is as figure A. Please note that the thin portion of the roller should be mounted innermost. The gap between the roller sections should be adjusted so that there is .02" more clearance than the thickness of the material being formed. Operate in accordance with the instructions on sheet 4-18218/E.

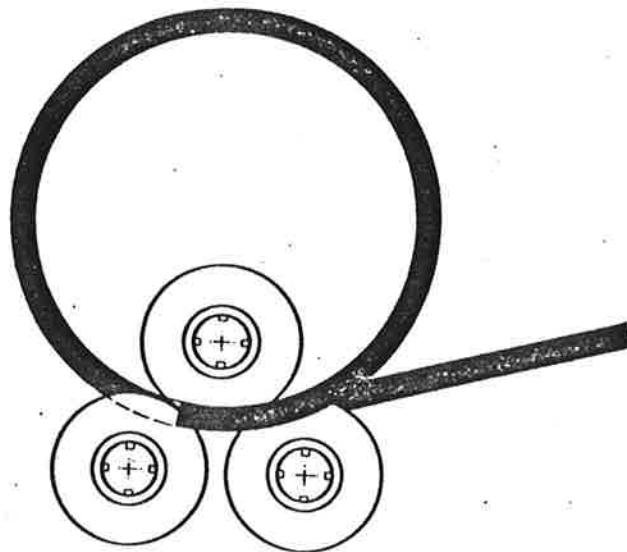
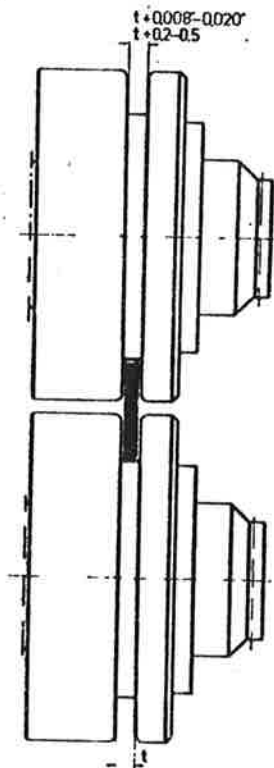
When bending small rectangular section, particularly if a small diameter is required, the rollers should be arranged as figure B.



### Spiral bending of vertical Rectangular Section

The rollers should be set as shown in the illustration. Notice that the wider portions are placed innermost on the shafts. The bending is carried out with uniform setting of both lower rollers. Adjust the guiding rollers in such a way that the first ring of the bent profile will pass in front of the lower inlet bending rollers.

Run desired number of turns.



## Bending of Angles

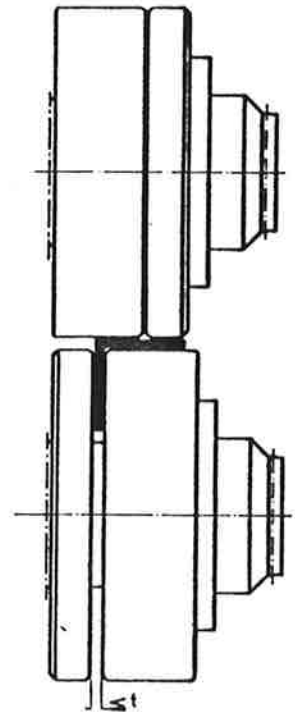
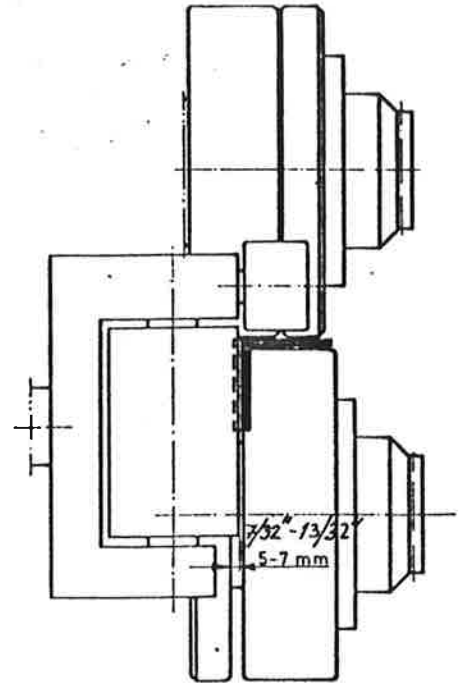


### Leg out

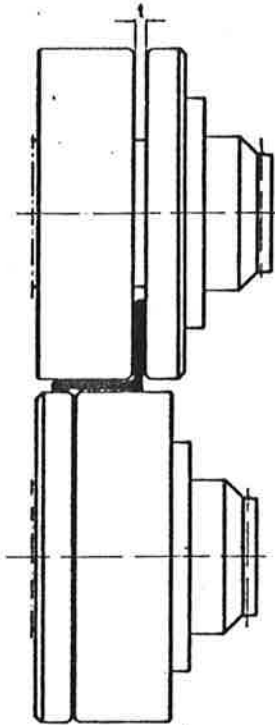
Mount the rollers in the manner illustrated. The guiding roller on the outlet side should be set  $7/32"$  to  $13/32"$  passed the outer edge of the thinner lower bending roller.

Operate in accordance with instructions on sheet 4-18219/E.

If the diameter of the ring produced is too large, the guiding roller on the inlet side must be adjusted to the same position as the guiding roller on the outlet side. Increase the pressure on the bending roller on the inlet side and run the ring until it is flat and the required size.



## Bending of Angles



### Leg in.

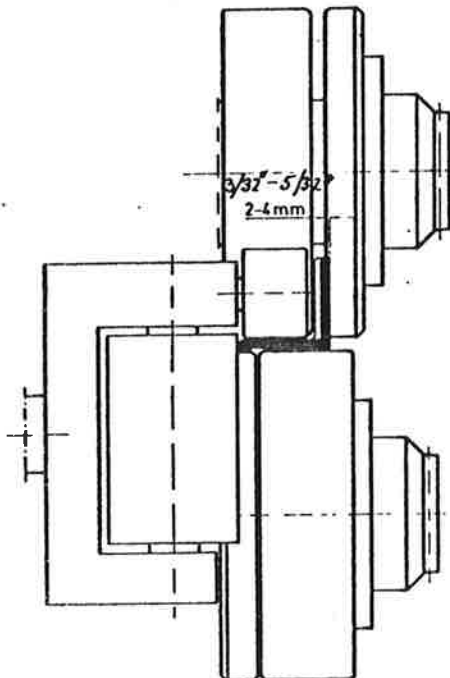
Set the rollers as shown in the illustration. Fit the machine with extra guiding rollers. Set the guiding roller at the outlet side so that it will over-bend approximately  $3/32''$  to  $5/32''$ .

Adjust the extra guiding roller to ensure that the section is straight.

NOTE. When setting the lower bending rollers, the extra guiding rollers must be adjusted upwards to correspond with the upper bending roller.

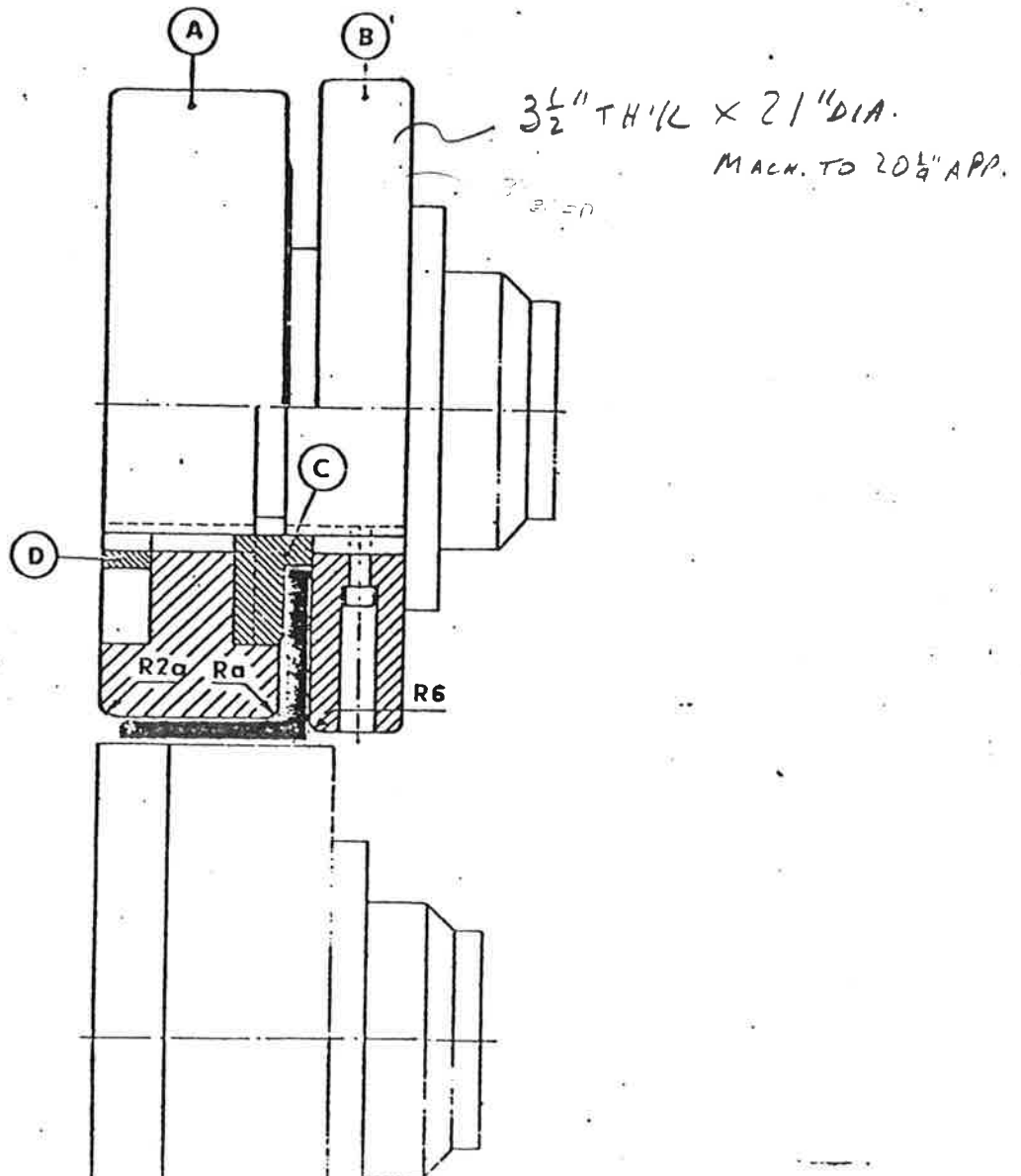
Operate in accordance with instructions on sheet 4-18219/E.

If the diameter of the ring is too large, the guiding rollers at the inlet side must be adjusted to the same position as the guiding rollers on the outlet side. Increase the pressure on the bending roller on the inlet side and work until the ring is flat and has the correct dimensions.

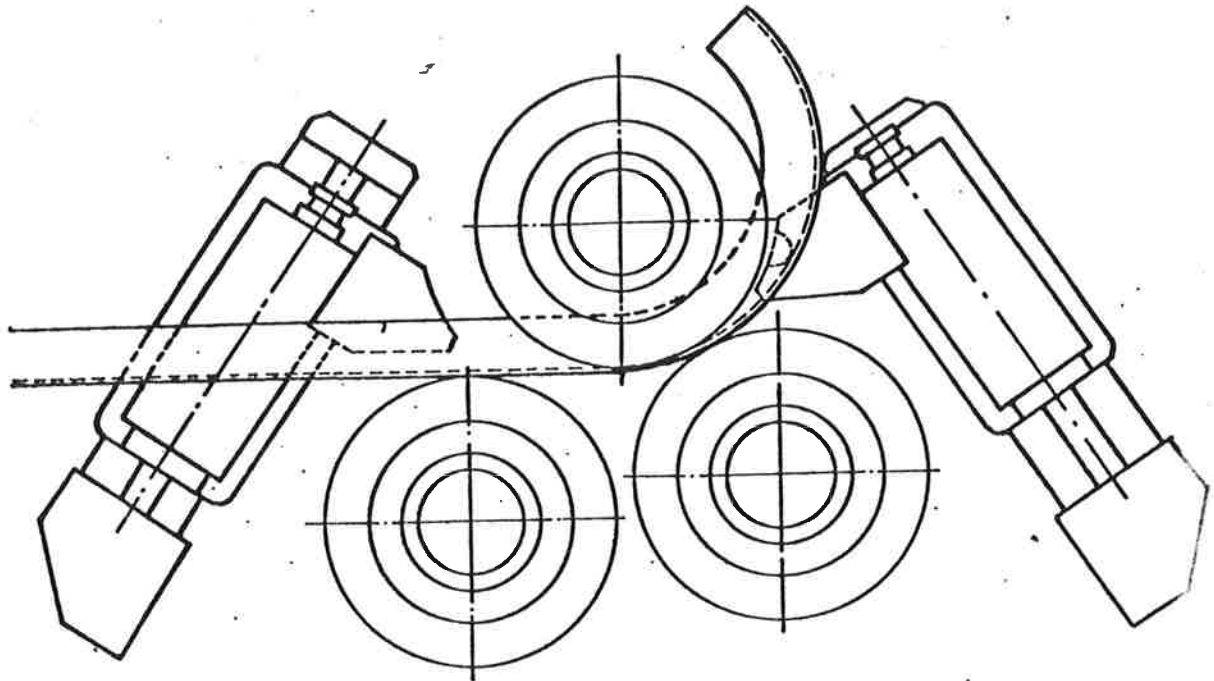


If when roller bending a L-bar with the upended flange turned inwards towards the centre of curvature it is absolutely essential to keep the original profile free of deformations. The machine is equipped with a special upper bending roller constructed as in the illustrating Figure. The roller is divided into two halves, a broad A and a narrow B. Between these there is a support ring C, the dimensions of which must be carefully adapted to the profile to be bent. A support ring D positions the broad half of the roller, which is fitted furthest in on the axle relative to the collar. The A half of the roller is shaped with different edge radii and when being fitted is turned so that the radius most like or slightly less than the angle radius of the roller profile is turned outwards. The narrow roller B has a larger diameter than roller A in order to give heel support to the bent profile. Standard rollers are used on the lower axles.

In addition to the bending accurate to shape, the above special roller causes far less material tensions in the bent profile bar and thereby reduces the risk of cracks and breakages.



Bending a L-bar with small sectional measurements.

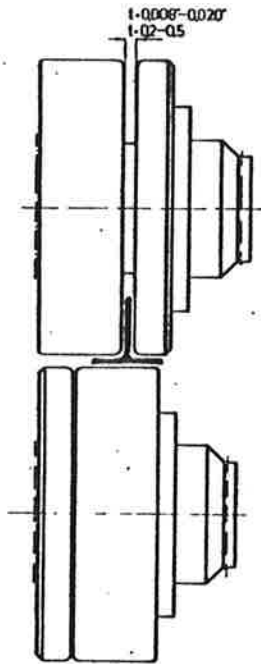


When bending a L-bar 3" x 3" x 5/16" or less to diameters under 35" the machine is equipped with special guide rails. Each guide rail is provided with one axle journal, which at time of fitting is pushed into the hole for clamping the extra guide roller in the proper guide roller bracket. The guide rails are locked in position by means of the stop screws for the extra roller.

Thanks to the special design of the rails in combination with the close positioning of the bending roller, the L-profile is given excellent support even in the case of small radii of curvature.

# Bending of T-section

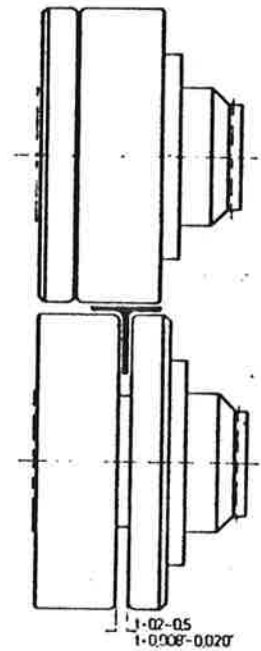
Leg in



Set the rollers in accordance with the adjoining figure. The gap between the pieces of the upper roller should be .02" larger than the thickness of the material to be formed.

Operate in accordance with instructions on sheet 4-18218/E.

Leg out

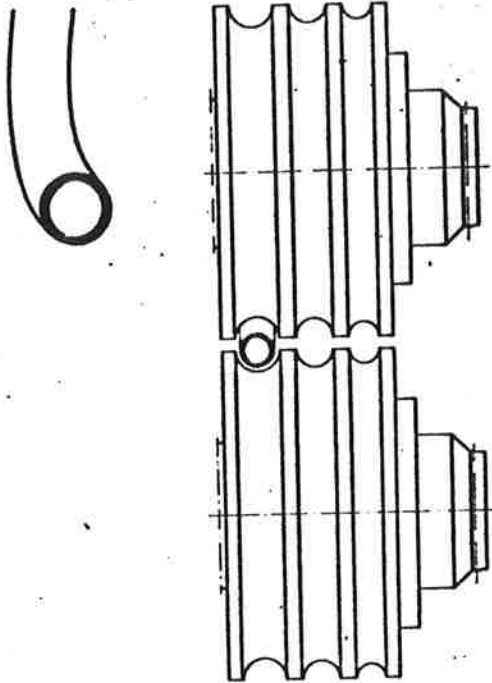


Set the rollers in accordance with illustration. The gap between the two sections of the lower rollers should be .02" larger than the thickness of the material being formed.

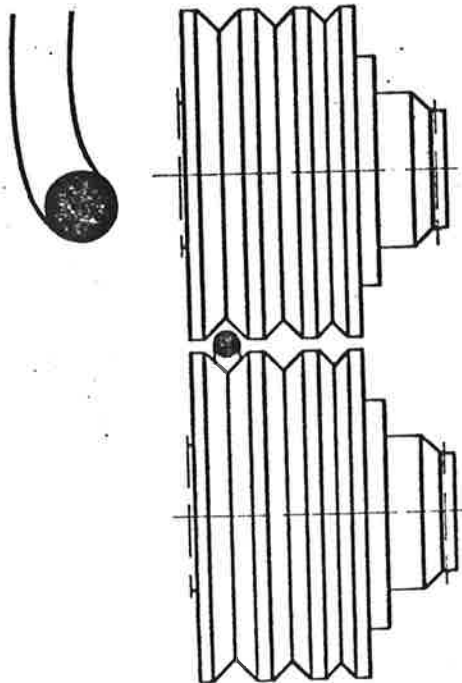
Operate in accordance with instructions on sheet 4-18218/E.



Bending of Circular Sections.



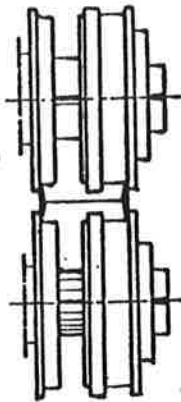
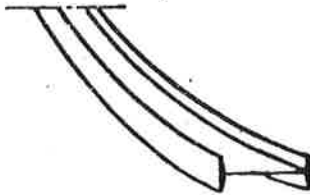
Fit the machine with the special bending rollers with V- or semicircular grooves. In order to avoid distortion, it is important that the dimension of the groove should correspond with the diameter of the section being formed. When bending tubular section, this is of the utmost importance.



Adjust both guiding rollers to the same distance from the machine.

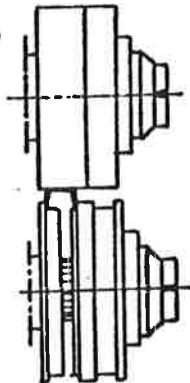
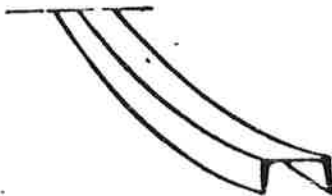
Operate in accordance with instructions on sheet 4-18218/E.

### Bending of Horizontal I-beams.



The machine has to be equipped with special bending rollers suitable for this work. The rollers are adjustable for varying web widths.

Adjust both guiding rollers to the same distance from the machine and operate in accordance with instructions on sheet 4-18218/E.

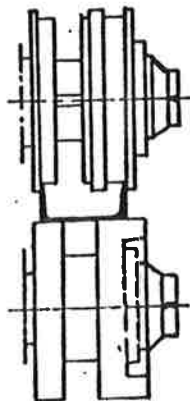
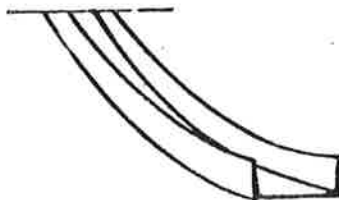


### Bending of Channel Section.

Leg out

Fit the machine with the special bending rollers as illustrated. The lower bending rollers should have grooves corresponding to the dimension of the flanges on the material being formed. Use standard upper roller. The same set of rollers can be used for different web widths.

Adjust both guiding rollers to the same distance from the machine and operate in accordance with instructions on sheet 4-18218/E.



Leg in

Equip the machine with standard rollers on the lower shafts. The upper bending roller must be made with grooves corresponding to the dimension of the material being formed.

Adjust both guiding rollers to the same distance from the machine and operate in accordance with instructions on sheet 4-18218/E.