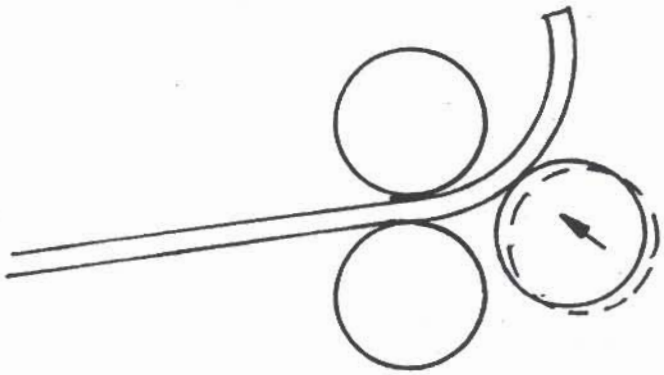
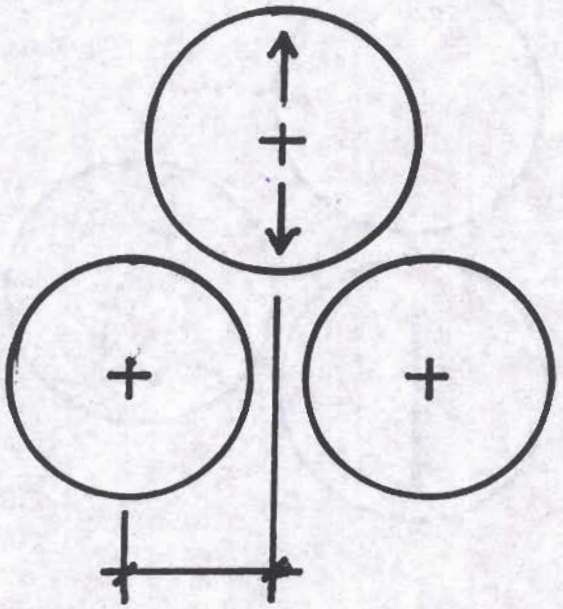
THE OPERATING PRINCIPALS OF

PLATE BENDING ROLLS



A.W. Weaver

WDM
MACHINE TOOLS
REAL WORK HORSES
from Kentucky
ATHENS CHESTNUT LEVEL RIDGE
LIBERTY, KENTUCKY * USA *



==========PYRAMID TYPE==========

ADVANTAGES

Economical

High capacity for given roll size

Uniform rolling

Ability to roll angle and flat bar with attachments

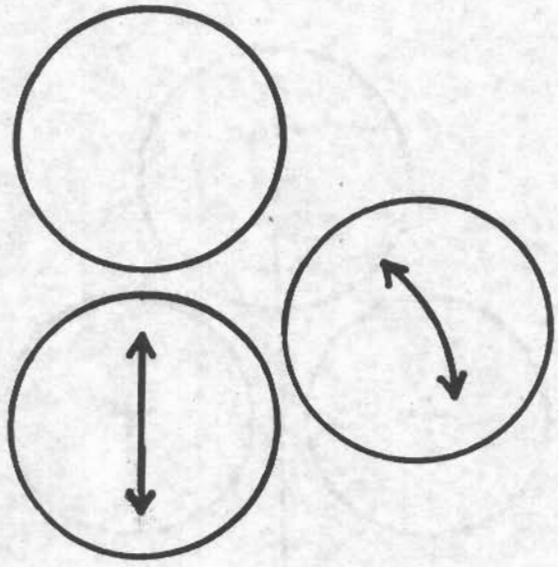
Good cone rolling

DISADVANTAGES

Leaves a relatively long flat on leading and trailing edges

WDM
MODELS

HIP
MIP



==========INITIAL PINCH==========

ADVANTAGES

Rolls minimal flats (approximately 1½ to 2 x metal thickness) on leading and trailing edges

Good cone rolling capabilities

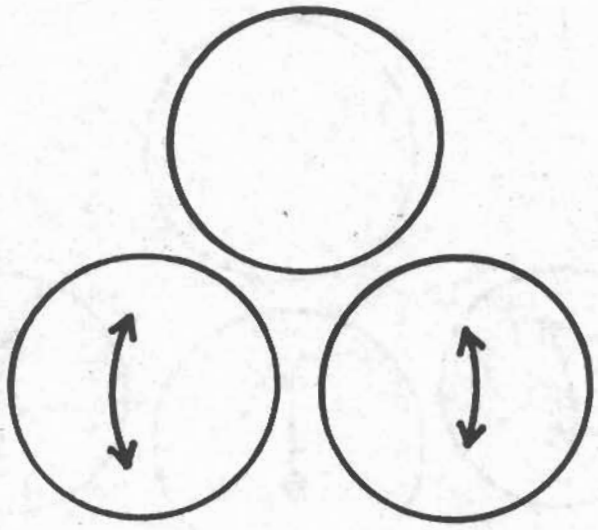
Good control of work piece

DISADVANTAGES

For proper formation work piece must be removed and re-entered in the opposite side of machine

Small opening between pinch and top rolls

WDM
MODEL
100



==========PINCH PYRAMID==========

ADVANTAGES

Minimal flats on both ends with one entry

Easy to operate

Increased capacity when rolling large diameters

Ability to roll angles and flat bar with attachments

Very versatile - symmetrical structural sections and welded/fabricated panels can be formed

DISADVANTAGES

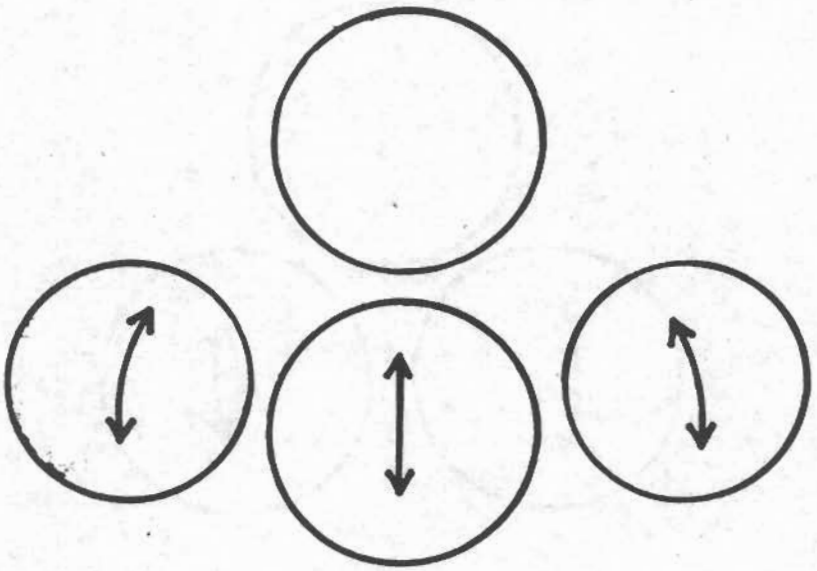
Moderate accuracy

Moderate cone rolling capability and capacity

Can have some flats on large diameters

Can lose control of work piece

WDM
MODEL
400



==========4 ROLL==========

ADVANTAGES

Minimal flats (approximately 1½ to 2 x metal thickness) on both ends with one entry

Can be conveyor fed

Excellent control of work piece

Excellent cone rolling capacities

Readily lends itself to automation

DISADVANTAGES

Larger machine

More costly

Can be confusing for the periodic and unskilled worker

SOME GENERAL

FEATURES OF WDM MACHINES

*All welded steel frame with integral hydraulic reservoir

*Medium carbon or alloy steel rolls and shafts

*Anti-friction - rolling element type bearings used throughout

*Sealed spherical roller bearings used on most roll journals

*Rolls driven -

- --by hydraulic motors directly (smaller models)
- --through spur gear train (medium size models)
- --individual planetary type speed reducers (12" roll or larger)

*Moveable roll position indicated with dial-pointer type indicator

*Rolls crowned for deflection under forming pressures

*Total hydraulic design

*All functions controlled by manual control valves located on console of main housing

*Efficient/cool hydraulic system

*Quiet gear type hydraulic pump

*Hydraulic oil filtered when leaving and returning to tank

*Oil temperature and level sight gauge

*Most hydraulic motors of LSHT disk valve type design

*Rolls adjusted by hydraulic cylinders with effective sealing features

*Roll adjusting circuit equipped with lock type valves

*Plate rolls equipped with special WDM designed PCR-100 valve units to automatically parallel the lower rolls

FEATURES cont.

*Trim valves to tilt lower rolls to facilitate cone rolling

*System speed controls on main housing for roll rotation and adjustment speeds

*Electrics to NFPA79 specifications

*TEFC motor

*230/460 volts 3 phase 60 hertz
other electrics available

*Safety emergency stop cable or emergency stop mushroom buttons on three sides of machine

*Nema 12 electric enclosures

*Main disconnect with interlock

*Painted with VOC compliant coatings

*Haze gray epoxy and safety blue enamel

SOME GENERAL
OPTIONS AVAILABLE
ON WDM PLATE ROLLS

*Alloy steel rolls heat treated to 28-32 Rc

*Flame hardened rolls to 55-60 Rc hardness

*Rolls polished to 32 RMS or better

*Cone rolling attachment

*Starting/Squaring grooves

*Circular grooves for rolling rounds or sheets with wired edges

*Special circular grooves

*Bar on edge attachment

*Angle attachment

*Side supports

*Overhead supports

*Feed tables

*Infeed guides and conveyors

*Ejectors

*Non-standard voltages

*Special pain color or type

SOME
CONTROL OPTIONS
FOR WDM PLATE ROLLS

*Swinging console with manual control valves mounted on drop end of machine

*Replace manual valves with-

- -Roving electric pendant on rubber cord
- -Moveable console control with joystick to control manual valves

*Foot switch for forward and reverse rotation of rolls

*Replace dial pointer type roll position control with-

- -Lighted LCD DRO (Series 421)
- -Lighted LCD DRO on each end of roll (useful for cone rolling) (Series 422)
- -LED DRO with 2 preset positions for rapid repeatability (series 423)
- -LED DRO with 2 preset positions and an LCD DRO showing position of far end of forming roll (used with cone rolling) (series 424)
- -Automatic PLC type control for full automatic cycle

*LCD DRO roll length indicator (Series L)

*LED DRO roll length indicator with 2 preset positions (Series LP2)

*LCD DRO roll length indicator with 6 preset positions (Series LP-6)

PLATE ROLLING

SYSTEM OPTIONS

*Plate rolls can be combined with peripheral equipment to make very productive systems

--Auto cycle ejectors

--Auto infeed systems

--Automatic unstackers and feeders

SOME COMPONENT SUPPLIERS

*SKF - Bearings

*TORRINGTON - Bearings

*CHAR-LYNN/EATON - Hydraulic Motors

*WHITE - Hydraulic Motors

*HYDRAFORCE - Hydraulic Valves

*PRINCE - Hydraulic Components

*WHITY - Valves

*COMMERCIAL INTERTECH - Hydraulic Components

*CONTINENTAL - Hydraulic Components

*PARKER - Hydraulic Components

*WEATHERHEAD - Hoses and Fittings

*LINCOLN ELECTRIC - Motors

*AUBURN GEAR - Gear Cases

*ESKRIDGE - Gear Cases

*LYNN GEAR - Gears

*LOVEJOY - Couplings

*SQUARE D - Electrical Components

*RED LION - Counters and Encoders

*ALLEN BRADLEY - Electrical Components and PLC's

*HOFFMAN - Enclosures

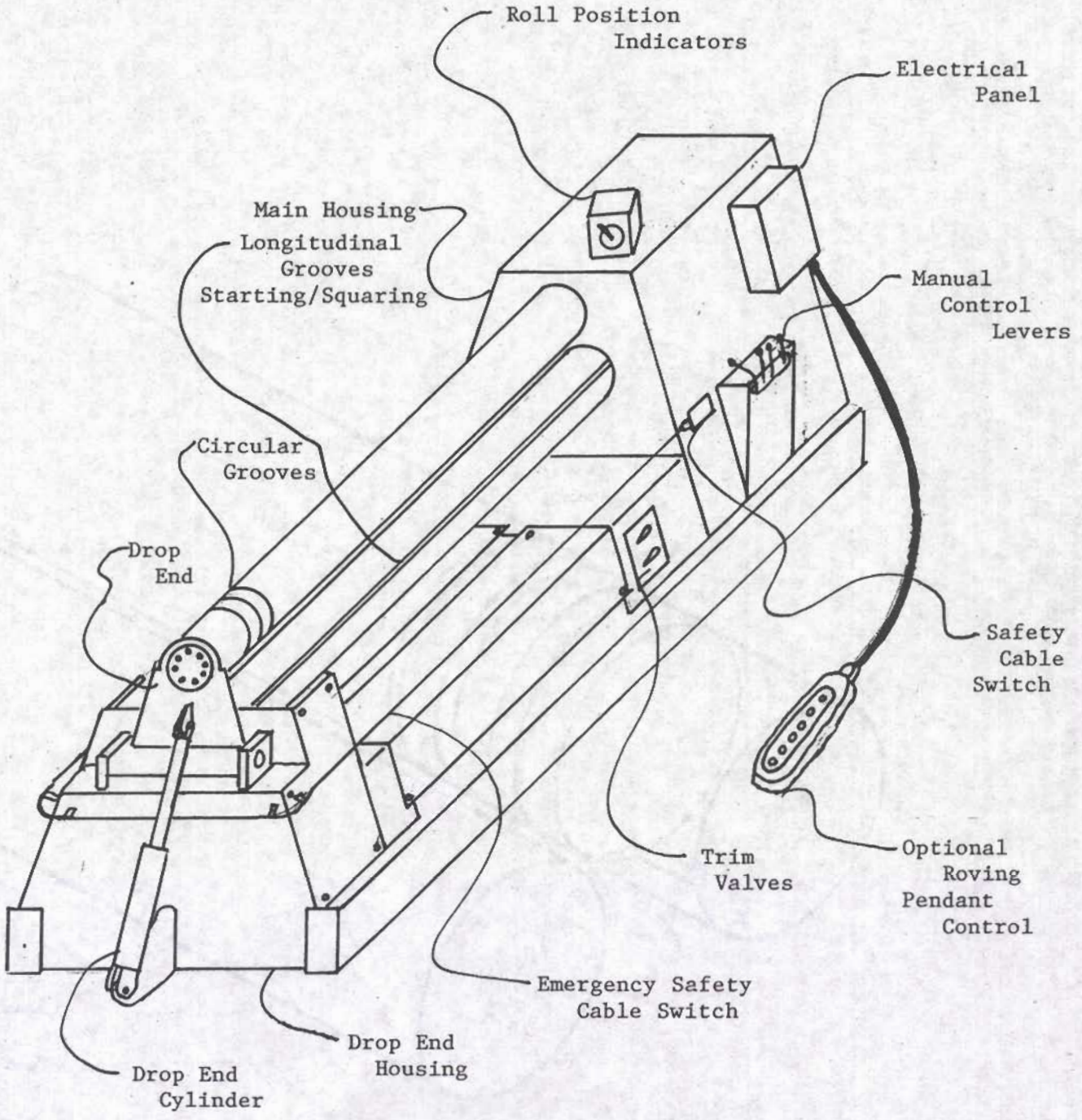
TYPICAL USERS OF
WDM PLATE ROLLS

* WELDING SHOPS
* MAINTENANCE SHOPS
* ARCHITECTURAL SHOPS
* AIR RECEIVER MANUFACTURING
* PROPANE TANK MANUFACTURING
* UNDERGROUND STORAGE TANK MFG
* AERO SPACE COMPONENT MFG
* EXCAVATING EQUIPMENT MFG
* LAWN & GARDEN EQUIPMENT
* PHARMACEUTICAL
* PAPER MILL MACHINERY MFG
* STEEL MILLS
* STEEL WHEELS & AGRICULTURAL EQUIPMENT MFG
* AIR CONDITIONING
* LIGHTING
* COLLEGES & UNIVERSITIES
* STAINLESS FOOD PROCESSING & TRANSPORTING TANKS MFG
* POWER PLANTS
* AIR FILTRATION & VENTILATION IND
* FOOD & PLASTIC STORAGE TANKS & SILOS MFG
* AUTOMOTIVE
* MINING
* TRAMPOLINE MFG
* SHIPYARDS
* PLAYGROUND EQUIPMENT MFG

U S E R S cont.

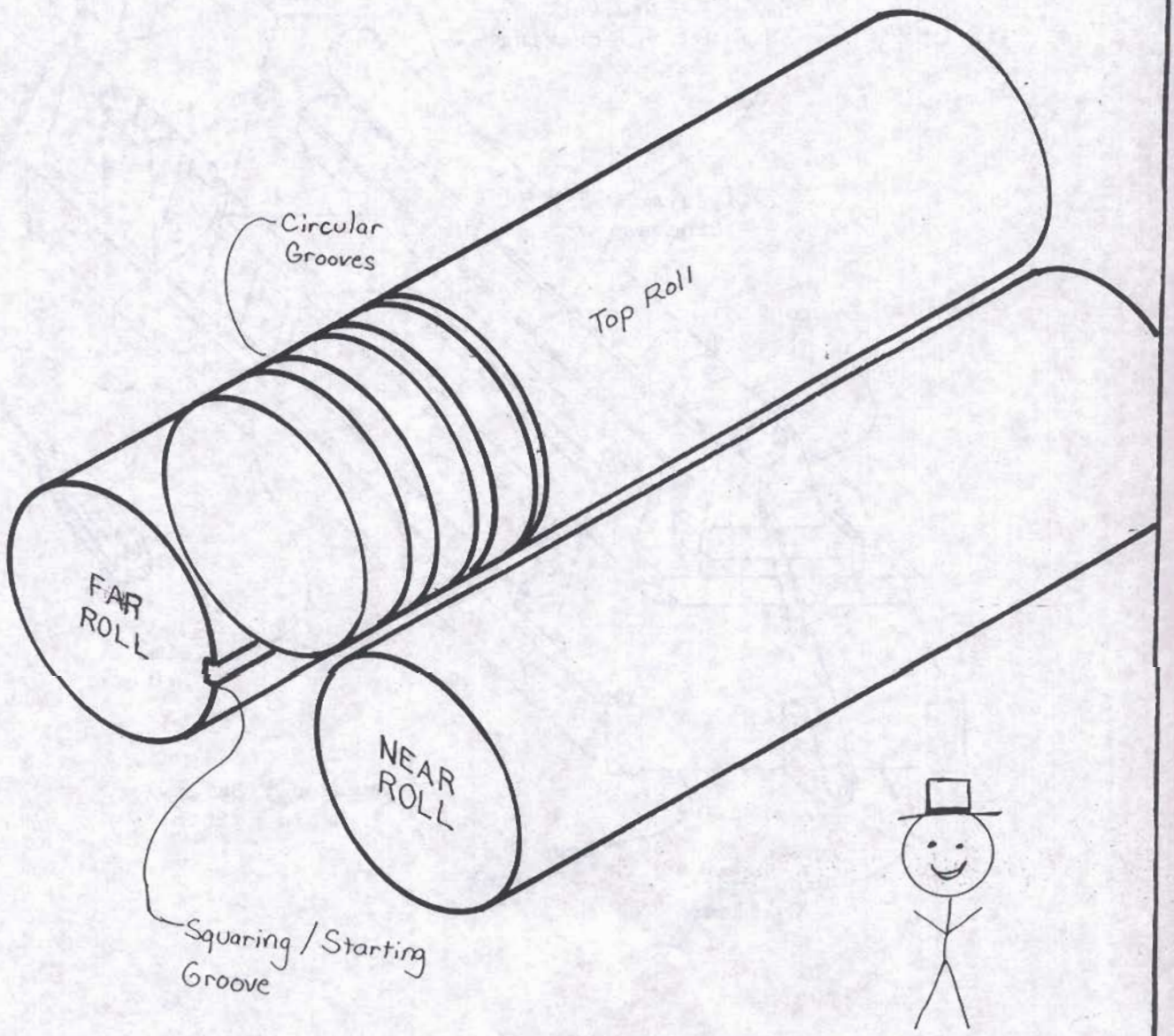
* CLOTHING MFG
* GREEN HOUSE MFG
* MASS TRANSIT
* REFINERIES
* TURBINE MFG
* TRUCK TRAILER MFG
* GRAIN HANDLING EQUIPMENT MFG
* HIGHWAY GUARD RAIL MFG
* BOILER MFG
* PUMP MFG

ROLL NOMENCLATURE



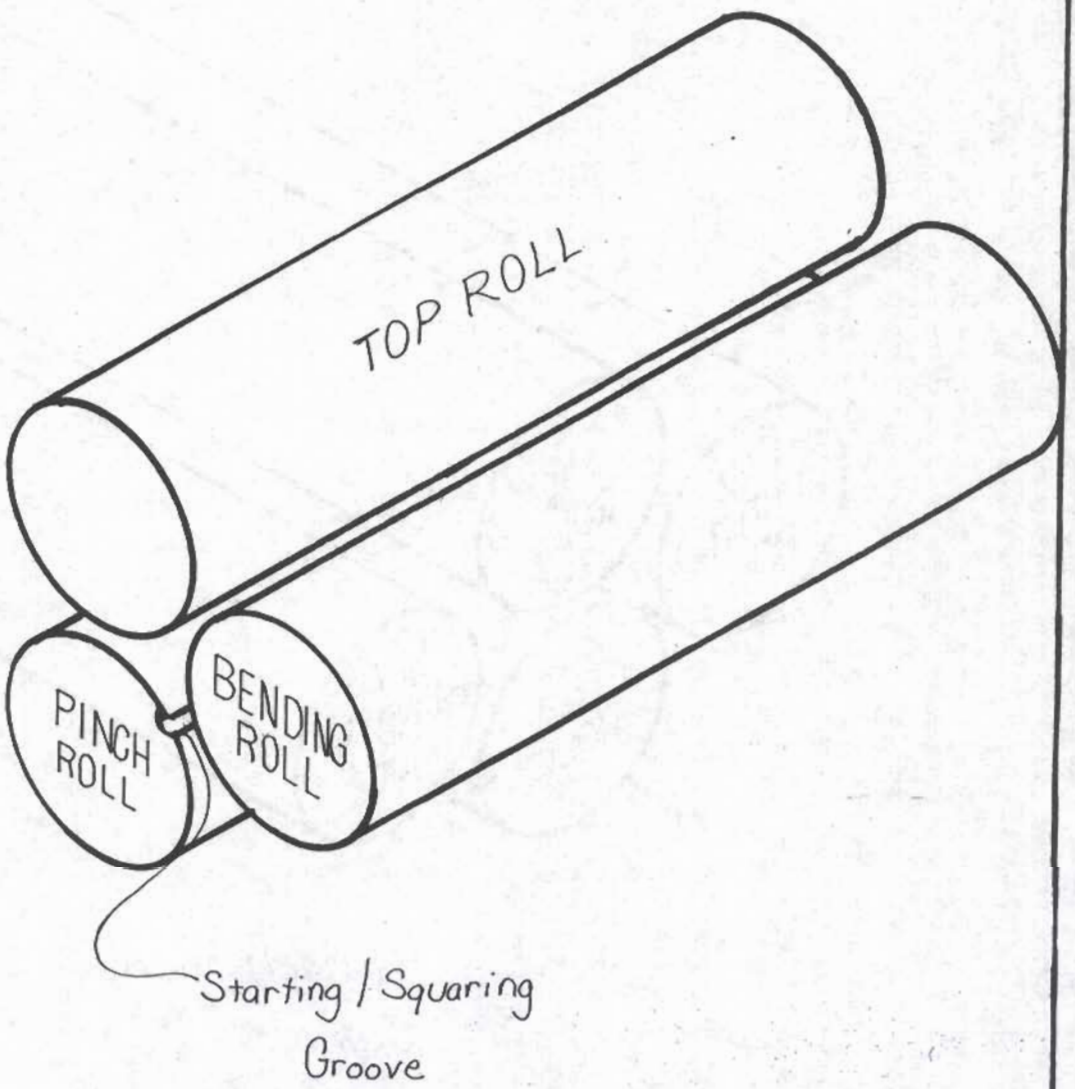
ROLL NOMENCLATURE

PYRAMID & PINCH PYRAMID



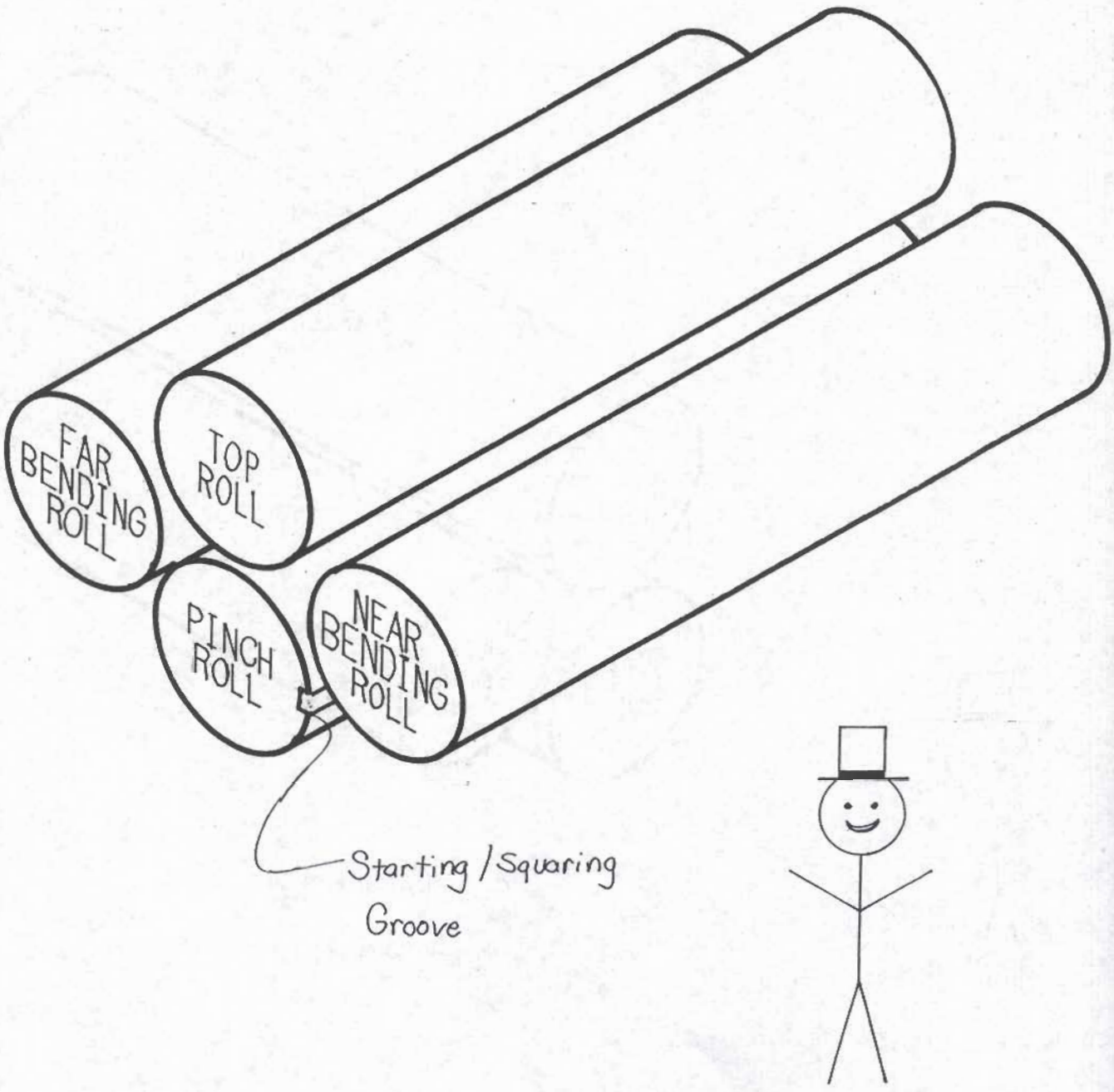
ROLL NOMENCLATURE

* * * INITIAL PINCH * * *



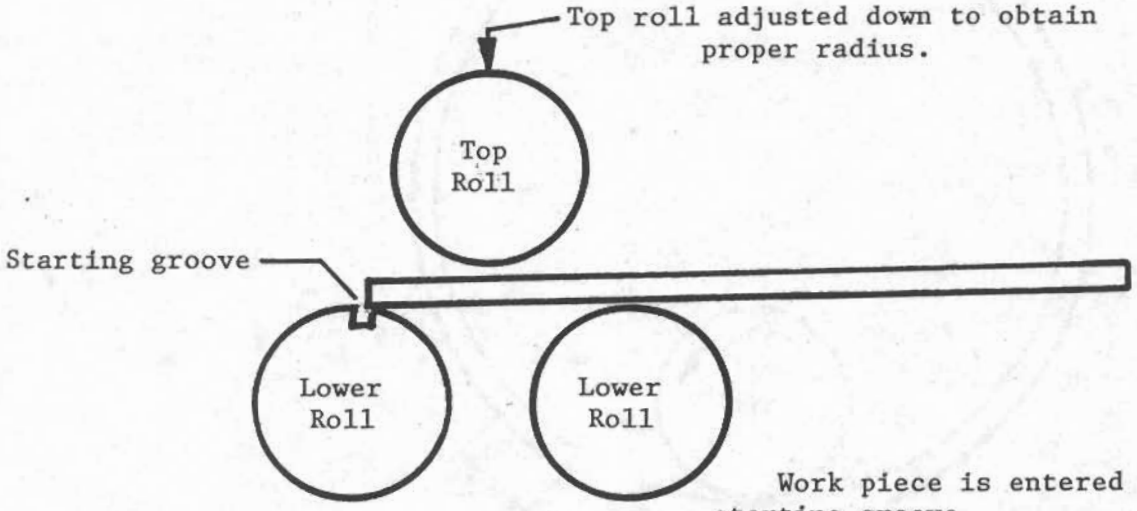
ROLL NOMENCLATURE

FOUR ROLL DOUBLE PINCH

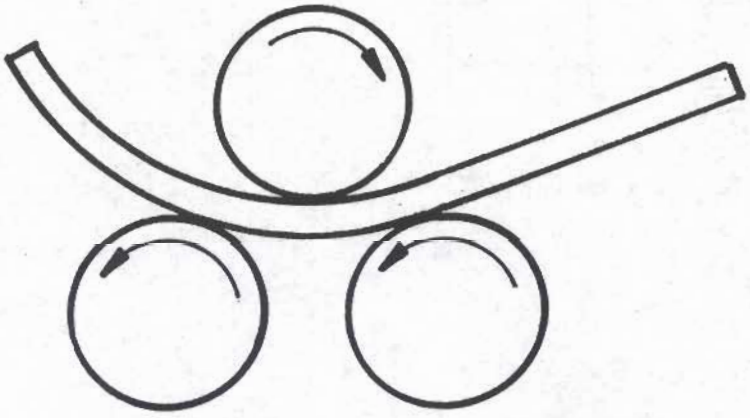


ROLLING CYCLE

PYRAMID ROLL



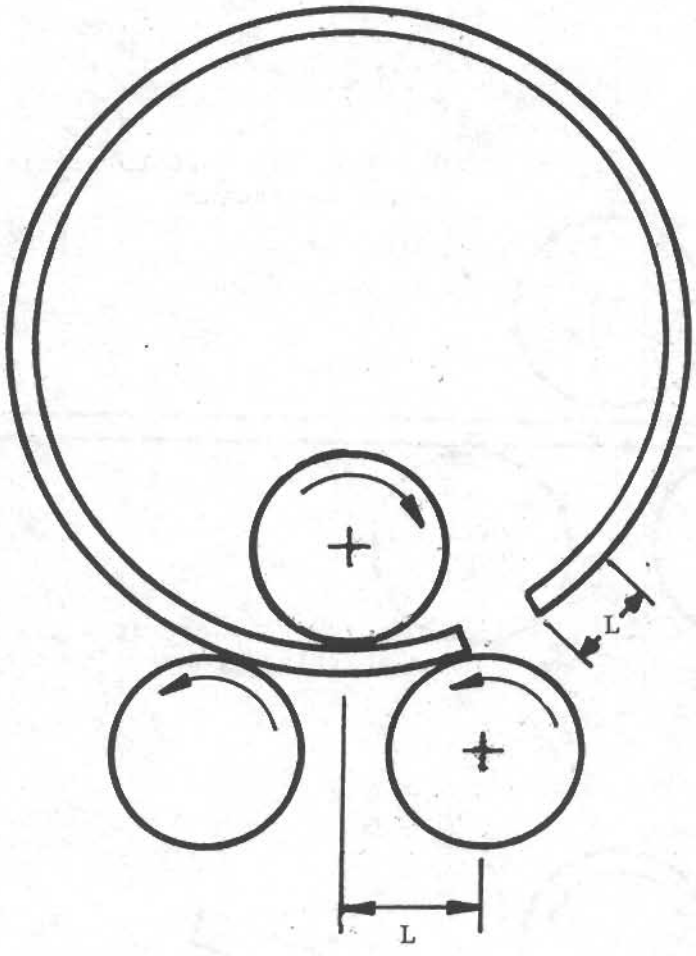
Work piece is entered into roll against starting groove.



Rolls are rotated to feed work piece through.

ROLLING CYCLE

PYRAMID ROLL
continued

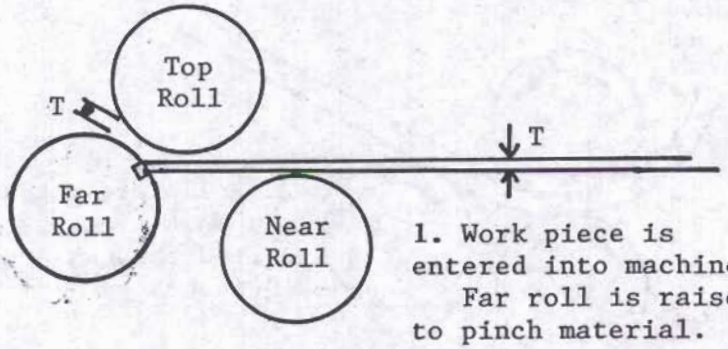


L = length of flat

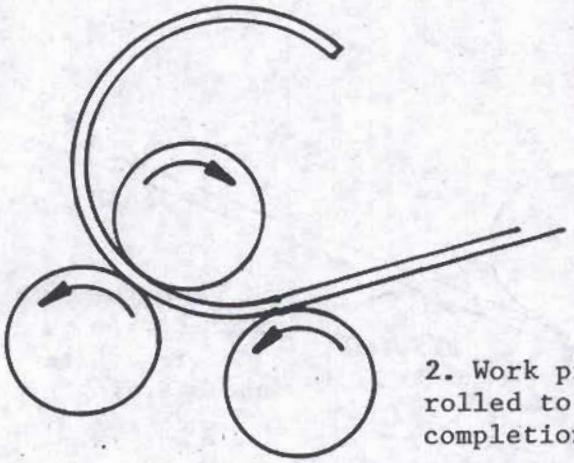
Rolled to completion.

ROLLING CYCLE

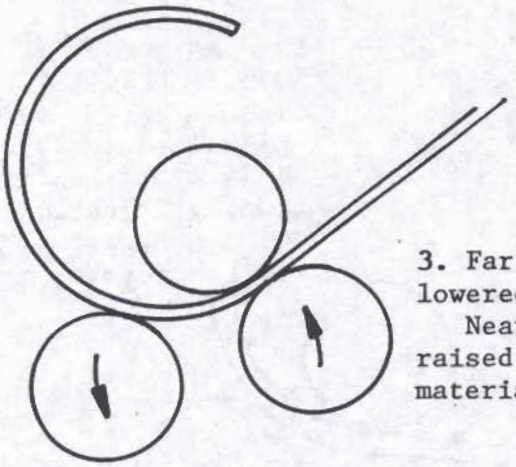
PINCH PYRAMID ROLL



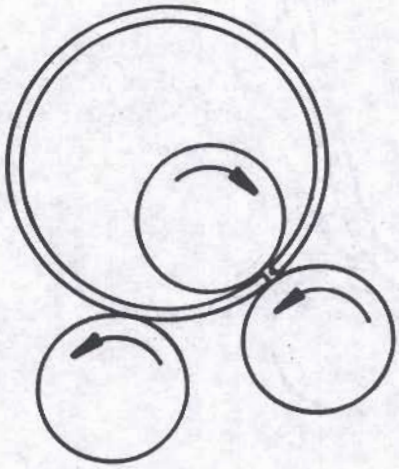
1. Work piece is entered into machine.
   Far roll is raised to pinch material.



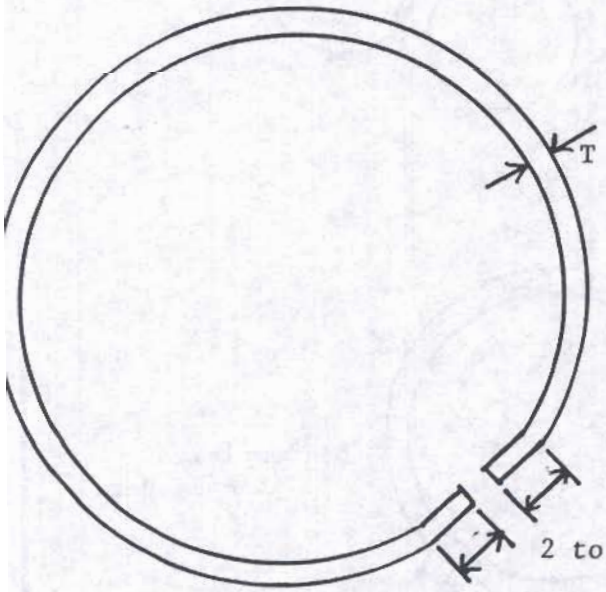
2. Work piece is rolled to near completion.



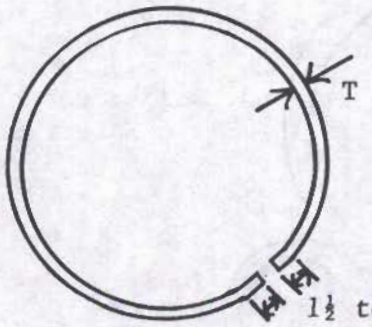
3. Far roll is lowered.
   Near roll is raised to pinch material.



4. Rolled to completion.



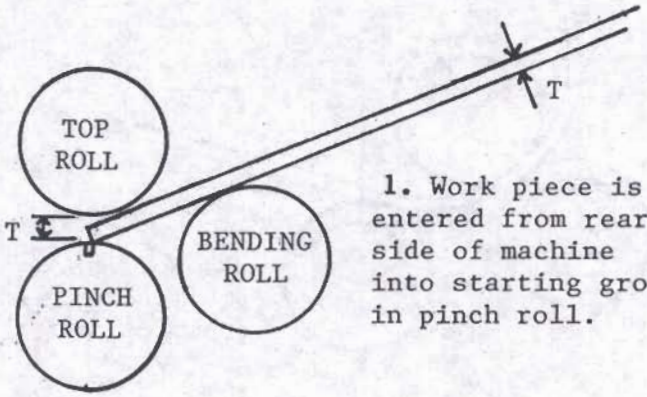
Larger diameters
> 4 to 6 x Top roll diameter



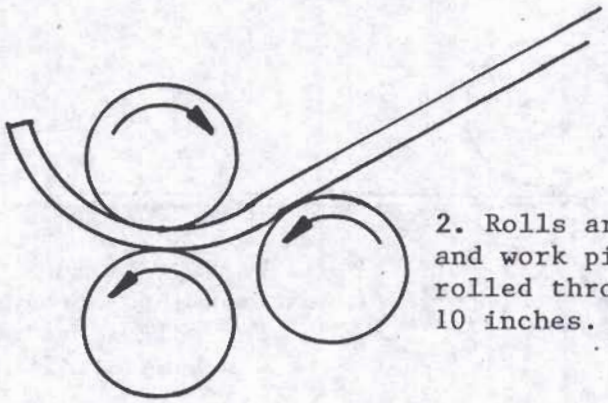
Smaller Diameters
≤4 to 6 x Top roll diameter

ROLLING CYCLE

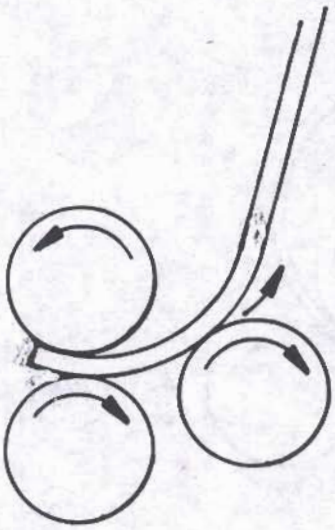
INITIAL PINCH ROLL



1. Work piece is entered from rear side of machine into starting groove in pinch roll.

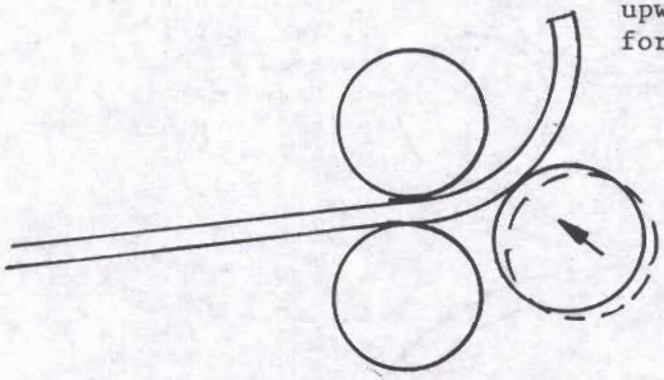


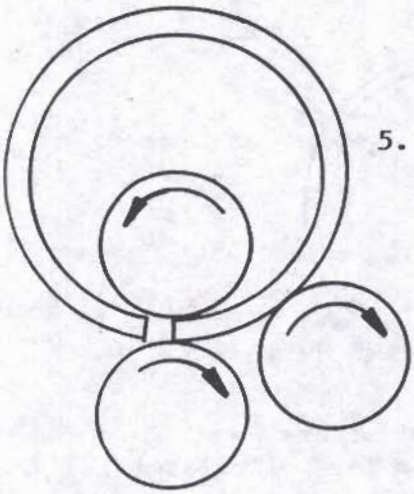
2. Rolls are rotated and work piece is rolled through 4 to 10 inches.



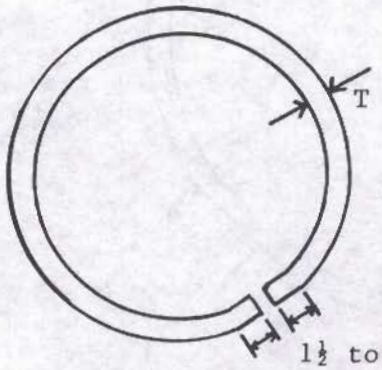
3. Rolls are reversed and pre-bent work piece is removed.

4. Work piece is re-entered and bending roll is adjusted upward to final forming position.





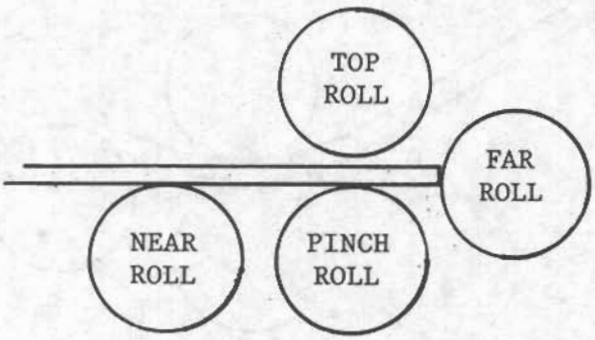
5. Rolled to completion.



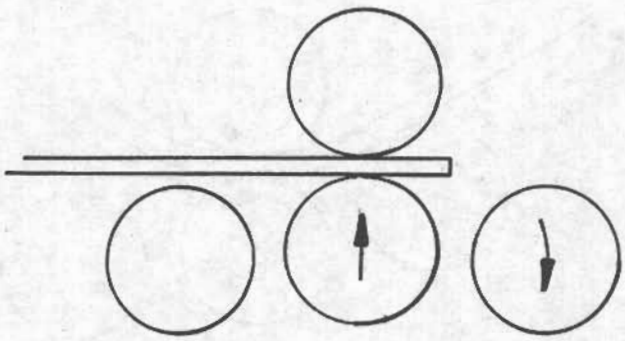
6. Completed cylinder.

ROLLING CYCLE

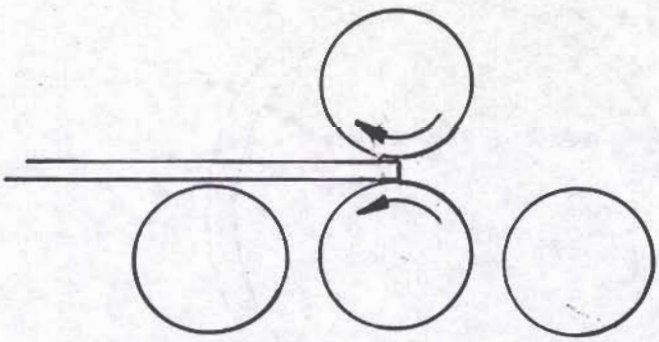
FOUR ROLL PLATE



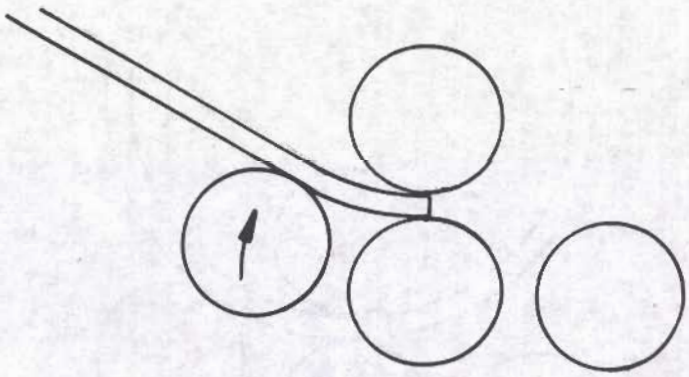
1. Work piece is entered and squared against far roll.



2. Pinch roll is raised to clamp work piece. Far roll is lowered.



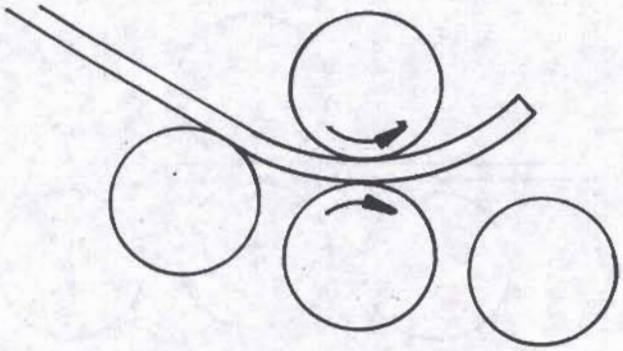
3. Rolls are reversed until leading edge is just short of the center line of the top and pinch rolls.



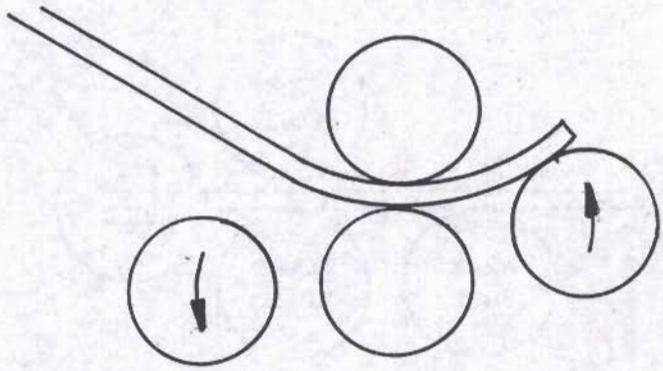
4. Near roll is raised to bending position.

ROLLING CYCLE

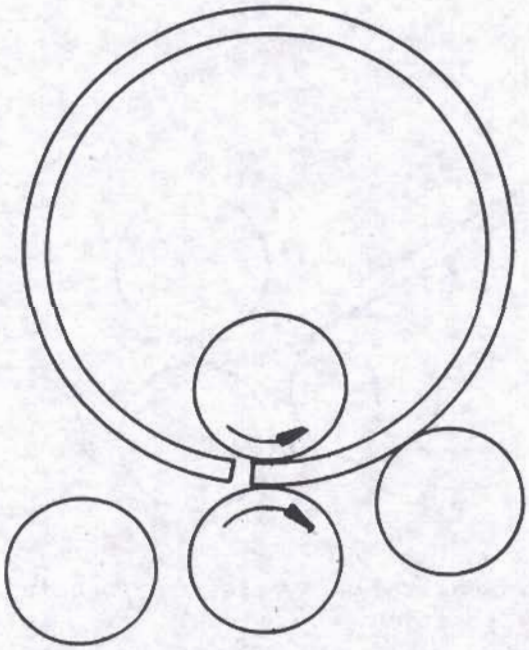
FOUR ROLL PLATE cont.



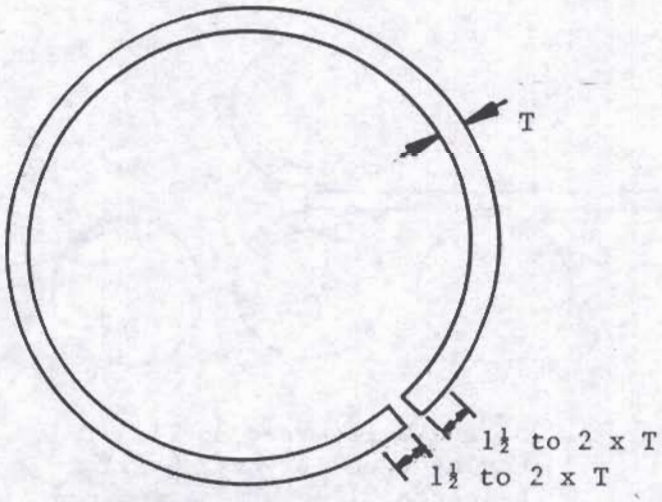
5. Rolls are rotated forward until prebend is complete.



6. Near roll is lowered. Far roll is raised to forming position.



7. Rolled to completion.



8. Completed cylinder.

WORK

PIECE

QUALITY

==

- WHAT AFFECTS IT
- HOW TO CORRECT IT

WORK PIECE QUALITY

FACTORS CONTRIBUTING TO WORK PIECE QUALITY

--Variations in metal thickness

--Variation in temper

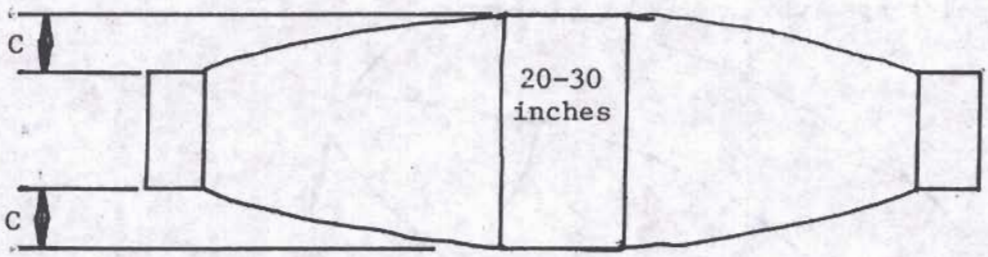
--Variation in physical characteristics of different heat numbers

--Grain direction

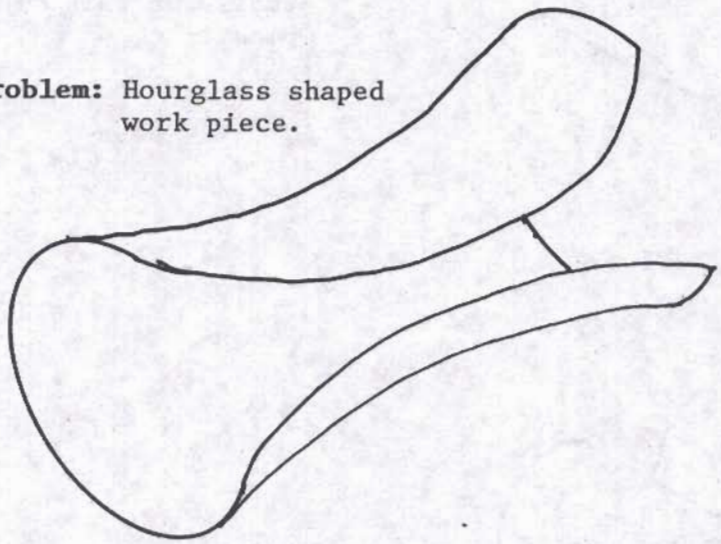
--Uniform cross section of work piece

WORK PIECE QUALITY

ROLL CROWN

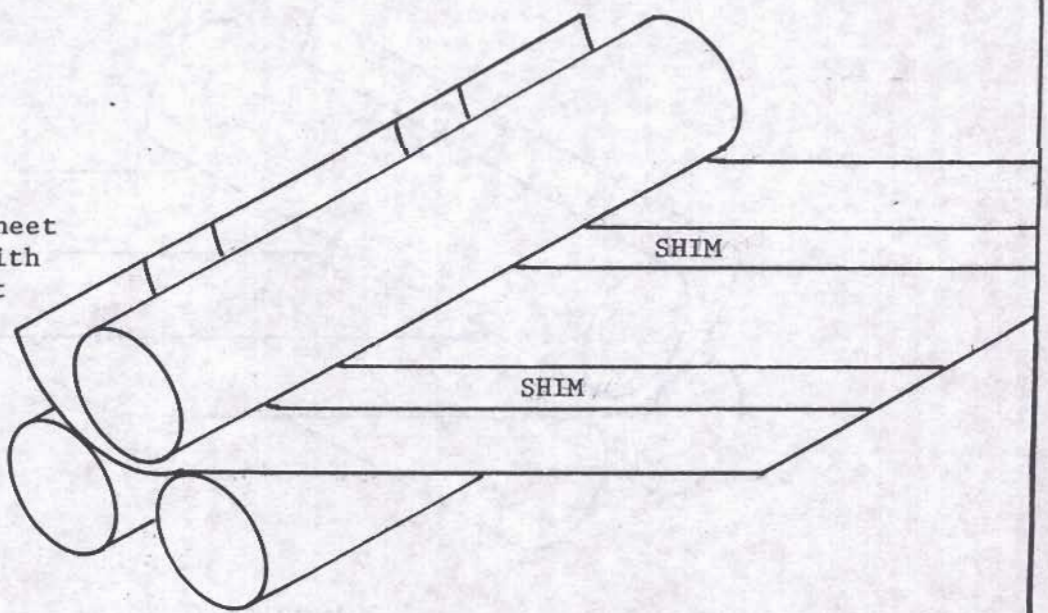


Problem: Hourglass shaped work piece.



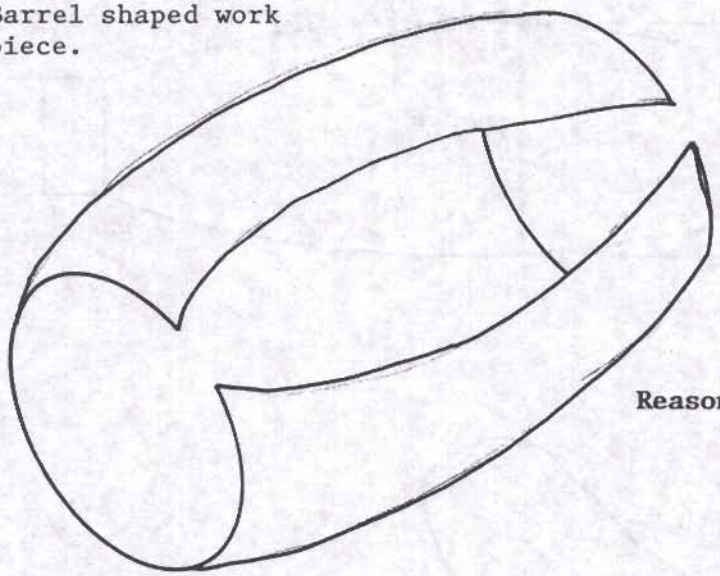
Reason: "C" (roll crown) to much for this size work piece.

Remedy: Roll cardboard or sheet metal shims along with work piece to affect over crowning.



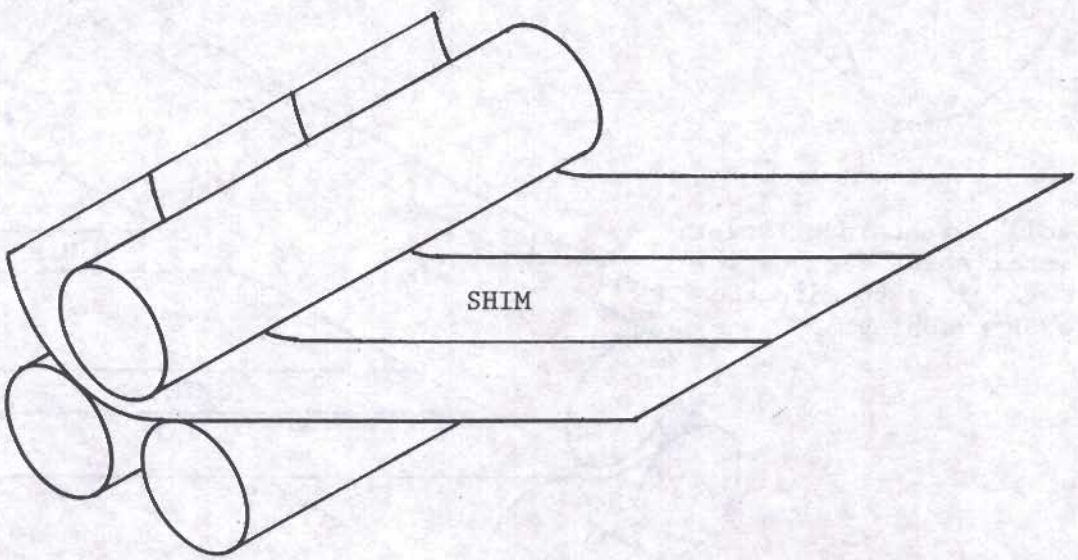
WORK PIECE QUALITY

Problem: Barrel shaped work piece.



Reason: "C" (roll crown) too small for this work piece.

Remedy: Roll cardboard or sheet metal shim along with work piece to off set under crowning.

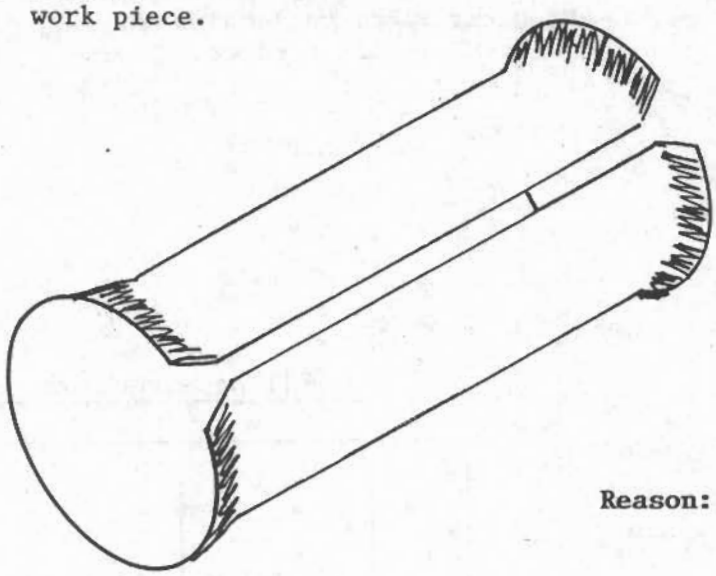


!!WARNING!!

Do not exceed machine capacity!

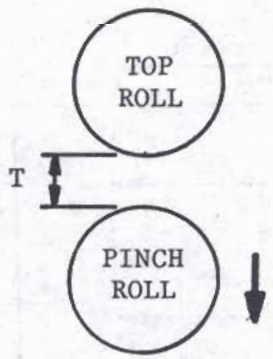
WORK PIECE QUALITY

Problem: Bell mouthed shaped work piece.



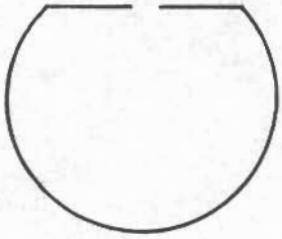
Reason: Pinch Roll pressure too tight. (cold working work piece edges)

Remedy: *Lower pinch roll so that opening at end of roll is equal to or greater than T (work piece thickness)*

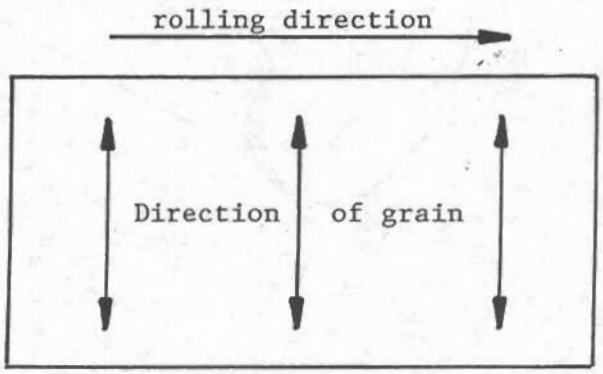


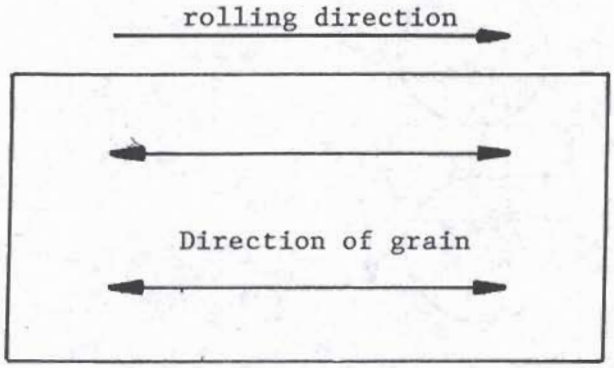
WORK PIECE QUALITY

Problem: Flats on leading and trailing edges.

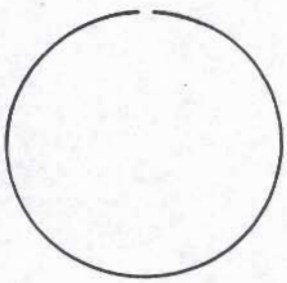


Reason: Rolling transverse or perpendicular to grain.



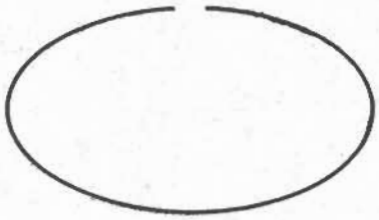


Remedy: Roll in direction of grain.



WORK PIECE QUALITY

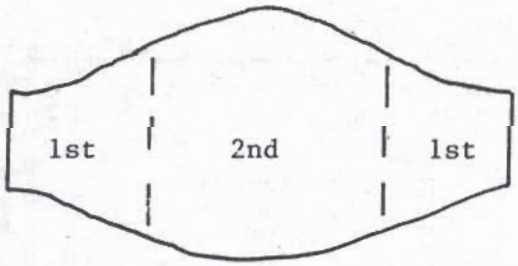
ELBOW GORES & SIMILAR PARTS



Problem: Obround work piece.

Reason: Unequal cross sections were rolled with one radius setting.

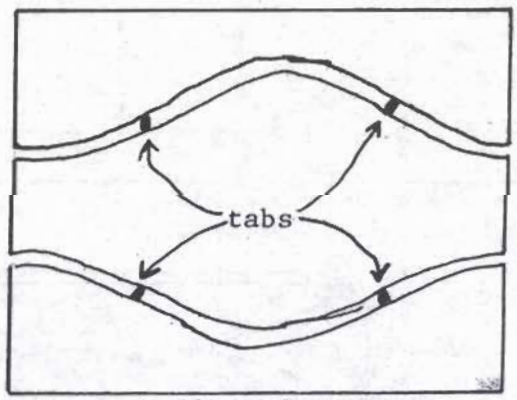
Remedy:



rolling direction

Roll with two radius settings.

or

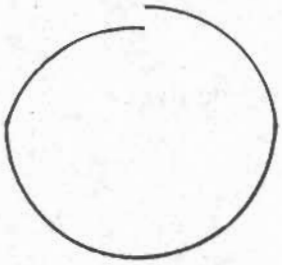


rolling direction

Create an equal cross section by connecting parts with tabs.

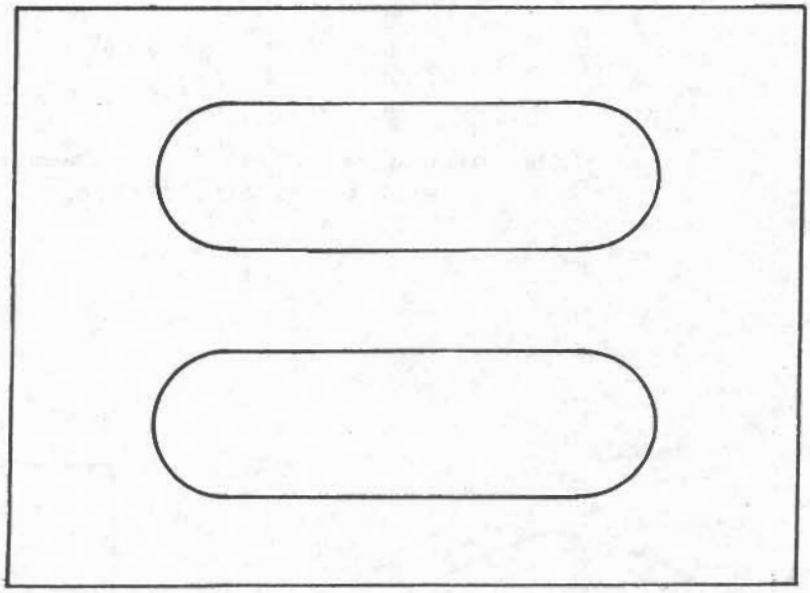
WORK PIECE QUALITY

WORK PIECES WITH CUT OUTS

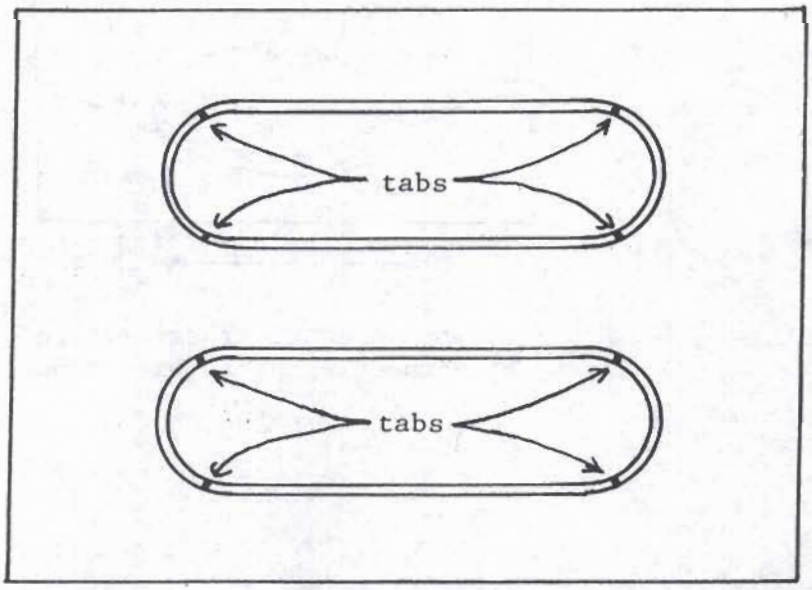


Problem: Obround cylinder.

Rolling direction



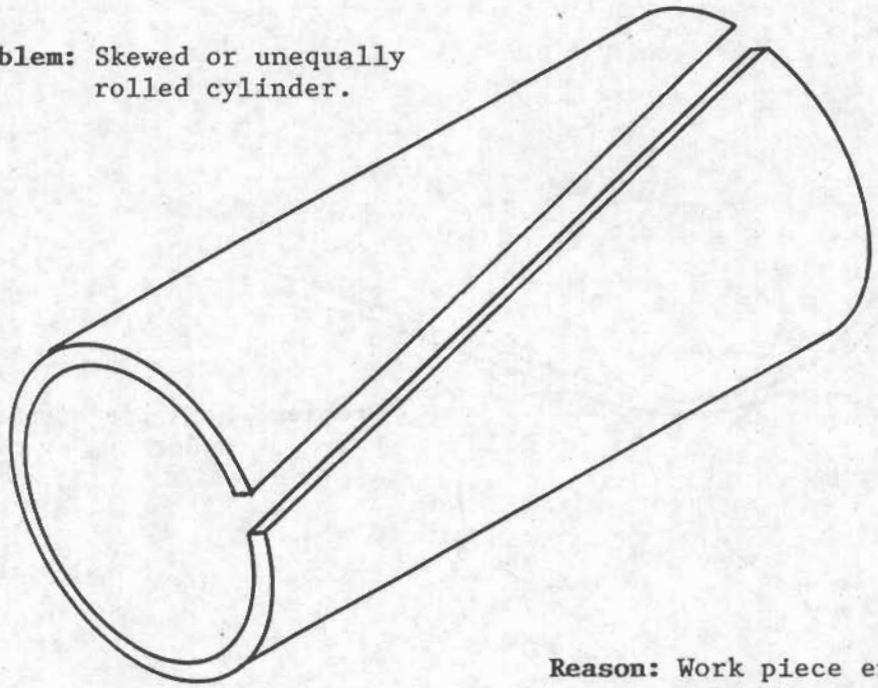
Reason: Unequal cross section.



Remedy: Create equal cross sections by connecting drop to work piece with tabs.

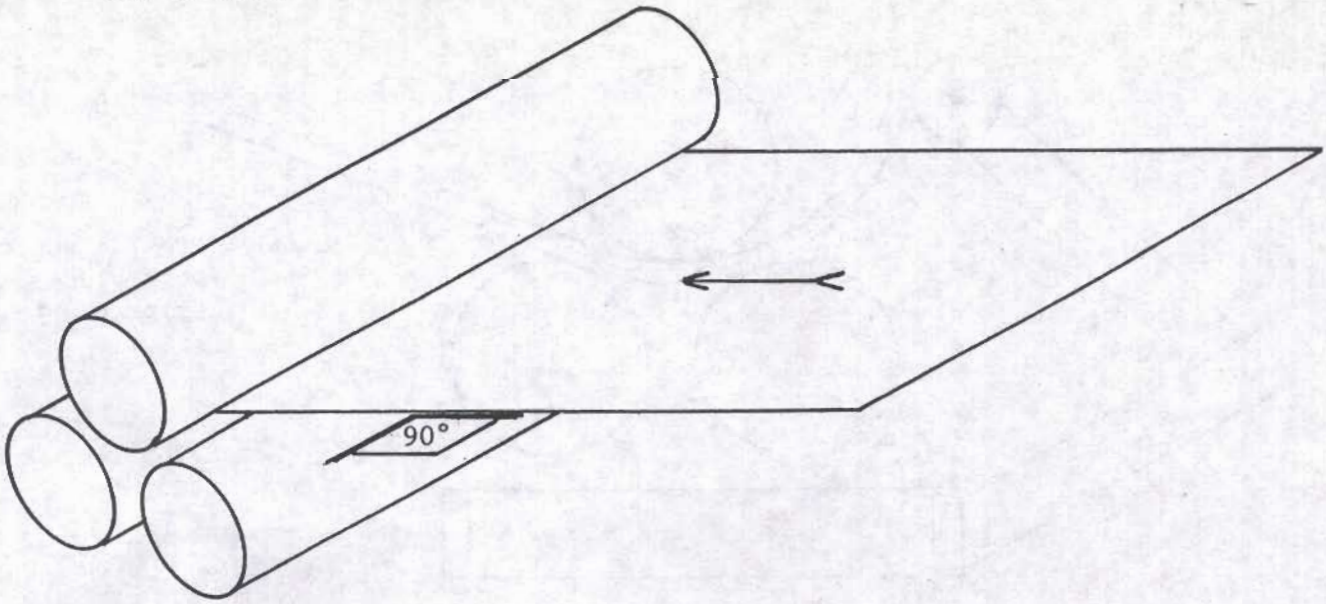
WORK PIECE QUALITY

Problem: Skewed or unequally rolled cylinder.

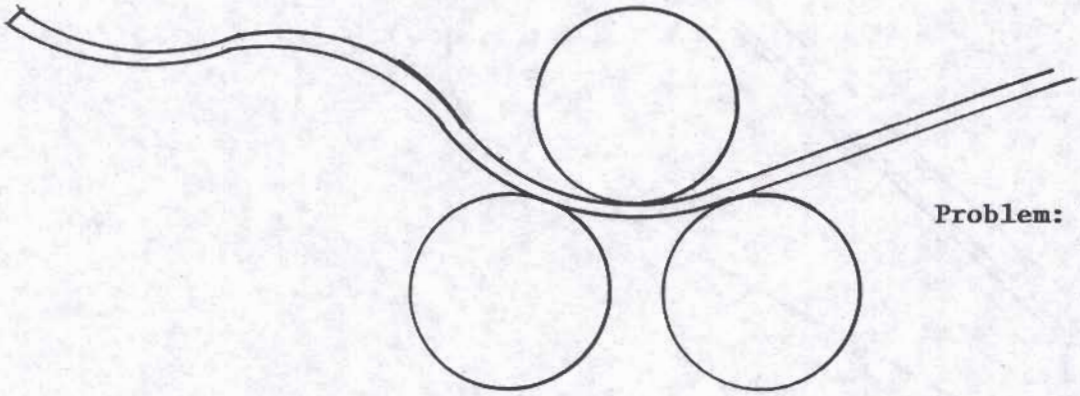


Reason: Work piece entered unsquare or rolls out of parallel.

Remedy: Align rolls.
Enter work piece squarely and in center of rolls.

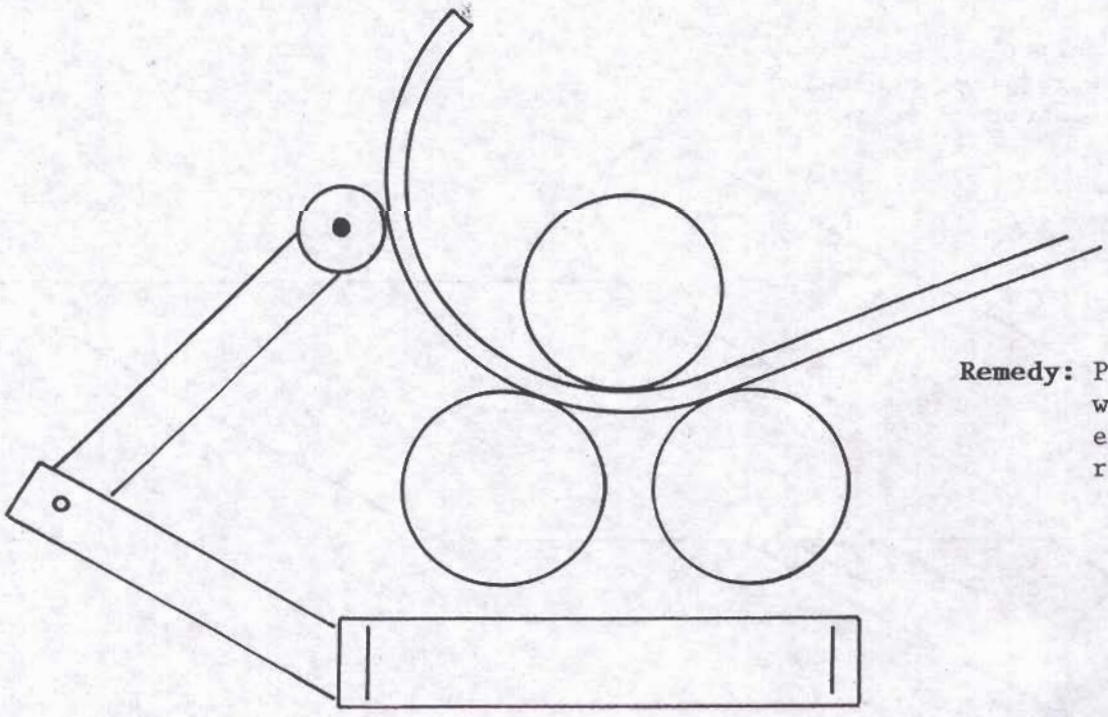


WORK PIECE QUALITY



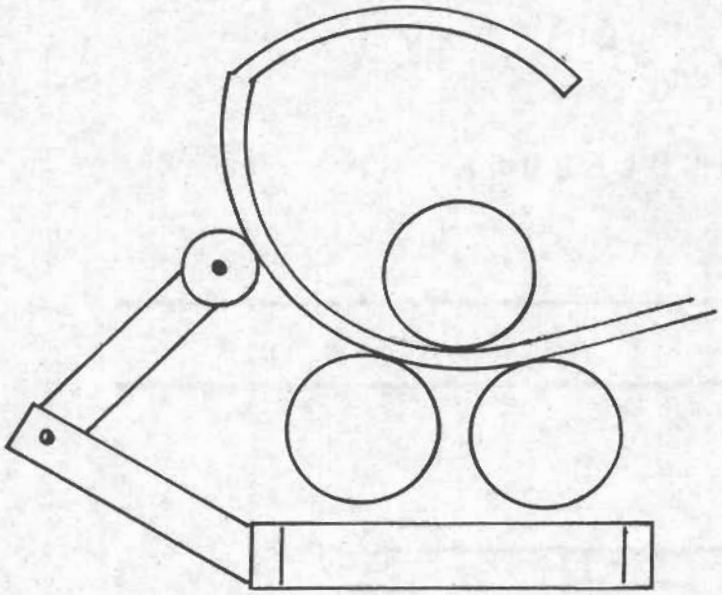
Problem: Work piece unbends under its own weight.

Reason: Material strength insufficient to support its own weight.



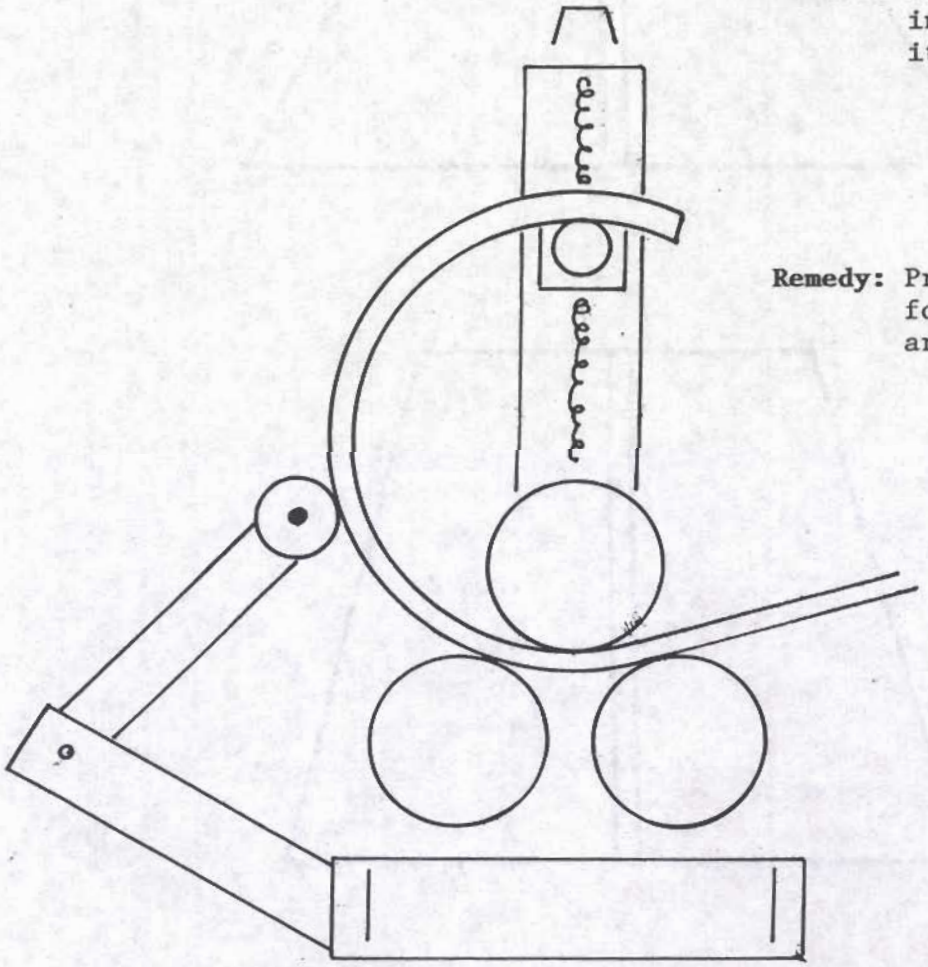
Remedy: Provide support for work piece as it exits the forming roll.

WORK PIECE QUALITY



Problem: Work piece collapses under its own weight.

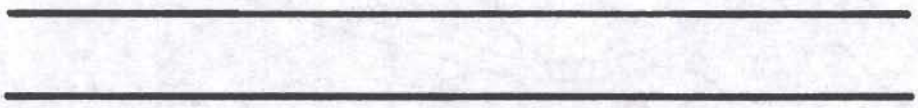
Reason: Material strength insufficient to supports its own weight.

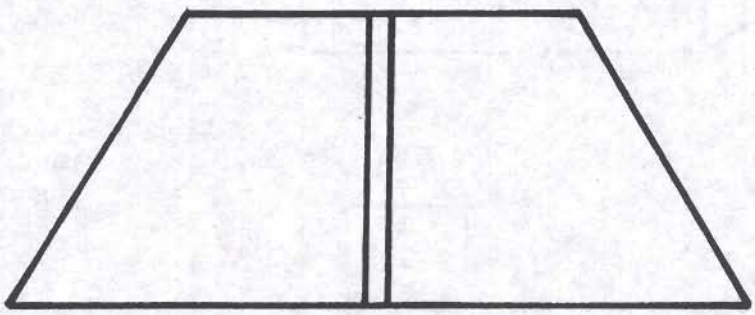


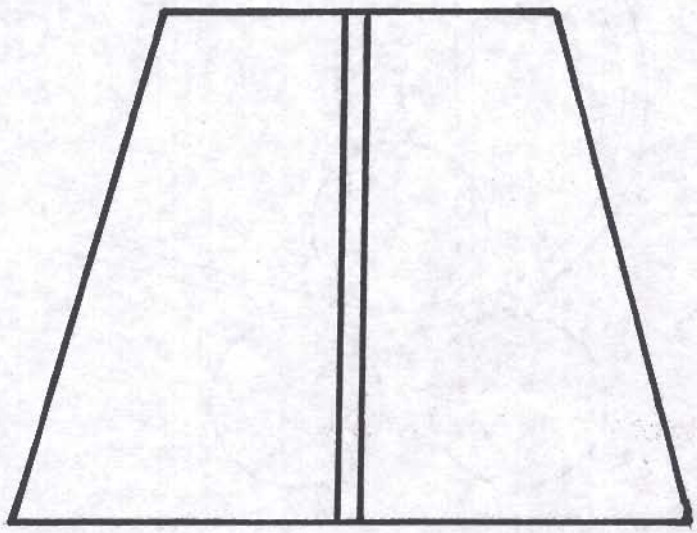
Remedy: Provide overhead support for work piece as it comes around overhead.

CONE ROLLING

PROCEDURE

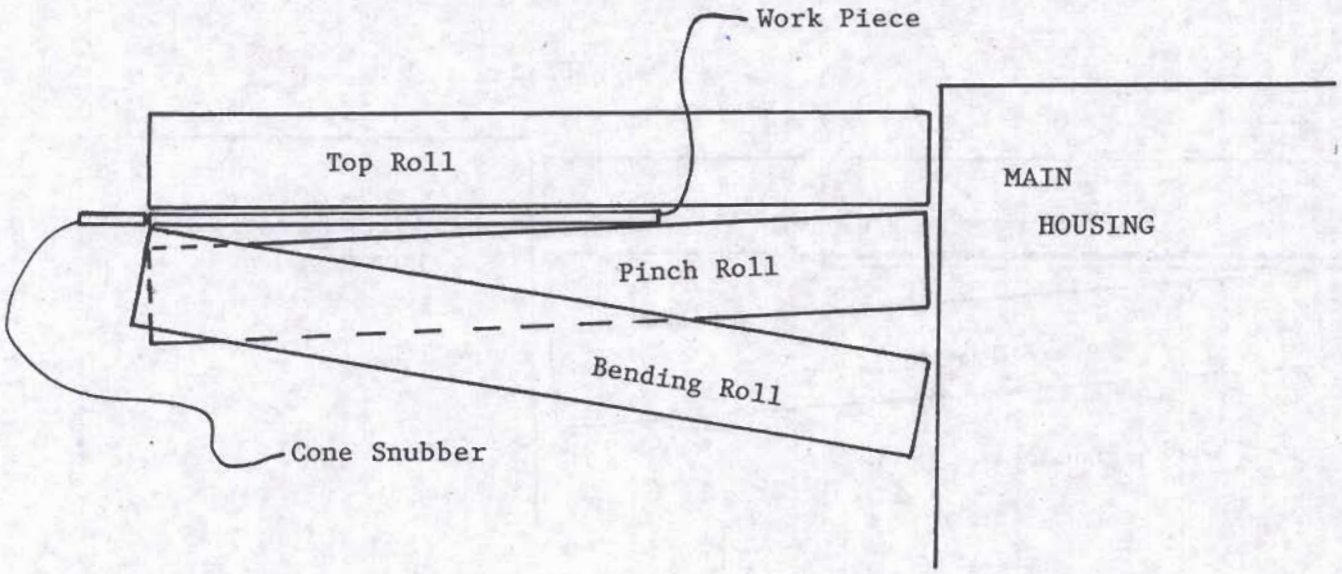






CONE ROLLING PROCEDURE

Initial Pinch & 4 Roll Machines



1. Angle Pinch Roll to grip long end of work piece.

2. Angle Bending Roll to form small end of work piece to a tighter radius.

3. Enter work piece with small end of cone blank against cone snubber.

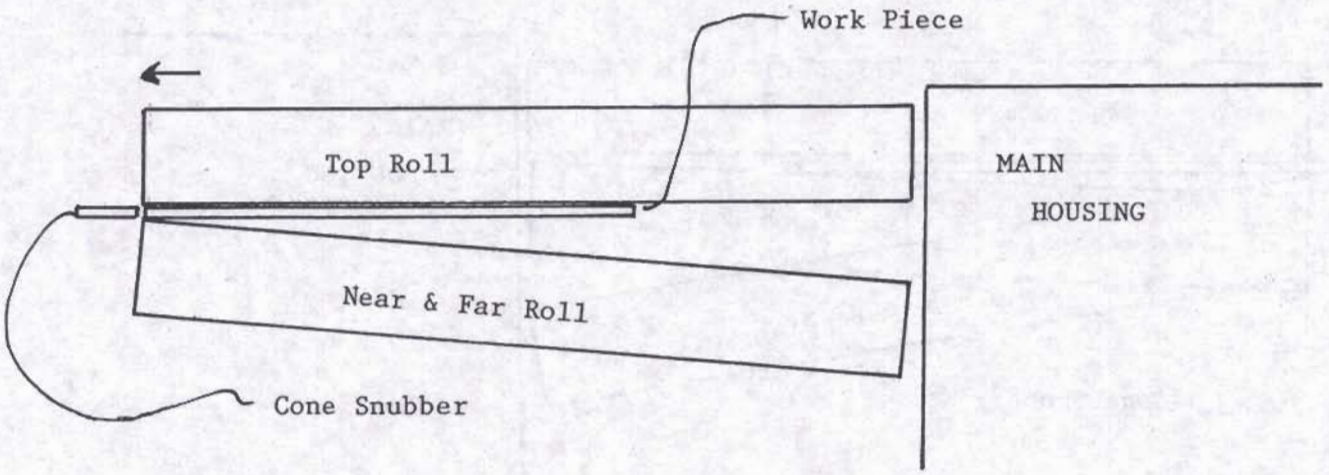
4. Raise Bending Roll to set radius.

5. Feed work piece through to obtain approximately half of bending required.

6. Raise Bending Roll for final pass & reverse to complete bend.

CONE ROLLING PROCEDURE

Pyramid & Pinch Pyramid



1. Angle Top Roll (on Pyramid) or both lower rolls (on Pinch Pyramid) to form small end of work piece.

2. Enter work piece with small end of cone against cone snubber.

3. Raise lower rolls (Pinch Pyramid) or lower top roll (Pyramid) to obtain about half of radius required.

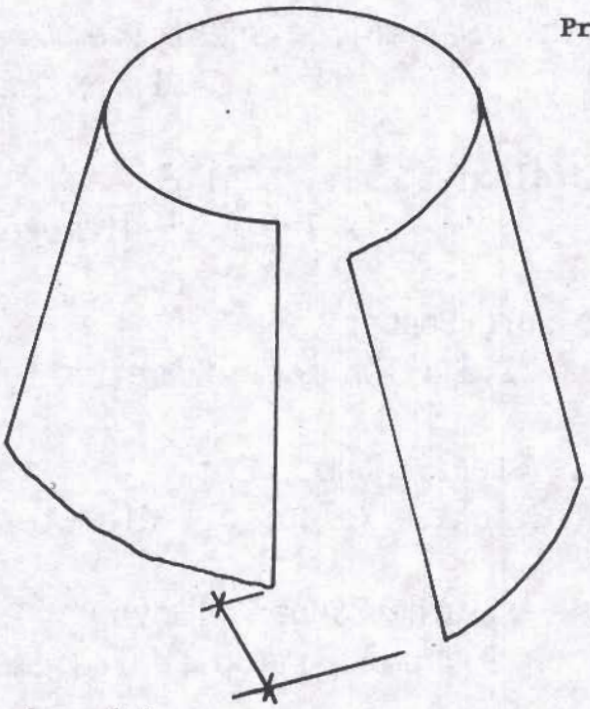
4. Roll piece through.

5. *Adjust rolls for final radius.*

6. Roll reverse for completion.

CONE QUALITY

Problem: Skewed ends.



Reason: Work piece formed in one rolling direction.

Remedy: Roll partially in one direction and complete rolling in opposite direction.

SOME RULES OF THUMB

Minimal Rolling Diameters

Mild Steel i.e. 1020
1.2 x Top roll diameter

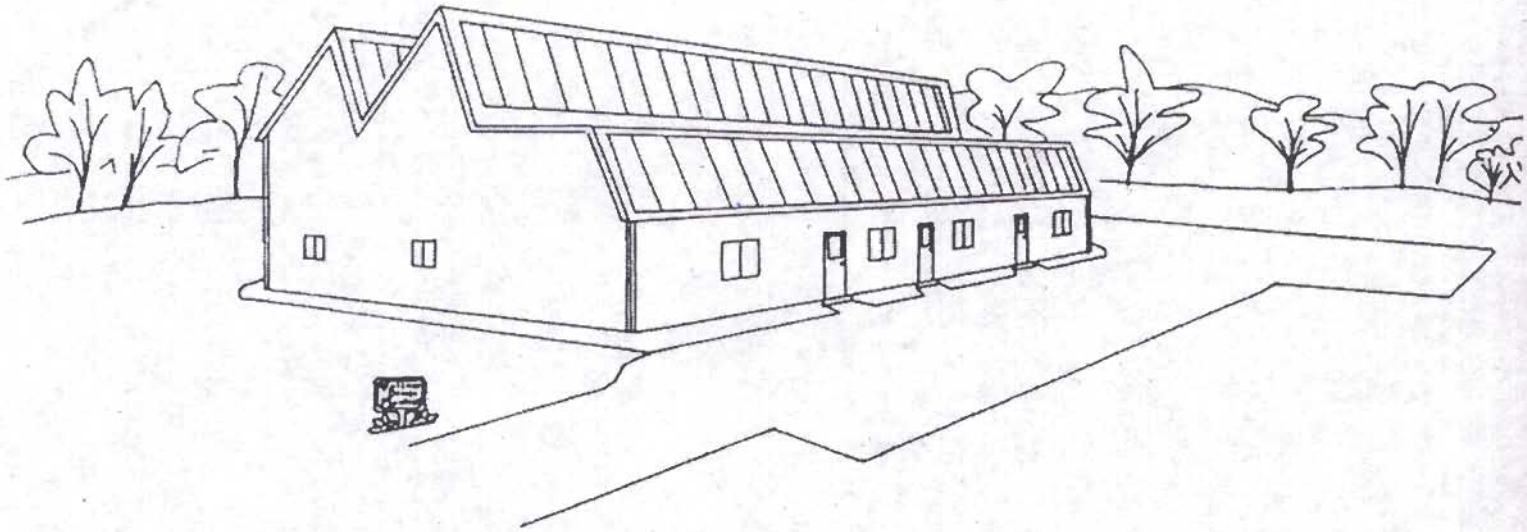
Cold Rolled Sheet or Thin Galvanized Sheet i.e. 20-28 ga
1.5 x Top roll diameter

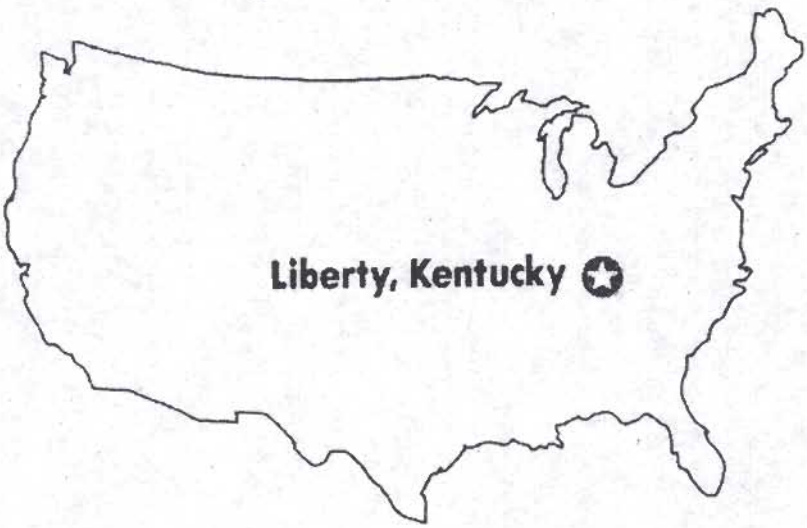
Tempered aluminum i.e. 6061T6
2 x Top roll diameter

Half Hard Copper
1.5 x Top roll diameter

Stainless Steel, Monel, Etc.
1.2 to 1.4 x Top roll diameter

A.R. Plate, T-1, Other Super Alloys
2 or more x Top roll diameter





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