Wire Drawing Machinery

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Reference: WAI, *Ferrous Wire,* Volume 1, Chapter 9

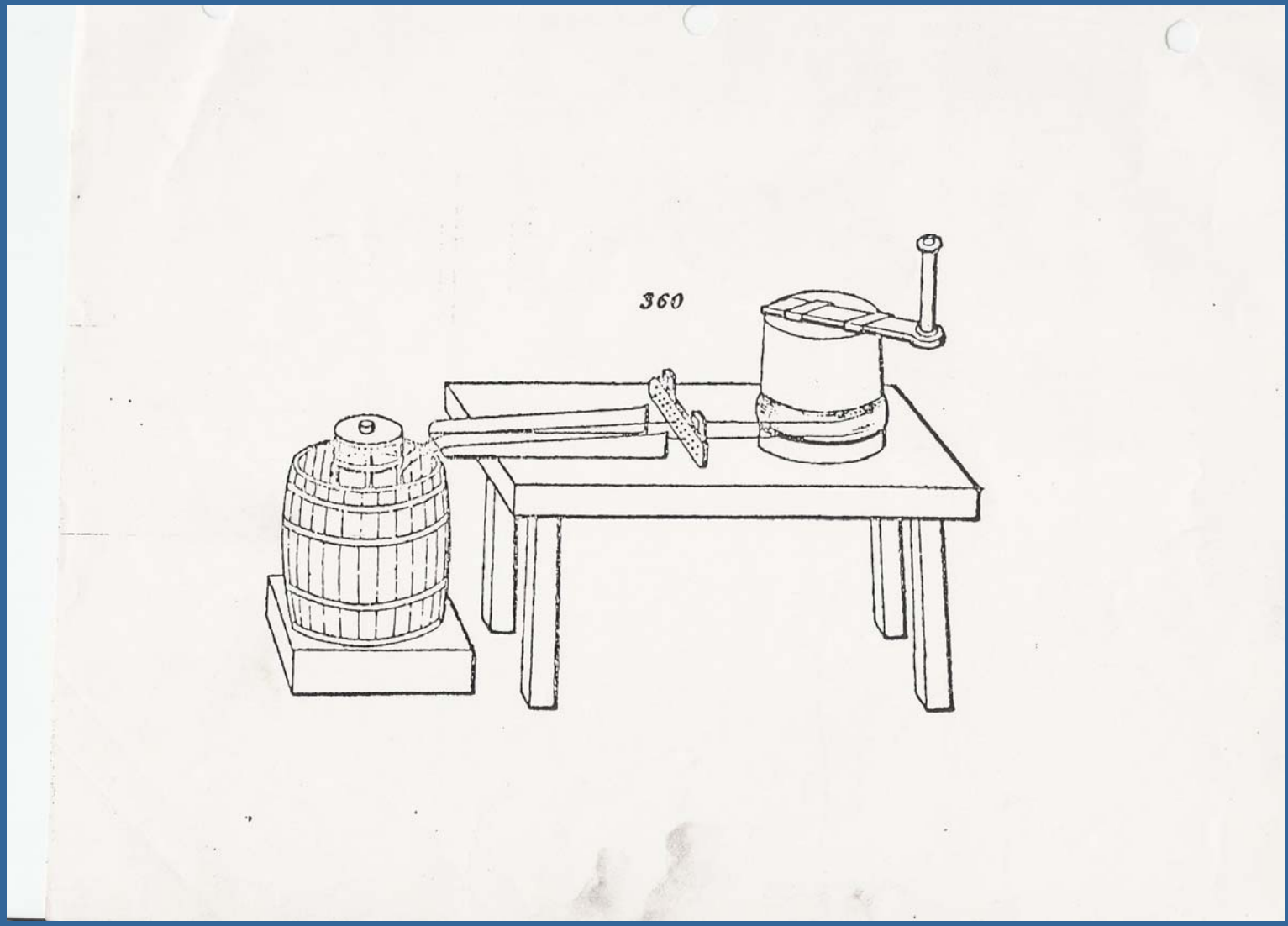
Introduction

- The class will provide descriptions, illustrations, and general information on various types of drawing machines

Topics of Discussion

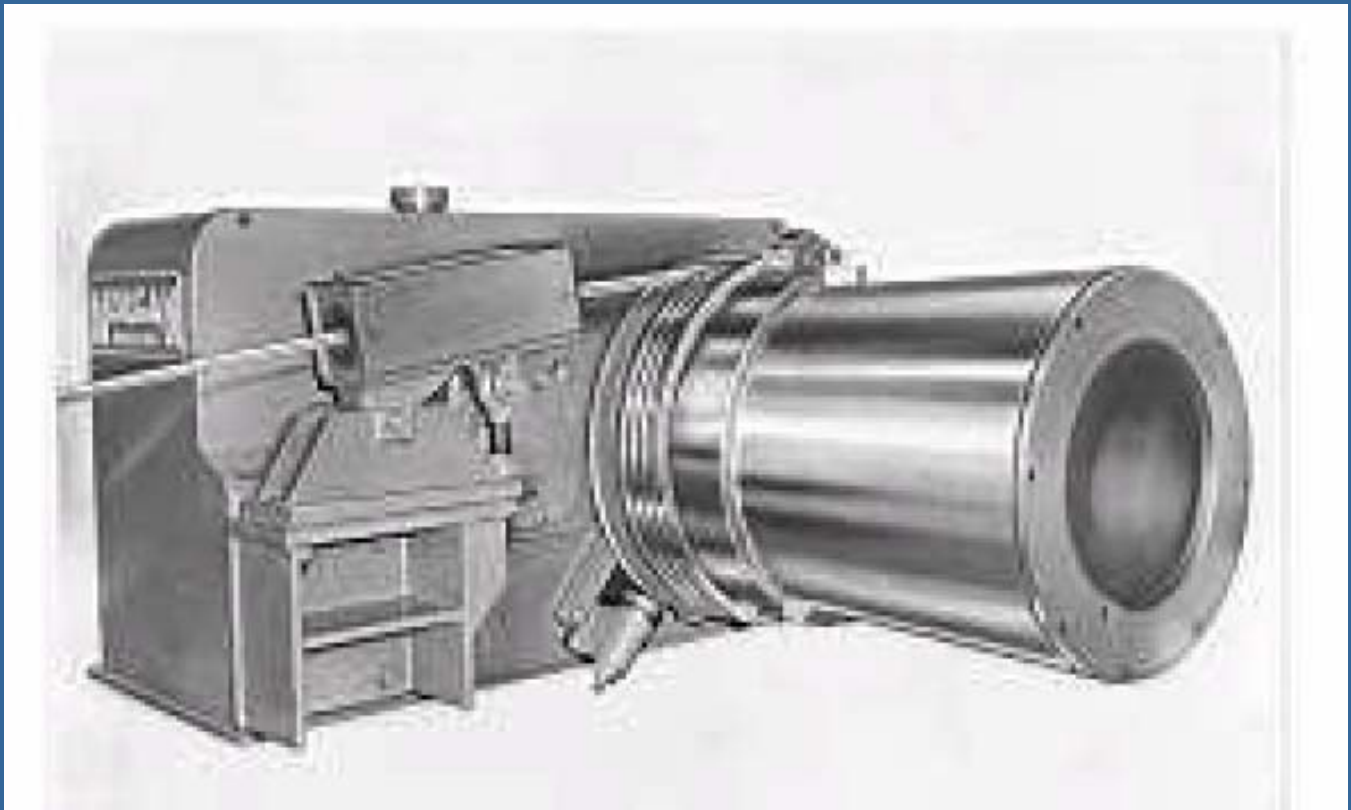
- Brief look at the evolutionary developments of the draw machine.
- Emphasis and detail will be given to the modern continuous draw machine and it's auxiliary equipment
- Factors needed to design or select a new machine.

The Machine Has Evolved but the Biggest Change Is in Die Design



Standard Vertical Bull Block

Morgan Horizontal Bull Block



Vaughn Horizontal Bull Block feeding Screw Machine

New Single Block Bull Block

Single Block With Guard Open

Inverted Bull Block

Inverted Bullblock with Pressure Rolls & Special Die Box

FEATURES–

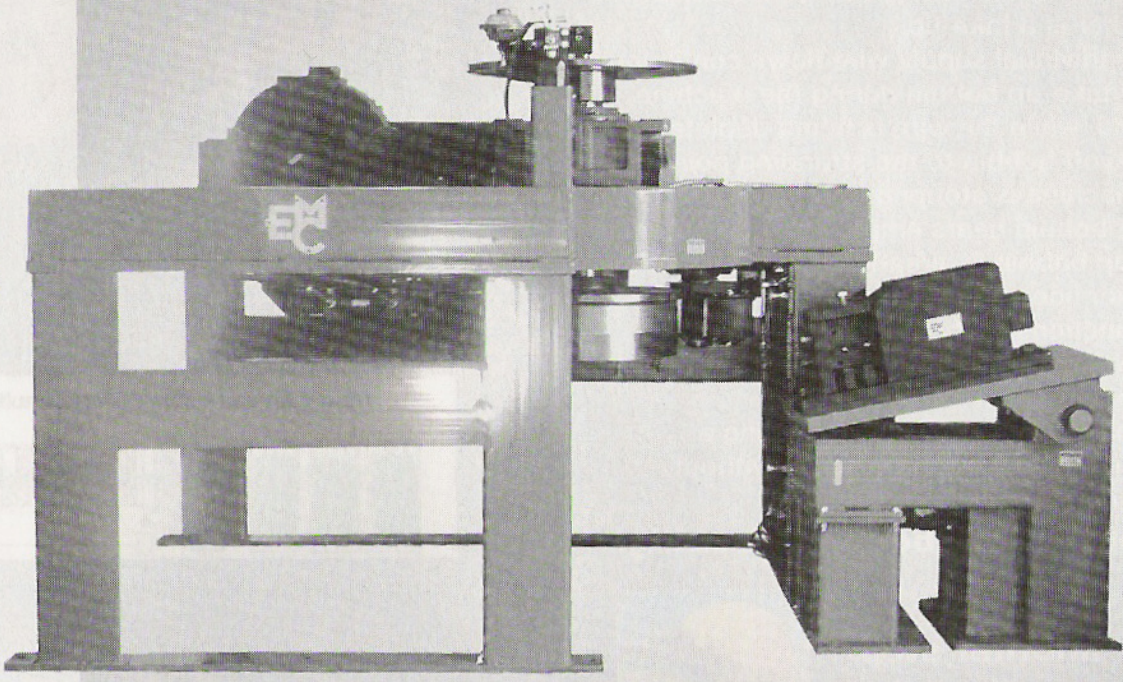
BLOCK RANGE–42″ dia. to 22″ with puller plate

WIRE RANGE–2″ dia. and smaller

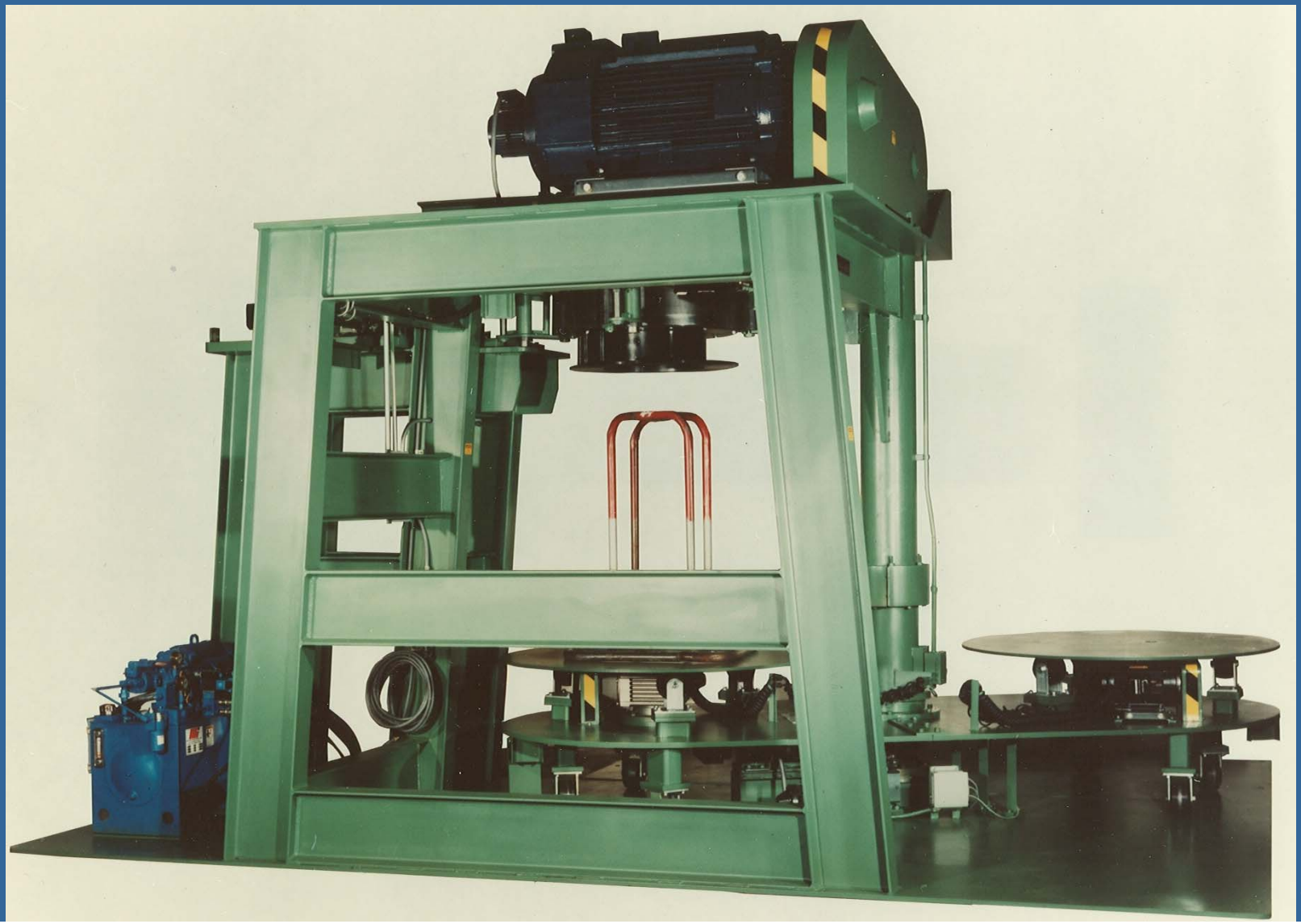
MATERIAL TYPES–High/low carbon steel and alloys

LINE-SPEED–Up to 600 fpm (182mpm)

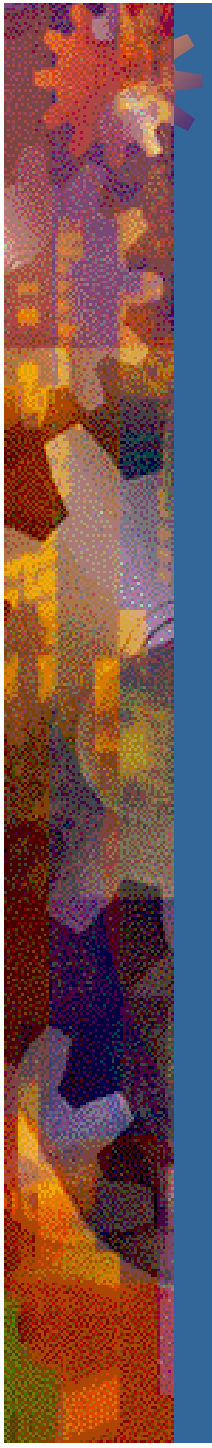
OPTIONAL ITEMS–Internal built-in puller-grip, 2 position shuttle turntable, 2 position indexing turntable



Inverted Bull Block



Inverted Bull Block



What Will My Bull Block pull?

SR = Motor's Base Speed ÷ Gear Ratio

Ft/min = SR x K (k= block circumference in ft)

(example a 30" block = 7.854 ft)

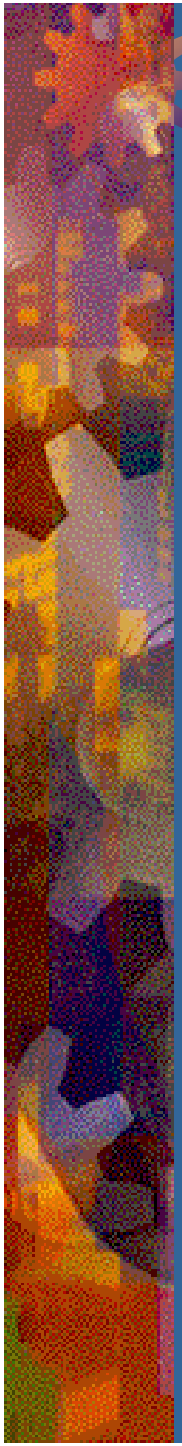
Die Pull = HP x 33,000 ÷ Ft/min

Example A 30" BB with 150hp motor base speed 400 and a 15:1 gear ratio would have a Die Pull of 23,638 lbs.

400 ÷ 15 = 26.67

26.67 x 7.854 = 209.4

150 x 33,000 ÷ 209.4 =23,638 lbs. Die Pull



Once you know DP you can calculate what you can draw

DP = 43.56d ² SK

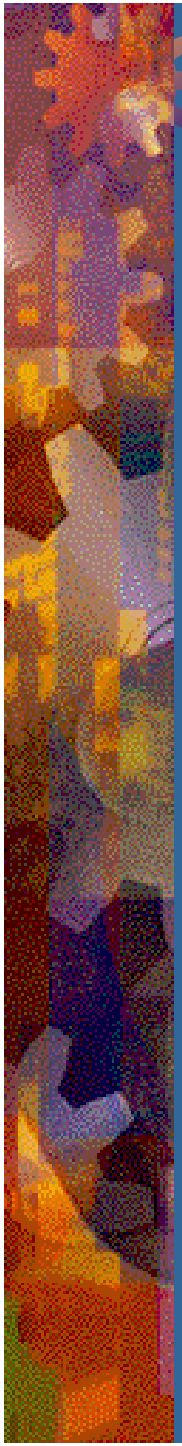
d = diameter after draft in inches

S = Tensile strength before draft

K = a factor which varies with % reduction

as shown in table 8A-I page 263 of the Ferrous Wire Volume 1 WAI.handbook

% reduction	K	% reduction	K
15	.0081	28	.0120
20	.0097	32	.0134
26	.0115	36	.0155



Example with the Die Pull of 26,638 DP =43.56d² SK

Can we draw .750” C1018 from .910” which is 32% reduction?

DP = 43.56x .750² x 75,000 x .0134

DP =43.56 x .5625 x 75000 x .0134

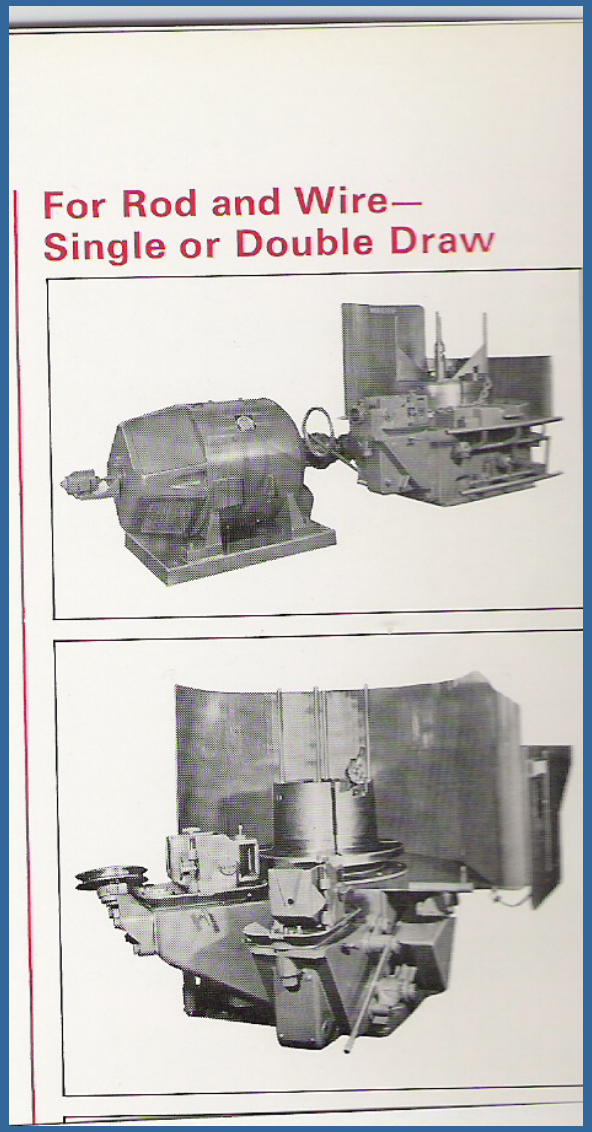
DP = 24.50 x 75,000 x .0134

DP =1837687 x .0134

DP = 24,625

Answer Yes!

Additional Old Bull Blocks

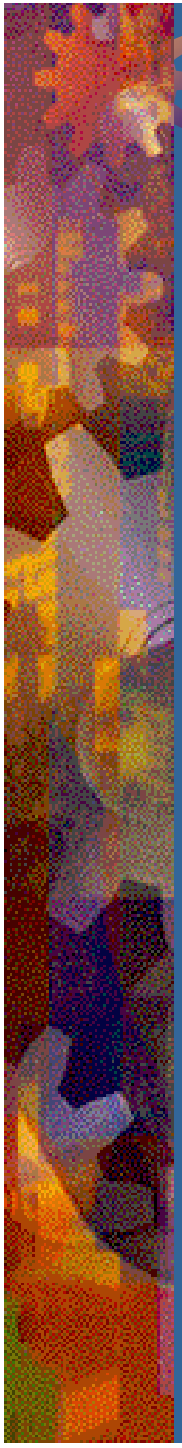


- Single Block, One die. Block set to have a Riding Stripper

Double Block, 2 Dies Collapsible Riding Stripper used to remove the wire

Important: That the drafting between the two dies be accurate, in order to control the bow going into the last die.

Newer Double Deck Block Bull Block



How to Determine Drafting on a Double Deck block

- Measure the diameter of each block
- Divide the smaller dia. By the large Dia. x100
- Subtract the answer from 100 %
- Add 1 to 2% to % reduction for slippage.
- **Example:**
- 18” small dia. ÷ 28” large Dia.=.643 x 100=64.3
- 100% - 64.3%= 35.7 % reduction of area

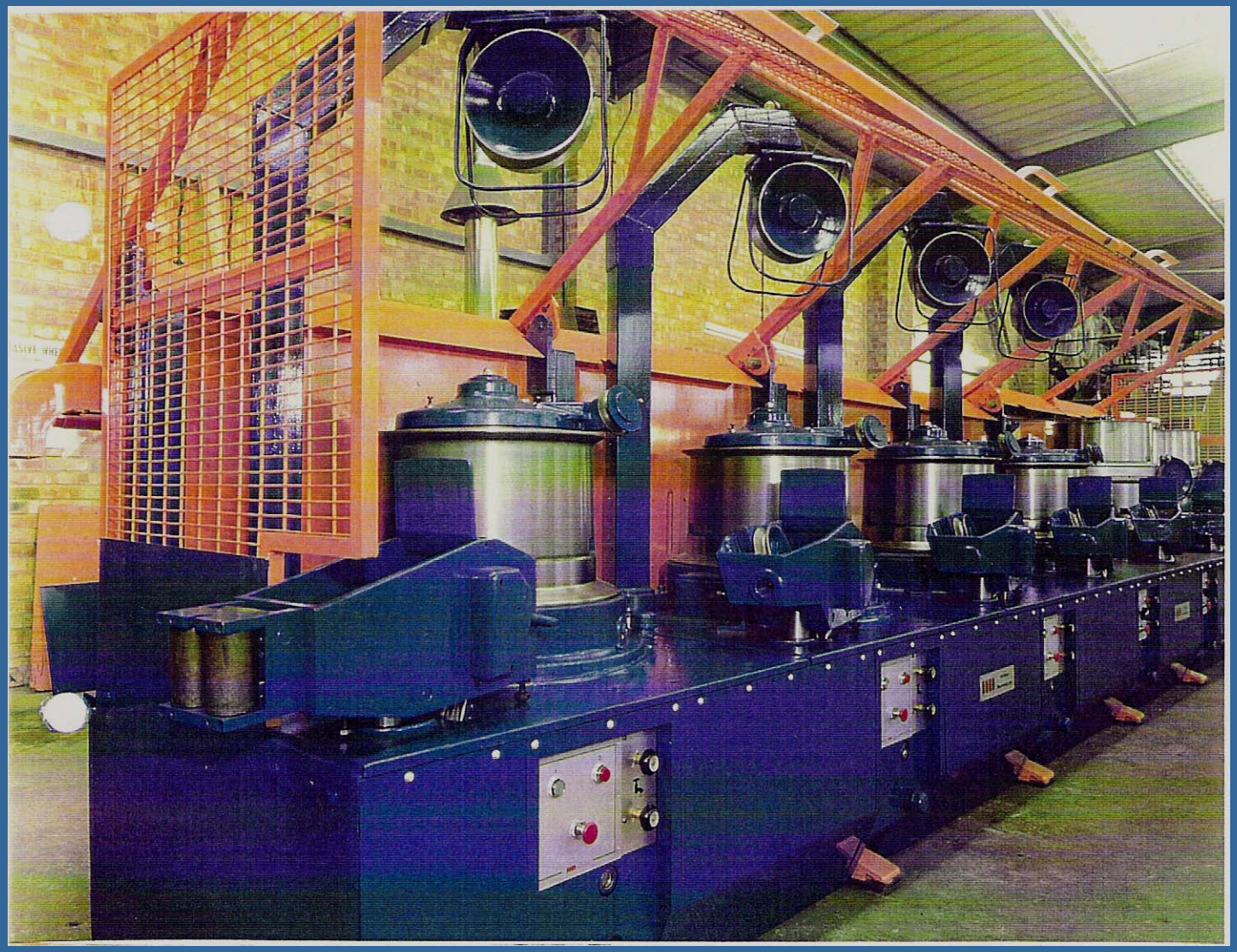
1% for slip =36.7% reduction between the 2 dies

Alternative To The Double Deck Bull Block with Variable Drafting

When three or more consecutive reductions are required, The Continuous Draw Machine or Multi-hole machine is the next choice in production.
Continuous Machines can be either be of the **Slip type** usually for wet draw or **Non-Slip** usually for dry draw.

The dry draw continuous machines falls into 4 categories: Accumulation Machines, Full Stroke Dancer, Limited or Short Stroke Dancer, and Direct Through or Back pull Machines.

OTO (Overhead Take –Off) Accumulator Machine

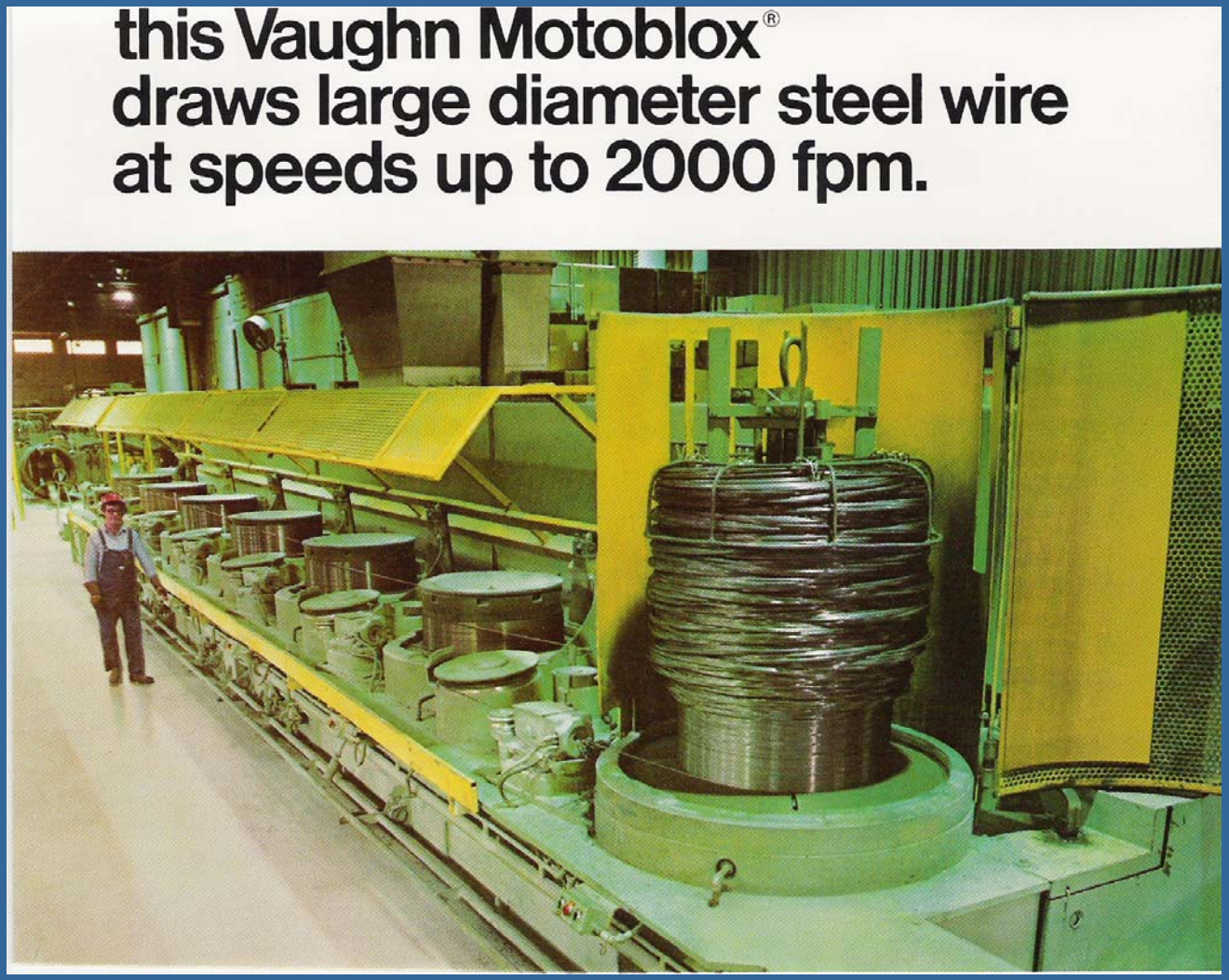


BB or Double Block Accumulator Machines

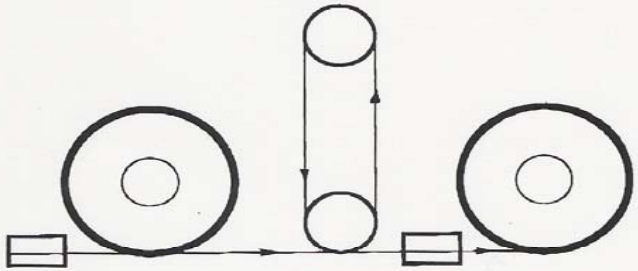
BB with Motorized Transfer Pulley

12 Die combination block size BB Machine

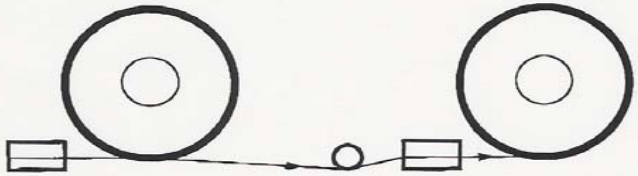
A Full Stroke Dance Machine is really a controlled Accumulator Machine



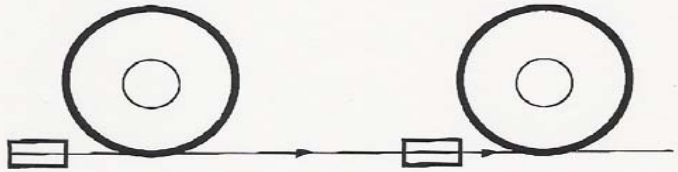
DANCER ARM MACHINE



SENSOR/TUNER ARM MACHINE



STRAIGHT THRU MACHINE



9 Die Vertical Axis Full Dancer

11 Die 200 mm Blocks Dancer Machine

11 Die 200 mm Block Dancer machine

Limited or Short Stroke Dancer Machines Vertical Axis 1200mm Blocks

Limited Dancer Machine Vertical Axis

Limited Dancer Horizontal Axis 900 mm Blocks

Back Side of Horizontal Machine

Horizontal Limited Dancer 14 Die 180mm blocks

Horizontal Modular Limited Dancer

Close View of Horizontal Modular

Vertical limited Dancer Modular

MTX dry 12 Die drawing machine

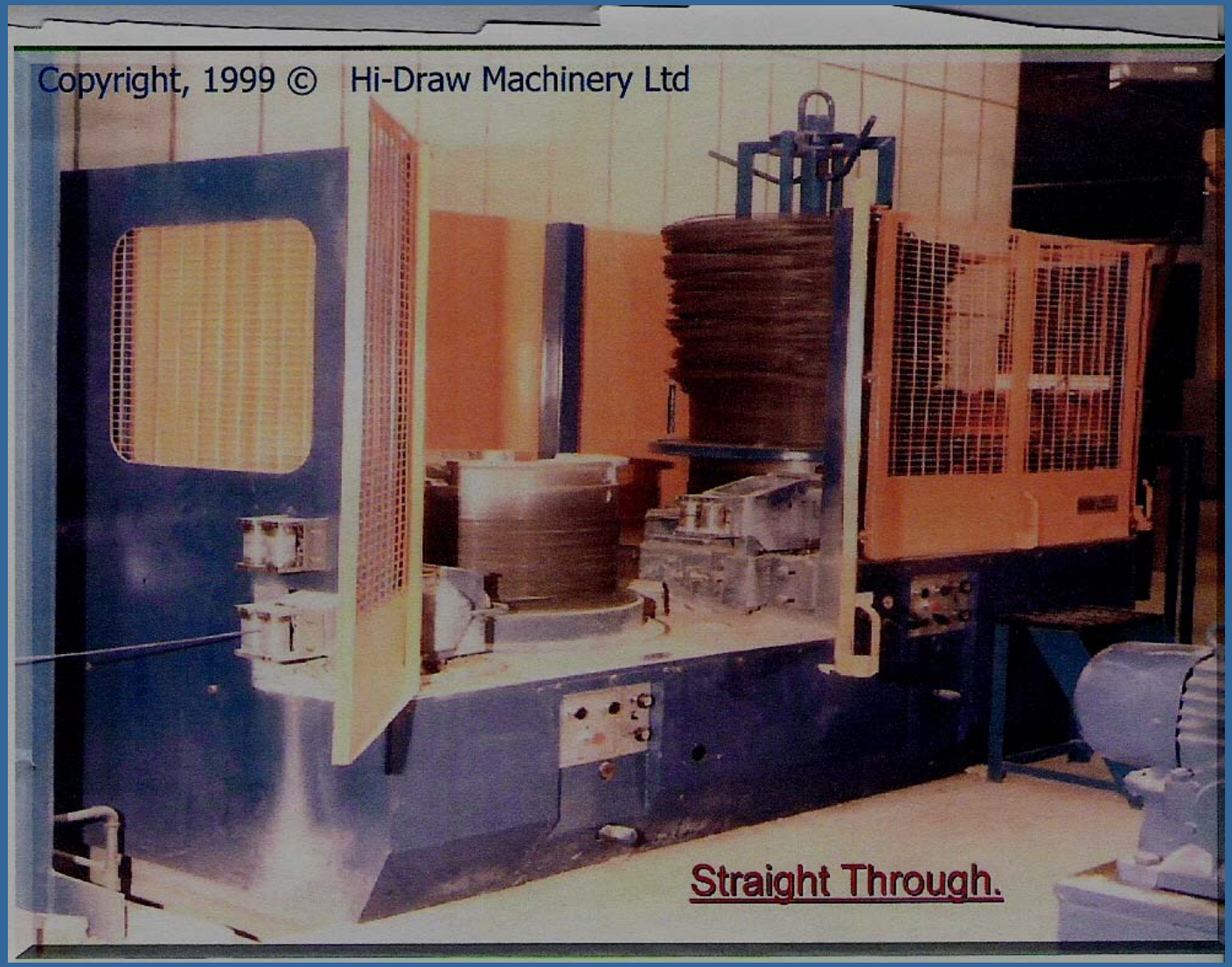
- Compact design
- Integrated electrical cabinet
- New transmission system

MTX Modular 4 block unit

MTX Modular Back Side Electrical Drives

Complete Modular Block Housing Drops In

Back Pull or Direct Through Machine



We'll take a look at the individual components of the Modern Continuous Draw Machine

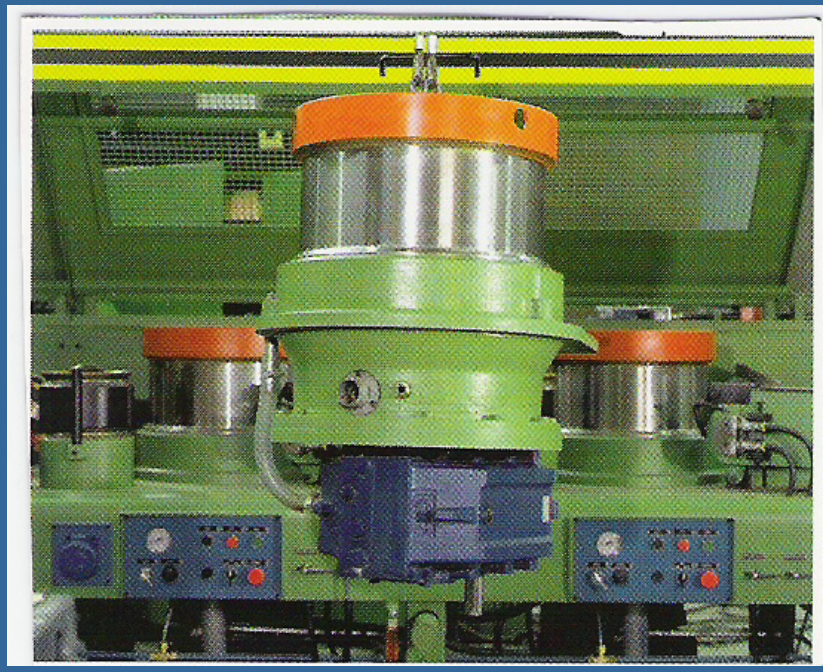
Steel Frame for Vertical Axis Machine with OTO position

Safety guards

Fully enclosed environmental
as on the right

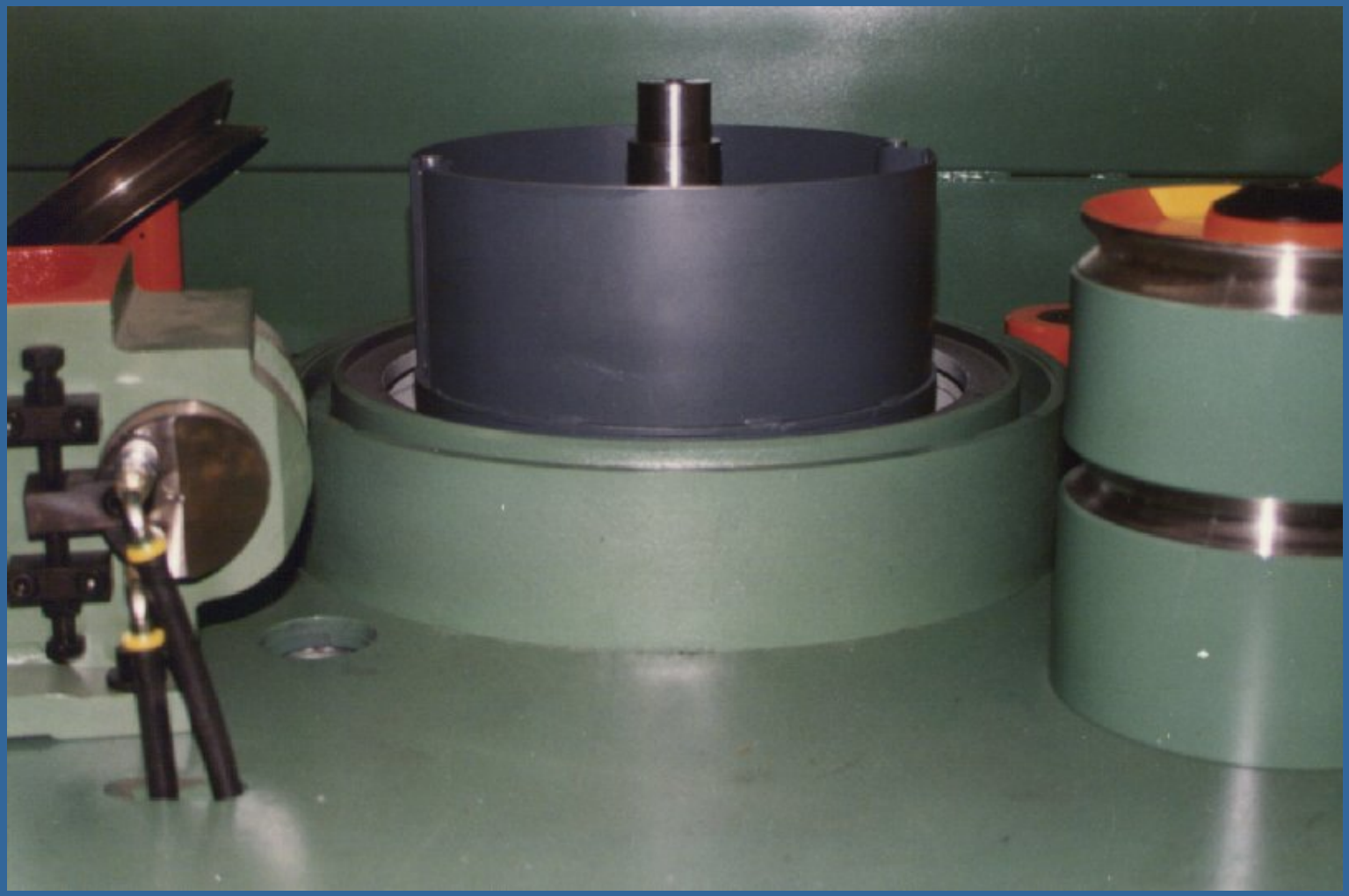
Or reinforced Mesh type
directly below

Gear Boxes and Block Housing

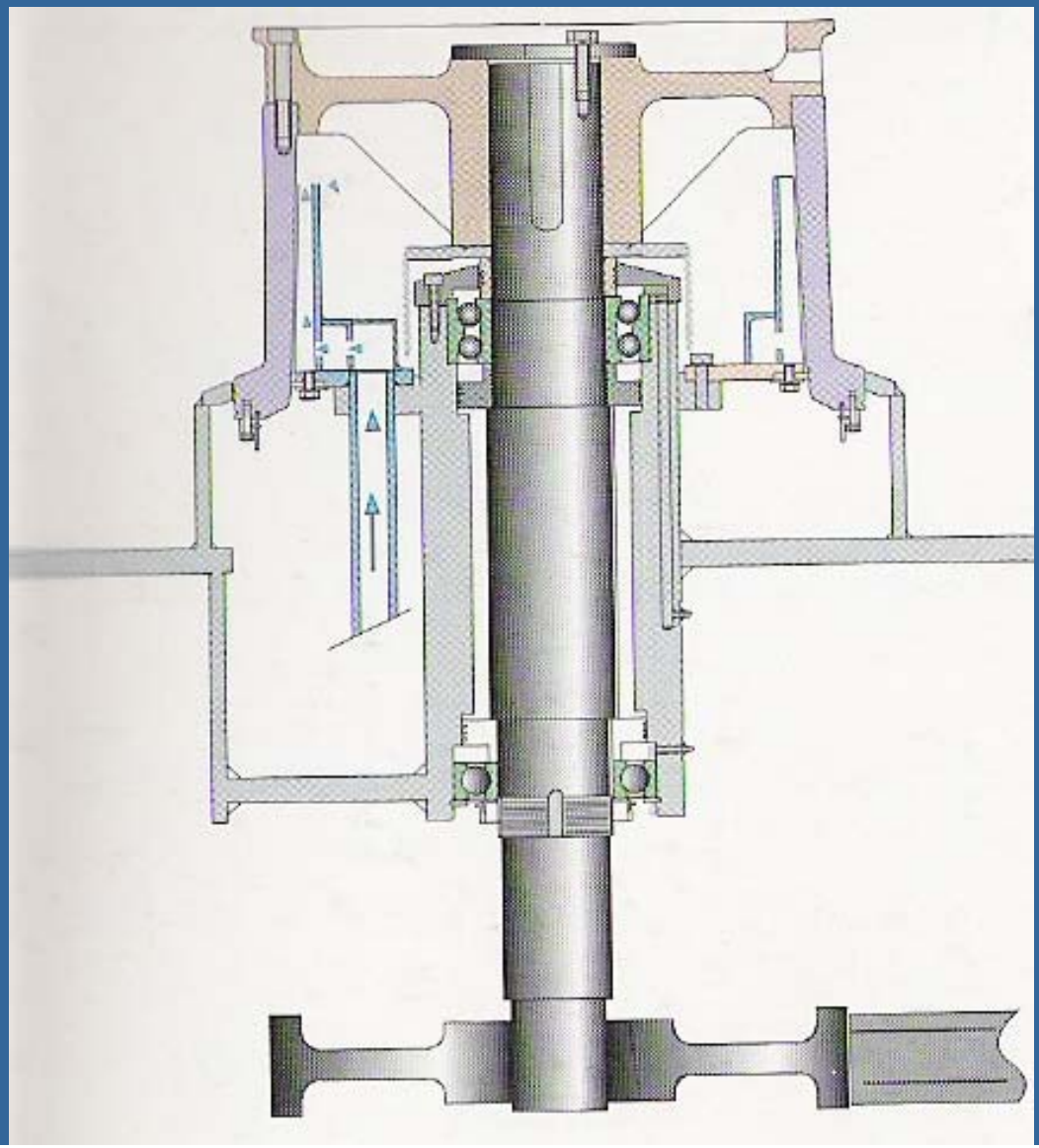


Gear Box and Inner Block

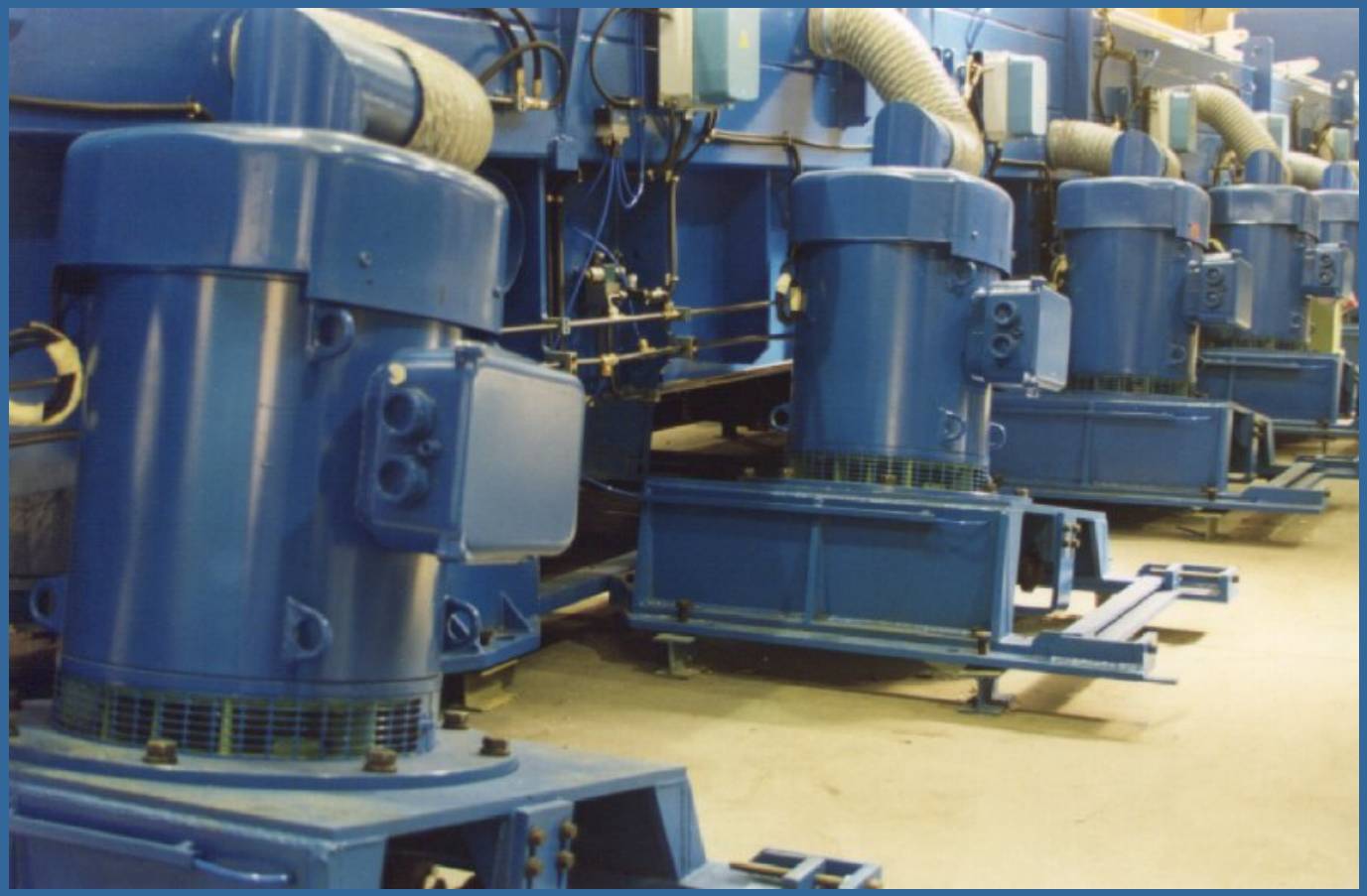
Inner block of Narrow Gap Cooling System on 450mm Block



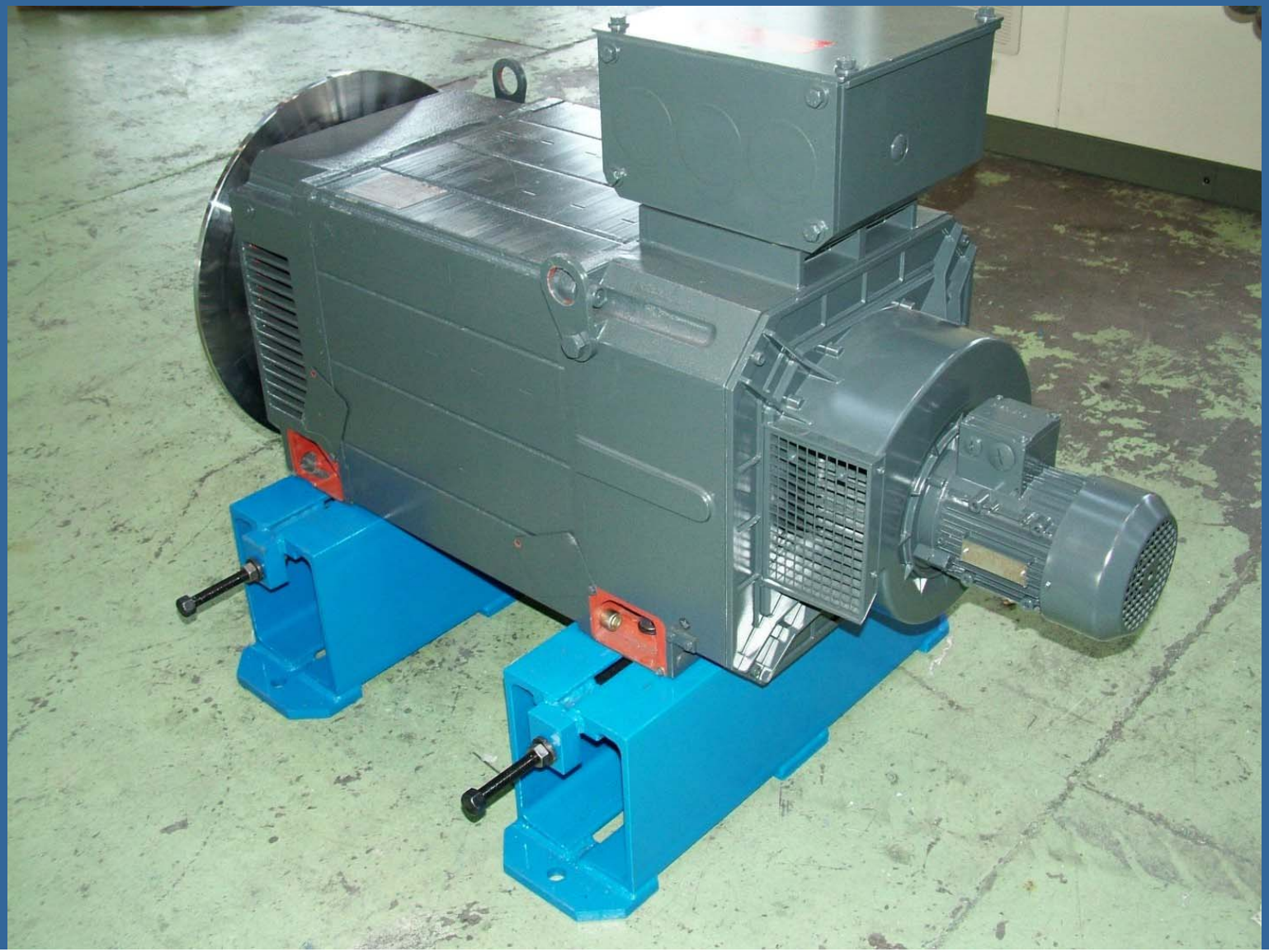
Drawing of Narrow Gap Cooling Block



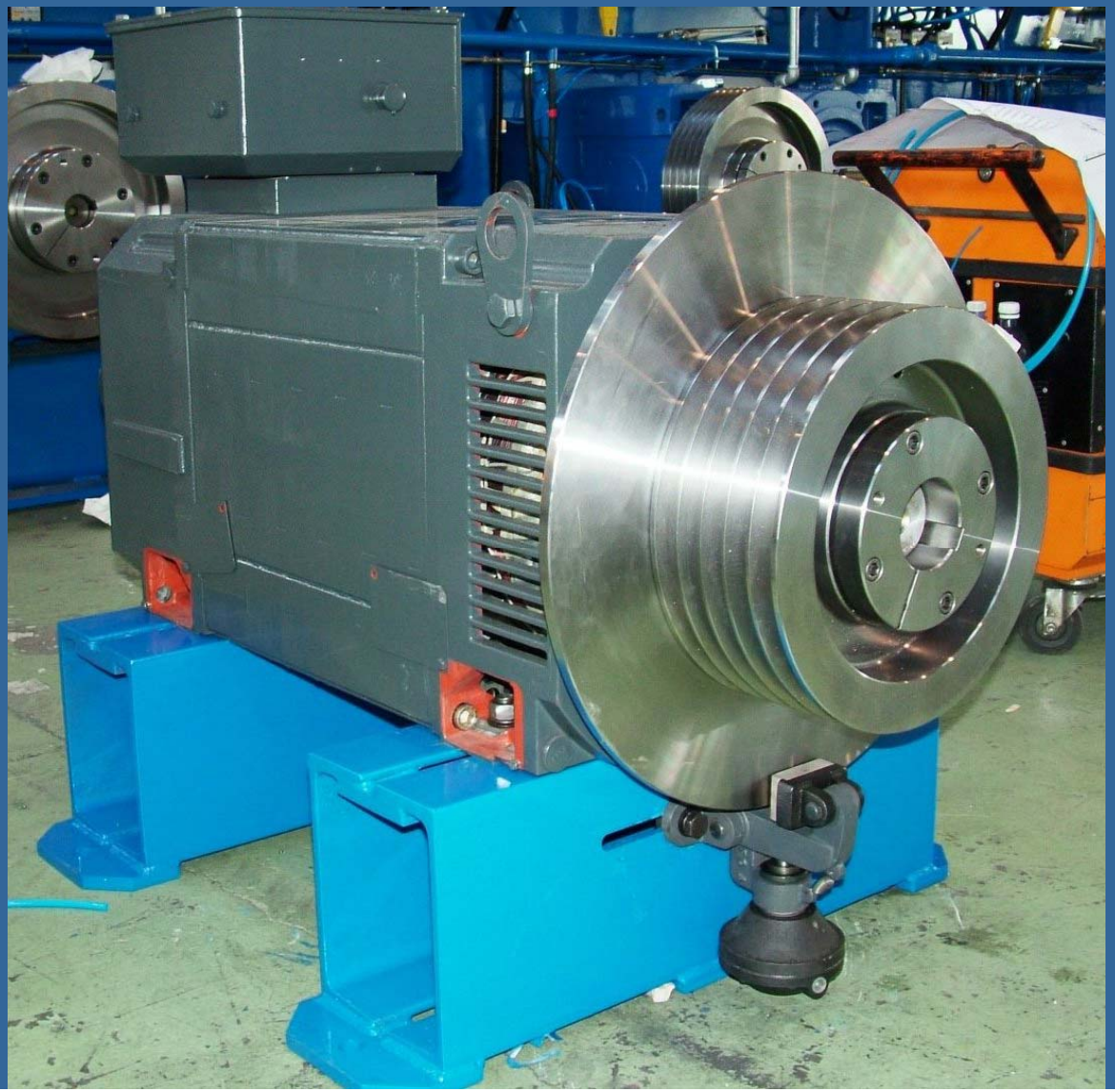
Motors on Floor Bases at back of Machine



AC Motor with Blower & Brake



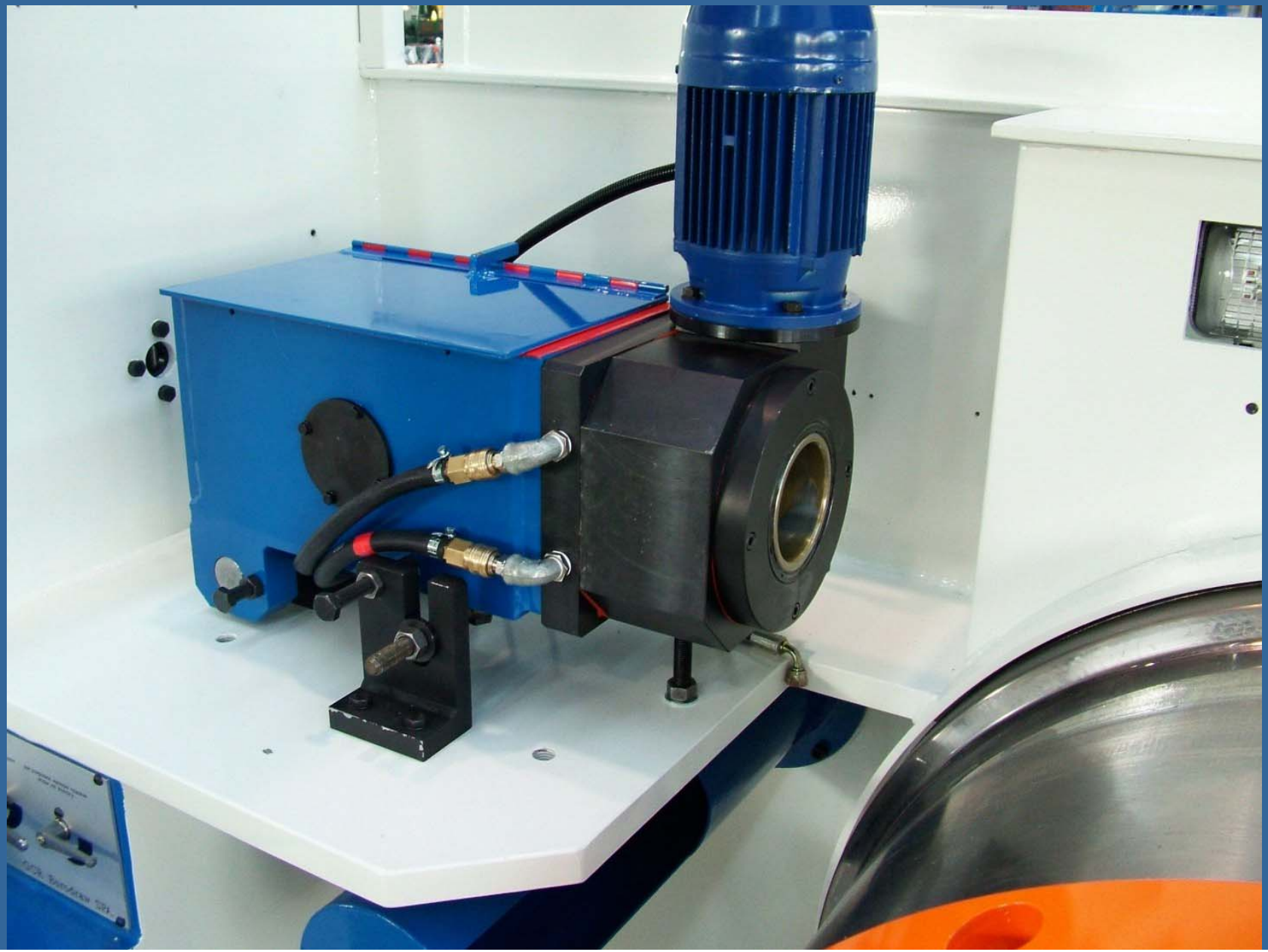
Closer Look at the Brake



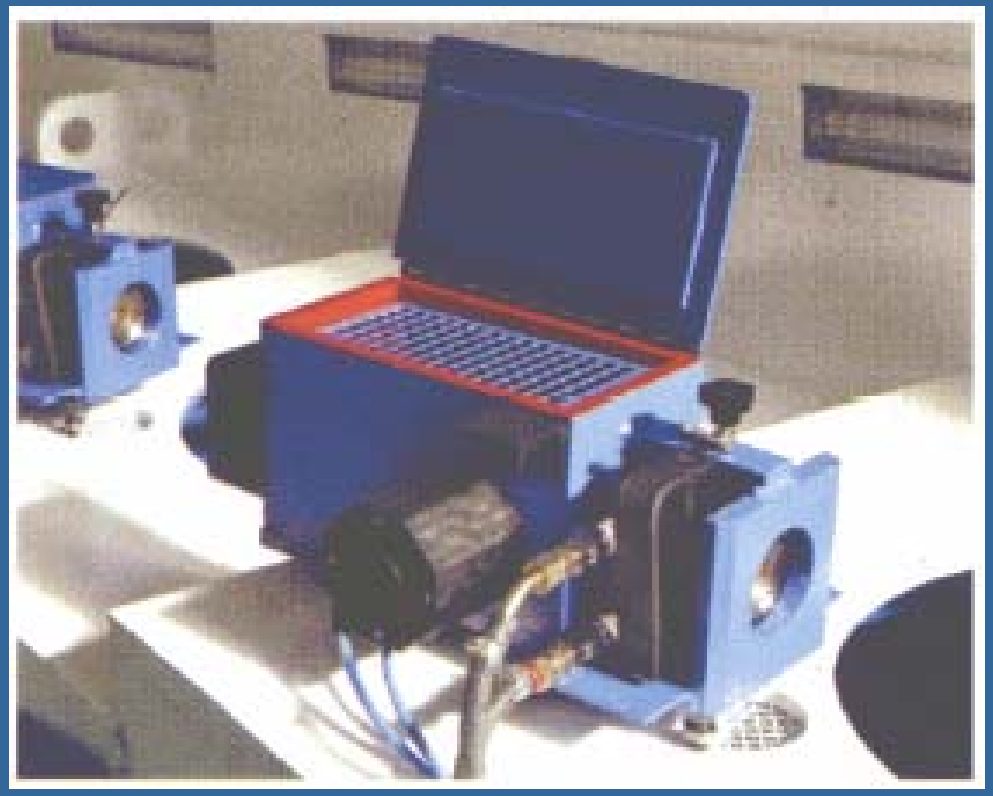
Motors Mounted to a 1200 mm Machine

Wet Die Box for Removal of Residual Draw Lube

Die and Soap Box Rotating Die

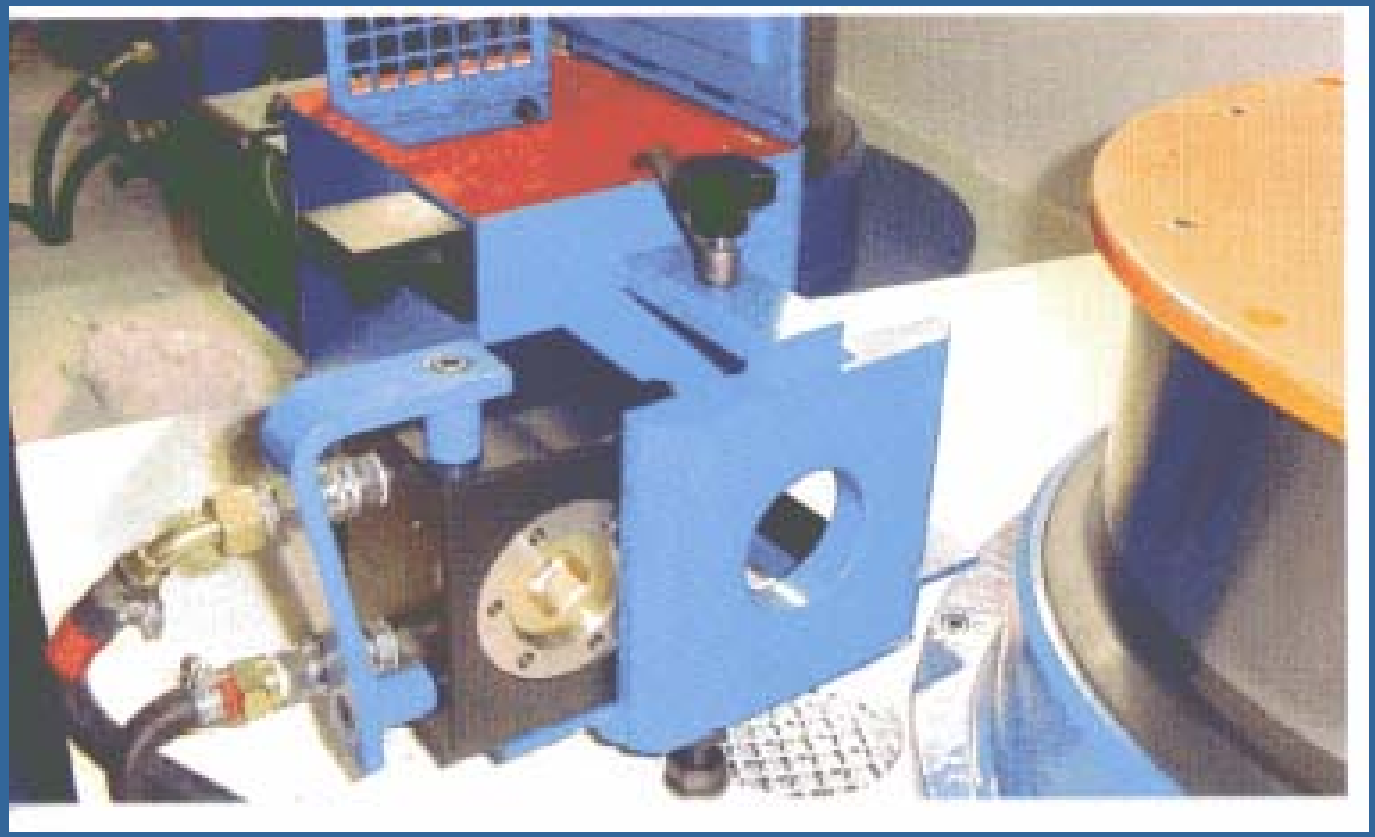


Pneumatic Soap Stirring Mounted on Side of Die Box



Electric Soap Stirring Mounted on back of Die Box

Quick Change Die Cassette



OTO Block First Position for Quick Stopping When Rod Tangles

Self Cleaning Laser Wire Measuring Gauge

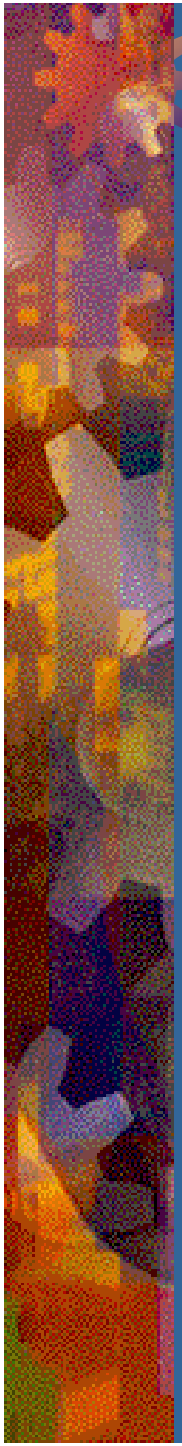
Electrical Control Cabinets

PLC Systems Replace the Old Relay Logic Control Functions

Common DC Bus used with DC/AC Inverters

Operator Control Panels

Operator Control Panel Attached to Machine



To Complete the wire drawing process the wire must be packaged to meet the next production process or customer needs

- This is done with one of the following:
- Lift-Off Riding Stripper
- Deadblocks with die
- Coilers without die
- Spoolers

Riding Stripper

Vertical Deadblock

- The draw die and wire straighteners are mounted to the rotating plate with coil lowering device underneath

Horizontal Axis Deadblock

Horizontal Deadblock Flyers

- Draw Die

Casting Device

The flyer can be gear or belt driven

Horizontal DB/Pattern Lay

Horizontal DB with Coil Lowering Pattern Lay Unit

Horizontal Stator Block Coiler with pattern laying & coil lowering

DB with Coil Accumulation for uninterrupted automatic run

Horizontal Axis Spoolers

Dual Horizontal Spoolers

Dual Spooler Opened Up

Dual Vertical Axis Spooler

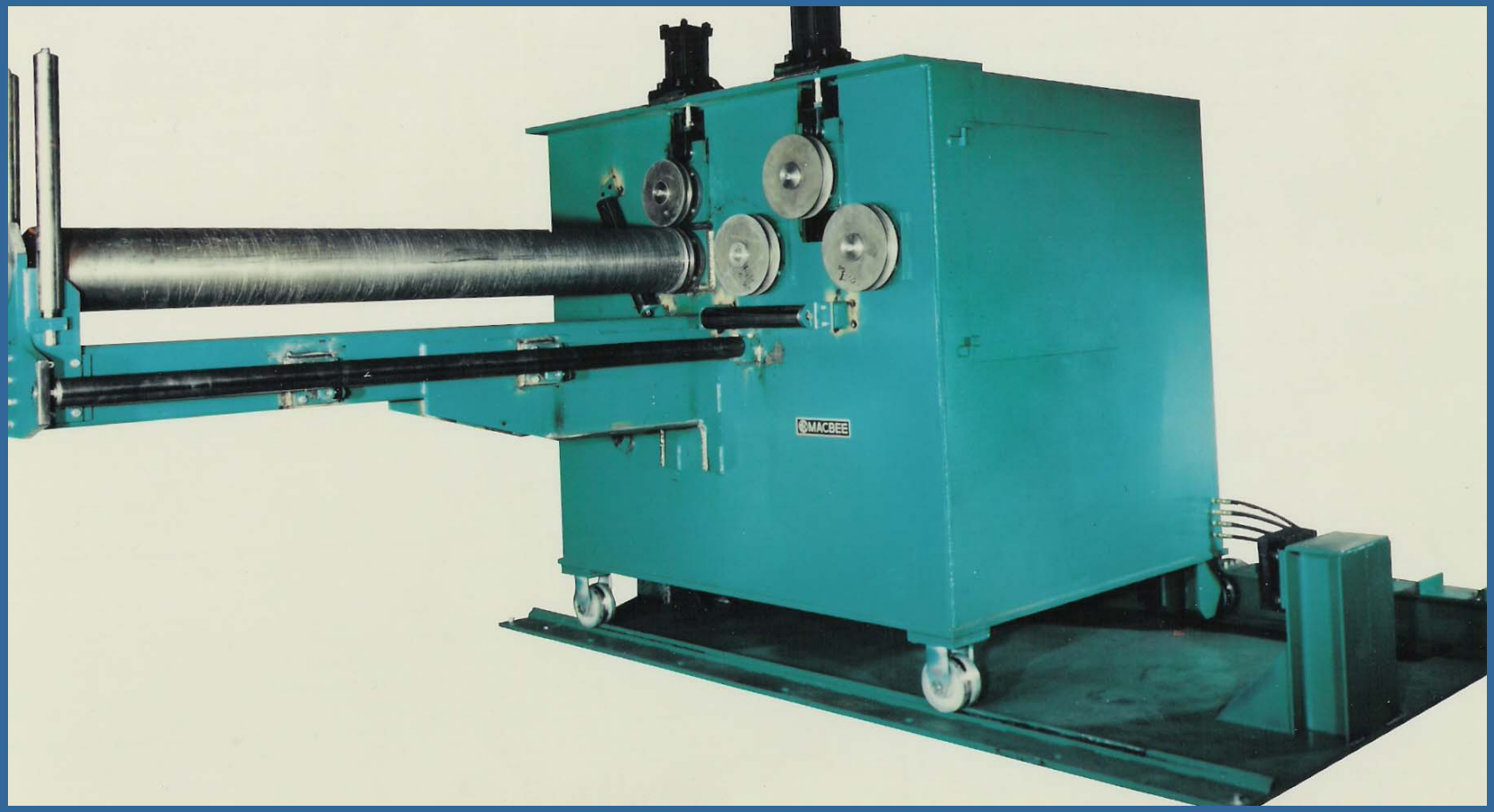
Stationary Horizontal Rod Payoff (Boom Flipper)

Vertical Rod Payoffs

Horizontal Flyer-Type Rod Pay-Off

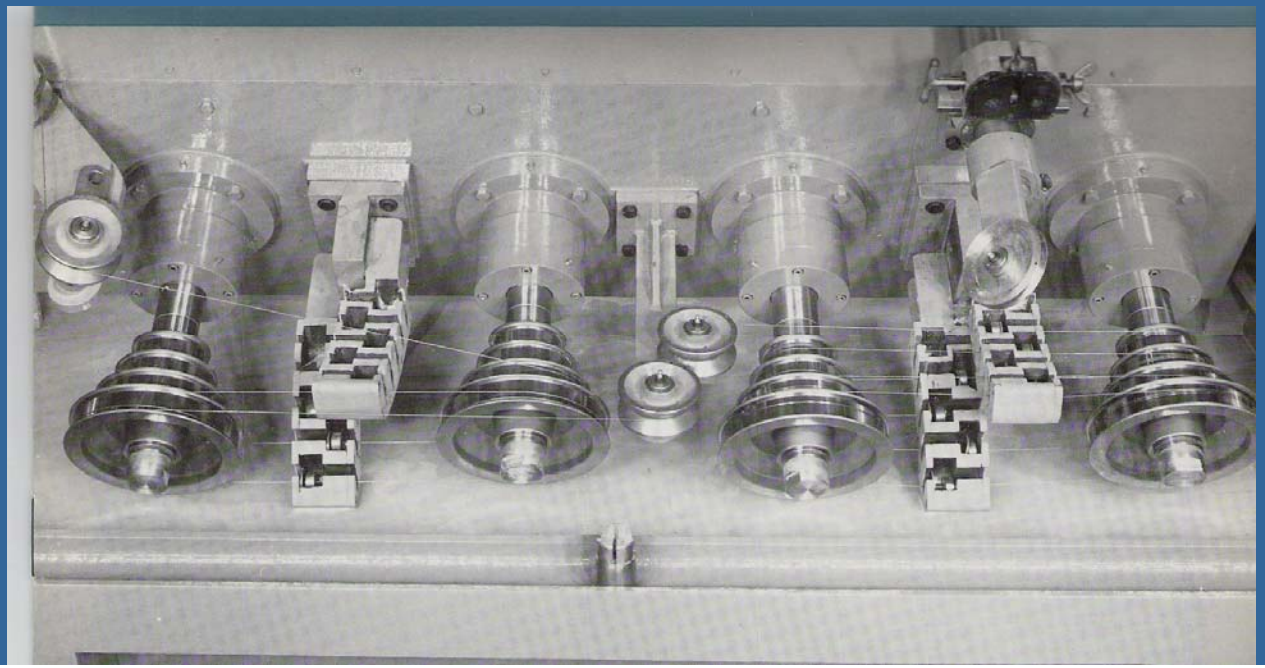
The Pusher Part of the Flyer-Type Pay-Off &Loading End

Horizontal Powered Payoff

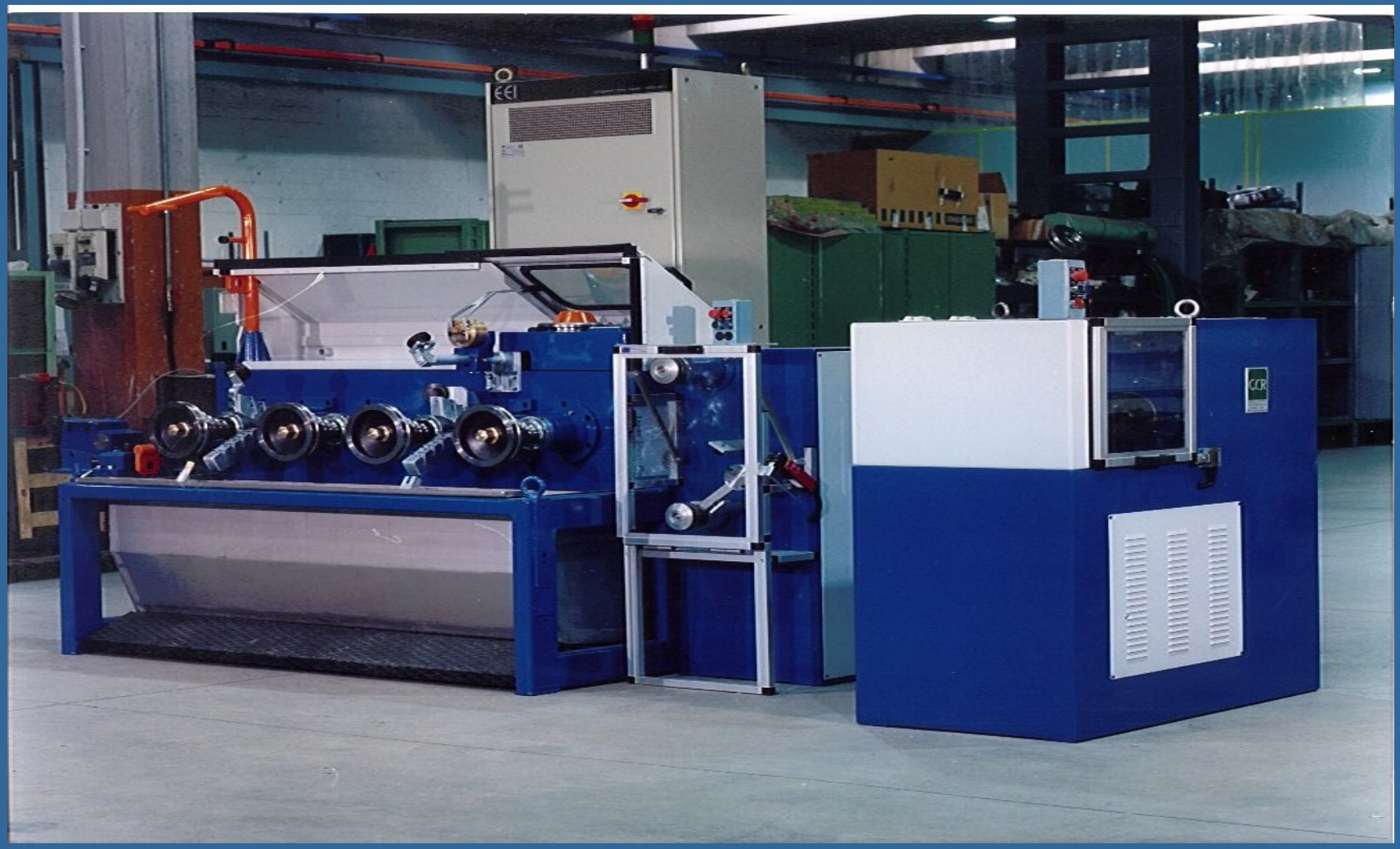


Wet Draw Machines

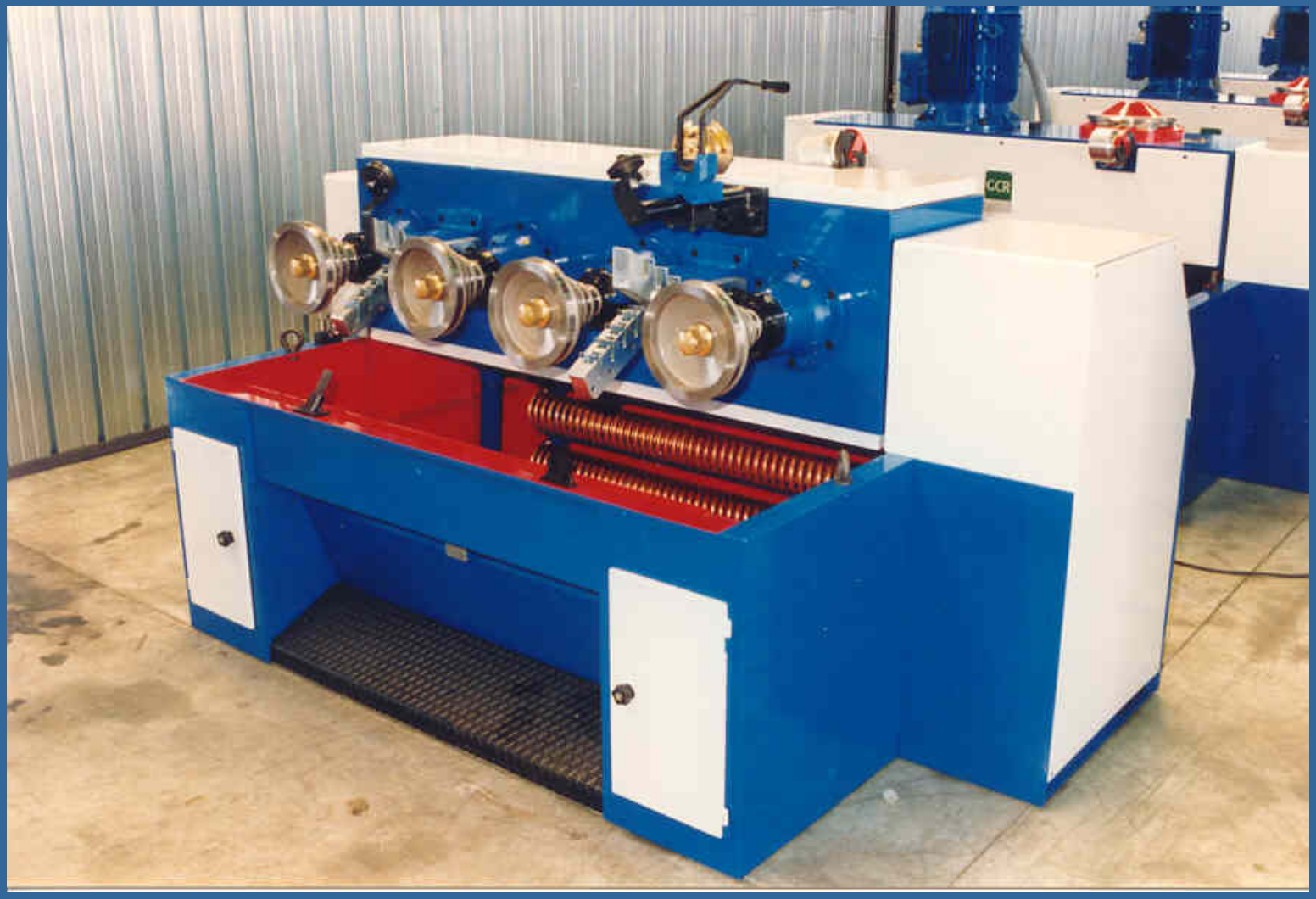
- Slip Accumulation
- Variety of Types basic difference is in capstan arrangement(Cone or Tandem) and method of lubricating dies and blocks (Tilting Immersion or Spray Style)



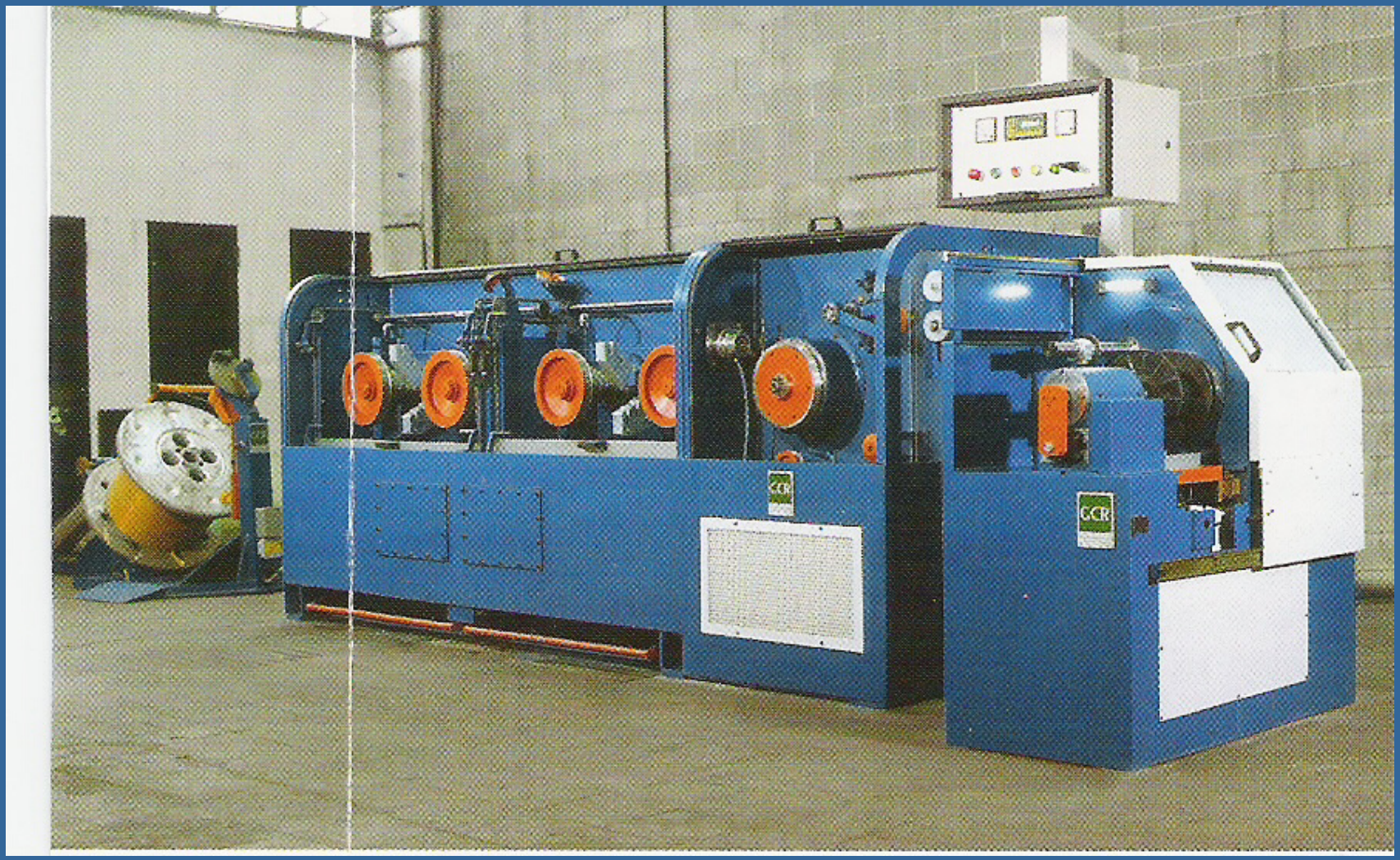
Cone Style Tilting Immersion



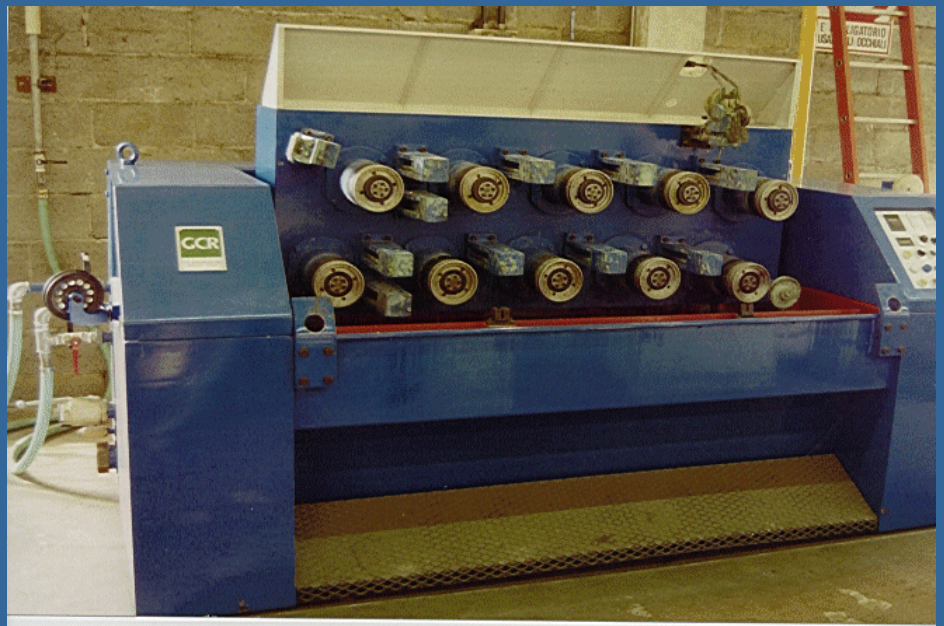
Close Up of Tilting Immersion



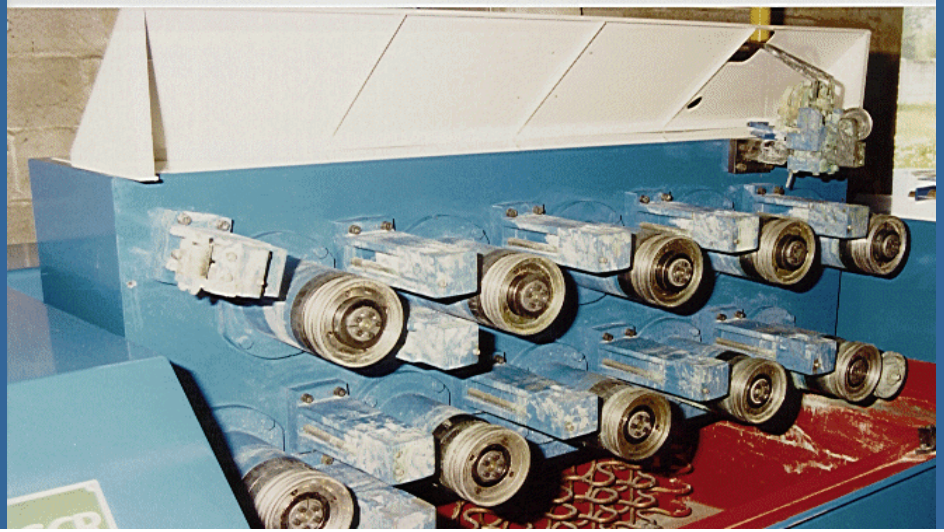
Cone Style Spray Type

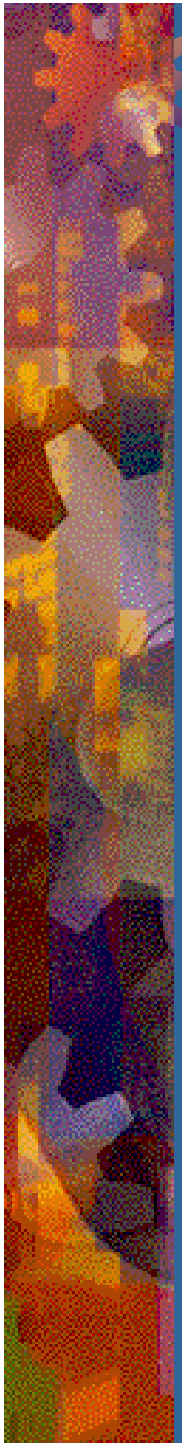


Tandem Capstans



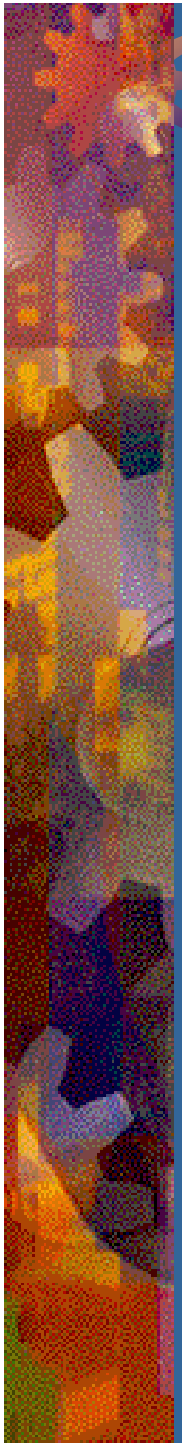
TB10 WET DRAWING MACHINE - K-1163





Requirements for Designing a Machine to Fit Your Needs

- Starting Material Size & Tensile or Carbon Content
- Finish Size & Tensile if Known
- Speed you want to run at
- How you want to Take-up or Package the finish wire (spools, carriers, etc.)
- Size of finish package (spool size, carrier arbor size and height, Weight required)
- The above information for all jobs to run on that machine

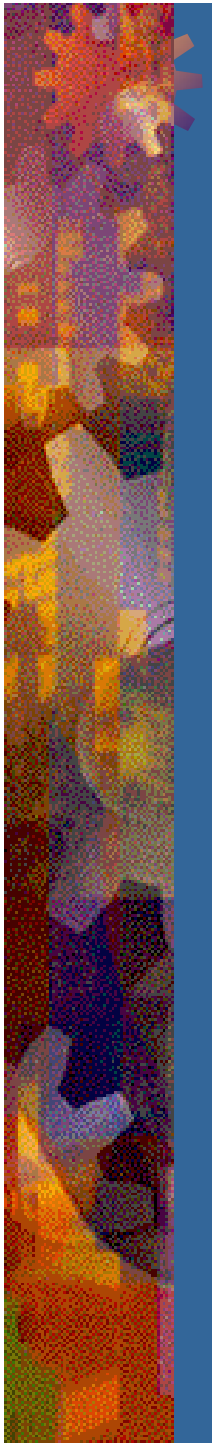


Once that information is gathered there is software to:

- Determine the number of blocks needed
- Calculate the horsepower required to run all duties at a given speed.
- Knowing HP manufacturer can determine block size for proper cooling
- Finally the gear ratio and gear box selection is made

Software Printout

MTS 610-8+ROT 610			Results:												
						Block	Total							Installed	Used
Entry diameter:	mm	7.13	Block	Diameter	Diemeter	Reduction	Reduction	Speed	Speed	Tensile	Tensile	Pull	Power	Power	Power
Exit diameter:	mm	5.25	Nr	mm	inch	%	%	m/sec	ft/min	kg/mm2	psi	kg	kw	kw	kw
Number of blocks:	N°	3.00	____	____		____	____	____		____		___	____	____	____
Final speed:	m/sec	5.00	0	7.13	0.281			2.71	542.18	126	182748				
Carbon content	%	0.80	1	6.27	0.247	22.69%	22.69%	3.51	701.26	137	199167	2131	73.2	90	81.38%
Reduction last block		0.14	2	5.66	0.223	18.46%	36.96%	4.30	860.00	146	212189	1572	66.3	90	73.63%
Production Theroetical	Kg/h	3059.44	3	5.25	0.207	14.00%	45.78%	5.00	1000.00	153	221814	1155	56.6	90	62.90%
Production Practical	Kg/h	2447.55													
Production practical / day	Ton/day	58.74													
Production practical /month	Ton/month	1409.79													
Inst. Power	kW	90													
Days per month	days	24													
Efficiency	%	80													
Production practical per shift	Kg/8 hours	19580.4													



Reference

- Wish to thank the following for pictures:
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- Hi-Draw
- MacBee ENG.
- Morgan Koch
- EMC
- A color copy of this presentation can be viewed & downloaded at: www.knottco.com For a copy on CD e-mail Don at: dyoung6775@cs.com.