

细支羊毛的梳理与精梳

CARDING AND COMBING FINE WOOL

加里 罗伯逊
Gary Robinson

经济效益方面的影响

FINANCIAL IMPLICATIONS:

工厂 PLANT	1%落毛的减少 Reduction of 1%Romaine	工厂效率 Plant efficiency %	产品价值 Product Value USD	每年潜在的收益 Potential Gain USD/ann.
原毛至毛条 1,000 公斤/小时 Greasy to top 1,000kg/hr	+10kg/hr	80	8.00 (10.00 – 2.00)	0.67M
纵向运行 – 原毛至面料 350 公 斤/小时 Vertical – greasy to fabric. 350kg/h	+3.5kg/hr	70	15.00/lin.metre (3m/kg)	1.32M

羊毛的初级加工

STAGES in ESP of WOOL

- 原毛混毛
Greasy Wool Blending
- 洗毛
Scouring
- 洗净毛的混毛
Scoured Wool Blending
- 梳毛
Carding
- 针梳
Gilling
- 精梳
Combing
- 成球
Top Finishing

羊毛的混毛

WOOL BLENDING

- **质量**
Quality 满足客户的需求
To meet customer requirements
- **价格**
Price 满足纺纱厂制定的价格
To meet the spinners price
- **利润**
Profitability 用最低的价格生产出最佳的产品
To produce the best product for the lowest price

生产过程中的回潮控制

REGAIN FOR PRODUCTION

- 增加回潮将降低纤维的强度
Increased regain reduces fibre strength
- 增加回潮同时也增加纤维的伸张性
Increased regain increases fibre extension
- 在一般的梳毛机以及高速梳毛机上，喂入回潮不影响纤维的扯断
At both conventional and high card speeds, feed regain does not affect fibre breakage.
- 控制纤维，**16 – 18%**回潮最佳
Regain important for fibre control – 16 to 18% optimum
- 高草杂的羊毛，越干燥越好
For high VM wools, drier is better

梳毛之前洗毛的质量控制

SCOUR QUALITY CONTROL BEFORE CARDING

湿度

Moisture Content

➤ 细支美丽努羊毛（低草杂） Fine Merinos (low VM)	15-17%
➤ 细支美丽努羊毛（<3%草杂） Fine Merinos (<3% VM)	12-14%
细支美丽努羊毛（高草杂） Fine Merinos (High VM)	<10%

梳毛之前洗毛的质量控制

SCOUR QUALITY CONTROL BEFORE CARDING

➤洗毛后全部含油脂成分（**TFM**）0.3- 0.5%

TFM content after scouring 0.3- 0.5%

➤洗毛后全部含灰成分（**Dirt**）0.4-0.6%

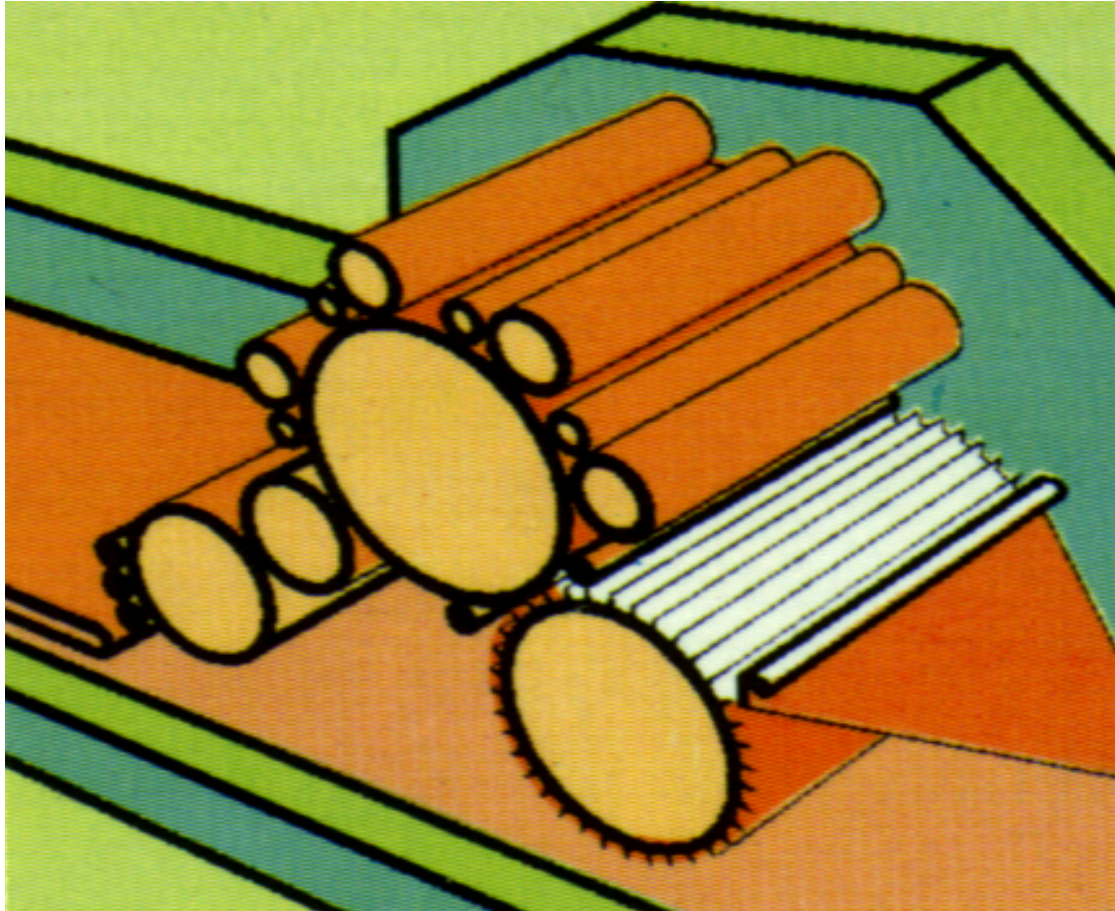
Dirt content after scouring 0.4-0.6%

梳毛之前洗净毛的打包

BALING OF SCOURED WOOL BEFORE CARDING

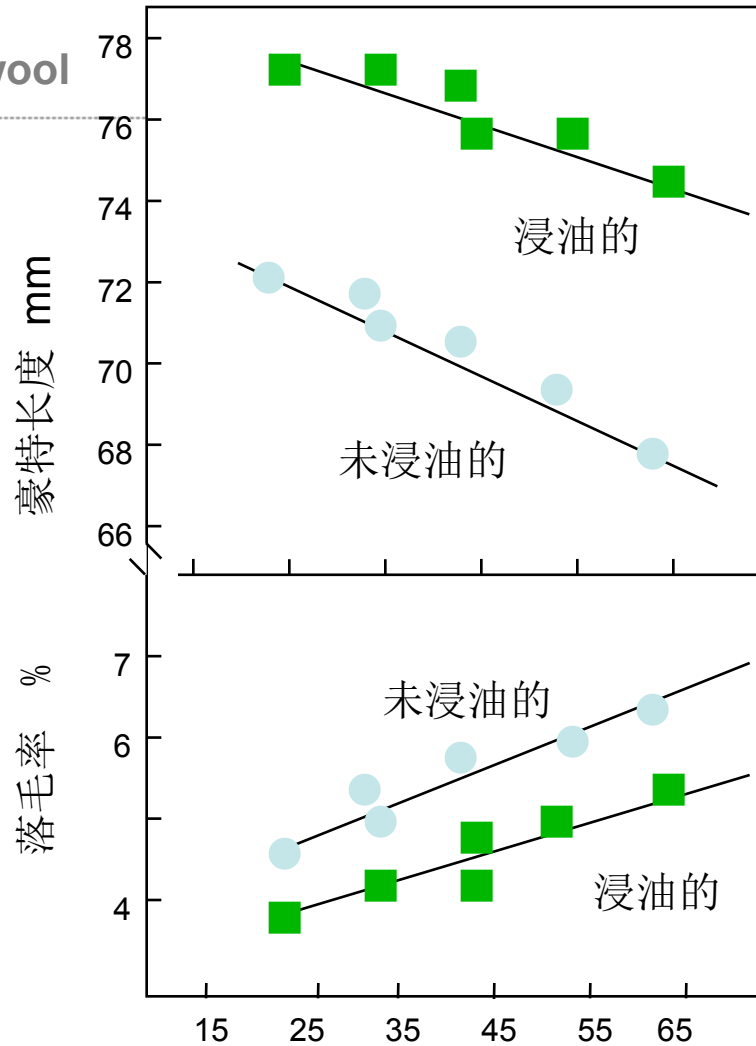
- 存储在**12**个月以上将减少**2至3**豪特毫米
Storing to 12mths reduces Huateur by 2 to 3mm
- 单轴压缩打包比双轴压缩打包好
Bi-axial pressing worse than mono-axial pressing
- 毛包的密度几乎没有影响
Packing density has little effect
- 打包时的回潮率影响不大
Regain during pressing not significant
- 如果洗净毛恢复状态大于**Tg**则损失可忽略不计
Losses erased if scoured wool relaxed $> T_g$

梳毛 Carding



和毛油

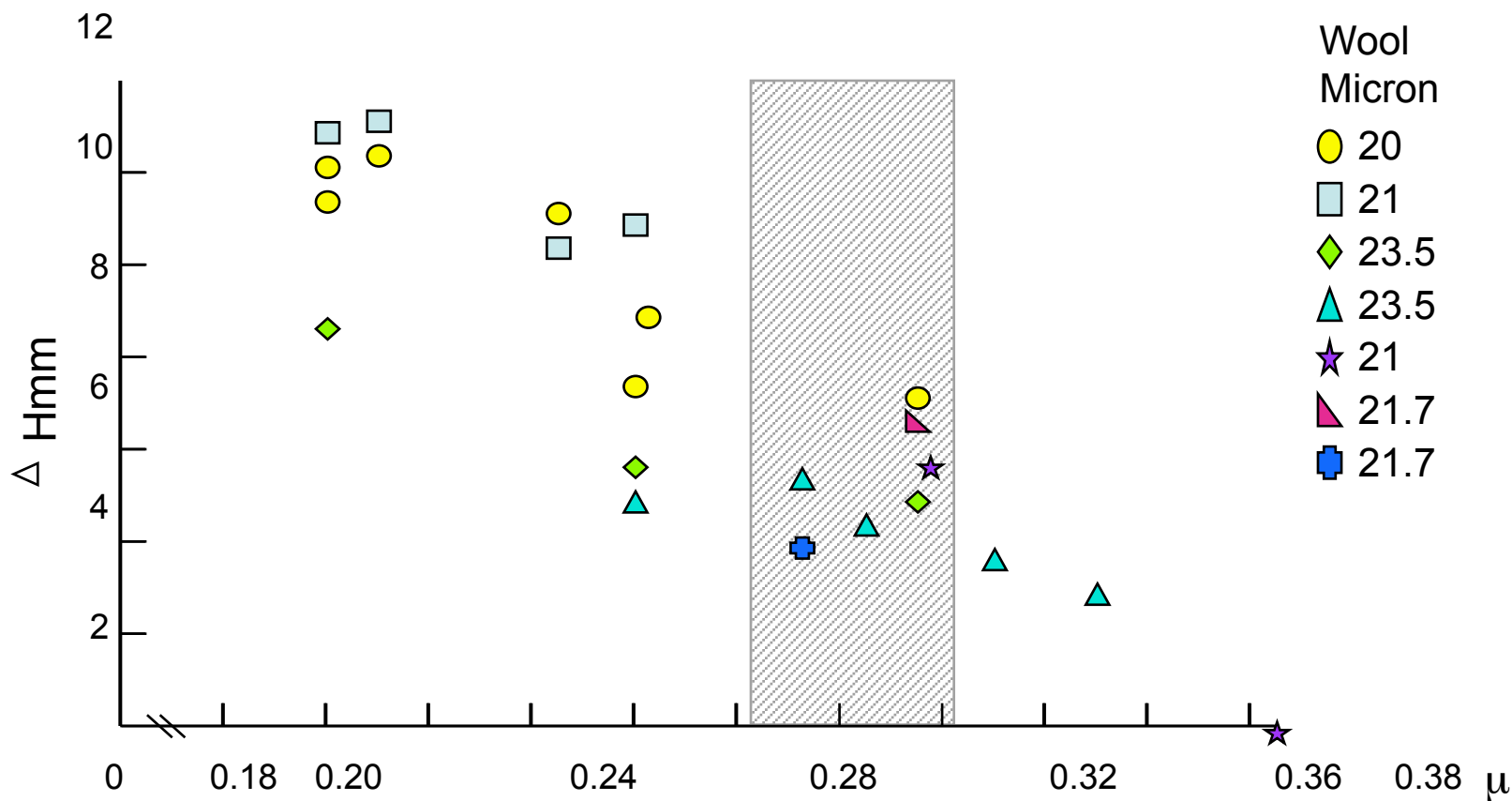
Lubricating wool



梳毛生产率 kg/h

豪特长度及摩擦

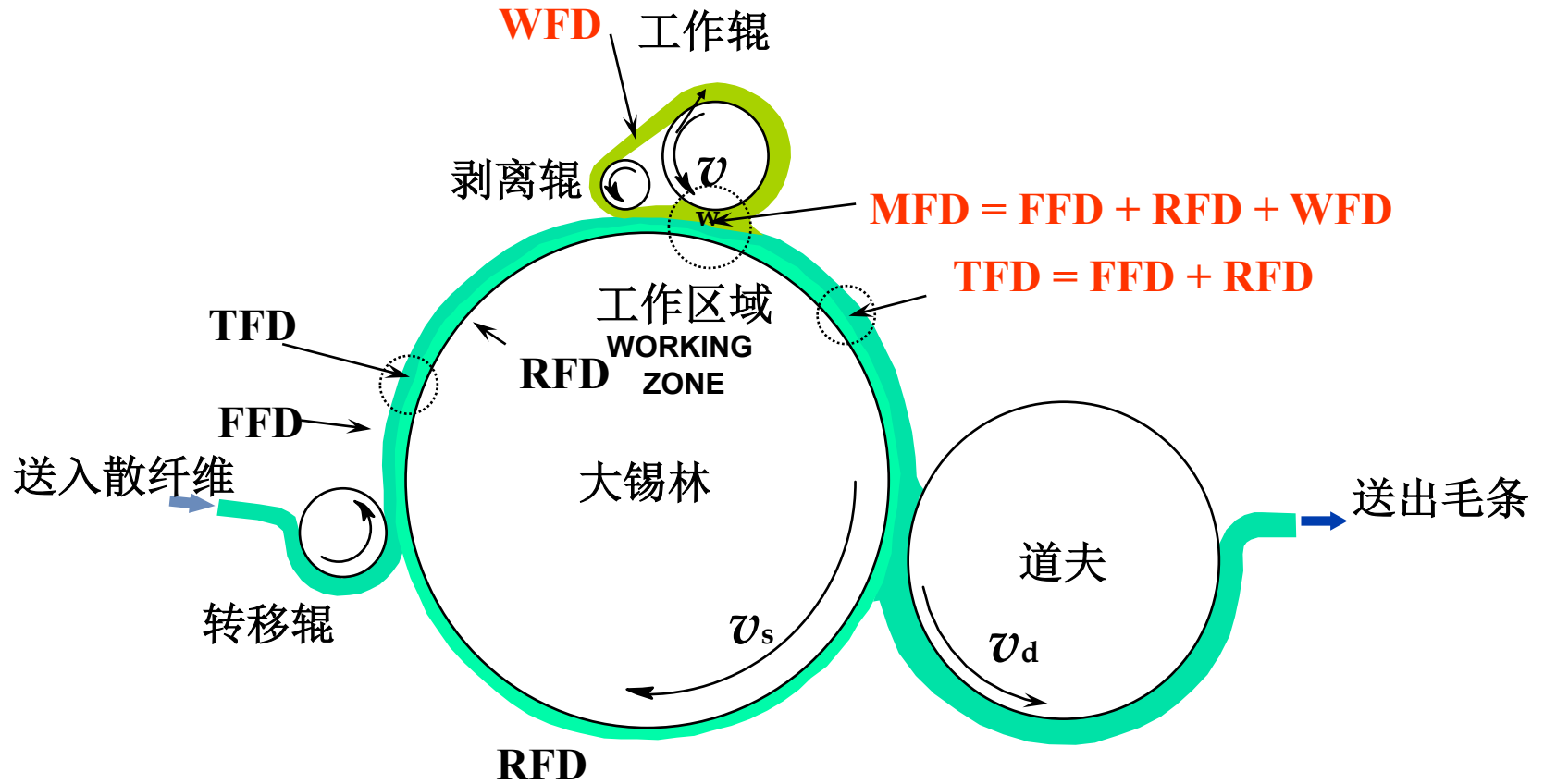
HAUTEUR AND FRICTION



豪特长度H的增加及摩擦系数μ的关系

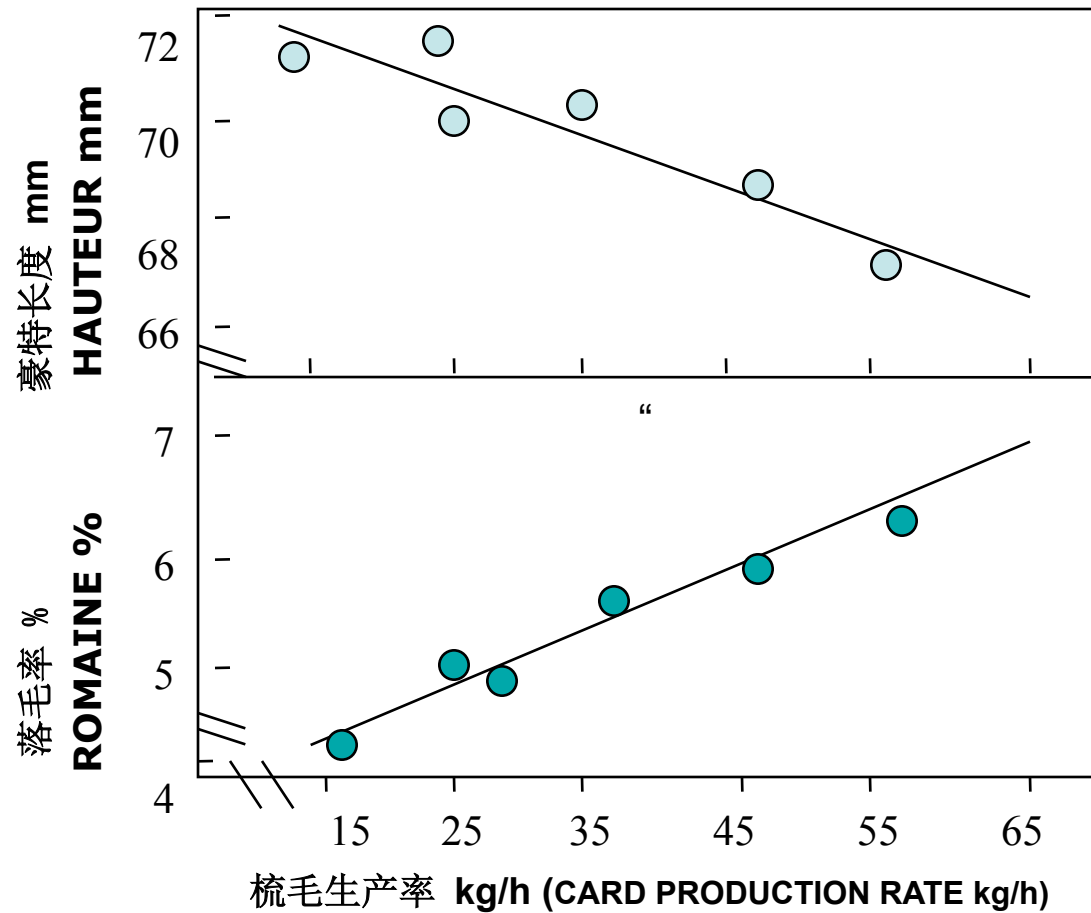
纤维的运动方向

THE FLOW OF FIBRES



生产率的影响

PRODUCTION RATE EFFECTS



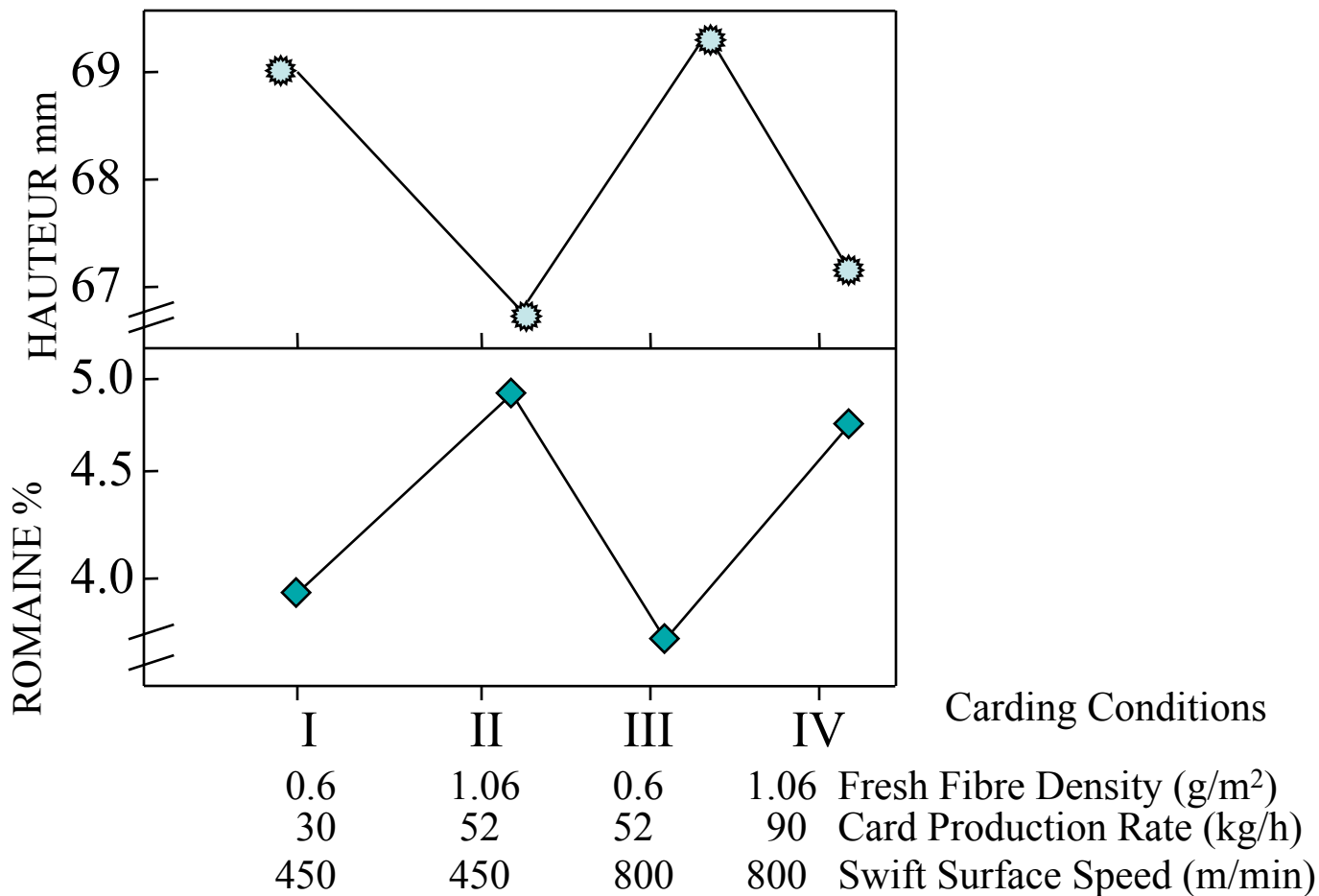
纤维密度和梳毛速度的影响

EFFECTS OF FIBRE DENSITY AND CARD SPEED

实验条件 Experimental Condition	梳毛机的 生产速率 Card Prod'tion Rate kg/m/h	梳毛机速度 (锡林) Card Speed (Swift) m/min	新鲜纤维 密度 Fresh Fibre Density g/m ²
I	17	450	0.6
II	30	450	1.1
III	30	800	0.6
IV	53	800	1.1

新鲜纤维密度以及梳毛速度对豪特与落毛率的影响

Effect of Fresh Fibre Density and Speed on Hauteur and Romaine



梳理超细毛时纤维的密度（**17.2微米**）

FIBRE DENSITY IN CARDING VERY FINE WOOL (17.2 μm wool)

锡林速度 Swift Speed (m/min)	纤维密度 Fibre Density (g/m ²)	精梳落毛 Combing Noil (%)	豪特长度 Hauteur (mm)
600	0.8	12.0	61.4
900	0.5	9.7	63.2

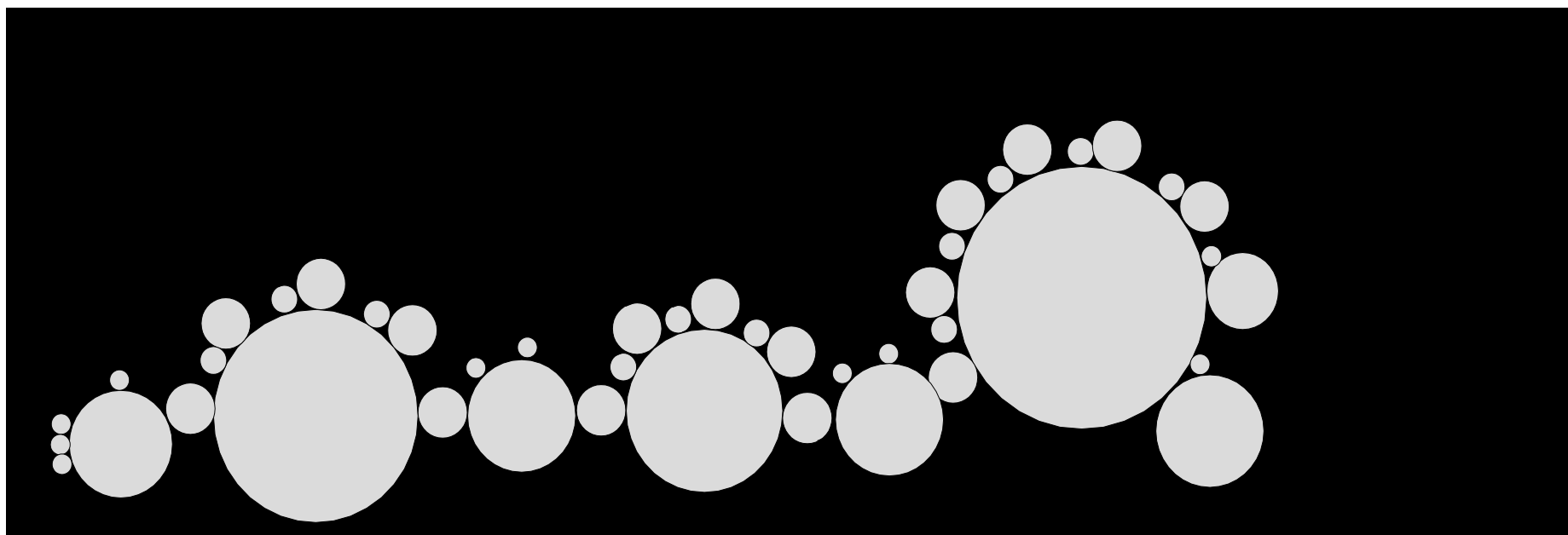
使用高速梳毛的两种方法

Higher Carding Speeds can be used in Two Ways

- 条件 **II** 到条件 **III**,
Condition II to condition III,
 - 在生产率没有发生变化的情况下质量得以保证并控制了下脚
there has been a gain in product quality and waste control at constant production rate.
- 条件 **II** 到条件 **IV**,
Condition II to condition IV,
 - 生产率取得了飞速增长，而没有以牺牲毛条长度和落毛为代价
a large gain in production rate has been achieved without any deterioration in top length or increase in noil.

THIBEAU CA7梳毛机

THIBEAU CA7



梳毛（毛粒形成）

CARDING (NEP FORMATION)

普遍认可影响毛粒形成的因素有.....

It is generally accepted that nep formation is affected by.....

- 洗毛过程中羊毛的缠绕程度
The degree of entanglement from scouring
- 剥离辊隔距
The stripper settings
- 道夫隔距
The doffer settings
- 锡林速度 - 纤维密度
The swift speed - fibre density
- 锡林与道夫之间的速度比（**SDSR**）
SDSR
- 梳毛针布种类及梳毛条件
The type of card clothing and its condition
- 湿度
Moisture content

梳毛（毛粒形成）

CARDING (NEP FORMATION)

在任意两个罗拉之间，有4个影响因素

Between any two rollers, there are four influencing factors...

➤ 几何学 (直径, 旋转方向)
Geometry (diameter, direction of rotation)

➤ 速度 (单独的, 微分的)
Speed (individual, differential)

➤ 隔距
Gauge

➤ 针布 (种类, 条件)
Clothing (type, condition)

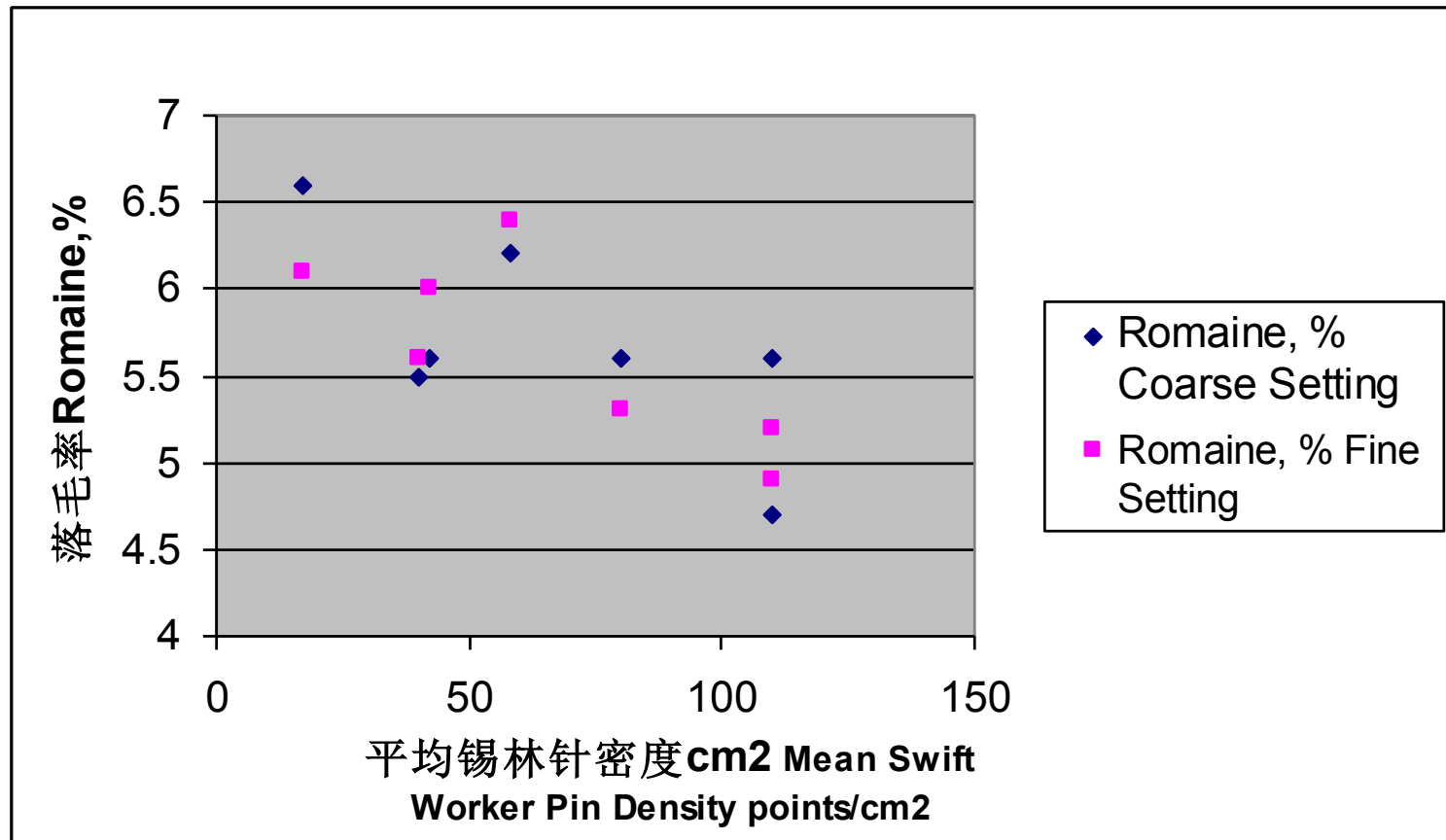
梳毛机的隔距

CARD SETTINGS

- 最终的隔距（工作辊与道夫之间）是主要的因素
Final Setting (both worker and doffer) are major determinant
- 较大的隔距调整会增加一些豪特值但是也会造成更多的落毛
More open settings gives small gain in H, but a lot more romaine
- 在梳毛机的前端部位进行调试所起的作用有限
Altering setting on forepart has little effect

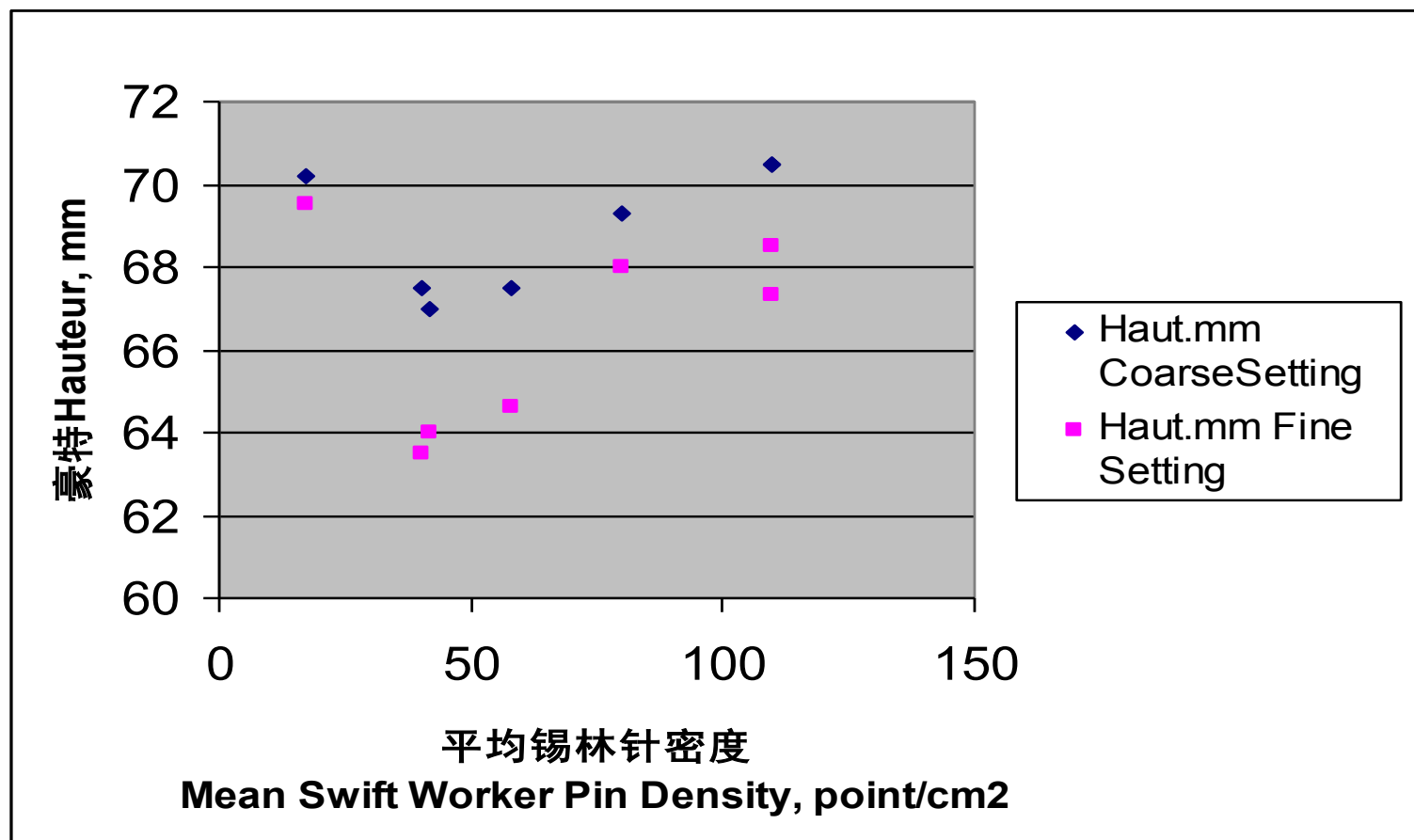
落毛与锡林针布上平均针密度的关系

Romaine & Mean Pin Density on Swift Workers



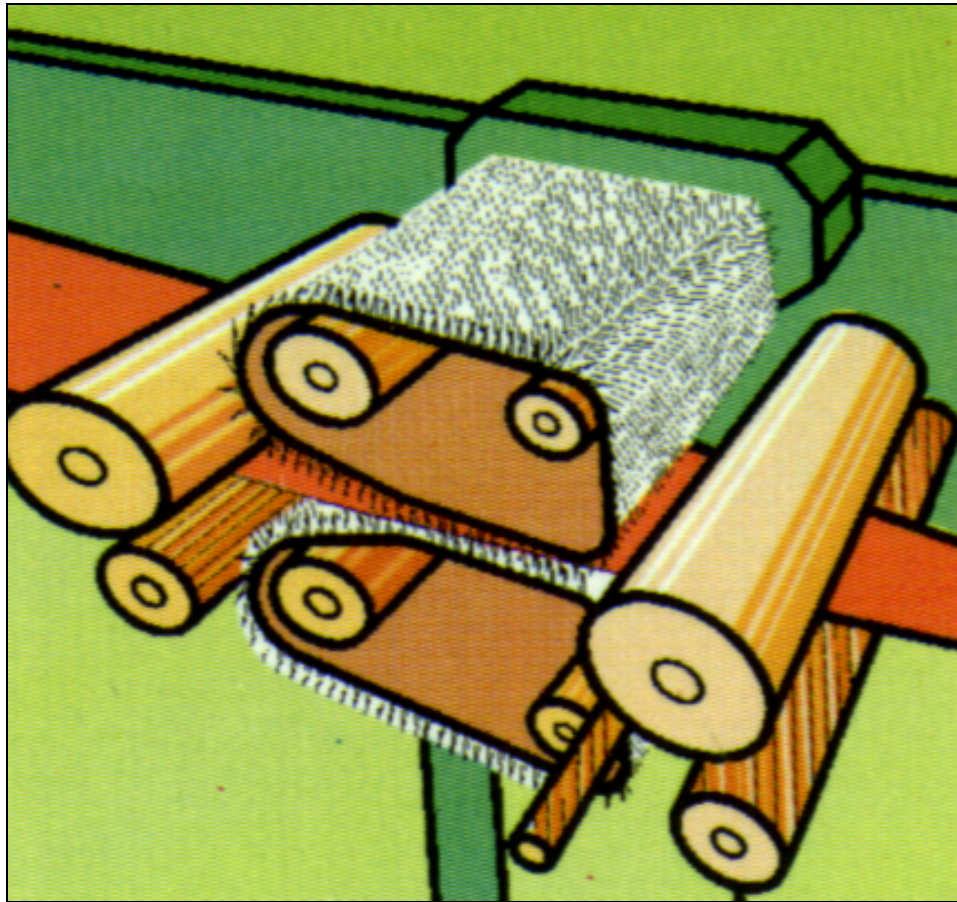
豪特与锡林针布上平均针密度的关系

Hauteur & Mean Pin Density on Swift Workers



针梳

GILLING



准备（针梳）

PREPARATION

准备的目的是.....

The objectives of preparation are to.....

- 将纤维排列成平行的形式
Align the fibres into a parallel form
- 在单位长度上获取稳定一致重量的条子
Produce a sliver with a uniform weight / unit length
- 增加纤维的混合程度
Increase fibre blending
- 尽量减少毛粒
Minimize neps

针梳

GILLING

所有针梳机的隔距设定是保证质量的关键

The setting of all gills is critical to quality

- ▶ 罗拉距离（钳口）
Ratch (nip distance) 专门为羊毛加工设定
wool specific
- ▶ 牵伸
Draft 专门为羊毛加工设定
wool specific
- ▶ 速度
Speed 纤维条件
fibre condition
- ▶ 喂入量
Feed load 专门为羊毛加工设定
wool specific

牵伸量（以及并合）是纤维合理混合的关键 – 牵伸越高越好

The amount of draft (& doublings) is critical to the proper blending of fibres – higher draft is better.

针梳准备工作

PREPARATION

牵伸是关键.....

Draft is vital for.....

- 纤维的混合
Blending
- 纤维的分布
Fibre distribution
- 将纤维弯勾部位去除
Removal of fibre hooks
- 纤维的平行拉伸
Drawing fibres parallel
- 最大程度减少毛粒
Nep Minimization

针梳中的牵伸

DRAFT LEVEL in PREPARATION

实验条件 Experimental Condition	豪特mm Hauteur, mm		落毛率% Romaine,%	
	Wool 1	Wool 2	Wool 1	Wool 2
控制批, 3道针梳 总牵伸=200 Control, 3 gills with total draft=200	67.2	67.0	5.3	5.9
高倍牵伸, 3道针梳总 牵伸=1350 High draft, 3 gills, total draft= 1350	70.6	69.7	4.7	4.9

针梳

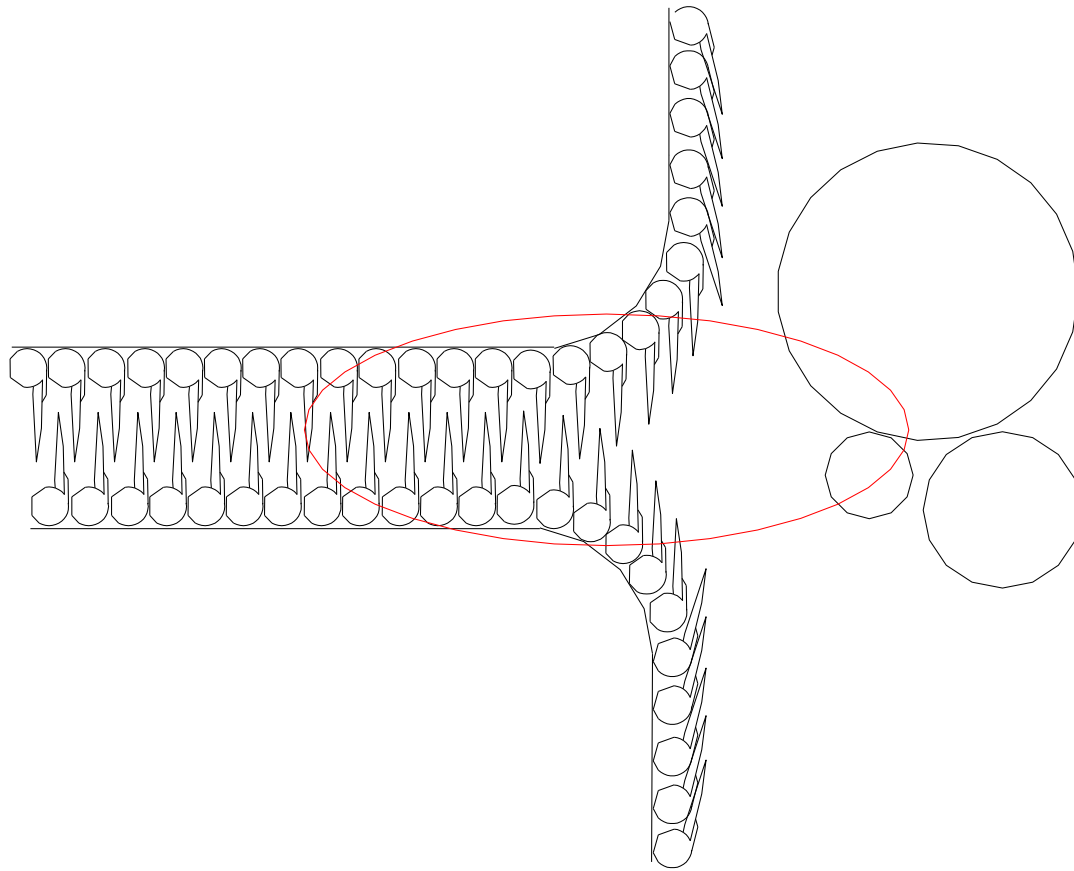
GILLING

设备的速度影响.....
Machine speed affects.....

- 生产力
Productivity
- 条干的均匀程度
Sliver evenness
- 机械磨损
Machine wear
- 纤维扯断
Fibre breakage

针梳 (牵伸区域)

GILLING (Draft Zone)



针梳 (罗拉中心隔距)

GILLING (Ratch settings)

前罗拉中心隔距 可以通过下列公式计算得出

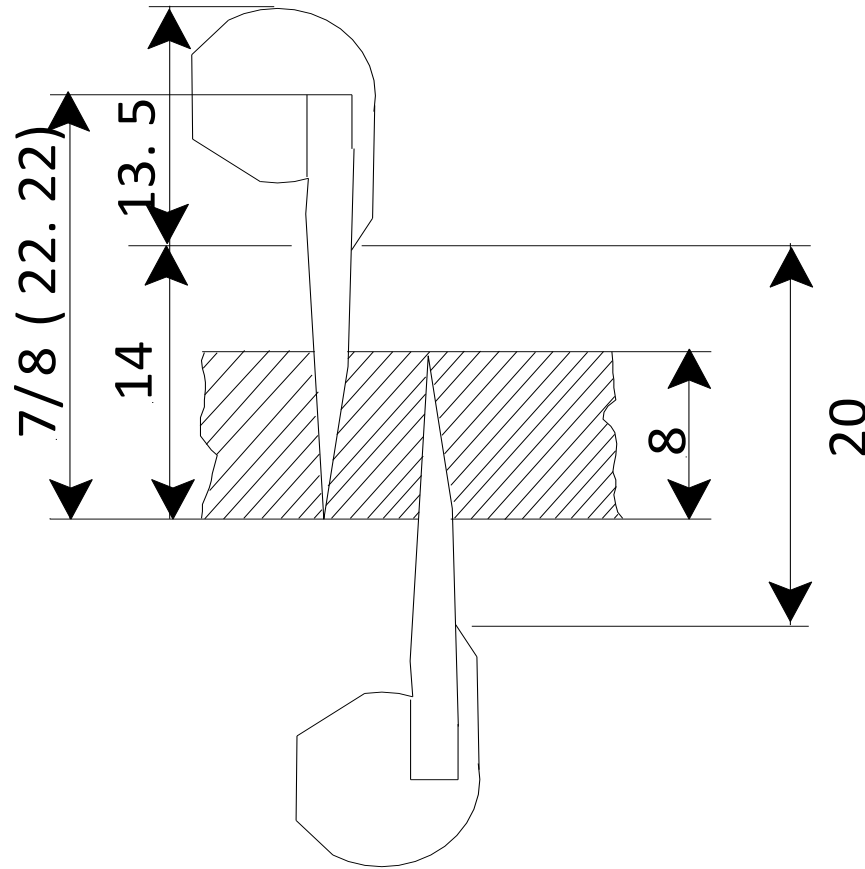
The front ratch settings can be calculated with the following formula....

$$\left[\frac{\text{Hauteur}}{2} \right] + 5 \text{ 例如 } \left[\frac{70}{2} \right] + 5 =$$

40mm

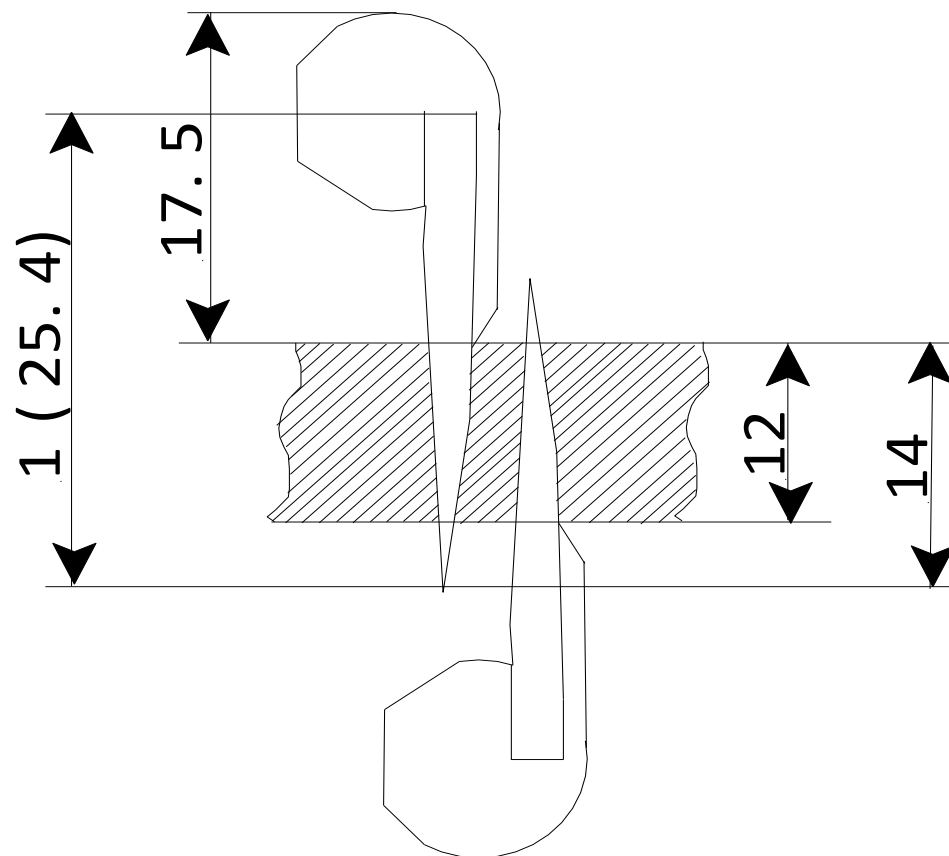
针梳 (1/3 针投影图)

GILLING (1/3 Pin projection)



针梳 (1/1针投影图)

GILLING (1/1 Pin projection)



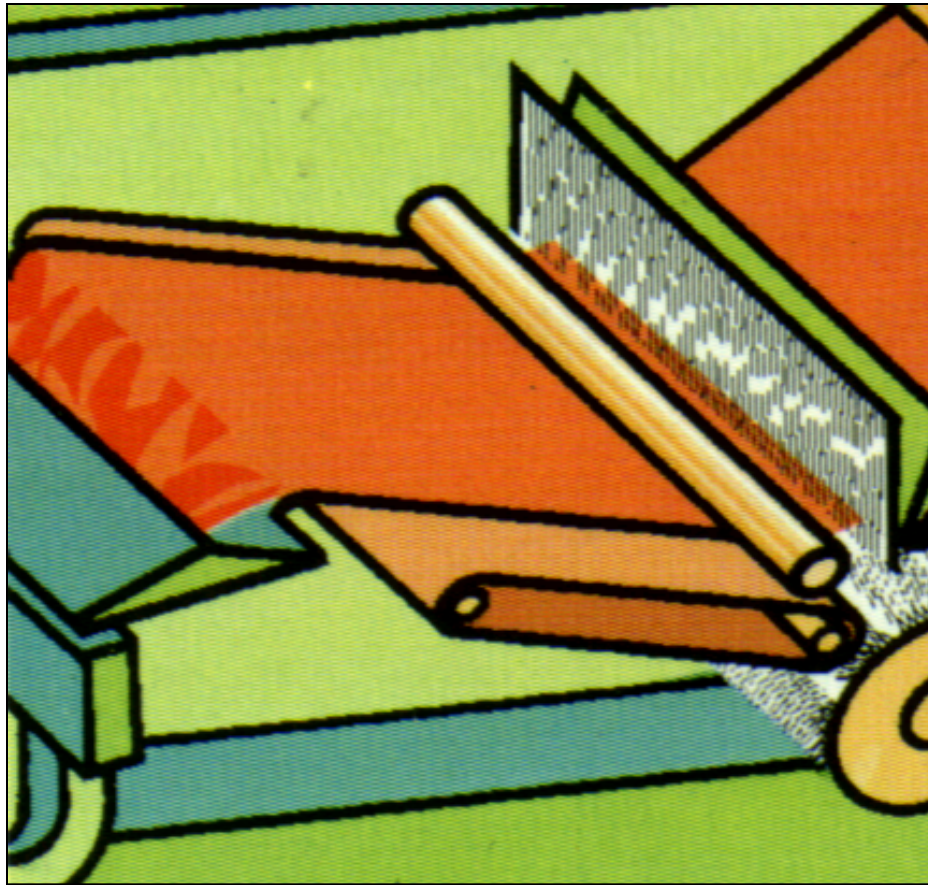
多道针梳的效果

EFFECT of MULTIPLE GILLINGS

针梳机数量 No. of Gillings	0	1	2	3	4	5	6	7
精梳落毛率 Combing Noil, (%)	14.6	12.1	10.8	10.1	9.6	9.3	9.0	8.8
100克中毛粒 的总数 Total Neps in top/100g	12	19	21	20	18	22	27	29

精梳

COMBING



精梳

COMBING

精梳的作用是.....

The functions of combing are to....

- 去除短纤维
Remove the short fibres
- 去除毛粒，粗结及残留草杂
Remove neps, slubs & remaining VM
- 把纤维排列成平行的状态并形成毛条
Arrange fibres into a parallel state & form a sliver

精梳

COMBING

在精梳前我们先应该知道.....

Before combing it is important to understand.....

- 混条的技术指标
The specifications of the input blend
- 羊毛的技术指标
The condition of the wool as input material
- 所要求的毛条技术指标
The top specifications required
- 所要求的隔距
The settings required
- 加工的操作环境
The operating conditions for the process
- 过去精梳的生产能力
The historical ability of the combs to produce to requirements

精梳 COMBING

*所有精梳隔距都是有决定作用的。
All comb settings are CRITICAL.*

*隔距将影响.....
Settings will affect.....*

- 生产速度
Production rate
- 质量
QUALITY
- 落毛率
Romaine
- 机器磨损
Machine wear

精梳喂入

FEED to COMB

- 细支羊毛（高卷曲度） → 毛球喂入而非筒式喂入
Fine Wools (hi - crimp) → ball feed NOT can feed
- **%落毛率0.5至1.0%的减少**
%Romaine savings of 0.5 to 1.0%

精梳

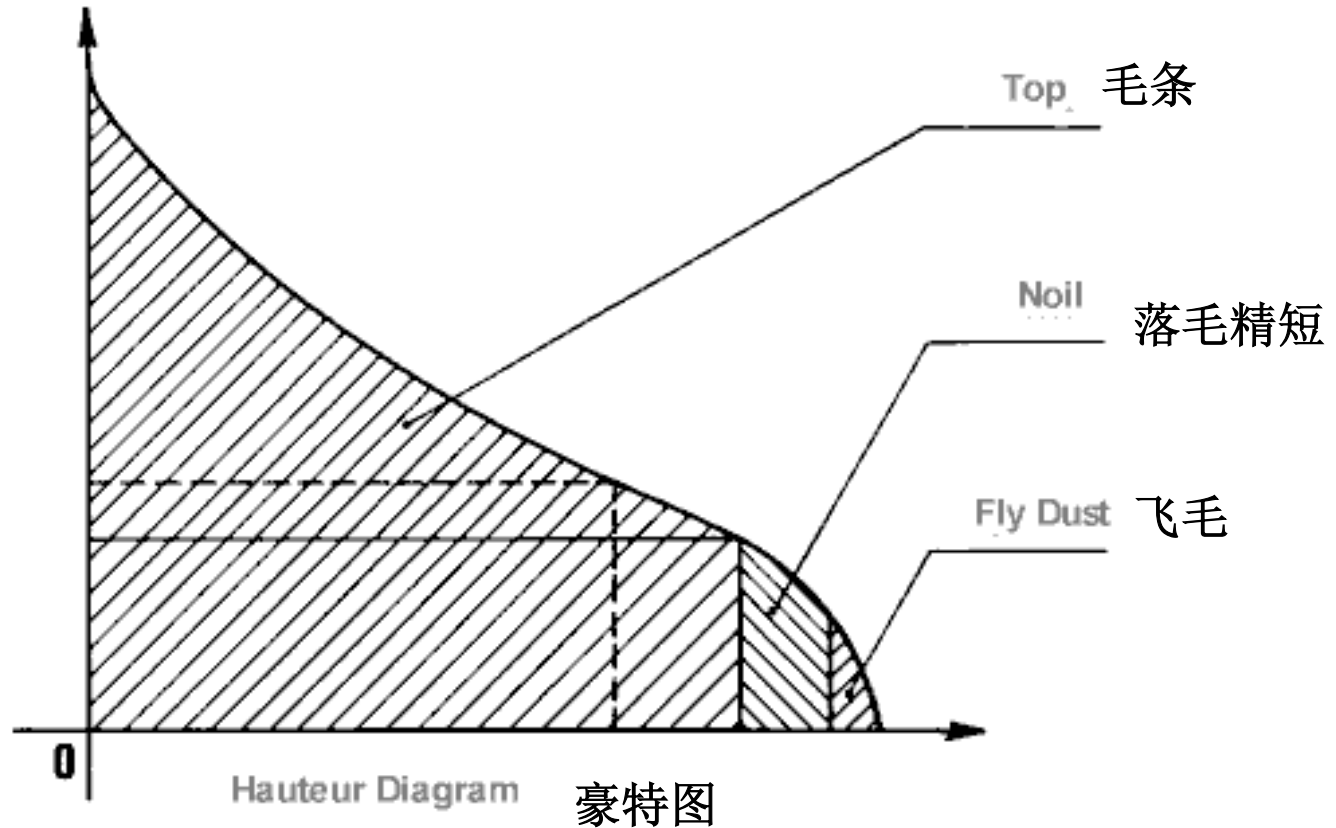
COMBING

精梳过程在隔距设置上及其相关的操作上都是非常复杂的
The comb is very complex both in it's settings and it's operation

隔距的调整只能由熟练的技师来操作
Settings should only be done by skilled technicians

精梳 (豪特图表)

COMBING (hauteur diagram)



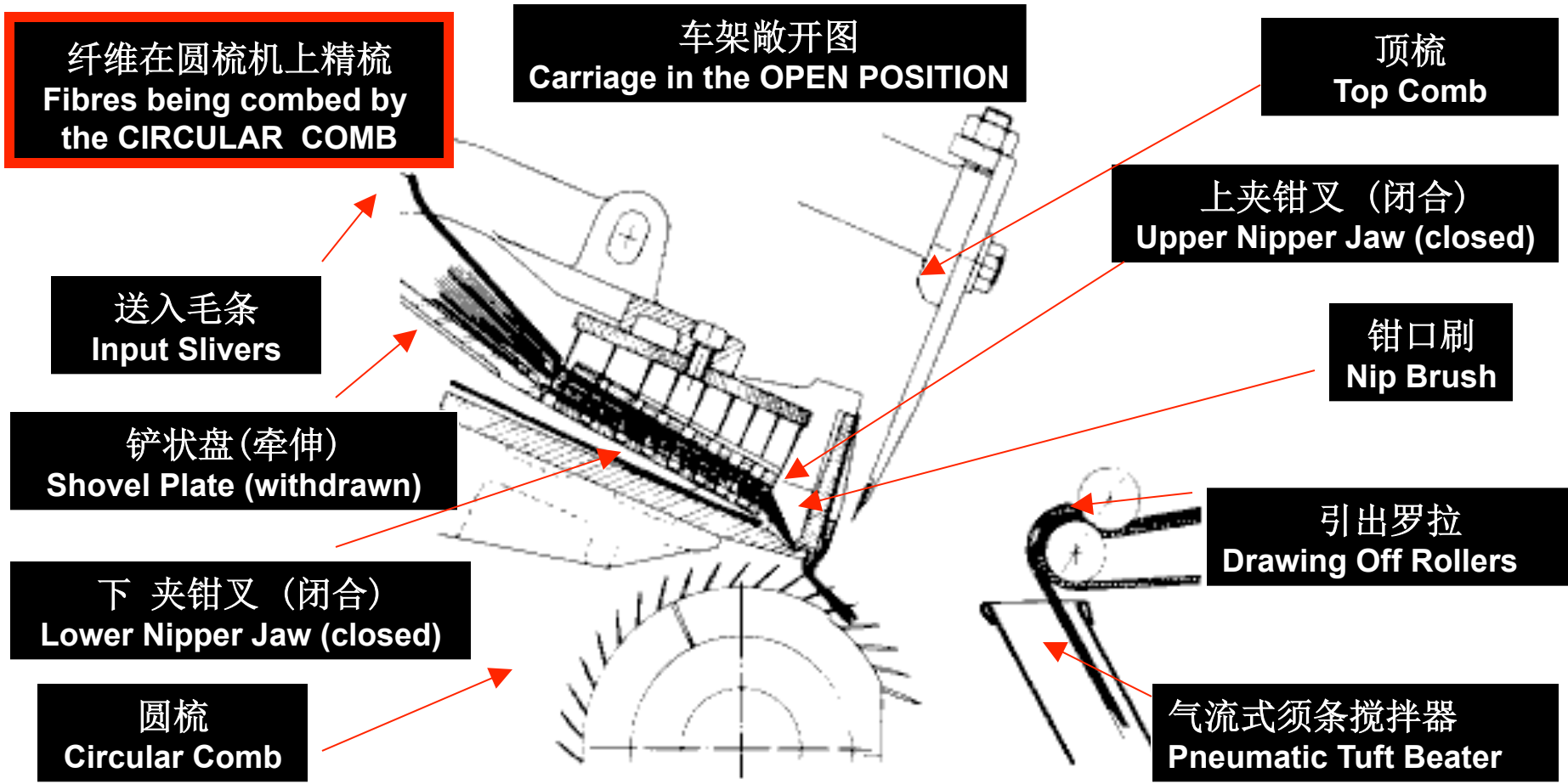
精梳 COMBING

*有两个单独的精梳区域.....
There are two separate combing actions....*

- ▶ “头部”精梳（圆梳）
Combing of the “heads” (Circular comb) and
- ▶ “尾部”精梳（顶梳精梳）
Combing of the “tails” (Top comb)

精梳 (头部精梳)

COMBING (Combing the Heads)



精梳 (尾部精梳)

COMBING (Combing the Tails)

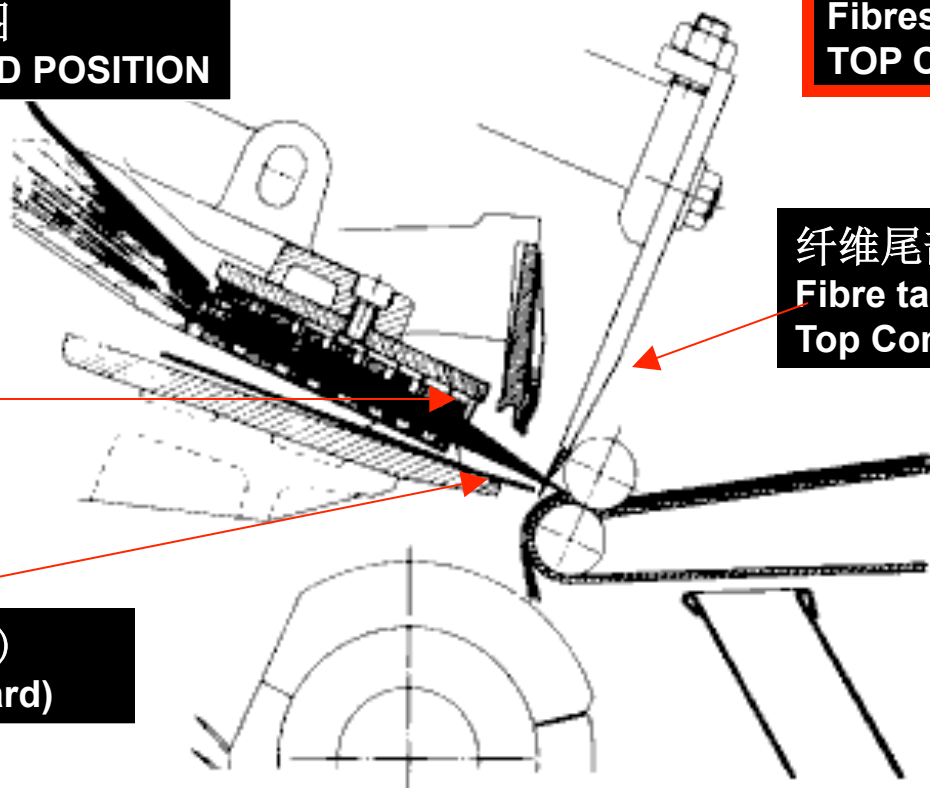
车架闭合图
Carriage in the CLOSED POSITION

纤维在毛条精梳机上精梳
Fibres being combed by the
TOP COMB

钳口叉开启
Nipper Jaws open

纤维尾部在精梳机上得到牵伸
Fibre tails being pulled through
Top Comb

铲状盘 (向前的)
Shovel Plate (forward)

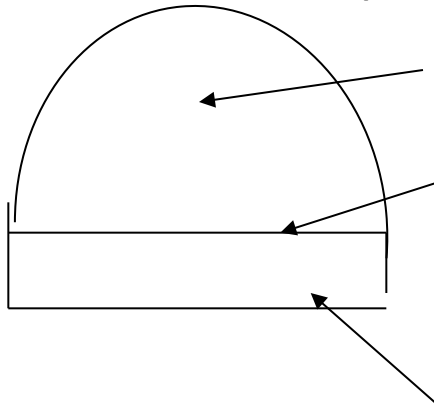


精梳过程的问题

FAULTS in COMBING

■ 毛网的清晰度

Web clarity



1.

圆梳太脏

Dirty Circ. Comb.

2.

钳口设置过窄

- Nip setting too short

3.

顶梳与牵伸罗拉空隙过大

- TC to DO cyl. Too great

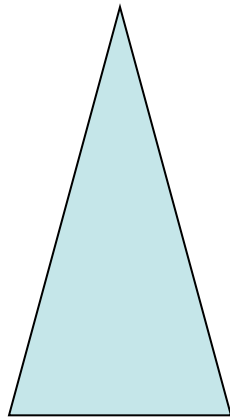
顶梳间隙过大/脏/针板损坏

TC too coarse and/or dirty/damaged teeth

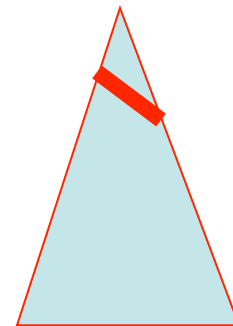
精梳过程的问题

FAULTS in COMBING

- 精梳针的寿命 / 磨损 – 各种精梳机
Pin Life/Wear – Vario Combs



- 通常**6**个月
Normal life 6months (24/7)
- 新的针口
New tooth 8%R
- 磨损之后的针口
Worn tooth 12%R



精梳过程的问题

FAULTS in COMBING

- 顶梳 – 精梳针磨损/寿命
Top Comb – Pin Wear/Life

- 对于细支羊毛或者是复精梳（**24/7**）每五周置换一次
Replace after five weeks (24/7) for fine wools and re-combing
- 对于大于**21**微米的羊毛每六周置换一次
Six weeks for > 21 micron

精梳过程的问题

FAULTS in COMBING

- 对于圆梳而言 – 每**48**小时将刷子转换一次方向
Circular Comb – turn brush every 48hrs
- 每**48**小时检查一下顶梳的刷子
Check TC brush setting every 48hrs

在精梳过程中改善条子的质量

To IMPROVE SLIVER QUALITY at COMB

- 在皮板上检查毛粒与草屑的情况
Check Nep & VM levels on Apron
- 减少喂入量
Decrease input load
- 增加喂入长度
Increase feed length
- 考虑细目的顶梳
Consider Finer TC
- 保持生产速率的稳定
Maintains production rate constant

毛条末道

TOP FINISHING

末道针梳的目的是.....

The objectives of finishing are to.....

- 保证纤维充分的混合
Ensures adequate blending of fibres
- 生产的毛条有一致统一的重量和单位长度
Produce a sliver with an even & uniform weight / unit length
- 生产的毛条有统一的规格，重量和密度
Produces a top of uniform size, weight & density
- 最后修整湿度及和毛油的成分
Final correction for moisture & oil content
- 满足顾客对最终产品的要求
The final product for the customer

毛条末道（第一末道）

TOP FINISHING (1st Finisher)

通常第一末道针梳.....

The 1st finisher normally.....

- ▶ 做最终的含潮率的调整从而可以将毛条更好的“公定”处理
Has a moisture application for final adjustments to “conditioning”
- ▶ 采用筒式输送既经济又可以将毛条方向调整
Has a can delivery for economics & sliver reversal

毛条后整理及成球

TOP FINISHING

通常第二（末道）针梳.....

The 2nd finisher normally.....

- 自调匀整器（机械的或电子的）
Has an autoleveler (mechanical or electronic)
- 成球或成筒
Can be bobbin or bump
- 有自动的转运装置
Has automatic delivery

取样及检测

SAMPLING AND TESTING

要想了解产出品的价值，取样及检测的计划至关重要！

It is vital that the Sampling & Testing Plan is reflective of the volume produced!

质量控制表格（取样与检测）

Quality control table (sampling and testing)

工艺	检测	次数	TOLLERANCE	责任归属
洗毛	湿度成分	Every 4 hours	+/-	Scour leader
	RG 成分	Every 4 hours	+/-	Lab staff
混条	湿度成分	Every 8 hours	+/-	Card Leader
	TFM	Every 8 hours	+/-	Lab staff
梳毛	湿度成分	Every 4 hours	+/-	Card leader
	草杂成分(视觉上的)	Every 4 hours	+/-	Card Leader
	毛粒成分(视觉上的)	Every 4 hours	+/-	Card Leader
	毛条重量	Every 4 hours	+/-	Card Operators
准备	毛条重量	Every 4 hours	+/-	Preparer Operators
	湿度成分	Every 4 hours	+/-	Preparer Operators
精梳	产品/ 落毛率 检测	xx combs / shift	+/- +/-	Comb Operators
	草杂成分(视觉上的)	xx combs / shift	+/-	Lab staff
	毛粒成分(视觉上的)	xx combs / shift	+/-	Lab staff
后整理	细度	Every 2500 kg	+/-	Lab staff
	豪特长度	Every 2500 kg	+/-	Lab staff
	草杂成分(视觉上的)	Every 2500 kg	+/-	Lab staff
	毛粒成分(视觉上的)	Every 2500 kg	+/-	Lab staff
	颜色	Every 2500 kg	+/-	Lab staff
	毛条重量	Every 2500 kg	+/-	Finisher Operators
	毛条重量	Every 2 hours	+/-	Finisher Operators
	毛条型号	Every 2 hours	+/-	Finisher Operators

Note

The above plan represents an example only of how such a system may be designed and operated.

The tollerances have not been filled in as the client mill must decide on their own operational standards that fit in with their business plan.

经济效益方面的影响

FINANCIAL IMPLICATIONS:

工厂 PLANT	1%落毛的减少 Reduction of 1%Romaine	工厂效率 Plant efficiency %	产品价值 Product Value USD	每年潜在的收益 Potential Gain USD/ann.
原毛至毛条 1,000 公斤/小时 Greasy to top 1,000kg/hr	+10kg/hr	80	8.00 (10.00 – 2.00)	0.67M
纵向运行 – 原毛至面料 350 公斤/小时 Vertical – greasy to fabric. 350kg/h	+3.5kg/hr	70	15.00/lin.metre (3m/kg)	1.32M