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Springer 纺织百科全书 G－Q

（注释本）

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中国纺织出版社专业辞书出版中心 译

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G

① **G,** symbol for giga, i.e. 10^9. A prefix used in the metric system to denote one thousand million times, e.g. 10^9 joules = 1 gigajoule (GJ).
② **g,** symbol for gram, a metric unit of mass equal to one thousandth of a kilogram. 1 g = the weight of 1 cm^3 of water at +4°C. 1 cm^3 = 1 g = 1000 mg. 1000 cm^3 = 1 l = 1 kg (of water). 1000 l = 1 m^3 = 1000 kg = 1 t.
③ **Ga,** chemical symbol for gallium (31).
④ **Gabardine** The word gabardine (alternative spelling in U.K. = gaberdine) is a collective term for certain woven fabrics and also describes a type of woven pattern. Gabardine is generally a fine, tightly woven warp-faced fabric. The warp density is generally considerably greater than the weft density and the diagonal cord or rib (steep twill line) is distinct, closely set, and raised. Gabardine is produced from carded or combed, single or ply yarns of wool, cotton and viscose. In one type of gabardine, the rib effect is produced with a secondary twill or a multi-shaft satin weave but most gabardines are usually woven in 2/1 and 2/2 twills where the higher the warp density the steeper the twill line. Without exception, coat fabrics (e.g. for trench coats) are woven in 4-shaft reversible twill or 2/1 or 3/1 warp twill. Some gabardines are produced with changeant or shot effects but, as a rule, this type of fabric has not attracted much interest for fashion goods or fashion styling. Good quality gabardine coat fabrics are woven from folded yarns in the warp, or even in both weft and warp. Because of the fine, uniform appearance of wool gabardine fabrics, they are produced almost exclusively with combed yarns in medium-fine to fine yarn counts from pure wool as well as wool blends based on all the usual blend ratios. Even blends with up to approx. 20% max. of polyamide fibres are possible (for alpine and ski gabardines). In practice, carded yarns have only found application as weft material and some fabrics of this type also have a viscose warp. Gabardines are closely cropped to emphasize the weave structure. Commercially, wool gabardine is vigoureux printed, yarn and piece-dyed, with the latter being the most important. Gabardines are usually produced in weights between 240–400 g/running metre and even up to 600 g/running metre in exceptional cases.
⑤ **Galactomannan** (mannogalactan). The main chemical component of e.g. → Carob (locust bean gum) and guar which is built up from the two simple sugars ($C_6H_{12}O_6$) → Mannose (which forms the main long straight chain of the basic skeleton) and galactose (as side chain linkages).
⑥ **Galacturonic acid** The fundamental building block of → Pectins; similar to → Glucose in starch and cellulose.
⑦ **Galalith** → Casein plastics.
⑧ **Galanga gum** A medium quality grade of → Senegal gum.
⑨ **Gall extract** Produced from the gallbladders of mammals, e.g. ox gallbladders, as a brownish-green mass giving a clear solution in water. Cattle gallbladders contain 6–8% dry substance consisting chiefly of so-called bile acids. Cholic acid, $C_{23}H_{36}(OH)_3$–COOH is the main constituent linked to glycocoll in an amide-like form as glycocholic acid $C_{23}H_{36}(OH)_3$–CO–NH–CH_2–COOH or to → Taurine as taurocholic acid $C_{23}H_{36}(OH)_3$–CO–NH–$C_2H_4SO_3H$, the alkali salts of which possess soap-like properties. The gall soaps, which contain approx. 8% gall extract and above, are characterized by a high emulsifying capacity and outstanding surface activity. Despite the useful properties of pure and concentrated gall extract preparations as good scouring soaps their importance has declined since the development of synthetic wash-active detergents.
⑩ **Gall nuts** Plant growths containing tannins which in Europe are mainly spherical and in Japan of irregular shape. The former are formed by the sting of the gall wasp on oak leaves and the latter by aphids. European gall nuts contain 7–28% of readily water-soluble tannins (→ Tannic acid) whilst the Japanese variety contain 58–75%.
⑪ **Gallon,**
I. British or imperial gallon. Non-metric unit of capacity equivalent to 4.543 l or 1.20 U.S. gallons.
II. U.S. gallon. Non-metric unit of capacity equivalent to 3.785 l.
⑫ **Galloon** A narrow band of cord, embroidery, braid, etc., used as a decorative trimming. → Braid.
⑬ **Gall-Riedel formula** → Depth of shade of dyeings and prints.
⑭ **Gall soaps** → Gall extract.
⑮ **Galvano screen** → Rotary screens for screen printing.

①词头，表示"吉"，10^9
②克
③镓的化学元素符号
④华达呢，轧别丁
⑤半乳糖甘露聚糖

刺槐豆胶和瓜耳豆胶

⑥半乳糖醛酸
⑦酪朊塑料
⑧塞内加尔胶
⑨五倍子提取物，没食子提取物
⑩五倍子果实，没食子果实
⑪加仑
⑫绣花装饰用窄带
⑬盖尔—里旦尔公式（表示印染深度）
⑭五倍子皂，没食子皂
⑮电铸筛网，电铸圆网

①莨绸
②槿麻，洋麻
③γ射线
④色域
⑤花园图案波斯地毯
⑥成衣干洗前预刷

图1：成衣的裁剪、缝纫和染色

① **Gambier** A Chinese textile speciality consisting of deep black clothing suitable for everyday use made from non-degummed, heavily-weighted butterfly silk (lightweight base fabric, plain weave) glaze-calendered on one or both sides (with polished stone rollers). Highly resistant to wear (washable, suitable for dry cleaning). The deep black is produced by piece dyeing with a reaction product from a gambier-like tanning substance (juice of the so-called kaki fruit) and a river sludge containing iron.

② **Gambo hemp** (gombo hemp) → Kenaf.

③ **Gamma rays** → Radioactive emission.

④ **Gamut** A term used in the dyeing and finishing industry for colour scale or palette (e.g. dye ranges illustrated in pattern cards).

⑤ **Garden carpets** Oriental carpets with designs representing gardens, e.g. the garden carpet of Chosroes, a Persian carpet of the Sassanid dynasty (AD 224–641) in which the whole design depicts a garden in springtime.

⑥ **Garment brushing in dry cleaning pretreatment** A treatment given to garments before

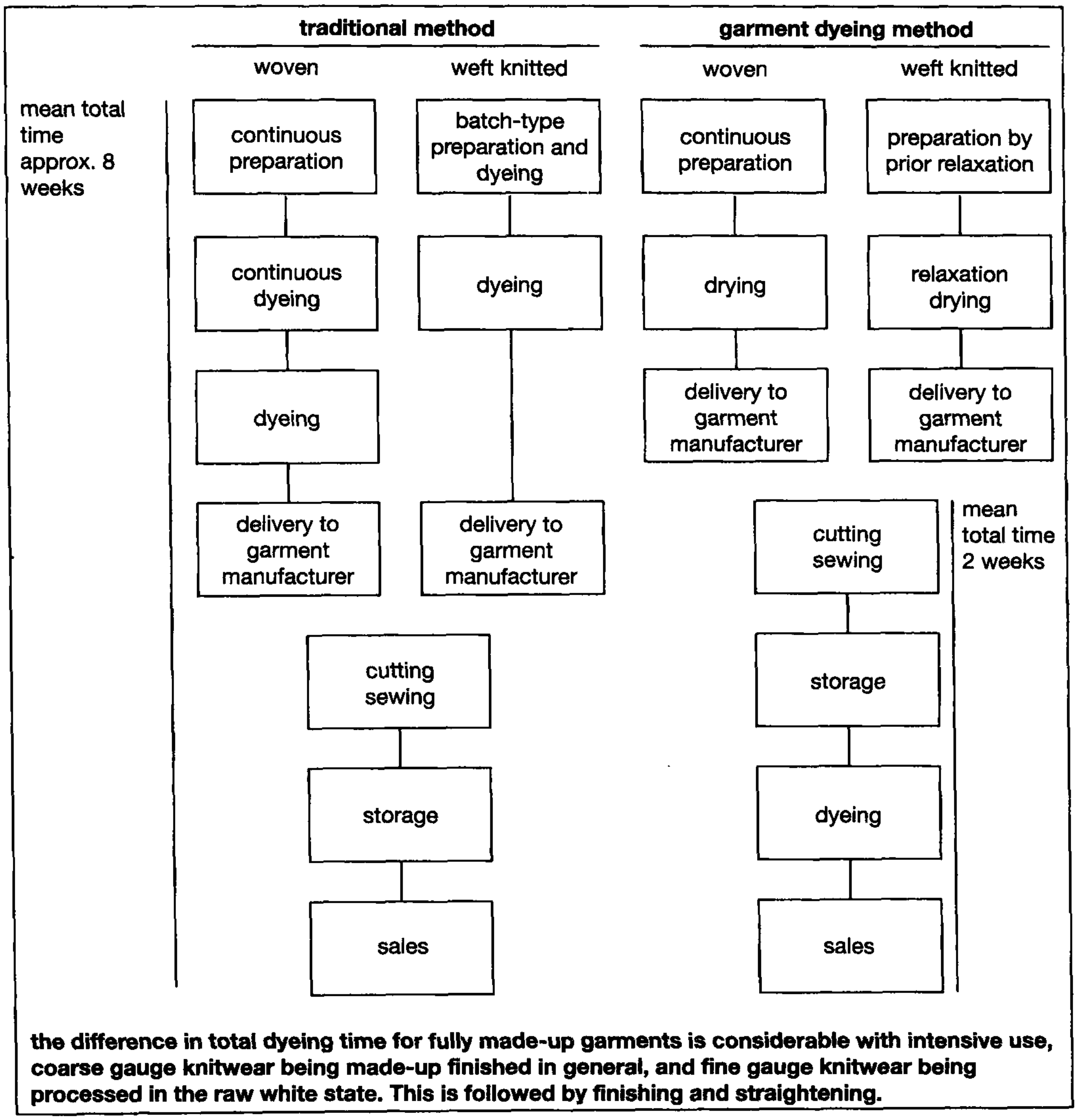

Fig. 1: Garment cutting and sewing, up to dyeing.

basic dry cleaning. Purpose: the brushing treatment reduces the time taken to dry clean garments which have been particularly heavily soiled and improves both the cleaning effect and the stain removal with little or no necessity for further aftertreatment.

① **Garment dyeing** (fully fashioned dyeing). For garment dyeing, textile material passes through all stages of manufacturing (with the exception of dyeing) up to the completed garment stage in order that garments can be stored and dyed in appropriate shades on demand. The dyeing of completed garments in the greige state has become increasingly important in recent years especially in the leisurewear and sportswear sectors. There can be no doubt that this form of dyeing represents a particularly economic alternative to conventional dyeing methods (Fig. 1). The significant growth in the demand for garment dyeing has, however, accelerated since the early 1980's due to the greater dependence of retailers on quick colour changes to meet their need for rapid fashion response (just-in-time concept) e.g. the dyeing of fashionable denim garments and T- shirts. Because of the reduction in lead times between garment dyeing and traditional dyeing methods (e.g. 4/5 days compared to 2/3 weeks), the dyeing of ready-made garments has proved so successful that the market place now has a tremendous demand for leisurewear and casualwear garments produced by the garment dyeing route, and these types of garments are very much colour and fashion orientated .

In 1989 the proportion of textiles dyed in garment form in the Federal Republic of Germany amounted to just 6%. It is obvious that, in Germany, only a limited opportunity has been seen to dye greige garments from the warehouse at short notice in the rotary dyeing machine even in the case of single-colour items. On the other hand, the potential advantages of this technology have been recognized in Italy and the U.K. for a long time both on the side of the manufacturer as well as that of the retailer. Benetton (Italy) and Marks and Spencer (U.K.) have both successfully embraced garment dyeing technology. Moreover, rapid developments in this field have also been observed in other countries, e.g. the USA and Japan. The reason for the cautious response of many companies to this technology is, to some extent, based on the fact that garments dyed in rotary dyeing machines have not always met required quality standards in the past. Insufficinet knowledge regarding the preparation requirements for garments to be dyed in rotary machines was one of the reasons for this market hesitancy. Another important reason, however, was the design of the rotary dyeing machine itself. These machines work on the principle of "movement of textile material and a stationary liquor". In order to achieve faultless dyeing, especially as regards seam penetration and levelness, the rotational speed of the dyeing drum must be relatively high in order to ensure intensive liquor exchange. This movement subjects the garments to a considerable amount of mechanical stress causing the garments to have a "used" appearance after dyeing which is not always desirable. One possible solution for a more gentle treatment of the garments involves dye liquor circulation by means of a pump. With this system liquor is pumped from the lower part of the machine through a by-pass circuit and then sprayed into the inner drum (Figs. 2 and 3).

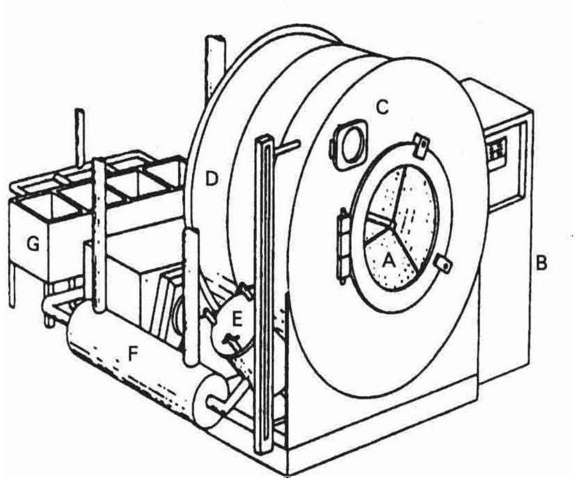

Fig. 2: Sketch of a drum dyeing machine for garment dyeing. A = perforated drum (with or without different subdivisions); B = machine control; C = sampling unit; D = liquor level indicator; E = fluff filter; F = heat exchanger; G = chemicals and liquor tanks.

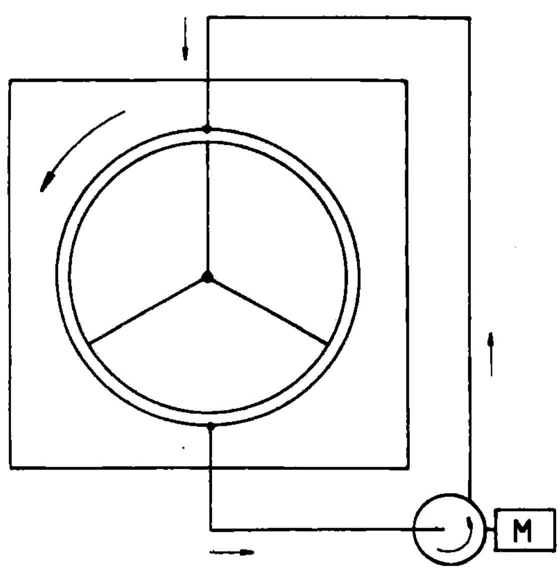

Fig. 3: Garment dyeing with liquor circulation (Proll & Lohmann) – old system-

①成衣染色

即时化生产理念

图2：
成衣圆筒染色机
A—多孔圆筒
B—控制台
C—取样孔
D—液面指示计
E—絮状物过滤器
F—热交换器
G—加料槽

图3：
成衣染色染液循环系统

图 4：
康比复合式成衣染色系统（染液通过圆筒轴循环）

专门技术

①成衣用皮革

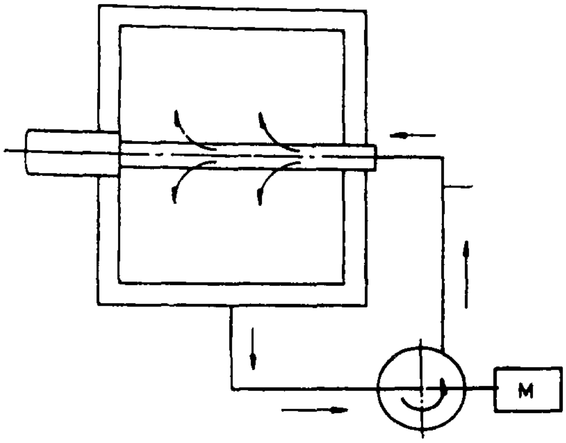

Fig. 4: Colour combi system, introducing the circulated liquor through the drum axle resulting in better dyeing liquor exchange.

This design was not, however, successful in providing the desired results since dye liquor was deflected by the revolving drum on entry. As a consequence, a ring of liquid was formed between the outer and inner drums which was unable to penetrate the perforations of the inner drum and could not therefore reach the textile garments. This shortcoming has since been eliminated with the development of the Colorcombi dyeing system of Proll & Lohmann, Hagen. This system is based on the principle of "movement of textile material and movement of liquor". With this system, dye liquor is pumped from the lower part of the machine and returned to the dyeing drum via its central axle (Fig. 4).

In principle, all completed textile garments suitable for dyeing by the exhaust process can be dyed by the garment dyeing route. All the chemical and technological considerations involved in the dye/fibre interactions in conventional dyeing are equally applicable to garment dyeing, i.e. all the various dye classes used in exhaust dyeing are, in principle, also suitable for application in garment dyeing. As far as the textile composition of garments for dyeing is concerned, most of the experience gained up to now relates mainly to cotton garments. However, wool, polyamide, acrylic and, to a lesser extent, polyester garments, may also be dyed successfully by this process. Since mixtures of textile materials are always involved in garment pieces (in the simplest case, the garment fabric itself and the sewing thread), account must be taken of the dyeing and chemico-technological properties of the various textile components present. In this regard, particular attention must be paid to the selection of component materials having similar shrinkage properties if problems of puckering, crimping, garment distortion and sewing thread breakages, etc., are to be avoided. Garments produced from several components (e.g. different outer materials, linings, interlinings, elastic waist bands) are particularly likely to give rise to problems of this kind; such cases demand considerable technical know-how, not only to ensure minimum possible damage to the respective materials during dyeing as well as their optimum pretreatment, but also to achieve the same hue and depth of shade on all the garment components. The various accessories attached to garments such as studs, buckles and zip fasteners can also represent a frequent source of problems in garment dyeing. These components must be constructed of non-ferrous metal alloys or break-proof plastic materials. In practice, however, it has been found that these requirements have, in many cases, not been observed. The consequences are rust stains, catalytic damage in bleaching with consequent fibre damage, and dye stains. It also has to be borne in mind that the surface effects given to the undyed, pretreated, fabrics before making-up (e.g. embossed and chintz effects, calender glazes) may be either partially or totally lost after treatment under dyeing conditions. On the other hand, unwanted changes in the surface appearance of sensitive articles such as surface roughening or felting, and irreversible creasing can result from the relatively high mechanical stresses to which the garments are subjected in the dyeing machine, during hydro-extraction, e.g. in the centrifuge, or in tumbler drying.

It is not only for economic reasons that dyeing processes where the maximum temperature of dyeing is as low as possible should be selected, without having to make concessions to full penetration of the textile material. A few machines capable of garment dyeing under high temperature conditions (140°C) are, in fact, available, e.g. as required for the dyeing of polyester. However, for the most efficient dyeing of garments, the use of polyester sewing thread in the making up of garments should be avoided in all cases. It is for these reasons that only specially selected articles are suitable for garment dyeing. Thus, leisurewear, sportswear, and jogging suits made from cotton, or cotton blends with polyamide, acrylic or modal fibres are particularly predestined for the garment dyeing route. For such articles, preference is given to woven or knitted fabrics which, in addition to having a low propensity to creasing or shrinking, also possess good dimensional stability to tensile stresses (Krämer and Hilden).

① **Garment leather** Leather manufactured from skins and hides subjected to various tanning and dressing treatments suitable for the production of leather garments of all kinds. Both garment → Leather itself and the garments produced from it, whether in part or entirely, must always be labelled with the name of the animal from which it has been produced (e.g. leather, calfskin, goatskin, sheepskin, lambskin, deerskin, buckskin, etc.). Garment leather should only be labelled as "washable" if it has sufficient resistance to washing; likewise "drycleanable" garment leathers should only be labelled as such providing no significant changes in dimensions, handle and shade occur after a proper drycleaning treatment and appropriate testing.

① **Garment-making accessories** These include all the various items necessary to produce a completed garment, e.g. underarm pads, interlinings, linings, belts, buttons, sewing thread, zip fasteners (zip fastener tapes), buckles, shoulder pads, edgings, stiffeners, waddings, etc. To be correct, consideration should also be given to garment accessories in the respective care labels since otherwise, e.g. unwanted staining or discoloration of the garment can occur due to differences in colour fastness of the various components.

② **Garment manufacturing** A term for the standard production of garments, garment pieces and various items of clothing.

③ **Garment manufacturing technology** If the process of garment manufacturing is divided into its basic elements, then in almost every clothing type the following sequence can be observed: cutting, arranging, pre-fabrication, intermediate ironing, assembling, final ironing, press finishing. This process-related sequence is not suitable for discerning technological trends in manufacturing technology. Depending on the actual garment, the scale of process etc., this sequence can change completely. It is therefore expedient to systematically subdivide the manufacturing processes. Accordingly, one divides into original forming, re-shaping, separating, joining and finishing, and it appears expedient to sub-divide the terms once more.

1. Original forming: injection moulding, e.g. buttons, creation of endless threads (polymer shape forming).
2. Re-shaping: ironing, styling, shape fixing, hot forming, knitting to shape etc.
3. Separating: cutting, stamping, pinking, weld-stamping.
4. Joining: sewing, fixing, gluing, welding, riveting, tacking, clipping.
5. Changing the material characteristics: heating, steaming, drying, cooling.
6. Coating: printing, applying adhesive.

A precise study of this system shows that a manufacturing process changes the work piece in order to achieve a certain state and a certain appearance. As a rule, tools and machines are necessary for this. Through mechanisation, automation and control, the individual elements are linked together, in conjunction with planning and organisation, to form garment technology.

④ **Garment prebrushing in drycleaning** → Garment brushing in dry cleaning pretreatment.

⑤ **Garment steamer** A steaming unit for garments; → Steaming dummies.

⑥ **Gas** → Natural gas; Thermal value of fuels.

⑦ **Gas bubble** The hollow space in a → Foam which is filled with gas (air) and surrounded by a thin envelope of liquid.

⑧ **Gas bubble method** A procedure for determining the maturity of cotton (→ Cotton maturity index). It is based on the permeability of the fibre wall to nitrogen; the thin walls of immature fibres have higher permeability.

⑨ **Gas burner** Multiple gas burners may be required for singeing, IR-driers or cylinder driers. Taking the AGI linear gas burner (see Fig.) as an example, a system of this kind can be explained as follows: the burner

①成衣辅料
②成衣制造
③成衣制造技术

1. 纽扣、线等原材料制作
2. 改变造型
3. 裁剪等
4. 缝制等
5. 改变材料特性
6. 涂绘

④成衣干洗前预刷
⑤服装熨烫机
⑥燃气
⑦气泡
⑧气泡法(测定棉成熟度)
⑨气体烧毛机

复式气体烧毛机

图：
法国燃气公司气体烧毛机
1—燃气
2—燃烧空气
3—标定孔
4—预混合区
5—燃气喷射器开口
6—观察孔
7—湍流环
8—填料箱出口
9—信号转换器
10—孔板(限定燃烧空气量)
11—火花塞
12—紫外火焰检测器连接点
13—特种玻璃纤维入口
14—特种紫外玻璃纤维

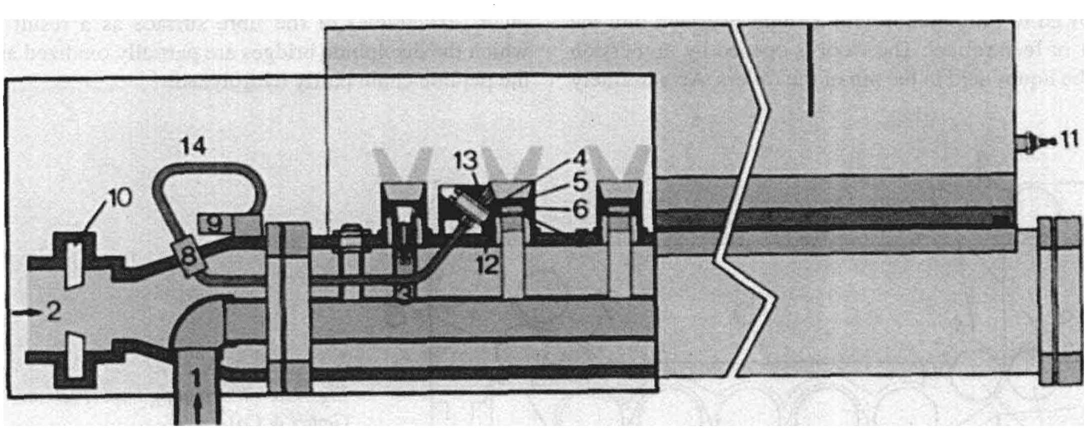

Fig.: "Gaz de France" (AGI) gas burner.
1 = gas; 2 = combustion air; 3 = calibrated opening; 4 = premix zone; 5 = open jet gas injector; 6 = observation port; 7 = turbulence ring; 8 = special glass fibre exit via stuffing box; 9 = signal converter (converting the optical into an electrical signal); 10 = pin diaphragm for limiting combustion air quantity; 11 = ignition plug; 12 = plug-in connection for ultra-violet flame detector; 13 = special glass fibre entry side; 14 = special ultra-violet glass fibres.

开口式燃烧器

①毛条气体氯化(防毡缩)

图:
气体氯化系统
1—喂入辊
2—给液系统
3—成对输入辊
4—浴中导辊
5—上层排液装置
6—底层排液装置
7—给液辊
8—成对轧辊

itself consists of two concentric tubes, the inner one for the gas supply and the outer one for the air supply. The openings in the outer tube for the individual burners are provided with impeller wheel turbulence rings for the combustion gas. In the middle of the turbulence ring is the injector which is supplied with gas from the inner tube. A mixture of gas and air is formed in the head of each individual injector.

The gas injectors are precision screw machine parts which ensure an extremely accurate throughput of gas. The injectors of the AGI burner are so-called "open-jet burners" and are manufactured under licence from the company Gaz de France, which also participated in the development of the linear gas burner. For flame monitoring purposes a special inspection hole is located in the burner itself, in which the entry end of a special glass fibre is mounted. From here the glass fibre cable is led through the air channel between the inner and outer burner tubes to a signal converter, i.e. it is protected from any mechanical damage. The UV radiation from the burner flame is converted by means of a UV cell into an electrical signal by the signal converter which is then further processed by a control unit.

① **Gas chlorination of wool** Combed wool tops can be given an antifelting finish by chlorination when the chlorination process is followed by a polymer treatment. The chlorine bath (Hercosett process) has been developed for the chlorination of wool tops (see Fig.: Gas chlorinating bath) with chlorine water (chlorine gas dissolved in water) and bleach liquor (aqueous solution of sodium hypochlorite). All parts of the applicator unit in contact with this very aggressive liquor are constructed of glass-reinforced plastic (GRP), polyvinyl chloride, or the hydrochloric acid resistant Hastelloy C4 grade of stainless steel. The combed slivers are drawn from the entry zone through a separator grid and allowed to run parallel with a slight overfeed into the pair of feed rollers. The wool is opened by immersion in the liquor held in the nip of the rollers. An extremely uniform application of liquor is assured by a spray pipe with an inclined applicator plate on each side of the sliver. By this means, the chlorination liquor is able to reach each individual fibre through immersion.

The required quantity of chlorine gas is injected into the process water in an injector and a wetting agent added at a subsequent point before the liquor is uniformly applied to the sliver via the application system. On passing chlorine gas into water hypochlorous acid (HOCl) and hydrochloric acid (HCl) are formed in accordance with the following reaction:

$$Cl_2 + H_2O \rightleftharpoons HOCl + HCl$$

In this reaction, the pH of the bath is automatically set at approx. pH 2–2.5 and must not be further adjusted. Compared to sieve drum chlorination, there is no requirement for sulphuric acid to lower the pH; and cooling of the bath, which is typical of all other existing chlorination processes up to now, is also unnecessary in gas chlorination because of the precise and absolutely uniform application system. Even at process water temperatures of up to 30°C, a faultless and uniform chlorination of the sliver takes place. The reaction of wool with hypochlorous acid proceeds very rapidly and is essentially completed in the first third of the bath. With this treatment, oxidation takes place to a greater extent on the surface of the fibre so that the actual wool fibre receives less damage. The scales of the wool fibre are smoothed out by this process, the fibre surface becomes homogeneously hydrophilic and, at the same time, a negative (anionic) charge is produced which gives the fibre affinity for the subsequent resin treatment. The hypochlorous acid reacts very rapidly with the protein layer (exocuticle) of the fibre surface as a result of which the disulphide bridges are partially oxidized and the peptide chain partly hydrolyzed.

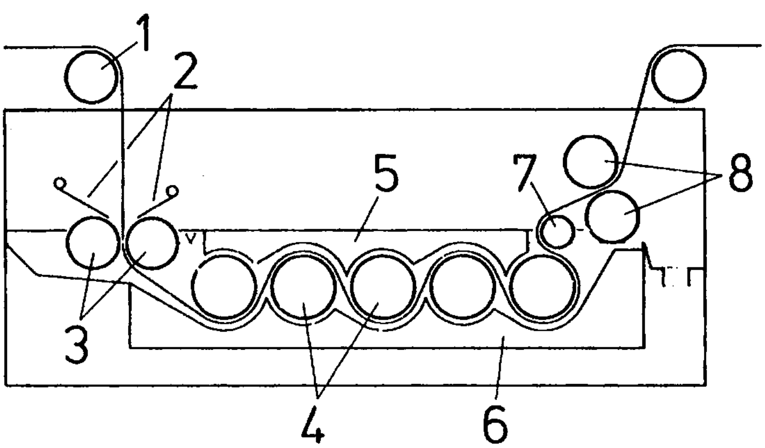

Fig.: Gas chlorinating bath (Fleissner GmbH & Co).
1 = feed roller; 2 = liquor application system; 3 = entry roller pair; 4 = bath guide rollers; 5 = top displacing element; 6 = bottom displacing element; 7 = application roller; 8 = presser roller pair.

① **Gas chromatography** (GC). This analytical technique is based on the sorption processes between a mobile phase and a stationary phase. Different components in the mobile phase move through the stationary phase at different rates due to their different distribution coefficients and so appear separately at the effluent end of the bed of packing where they are detected and measured by thermal consductivity changes, density differences, or ionization detectors. GC provides two results:

1. Retention time: the time taken for a substance to pass through the stationary phase. Under the same apparative conditions it is always the same; a substance may thus be indirectly identified by this means.
2. Signal response: in the case of ionization detectors the field under the detected signal is proportional to the concentration of the substance. This enables the concentration of a particular substance in a mixture to be determined with precision provided that substance-specific indication errors are taken into account.

The mixture of substances under investigation is passed through a column coated with a specific stationary phase by an inert carrier gas (e.g. helium). Thus the mixture to be separated is injected directly into the capillary column (i.e. "on column injection") and passes through the column by the gas current. By this means, a distribution of substances between the mobile (gas) and stationary (coating) phases takes place. Since the distribution coefficients of most substances are different, they will be retained for different lengths of time. Temperature-dependence of the distribution coefficients can be used to advantage in the separation of components at their boiling points provided the stationary phase layer has a similarly high affinity for all the substances present. Discrete bands (peaks) are formed which, corresponding to their different retention times, pass through the detector one after the other.

There are two possibilities for sample introduction:

1. Injection technique: the mixture under investigation is dissolved in a solvent and an aliquot of this solution (μl range) is injected and detected.
2. Gas sample injection (head space GC). The material on to which the sample under investigation is adsorbed (silica gel, textiles, etc.) is transferred to a head space vial that is sealed and placed in a thermostat at a preselected temperature to drive the desirable components into the head space for sampling. To achieve better desorption, the material is often covered with solvent and the resultant gas phase introduced into the GC system. The technique can also be used for the direct investigation of liquids such as textile auxiliaries for analysis of their readily volatile components.

The choice of stationary phase (column material) and its degree of activity is determined by the sample to be analyzed. To separate a polar mixture such as alcohols a different column material to that used for the detection of alkanes is used. In addition, different detector systems are also available. One of the most frequently used is the → Flame ionization detector (FID). For special applications, e.g. a photo-ionization detector (PID) by means of which substances are ionized and made detectable through the action of light may be suitable. A mass spectrometer can also be coupled to gas chromatography as a detector system (GCMS).

Gas chromatography is in very widespread use as an analytical tool, almost entirely for organic materials; the technique is rapid, simple, and can cope with very complex mixtures (100 or more components) and very small samples (nanograms); useful for both qualitative and quantitative analysis. Relative precision of 2–5%. Disadvantages: samples must be volatile and thermally stable below about 400°C; most commonly used detectors are non-selective; published retention data is not always reliable for qualitative analysis.

② **Gas fading** A change in shade of dyed or printed fabric caused by chemical reaction between certain disperse dyes and gaseous contaminants in the atmosphere, chiefly acidic gases from fuel combustion (NO_x; SO_2). →: Colour fastness to atmospheric contaminants: nitrogen oxides; Burnt gas fumes.

③ **Gas fading inhibitors** → Inhibitors which offer protection against → Gas fading.

④ **Gas fastness** →: Colour fastness to atmospheric contaminants: nitrogen oxides; Burnt gas fumes.

⑤ **Gas-flow transfer printing** A further development of vacuum transfer printing technology.

The process uses a hot flow of gas directed on to a dye carrier medium (e.g. gas-permeable transfer printing paper) which it penetrates. The sublimed dye is carried along with the hot gas and deposited on the continuous web of fabric which rests on a gas-permeable conveyor belt. The direction of the gas flow passing through the dye carrier medium and the fabric is assisted by suction applied from beneath the conveyor belt. The choice of dye carrier medium, gas flow temperature, pressure difference between the upper and under sides of the fabric and the contact time are decisive parameters for control of the process. The degree of colour penetration achieved on pile fabrics by this process is far superior to that obtained by other transfer printing processes up to now. Since the dye carrier medium is only in light contact with the fabric being printed, no pile deformation occurs.

⑥ **Gas fume exposure test** → Gas fume fading.

⑦ **Gas fume fading** →: Colour fastness to atmospheric contaminants: nitrogen oxides; Burnt gas fumes.

⑧ **Gas fume fading inhibitors** Additives made to print pastes in order to prevent the reaction of nitrogen oxides (normally present in the atmosphere as contaminants, especially in industrial centres and areas of high

①**气相色谱法**
流动相
固定相
分配系数
1. 保留时间
2. 信号响应
1. 进样技术
2. 气态样本进样
火焰离子化检测仪
光电离检测仪
质谱仪
②**烟气褪色**
燃烧烟气
③**烟气褪色抑制剂**
④**耐烟气牢度**
⑤**气流法热转移印花**
⑥**烟气曝露试验，烟气褪色试验**
⑦**烟气褪色**
⑧**烟气褪色抑制剂**

①燃气加热，煤气加热
②气相交联
③气相处理

图：
扩散系数的数量级决定气相处理条件

热转移印花

④气流推进（气流染色）

气流染色法

⑤气体取样
⑥气体烧毛
⑦气体烧毛机（纱线烧毛机）
⑧气体检测管
⑨气体微量分析，气体痕量分析

电化学测定

⑩热电联产燃气轮机

population density) with disperse dyes belonging predominantly to the anthraquinonoid class.

① **Gas heating** Used in textile driers, curing machines and stenters. Auxiliaries which are liable to volatilize or sublime must not come into direct contact with the flames in order to prevent their decomposition. Damage to the textile material can also occur.

② **Gas phase crosslinking** A commonly used term for crosslinking reactions, e.g. with cellulose in the gas phase. →: VP3 process; Form V process; Cross-linking.

③ **Gas phase processing** Gases diffuse in fibres much more quickly than liquids (see Fig.). It is for this reason that attempts to promote gas phase processing have been made again and again in the recent past. For environmental reasons, however, the handling of gases is frequently problematic. Moreover, appropriate machinery for gas phase processing is expensive in many cases. However, in the case of heat transfer printing, gas phase processing, which involves the sublimation of disperse dyes, is quite simple.

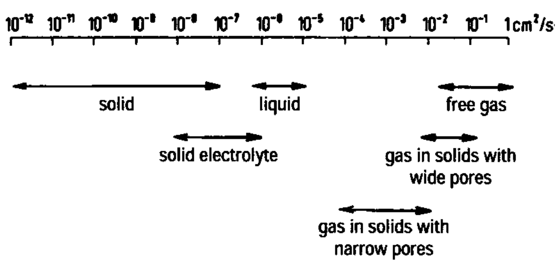

Fig.: Orders of magnitude of diffusion coefficients (D_0) as a prerequisite for gas phase processing.

The thermosol process (thermofixation) represents a special dye fixation technique for the continuous dyeing of polyester fabrics. It involves the following process stages: application of dye by padding, drying, thermosol treatment and afterwashing. The processing elements of immersion, squeezing-off and spraying predominate in the wet treatments whilst heating-up and cooling-down operations predominate in the thermal treatments. At the thermofixation temperature, only a few typically basic processes occur which, apart from coloration, would not be relevant. These can be described by the following primary functions: at 200–220°C, many crystals in the polyester fibre exist in the molten state, just as in heat-setting, and are therefore accessible to the dye. Depending on its molecular weight, the disperse dye actually sublimes under these conditions, i.e. it is converted from the solid state on the surface of the fibre to the gaseous state and diffuses rapidly and extensively into the fibre in the form of a gas before it becomes solid again at lower temperatures. On cooling, some of the dye co-crystallizes with the fibre polymer and thus becomes firmly anchored to give a fast dyeing.

④ **Gas propulsion** (in jet dyeing machines). In the Airflow system developed by Then, propulsion of textile fabrics is achieved by means of an inert gas so that movement of fabric without liquor load, or with a desired proportion of moisture is assured. The necessary dyes and auxiliaries are atomized and injected into the circulating gas stream where they are brought into contact with the fabric. Advantages: very short liquor ratios with consequent savings of water and energy. In adition to the dyeing and rinsing processes, fabrics can also be dried in the machine.

⑤ **Gas sampling** (pumps). In order to determine emissions in the laboratory qualitatively and quantitatively, the gaseous substances to be examined must first be adsorbed on to a suitable medium, preferably silica gel, activated carbon, etc. and then desorbed in the laboratory to facilitate measurement. To obtain quantitative measurements the pumps used to collect the gases must comply with certain conditions. For this reason, they are provided with automatic air flow control and can pump a specific volume minimum and maximum over a given time period. These parameters can be preprogrammed.

⑥ **Gassing** → Singeing.

⑦ **Gassing machines** (yarn singeing machines). Machines used for the singeing of yarns.

⑧ **Gas testing tube** A gas detector in the form of a small tube filled with a gas-permeable chemical which changes colour (due to a chemical reaction) when the air being tested is sucked through it. The length of the colour zone is a measure of the pollutant concentration. Accuracy of measurement ± 25%.

⑨ **Gas trace analysis** Analysis in the ppb or ppm range. Achieved mainly by means of electrochemical measurement.

⑩ **Gas turbines in combined heat and power generation** If it is assumed that the effective costs for electricity generation by electricity supply companies are too low since too many costs are externalized to the community, then the cost of electricity can be expected to rise further. These circumstances already dictate that production prices for electricity must reach appreciable levels. In many cases, therefore, in-house electricity generation can become viable within a short time. This is especially true if total energy plants and emergency power capacities can be combined, or existing emergency electricity generators can be converted to gas power or waste heat utilization. In principle, the use of gas engines for small total energy plants is to be recommended. Block-type thermal power station modules are available in the market for the generation of electrical power outputs from 90 kW with the entire waste heat exchanger system built into the base of the unit. These modules can be supplied with a complete control system ready for connection. For larger plants, especially where steam also has to be generated, gas turbines with a generating capacity of around 500 kW should be considered.

A gas turbine for combined heat and power generation operates as follows: the gas turbine compressor sucks in air for combustion via a sound muffler and compresses it to, e.g. 12 bar. This air is then heated in the combustion chamber of the gas turbine to approx. 1000°C. Combustion takes place with a large excess of air (lambda from 3.5 to 5). The pressure of the hot gas drops to atmospheric pressure in the turbine and the mechanical energy of the turbine is supplied to the compressor. The power requirement for the compressor lies considerably below the power output of the turbine. Consequently, the resultant excess power is converted into electrical energy in the generator. The exhaust gases are cooled down from approx. 1000 to 500°C by the pressure drop in the turbine and the heat contained in the exhaust gases is then converted, for the most part, into steam in the downstream waste heat boiler. The high vapour pressure, e.g. 10 bar, means that the exhaust gases are not cooled down to a desirable operating point level, i.e. the water vapour dew point of the waste gases, but only to considerably higher temperatures, e.g. 170°C.

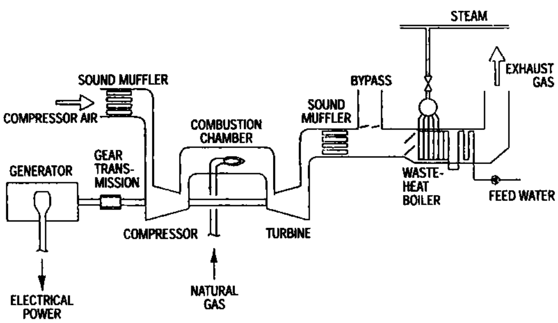

Fig. 1: Combined heat and power generation with a gas turbine.

The combination of a heat pump circuit with a gas engine is of interest if the gas heat pump is produced by heat recovery from the engine cooling water and the exhaust gases. On average, the energy saving achieved is in the region of 50%. If, however, waste heat is available from any other processes which would otherwise be released into the atmosphere, but can be used with the heat generated by the gas heat pump (Fig. 2) to the lower temperature level (exhaust gas heat recovery to the dew point) then, by including the former wastage due to non-utilization of waste heat in the calculation, energy savings of approx. 60% are arrived at. Gas heat pumps are economically interesting for outputs of about 400 000–600 000 kJ/h. Further additional energy-

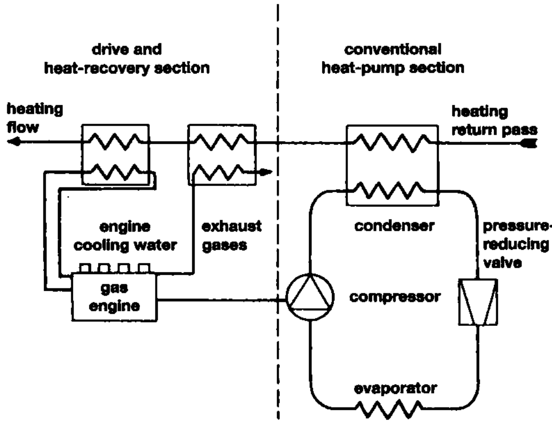

Fig. 2: Schematic diagram of a gas heat pump.

saving opportunities with industrial gas engines can be exploited because two shaft ends are available (simultaneous generation of electricity and heat). A particularly useful energy saving application of a gas heat pump, especially in textile processing plants with a high consumption of hot water during the summer, is to use the gas heat pump as a refrigeration unit for air conditioning systems or other cooling applications. Since waste heat is still produced by the engine despite application of the heat pump circuit as a cooling machine, its effective utilization must be ensured.

The open-cycle gas turbines are of the single-shaft type, i.e. compressor, turbine and power turbine are arranged on a common shaft. Major turbine components: air intake casing, two-stage centrifugal compressor, two- or three-stage axial turbine (depending on the turbine type) with exhaust diffuser, and single can combustor with central nozzle and high-energy ignition. The casing components are of ductile cast iron. The compressor wheels are of stainless cast steel, while the turbine's vane assemblies are precision castings of high-temperature steel. The turbine rotors consist of discs, with the rotor blades retained by a fir tree arrangement. The rotors and shaft components are centered with radial toothing and connected by a tie rod. The turbines designed for continuous duty are supported in plain bearings. Turbine cooling is by air taken from the air compressor. Cogeneration of power and heat or Combined Heat and Power (CHP) as it is called – the concept for efficient utilisation of primary fuel energy – is making vast inroads. Gas turbine generator sets (Fig. 3) provide electrical power at a location where it is needed, and at the same time produce useful heat for production and administration.

① **Gaufre** (Fr.: *gaufre* = waffle, emboss). Flat fabrics in plain-weave, twill, or satin construction as well as plush materials and velvets with an embossed waffle-like pattern (→ Embossing) or a low lying pile

图 1:
热电联产燃气轮机

图 2:
燃气热泵的工作原理

热电联产

燃气涡轮发生器

①拷花，轧花

图3：
M1A-13型联产燃气轮机

①机号

I. 表示针织机单位长度(1英寸)的针数
II. 表示针织物每英寸纵行数

②纱布
③纱罗组织

图：
半纱罗与全纱罗组织比较

④英国专利
⑤气相色谱法
⑥钆的化学元素符号
⑦德国化学家协会
⑧锗的化学元素符号
⑨齿轮传动

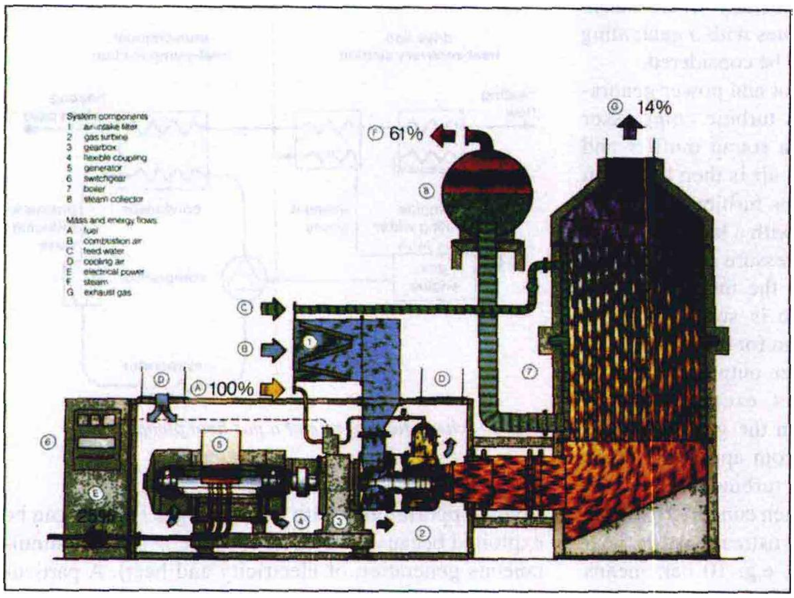

Fig. 3: Cogeneration System with M1A-13 Gas Turbine from Deutz MWM.

(= velvets). Gaufre fabrics include, e.g. →: Moiré fabrics; Reversible, etc.

① **Gauge** (g),

I. A measure of the number of needles per unit length in knitting and hosiery. The greater the number, the closer and finer the knit. (e.g. raschel machine = 2 English inches; fully-fashioned knitting machine = 1.5 English inches; circular hosiery knitting machine = 1 English inch).

II. The number of wales per inch in a knitted fabric.

② **Gauze** Lightweight, open-texture, net-like woven fabrics named after the Palestinian town of Gaza where they were originally used for veils. They mostly consist of thick yarns with a full finish or fine yarns with a veil-like appearance. Gauze fabrics (gauze weave) should not be confused with those produced by the leno weave, which is also a loose, open weave. Different types of gauze include: screen gauze (for screen printing), silk gauze, bolting cloth, cotton gauze (damask gauze, net curtains), wool gauze (→ Étamine, Marquisette), lining gauze, embroidery muslin, cotton muslin, etc. Cotton gauze is mainly used for surgical dressings.

③ **Gauze weave** A weave used in very thin fabrics, e.g. gauze, or for the production of woven effects (see Fig.). With a full leno weave, the warp threads are made to cross one another between the picks. In simple leno weaving, one warp thread (generally referred to as a crossing or leno end) is caused to lift alternately on one side and then on the opposite side of the neighbouring thread (usually referred to as the standard end) thereby producing "crossed" or "open" sheds. The leno ends are also drawn through a second heald which changes its position between the individual weft insertions. Advantage of the leno weave: the weft is anchored and therefore resistant to slippage.

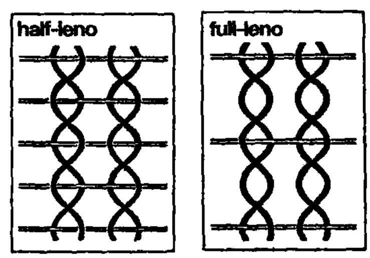

Fig.: Comparison between half-leno and full-leno weave.

④ **GB,** prefix for: British patent.
⑤ **GC,** abbrev. for: → Gas chromatography.
⑥ **Gd,** chemical symbol for gadolinium (64).
⑦ **GDCh** (Ger.), abbrev. for: Gesellschaft Deutscher Chemiker (German Society of Chemists).
⑧ **Ge,** chemical symbol for germanium (32).
⑨ **Gear drives** The stepless changing of the drive speed on process machinery can be facilitated by using mechanical gearboxes with constant motor speed or by directly adjusting the motor speed with electronic controls. Machinery with frictional drive gears and drive belts have no alternative electronic control of comparable price. For higher requirements, a mechanical ball/disk control mechanism has been developed, for outputs of up to 3 kW, which can regulate the speed down to a stop. Belt contact drives transmit outputs of up to 150 kW. Parallel to that, and for outputs which are

higher still, three-phase current drives with a frequency converter are of interest (Fig. 1).

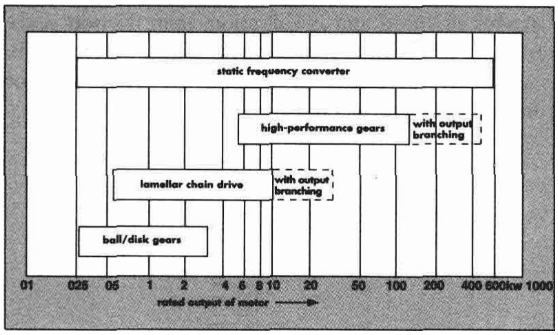

Fig. 1: Output ranges of infinitely variable drives.

Gears are torque converters. They consist of several machine elements and have the task of transmitting movements and forces, or of converting them. They transmit movements

a) by friction, i.e. actuated by pressure contact, e.g. belt drives, friction wheel drives;

b) via interlocking forms, i.e. with positive locking, e.g. toothed wheel gears, worm drive pairs, chain drives.

The speed change of drives can be regulated in steps (toothed wheel gears, chain gears) or in an infinitely variable manner (PIV drives, Variomat, etc.).

I. Toothed wheel gears consist of two or more gearwheels which work together. Depending on the type of teeth and the position of the gearwheels in relation to one another, we speak of:

- spur gears,
- spiral gears,
- bevel gears,
- worm drive pairs.

The speed change takes place step-wise through a train of gear wheels. The torque between two shafts or over a small distance are transmitted directly by gearwheels, in a positive locking manner. It is also possible to produce transmissions and direction changes. Transfer takes place when the projections of the one wheel – teeth – engage with corresponding gaps between teeth on the other wheel.

By "meshing" with one another, gearwheels transfer forces and movements. They are often combined to form toothed wheel gears. Here, it is important to permit only those that have identical tooth dimensions to mesh. The number of toothed wheels with their teeth must be in the same ratio as that of their reference circles. There are toothed wheels with spur teeth and also those with helical gearing. Helically-geared wheels demonstrate little play, little wear and run with less noise. Various gearwheel types are used in toothed wheel gears (Fig. 2), e.g.:

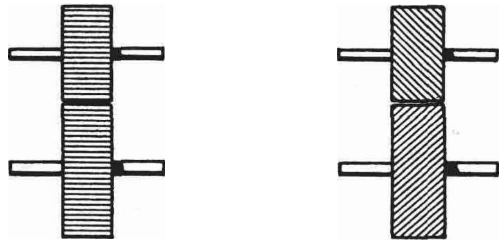

Fig. 2: Spur-toothed and helically-toothed gear pair.

1. Spur wheels: these have teeth on the frontal face.
2. Bevel wheels: they have teeth arranged in a conical manner. Bevel wheels are used when torque and forces of two non-parallel shafts are to be transmitted; in the case of spur gears, the shafts must lie parallel in order to transmit movement.
3. Helical gear wheels: these are spur gears whose teeth are cut in a helix. They are used in gears where shafts cross one another. Here there is also the possibility of transferring forces and torque of shafts which cross one another, by using a worm and worm wheel (worm gear pair, Fig. 3). If gearwheels are used as intermediate wheels, then they can be disregarded for the purpose of calculating the speed. Please note: Intermediate wheels can effect a change of rotation direction, but never a change of rotational speed.

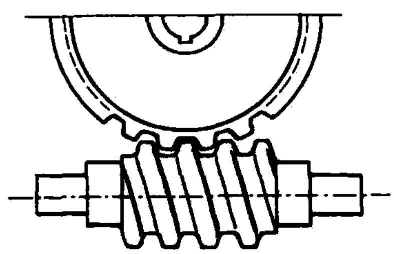

Fig. 3: Worm and worm wheel drive.

II. Chain drives (Fig. 4) transfer forces in a positive locking manner via two shafts, the distance between which cannot be bridged by means of gearwheels. Here, links of a chain engage into the teeth of chain wheels.

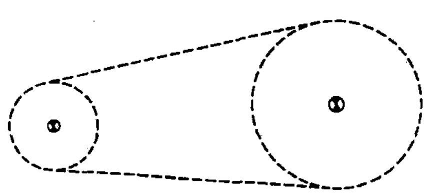

Fig. 4: Chain drive principle.

图 1:
无级变速传动的输出幅度

a) 摩擦力
b) 联动系统

I. 齿轮传动

- 正齿轮
- 螺旋齿轮
- 伞齿轮
- 蜗轮与蜗杆

图 2:
正齿轮与斜齿轮

1. 正齿轮
2. 伞齿轮
3. 斜齿轮

图 3:
蜗杆与蜗轮传动

II. 链传动

图 4:
链传动原理

III. 带传动

图 5:
平带传动

图 6:
V 形带传动

IV.摩擦传动装置

图 7:
摩擦齿轮

V.无级变速传动装置

1. PIV 无级变速装置
2. WKT 无级变速装置
3. PC 无级变速装置

图 8:
PIV 无级变速器

VI. 凸轮传动

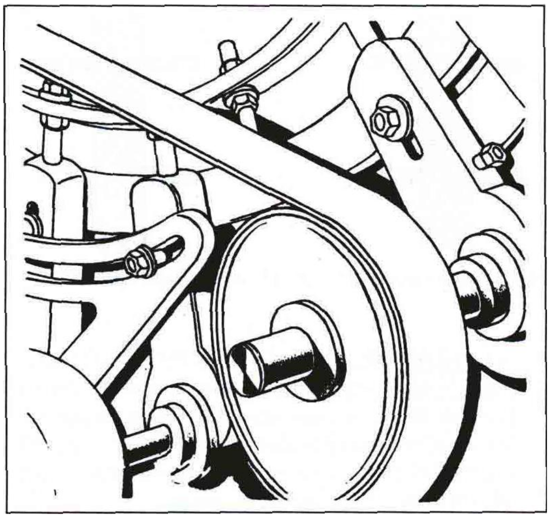

Fig. 5: Flat belt drive.

III. Belt drives (Fig. 5) transmit torque through friction. They transmit forces between shafts either via flat belts or via V-belts. Depending on the way in which the flat belt is guided (open or crossed), by changing the angle of belt contact, friction losses (slippage) can be avoided and changes in rotational direction can be achieved. V-belt drives (Fig. 6) have very low slippage. Here, a V-shaped belt runs in a groove of the pulley. The changes in speed are effected here in a step-wise manner through so-called step transmission, pulleys with varying disk diameters.

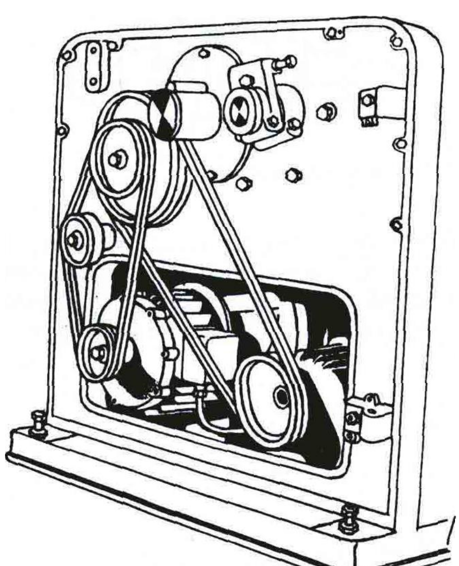

Fig. 6: V-belt drive.

IV. Friction gears (Fig. 7): If torque is to be transferred between two parallel shafts which cross or cut across one another, with only a small distance between them and with high circumferential speeds, frequent changes in speed and in direction, then friction gears are used. They can be regulated in an infinitely variable manner, by varying the position of the drive element relative to the driven element.

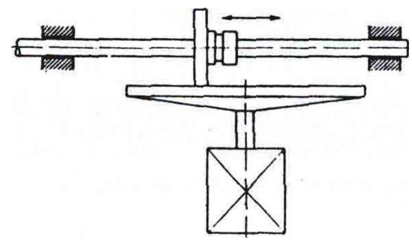

Fig. 7: Friction gears: crown gear with sliding gear wheel.

V. Infinitely variable gears: Infinitely variable drives run quietly and vibration-free; they can adjust the desired rotation range to the given working conditions. With them, speed changes can be effected whilst the machine is running. The following types are known:
1. PIV drives.
2. Würfel-Kopp-Tourator (balls control the adjustment range).
3. PC drive: (cones control the adjustment range).

In a PIV drive (Fig. 8), a V-belt or a link chain can act as a connector between the pulleys. The shaft (1) is the driving shaft; the power flows to the shaft (4) via toothed bevel disk pairs (2) and a wide lamellar chain (3). By means of a hand crank (5) via a rod linkage, the distance between the bevel disks can be changed and thus also the speed of the shaft.

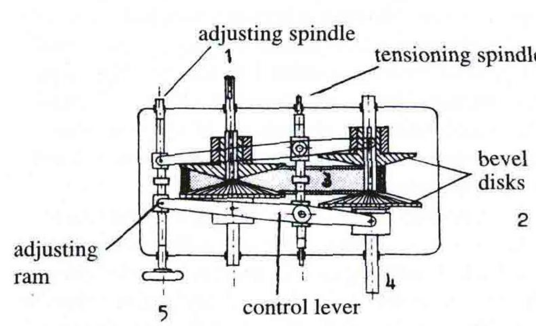

Fig. 8: PIV gears.

VI. Cam drives: If movements are to be converted, in modern textile machines increasingly the trend is to use cam drives. A cam (Fig. 9) (eccentric or cam disk) transmits the movement to the drive element (lever,

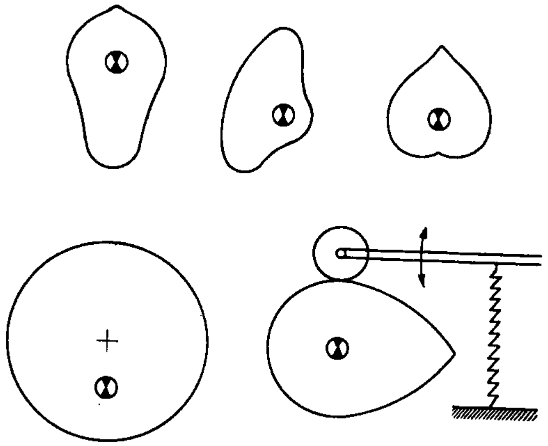

Fig. 9: Various cams for cam gears.

rod), usually by means of a roller. Transmission of movement is possible only when the cam follower is constantly in contact with the cam. There are two possibilities for this connection:

a) the cam contour is on the circumference (open cam gear), the cam follower is held down by means of springs,

b) the contour is milled into the cam as a groove; the cam follower is guided in this link by rollers.

Cam drives permit all types of movement, including movement intervals, but no movement of the cam follower can be achieved through arcs of the cam (dead position). Cam gears can be executed in open and closed forms.

① **Gedda gum** → Gum arabic.

② **Gel** A gelatinous, glassy, easily deformable mass comprising a disperse system of at least two components, i.e. of a colloidally distributed solid substance (e.g. →: Gelatin; Silicic acid) and a liquid (→: Lyogel; Xerogels). A gel can be prepared from a → Sol. Gels consist mainly of two components: the dispersed substance (gel binder) and the dispersion medium (solvent). Both components penetrate each other and join together. The coherence of both systems is the main characteristic of a gel, i.e. any point within the respective system can be reached from any other point without ever having to leave the system itself. The coherence of the dispersion medium is characterized by the fact that the diffusion of small molecules takes place at practically the same rate as in the pure solution. The gel structure consists as a rule of molecules which are connected to each other at adhesion points or adhesion zones depending on which type of energetic interactions between the (mainly) filamentary molecules exist. In the first case, they are referred to as primary valency gels: the chain molecules are bound by homopolar bonds into a three-dimensional network. In the second case, a secondary valency gel is present which is formed by the bonding of linear polymer chains by secondary valency forces (e.g. gelatin). It is in the nature of things that the second type of gels can be transformed into the solution state by changes in the environmental conditions whilst the primary valency gels are very stable under all conditions. If the solvent is removed from such a gel, or better, the swelling medium, it shrinks in most cases (xerogel), only to swell again on adding the dispersion medium. The size of the gel pores depends on the degree of swelling and this, in turn, depends on the solvent as well as the number of linkage points between the polymer chains. A range of porous polymers do not lose their structure, or only slightly, if the dispersion medium is removed (drying).

③ **Gelatin** The pure glue obtained by hydrolysis of collagen by boiling hides, cartilages and bones. Available as thin flakes or powder. Properties: transparent, glassy, lustrous material; colourless, odourless and tasteless. Water-soluble after prior swelling giving more or less viscous solutions. The addition of formaldehyde reduces water-solubility. Quality evaluation: 1 g in 100 ml water must still set to a jelly above 0°C. Uses: finishes, sizes and printing thickeners.

④ **Gelatinizer** → Plasticizers.

⑤ **Gel dyeing** (wet tow dyeing). Here, polyacrylonitrile fibres which have been produced by the wet spinning method are passed, still in the swollen state, through an aqueous dye bath (40–60%) during or immediately after drawing. A subsequent drying (heat treatment at 105–150°C) closes the pores of the fibre surface, by which the dye is fixed. Dark, intense shades are achieved with dye penetration and fastness equivalent to exhaust dyeing. Whilst polyacrylonitrile fibres are still predominantly dyed according to the exhaust method, it is apparent that gel dyeing has become the second most important dyeing method and has clearly overtaken continuous dyeing (pad-steam method). For its part, tow finishing (gel, spun dyeing, pad steam and exhaust methods) has been dominated by gel application for years. Wet tow dyeing is carried out following on from the extrusion spinning of the fibre, by the fibre manufacturer, and for this reason has a special position compared with other continuous dyeing methods with which the textile finisher is more familiar.

As is well known, polyacrylonitrile fibres are manufactured either according to the dry or wet spinning method. Whereas in dry spinning, the fibre is created from a solution of the polymer, predominantly in dimethyl formamide, by evaporation of the solvent, in wet spinning the fibre formation takes place in an aqueous precipitation bath with various additives. Besides dimethyl formamide, solvents include dimethyl acetamide, aqueous sodium thiocyanate, nitric acid, etc. The fibres produced in this way are initially present in a hydrated - i.e. swollen or gel-like - state, and show a particularly high affinity for dyestuffs. For this reason,

图 9:
凸轮传动的各种形式

凸轮从动件

a)圆盘式凸轮
b)沟槽式凸轮

①阿拉伯树胶
②凝胶
③动物胶，明胶
④胶凝剂
⑤凝胶着色(湿法丝束染色)

轧蒸法

凝胶与原液着色

浸染法

图 1：
湿纺着色法制造聚丙烯腈纤维的流程图

表：
湿纺聚丙烯腈纤维的比表面积

图 2：
纺丝工艺中聚丙烯腈纤维的比表面积与着色性能的关系

吸附等温线

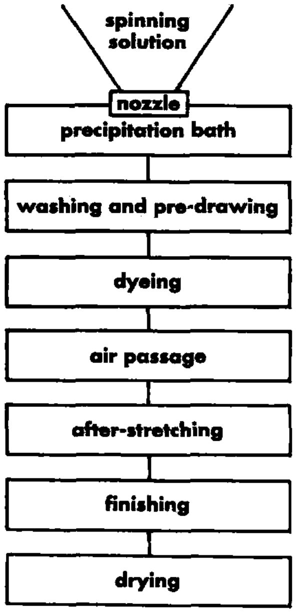

Fig. 1: Schematic sequence of polyacrylonitrile fibre manufacture according to the wet spinning method, with integrated dyeing process.

fibre type (3.3 dtex)	specific surface "BET" m²/g wet tow	drawing	dry tow
NaSCN, A	160	hot-drawn	0.3
NaSCN, B	140	cold-drawn	0.33
DMF	90	hot-drawn	0.25
DMA	114	cold-drawn	0.27
HNO_3	204	cold-drawn	0.35

Tab.: Specific surface of wet-spun polyacrylonitrile fibres.

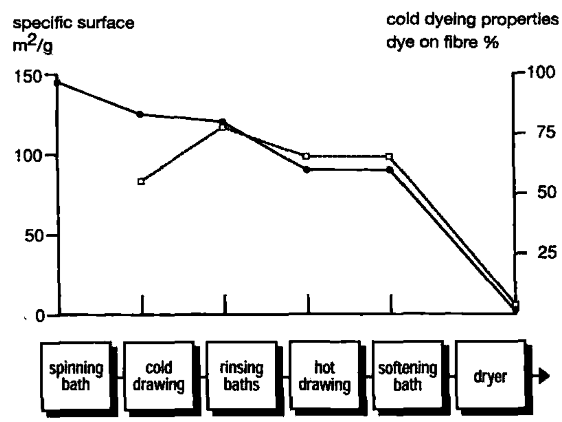

Fig. 2: Specific surface – cold dyeing properties in the course of the spinning process (as a precondition for gel dyeing).

dyeing can be integrated in the continuous process of fibre production (Fig. 1).

Depending on the spinning solution, precipitation bath composition and the working method, fibres are produced which often differ considerably in terms of their dyeing behaviour. For this reason, not all wet-spun polyacrylonitrile fibres are equally well suited for the wet tow process. The most important requirement for dyeing is sufficiently good accessibility of the tow, since only a few seconds are available for the contact between the wet tow and the dyeing liquor. In wet tow dyeing, diffusion plays only a subordinate role as compared with the dyeing of conventional polyacrylonitrile fibres. The dye absorption takes place via a pure adsorption mechanism which progresses very rapidly and is influenced very little by temperature. Gel application refers to dyeing or optical brightening in the spinning production line, namely after the rinsing section but before the drying unit. The dyeing mechanism is determined by the fibre structure - which is very open in this area - and the degree of orientation of the macromolecules, which is still relatively low. The amorphous structure means a high porosity of the fibres, and thus a very large specific fibre surface being available to the dye or optical brightener. It can be determined comparatively on freeze-dried tows in accordance with the Brunauer-Emmet-Teller method, and at room temperature it can amount to several times that of a dried, collapsed fibre of the same type (see Tab.).

How the specific surface of the fibre has changed in the course of the spinning process, and what this means for cold dyeing properties (an indicator of the dyeing properties under gel conditions), is shown by the block diagram in Fig. 2, which takes the example of a fibre type which has been wet-spun from DMF.

After fibre formation (145 m²/g), a constant slow reduction in the specific surface (90 m²/g) is to be observed over cold drawing, rinsing sections and hot drawing. Only after drying does this drop to the very low level. The so-called cold dyeing properties also move within a similar frame. In the present case, they were established by determining the relative degree of absorption of dyeing (3 seconds at 40°C) with C.I. Basic Red 46 (5 g per litre). Furthermore, the dyeing duration chosen here lies within the upper range of the actual ones customary in gel application, which are determined by the dimension of the dyeing unit and the run speed of the tow at the place of dyeing. Even though various hypotheses about the dyeing mechanism exist, it nevertheless seems to be clear that due to the strongly developed surface, the adsorption represents the dominant step in gel dyeing. Whilst most sources point to Langmuir's theory by way of explanation for this, there are also observations according to which the → Adsorption isotherms in equilibrium approximate more to those according to Freundlich. It must also be assumed