粗纺梳毛与纺纱

WOOLLEN CARDING & SPINNING

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粗纺用原料
Woollen Inputs

拉断毛条	Broken Top
牵切短毛条	Stretch Broken Top
碳化毛	Carbonised Wool
碳化精短毛	Carbonised Noils
低草杂含量的洗净毛	Low VM scoured wools
化纤	Synthetics
特殊纤维	Exotic fibres
回收纤维	Recycled Fibres

拉断毛条
Broken Top

- 质量好但是毛纤维短
  High Quality but short wools
- 通常是羔羊毛（通常是皮剪毛）
  Usually lamb's (often slipe)
- 毛条生产厂家已经梳理成条，而且精梳隔距为**25**至**30mm**，然后由罗拉牵伸机拉断并打包运输
  Carded and combed by top-maker with noil setting of 25 to 30mm then broken by roller draft and bailed for delivery
- 昂贵，但是长度好并且不含草刺和其它杂质
  Expensive but good length and free of VM and most contamination
- 技术指标包括：细度，豪特长度，长度离散
  Specifications cover: micron, Hauteur, CV_H

牵切短毛条
Stretch Broken Top

- 精纺用的毛条牵切成要求的长度
  Worsted tops stretch-broken to required length
- 非常的昂贵，但是长度好，不含草刺和其它杂质，短纤维含量低并且几乎不存在长纤维
  Very expensive but good length and free of VM and most contamination, low short fibre content, guarantee zero long fibre content
- 毛条可以在被牵切之前进行染色处理
  tops may have been dyed before breaking

碳化毛
Carbonised Wool

- 原料范围：
  Range of input qualities:

高草杂的套毛	high VM Fleece wools
精短毛	Noils
腹部毛	Bellies
边坎毛	Pieces
二剪毛	Second cuts
粪污毛	Dags

碳化加工 - 黑色艺术
The Carbonising Process (a black art)

- 主观选毛 Inputs *subjectively* chosen to meet specs
- 混毛 Blending
- 洗毛 Scouring
- 硫化 acidification (Conc. Sulphuric)
- 烘干处理 Baking: cellulosic material “carbonised”
- 结块粉碎 Crushing, dusting
- 中和处理 neutralising
- 漂白处理 bleaching
- 烘干处理 drying
- 检测：草刺 testing: count VM
- 打包 baling

注：碳化毛在销售的时候一般只保证细度。而其它参数则只参考样品。所谓的“保证”只是保证大货与样品的基本一致。
NB: often only micron is guaranteed, most carbo types sold by sample, “guarantee” is that lot is like sample

粗纺用原料
Woollen Inputs

- 化纤
  Synthetics
  - 尼龙
    Nylon
  - 腈纶
    Acrylic
  - 丙纶
    Polypropylene

  增强生产效率及产品的性
  Enhance production efficiency & product performance

- 其它纤维
  Exotics
  - 山羊绒
    Cashmere
  - 安哥拉兔毛
    Angora
  - 马海毛
    Mohair
  - 羊驼毛
    Alpaca

粗梳纤维的技术指标
Fibre Specification For Carding Wools

- 纤维细度，纤维长度（毛丛）
  Fibre micron, “fibre length” (of staples)
- 到目前为止对于粗纺使用羊毛的性能而言并不能够通过如同精纺中的**TEAM**公式或**TOPSPEC**的技术对加工与产品的性能进行预测
  Currently no good measure of carding wool properties available to predict their processing and product performance in the way that the TEAM formula or TOPSPEC can.
- 对短毛条的技术指标定义仍参见对精纺毛条的技术要求
  Open & Broken Top specified like Worsted Tops

粗梳纤维的技术指标
Fibre Specification For Carding Wools

- 梳毛之后的长度（**LAC**）
  Length After Carding (LAC)
  - 由**CSIRO**与其它机构共同开发。目前正由**AWTA**向国际毛纺织组织申请技术鉴定并得到国际标准的认可
    Developed by CSIRO and others, now being pushed by AWTA for IWTO approval
  - **LAC**的原理是将羊毛在“标准梳毛机”上进行梳理，三级针梳然后通过**Almeter**进行检测
    LAC: samples carded on “standard” card, 3 passages of back draft gill then Almeter.
  - 许多加工厂家对这个技术持怀疑态度
    Most processors suspicious of its merits.
  - 粗梳用毛质量差异大，所以取样工作至关重要
    Carding Wools highly variable: good sampling techniques are essential

粗梳纤维的技术指标
Fibre Specification For Carding Wools

- 赛罗强力仪可以对束纤维的强力进行检测
  Sirolan Tensor can provide measure of fibre bundle strength.
  - 可能与梳毛效能相关
    May correlate with performance in carding
  - 可以对由于碳化或染色对纤维破坏的程度进行检测
    May be measure of damage caused in carbonising or dyeing
  - 有关的科研项目仍在继续进行
    Research is on-going

散毛染色
Loose Stock Dyeing

- 在大染缸内进行 — Conducted in large Vats
  - 损伤纤维 — damages fibre
  - 纤维缠绕严重 — sets fibre in an entangled state:
  - 梳毛时纤维易被拉断 — causes fibre breakage in carding
  - 只能用此法进行纤维混色 — provides colour blends that are only obtainable in this way
- 添加的辅料 — Addition of auxiliaries
  - 防定型降剂 — Anti-Setting Agents (ASA's)
  - 赛罗**LTD:**可进行低温染色 — Sirolan LTD: allows lower temperatures to be used:

和毛
BLENDING

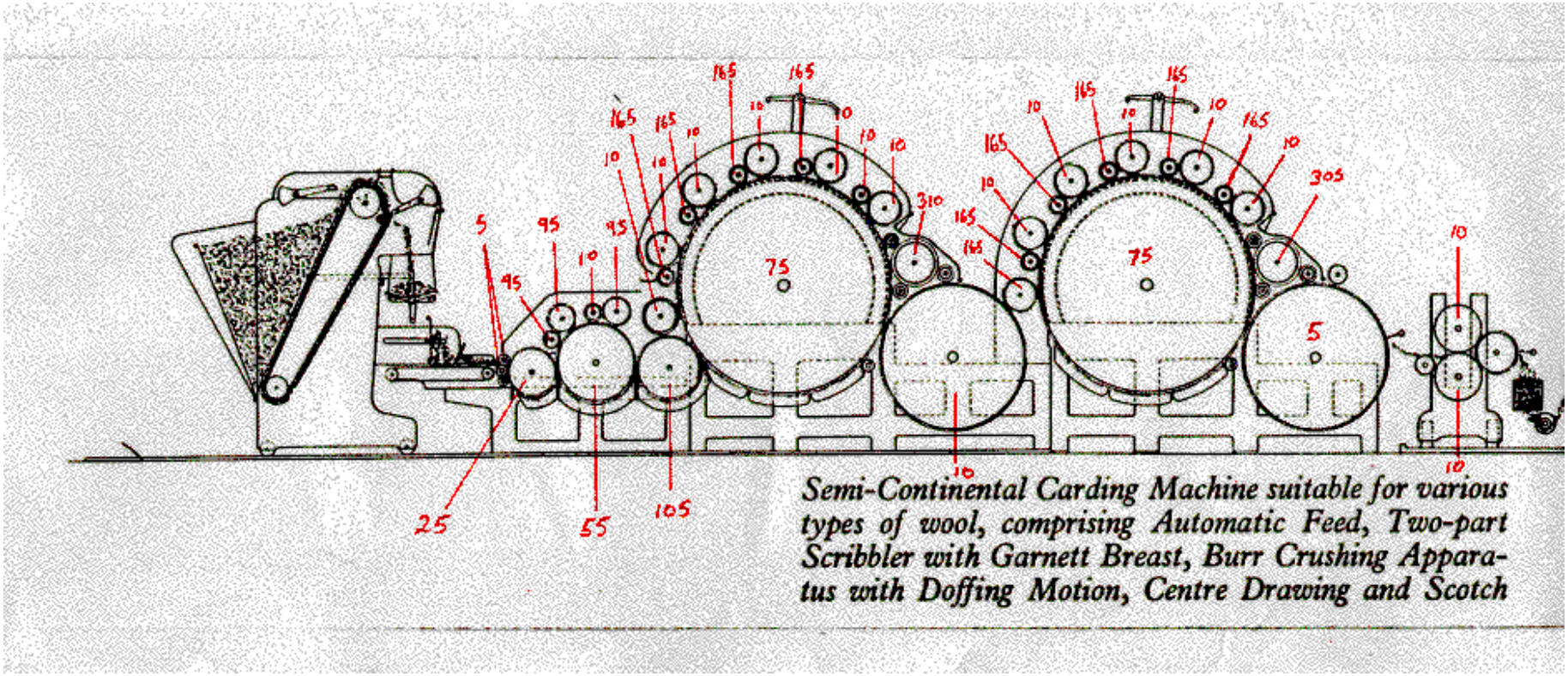
- 使产品中的各混料成分分布均匀
  Provides large scale uniformity of Product:
  - 颜色：对于粗纺而言，可能会出现多种颜色混在一起的情况
    Colour: many different colours may be used in woollen blends
  - 纤维：许多不同种类的纤维一起使用
    Fibre: many different *types* may be used
  - 和毛油：多达**10%**用于粗梳
    Lubrication: up to 10% oil is used on Woollens
    - 由于大量短纤维的存在，为了使纤维附着在梳毛机上，则必须添加一定数量的和毛油与粘合剂以提高制成率
      High short fibre content common, oil and adhesion aids keep fibre on the card: improves yield

梳毛的目的
The Purpose of Carding

- 开松并使纤维成单根状态
  Opening & Individualisation of Fibres
- 连续对纤维进行混合
  Intimate Blending of Fibres
- 平行排列纤维
  Parallelisation of Fibres
- 型成均匀的毛网
  Formation of a uniform web
- 形成粗纺纱线以便进一步纺纱
  Division into “Slubbings” for Spinning

粗梳毛机

The Woollen Carding Machine

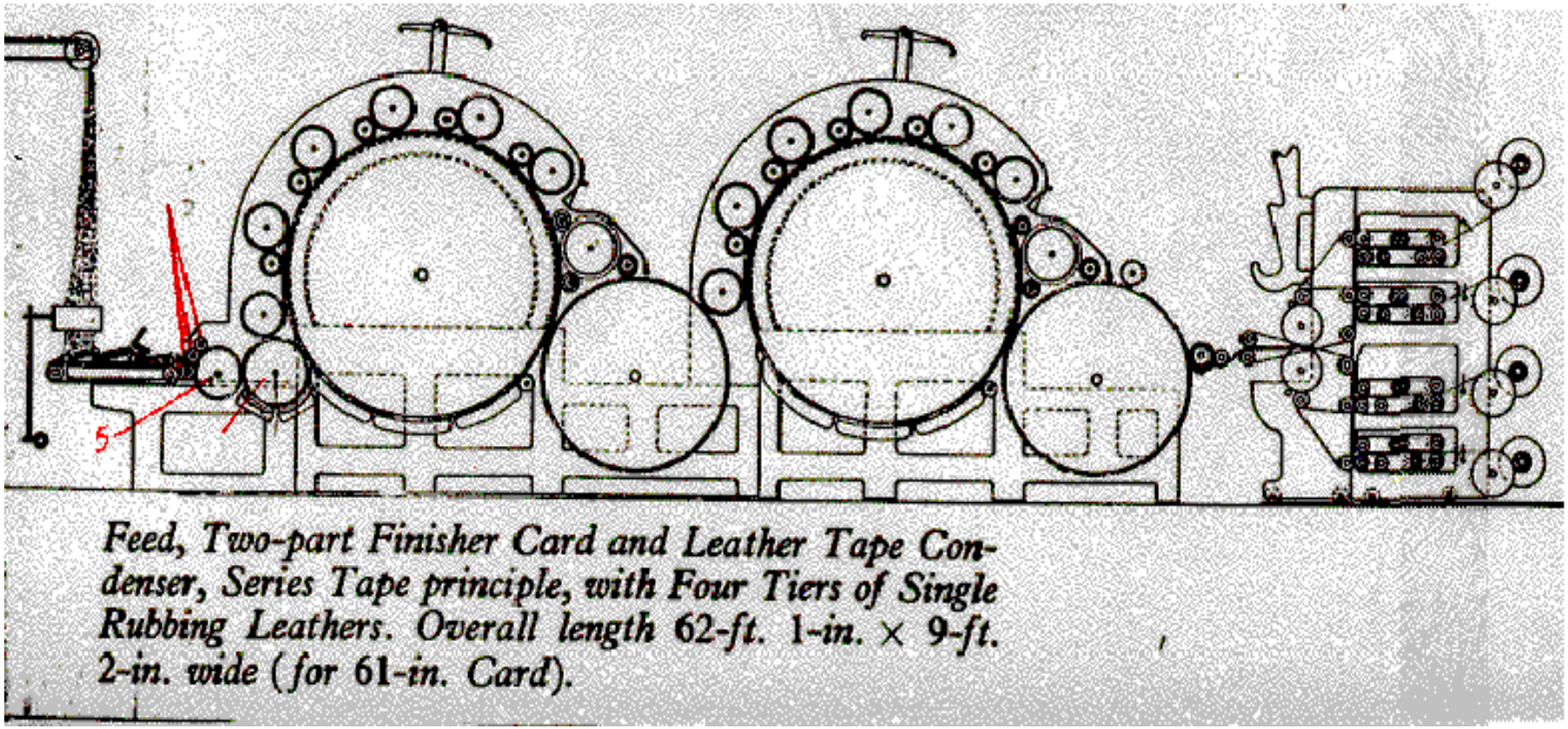


（预梳）The Scribbler Section

粗梳毛机采用弹性针布以便得到比精纺梳毛机更高的梳针密度

Woollen cards use flexible “fillet” wire to get higher point density than worsted cards

粗梳梳毛机
The Woollen Carding Machine



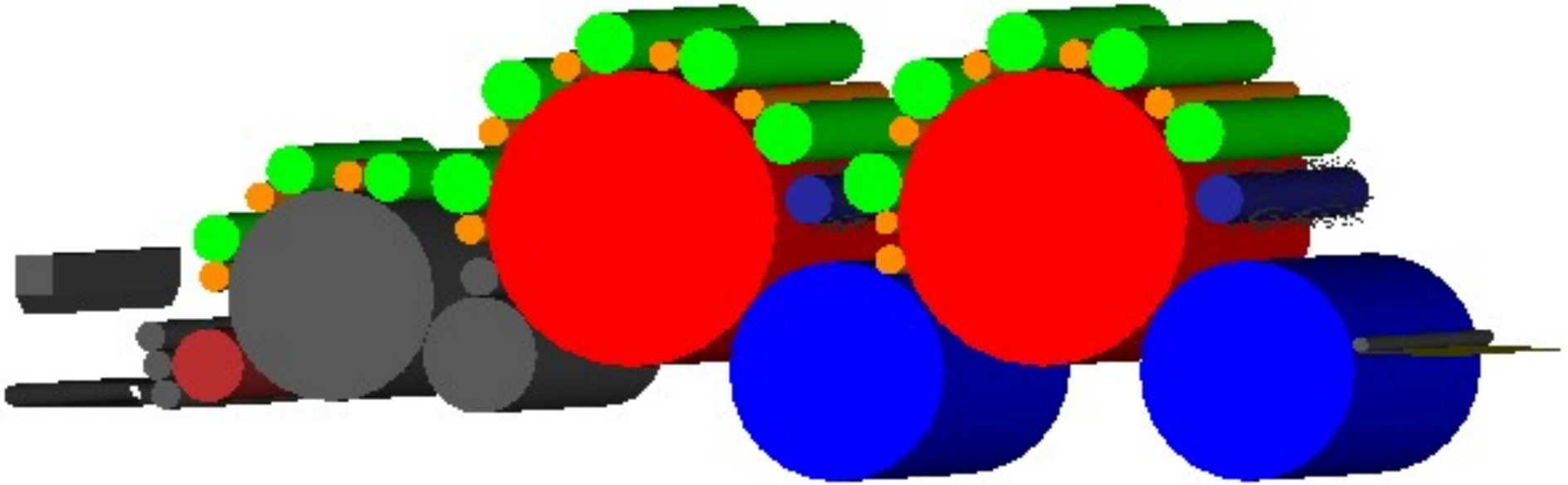
Feed, Two-part Finisher Card and Leather Tape Condenser, Series Tape principle, with Four Tiers of Single Rubbing Leathers. Overall length 62-ft. 1-in. × 9-ft. 2-in. wide (for 61-in. Card).

末梳

The Finisher Section

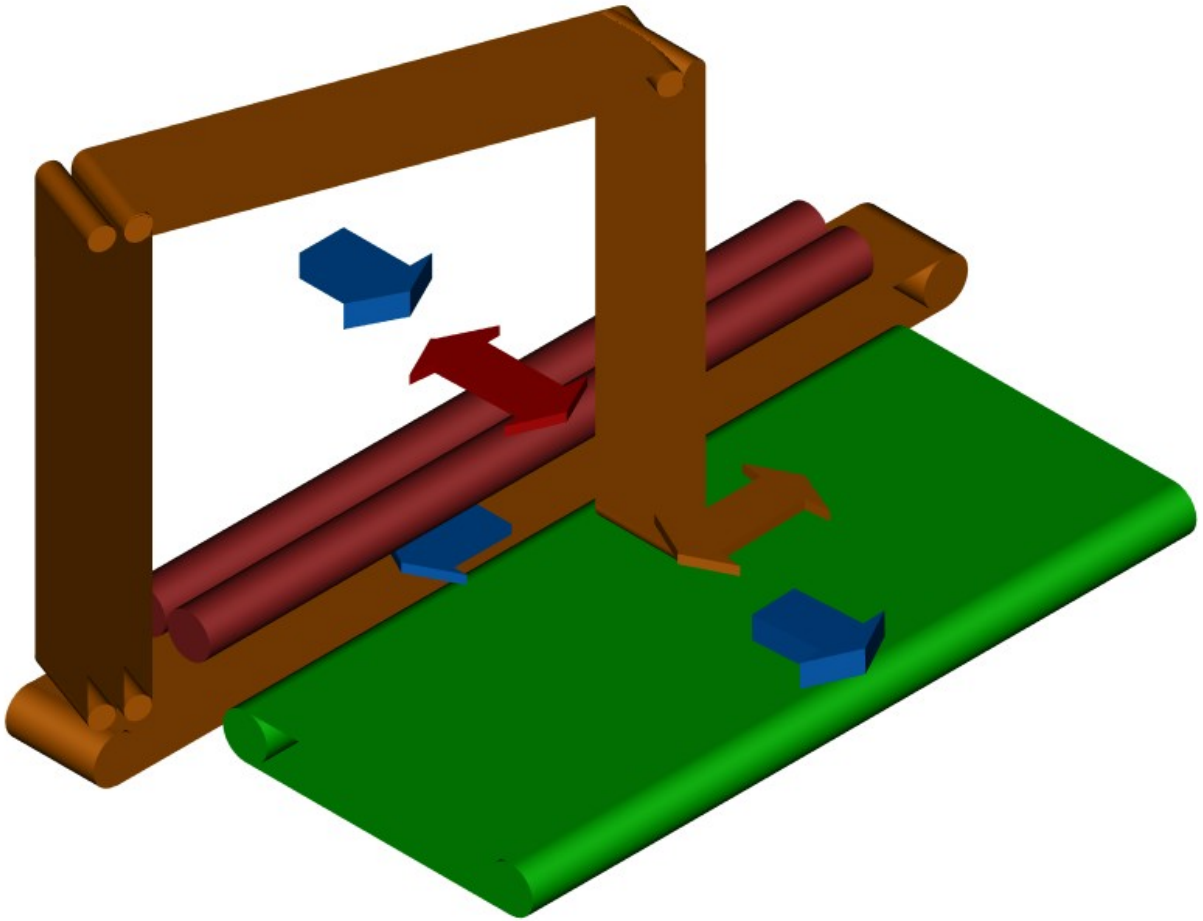
粗梳毛机 – 预梳机部件

The Woollen Carding Machine (Woolen Card – Fore Part)



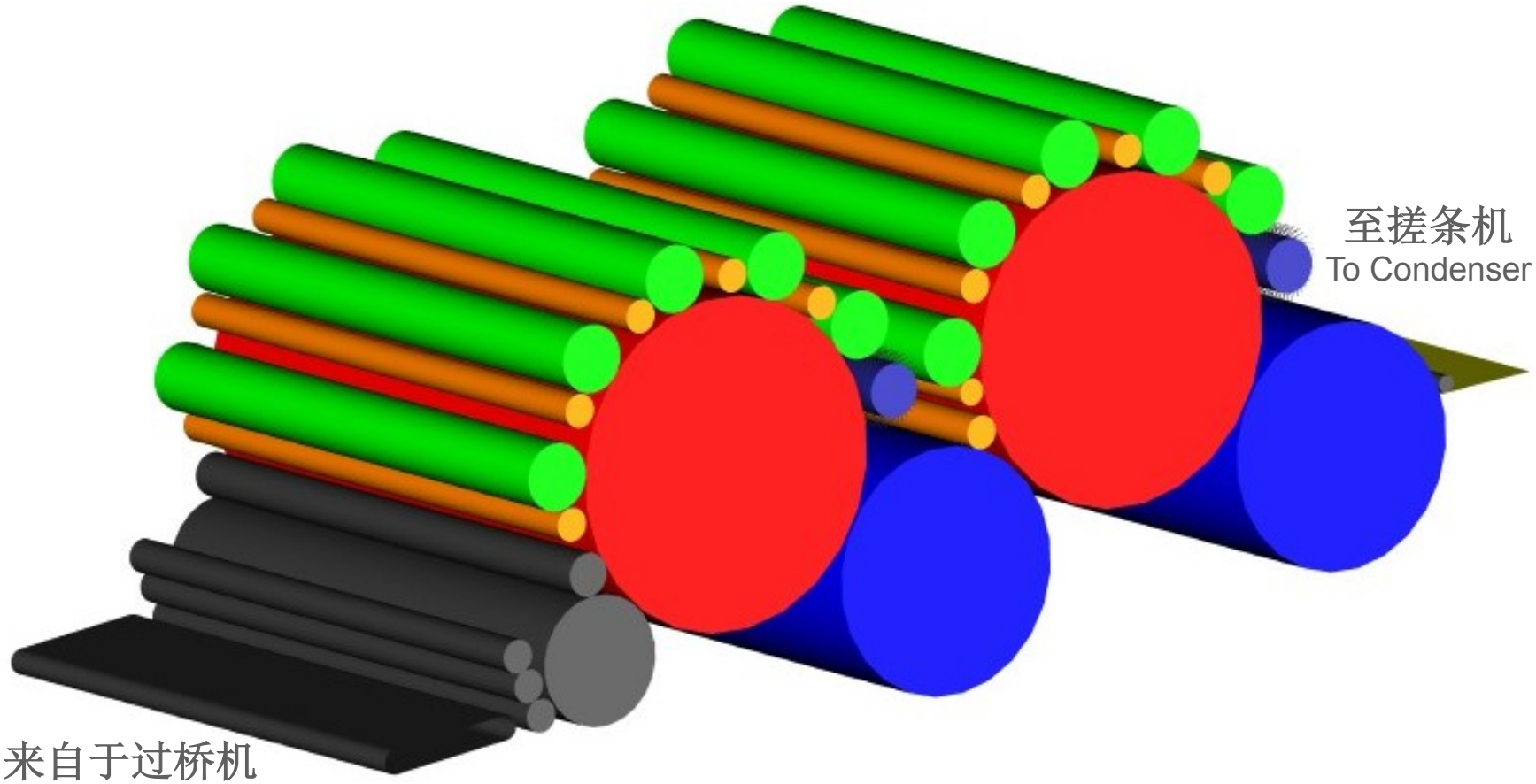
粗梳毛机 – 过桥机

The Woollen Carding Machine (Woollen Card Intermediate)



粗梳梳毛机 – 末梳机

The Woollen Carding Machine Woollen Card Finisher Section

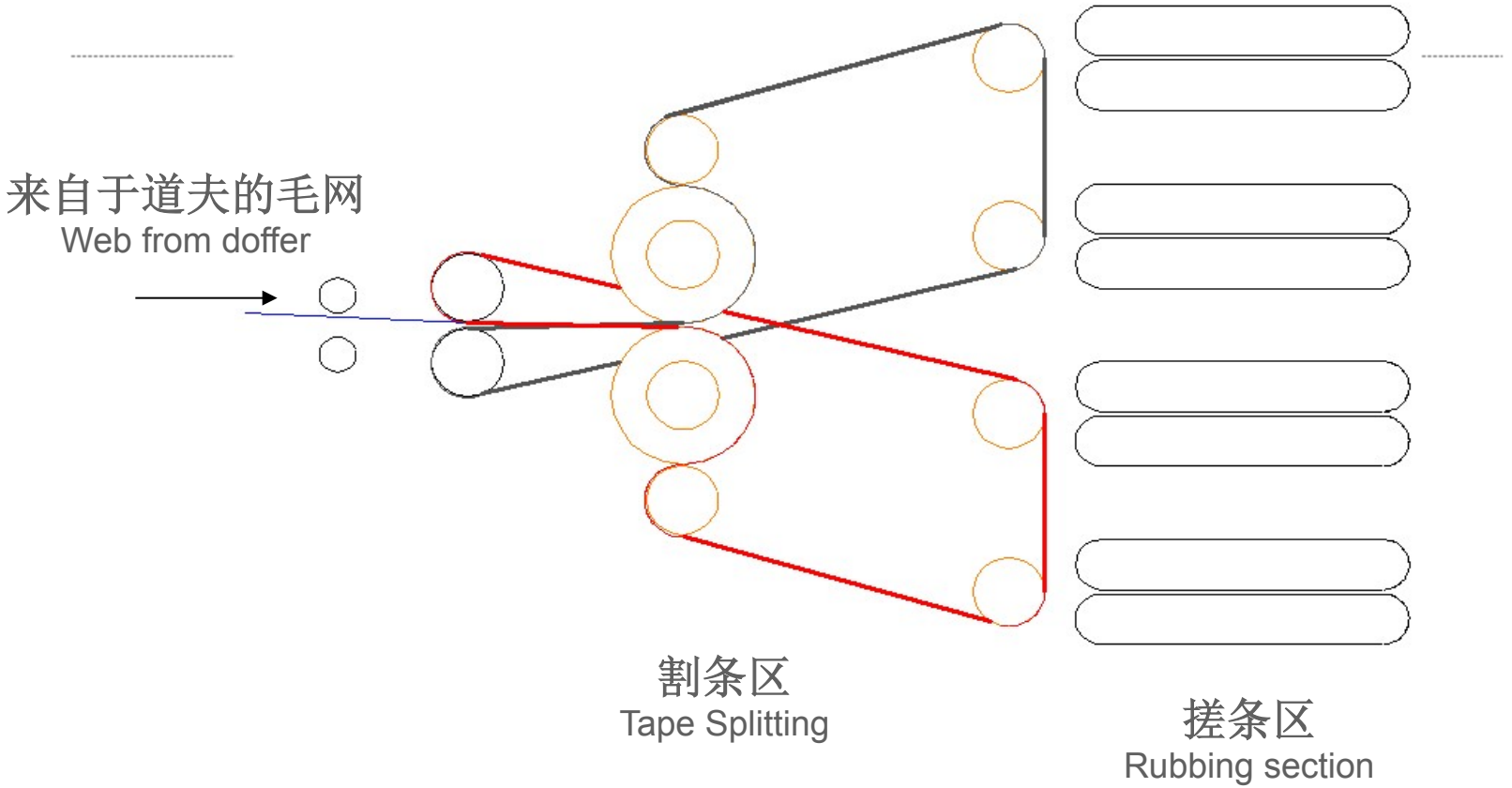


粗梳梳毛机 – 搓条机

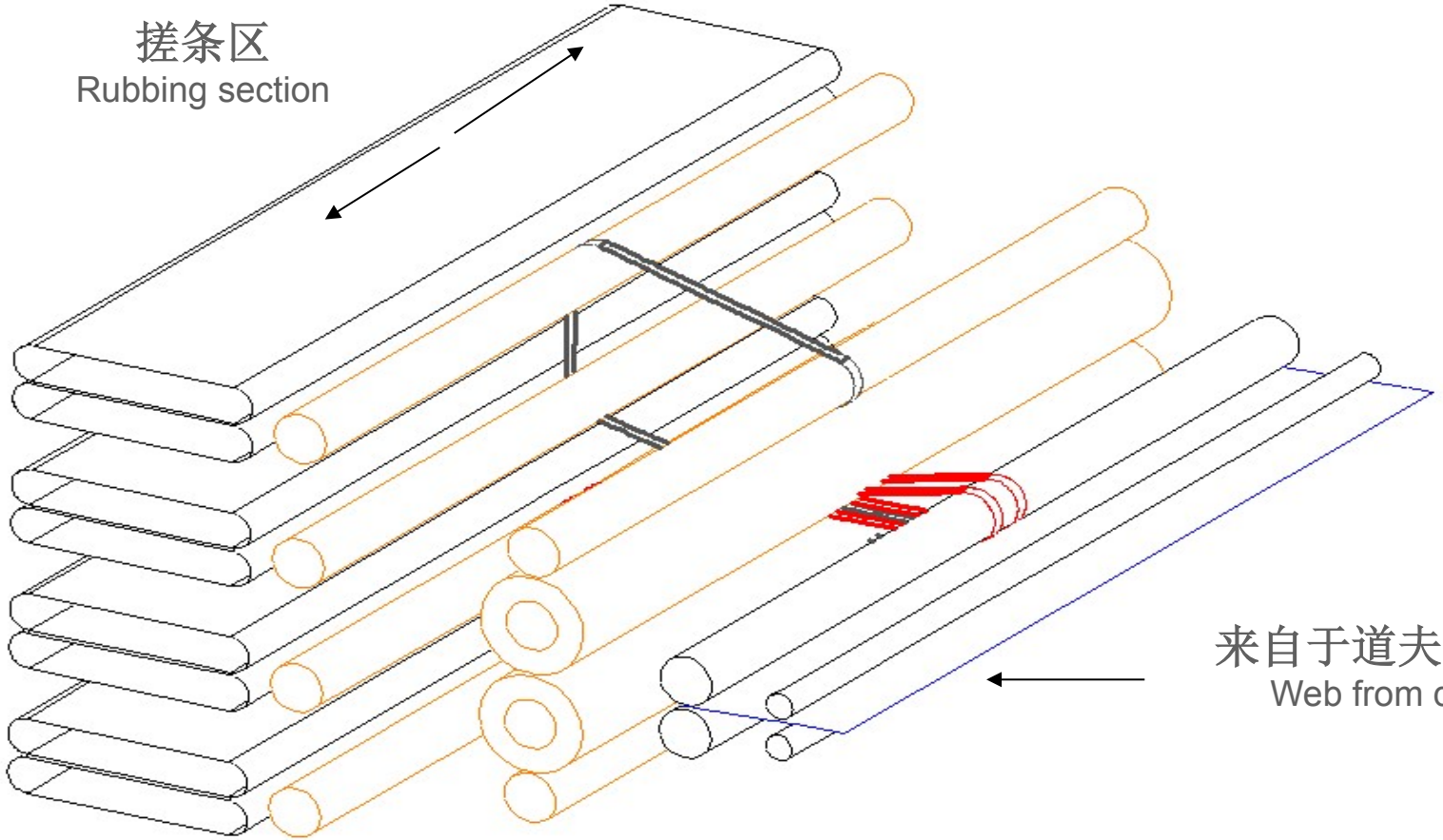
The Woollen Carding Machine – (Woollen Card Condenser)

Octir Woollen Card

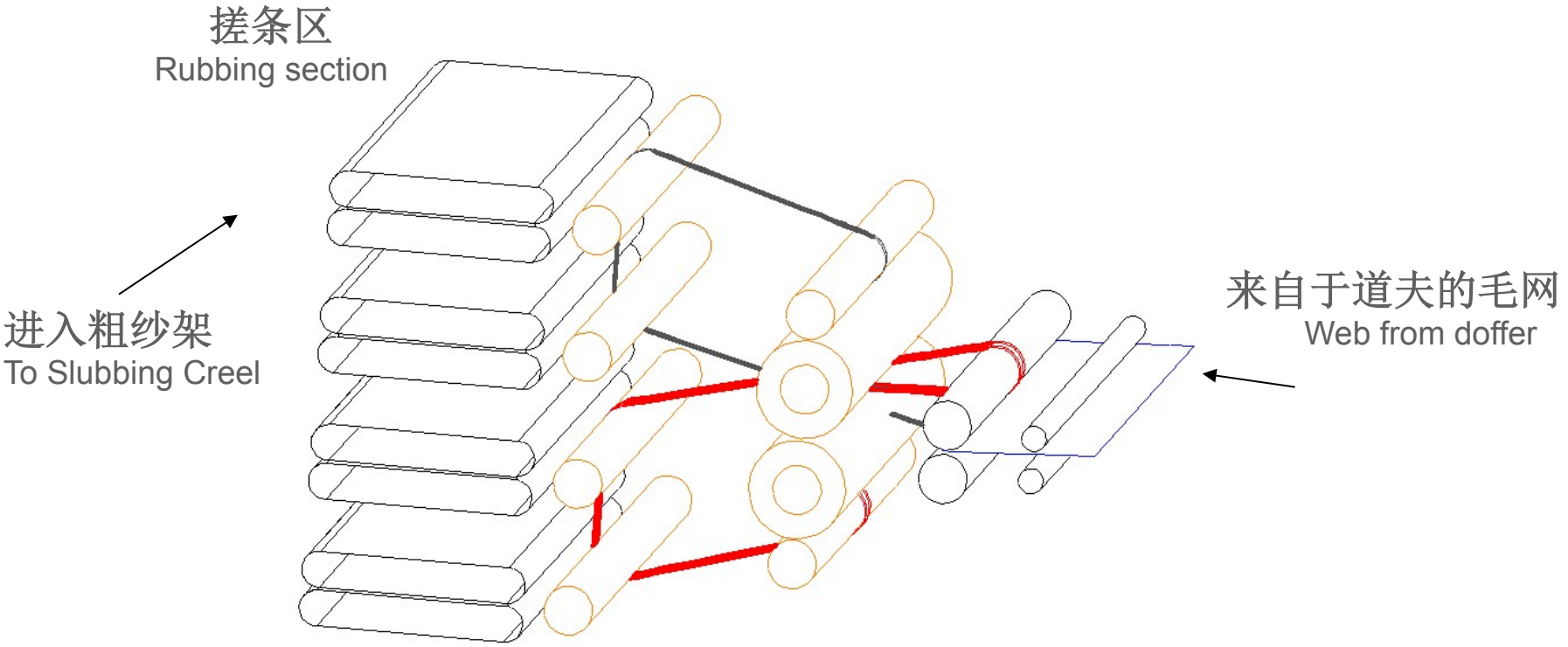
粗梳毛机搓条机示意图
Woollen Card Condenser



粗梳毛机搓条机示意图
Woollen Card Condenser

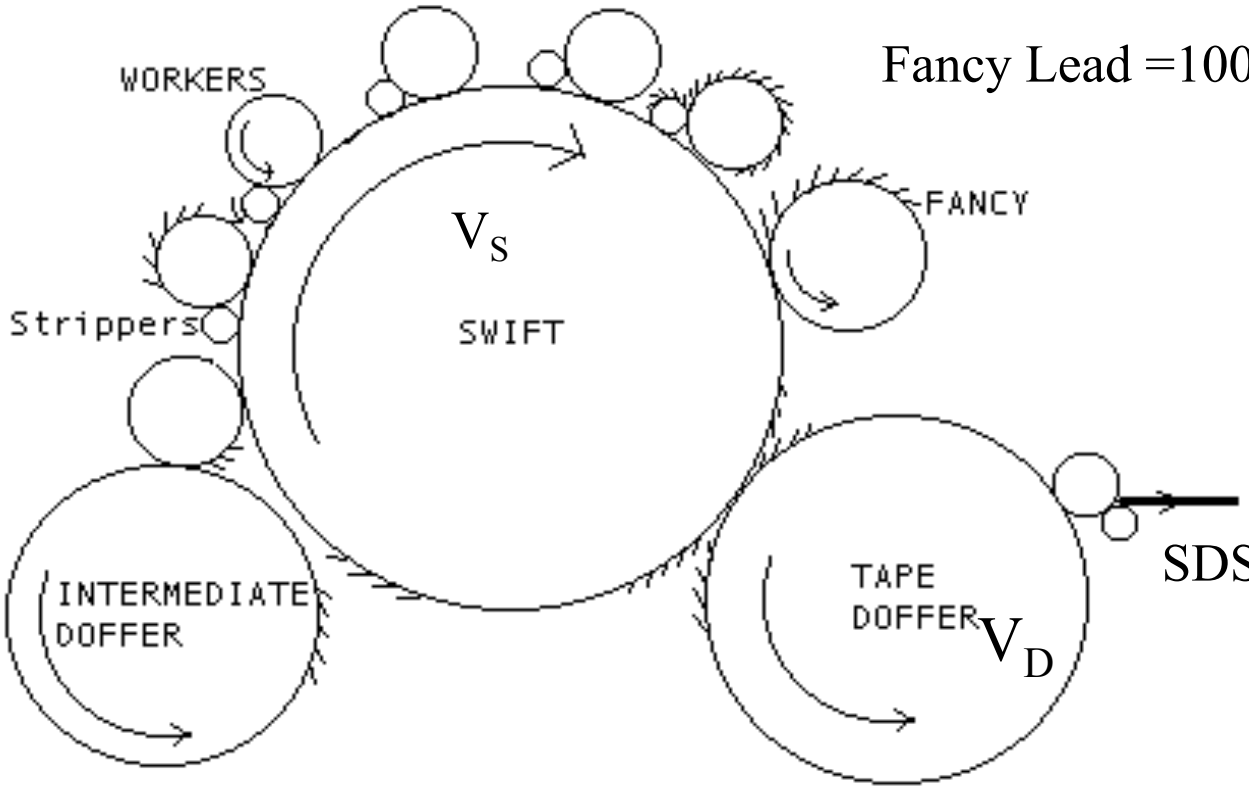


粗梳毛机搓条机示意图
Woollen Card Condenser



粗梳机图示

The Woollen Carding Machine



Fancy Lead $=100\% * (V_F - V_S)/V_S$

$SDSR = V_S / V_D$

锡林与道夫之间的速比以及风轮的起出作用决定运送效率和纤维的返回负荷

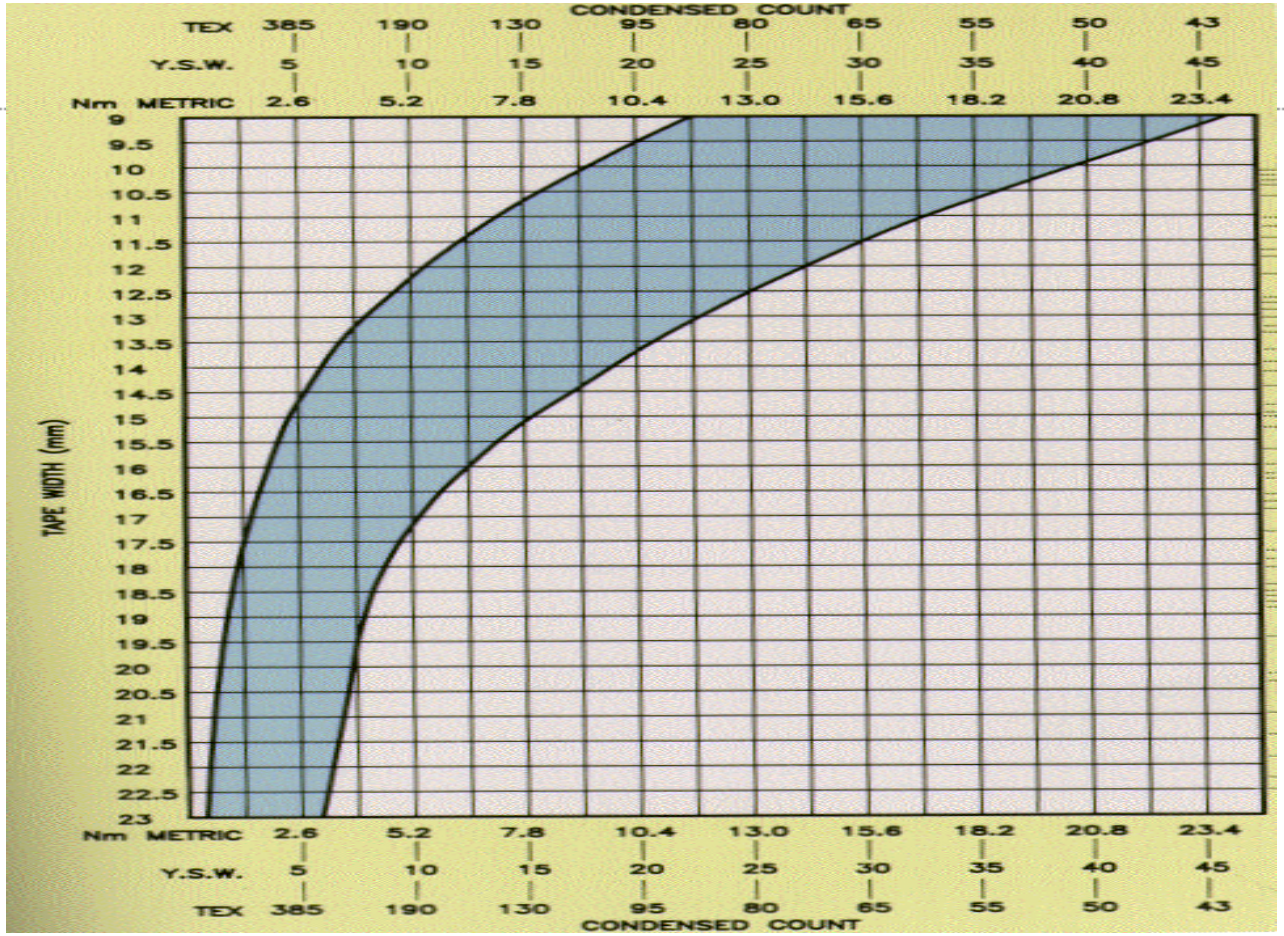
The Swift-to-Doffer-Speed-Ratio and the Fancy Lead determine Transfer Efficiency and hence the degree of fibre recycling.

粗纺梳毛
Woollen Carding

主要的参数：
Important Parameters:

- 纤维细度
  Fibre micron
  - 纱线中纤维的数量越多则纱线越均匀
    The more fibres in the yarn the more even it is
  - 梳毛机的针布限制了纤维细度的范围
    card wire limits micron range
  - 纱线支数取决于纤维的细度　**>90**纤维
    yarn count dictated by micron >90 fibres
  - 割条皮带的宽度也影响支数的范围
    tape width also limits range of counts available

割条皮带的宽度与纱线支数的关系
Condenser Tape Width v. Yarn Count



Courtesy Tatham UK

粗纺梳毛
Woollen Carding

主要的参数：
Important Parameters:

- 纤维的长度与强度
  Fibre Length & Strength
  - 纤维长度越长越好
    The Longer the fibres the better
  - 强力好的纤维保证长度→ 更好的纱线
    Stronger fibres maintain Length → better yarns
  - 添加少量的化纤可以有效地提高效益
    Small Quantity of Synthetic fibre can improve performance dramatically

粗纺梳毛
Woollen Carding

- 通常的情况下，纤维喂入量低则会形成更好的毛网→更好的纱线
  Generally, the lower the fibre loading the better the web evenness → better yarn

- 强力越低或越短的纤维则
  The weaker or shorter the fibres:
  - 必须降低喂入量
    the lower the loading must be
  - 将最大生产量调低
    the lower the maximum production rate

粗纺梳毛
Woollen Carding

主要的参数：
Important Parameters:

- 梳毛机的针布与配置限制了纤维的投入
  Card Clothing and configuration limits the range of fibre inputs
- 通常，梳毛机上纤维的数量保持不变：细纤维=低量喂入=低速
  Roughly, fibre number is kept constant on the card: finer fibres = lower kgs loading = lower speed
- 粗支数：可以实现快速生产
  Coarser counts: faster delivery possible
- 在工业操作中锡林的转速不应该超过**450m/min**
  Industrially, Swifts are not run faster than 450m/min.
- 输送速度范围**15m/min**（细支） **50m/min**（地毯）
  Delivery ranges from 15m/min (fine counts) to 50m/min (carpets)

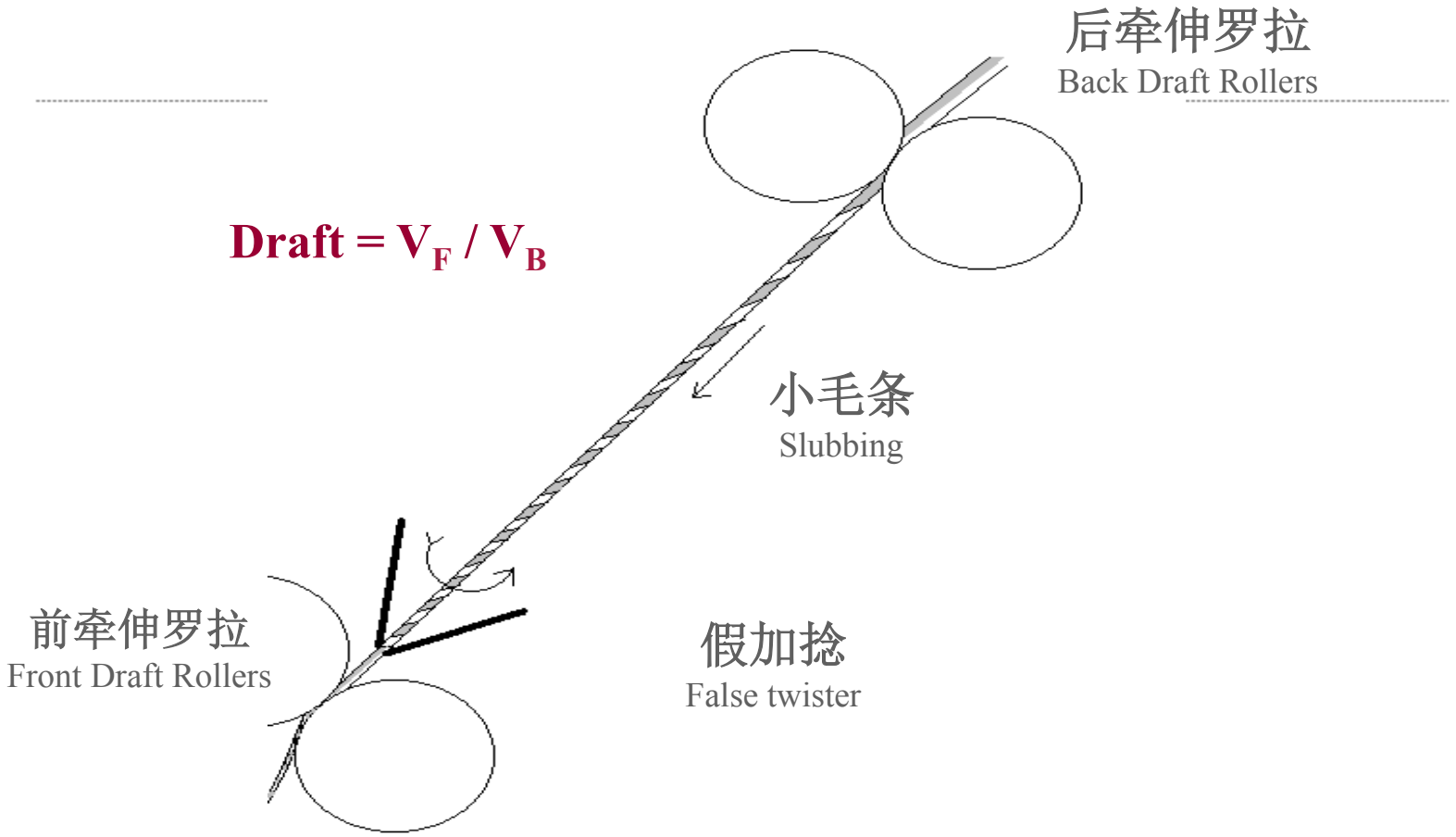
粗纺特点
Woollen Character

- 纱线结构：
  Yarn Structure:
  - 缠绕、纤维圈以及绒面是“粗纺产品的特点”
    entangled, fibre loops & surface hairs provide “Woollen Character”
  - 具有厚实的手感
    Gives BULK and HANDLE
  - 面料一般经过了缩绒与起毛
    Fabrics Often Milled & Raised
  - 与精纺相比，粗纺中纤维对纱线强力的影响不大
    fewer fibres contribute to the yarn strength compared to Worsted Yarns
  - 更多的纱线截面纤维根数：**>100**
    Many more fibres required in cross-section: usually >100

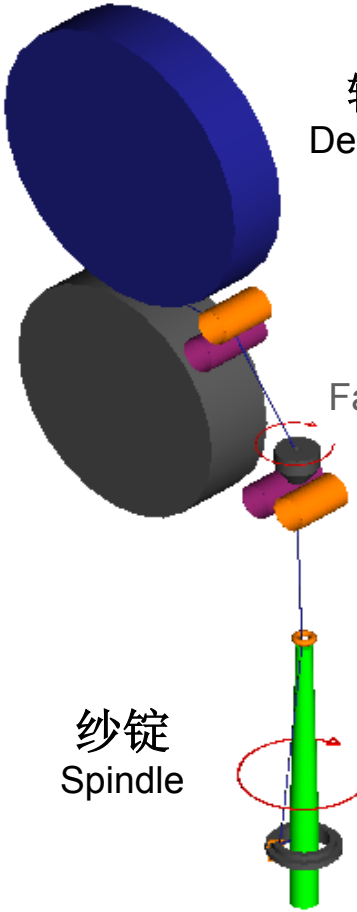
粗纺纺纱
Woollen Spinning

- 梳毛机产出“小毛条”（粗沙）
  Card Produces “Slubbings” [rovings]
- 小毛条在牵伸过程中在纺纱摇架形成“假”捻然后再进行“真”加捻并形成纱线
  Slubbings drafted against “false” twist on Spinning Frame or Mule and “real” twist inserted to form a yarn
- 在粗纺纺纱中牵伸的倍数一般在**1.3** 至**1.5** 。在走锭纺上则稍为高一些
  Maximum draft in Woollen Spinning is about 1.3 to, slightly higher on Mules

粗纺环锭隔距
Woollen Ring Spinning Draft



粗纺环锭纺纱
Woollen Ring Spinning



输送罗拉
Delivery rollers

表面
Surface drum

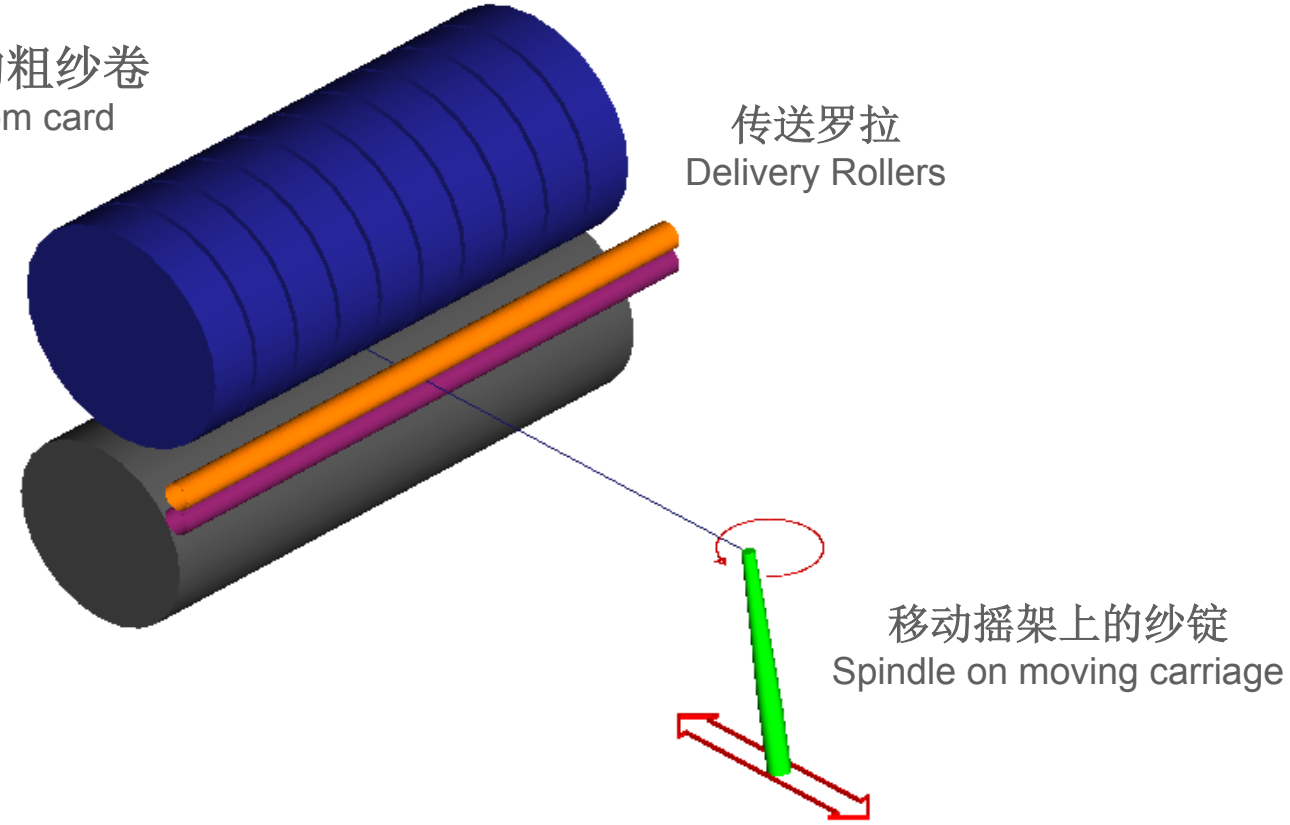
假捻器
False Twister

牵伸罗拉
Draft rollers

纱锭
Spindle

钢领与钢丝钩
Ring & Traveller

走锭纺纱
Mule Spinning



粗纺牵伸
Woollen Spinning Draft

- 当牵伸倍数达到**~1.35** 时
  As Draft Increases up to ~1.35:
  - 纤维被拉直
    Fibres straighten
  - 强力增加
    Strength Increases
  - 张力减小
    Extensibility decreases
  - 超出**~1.35** 后质量下降
    Above ~1.35 Quality decreases
- 牵伸加捻程度将影响牵伸的质量
  Drafting twist level affects draft quality
  - 捻度与纺纱机有关
    varies according to Spinning frame
  - **CSIRO**的纺纱机优化值 α_m**~30**
    α_m~30 is optimal on CSIRO's frame

茅盾的难题：
Dilemmas:

改善纤维质量	Increased Fibre Quality
增加投入成本	*Increases* Input costs
但是	BUT
增加效率	*Increases* Efficiency
改善产品质量	*Increases* Product Quality
减少生产成本	*Decreases* Conversion Costs

茅盾的难题：
Dilemmas:

增加梳毛机的效率	Increased Card Production Rate
减少梳毛成本	*Decreases* Carding Cost
但是同时	BUT ALSO CAN
质量下降	*Decrease* Quality
纺纱效率下降	*Decrease* Spinning Efficiency
织布效率下降	*Decrease* Weaving Efficiency
成本增加	*Increase* costs

茅盾的难题：
Dilemmas:

纱锭转速增加	Higher Spindle Speed
=提高生产率	= Higher Productivity
=降低成本	= Lower Cost
但是同时	BUT ALSO
=纱线张力增加	= higher tension
=断头率增加	= higher end breakage rate
=劳务成本增加	=higher labour cost
=接头疵点增加	=more joins
=质量下降	=lower quality

粗纺产品
Woollen Products

- 针织面料
  Knitted fabrics
- 机织面料
  Woven fabrics
- 地毯：簇绒与机织
  Carpets: Tufted and Woven
- 毡子
  Felts

公制捻系数α_m= t.p.m./ √Nm
Metric Twist Factor: α_m= t.p.m./ √Nm

- 针织纱：松软，低捻度
  Knitting Yarns: softer, lower twist
  - 针织纱捻系数范围
    Knitting Twist Range

    α_m = 65 to 85

- 机织纱需要强力
  Weaving Yarns need strength
  - 经向**Warp α_m = 85 to 120**
  - 纬向**Weft α_m = 75 to 95**

纺纱之后
After Spinning

- 与精纺相似，去除粗结与细结
  Similar to Worsted, thin & thick faults removed
- 加捻：
  Twisting:
  - 对针织纱而言，通常为两倍或三倍的捻度
    Two-fold or Three-fold common for knitting
  - 加捻平衡处理 – 不要产生螺旋
    Provides twist balance - no Spirality
  - 经向纱线通常加两倍捻度
    Two-fold sometimes used for warp yarns
- 绞纱：
  Hanking:
  - 如果将纱线染色之后进行定型处理则可以得到理想厚实的纱线
    Allows yarn to be dyed and set in relaxed state providing desirable YARN BULK

纺纱之后
After Spinning

- 蒸纱 （Steaming）
  - 在不同的工序中均可以进行以便定捻
    Occurs at various stages to set twist
- 成球 （Balling）
  - 只是适用于手工编织纱
    for hand knitting yarns only
- 簇绒
  Tufting
  - 用于制造地毯或者某些特殊产品如抛光垫和汽车座垫
    To make carpets and specialist products like polishing discs and car seat covers

粗纺纱线的单位
Woollen Yarn Units

纱线支数：（**Counts**）

- Tex = g/km = 1000/Nm
- Metric Nm = m/g = 1000/Tex
- YWS, Yorkshire Woollen Skein
  = 1942 / Tex = Nm / 1.942

(YWS = length in yards that balances a 1/16 oz.)
（约克郡粗纺毛纱支数**=1/16**盎司重的码长度）

粗纺纱线的单位
Woollen Yarn Units

捻度:
Twist:

- （每米捻回数） **tpm = turns per metre**
- （每英寸捻回数） **tpi = turns per inch = tpm/39.4**

捻系数
Twist Factors:

- （公制） **metric, α_m= t.p.m./ √Nm**
- （特制） **Twist multiplier = tpm √tex**
- （约克郡制） **Twist multiplier = tpi / √YWS**