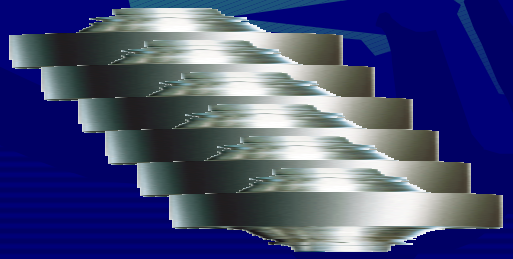
ROLLS
LIFELINE OF ROLLING MILLS



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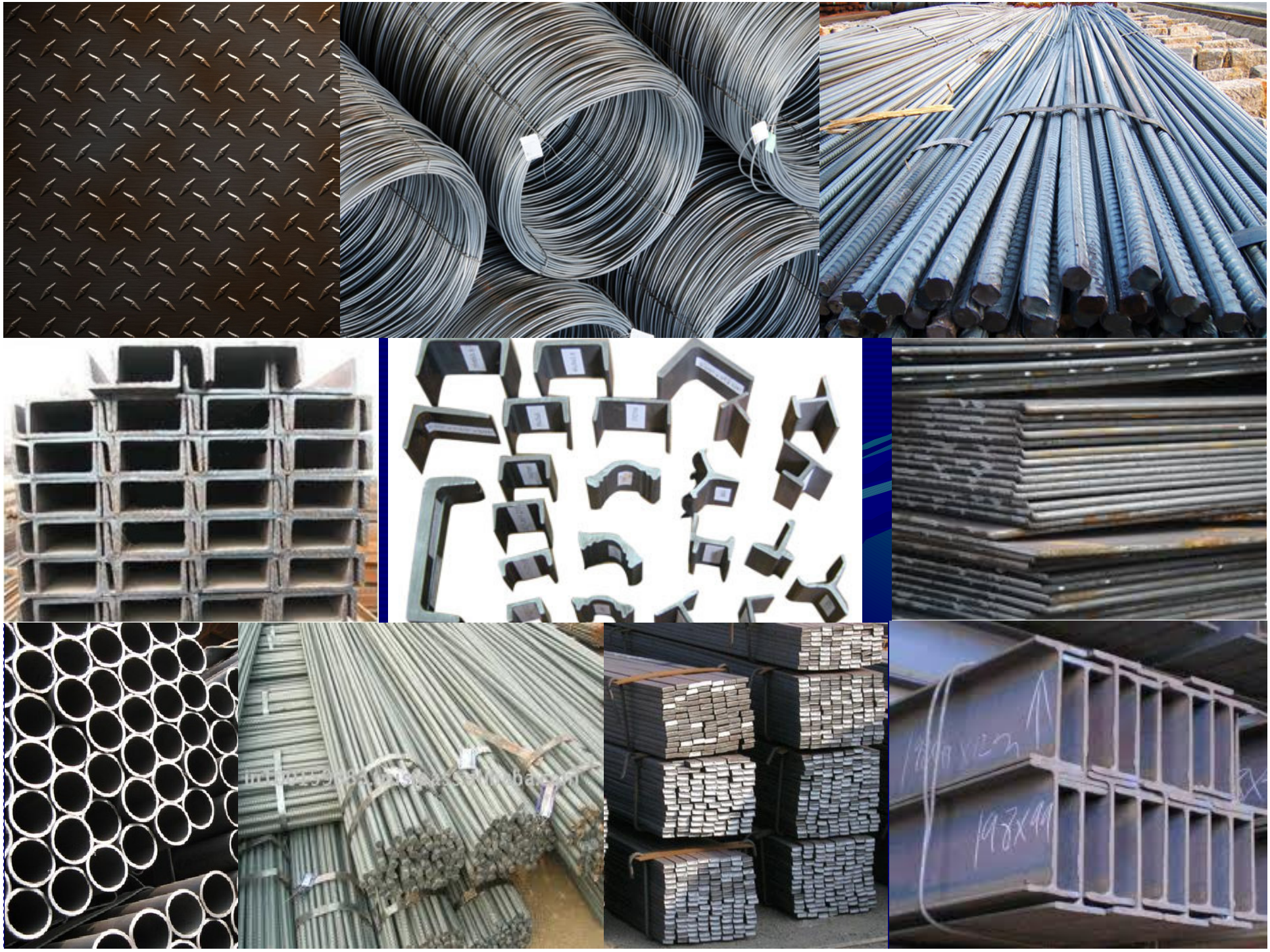



What is common in all the pictures ?


These are produced from
Rolling Mills

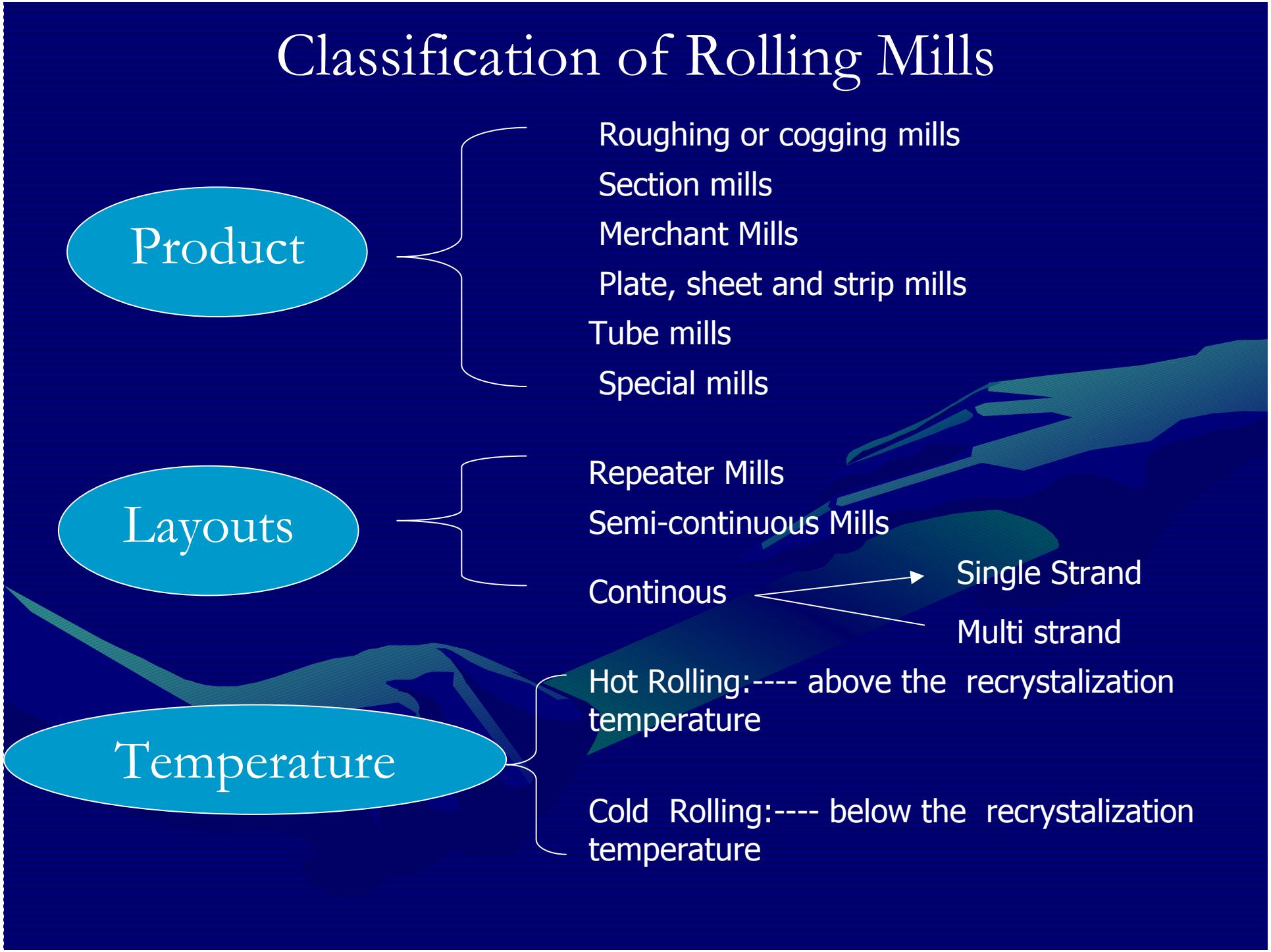
What is Rolling ?

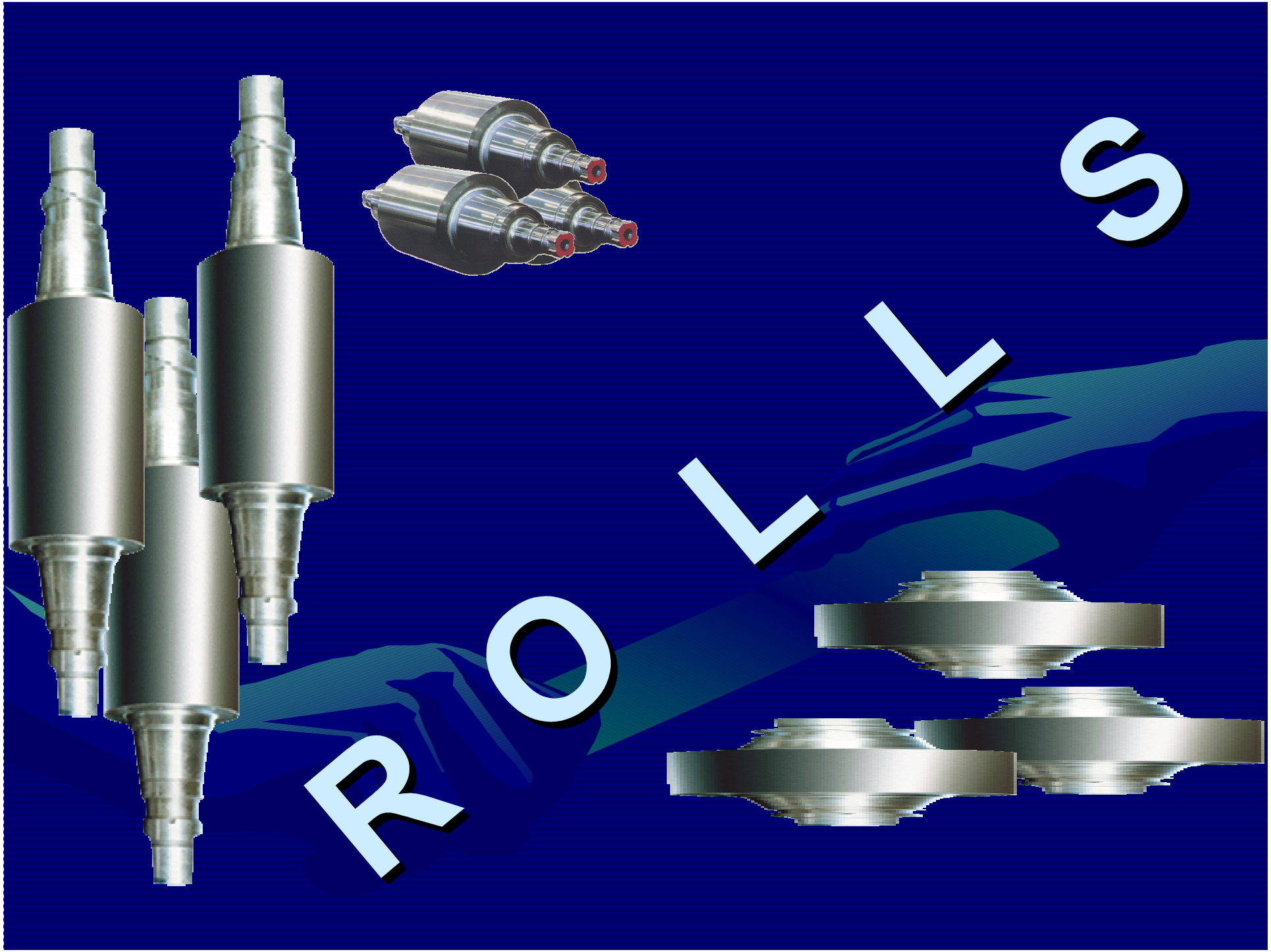
Rolling - a process

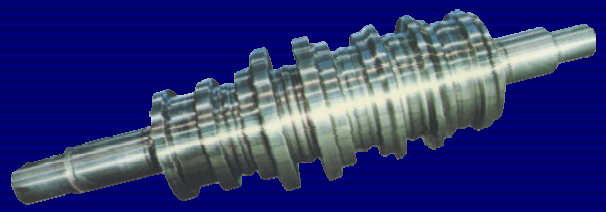
Where in metal is formed to the **desired shape gradually** through a pair of **revolving rolls** (plain or grooved) barrels.

Rolling is a major and a most widely used mechanical working technique.

Classification of Rolling Mills




ROLLS



ROLLS

- FUNCTIONS

- **EXECUTE – SPECIFIC AND DEMANDING FUNCTIONS UNDER SEVERE CONDITIONS OF HEAT AND PRESSURE**

Product quality

Production

- *Rolls being the costliest consumable in the mill*

EXPENSIVE TOOL

60% **CONVERSION COST**

8% to 12 % **TIME LOSS**

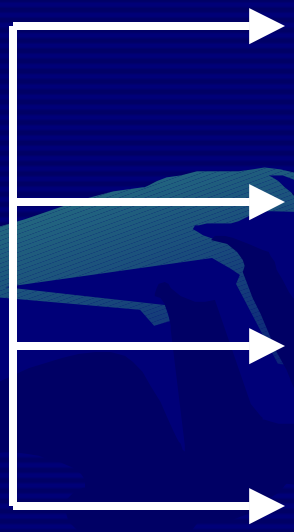
FAILURE

- ROLL FAILURE

  –ECONOMIC DISATSTER

  –PRODUCTION LOSSES

- GENERAL REASONS

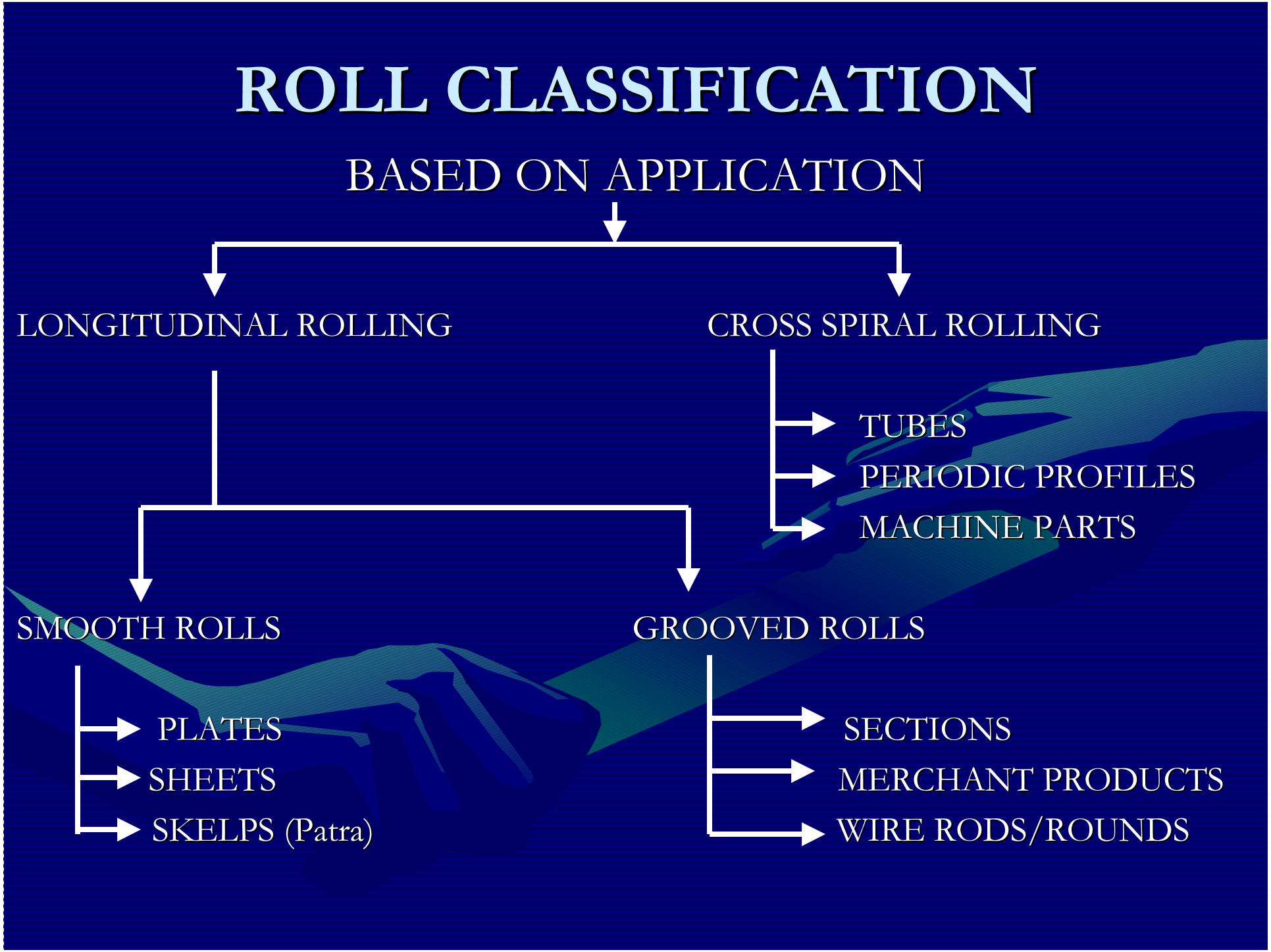


  - DEFECTIVE MATERIAL
  - FIRE CRA CKING
  - SPALLING
  - COLD MATERIAL

ROLL REQUIREMENT

- BLEND OF **HARDNESS & STRENGTH**
- RESISTANCE TO **THERMAL CRACKING SHOCK LOADING WEAR**

ROLL CLASSIFICATION



ROLL CLASSIFICATION

BASED ON PROPERTIES

SOFT	BHN 150-250	SH 25-35
SEMI-HARD	BHN 250-400	SH 35-60
HARD	BHN 400-600	SH 60-85
VERY HARD	BHN 600-800	SH 85-100

BASED ON GRADE

IRON ROLLS

STEEL BASED ROLLS

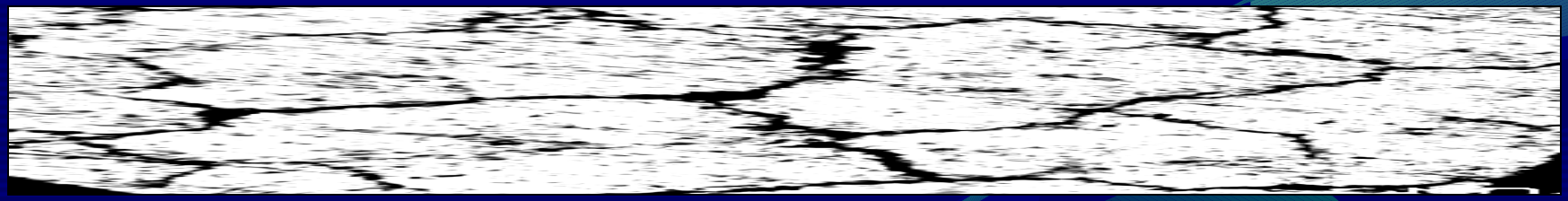
BASED ON MANUFACTURING PROCESS

FORGED

CAST

ROLL DEFECTS

- HIGH AND NONUNIFORM WEAR ***(poor surface finish & shape)***
- FIRE CRACK ***(mark on the product as well as poor surface finish)***



- PITTING localized indentation ON SURFACE

  (mark on the product as well as poor surface finish)

ROLL DEFECTS

- SPALLING/CHIPING (*mark on the product as well as poor surface finish) (tearing of rolled product during rolling)*

- BANDING/PEELING *(harmful for strip rolling, lead to rolled in scale along with roll).*

ROLL DEFECTS

- HARD AND SOFT SPOT (***Harmful particularly during structural/sectional rolling. These defects will lead to poor dimensional accuracy as well as mark on the product)***

- ROLL CASTING DEFECT (***Casting defect like blow holes/pinholes/inclusions will lead to mark on the rolled product.)***

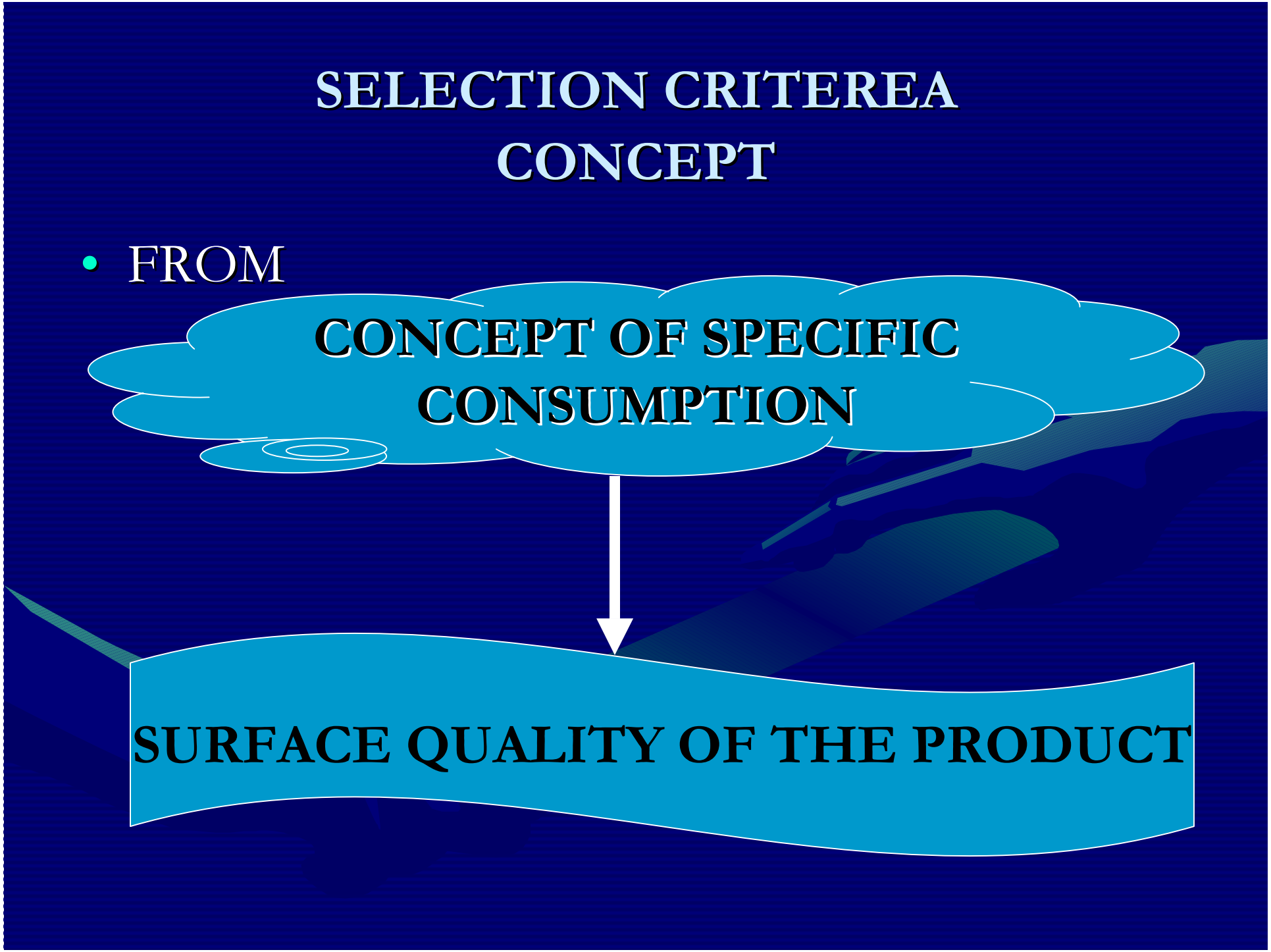
DEFECT MITIGATION

Defects can be minimized by

- ***Proper selection of roll***
- ***Proper cooling water arrangement***
- ***Proper roll maintenance***

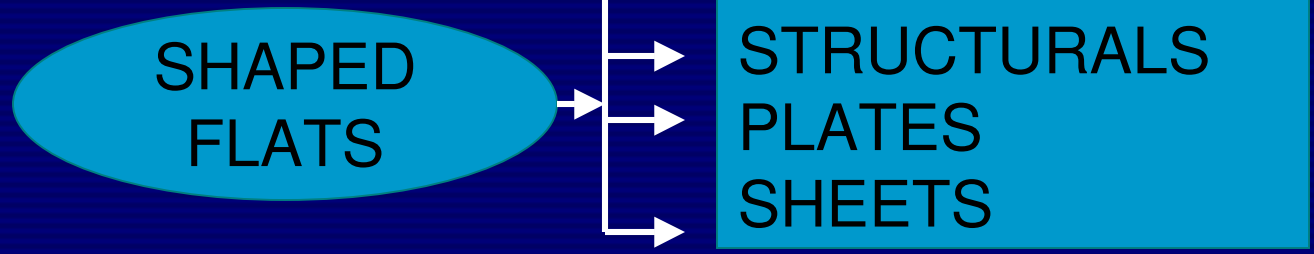
SELECTION CRITEREA CONCEPT

- FROM



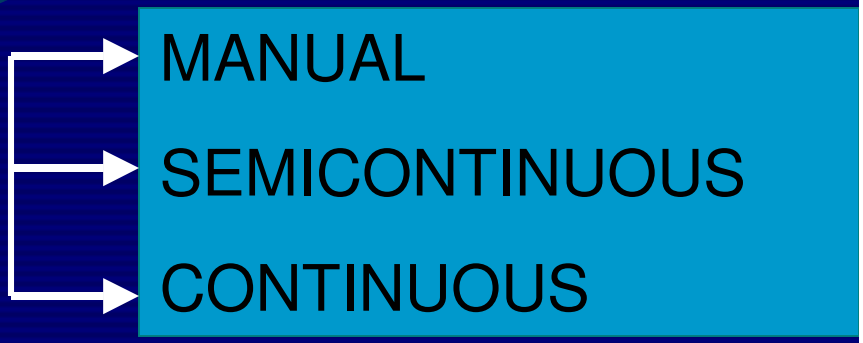
SELECTION CRITEREA

- PRODUCT



- PASS DESIGN

- MILL CONFIGURATION



SELECTION CRITEREA

- TYPE OF STANDS

2 Hi, 3 Hi, ALTERNATE 2 Hi, HOUSINGLESS

- ROLLING TEMPERATURE

COLD ROLLING OR HOT ROLLING

- ROLL COOLING

WITH COOLING TOWER / WITHOUT COOLING TOWER

- PRODUCITON RATE

ROLL MANAGEMENT

FACTORS TO BE CONSIDERED

- ***ORDERING – SPECIFICATIONS***

  (Hardness/tensile strength/composition/structure/chill depth)

- ***TEST CERTIFICATES***

  (Demand certificates/documentary evidence wherever possible)

- ***MAINTENANCE OF ROLL HISTORY SHEETS***

  (Evaluate the performance in each campaign)

- ***MONITORING OF ROLL COOLING WATER***

  (Quantity/pressure and temperature)

- ***OPERATIONAL SETTINGS AND DISCIPLINE***

  (minimizing vibrations/proper alignments/metal control etc.)

ORDERING – SPECIFICATIONS

Grade	Hardness	Composition Range %						Physical Properties				Suitability for					
												Bar & Rod Mill			Section Mill		
								Tensile Strength		Bending Strength		Roughing Train	Intermediate Train	Finishing Train	Roughing Train	Intermediate Train	Finishing Train
	^{0} Shore	C	Si	Mn	Ni	Cr	Mo	T/in^2	Kg/mm^2	T/in^2	Kg/mm^2						
Alloy Cast Steel	28 -45	0.4/1.4	0.3/0.8	0.5/1.0	0.5(max)	0.8/1.4	0.1/0.5	40 -50	65 - 80	70 - 90	110 - 140				√		
Alloy Steel Base																	
Spherodised pearlite	35 - 43	1.2/1.4	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)	Low Carbon									
Lamellar Pearlite	40 - 48	1.4/1.6	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)	30 - 40									
		1.6/1.8	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)					√	√				
		1.8/2.0	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)		50 - 65	45 - 60	70 - 95						
		2.0/2.2	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)	High Carbon									
		2.2/2.4	0.4/0.8	0.5/0.9	0.3/1.0	0.8/1.4	0.25 (max)	25 - 30	40 - 50	35 - 45	55 - 70	√	√		√	√	
Graphitic Steel Base																	
Spherodised pearlite	35 - 43	1.2/1.4	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)	Low Carbon									
Lamellar Pearlite	40 - 48	1.4/1.6	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)	30 - 40	50 - 65	45 - 60	70 - 95						
		1.6/1.8	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)					√	√		√	√	
		1.8/2.0	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)										
		2.0/2.2	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)	High Carbon									
		2.2/2.4	0.8/1.8	0.5/0.9	0.3/0.8	0.6/1.2	0.25 (max)	25 - 30	40 - 50	35 - 45	55 - 70						
Hi-Ten Special Steel Base																	
Non Graphitic	45 - 55	1.5/2.0	0.4/0.8	0.7/1.2	1.5/2.0	0.8/1.3	0.2/0.6	25	40	40	65	√			√	√	
Graphitic	45 - 55	2.0/2.5	0.8/1.3	1.3/1.8	1.3/1.8	0.5/1.0	0.2/0.6										
S G Extra	35 - 50	3.0/3.5	1.3/2.5	0.5/0.9	1.5/2.5	0.4 (max)	0.4/1.0	35 - 50	55 - 70	65 - 80	100 - 130	√	√		√	√	√
S G Pearlitic Chill	45 - 55	2.8/3.4	1.5/2.5	0.5/0.9	1.2/1.9	0.2/0.5	0.1/0.3										
	55 - 60	3.2/3.5	1.0/2.0	0.5/0.9	1.5/2.5	0.2/0.5	0.1/0.3	24	40	55	85	√	√	√	√	√	√
	60 - 70	3.2/3.5	1.0/1.6	0.5/0.9	1.5/3.5	0.4/0.8	0.2/0.5										
S G Accicular Chill	60 - 70	3.2/3.6	1.0/1.8	0.4/0.9	2.8/4.0	0.2/0.8	0.4/1.0	36	57	65	100			√			√
	70 - 80	3.2/3.6	1.0/1.8	0.4/0.9	3.0/5.0	0.2/1.5	0.2/1.0										
Superten Alloy Steel																	
Non Graphitic	50 - 65	1.0/2.0	0.4/0.8	1.3'1.8	1.0/2.0	1.0/2.0	0.3/1.0	35 - 45	55 - 70	65 - 75	100 - 120	√			√	√	
Graphitic	50 - 65	1.0/2.0	1.2/1.8	1.3'1.8	1.0/2.0	1.0/2.0	0.3/1.0										

MAINTENANCE OF ROLL HISTORY SHEETS

Roll identification number								
Roll material								
Name of the Supplier								
Expected Life (Tonnes)								
Composition								
Hardness								
Expected Life	(Tonnes)							
Paper Diameter	(mm)							
Scrap diameter	(mm)							

Date of placement in rolling	Diameter	Diameter after dressing	Profile rolled	Stand No.	Number of passes		Date of removal from rolling	Tonnage rolled
	mm	mm			usable	not usable		tonnes
REMARKS								

MONITORING OF ROLL COOLING WATER

- Good roll cooling means

  Roll at ambient temperature

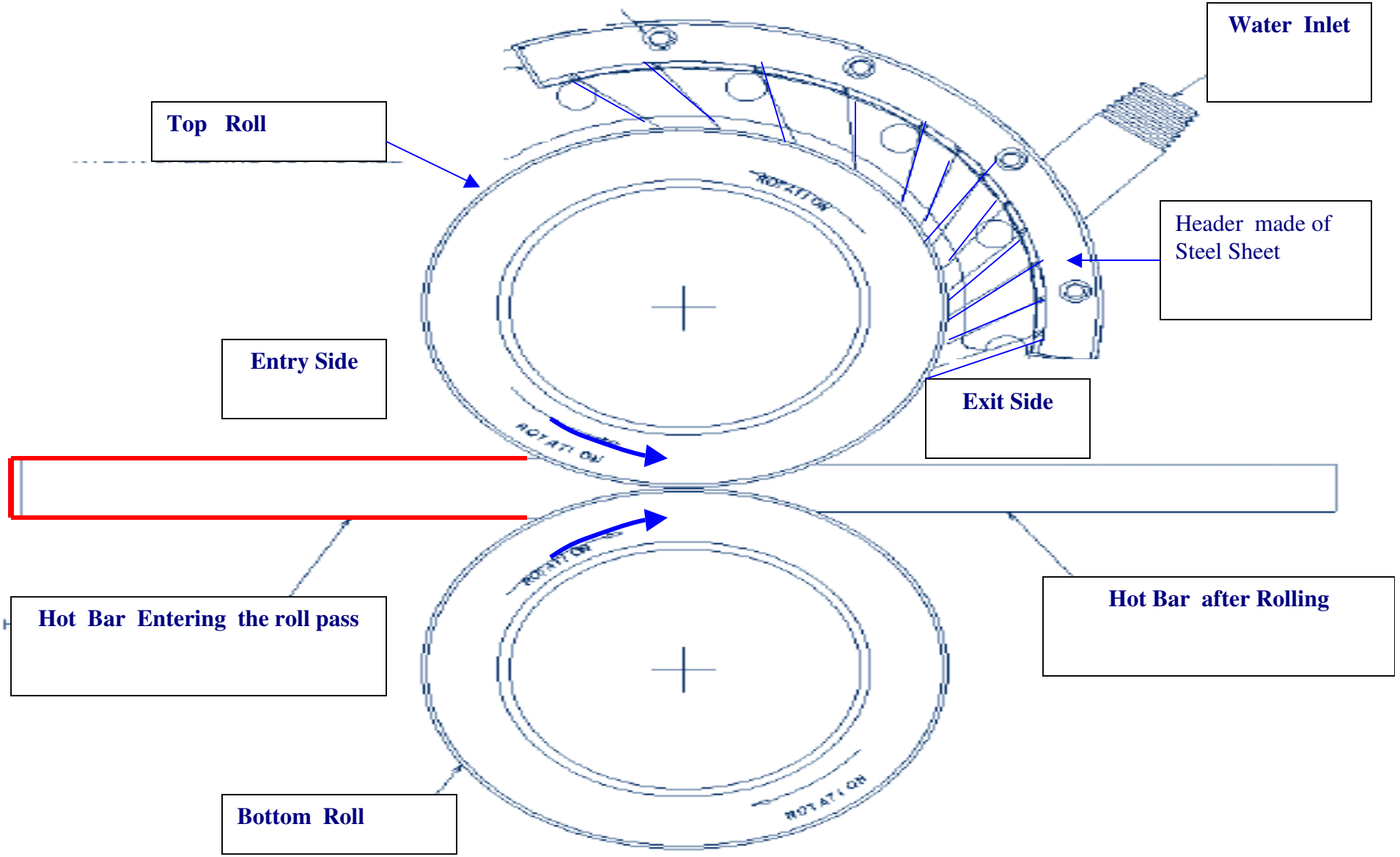
  Uniform distribution of temperature throughout the barrel length.

- Optimizing water requirement

- 1/3rd of roll surface should be water cooled.

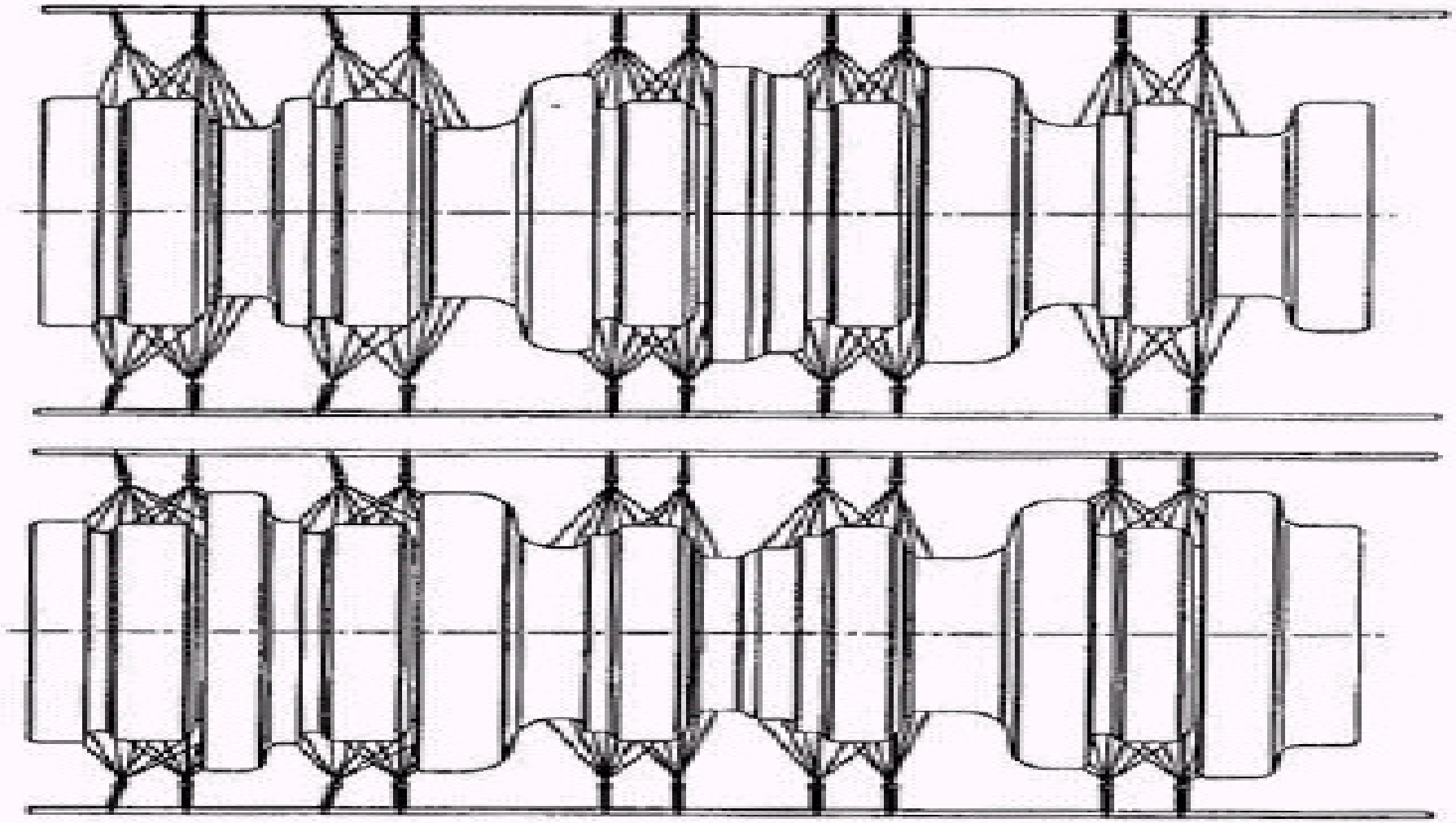
- Water is directed to the rolling passes through a common header and nozzles

ROLL COOLING – 2Hi



Water Header Design

ROLL COOLING – 3Hi



NORMALLY TWO COOLING PIPES PER ROLL
AND SEGMENT PIPE AT CRITICAL PLACES

LATEST DEVELOPMENTS IN ROLLS

- **DISPERSED CARBIDE INDEFINITE CHILLED ROLL**

  Increased life of about 30% to 40% over normal indefinite chilled roll

  Application Hot strip mill finishing stand & Bar & rod mill

- **DISPERSED CARBIDE NODULAR IRON ROLL**

- Increased life of about 30 to 40% over normal nodular iron.

  Resistant to fire crack

  Application Bar & rod mill. & Structural mill

- **HIGH SPEED STEEL ROLL**

  This is the latest developed roll material .Rolling mill all over the world have started using this grade getting wide benefits.

  Application Bar & rod mill (both intermediate & finishing stand), Small section like channel & angle mill. & Hot strip mill.

LATEST DEVELOPMENTS IN ROLLS

- **SOFT ANNEALED NODULAR IRON ROLLS** :

  High fire crack resistance Lower amount of dressing

  Application Roughing stand for bar & rod mill & Structural mill

- **BAINITIC S.G. IRON ROLLS**

  Higher tensile impact strength due to Bainitic structure

  very good wear resistance & higher pass life

  Application Intermediate stand rolls of Bar & Rod Mills & Pre & Finishing Stands of Structural Mills for channel rolling

- **COMPOSITE ROLLS**

  Tungusten/HSS rings on Nitrided shaft with adequate clamping system

- *Roll management is the key requisite for the survival of the rerolling industry in this globally competitive market scenario*


Thanks

ASSUMPTIONS							
VARIABLE PARAMETERS	UNIT	ROUGHING STAND	INTERMED STAND	Finishing Stands			
				F1	F2	F3	F4
Peak load	Tonnes	100	85	30	30	20	15
No of bearings		9	9	8	8	8	8
Journal dia	mm	235	235	200	200	200	200
RPM		100	100	100	100	100	100
Heat lost by material per pass	Deg C	10	10	10	10	10	10
Heat absorbed by water per pass	Deg C	5	5	5	5	5	5
Heatabsd by water with cooling tower	Deg C	10	10	10	10	10	10
TPH	TPH	10	10	10	10	10	10
No of passes		8	4	1	1	1	1

WATER REQUIREMENT IN CUBIC METER PER HOUR			
	BEARINGS	ROLL COOLING	
		Without Cooling Tower	With Cooling Tower
ROUGHING STAND	41	77	38
INTERMEDIATE STAND	35	34	17
FINISHING STAND-1	9	9	4
FINISHING STAND-2	9	9	4
FINISHING STAND-3	6	9	4
FINISHING STAND-4	5	9	4
SUB-TOTAL	106	145	72
GRAND TOTAL		250	178