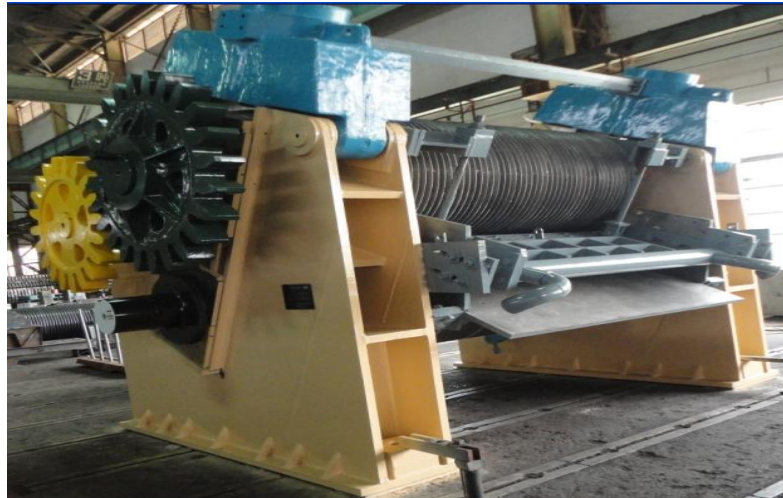




TECHNICAL WORKSHOP ON
PERFORMANCE OF TWO ROLLER MILLS
ORGANISED BY PSST
JUNE 08, 2013, AT AVARI HOTEL LAHORE



NADEEM MEHDI (DGM DESIGN)
HMC TAXILA



HymeCh-2 ROLLER MILL

HYMECH



DESIGN AND
MANUFACTURED BY HMC TAXILA

ABSTRACT

Hy Mech is a 02 roller cane crushing mill,
indigenously developed by HMC, Taxila,
Pakistan,

to extract more juice with reduced power
consumption and maintenance cost/time.

Initially HMC has developed three models,

42"/45" X 84"

46"/50" X 90"

52"/55" X 106"

Performance of these mills are much better than conventional 03 roller mills and is comparable to any internationally developed 02 roller mill, its features are unique, different then other 02 roller mills available in market. Main features are following,

- It is two roller mills w/o trash plate.
- Re absorbtion is controlled by decompression chute
- Top roller is hydraulically loaded.
- Top roller has lotus arrangement.

- Bottom roller has more surface and drainage area than top roller.
- Mill is driven by bottom roller.

OUTLINES

In the workshop I will talk more about conceptual and design aspects of Hy-Mech. Following are topics to be discussed,

1- Comparison of 2 and 3 roller mills.

- Reabsorption of juice.
- Power consumption.
- More wear tear in three roller mills.
- Mill setting.

2- Special features of Hy-Mech.

- In Pakistan Importance of hydraulically loaded top roller.
- Juice drainage from top roller through lotus arrangement v/s Macherate grooves.
- Unique concept of bigger bottom roller.
- Mill driven by bottom roller

3- Technical requirements to install Hy-Mech.

4- Performance

5- Problems faced and improvements.

1) COMPARISON OF 2 AND 3 ROLLER MILLS:

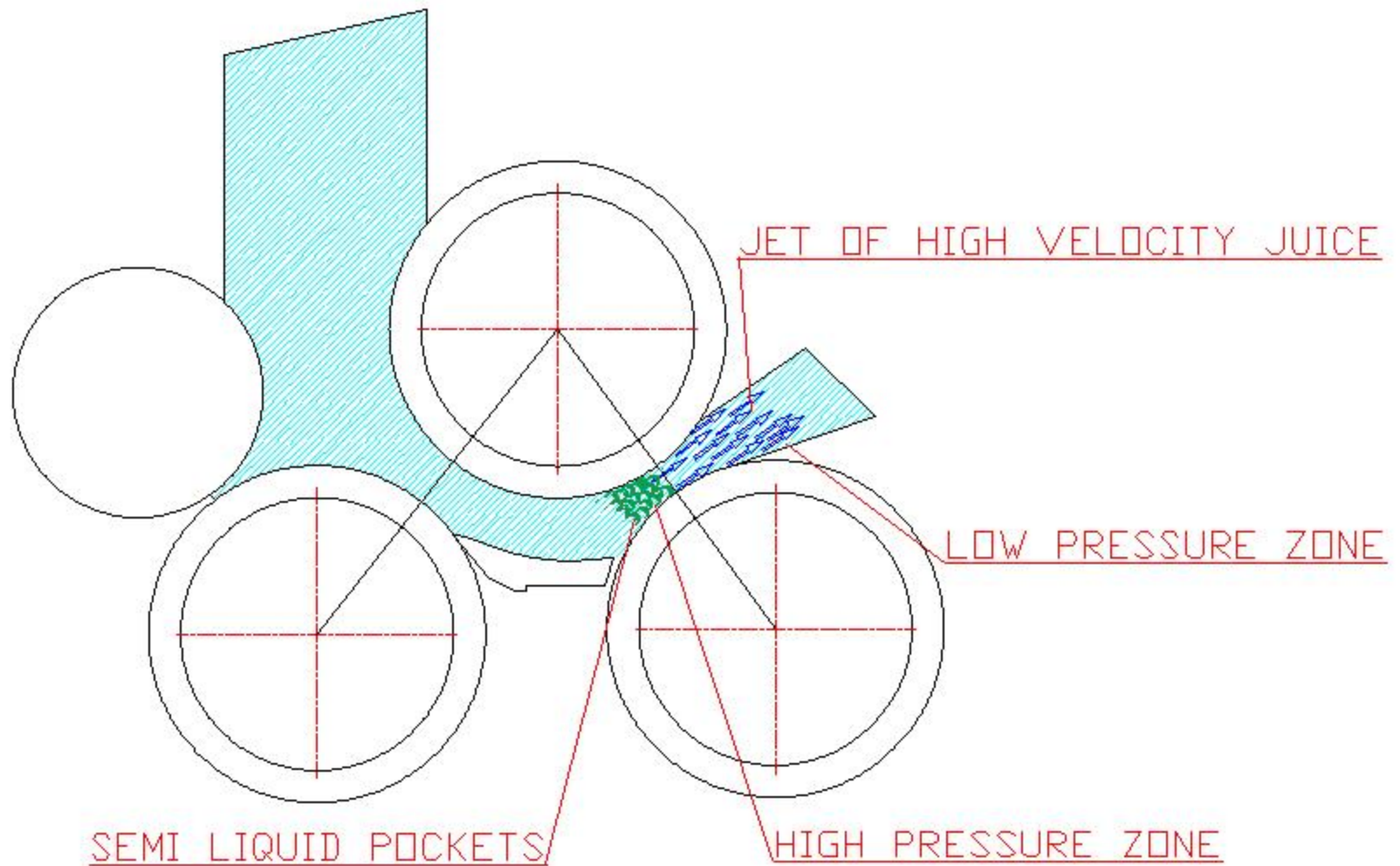
A. REABSORPTION OF JUICE

The extraction of juice in 2 roller mill is better than 3 roller mill; it is mainly due to better control on re absorption of juice.

In the 3 roller mill when cane blanket travels over a trash plate it is subjected to a heavy pressure, it reaches to peak value just before discharge work opening and after that pressure again releases.

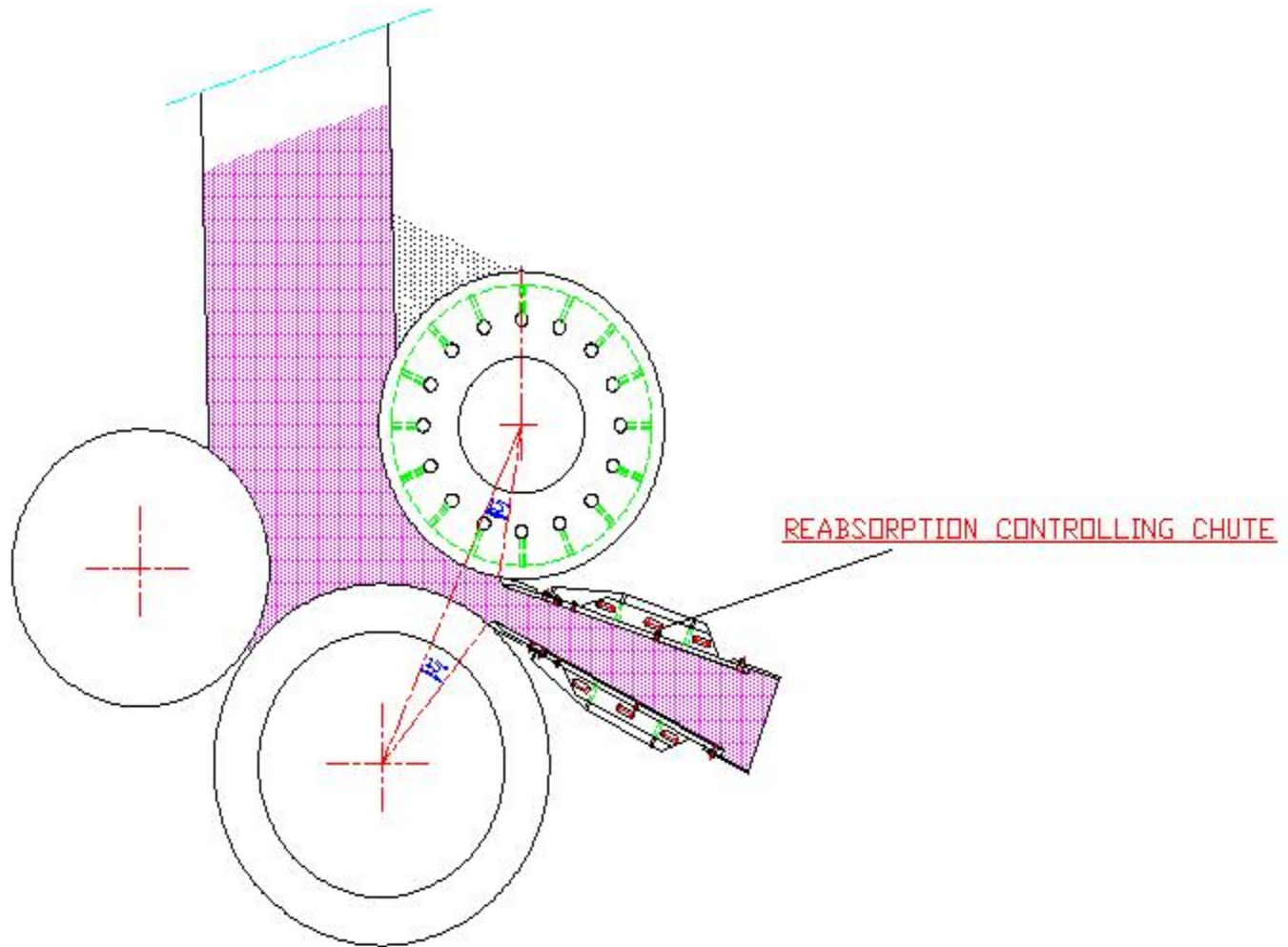
The huge pressure difference before and after discharge opening causes juice particles to jump at a high speed from high pressure zone to low pressure zone, this juice is again absorbed in bagasse at discharge side and is called re absorption.

It is not possible in 3 roller mill to fully control it due to geometry of these mills.



REABSORPTION OF JUICE IN 4-ROLLER MILL

In 2 roller mills re absorption is controlled by creating a pressure zone after discharge work opening. This pressure is gradually released in a device called gradual decompression chute. No pressure difference is created, juice cannot jump into pressure zone and ultimately it is drained from no pressure areas, i.e. bottom roller, top roller, under feeder, mecharte grooves, and lotus arrangement.



GRADUAL DECOMPRESSION/PRESSURE RELEASE

B. POWER CONSUMPTION

Power consumption in 2 roller mills is about 30% less than in 3 roller mills, it is due to less moving parts and no trash plate. (trash plate consume about 25% of total load).

COMPERISON OF PARTS:

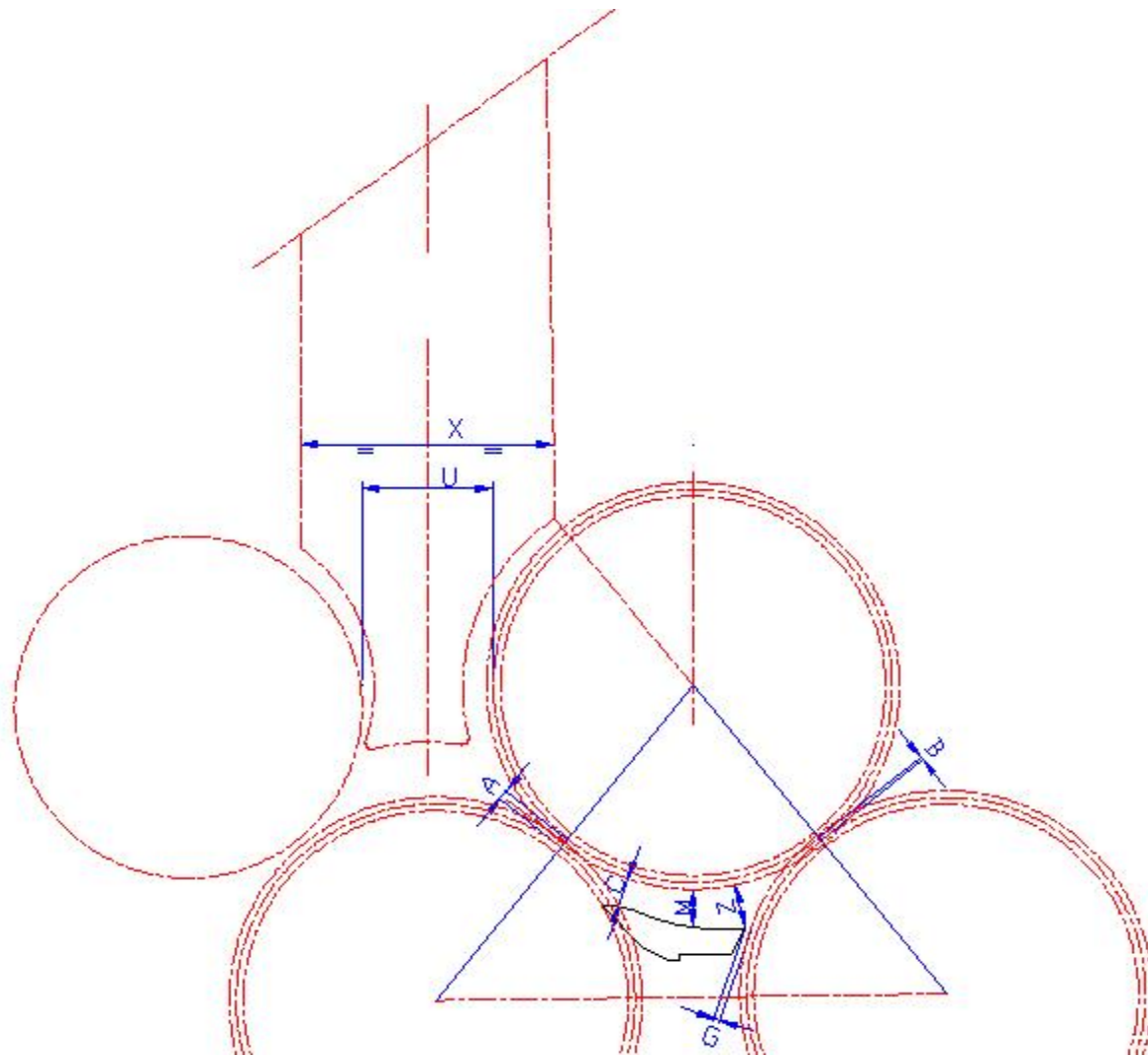
	3- ROLLER MILL	2- ROLLER MILL
No. OF ROLLERS	03	02
No. OF CROWN PINIONS	03	02
TRASH PLATE	YES	NO
No. OF BEARINGS UNDER LOAD	06	04
TAIL BAR LIFT	YES	NO

C. MILL SETTING

Good mill settings are essential to take good performance from conventional mills, however it is a difficult job; it is always based on detail calculations and experience of operational staff.

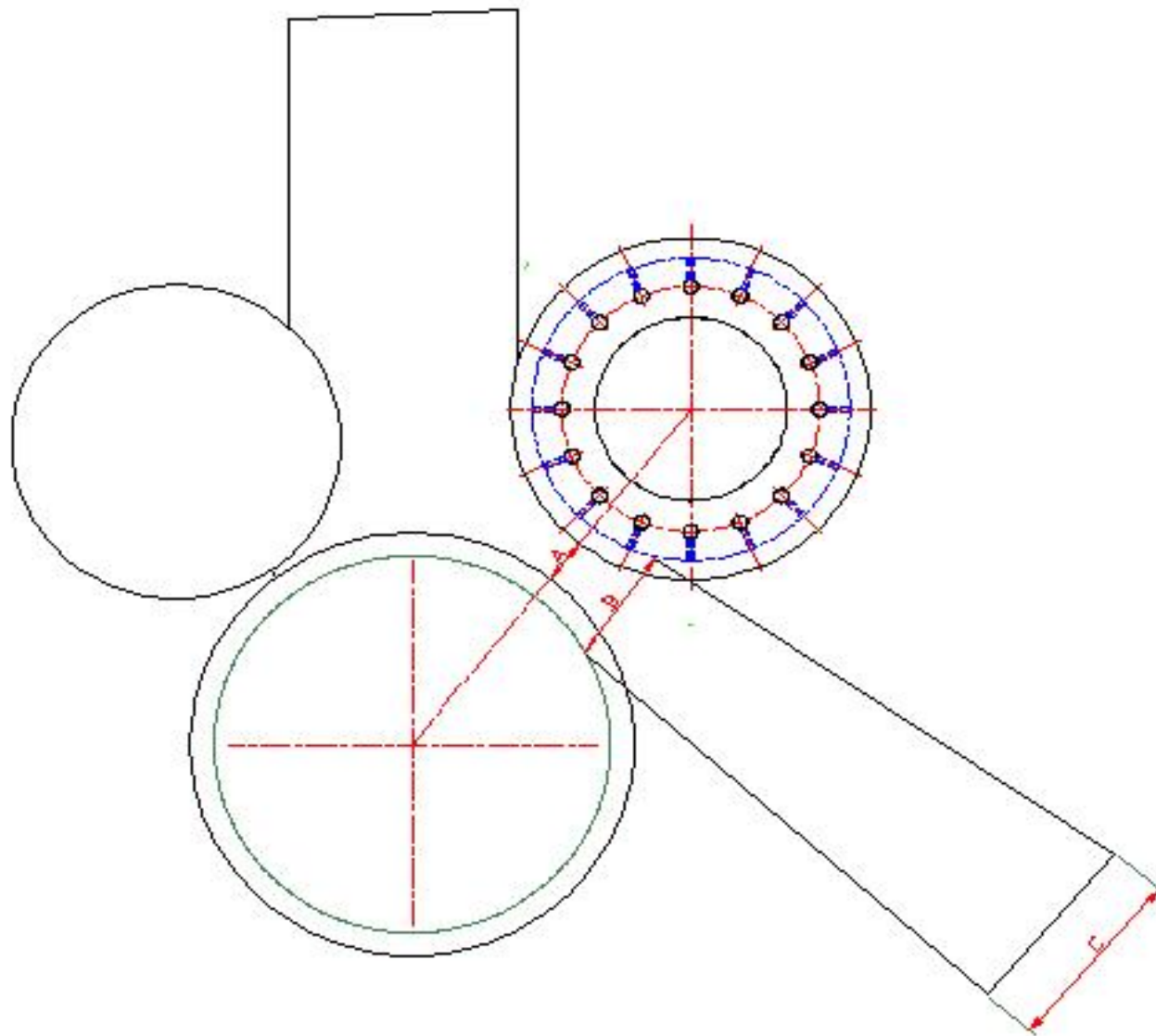
Unfortunately, a general operational staff has not enough knowledge to calculate it and usually we face problems like poor performance, feeding/choking, more wear and tear problems etc.

In conventional mills there are at least 6 openings (feed, discharge, tip, center, heel and juice gape) which are calculated and in addition trash plate profile is also drawn.



MILL SETTING IN 3 ROLLER MILLS

- In comparison to this there are only three opening to be calculated for 2-roller mills (rollers opening, decompression chute inlet & outlet openings).



MILL SETTING IN HYMECH

SPECIAL FEATURES OF HY-MECH

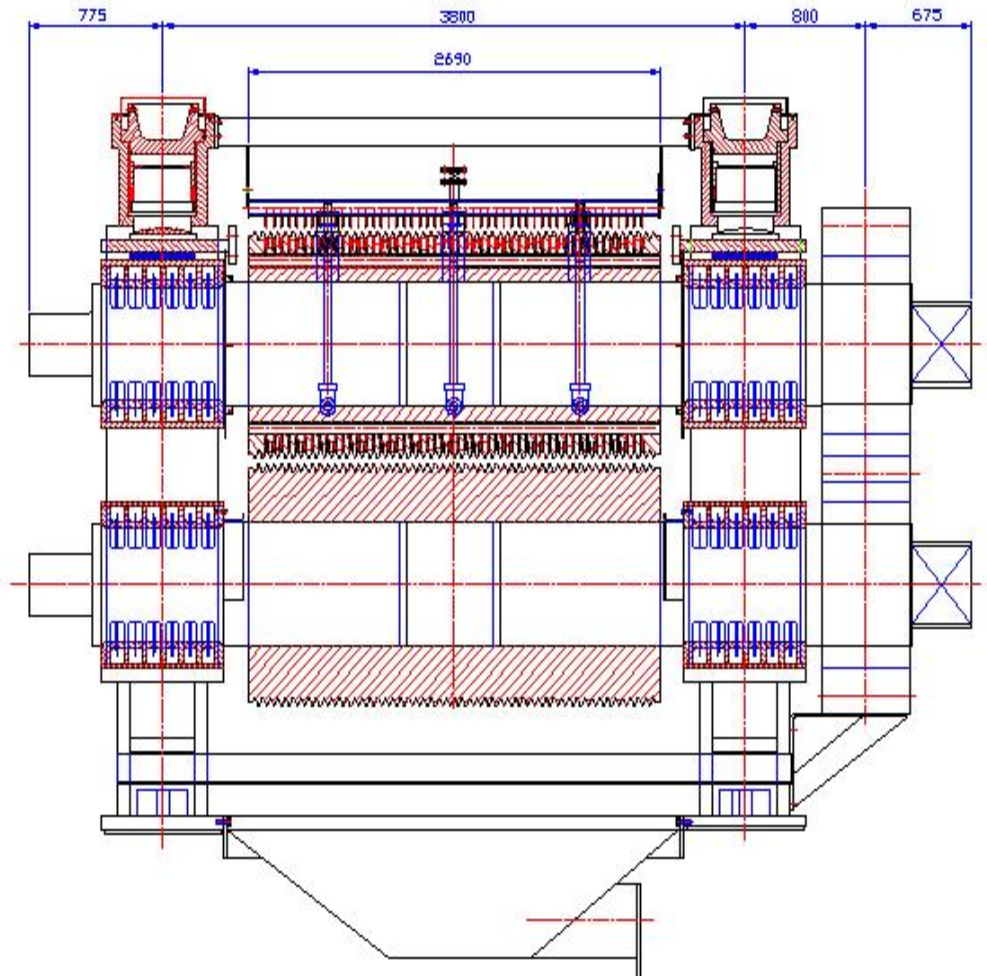
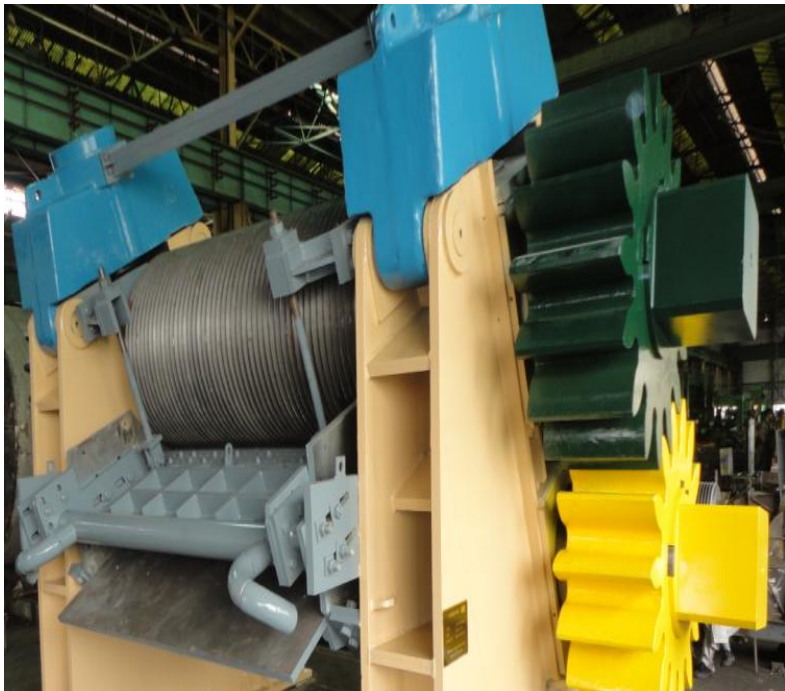
TOP ROLLER HYDRAULICALLY LOADED

Top roller of HYMECH is hydraulically loaded; it keeps constant pressure on cane blanket, irrespective of cane flow, top roller take lift freely under hydraulic load. This arrangement also safeguard mill against any foreign metal piece.

In Pakistan this system is essential due to following reasons.

- i. Lot of variation in cane crushing due to cane supply.
- ii. Variation in cane feeding due to manual loading and no automation on cane feeding.
- iii. There is frequent variation in donnelly chute level, causing variation in performance.
- iv. If there is no flexible arrangement of inserting pressure on top roller, the extraction will drop with low crushing rate and at higher crushing rate wear/tear, power consumption and re absorption will increase.²⁴

- iv. Because of poor metallurgy used by some vendors usually broken pieces of leveler, cutter knives, shredder hammer, nut and bolts reaches mill they will damage rollers more seriously even a major accident may take place if there is no hydraulic system on top roller.



BIGGER BOTTOM ROLLER:

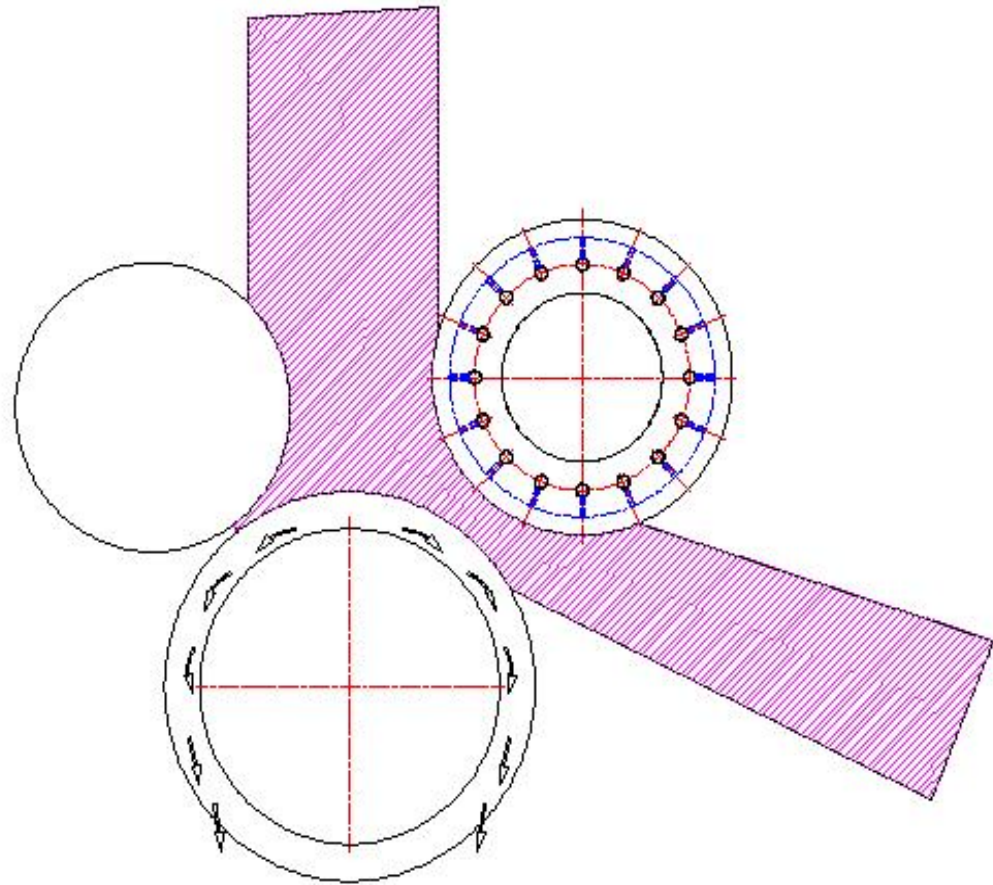
We have already discussed decompression chute, kindly note that this chute only control the reabsorption of juice it does not eliminate the root causes of re absorption.

The root causes of re absorption are “more extraction of juice with less juice drainage area and time.”

We have focused on these phenomena and provided more surfaces and drainage area in the Hy Mech, then the same capacity O2 roller mills available in the market. The cane blanket thickness and linear speeds are reduced automatically. ²⁷

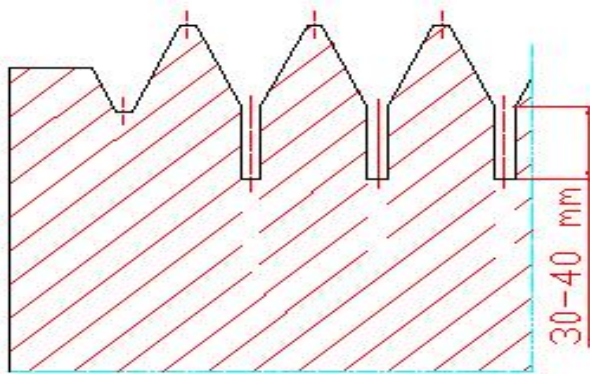
So we are able to put double check on re absorption. It is controlled at start of pipe as well as at end of pipe.

Specially we increased the surface and drainage area of bottom roller and adapted a unique concept that bottom roller is bigger than top roller. It is based on the idea that juice flows by gravity downward, more surface and drainage area at bottom roller drains juice more quickly.

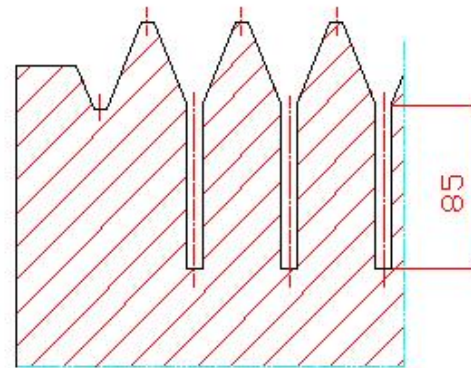


JUICE FLOW FROM BIGGER BOTTOM ROLLER

Juice drainage area is increased by cutting deep macherate grooves 85 mm deep, in conventional mills it is about 35 mm deep only.



CONVENTIONAL MECHARATE GROOVE



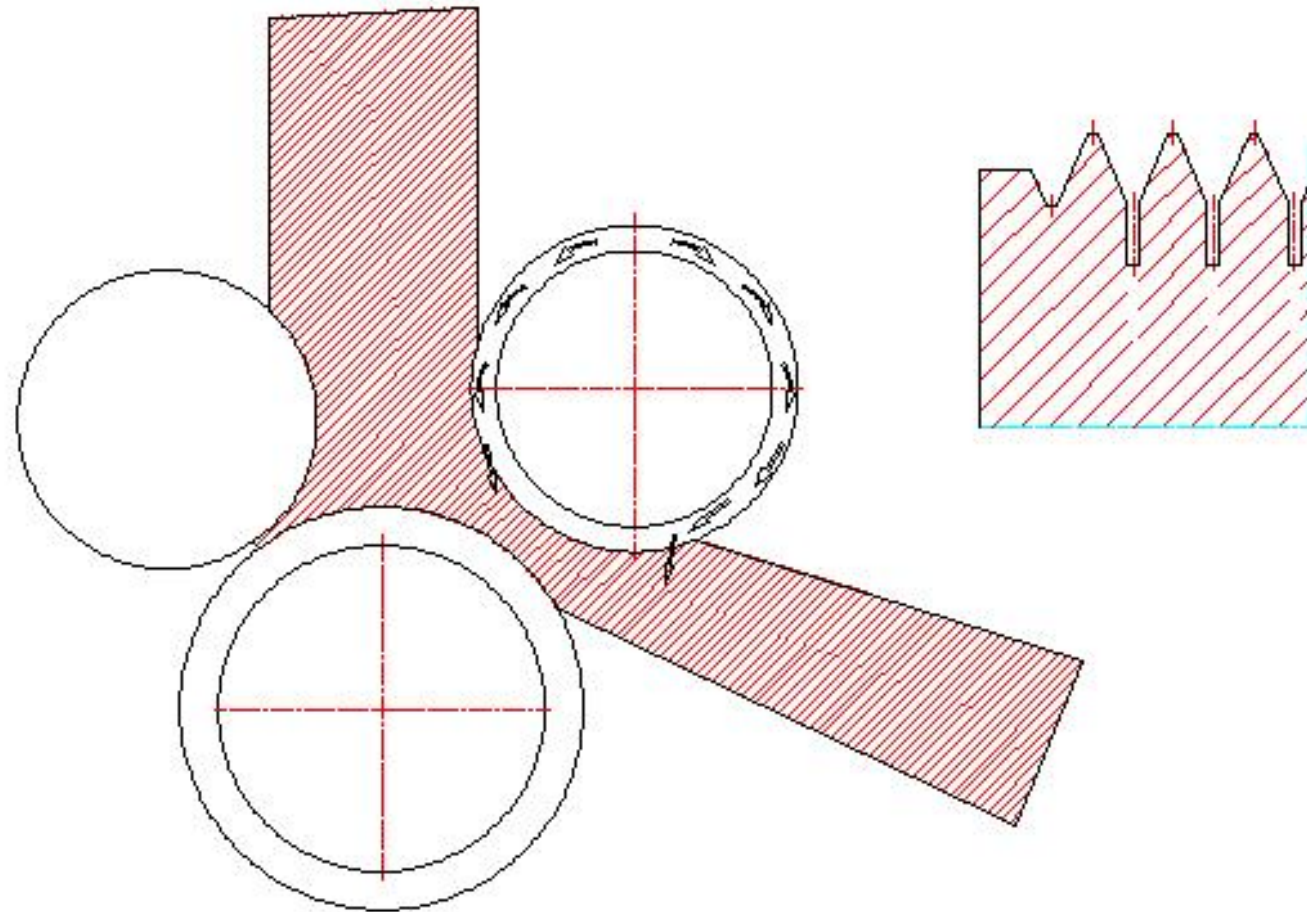
HYPECH MECHARATE GROOVE

TOP ROLLER LOTUS TYPE

There are two techniques to drain juice from top roller.

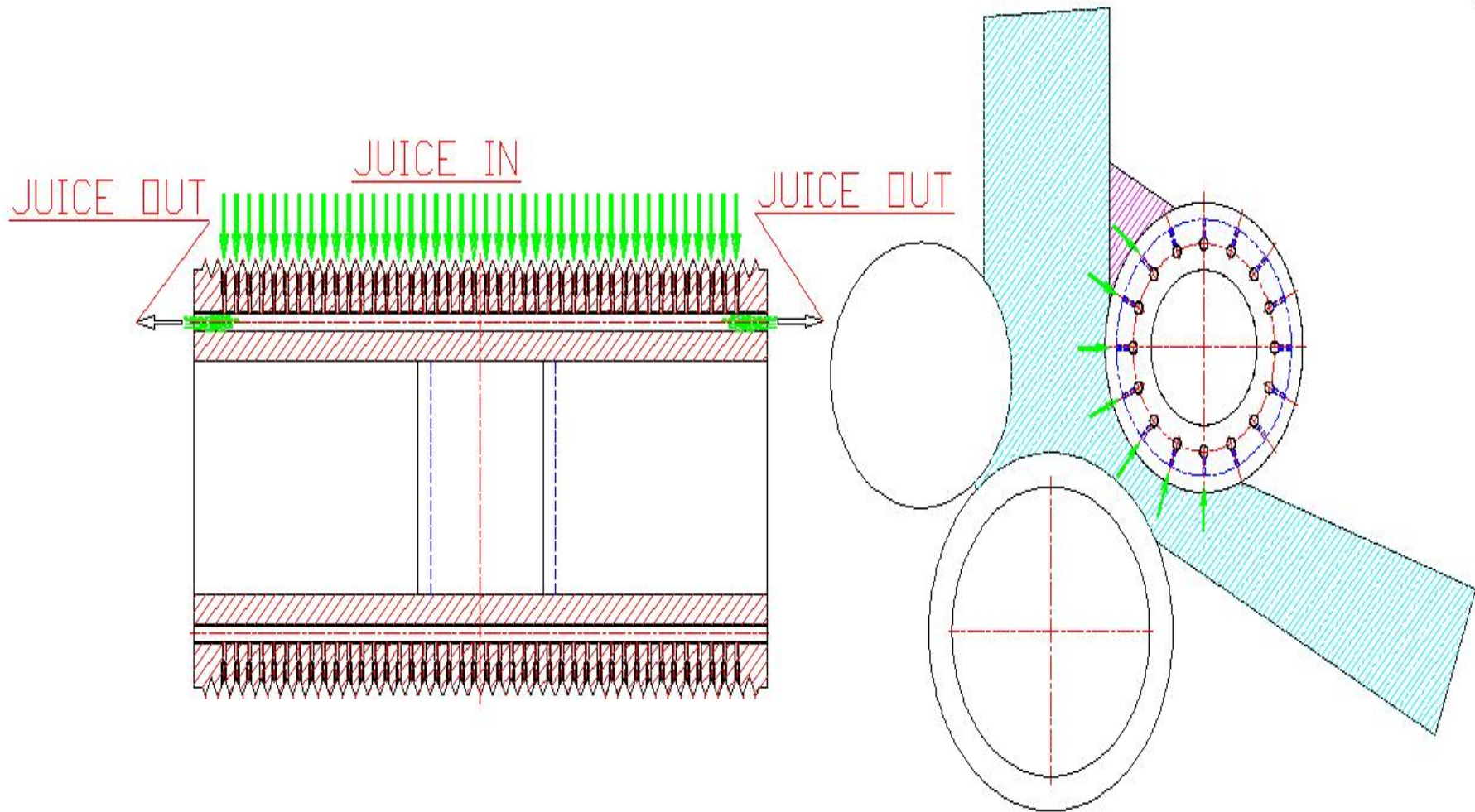
- Lotus roller
- Macherate grooves

The advantages of macherate grooves in top roller are very debatable as there are chances of re absorption of juice through macherate grooves more over they also reduce the compaction areas of top roller.



JUICE FLOW IN TOP MACHERATE GROOVED ROLLER

Juice drainage from top lotus roller is very effective and no chances of re absorption.

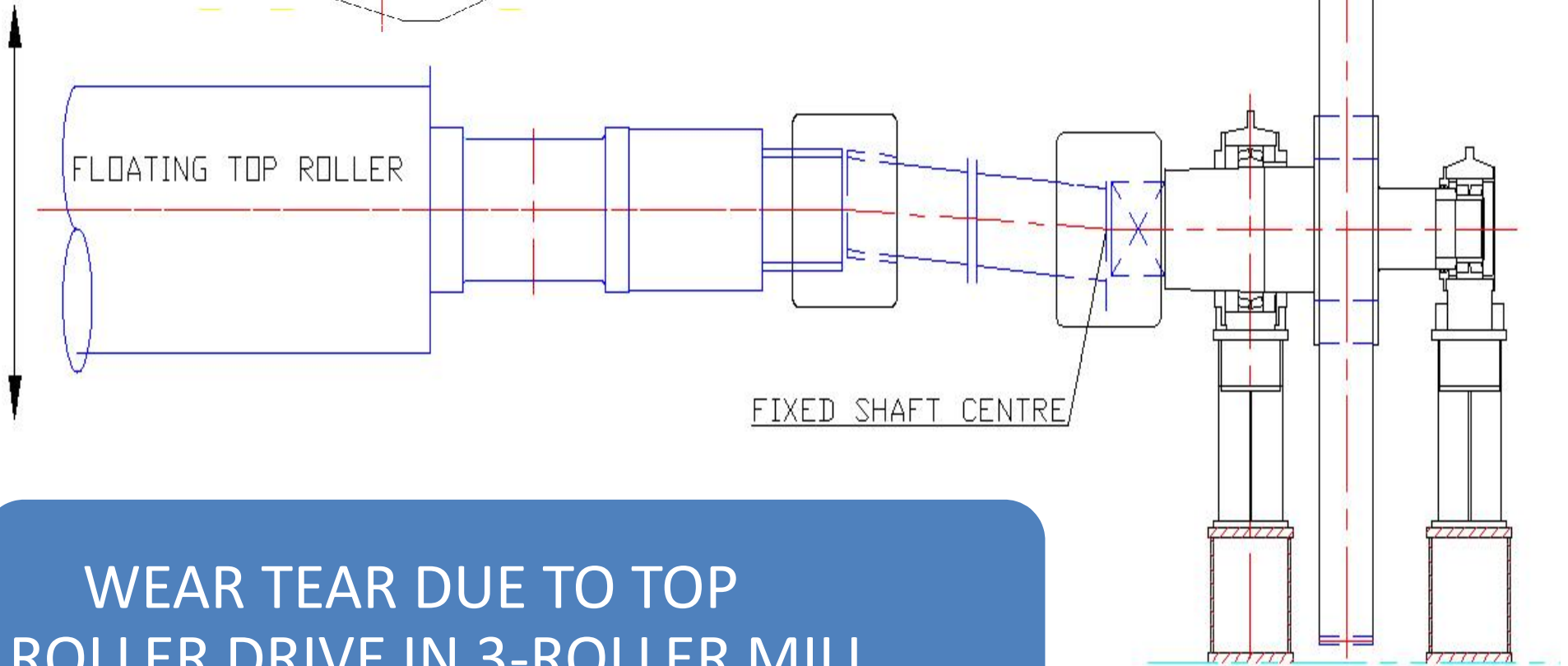
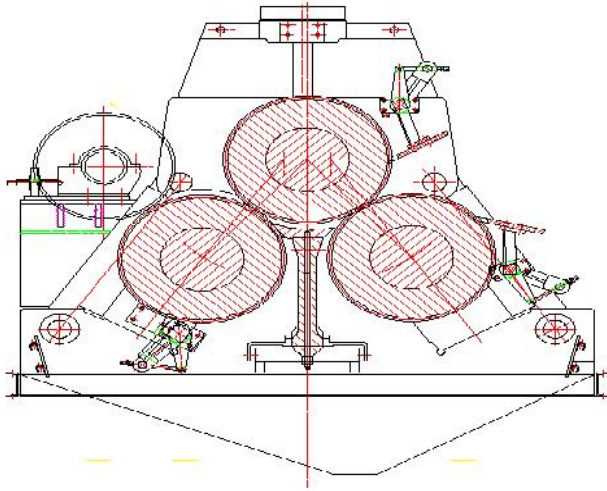


JUICE FLOW IN TOP LOTUS ROLLER

BOTTOM DRIVE

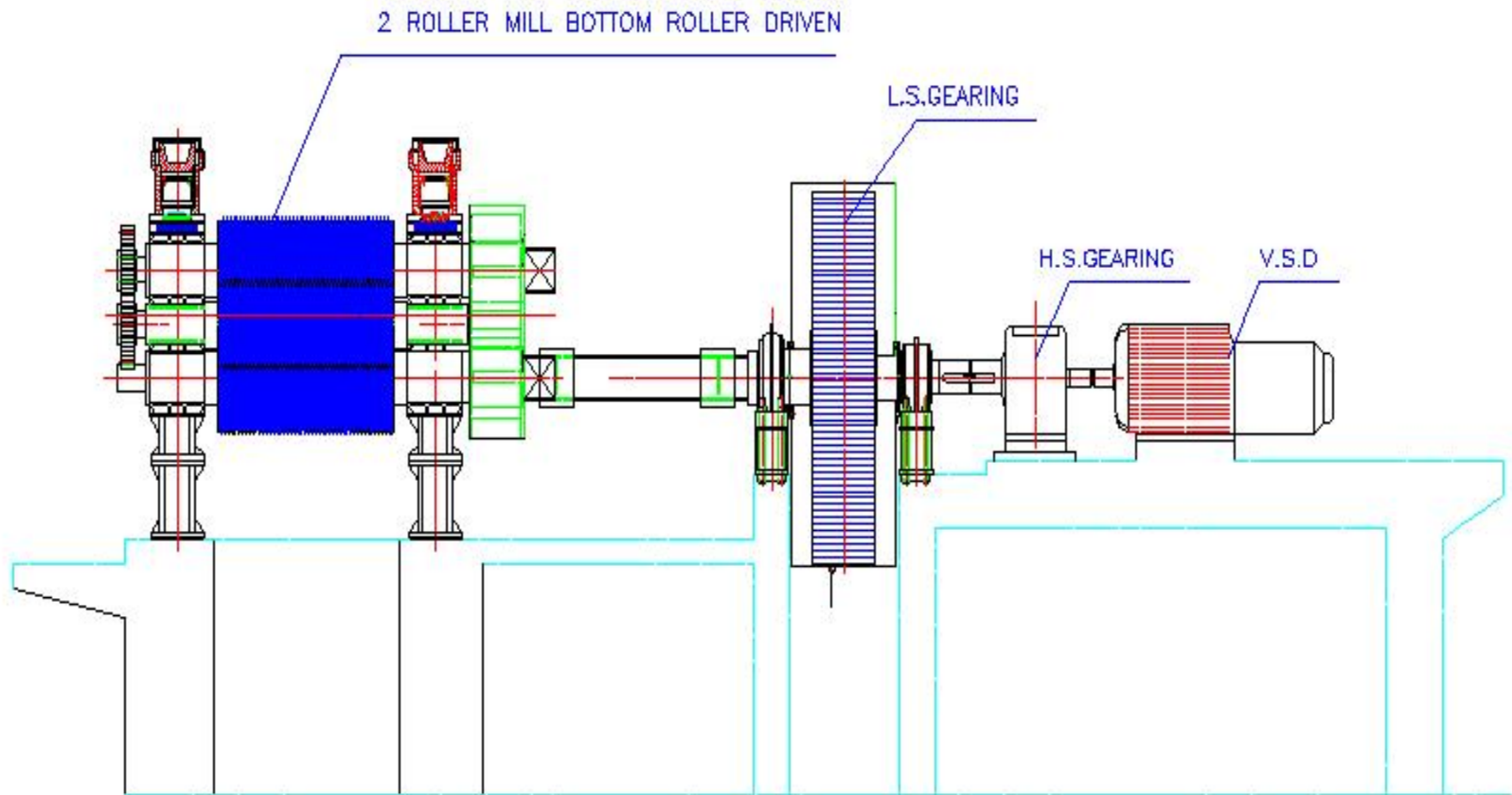
In three roller mills, drive is from top roller as it drives other two rollers through pinions; there is no alternate of it as far as 3-roller mills are concerned. However, it has some problems.

Top roller takes lift, while gearing output shaft only rotates on its axis. Top roller lift is accommodated in box coupling, however sometime this lift is abnormal and there is excessive wear, tear and breakages in box coupling, tail bars, bearing bolts, foundation bolts, mill bearing etc.



WEAR TEAR DUE TO TOP
ROLLER DRIVE IN 3-ROLLER MILL

In HYMECH, we drive the mill from bottom roller, so that top roller takes lift freely w/o any lift effect on other components, chances of wear tears are reduced.



Hy Mech driven by bottom roller

TECHNICAL REQUIREMENTS TO INSTALL HYMECH.

1) PREPARED CANE:

CANE PREPARATION INDEX	+90 %
TRASHES % CANE	3-5 %

2) MILL TO MILL CENTRE:

For mill 45/42" x 84 "	+10m
For mill 50/46" x 90 "	+11m
For mill 55/52" x 106 "	+12m

3) DONNELLY CHUTE HIGHT:

4-5 m above the axis of top roller.

4) AUTO LEVEL CONTROL:

Auto level control on Donnelly chute to keep it fill by 2/3 height.

5) MILL RPM:

2.5-6



FARAN SUGAR MILLS LIMITED

Dated: 15-05-2013

PERFORMANCE CERTIFICATE OF 02 ROLLER MILL (HY MECH) SUPPLIED BY HMC TAXILA

Mill Size	46"/50" x 90"
Crushing season	2012 – 2013
Maximum cane crushed	5980.940 TCD
1 st Mill extraction (Maximum achieved)	77.29
1 st Mill extraction (Average of season)	73.79
1 st Mill bagasse moisture (Minimum achieved)	52.51
1 st Mill bagasse moisture (Average of season)	54.91
Power consumed by Mill (Maximum)	10.73 kW/ton of fiber

GENERAL COMMENTS / SUGGESTIONS

The performance of the Mill was found satisfactorily throughout the season 2012-2013.

Omar Bawany
Vice Chairman

FARAN SUGAR MILLS LTD.

3rd Floor, Bank House No. 1 Habib Square, M.A. Jinnah Road Karachi-74000, Pakistan. U.A.N : 111-786-878, Fax: (92-21) 3242-1010
URL: www.faran.com.pk - www.bawany.com.pk
E-mail: info@faran.com.pk

SHEIKHOO SUGAR MILLS LTD.



Performance Certificate

Crushing Season	2012-13
Mill Type	02 Roller (Hy Mech)
Supplied By	HMC Taxila
Mill Size	55" / 52" x 106"
Position of Mill	1 st Mill
Cane Crushed	14200 ~ 14500 TCD
1 st Mill Extraction	68 ~ 70%
Steam Consumed by Turbine (old turbine model 1980, 1500 KW)	8 ~ 9 t/h

Benefits gained

- Gain in crushing by 2000 TCD
- Much gain in 1st mill extraction, previously it used to be only 55% (approx).
- Steam consumption of Hy Mech is less, our conventional remaining mills consume about 10.5 t/h (average).

Problems faced

- Nose plates had to tighten twice during a season.
- For few days, minor vibration was noted in head stock, soon it was overcome by improving oil circulation in top wear plates and reducing hydraulic load resulting in higher lift.
- Excessive wear in crown pinions teeth.

Suggestions

- Reduction in crown pinion diameter with new teeth profile to avoid vibration in Head Stock and teeth wearing.
- Lubrication arrangement of wear plates to be improved.
- Under feeder teeth orientation to be reversed or cast iron under feeder with machaert groove to be used to avoid bagasse dropage and to improve juice drainage i.e. extractions.
- Bagasse accumulation at top chute plate to be controlled, it will further improve extraction.

In general experience of installing Hy Mech was satisfactory, we understand that any innovation take some time to give best performance, we hope that after incorporating above suggested modification this mill will be very successful in coming years.

Mahmood-ul-Hassan Khilji
General Manager



ASHRAF SUGAR MILLS LIMITED
ASHRAFABAD BAHAWALPUR

Refer No. ASML/LAB/
Date: 08 January, 2013

To,

Muhammad Ilyas
Manager (S&MII), HMC

E-mail: marketing@hmc.com.pk

Subject: **HMC Supplied 02 Roller Mill (HY MECH).**

This refers to your letter No. HMC / S&MII/SUG/12-13/1533 dated 3/11/2013 subjected as above.


The Laboratory performance report of 02 Roller Mill (HY MECH) is as under.

Date	7/1/2013	7/1/2013
Prtic. TIME.	8-30 pm	01-00 am
Brix % Bagasse	10.646	11.059
Fiber % Bagasse	27.953	26.840
1 Hrs Cane Crushing	309	309
Total Wht Pol in Cane	37.450	37.450
Total Wht of Fiber	40.046	40.046
Total Wht of Bagasse	143.26	149.200
Total Wht pol Bagasse	12.592	13.815
Wht Instruction Cane	24.858	23.634
Mill Extraction	66.375	63.108
RPM	1050	1100
Water flow	50 ton/hrs	50 ton/hrs
Juice flow	280	280
Analysis		
Crusher Juice Pty	82.56	83.73
Bagasse Pol	8.79	9.26
Bagasse Moisture	61.4	62.1
Fiber % Cane	12.96	12.96
Pol % Cane	12.12	12.12
Cane Flow	309	309
Cane preparation index	92.63	92.92


Lab Manager

*Kindly depute your expert to increase the
Mill Extraction.*


Technical Director 08/01/2013


General Manager (Mills) 08/01/13



ASHRAF SUGAR MILLS LIMITED
ASHRAFABAD BAHAWALPUR

Refer No. ASML/LAB/
Date: 10- January, 2013

To,

Dr. Muhammad Ashraf
Managing Director,
HMC, Taxila

E-mail: marketing@hmc.com.pk and hmcengg@hmc.com.pk

Subject: **HMC Supplied 02 Roller Mill (HY MECH).**

This refers to your letter No. HMC / S&MII/SUG/12-13/1533 dated 3/11/2013 subjected as above.

The Laboratory performance report of 02 Roller Mill (HY MECH) is as under.

Date	10/1/2013	10/1/2013
Prtic. TIME.	5-20 pm	01-10 am
Brix % Bagasse	11.042	11.319
Fiber % Bagasse	29.557	28.980
1 Hrs Cane Crushing	275	275
Total Wt. Pol in Cane	33.214	33.214
Total Wt. of Fiber	35.860	35.86
Total Wt. of Bagasse	121.321	123.738
Total Wt. Pol Bagasse	11.234	11.792
Wt. Instruction Cane	21.980	21.422
Mill Extraction	66.176	64.496
Motor RPM	880	1000
Water flow	58 ton/hrs	58 ton/hrs
Juice flow	270	270
Analysis		
Crusher Juice Pty	83.86	84.19
Bagasse Pol	9.26	9.53
Bagasse Moisture	59.40	59.70
Fiber % Cane	13.04	13.04
Pol % Cane	12.078	12.078
Cane Flow	275	275
Cane preparation index	93.12	93.00

Kindly depute your expert to increase the mill extraction.


Lab Manager


Technical Director


General Manager (Mills)

Copy to:

1. Muhammad Ilyas, Manager (S&MII)
2. Office Copy



ASHRAF SUGAR MILLS LIMITED
ASHRAFABAD BAHAWALPUR

Refer No. ASML/LAB/
Date: 13- January, 2013

To,

Dr. Muhammad Ashraf
Managing Director,
HMC, Taxila

E-mail: marketing@hmc.com.pk and hmcengg@hmc.com.pk

Subject: **HMC Supplied 02 Roller Mill (HY MECH).**

This refers to your letter No. HMC/S&MH/SUG/12-13/1533 dated 3/11/2013 subjected as above.

The Laboratory performance report of 02 Roller Mill (HY MECH) is as under.

Date	13/1/2013	13/1/2013
Prtic. TIME.	9-45 am	6-10 pm
Brix % Bagasse	11.457	11.250
Fiber % Bagasse	28.252	28.750
1 Hrs Cane Crushing	280	280
Total Wt. Pol in Cane	34.048	34.048
Total Wt. of Fiber	36.68	36.680
Total Wt. of Bagasse	129.828	127.582
Total Wt. Pol Bagasse	12.372	11.941
Wt. Instruction Cane	21.657	22.106
Mill Extraction	63.661	64.926
Motor RPM	930	950
Water flow	60 ton/hrs	60 ton/hrs
Juice flow	290	290
Analysis		
Crusher Juice Pty	82.53	83.20
Bagasse Pol	9.53	9.36
Bagasse Moisture	60.20	60.00
Fiber % Cane	13.10	13.10
Pol % Cane	12.160	12.160
Cane Flow	280	280
Cane preparation index	93.45	93.16

Kindly depute your expert to increase the mill extraction.


Lab Manager


Technical Director


General Manager (Mills)

Copy to:

- 1 Muhammad Ilyas, Manager (S&MH)
- 2 Office Conv

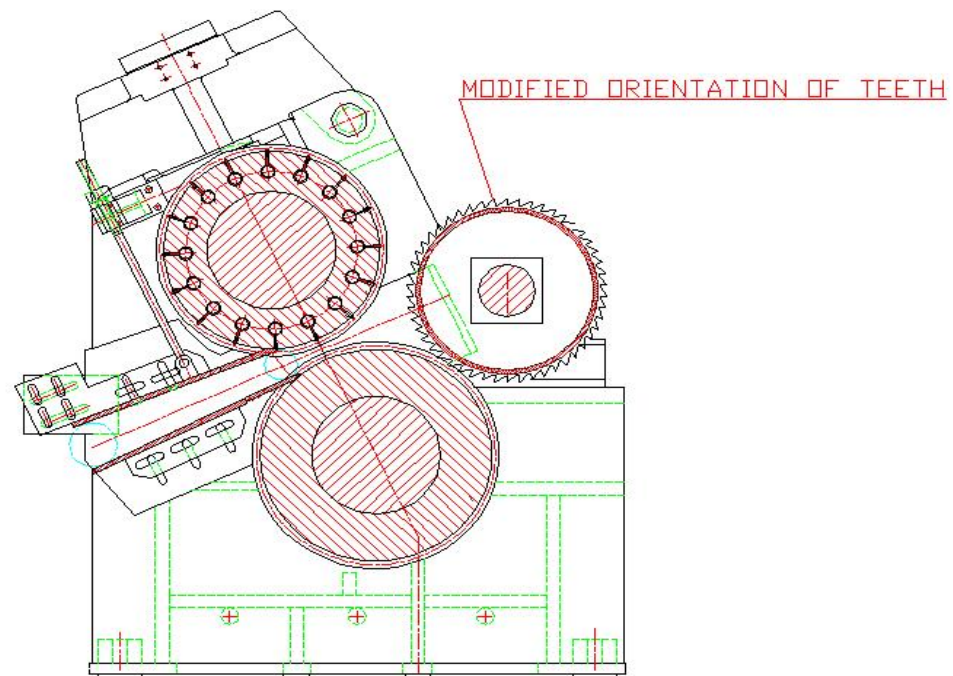
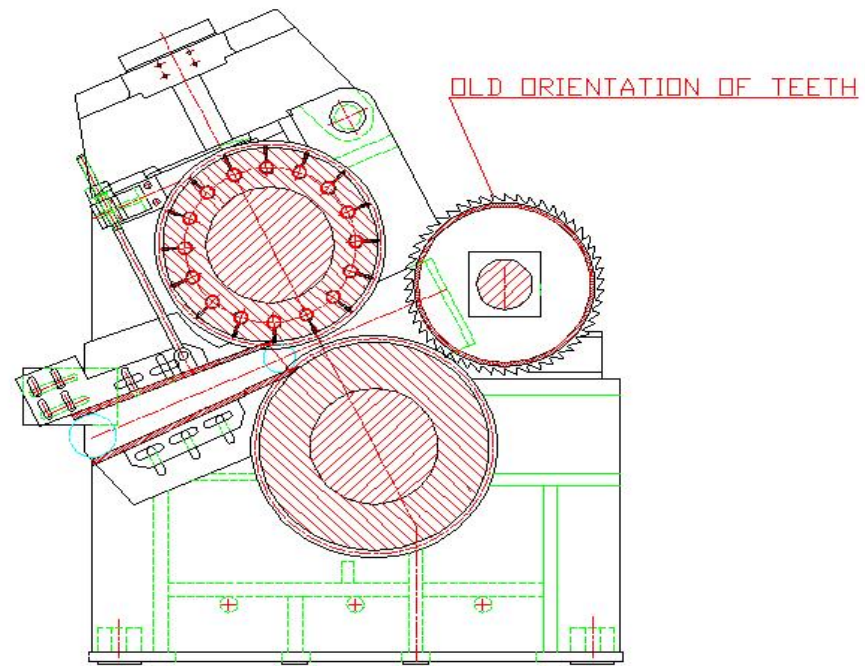
PROBLEMS/ IMPROVEMENTS.

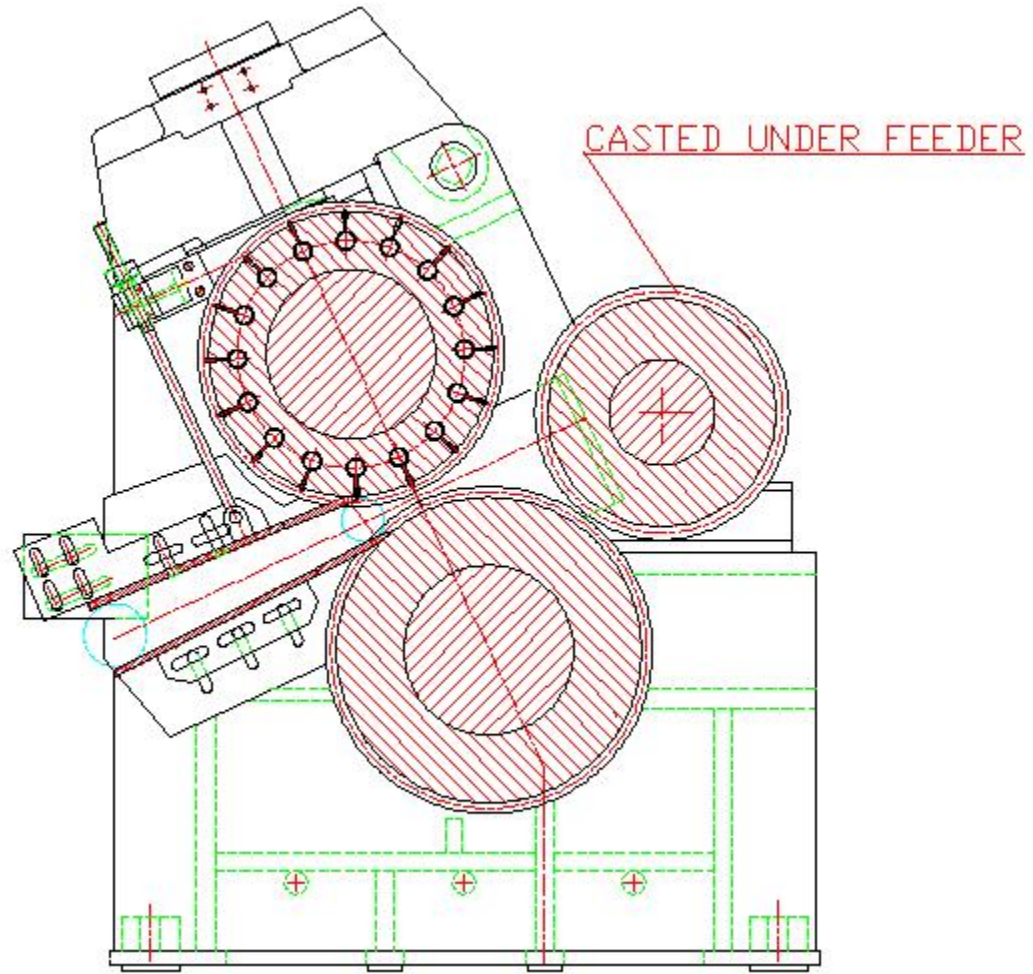
It was the 1st experience of HMC to put into operation a newly developed 2 roller mill , it was expected that in 1st go some problems will be faced, however our problems were not of permanent nature, they are minor, can be rectify/improve. We are very confident that in coming years after removing these problems, HYMECH will be very reliable mill both from mechanical and performance point of view.

1) FABRICATED TOOTH TYPE UNDER FEEDER:

It was overlooked by us, while fitting fabricated under feed roller on shaft, that direction of teeth were opposite than the requirements. It started to drop excessive bagasse. We managed it to run by reducing the depth and sharp edges of teeth.

For the next crushing seasons we are reversing the teeth direction and also installing cast iron under feed rollers, which we have already tried in Faran sugar mills and it is giving good result.





2) PINIONS:

we are modified pinions for closer mill setting and to take into account wear effect of rollers.

3) MILL SETTING:

In HYMECH adjustment in performance and crushing rate is accomplish by variation in speed and hydraulic load, however there is also provision for rollers opening readjustment due to some special reasons. Our previous arrangement was little difficult, we are modifying it for easy and quick readjustment.

4) BAGASSE ON TOP CHUTE PLATE:

Bagasse come out through the gape between teeth of roller and noze plate, it is accumulated at top chute pate, from where it is removed by water spray or manually.

We are improving it by reducing depth and quantity of chevron grooves on top rollers. Grooving of noze plate will also be modified.

5) OTHER MODIFICATION:

we are also doing lot of minor modification for further improvement in performance and working.



