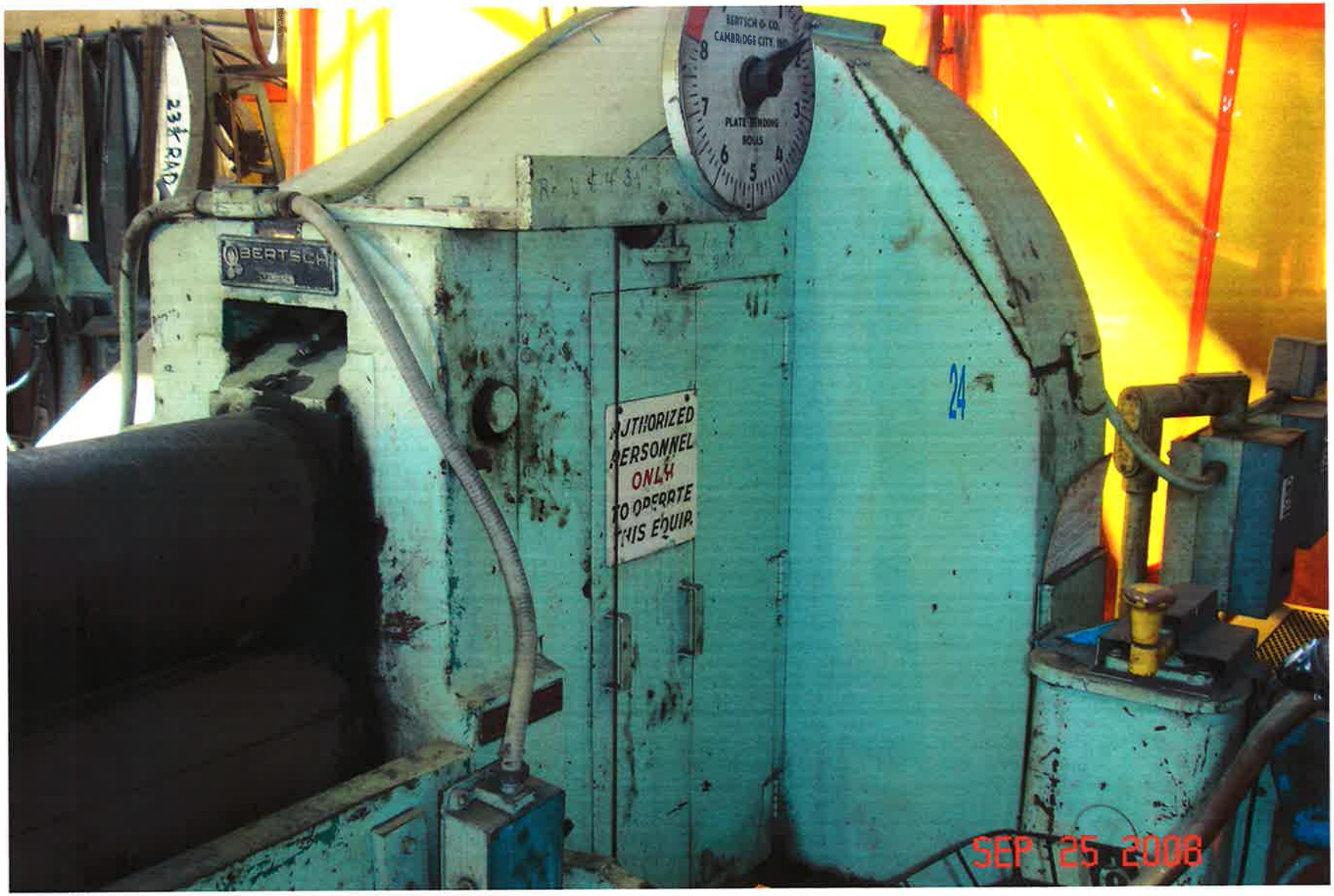

SEP 25 2008


SEP 25 2008


BERTSCH & CO.
CAMBRIDGE CITY, IND.
PLATE BENDING ROLLS
BERTSCH
AUTHORIZED
PERSONNEL
ONLY
TO OPERATE
THIS EQUIP.
24
SEP 25 2006

BERTSCH & COMPANY, INC.

Cambridge City, Indiana

INITIAL PINCH TYPE

PLATE BENDING ROLLS

OPERATING INSTRUCTIONS

Machine Serial M- 9854 Date 11/12/68

Size #9, 10" x 8'

User: Atlantic Richfield Company
Watson, California

User's order number 4013882

INDEX

FOUNDATION AND INSTALLATION

The foundation and pit should be constructed so that it conforms to the dimensions shown on our foundation and pit drawing. Please note that we can only make general recommendations on depth or thickness of concrete due to variations in soil conditions.

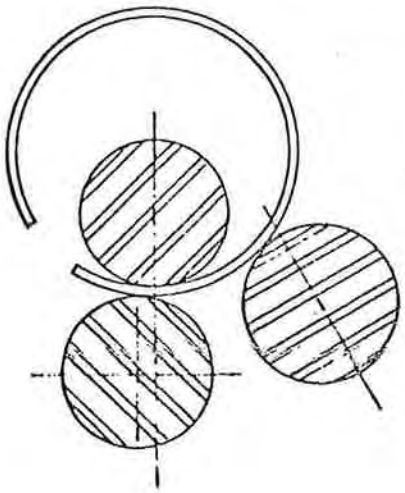
The floor must be sufficiently rigid to support the weight of the machine plus the weight of a maximum capacity plate. The machine must be supported and anchored so that it will retain its alignment, under load, without sinking, sagging or twisting.

After alignment, the foundation beams must be grouted for full support.

To check the alignment of a Pinch type Bending Roll, we suggest the use of a transit or "Dumpy" level and a scale long enough to reach from the foundation beams to a point above the top roll. To level the machine after erection, place the scale at three points on the top of each foundation beam and take the following transit readings. The first point is just inside the hinge end main frame, the second point is just inside the gear end main frame and the third point is at or near the extreme gear end of the foundation beam. These transit readings on both beams will indicate the necessary shim required for leveling.

After shimming, all six points should read at the same level. Please note that a spirit level placed on the beams is not sufficient for leveling because of beam variation.

ARRANGEMENT OF ROLL FORGINGS



The three roll forgings are not necessarily the same diameter. On most machines they are all geared or driven so that a plate may be more easily entered into the machine. The top roll is in a fixed position except for tilting for removing roll cylinders. The lower front roll is adjustable up and down to suit the thickness of the plate being rolled and the rear roll, or bending roll is adjustable up and down to determine the diameter of the cylinder produced.

REMOVING FULL CIRCULAR WORK
(drop hinge action and adjustment)

The machine is opened to remove a full circular form, by simply lowering the drop hinge. The single operation of lowering the hinge tilts the top roll and also drops the gear end of the lower pinch roll, automatically releasing pinch pressure over the full length of the plate.

Raising the drop hinge automatically returns the forgings to their original position. The hinge must be locked in the up position before the next piece is rolled.

If the machine is stopped with a heavy plate between rolls, the plate pressure pushing up on the top roll, has a tendency to lock the hinge up. If this occurs, start the rear roll down, thus releasing the pressure and then lower the hinge.

The operator must stop the forgings from revolving before lowering the hinge to remove a formed piece.

After long usage, lowering the hinge may not raise the top roll sufficiently to allow removing a formed plate. This will be due to wear in the connections between the counter-balanced bar and the top roll, on the gear end of the machine. Adjustment of the turnbuckle in the counter-balance connection will correct this situation.

ADJUSTMENT OF LOWER FRONT ROLL

The lower front roll is adjustable up and down to suit the thickness of plate being rolled. For forming medium or large diameter cylinders, we recommend operating with opening between the pinch rolls equal to the MAXIMUM thickness of the plate to be rolled. Set the lower pinch roll down, with opening between pinch rolls equal to slightly over twice the thickness of plate being rolled when rolling a plate that is to be finished with a lap joint, or when the lapped joint will be rolled into the pinch.

ADJUSTMENT OF REAR ROLL

The height at which the rear roll is set determines the diameter cylinder formed. This forging is adjusted up and down by power from a separate motor. The adjusting motor has sufficient power to bend plates within the machine capacity.

The operator may adjust the rear roll up or down as the main motor is driving the forgings in either directions. With a plate in the machine and the forgings not revolving, more internal strain will be developed by adjusting the rear roll up. We therefore recommend jogging or revolving the rolls when possible. This is most important on three roll geared machined without friction drive. (5/8" and lighter).

The above also applies to single motor drive machines, except that the power is taken from the main drive motor through a multiple disc clutch.

MOTOR AND CONTROL CHARACTERISTICS
WOUND ROTOR OR SLIP RING MAIN DRIVE MOTOR

SLIP RING MOTOR TROUBLE: Lack of sufficient power, especially in new machines is not uncommon slip ring motors. We know the motor recommended has power for all work specified. If it will not pull the maximum work, the trouble will be due to one of the following causes: 1. Low voltage. 2. A break or crack in a grid resistor. 3. Improper wiring.

DRUM CONTROLLER/SPEED CONTROL: Speed control is directly proportional to the load applied. Under full load conditions there will be approximately 50% speed control or differential.

Drum Controller SPEED NOTCHES: If the machine is operated with the drum controller on one of the low or intermediate speed notches, only part of the current is going to the motor. The remainder is being absorbed by the grid resistor. This is wasting the electric energy. In view of this, on plain cylindrical work the operator should revolve the drum handle directly to the high speed notch in the desired direction. Only operate the machine on the low speed notches when doing work that requires "inching" or "jogging" plates slowly. An example: when approaching a point where the operator desires to stop rolling.

REVERSING: The control equipment furnished for Bending Roll duty is designed so the operator can throw the drum controller frum full speed one direction to full speed the opposite direction. This severe method of operation should only be used when handling a special job.

STOPPING: If the drum handle is thrown from a high speed notch to the neutral notch, the gears and forgings will continue revolving for a short period. When the operator desires to roll part of a plate, leaving the remainder flat, he stops the machine by throwing the drum controller past neutral, just touching the first reversing speed notch, then back to neutral. This stops the machine instantly at the point desired. In effect, this is electric braking.

REAR ROLL ADJUSTING MOTOR

This is a high starting torque, squirrel cage motor with ample power to adjust the rear roll up against a plate and to brake the plate being formed. We recommend push button control with a two button station marked "up" and "down", so that the operator has to hold his finger on the desired button until adjustment is completed. A three button station is not recommended because of danger of the operator's forgetting to stop the motor before reaching top or bottom limits.

FRICTION DRIVE

Bertsch Pinch type Rolls are built with the lower roll forgings slightly larger in diameter than the top roll. The lower rolls therefore have slightly greater linear feeding speed. The lower rolls travel with the outside diameter of the cylinder being rolled while the top roll travels with the inside. This greater linear speed of the lower rolls is correct for only one particular thickness of plate when being rolled to one particular diameter. For any other thickness or diameter there is some slippage between the plate and the roll forgings.

On machines built for 3/4" x 8' and lighter, the slippage is not harmful to either the plate or the machine. We therefore build lighter machines with all three rolls power driven by solid keyed pinions.

On machines built for 3/4" x 10' and heavier work, the bending pressure between the plate and the forgings is so great that slippage would not occur. This could result in damage to the gears or other parts. These heavier machines are therefore built with friction drive. The feed pinions mounted on the journal of the lower front roll are not keyed to the roll but are driven by adjustable friction.

A large steel disc is keyed to the lower front roll between the feed pinions and the main frame. A steel disc covering the extreme end of the lower front roll is fastened to the roll by studs. Driving power is obtained by pressing the gears and collars between these two driving discs. This provides sufficient friction to drive the lower roll forging but allows them to slip to the speed of the plate which is then controlled by the driver or top roll.

FRICTION ADJUSTMENT: When the machine is idling (not rolling a plate) all roll forgings should revolve. If the lower rolls fail to revolve, it is due to wear of, or too little pressure between, the friction drive discs. In this case, increase the friction by tightening the nuts on the extreme end of the lower front roll. Slippage is only desired in very small amounts when rolling near capacity plates. The friction drive should therefore be adjusted tightly enough so that a plate may be pulled into the machine from the front.

When entering from the rear, the friction may slip if the rear roll is too high. The rear roll should be low enough that the plate can be brought into the pinch and then raised for forming.

LUBRICATING INSTRUCTIONS

COUNTERSHAFT and JOURNAL BEARINGS: These bearings are lubricated either by a Farval Dualine central system or by hydraulic fittings mounted on blocks at convenient places on the machine. For either system see our lubrication drawing for schematic view and lubricant chart. When the Farval system is used there will be a booklet explaining the design and principal of the Dualine system.

We emphasize for either method of lubrication the frequency of lubrication will depend upon the age and use of the machine. All bearings should be greased until the lubricant is seen oozing from them. On Farval systems it may be necessary to adjust some valves down to prevent over greasing. This machine was broken in with a Moly Sulfide (MoS^2) grease.

WORMS AND WORM GEAR: These parts are enclosed in a cast iron case on the lower rear side of each end frame and arranged to operate in a bath of oil. There is a fill hole at top, an overflow or oil level indicator on the side, and a drain hole at the bottom. These gear cases should be drained after about two months of use and changed each six months after that. CHECK OIL LEVEL WEEKLY.

We break in the machine with a Moly Sulfide (MoS^2) oil in these cases and recommend it for the customer. However, if MoS^2 is not used, use a good grade of E.P. gear oil, SAE #140, or #90 where specified.

SPUR GEARS: We recommend a periodic check of open gears for any sign of cutting or galling. If any occurs, clean the gears and apply new grease. The steel cast feed pinions may show some cutting at first. This is normal. After they are sufficiently worn-in this cutting should stop.

Lubricant for Spur Gears should be an open gear lubricant such as "Bison 88" (American Lubricants Co., Dayton, Ohio) or "Stix-on" (Dens Oil Co., Kansas City, Missouri) or equivalent. Do not use petroleum grease on rawhide pinions or their gears. Use Rawhide Lubricant or leave dry. Any lubricant may be used on the Fibroil pinions.

AIR CYLINDER AND VALVE: The air system is lubricated automatically. Keep lubricator filled with a turbine oil of 150 Vis. at 100°, SAE 5 to 10.

Proper attention to lubrication will extend the life of the machine and reduce maintenance to a minimum. Place lube drawing and chart at the machine.

MACHINE CAPACITY

Pipe vs Boiler Duty: A heavier bending load is required to form a given plate to small diameter for PIPE duty than is required to form the same plate to medium or large diameter for BOILER DUTY. The following capacity chart gives maximum rating, both PIPE and BOILER duty on the machine sold herewith.

Capacity Chart:

1/2" x 8'	to 48"	or larger inside dias. in one pass, boiler duty,
1/2" x 8'	from 48" to 16"	I D. in several passes,
13/32" x 8'	and lighter to 11"	or larger I.D. in one pass, pipe duty.

Capacity also varies with tensile strength of the plate being rolled, therefore we emphasize that the above capacity chart is Mild Steel plate having a maximum of 60,000 PSI or lower unit tensile strength. In case you have any high tensile plate to roll, above 60,000 PSI unit tensile, advise us the type and maximum tensile of that plate and we will supply a chart to suit.

OVERLOAD WARNING

A Bending Roll can be overloaded by rolling plates thicker than shown in above chart. It can also be overloaded by rolling too great a thickness to too small a diameter in one pass. The operator should therefore not only watch the thickness being handled but also the diameter being formed.

A Bending Roll can be overloaded to the breaking point, even when handling the lightest gauges of sheet metal. Forcing a piece in the machine with less opening between the pinch rolls than the thickness of the piece being rolled or running a lapped joint between the pinch rolls when the opening between them is equal to only one thickness of the metal will overload the machine.

MINIMUM DIAMETER CYLINDERS

If a plate is formed in several passes thru a Bending Roll, the smallest diameter that can be rolled will be 6" to 10" larger than the diameter of the top roll. After breaking the fiber in the plate on the first pass, the same plate cannot later be rerolled to produce as small a diameter as could have been obtained on the first pass. If the finished cylinder must be closer than 6" to 10" of the diameter of the top roll, the plate must be bent close to its final size on the first pass. In other words, the operator will never finish a piece to a minimum diameter cylinder if he does the rolling in many passes.

The above also explains why the heavy boiler duty sizes specified in the first line of the capacity chart cannot be formed to small diameter pipe.

Please note that our warranty is void if the machine is operated in an overloaded condition.

MINIMUM DIAMETER CYLINDERS (continued)

The Bertsch Bending Roll is built to form cylinders having inside diameters of approximately 1-1/2" larger than the top roll. This can be done by using standard rolling procedures if the material has the ability to form to the small diameter. If it is desirable to form diameters smaller than the above, we suggest that you call the factory for aid in procedures.

To avoid overload please note that these small diameters must be formed in one pass through the machine after preforming one end. The material must not exceed the limit set forth for pipe duty described on page 6.

DUPLICATE OR CHART ROLLING:
Bertsch Pinch type Rolls have either indicators or a dial to show the relative position of the rear Bending Roll. A chart should be made to record settings used for the most common rolling. Settings and results will vary with material, thickness and width so that the charts should show the following:

MATERIAL	THICKNESS	WIDTH	DESIRED DIAMETER	PINCH SETTING	REAR ROLL SETTINGS		
					PRE-FORM	PASS #1	FINISH

Until the operator is familiar with the rolling characteristics of the machine and various materials to be rolled he will be uncertain in setting the rear roll. This is an excellent time to record the various diameters resulting from his settings. This will give a greater range of principle settings than charting only the settings for the desired diameter.

DIAMETER VARIATION

No two plates will be rolled to the same diameter with exactly the same roll settings. The diameter produced varies with minor variation in plate thickness, carbon content, hardness, etc.

The operator should not attempt to form an exact diameter in one pass. The forging should be set to produce a slightly oversize shell that is open at the longitudinal butt joint and make a series of passes to close the cylinder.

If the operator attempts to roll an exact diameter in one pass, he will frequently produce a cylinder that is undersize and difficult to open. Even if it is not undersize, it will undoubtedly be out of round.

PRODUCTION ROLLING

Lighter materials may be formed on a high production basis by setting the rolls to the predetermined chart setting and preform the entire lot from the rear. Reset the rolls to the proper setting and roll from the front in one pass. The operator will disregard the variations at the butt joint as they can be adjusted during welding.

SHELL QUALITY

TRUE ROUND CYLINDERS WITHOUT FLATS

When a plate is entered from the front of a Pinch type Bending Roll, there is a wide flat on the first edge entered, and a narrow flat on the last edge through the machine.

If the plate is entered from the rear of the machine, then the narrow flat is on the first edge and the wide flat on the last edge through the machine.

Combining the above facts will allow rolling a sheet in the pinch type machine with a narrow flat on each edge. First, enter the plate from the rear of the machine and form only a short distance past the edge. This produces a narrow flat on that edge. Reverse the machine, remove the plate and enter this preformed edge from the front. Continue on through to form the desired diameter from the front in as many passes as required. This produces the narrow flat on the last edge so that both flats are minimum and equal.

In case more nearly perfect results must be obtained than are produced by this method, then the edges of the plate may be prepressed between dies and the shell then finished in the Initial Pinch type machine. If a press is not available, this work may be done in the Pinch type Roll by a special "bumping" method. Please contact the factory for information on this procedure. This procedure can be unsafe and will be used at the risk of the machine user. In several previous headings we recommended producing close to the desired diameter in one pass through the machine. In all cases, this is to be interpreted as one pass after preforming one edge from the rear of the machine.

ROLLING PROBLEMS AND CORRECTIONS

ONE END LARGE IN DIAMETER: If one end of the cylinder or segment is produced larger in diameter than the opposite end, the trouble may be one of the following:

The machine may be out of alignment. This should be corrected by following the installation and alignment instructions on page 2.

One of the bottom rolls may be out of level with the top roll. This may be corrected by adjusting either end of the roll to make it parallel. Note, that the rear roll worm adjusting shaft is provided with a split clutch so that this roll may be leveled by adjusting one end only.

The hinge or drop end may not be in the full up position. Correct this by relieving the pressures on the rolls and locking the hinge in the full up position.

The plate may be thicker on one side than the other. In this case, the rolls must be adjusted out of parallel with each other to correspond to the difference in thickness of plate.

ROLLING PROBLEMS AND CORRECTIONS (Cont'd)

LARGE DIAMETER AT CENTER: All three roll forgings are crowned and are larger in diameter at the center. This is necessary due to the deflection under the bending load. With no crowning in the rolls, all shells would be larger in diameter at the center than on either end. This would make it difficult to form good cylinders from heavy plate. Since the deflection varies with the bending load the crowning is average to suit the customer's average work and to produce as nearly uniform diameter as possible on both light and heavy work.

Note that this condition usually exists only a few inches from the butt joint edge and does not extend throughout the shell. This may be corrected by inserting shims of light gauge metal or cardboard between the top roll forging and the plate. When rolled with the plate these shims increase the crowning at the desired point and form a tighter radius at the desired point in the plate.

Care must be taken that the amount of shims used does not increase the plate thickness to a dimension greater than the end openings between the top and lower rolls.

SMALL DIAMETER AT CENTER: A cylinder which is smaller in diameter at the center than on either end will usually be of light material not having enough bending pressure to overcome the crowning of the forging. It is corrected as above except by rolling strips at the ends of the plate until the longitudinal butt joint is even throughout.

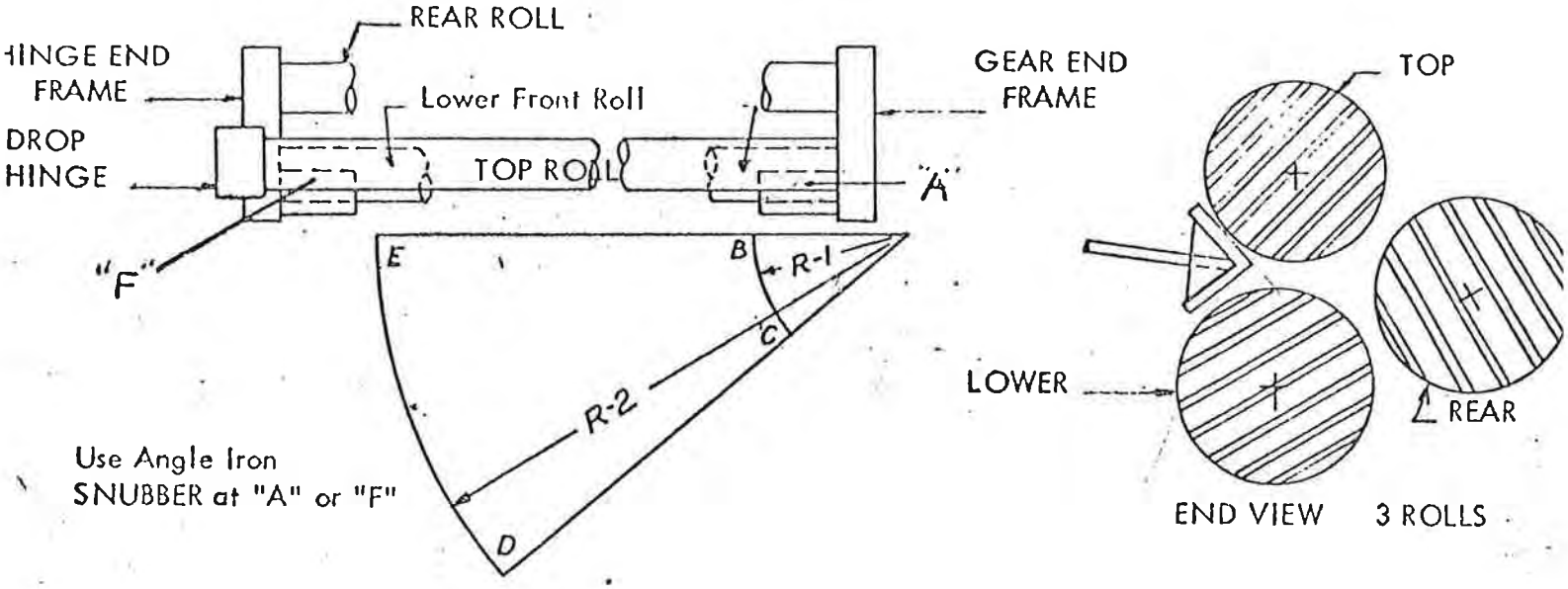
SAFETY PRECAUTIONS: Due to the varied operation of a Bending Roll, several safety precautions must be observed. A two man operation is much safer than one man operation in that the control operator should always be at the controls.

The machine must be stopped when checking a radius which is entering the rolls from either direction. Extreme care must be taken to prevent a plate being rolled out of the machine. The control operator should stop the machine while the plate is still held in the pinch. The plate should not be handled or touched unless the machine is stopped.

Overloading the machine is not safe in that the plate may break or be forced from the machine due to pressure involved.

ROLLING CONES

ANGLE HOLDBACK METHOD: This method will produce cones of better quality in less time than any other method; it is especially recommended for cones of steep angle.



A plate is first cut to the shape shown above, with radius R1 and R2 developed so the finished cone will have parallel ends and when rolled will have correct diameters at each end. The above sketch is a plan view of the Bending Roll showing plate in position ready to enter in the machine. The plate is entered in the machine with edge "B-E" parallel with the roll forgings, edge "B-C" rubbing against the angle snubber at "A". Curve "B-C" hooks around "A", therefore holds back the small end of the cone in proportion to feed on the large end, automatically producing cone of correct taper.

ANGLE IRON SNUBBER: The use of a piece of angle iron as a snubber is recommended in that the snubbing is done much closer to the point of bending, thus practically eliminating the spiral effect.

Another advantage of the angle iron snubber is that it may be used at either end of the machine for two pass rolling. Multi-pass rolling in conical work has the same effect as in straight cylindrical rolling, that is, the flats or irregular surfaces at the butt joints are reduced.

The size of the angle will vary with the roll size, the plate thickness, and the work diameter. It should be long enough that there will be no interference of the curved plates with the frames of the roll. When high pressures are involved, as in heavy plate, it is necessary to put gussets in the angle to prevent collapse.

All contact surfaces - plate to snubber, and snubber to rolls, should be smooth and well lubricated. In snubbing a plate, the edge at the small end may be cut or upset by rubbing against the snubber. This may be reduced by surfacing the snubber contact area with Stellite or hard face weld rod, and by grinding or polishing that area. Excellent results have been obtained by covering the top side of the plate with liquid soap to reduce the friction between the roll and the plate.

ROLLING CONES

The opening between the pinch rolls must be great enough to ASSURE NO PINCHING OF PLATE AT ANY POINT.

TILTING ROLLS: Fair results may be obtained by forming with all rolls parallel and depending on the snubber to pivot the plate. Tilting the rolls will usually give better results and reduce the pressure on the snubber and the upsetting of the plate edge. The rolls will be tilted so they are HIGHER AT THE SMALL END of the cone. The rear roll may be tilted 1" to 3", depending on the angle of the cone, and the lower roll may be tilted 1/4" to 1/2", noting it must not pinch the plate at the high end. By experience you will learn when and how much to tilt the rolls.

When tilting the rolls, the operator should make a visual check of the linkage connecting the two lower rolls. The rolls should never be tilted to the degree that this linkage is put into a twist or bind.

MULTI-PASS ROLLING: For best accuracy and reduced flat areas, you should roll near the final size as described above, reverse the tilt of the rolls, move the snubber to the other end and finish rolling to size. When rolling cones in several passes by reversing the plate and changing ends, the taper is improved and the spiral reduced. Some operators do the multi-pass method by simply moving the snubber to the rear of the rolls at the same end and roll the final passes from the rear.

SEGMENTS: Several segments may be welded together when flat, and this unit rolled in one piece. This will depend on size and weight limitations. It is recommended because you then have perfect bending at the prewelded joints and fewer butt joints to fit. It is easier to fit a cone of two segments than one of 4, 6 or 8 segments.

When rolling cones over 3/4" thick, the pressure against the snubber is very high. It is therefore best to roll the heavy plates by marking radius lines on the plates. Tilt the rolls as described above and use no snubber. Roll between two radius lines, lower the rear roll and shift the plate to the center of the next section between radius lines, and roll another part of the plate. Continue in this manner, rolling narrow areas until the cone is completed.

OTHER METHODS OF ROLLING CONES: When rolling very light sheets, it is possible to hold back the small end of the cone by clamps instead of the angle iron snubber.

SPECIAL NOTE: In conical forming it must be remembered that the small end may be in the pipe duty range and the large end may be in the boiler duty range, as given on page 7. It could therefore become necessary to use the pipe duty rating on some conical sections of plates which would normally roll within the boiler duty range.

Capacity Chart

CAPACITY CHART

Date _____
Page 1 of 2

9, 10" x 8' Bertsch Pinch Roll

Mail to:

The pressure to form a plate varies with the unit tensile of the material being rolled, so that we submit these charts on several grades of material. The unit tensile strength specified is not the code or handbook minimum, instead, it is the code maximum or the probable commercial maximum tensile that you will encounter in each grade.

In each chart, in addition to full length boiler duty rating, we also give short thick boiler duty ratings, emphasizing that each of the short thick capacities has been calculated, and each results in the same internal strain, i the top roll as full length work for which each machine is normally offered.

A greater bending load is required to form a given plate to small diameter than is required to form the same plate to medium or large diameter, so that the last line in each chart is full length pipe duty rating, giving capacity forming smaller diameters than can be produced when rolling in several passes.

Chart #1: - Mild Steel, Having 60,000 PSI or Lower Unit Tensile:

1/2"	x 8' to 48"	and larger dia. in one pass,
9/16"	x 64"	Ditto
5/8"	x 44"	"
11/16"	x 34"	"
3/4"	x 27"	"
7/8"	x 19"	"
1"	x 14"	"
1-1/8"	x 11"	"

Any of the above from 48" to 16" I.D. in several passes,
13/32" x 8' and lighter to 11" I.D. and larger in one pass.

Chart #2: - A-7 or A-201 or A-285 Code Steel Having 72,000 PSI Tensile:

29/64"	x 8' to 48"	and larger dia. in one pass,
15/32"	x 65"	Ditto
1/2"	x 61"	"
9/16"	x 42"	"
5/8"	x 32"	"
3/4"	x 21"	"
7/8"	x 15"	"
1"	x 11"	"
1-1/8"	x 8"	"

Any of the above from 48" to 18" I.D. in several passes,
23/64" x 8' and lighter to 12" I.D. and larger in one pass.

BERTSCH & COMPANY, INC.
CAPACITY CHART
#9, 10" x 8' Pinch Roll
Page 1 of 2

7A

, 10" x 8' Bertsch Pinch Roll

Chart #3: - A-212 Code Steel Having 85,000 PSI or Lower Unit Tensile:
27/64" x 8' to 48" and larger dia. in one pass,
1/2" x 52" Ditto
5/8" x 28" "
3/4" x 18" "
7/8" x 13" "
1" x 10" "
1-1/8" x 7" "
Any of the above from 48" to 18" I.D. in several passes,
21/64 x 8' and lighter to 12" I.D. and larger in one pass.

Chart #4: - Stainless Steel, Having 120,000 PSI and Lower Unit Tensile:
23/64" x 8' to 48" and larger dia. in one pass,
3/8" x 57" Ditto
1/2" x 26" "
5/8" x 16" "
3/4" x 10" "
7/8" x 7" "
1" x 5" "
1-1/8" x 4" "
Any of the above from 48" to 18" I.D. in several passes,
19/64" x 8' and lighter to 12" I.D. and larger in one pass.

Chart #5: - T-1, tempered Code Steel Having 140,000 PSI YIELD:
9/32" x 8 to 48" and larger dia. in one pass,
5/16" x 49" Ditto
3/8" x 30" "
1/2" x 16" "
5/8" x 9-1/2" "
3/4" x 6-1/2" "
7/8" x 4-3/4" "
1" x 3-1/2" "
1-1/8" x 2-7/8" "
Minimum diameter varies with thickness being rolled as follows:
3/16" to 1/4" thick from 48" to 26" I.D. in several passes,
Over 1/4" to 3/8" from 48" to 24" I.D. in several passes,
Over 3/8" to 1/2" from 48" to 22" I.D. in several passes,
Over 1/2" to 3/4" from 48" to 21" I.D. in several passes,
Over 3/4 to 1" from 48" to 20" I.D. in several passes,
Over 1" from 48" to 19" I.D. in several passes.

BERTSCH & COMPANY, INC.
CAPACITY CHART
#9, 10" x 8' Pinch Roll
Page 2 of 2