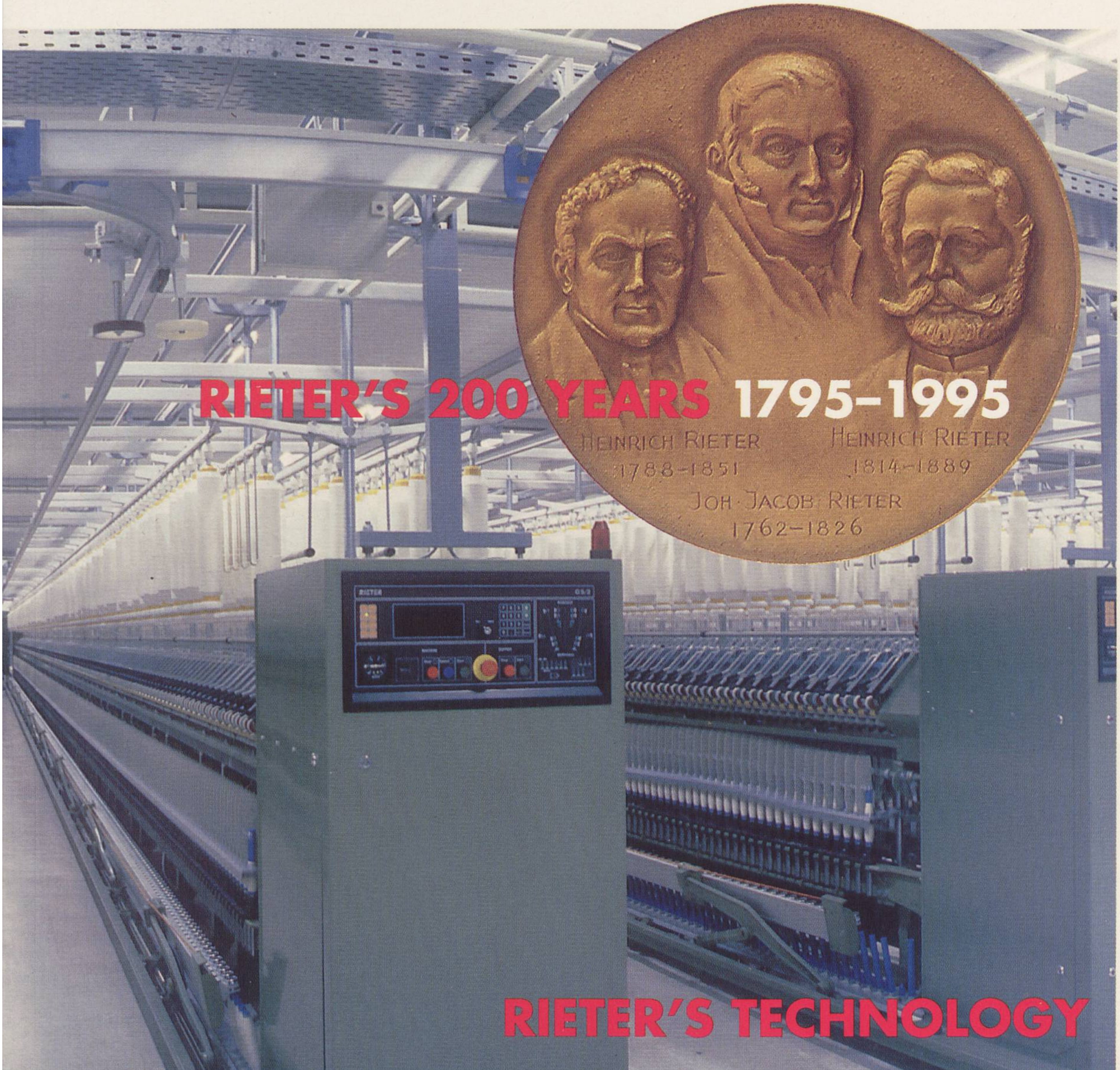
SWISS

Pioneers

OF ECONOMICS AND TECHNOLOGY



ASSOCIATION FOR HISTORICAL RESEARCH IN ECONOMICS

Swiss Pioneers of Economics and Technology

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3e Rieter (Vol. 1 History, Vol. 2 Technology)

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Swiss Pioneers of Economics and Technology
3

Rieter's 200 Years
1795 – 1995

VOL. 2

Rieter's Technology

by Alfred J. Furrer, Winterthur
translated by Herbert Hind, Weiach

Association for Historical Research in Economics
(Verein für wirtschaftshistorische Studien), Meilen

Published by Association for Historical Research in Economics,
Weidächerstrasse 66, CH-8706 Meilen, Switzerland.
Production: gsd glarus satz + druck AG, CH-8750 Glarus, Switzerland.

Contents

Modern draw texturing machines for industrial filament yarns

Preface

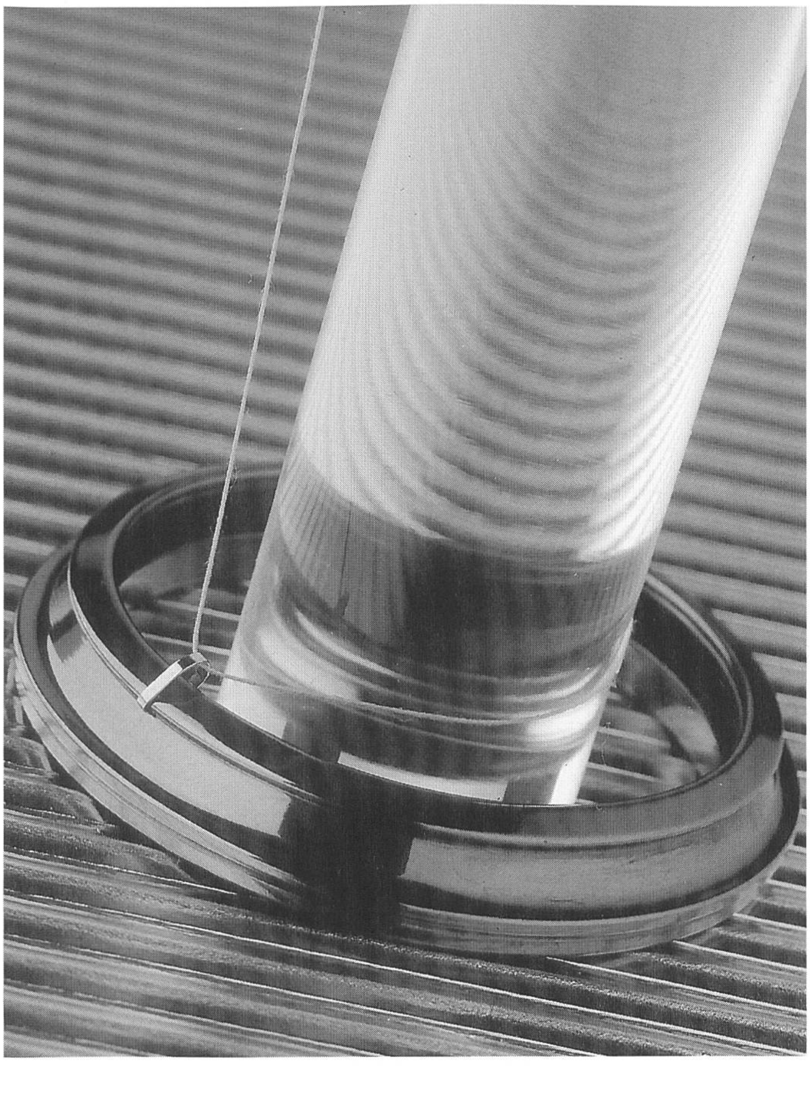
Rieter's involvement in technology commenced with spinning machinery in the early 19th century, and passed through important phases of diversification into other sectors. Recently it has concentrated on the field of spinning in staple and continuous filament installations, special plastics applications, and the technology of noise control and thermal insulation.

Technical developments are referred to only briefly in the first jubilee volume of «Rieter's 200 Years», which concerns itself mainly with historical events from 1795 to 1995. This second volume focusing on Rieter's spinning systems has therefore been compiled as a supplement to this. By way of a continuation of the jubilee volumes published in 1945 and 1970, we shall concentrate our attention on the past fifty years, but without losing sight of overall developments and of machinery manufacture in general.

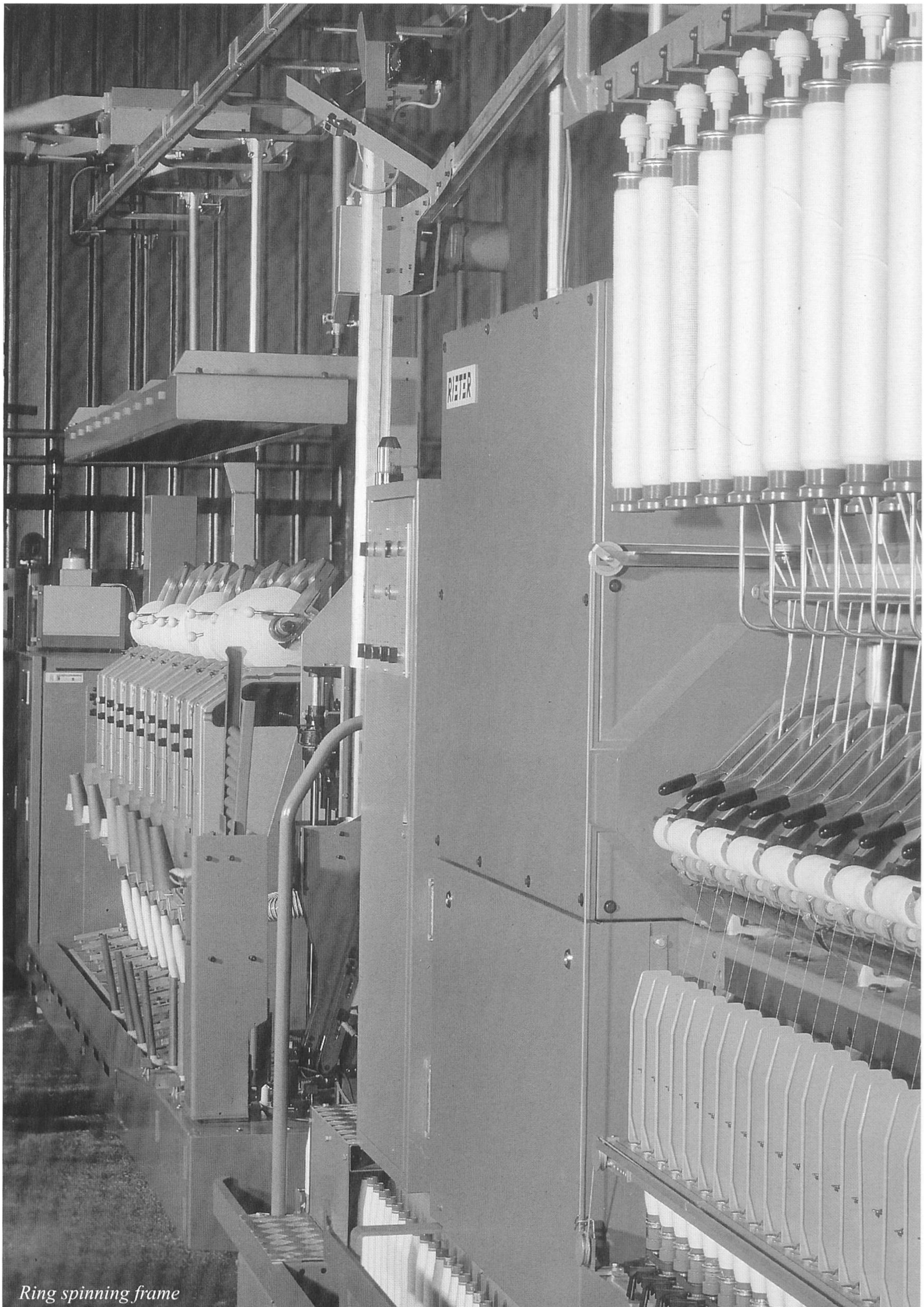
Technical terms and the most important abbreviations used are explained in the appendix in order to make this volume accessible to a broad readership.

Rieter has always attached proper importance to technical literature. The author of this work had to evaluate a wide range of information during his research, and the selection for this chronicle therefore shows his personal assessment. He takes responsibility for this and hopes this will be appreciated by his readers.

Winterthur, Summer 1994
Alfred J. Furrer



Ring and traveller of the ORBIT system for high performance ring spinning frames



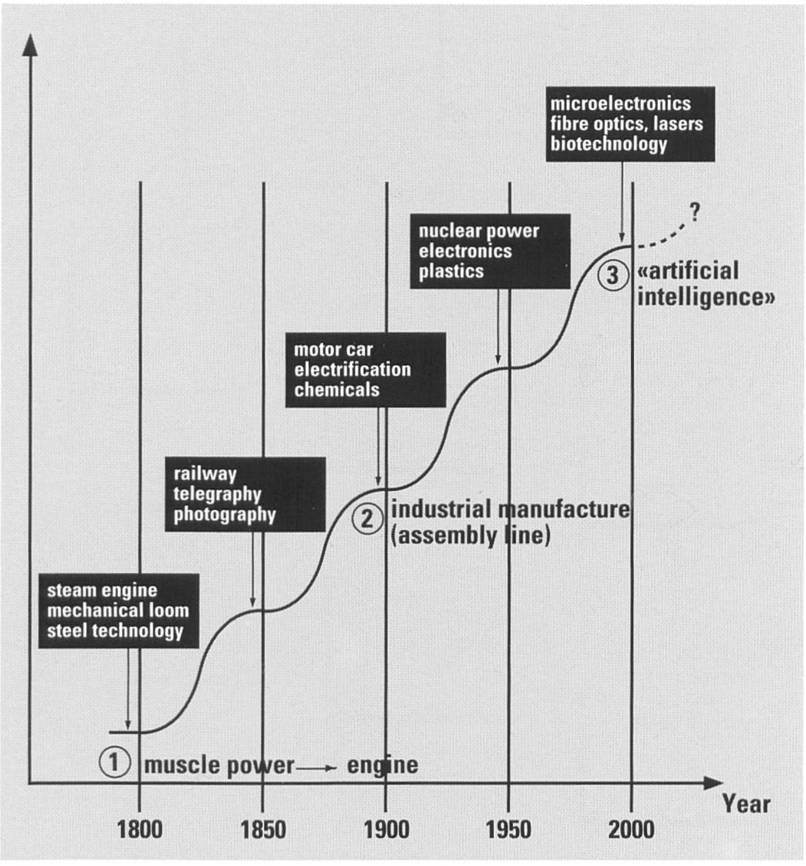
Ring spinning frame and winding machine in a hybrid system

Introduction

Technological change

The 200-year history of the Rieter company is characterized by a continuous process of change. These changes have affected people and their environment, office and manufacturing premises, jobs and the tools used in them, and social and welfare facilities. Over generations of personnel, the jobs in the machine shops initially using simple, manual tools developed into systems with computer-controlled machining centres. In the offices, development progressed from the high desk, through the carbon copy system and the slide rule, to semi-automatic typewriters, computer terminals or PCs at the workplace, modern copying systems and the databases of the up-to-date office. The future may well turn out to be the paperless office.

The stages of economic growth (Kondratieff)



Rieter research personnel initially performed their duties as skilfully inventive craftsmen who took pride in their original development premises, the «cylinder house» on the banks of the Töss. Nowadays development work is carried out in the state-of-the-art research centre at Niedertöss. Scientific cooperation with universities is sought for important projects.

Well-balanced social and welfare facilities covering health care and provision for old age also give sensitive research personnel the security they need in order to concentrate all their efforts on the company's interests.

The hypotheses proposed by the Russian physicist Kondratieff suggest that we are currently in the microelectronics phase, which is forging on in the direction of artificial intelligence with fibre optics, lasers and biotechnology. These will probably lead a new generation of technology to new developments.

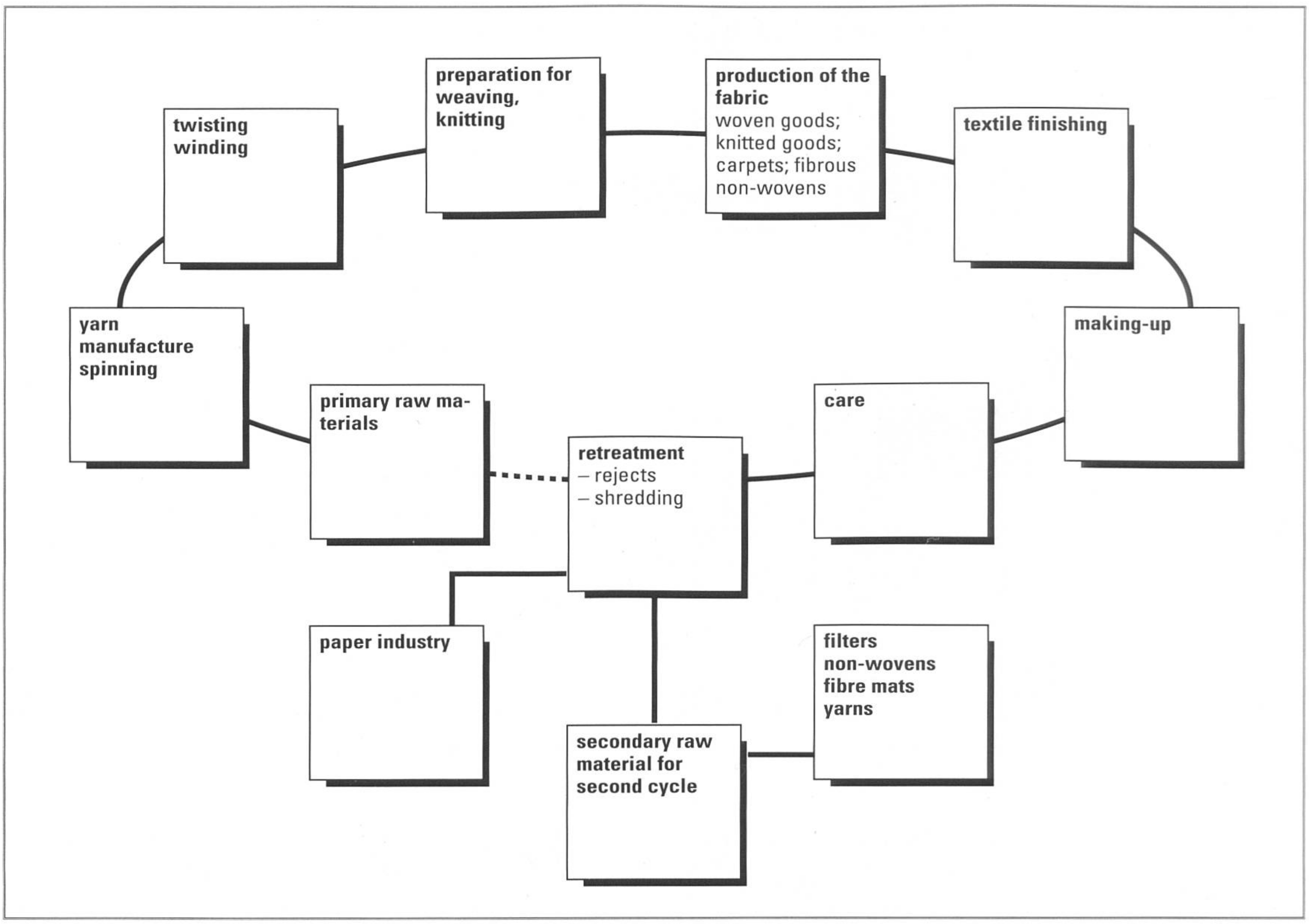
Rieter engineering in general

Rieter's designers in the 19th century viewed engineering primarily as applied natural science. The diversity of Rieter's products, which included transmissions, water turbines, machine tools, electrical installations and electric tramways, bridges and rifles in addition to textile machinery manufacture, is described in the first volume of this bicentennial publication. The variety of sectors bears witness to an almost unlimited degree of enterprise. They demonstrated the potential of designers willing to take risks in the early days of specialist engineering. If these non-textile products are compared with the present day, the diversification efforts are most impressive. However, as engineering has become increasingly sophisticated, modern articles have developed into leading products whose manufacturing processes cannot be regarded as merely secondary. The time and cost involved and the effort invested in selling the products could not have been justified on this basis. Rieter Sympatec's air separation installations, Mägerle's laminate tube machines and experience at Unikeller can be cited as examples of these aspects.

Textile technology as a system

When Rieter was founded, textile technology was already an art and craft several thousand years old. The relevant spirit of inventiveness is to be found, for example, around the year 1100 in ancient Chinese literature, in which a silk reel is described. Special reference was made around 1600 to the guild of hose knitters for male outerwear. Basic developments to the mule - the first mechanical, multi-spindle spinning machine - were recorded in 1790. The technology outlined here assumed an increasingly rapid pace with inventive ideas during the period which followed. The development steps followed each other in rapid succession. It is therefore appropriate to take a look at the overall textile process, both in its manufacturing stages and in its total life cycle. What began with primary raw materials experiences total recycling into a new existence after being manufactured and used until it is worn out. However, disturbing factors such as global warming also play a part in these considerations. The increase in temperature of some 1.5 degrees Celsius in the past hundred years has created conditions conducive to the use of

The overall textile process – a life cycle



lighter woven and knitted fabrics. These require finer fibres to produce finer yarns in ideal quality.

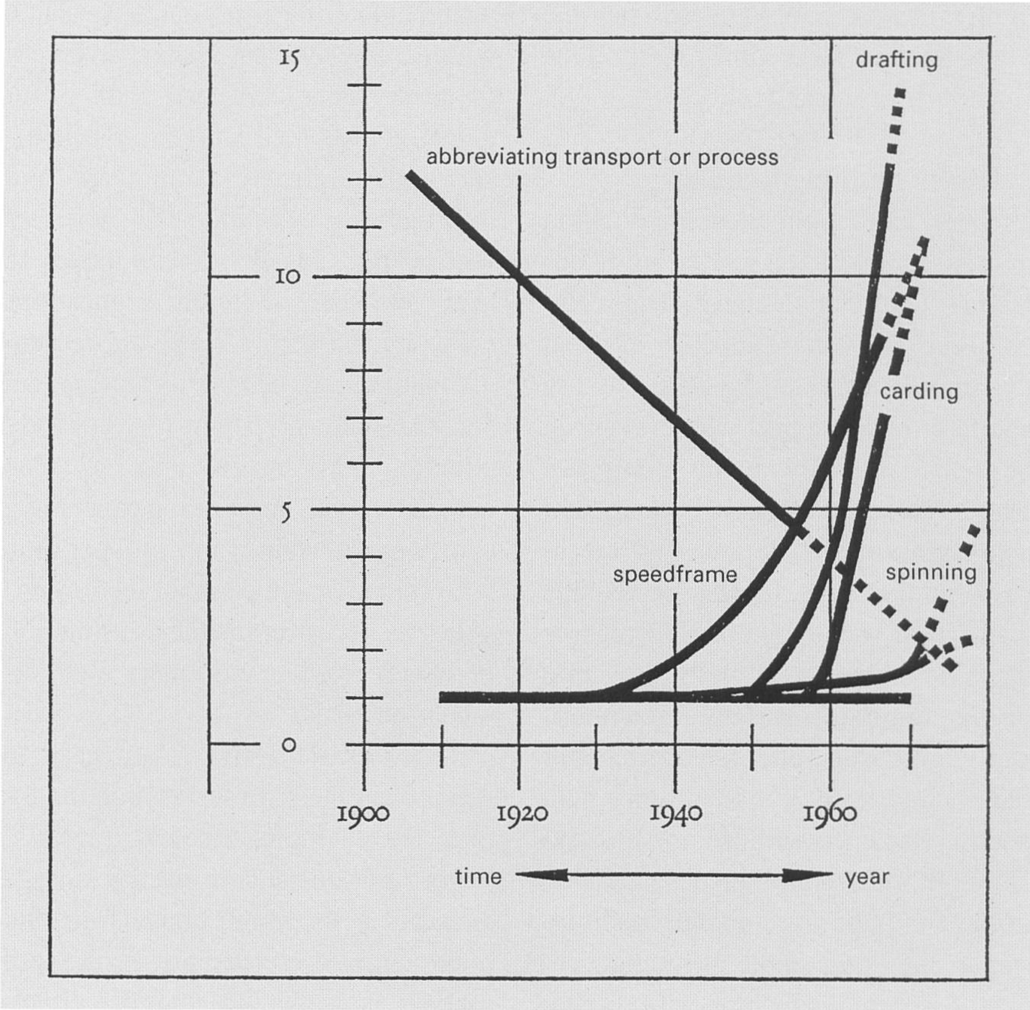
Rieter spinning technology

Rieter has sought a leading position in this sector since it started to manufacture textile machinery. The company seeks to advise its customers on the most appropriate systems to use and to provide support wherever it can be applied profitably in the system as a whole. This task starts with the use of appropriate raw materials, and nowadays continues as far as the reliable disposal of waste materials. It regards machine manufacture as the selection of the optimum structural elements and maintenance and operating materials which can be advocated with good conscience with a view to recycling. While technological leadership in the fields of short-staple, medium-staple and long-staple spinning processes is a realistic proposition, filament spinning systems are generally subject to different rules. The top rank of major chemical groups in the sector conducted their own technological research and contracted out exacting machine manufacturing assignments to Rieter. This philosophy demands high performance from Rieter and imposes requirements of discretion. There is therefore a sound basis for the company's efforts to become a technological leader in the filament sector, too.

Future developments with coordinated project groups

The demands imposed by textile high technology are very exacting. The highest standards achieved by aerospace engineering are far from adequate for continuous, three-shift textile operations, and the idea of building new textile machines from tried and tested automobile components would make these products unusable within a few months. The achievement of peak technical performance requires coordinated work by mechanical and electronics engineers and information technologists, together with a high degree of willingness to take into consideration suggestions made by marketing staff, the recommendations of production personnel and the needs of patent lawyers. Full attention must be given to the basic and further training of all partners in a coordinated team, and cooperation with scientific educational institutions is just as necessary as the consultation of experienced practitioners and service specialists.

There are still significant gaps in general engineering's route into the future. For example, wireless transmission of power, random energy storage and fuel cells which convert air and hydrogen into electric power, are still utopian concepts. In textile technology, for example, textile crimping and easy-to-wear synthetic filaments are still far from perfect. The heat and moisture exchange of synthetic filaments still does not bear any comparison with the behaviour of yarns such as wool. Wide areas of endeavour therefore remain open for research and development. The prerequisites for future success are within reach thanks to CAD technology, manufacturing using CIM/CNC, and information technology aids in virtually all areas of activity. At the same time the solution to the problem has to be sought at ever higher speeds. The physical properties of the raw material used, the efficiency of the process modules and the service requirements impose technical and financial limits in this context.



Multiple increase in productivity in the spinning mill

Short-staple spinning processes

According to Rieter's business records, the company has been involved in spinning since 1808. Napoleon's continental blockade with its severe obstacles to trade forced Rieter to make repairs to its English spinning machines between 1806 and 1813. This work was performed in the Töss workshops, initially for the company's own use and increasingly also for associated companies. In-house spinning machine manufacture commenced in 1821 on the basis of the experience gained from this.

Rieter has developed into a systems supplier and leading specialist with these products and installations.

If the development of spinning machines is compared with advances in automobile engineering, it is surprising to note the similarities. For example, the motor car almost totally lacked «intelligence» at the turn of the century, and transport using the new-fashioned vehicle remained at the level of horse-drawn carts. Drivers were therefore responsible for operating this system intelligently. The motor car and motorized transport have developed up to the present day to the level of artificial intelligence. Human beings therefore perform the functions of commander, manager and supervisor. This situation corresponds almost entirely to the development of modern spinning systems.

If the development in operating speeds at the various process stages is also reviewed, the emergence into the current era of high performance took place in the nineteen-fifties. The following **increases in performance** were made at the various process stages between 1950 and 1994:

Machine	from	to	increase
card	3	70 kg/h	= 25times
drawframe	30	800 m/min	= 25times
combing	100	300 nips/min	= 3times
speedframe	600	1 200 rpm	= twice
ring spinning	10 000	25 000 rpm	= 2.5times
rotor spinning	20 000	120 000 rpm	= 6times

If this is compared with systems used in daily life, such as cars, railways, aircraft, refrigerators and washing machines, performance has generally doubled since 1970. Textile machinery manufacture can, incidentally, certainly stand up to comparison with aerospace engineering. Whereas satellites are built to withstand a maximum of 20 g (acceleration constant), spinning machinery manufacture in man-made fibre technology copes with yarn guide loads of up to 300 g. In three-shift operations with long life expectancies, this corresponds to a multiple of the performance achieved in space technology. Similar examples could also be offered, for example, from the fields of carding, combing, and ring and rotor spinning. These record achievements have necessitated consistent, systematic planning and hard work. Rieter's engineering operations here made use of appropriate functional diagrams, technical guidelines, R&D planning, etc. Value analyses were performed with external partners for purposes of regular assessment and the necessary constructive criticism, and promising approaches for marketing, design and production were sought with the help of competent advisers.

In the course of organizational changes in the early nineteen-nineties the transition was made from the earlier, steep management pyramid to bulbiform structures with sectoral systems and short management lines.

Rieter's market value was boosted considerably in 1987 by the merger with Schubert & Salzer AG in Ingolstadt (Germany). This company had actually commenced textile machinery manufacture as far back as 1883 in Chemnitz (Germany) with a hosiery knitting machine. At the time of its acquisition by Rieter, the company was regarded as a serious competitor in the spinning machinery sector. The subsequent coordination of product ranges has reinforced Rieter's position on the world market.

The stimulus of exhibitions

Development achievements are measured against comparable products manufactured by competitors. This provides the stimulus for innovations which in turn promote sales. The international textile machinery exhibitions held at 2 to 4-year intervals under the headings of ITMA (Europe), ATME (USA) and OTEMAS (Japan) are of special significance here.

Short-staple spinning

Fibres up to 60 mm long are generally processed in short-staple spinning. Special drawframe designs enable medium-staple fibres up to 70 mm to be spun; these are used in niche markets. Cotton is the preferred natural fibre for spinning. The planting, cultivation, harvesting, ginning and baling of this raw material are among the tasks attributable to the textile sector. Soya beans can also be cultivated to utilize fields more efficiently. This interplay between fibres and foodstuffs influences cotton prices. Synthetic/chemical staple fibres such as those mentioned briefly in the chapter on «Manmade fibre machinery and systems» are increasingly being spun as an admixture to cotton or as an independent raw material.

Finally, secondary raw materials obtained from torn and separated fabrics are used to produce fashionably coarse yarns, nonwoven fabrics, fibre webs, etc. In this field there are synergies with insulation materials such as those used by Unikeller for noise control and thermal insulation.

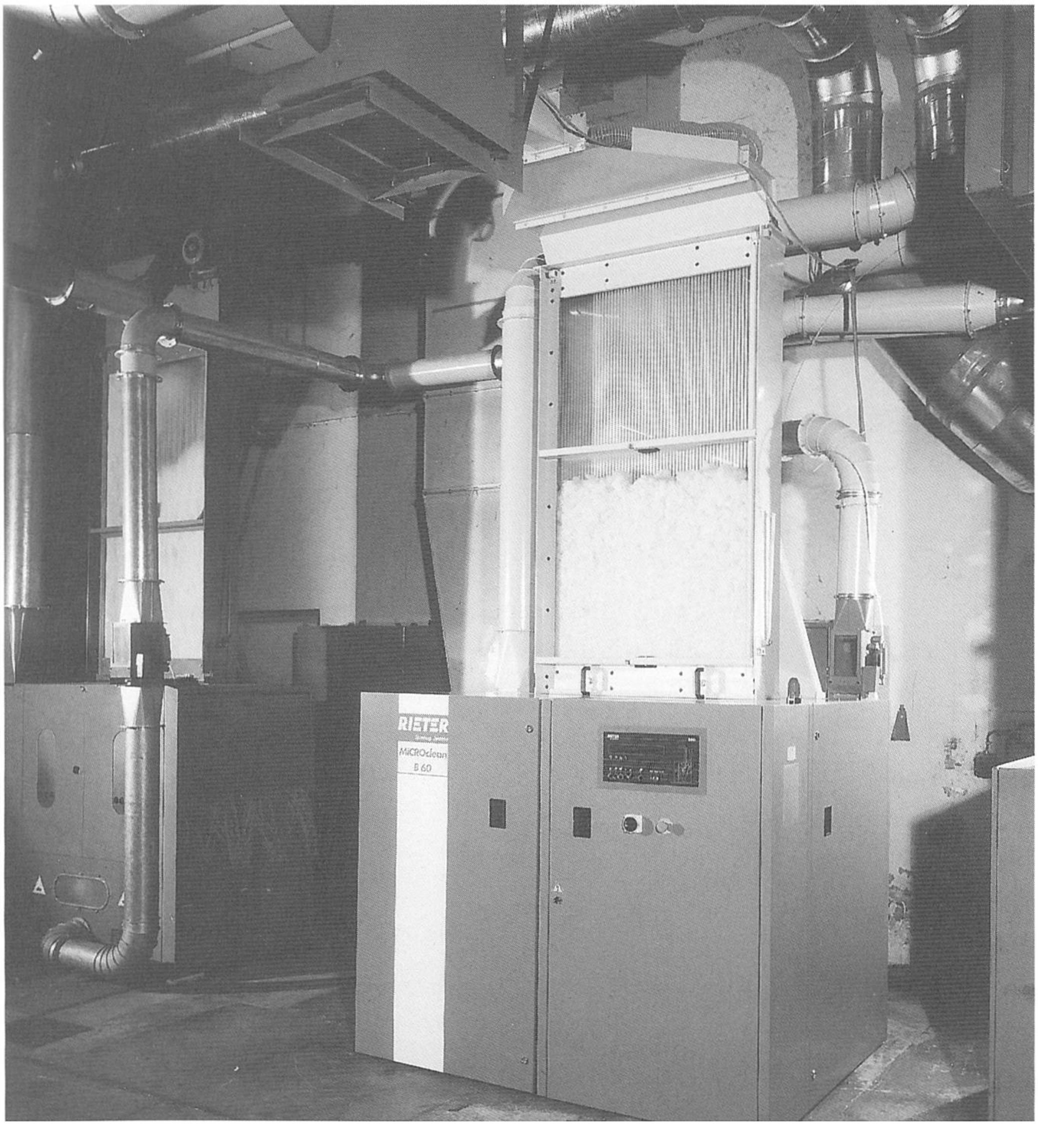
The stages of the process are described briefly below:

Opening and scutching machines; stock feed

The natural or synthetic fibres are delivered to the spinning mill in bales of approx. 200 kg. A wide variety of blends is possible at the feed stage to enable yarns with the most appropriate properties to be spun.

The rotating beater elements of modern opening and scutching machines release open or fixed fibre dust, which is removed by blowing and suction. Vegetable residues and quartz sand are separated out via fixed grids and screens during this process. Flocks of the highest possible cleanliness are produced using machines such as the

The UNIflex B 60 fine cleaning and dust extraction machine



UNIfloc bale opening machines reduce the raw material into flocks of small size.

Nr. 369601 **PATENTSCHRIFT** Nr. 369601

SCHWEIZERISCHE EIDGENOSSENSCHAFT

EIDGENÖSSISCHES AMT FÜR GEISTIGES EIGENTUM

Klassierung:	42 e, 27 [76 c, 30/10]
Gesuchsnummer:	73863/59
Anmeldungsdatum:	1. Juni 1959, 24 Uh
Patent erteilt:	31. Mai 1963
Patentschrift veröffentlicht:	15. Juli 1963

HAUPTPATENT

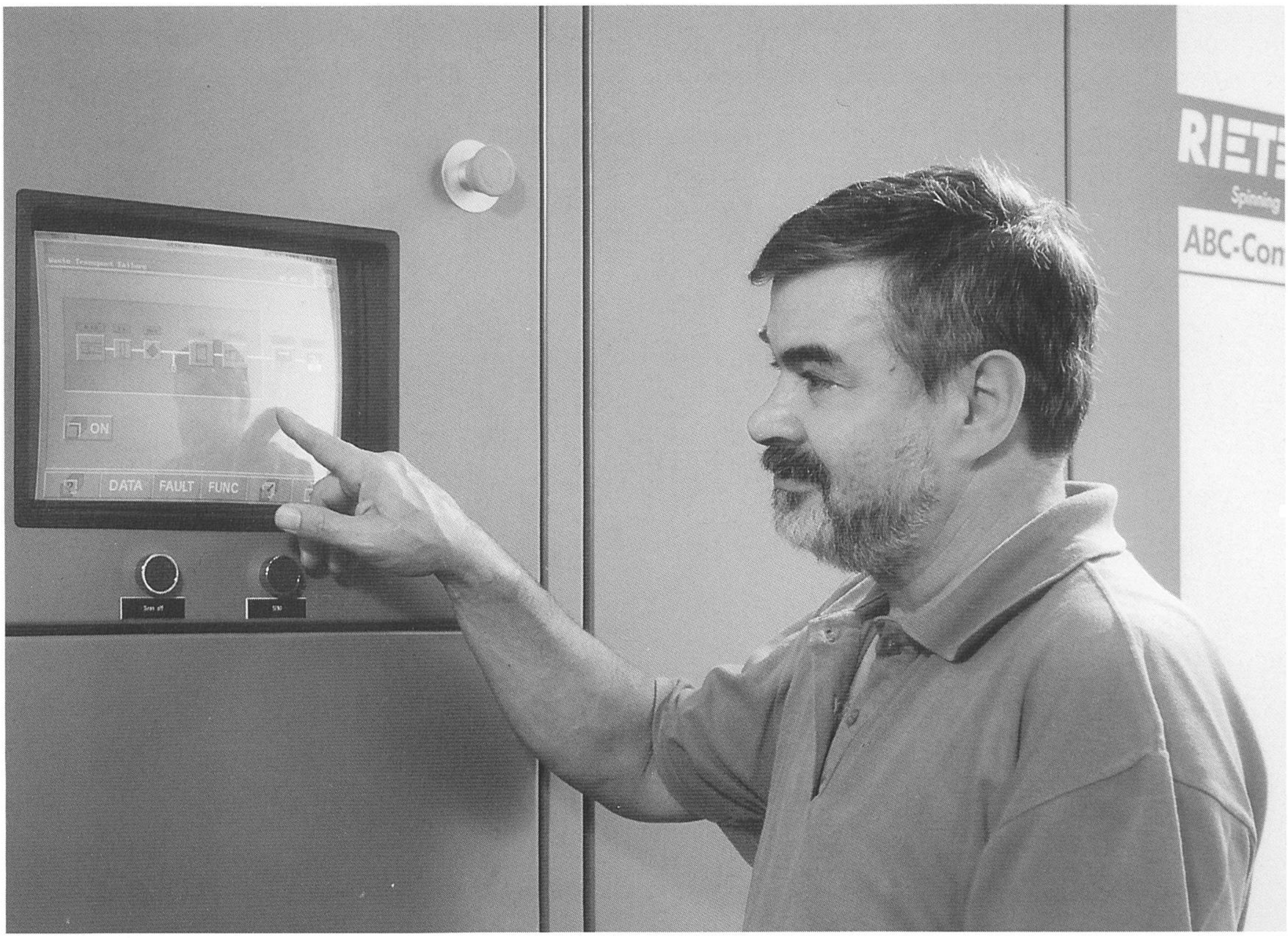
Maschinenfabrik Rieter AG, Winterthur

Verfahren und Vorrichtung zur Messung des Volumens bzw. des Gewichtes von in der Regel nicht gleichzeitig einen Kanalquerschnitt durchtretenden Körpern, insbesondere solchen ungleicher Größe oder Ansammlungen von solchen, z. B. Faserflocken

Hansruedi Lamparter, Winterthur, ist als Erfinder genannt worden

The patent specification for the «Flockmeter»

The modular ABC control system makes provision for customer-specific approaches for all monitoring functions.



UNI-floc A10, the UNIclean B1 or the B4/1 monoroll cleaner, the B3/4 blending opener or the UNImix B7/3, the Contimeter B0/1 fibre metering machine, the B50 or B60 fine cleaner as the successor to the ERM B5 standard cleaning machine, fans, dust and solids separators, etc. Additional systems such as spark monitors, etc., check the safety of the processes.

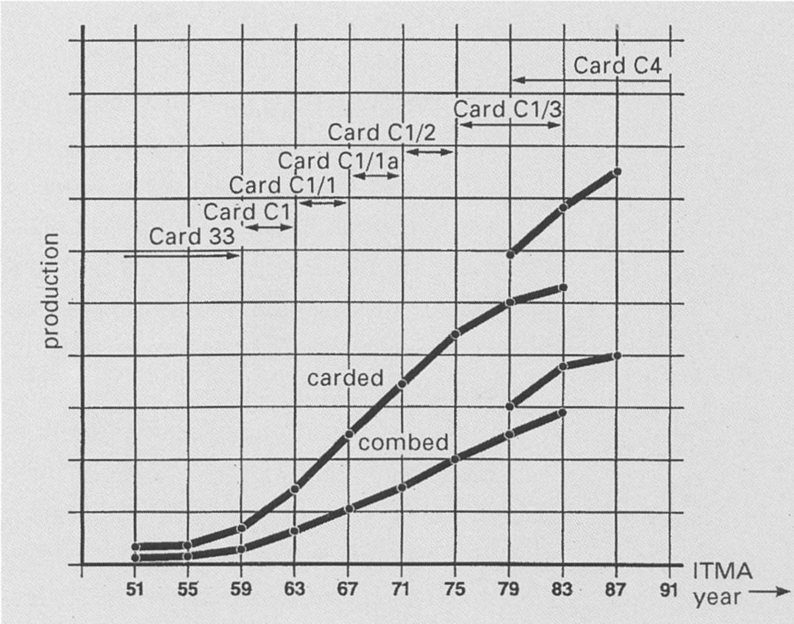
The classical line of development in blending technology has brought forth the bale opener or blending hopper bale opener, which is loaded by hand with layers of fibre from the bales. The fibre blends depend here on the reliability of the spinning mill personnel. The Rieter Contimeter was the first continuous blending machine which satisfied the high quality requirements in full. Automation of the opening machines using entire bales has been the target since 1950 with a view to improving blends and thus assuring quality. The bale disintegrator thus emerged in the nineteen-sixties as the forerunner of the carousel, which appeared around 1965 and was finally followed by the UNIfloc A1 about 1976. This latter machine satisfied requirements for process flexibility, online quality manufacture, and operation with minimum personnel. Via the A1/2 series in 1983, by 1994 its development reached the UNIfloc A10, which could handle four varieties at a maximum of 1400 kg/h.

In earlier times, the classical opening and scutching systems reflected the technology utilized by English machine manufacturers. Manually fed blending hopper bale openers and, for example, perforated cage cleaners, Crighton openers, suction boxes and double scutchers produced metre-wide laps, which fed «pressed» flocks to the cards until the nineteen-sixties. In modern blowing rooms, by contrast, the fibres are converted very gently from pressed bales into approx. 50 mg (milligrams) flocks suitable for carding. The volume of flocks is metered by the Rieter flock meter, which introduced electronics to opening and scutching operations in 1959. The ducts of the U Aerofeed system, which are free of fibre drag, enable flocks to be fed to the cards with a high degree of flexibility.

Cards and sliver conveyors

Carding the fibres is the main task of the spinning mill. Fine opening of the stock takes place on the card. The rotating elements of the machine, on which wire clothing is mounted, draw the fibres over blades and clothed bars or segments. Counter-rotating, clothed rollers can also be used instead of bars for longer staple fibres. A narrow gap of 0.15 to 0.2 mm is set for the passage of the fibres between the carding elements. The tips of the precision sawtooth wires used for the clothing have hardnesses of 800–900 HV (Vickers). They are manufactured with a height tolerance of 0.02 mm. The carding bars or covers are also equipped with clothing in which sharply ground wire staples are embedded in multi-layer materials. The carding process between the high-speed main cylinder of the card and the very slow-moving carding bars, stationary segments or rotating rollers collects non-fibrous impurities, clumps of immature or agglutinated fibres, and removes them. The combing motion parallelizes the tangled fibres for the first time in the spinning process and forms them into a state capable of being drawn. This leaves the card as a very thin fibre web, and at the outlet of the machine is combined into a sliver, which is moved on to further processing coiled in transport cans. The quality of the carding process has a direct influence on the quality of the yarn.

Increase in card productivity



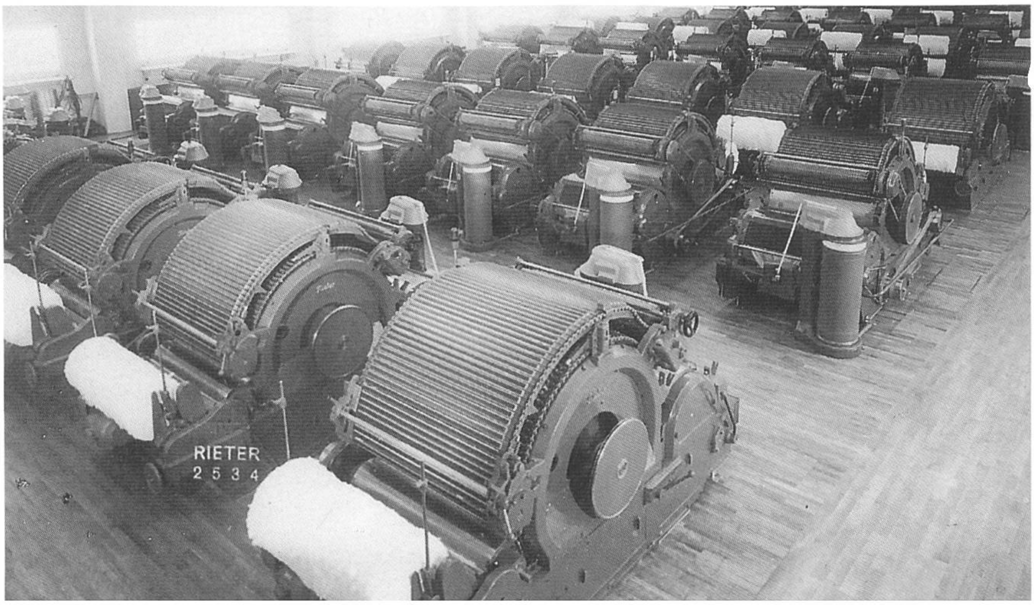
According to the doctrine of spinning technology, the saying: «Properly carded is half spun» is still applicable.

The following **models of cards** have been produced since about 1925:

Date	Series	Cylinder dia.	Cylinder rpm	Output kg/h
until 1932	24	1200	150	1,5–3
1933–1960	33	1000	180	1,5–5
1960–1984	C1	1290	180–250	up to 20 and more
	C1/1, C1/2, * C1/3	1290	360–450	up to 45 and more
1979–1993	* C4	1290	up to 600	up to 70 and more
from mid-1993	* C10	1290	up to 600	up to 70
ab 1994	* C50	1290	up to 600	up to 80

*) • Optional regulating system for long-term and short-term variations in the sliver

*) • Sliver coiling for max. 250 m/min. in cans from 600 to 1000 mm in diameter



C1 card in the spinning mill. Version with lap feed ca. 1960

As befits the importance of the carding process, the card is usually equipped with a Rieter long-term and short-term regulating system with a view to achieving high online sliver quality.

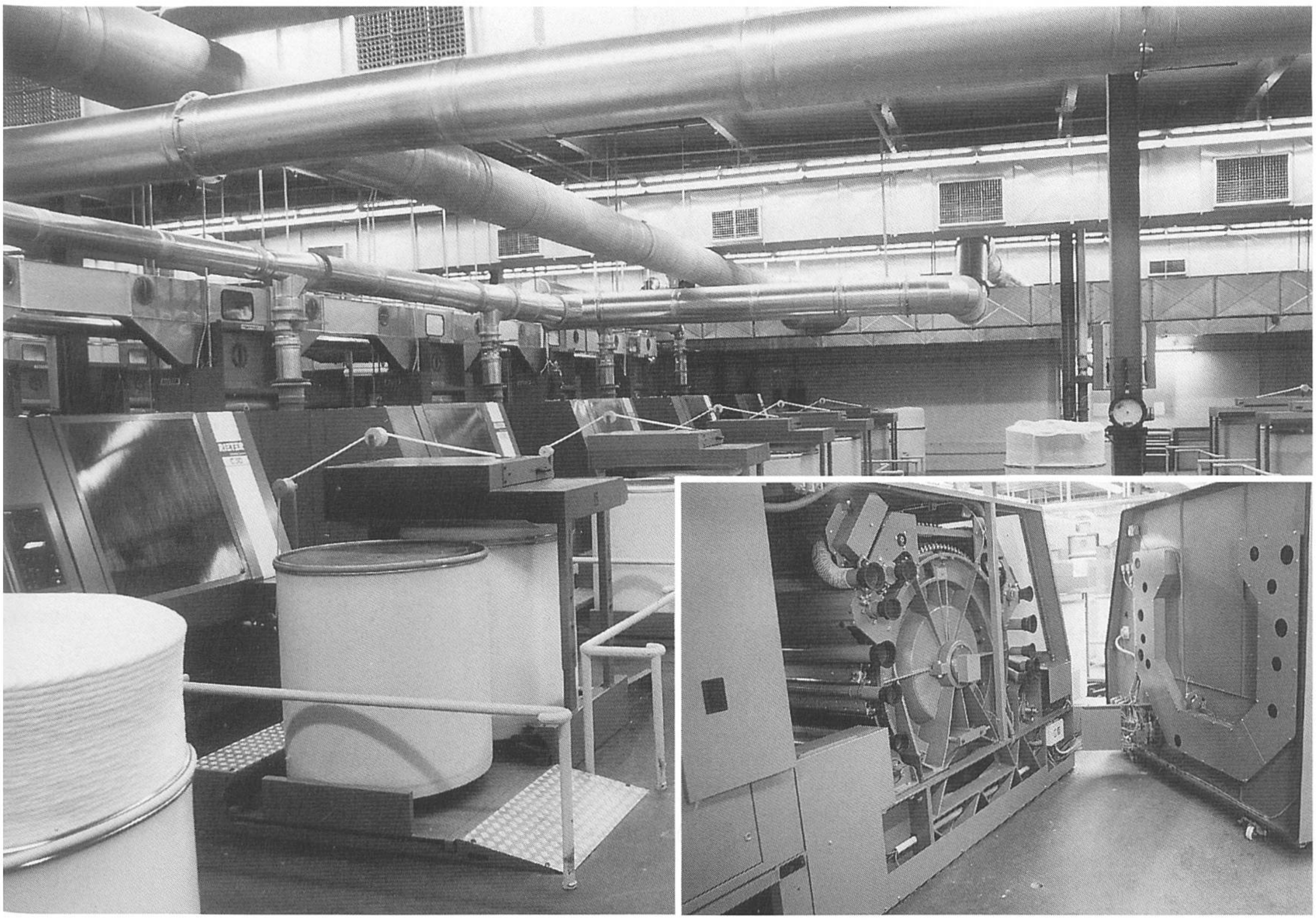
The product of carding – the carded sliver – is deposited at 100–250 m/min. in transport cans, which are moved on castors. Since the nineteen-seventies these cans have grown from a maximum diameter of 300 mm to 600–1000 mm. Large amounts of capital are thus tied up in the material containers for the process. A sophisticated operational management organization must therefore ensure rapid throughput with automatic conveyors.

Direct belt conveyors were also used at an earlier development stage. The carded sliver was then fed to a buffer, the C7 sliver storage unit, and from this via a conveyor belt preferably to an autoleveller. The rise in card delivery speed to 150–250 m/min. meant that this approach became increasingly less suitable due to the intake speed of the drawframe (only some 100 m/min.).

Combing machines and lap handling

Natural staple fibres such as cotton contain short fibres which are not fully incorporated in the spinning process. They thus protrude partially from the bundle and affect the hairiness of the yarn or cause pilling in the fabric. Short fibres are now combed out on the combing machine. The proportion combed out is between 10 and 18 percent (14 to 18 percent with full combing and 10 to 12 percent with semi combing). This creates the prerequisites for producing top quality yarns. Even 15 to 20 years ago the combing process was subject to wide fluctuations in demand. More recently this interplay has given way to an increase in demand. This is probably due in

The C50 card is the latest model in a successful series.
Inset: With the side panel removed, the robust drum bearing and multiple air extraction facilities are visible.



part to the warmer climate and the increase in the air conditioning of premises and vehicles, with the consequence that lighter clothing is being worn. However, the influence of current fashion maintains the relationship between carded and combed yarns, textured filaments and natural silk.

Technical advances in combing machinery

Rieter can look back on three generations of combing machines.

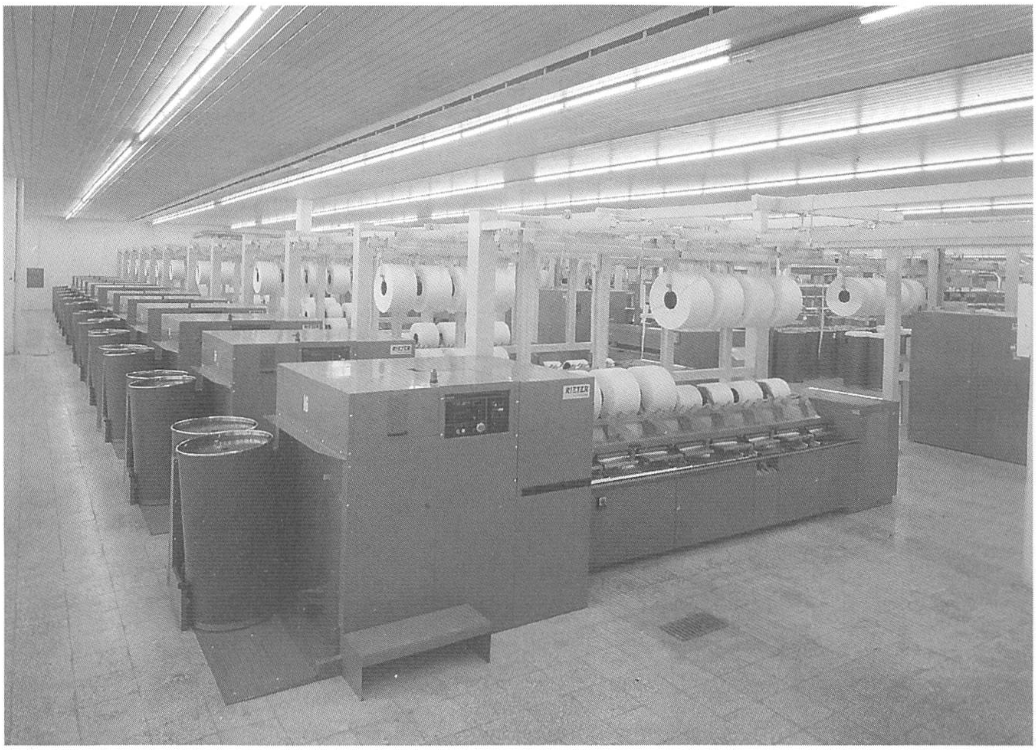
The 15 Series combing machine, built in accordance with Joshua Heilmann's inventions in 1846, operated very successfully around the turn of the century with 80 nips/min. The improvements made by John William Nasmith between 1895 and 1925 made a significant contribution to this.

The follow-up model was the 39 Series combing machine. This in-house design, which increased performance to 120 nips/min., also achieved recognition in mill operations.

Finally, we come to the technological leap made in the nineteen-fifties, ushered in by the American Whitin company with its Model J comber, a completely new design which achieved 160 nips/min. Rieter analysed this innovation, discovered its weaknesses, and responded with its E7 combing machine, which operated at 160 to 180 nips/min. and was systematically developed to full mill maturity. The subsequent E7/1–E7/6 models bear witness to the company's success as world market leader in terms of production, quality and sales volumes. The 350 nips/min. run nowadays are still the target being aimed at by Rieter's main rivals, but Rieter's development work is continuing.

The entire combing process is based on balanced combing preparation. Two main processes are customary in this field of operations:

- Ninety percent of the installations supplied are intended chiefly for vertically integrated operations which control the process from the raw material through to the store counter. The flow of fibres passes via card – drawframe –



E7/6 combers with lap transport

UNIlap 3 (sliver lap machine) – comber – autoleveller, etc.

- Rieter supplies the remaining ten percent of preparation lines for top-quality yarns, i.e. for commercial spinning mills. Here the machine sequence is: card – UNIlap 2 (blower and spreader) – UNIlap 4 (ribbon lap machine) – comber – autoleveller.

Until around 1975 the E2/4 blowers and spreaders for lap weights of approx. 60 g/m, package weights of some 15 kg and delivery speeds of up to 65 m/min. were regarded as classical preparation machines. The follow-up machine was the E4/1 ribbon lap machine with similar performance statistics. A further leap in development at the end of the nineteen-seventies was made possible by massive research effort in lap formation. The new generation – UNIlap E5/2 (blower and spreader), UNIlap E5/3 (sliver lap machine) and UNIlap E5/4 (ribbon lap machine) – currently operate with lap weights of up to 80 g/m, delivery speeds of up to 120 m/min. and packages of up to 25 kg.

These huge increases called for the E6/4 conveyor system to make operations more user-friendly. This system links preparation operations with the comber. Its extensive automation reduces the heavy work involved in package handling to a reasonable level and supports quality targets.

Finally, a reference to the short fibres combed out in the process – the combing noils – which are supplied as valuable secondary raw material to OE rotor spinning operations for coarser yarns, processed into heavier yarns in the ring spinning process, or extend appropriate fibre blends as a filler component.

Drawframes

In the spinning process, drawframes are used to ensure uniformity of the slivers and improve the parallel orientation of the fibres. Six slivers are usually fed in and then drawn to six times their length. This compensates for the periodic faults in combing. The drawing process also extends front and rear hooks of the individual fibres. These drawframe slivers are thus used

Combing room with UNIlap units and lap transport

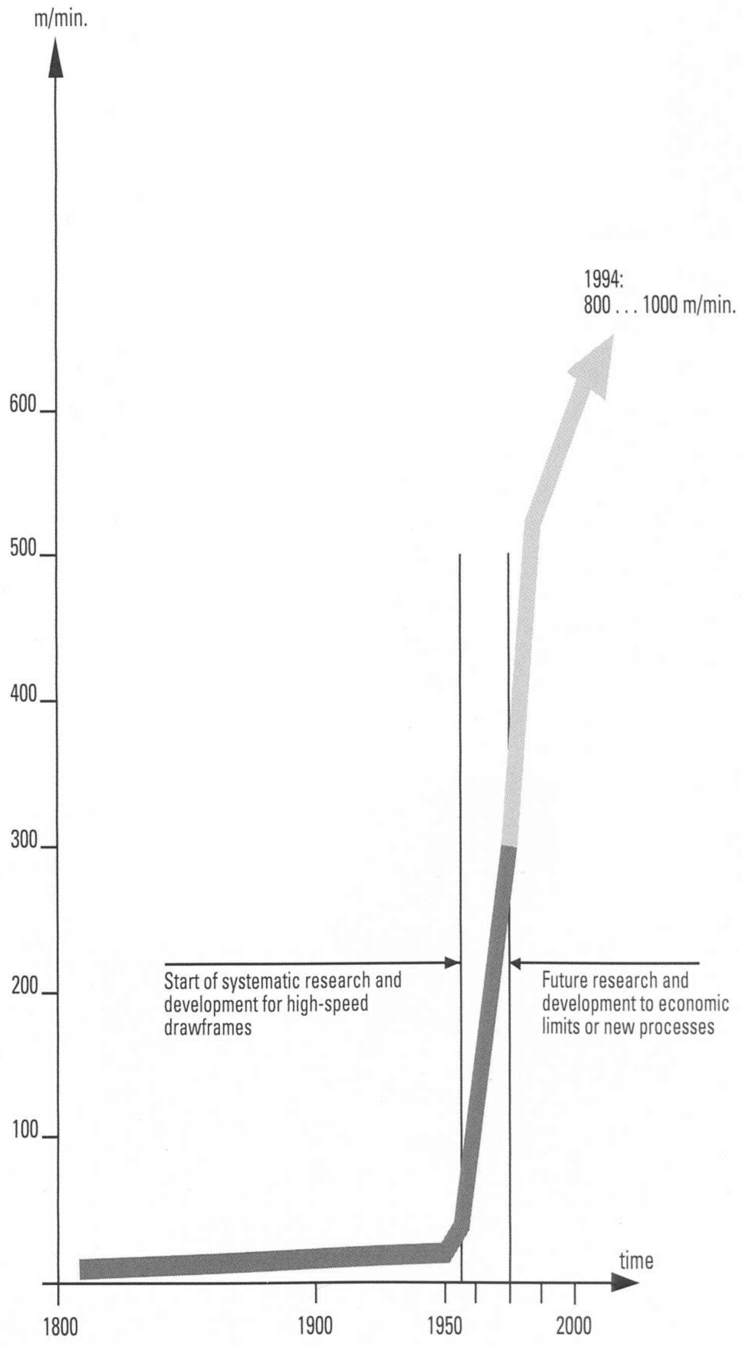
for the classical process with speedframes and ring spinning frames, OE rotor spinning and direct sliver-to-yarn spinning. Historically, the drawframe is the oldest machine manufactured by Rieter. By analogy with French terminology, it bore the name «laminoire» in the classical spinning mill. Over many decades of development the drawframe grew from a single-head version to an eight-head machine in the 44 Series. Its numerous variations have been further increased by twin versions. The rise in operating speed reflected advances in manufacturing assembly and bearing engineering. Current speeds of 800–1000 m/min. developed from the original delivery speeds of 10 to 20 m/min. in the 19th century. Production performances have therefore been achieved which require coordination within the process as a whole. Rectangular drawframe cans which permit long running times due to the density of the feed sliver have been developed since 1990 for feeding OE rotor machines.

New partner Schubert & Salzer AG added its drawframes to Rieter's technology package in 1987. The simple SB 51 and 52 models from Ingolstadt and the RSB 51 and 851 autolevellers carried the day against the sophisticated Mechatronic features of Rieter's latest D1 model. Ingenious, robust simplicity was thus reflected in market success. In autolevellers the objective was again to aim for «as good as necessary» online quality, since refinements in the drawframe sliver were unlikely to pay off in the process as a whole.

Speedframes – Ring spinning frames – Ring twisting frames

This set of machines is one of the oldest stages of the mechanical spinning process; its origins go back to hand spinning and the spinning wheel.

Rising productivity of cotton drawframes



44 Series drawframes in the spinning mill

Drawframe models

Date	Model	Specification	Operating speed in m/min.
until 1959	34 Series	sliver drawframe	20–50
	44 Series	2–8 heads	
	DB Series	sliver drawframe	
	DZ Series	double sliver	
from 1959	D0, D0/1	sliver drawframes	up to 200
1961–1985	D0/2	sliver	up to 300
1969–1972	D7/1	autoleveller	up to 300
1971–1982	D7/2	autoleveller	up to 300
from ca. 1975		can dia. at delivery up to 600 mm can dia. at feeding up to 1000 mm	
1973–1985	D0/5	sliver drawframe / 1 head	up to 500
1978–1991	D0/6	sliver drawframe / 2 heads	up to 500
1982–1992	D1/1	sliver drawframe / 1 head	up to 800
	D1/2	sliver drawframe / 2 heads	
from 1987	SB 51	sliver drawframe / 1 head	500
from 1993			up to 1000
from 1987	SB 52	sliver drawframe / 2 heads	500
from 1993			up to 1000
from 1987	RSB 51	autoleveller	600
from 1994	RSB 851	autoleveller	up to 1000

Rieter D0/6 drawframes and Rieter RSB 851 autolevellers

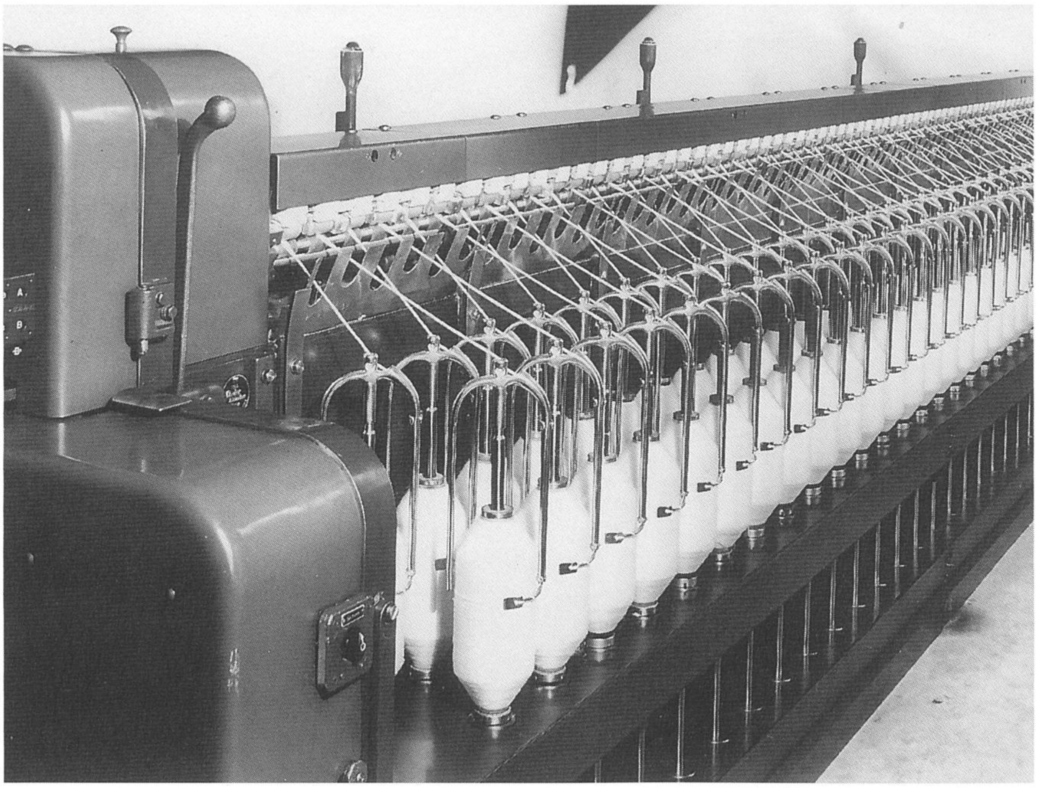
Due to the influence of modern processes, speedframes and ring spinning frames are those sectors which have probably been declared defunct and resurrected again more often than any other. If speedframes and ring spinning used to be notorious as «anti-automation», Rieter's achievements and/or acquisitions in the past twenty years have made them into successful lines which have gradually regained top rankings. They are regarded as shining examples of the systematic concentration of resources, and have provided Rieter with tough, but nevertheless very digestible daily bread.

The speedframe – the spindle roving frame – produces the roving or slubbing for the ring spinning frame. In Rieter's recent history the 23 Series speedframe was produced until 1935. The 35 Series in particular was used until 1969 in versions ranging from fine speedframe FN to intermediate frame MN and slubbing frame GN/GS. Machines for finer rovings did not initially come into consideration. The F3/1 speedframe, which was first unveiled as a state-of-the-art innovation at the 1979 ITMA, was intended to be the great leap forward. However, the expected flyer speed of 1800 rpm, the total textile air management, the electronic motion control and the high degree of automation were an overloaded programme which, like the new design launched in the eighteen-forties, could not be completed within a reasonable period of time and had to be cancelled. Incidentally, at that time twenty innovations were simultaneously being developed. All resources were finally concentrated on the new D1 high-speed drawframes and M1 rotor spinning lines. The speedframe gap was then bridged with the improved F1/1 Series, which produced excellent technology with 120 spindles and 1300 rpm with stand-up flyers. This was superseded in 1992 by the F4/1 Series, which had come into production in 1988. With a maxi-

F1/1a speedframe with 355x178 mm (14 in. x 7 in.) packages and cast aluminium flyers ca. 1990

mum of 120 spindles operating at 1300 rpm, it had a carriage-borne doffing aid. Bottlenecks were overcome by a partnership agreement with Marzoli. Finally, the F5 Series with 120 flyers operating at a maximum of 1500 rpm also became available in 1992. The hard labour involved in changing packages was very much reduced by the integrated doffer. Toothed belts for driving the flyers kept the machine's noise level within bearable limits.

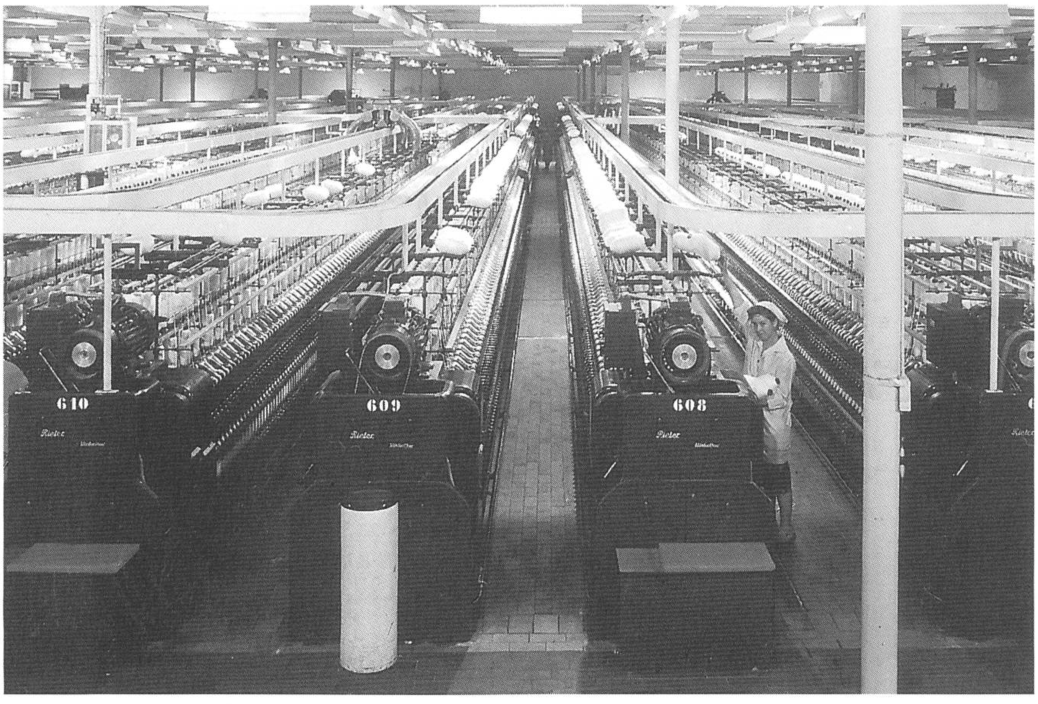
These machines were followed in the spinning process by the G ring spinning frames which Rieter, in contrast to its competitors, equipped with components produced in-house, such as spinning rings, travellers and drawframes. This proven and well-balanced design has been modernized systematically in many small steps in recent generations. This resulted in slim-line machines which were a mere 600 mm wide across the spindle axes. The four-spindle belt drive has been able to hold its own against modern tangential belts, since it requires about 25 percent less energy. The flexible main drive has been modified from interchangeable belt pulleys via V-belt variable drives to frequency controlled drives and the power consumption guaranteed in a limited space. The integrated doffer considerably facilitates package change, and robotics made its breakthrough with the Robofil thread piecer with splicer for knot-free yarn, and the Robocreel. Systematic development of rings and travellers resulted in a maximum spindle speed of 25 000 rpm. The hybrid machines with smaller packages and total integration with winding machines abruptly increased the profitability of ring spinning. Further developed double apron drawframes and balanced thread run geometry brought the main objective of zero broken ends within realistic reach.



GS speedframe with forged steel flyers

These key statistics for ring spinning in our jubilee year completely overshadow the figures of the nineteen-fifties, with – for example – 10 000 spindle rpm and 20 m/sec traveller speeds. However, they also evoke memories of developments such as the Hebucofil extractor system for broken ends and fly fibre, which was ready for sale at a time when Rieter customers in general were not prepared to invest heavily in overall textile air management.

If we look at the sequence of ring spinning frames in this century, the chronicle starts with the 18 Series, which was on sale until 1951. The subsequent 31 Series, the first with a moving spindle rail, met with an encouraging response on the market. The moving spindle rail was an important selling point. The G3 and G4 Series of

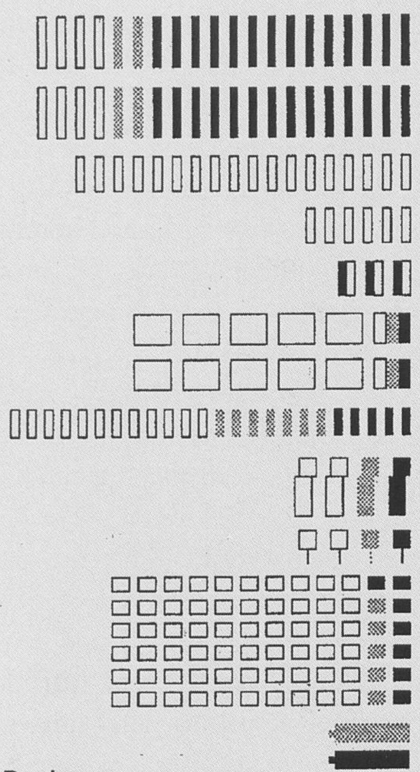


Ring spinning mill with G4 Series and overhead blowing systems for the machine cleaning, ca. 1960 ring spinning frames, the latter once again featuring a moving spindle rail, superseded the 18 and 31 Series, and were in use until 1965 and 1962, respectively. The G0 Series was on sale until 1982. Production of the G5 Series ring spinning frame, which was operated with a high level of automation as the G5/1 or G5/2, began in 1979. The hybrid version which significantly improved efficiency with package transport to the integrated winding machine, was also available from 1984. The Rieter integrated doffer for automated package change has been available since 1972. Many customers also upgraded their G Series machines with Maier carriage doffers.

Recently the G30 Series with doffer and frequency controlled main drive has ushered in the new generation of ring spinning frames. Successes in the field to date point to a profitable future for this innovation.

Attention can also be drawn to specialities in the field of ring spinning, such as the Cutdrafil cut-and-spin process. This process is described in the chapter on long-staple fibres and requires no further mention here. Reference can also be made to direct sliver-to-yarn spinning, which converted light drawframe slivers precisely and

Changes in the number of machines in a spinning mill for combed yarns between 1947, 1966 and 1987



Type of machine	Number of machines 1947	1966	1987
ring spinning (500 spindles each)	40 (20'000)	32 (16'000)	28 (14'000)
fine speedframe	18	0	0
intermediate speedframe	6	0	0
coarse speedframe	3	3	3
drawframes	2x36	2x4 deliveries	2x2
combing machines	24	12	5
ribbon lap machines	4	2	1
blowers and spreaders	4	2	1
cards	72	12	7
scutchers	2	2	1*
Total	245	73	50

Basis:
14 tex combed yarn
spinning production
160 kg/h
*Aerofeed U flock feed

directly into coarse to medium yarns via adapted drawframes. In the case of this speciality Rieter confined itself largely to comparative laboratory tests and relinquished the market to the German Pfenningsberg company and others.

The quality of the ring spinning yarns and the profitability of automated hybrid systems mean that the ring spinning process cannot be looked upon as obsolete. Furthermore, the quality and flexibility of the ring spinning system are still exemplary for all new spinning systems.

In the period between 1918 and 1966 Rieter, like many of its rivals, also manufactured ring twisting frames. These incorporated the drives and frames of the similar ring spinning frames, which were equipped with twisting mechanisms for their special function. The J2 Series, a new in-house design, was the last attempt to retain a foothold in the ring twisting market. Finally, it was acknowledged that this process was a niche activity and that the trend was towards two-for-one twisting, so this technology was left to the specialist firms in the field. This withdrawal from ring twisting was accepted by Rieter's customers and also improved the company's existing good relations with the competitors concerned.

Open end rotor spinning

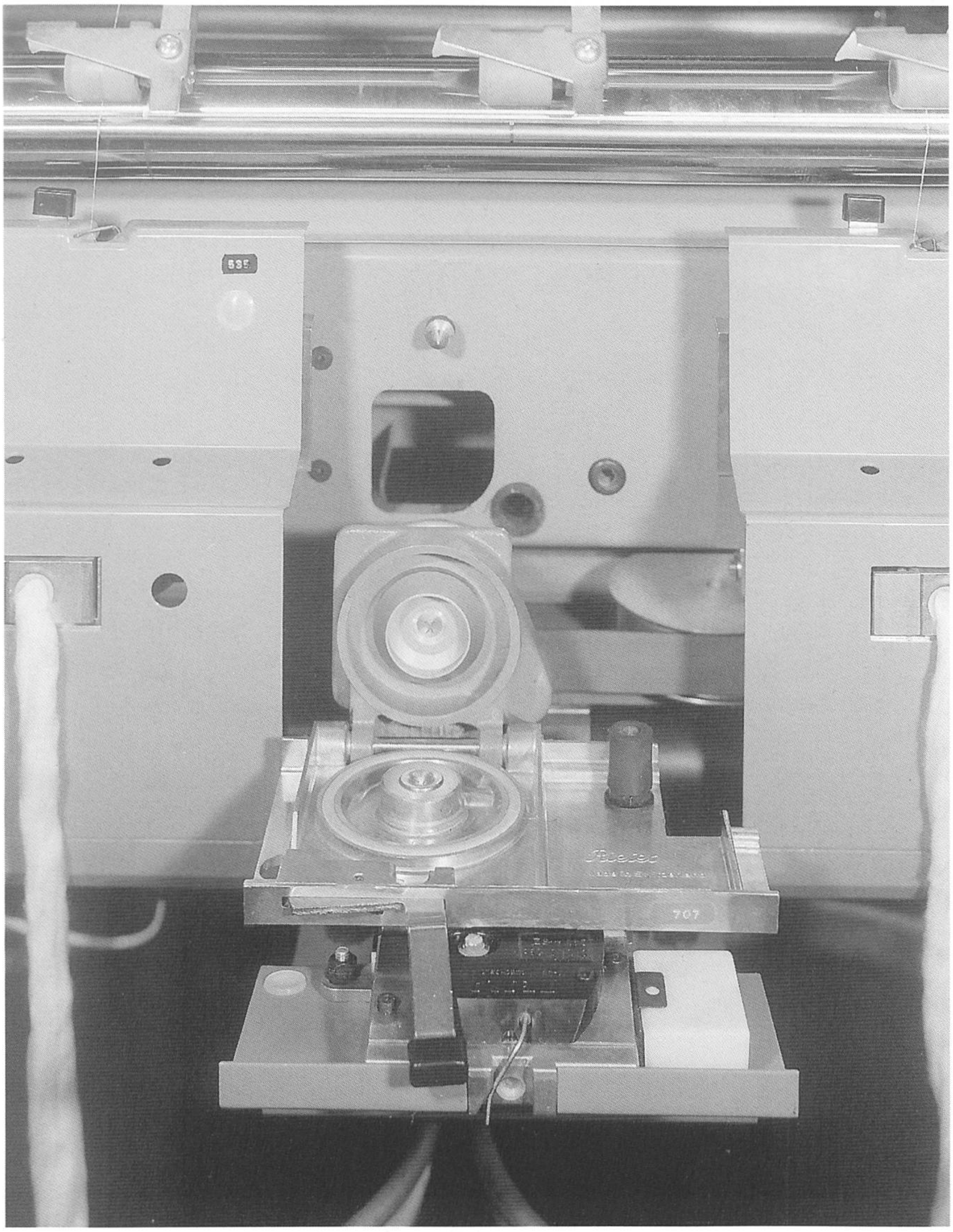
The first patents for rotor spinning go back to the beginning of the 20th century. The first prototypes of what was then still an unconventional technology were produced in the mid-nineteen-sixties by Rieter's research laboratories. In this process, the sliver was no longer drawn by a drawframe, but by means of spiked opening rollers and nips. The system fed the individual fibres into spinning rotors, from which twisted yarn was removed via a central outlet tube. The open yarn end which gave the process its name was therefore in the rotor. The cross-wound bobbin was chosen as the most efficient yarn package. This started cut-throat competition on the market between «spinners and winders». The manufacturers of spinning and winding machines did battle over patent protection for the relevant know-how in bitter legal disputes. This presaged the conflicts between the rival parties to maintain their positions.

The leading manufacturers of spinning machinery, who knew and respected each other from the international textile machinery exhibitions and symposia which they all attended, already conducted a useful exchange of experience on research issues. Regular meetings also took place at international standards gatherings, in the TC 72 committee of the ISO, which Rieter has chaired since the ISO was founded in 1948. Technical terms and definitions have been standardized in this cooperative work. Very successful agreements have been reached on standard dimensions, for example for sliver cans and spinning tubes. An understanding on procedural questions therefore suggested itself. Well aware of the fact that research and development require time and money, and that these needs were growing as advanced technology progressed, the OE issues were dealt with in a consortium. From the range of fair competitors, Platt (UK), Schubert & Salzer (Germany) and Rieter (Switzerland) finally got together. Rieter's participation also included Elitex (Czechoslovakia), which held significant basic patents. Negotiations were conducted with accessory suppliers - for example, on the subject of high-speed rotor bearings, with SKF, Süssen and INA. This narrow selection of consortium partners provoked subsequent attacks on patents and related lawsuits. Bearing supplier Süssen in particular sought contacts with other manufacturers after being excluded from the consortium and pursued a very aggressive patent policy vis-à-vis Rieter. Although Rieter finally won and was compensated accordingly, the payments could not replace in full the loss of reputation which had been suffered.

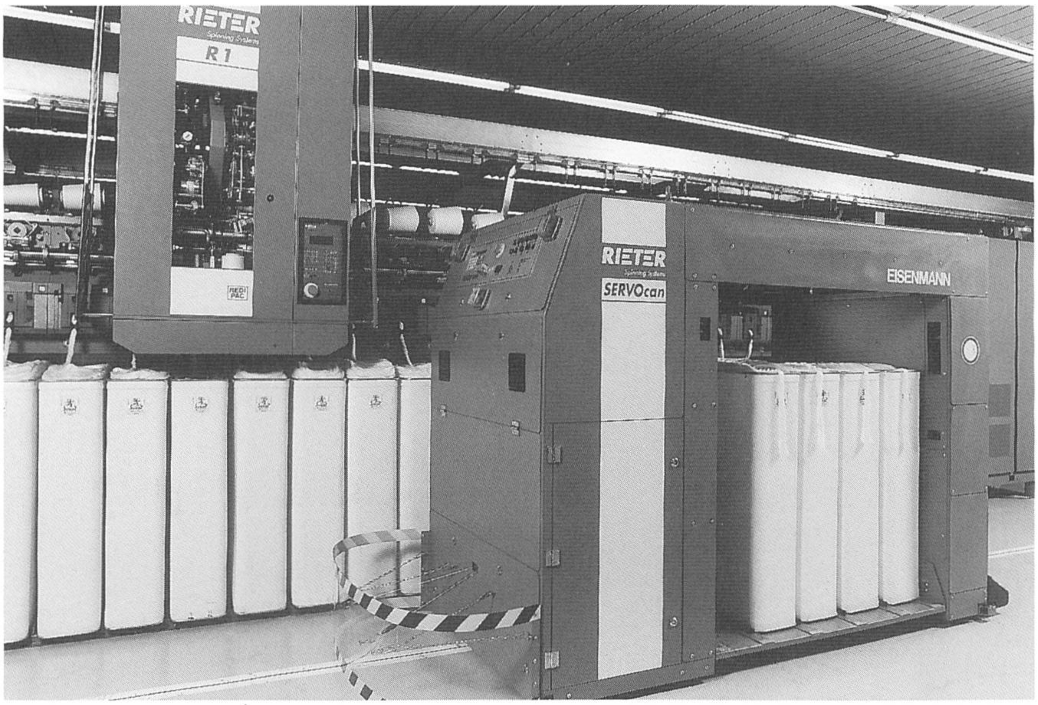
In retrospect, the consortium sought to bring together joint know-how efficiently to obtain joint patents. This was aimed at speeding the pace of R & D and establishing links across the EFTA/EC divide. Joint, efficient material procurement in order to cut costs was not ruled out. However, in order to conform to legal requirements, a precondition was that the subsequent products of the companies had to bear their independent technical signatures.

A glance at the development history of rotor spinning reveals initial prototypes in the nineteen-sixties, which were used primarily to gain experience. Major production efforts involved the M0/5 Series between 1972 and 1979, while from 1975 to 1988 it was

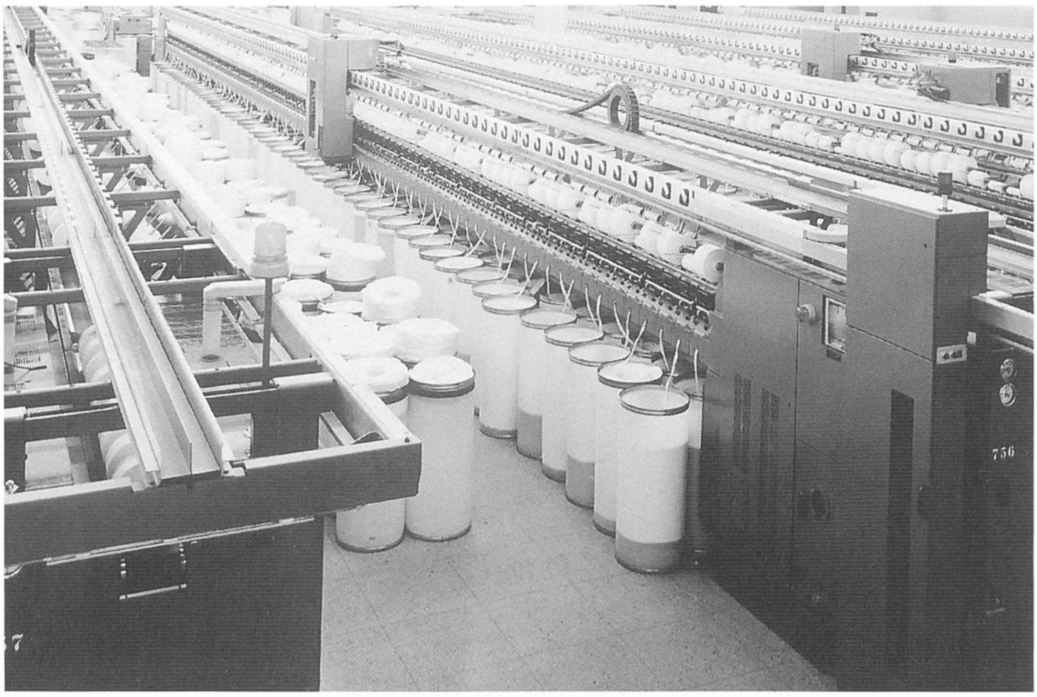
M1/1 OE rotor spinning machine with a universal spinning box for all fibres up to 60 mm long



the M1/1 on which automation problems, especially thread break piecing and package changing, were solved together with specialists from Schweiter, which subsequently became Rieter Automatik. The M2/1 Series was in operation from 1983 to 1988. As a result of the acquisition of Schubert & Salzer the SSI models were preferred as technically superior. In this new SSI OE range the RU 04 was the manual machine for 100 000 rotor rpm. However, the main focus of interest was the SPINCOMAT RU14 and the RU14-A. These extensively automated models operated at 100 000 rpm with rotors which had a minimum diameter of 32 mm, were equipped with Spincontrol machine controls and had two automatic travelling units for thread break clearance and package change, as well as the tube loader for supplying yarn bobbins. Finally, in the battle against the company's main rival, the top model R1 was produced, which in addition to the advantages of the



RU14 SPINCOMAT rotor spinning machines (bottom) and the advanced R 1 rotor spinning machine with CUBIcan system (top)



RU14-A achieved a maximum of 130000 rpm with rotors only 30 mm in diameter and utilized the space under the machine especially efficiently with rectangular cans.

As regards the rotor drives, the subject of important patents and legal action, three versions were under discussion in the course of development:

Direct bearing support with tangential belt drive was a component part of Rieter's M generation. These INA super bearings for a maximum of 100000 rpm were regarded as an outstanding piece of engineering, but also involved risks.

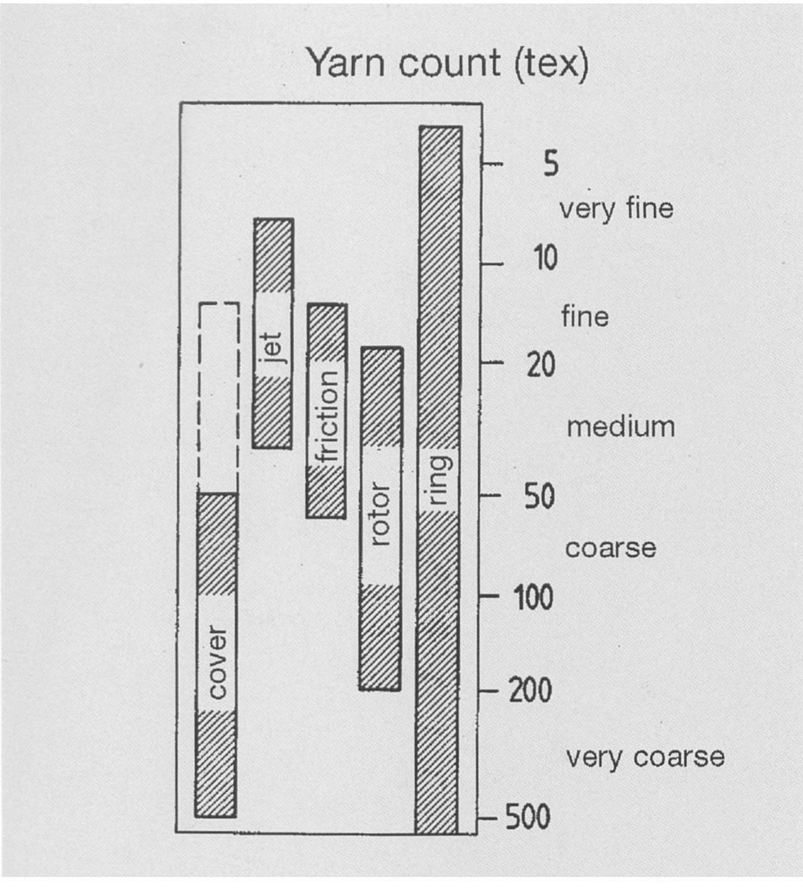
Direct rotor bearing with individual motors, pursued doggedly by Brown Boveri (BBC/ABB), a scientific flight of fancy which underestimated the start/stop behaviour of the system and the textile dust in continuous operation, and wore itself out on this problem.

The indirect bearing of the rotor on supporting rings – an approach pursued by Süssen with Schlafhorst and by Schubert & Salzer alone – represented the triumph of so-called «simplicity» with proven precision mechanics and reliable bearings in the range from 10 000 to 15 000 rpm. This permitted 100 000 rotor rpm and more without complicated risks.

In the field of OE yarns, only counts coarser than Nm 50 were possible originally. RICOFIL technology, i.e. the feeding of combed slivers with 8 to 12 percent combed out, enabled yarn counts to be increased to Nm 70, thus considerably expanding the range of application for rotor yarns.

As we have already said, the development route of rotor spinning was characterized by very costly patent proceedings, especially in the American legal system. This blocked the market and caused delays in product sales. However, with the settlement of the legal issues and above all the advent of the new R1 rotor spinner, Rieter's breakthrough on the American market finally became unstoppable.

The yarn count range of the four new processes compared with ring spinning



New spinning processes

The increasingly rapid development of mechanical spinning and winding since the 18th century has been unmistakable. Research and patent literature, and the design drawing archives, have recorded development steps which often foundered on material, manufacturing or bearing technology. As an example, Rieter archives inform us of a completely enclosed card with circulating air fed through varnished wooden hoods. Contraction of the wood and cracked varnish caused yarn obstructions, and only modern sheet metalwork in the 20th century with air feed free of fibre drag enabled these earlier ideas of the engineers to be implemented.

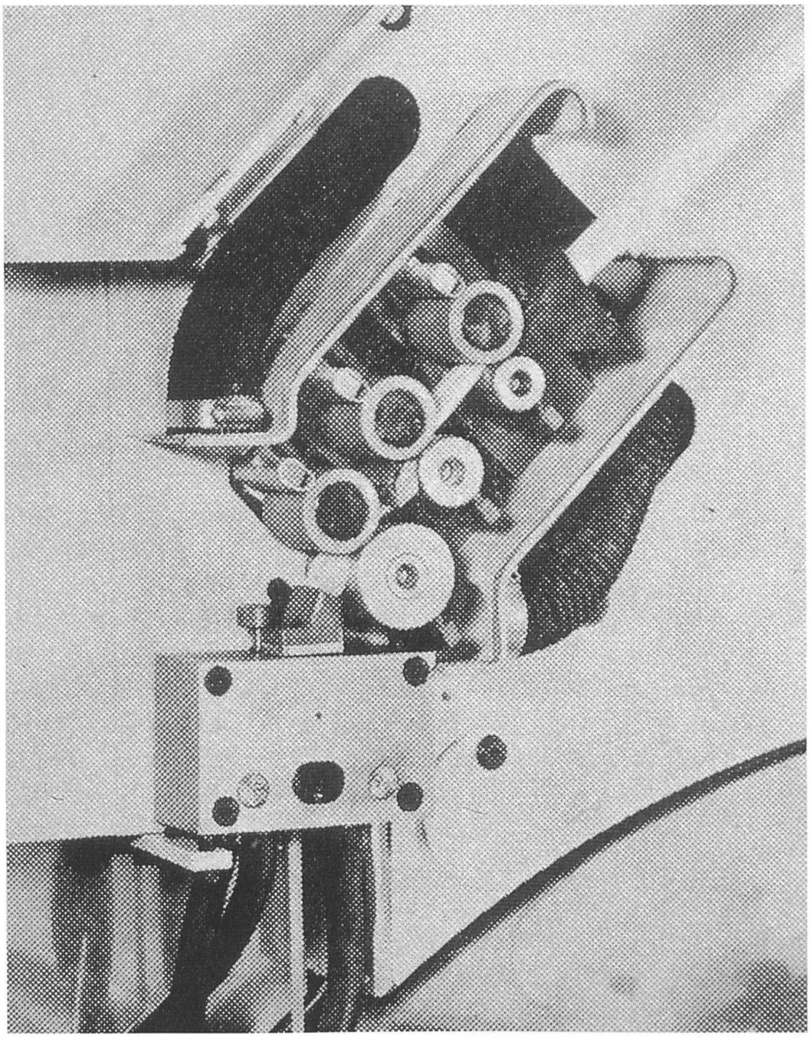
The same applies to the final stage of yarn formation, which has been developed via the hand spindle, the spinning wheel and the mule to the ring spinning frame. Ideas also arose for new spinning processes which could be described as unconventional in comparison with ring spinning. We refer here only to the Pavena process, rotor spinning, cover spinning, jet spinning and friction spinning.

The Pavena process, in which Rieter took a close interest in the nineteen-sixties and seventies, was a completely new approach to the development of draft on the drawframe. It introduced novel adhesives into the fibre bundle, which as pigment vehicles also served to dye the fibres and supported the fibre bundle during the drawing process. Rotary dryers were used to process Pavena slivers impregnated in this way. The adhesive technology meant that a single-zone drawframe could be used on the ring spinning frame. However, despite completely new potential for home textile yarns, the arguments in respect of the energy balance, especially the input required for evaporating the solvent, could not be dismissed. Even the considerable interest shown by a few specialist spinning mills was insufficient to ensure the success of the Pavena process, and production had to be discontinued in the mid-nineteen-seventies.

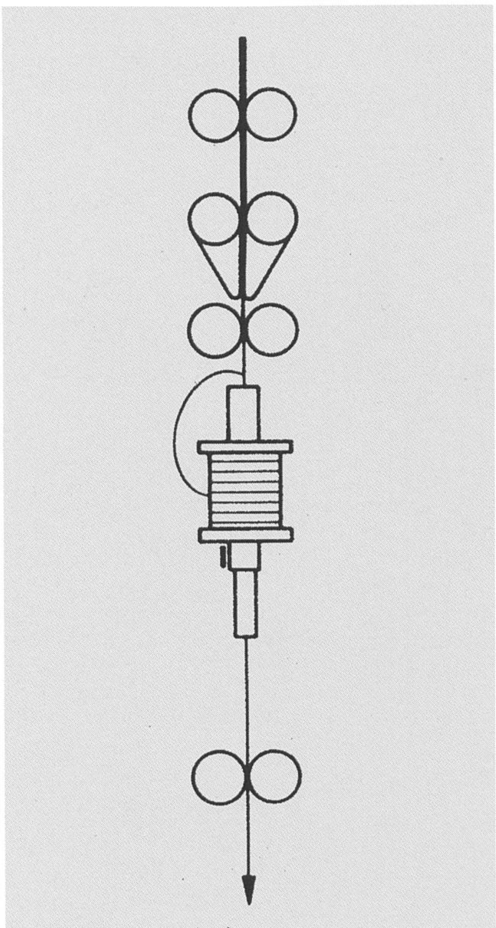
The comparable Canadian Bobtex ICS system suffered a similar fate, and was abandoned around 1970.

OE rotor spinning has had the greatest market success to date of the new spinning processes.

Cover spinning set new standards, for example, for coarse carpet yarns and finer special yarns. The distinguishing feature of this spun thread was the covering of the body of the yarn with a fine, synthetic filament; this discouraged Rieter from utilizing its relevant laboratory know-how for



The drawframe as a basic process in Pavena technology

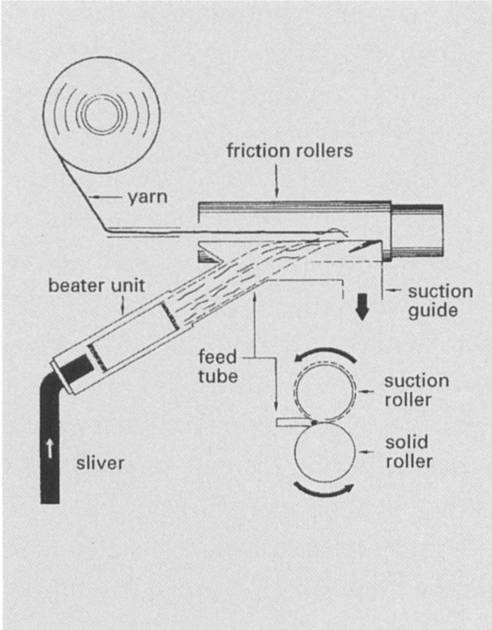


Cover spinning

volume production, since the filament component severely limits the applications of the yarn.

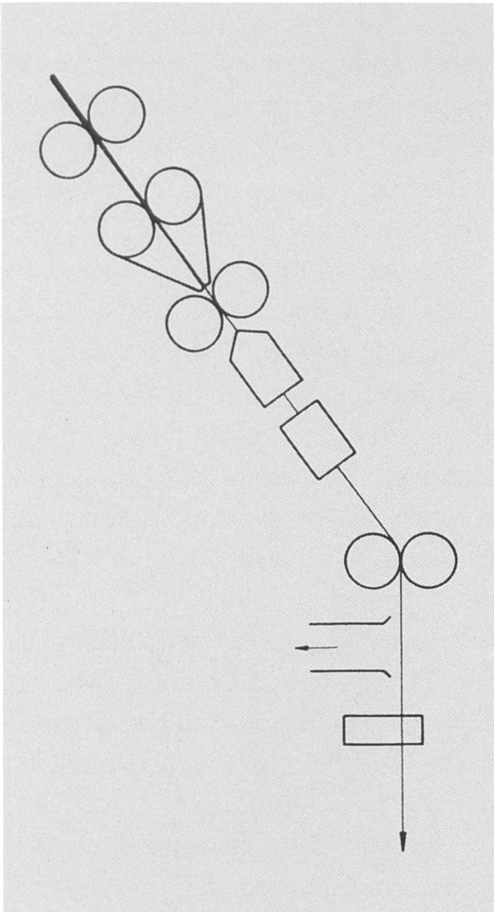
Jet spinning was also scientifically studied and tested by Rieter. However, the arguments for embarking on volume production were insufficiently convincing, since the efficient range of application is currently limited to finer yarns.

In friction spinning the opportunities for the medium yarn range from 10 to 50 Tex are entirely realistic. Rieter therefore entered into a cooperative development venture in 1993 with Dr. Ernst Fehrer AG in Linz (Austria) with a view to bringing the DREF condensor spinning process to the volume production stage.



Friction spinning

Jet spinning



The search for improved profitability of the spinning process remains one of the permanent tasks of any company seeking to maintain a position as a leading supplier. Within the framework of these efforts, the automation of ring spinning, rotor spinning and other new spinning processes is under constant study.

The criteria for yarn quality are still set by ring spinning yarns and «as good as necessary» requirements. Vertically integrated textile mills have the best chances of achieving efficiency and success here.

Short-staple installations and systems

Short-staple spinning has been in a continuous process of development, as the comparative survey of progress from 1947 to 1994 has shown. The performance of the individual machines has increased continuously, and steadily fewer personnel have become necessary to operate the installations. The example of the card is especially illustrative of this development. After the spinning process had originally consisted of separate machines and groups of machines supervised by the mill foreman and his staff, technical progress proceeded via complete machine and group controls, such as those which were used initially in opening and scutching operations.

Full electronic controls with the applications of artificial intelligence were the logical consequence. Modern mills are therefore generally supervised at different, interlinked management levels. These start with elements of sliver or yarn monitoring, continue in subsystems of the machine, finally cumulate the performance of the individual groups of machines and control the key statistics of the mill as a whole. Links with commercial requirements complete a modern CIM system.

Transport automation has also kept pace with this development in controls over the past fifty years. The laps of the double scutcher, which used to be the last scutching machine, made way for flock conveyors and conveyor channels which fed the raw material gently to the cards. The carded slivers were moved to the subsequent combing rooms or drawframes in large volume cans by automated conveying systems. The laps from the combing machines were moved with assured quality in the system. Finally, speedframe packages were fed to the ring spinning frame on automatic conveyor systems and the small packages from the ring spinning frames were processed into cross-wound packages via winding machines integrated in the hybrid system. Cross-wound packages in efficient formats for further processing were therefore produced directly in the OE process.

A similar development took place in quality control, which clearly favoured the online production of quality over the old methods which sought to «test quality into the products».

Finally, the development of splicers permitted the knot-free joining of yarns, thus opening up new horizons for automatic package changers. It remained the declared aim of Rieter development staff to increase and secure the profitability of installations, as well as continuing to press ahead with automation and to identify and prepare new processing systems for new materials.

The future

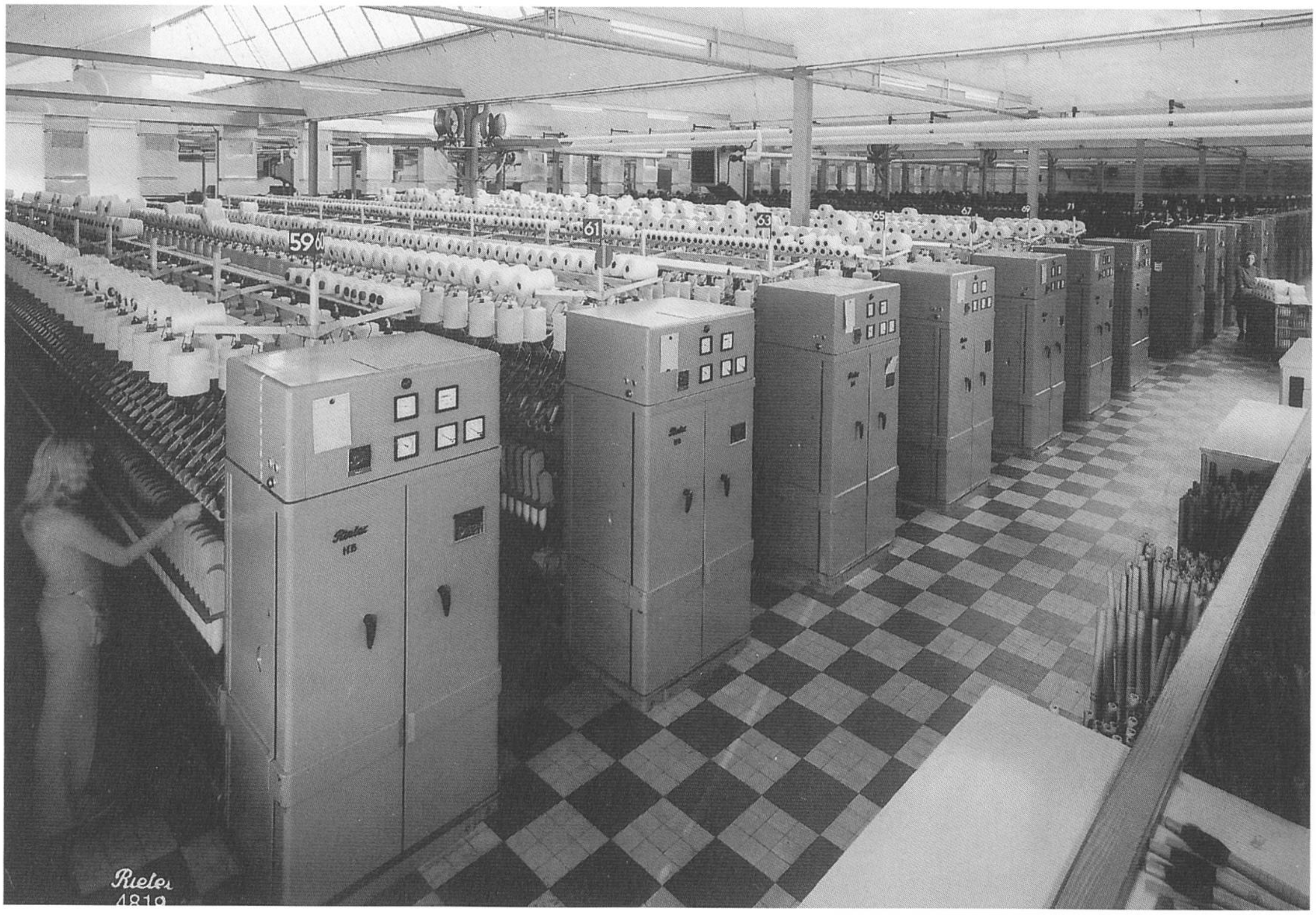
In the short-staple process Rieter is the comprehensive, one-stop supplier offering competent hardware and software for ring spinning and OE technologies. The objective here is to replace wage costs by capital costs through reliable automation. This benefits customers in high-wage countries in particular. Since 1960, Rieter has also sought to take full advantage of different markets and wage levels. This is clearly demonstrated by its joint venture with Lakshmi Machine Works in India and recently by the project with Jingwei for combing room equipment in China. The importance of the Asian markets in general with their low wage costs is increasing constantly.

A comparison of personnel numbers employed in short-staple spinning between 1960 and 1994 shows that the incremental improvements have brought a reduction in the workforce. However, this positive trend cannot compensate for the wage differentials between Asia and Europe. Rieter's market potential is backed up by suitably located outposts with complete service facilities and rapid spare parts supplies. Trading in used machines, as in the motor industry, is also intended to make its contribution.

The yarn manufacturing processes described here provide for classical further processing via weaving or knitting into fabrics. In the search for competing processes one is certain to encounter non-woven systems, which also produce fabrics from fibrous webs. This type of fabric is ideal, for example, for disposable hospital linen, fashionable bed and table linen for hotel use, filter mats and other technical applications. The original idea of using non-wovens, for example, for ladies' outerwear, has foundered on quality standards, and is also likely to remain utopian for the future. In the absence of new, replacement processes, the futur of short staple thus seems assured.

Conversion formulae for specific yarn weights

	1	2	3	4	5	6	7	8
Metrische Nummer Metric count	**Nm**	NeB = 0,590541 Nm	NeL = 1, 65352 Nm	NeK = 0,885812 Nm	NeW = 1,93771 Nm	Td = 9000 / Nm	Ts = 29,0291 / Nm	Tt (tex) = 1000 / Nm
Engl. Baumwollgarn-Nr. English cotton count	Nm = 1,69336 NeB	**NeB**	NeL = 2,80000 NeB	NeK = 1,50000 NeB	NeW = 3,28125 NeB	Td = 5314,87 / NeB	Ts = 17,1429 / NeB	Tt (tex) = 590,541 / NeB
Engl. Bastfasergarn-Nr. English linen count	Nm = 0,604772 NeL	NeB = 0,357143 NeL	**NeL**	NeK = 0,535714 NeL	NeW = 1,17188 NeL	Td = 14881,6 / NeL	Ts = 48,0000 / NeL	Tt (tex) = 1653,52 / NeL
Engl. Kammgarn-Nr. English worsted count	Nm = 1,12891 NeK	NeB = 0,666667 NeK	NeL = 1,86667 NeK	**NeK**	NeW = 2,18750 NeK	Td = 7972,31 / NeK	Ts = 25,7143 / NeK	Tt (tex) = 885,812 / NeK
Engl. Streichgarn-Nr. English woollen count	Nm = 0,516072 NeW	NeB = 0,304762 NeW	NeL = 0,853333 NeW	NeK = 0,457143 NeW	**NeW**	Td = 17439,4 / NeW	Ts = 56,2500 / NeW	Tt (tex) = 1937,71 / NeW
Internationaler Titer Internat. denier count	Nm 9000 / Td	NeB = 5314,87 / Td	NeL = 14881,6 / Td	NeK = 7972,31 / Td	NeW = 17439,4 / Td	**Td**	Ts = 0,00322545 Td	Tt (tex) = 0,111111 Td
Schottischer Titer Scottish count	Nm = 29,0291 / Ts	NeB = 17,1429 / Ts	NeL = 48,0000 / Ts	NeK = 25,7143 / Ts	NeW = 56,2500 / Ts	Td = 310,034 Ts	**Ts**	Tt(tex) = 34,4482 Ts
Feinheit im Tex-System Fineness Tex-System	Nm = 1000 / Tt (tex)	NeB = 590,541 / Tt (tex)	NeL = 1653,52 / Tt (tex)	NeK = 885,812 / Tt (tex)	NeW = 1937,71 / Tt (tex)	Td = 9 Tt (tex)	Ts = 0,0290291 Tt (tex)	**Tt** (tex)



H6 ring spinning frames at Filature de Laine peignée Alle SA (Flasa)

Long-staple spinning processes

Staple fibre spinning is divided into the main sectors of short and long-staple spinning; short-staple fibres are up to 60 mm long, long-staple fibres from 60 to 300 mm long. On the borderline between these two ranges, reference is also made to medium staple with fibre lengths of 45 to 70 mm. Two main processes are used in long-staple spinning systems: carded wool spinning for more full-bodied fabrics in the home textile sector, and worsted spinning, for example for fine and very fine outerwear. In the worsted system, shorter fibres are removed from the fibre structure by means of long-staple combers. This creates the prerequisites for fine yarns, which are essential for producing fine fabrics.

Fundamental aspects of long-staple spinning processes

Rather more bulky yarns for home textiles, such as curtains, furnishing fabrics, carpets and fashionable outerwear, are produced using the carded wool spinning process. In this the web of the long-staple card is separated into narrow ribbons by the web divider, compacted by the rubber gear and spun out into a fluffy yarn on the ring spinning frame for woollen yarns with needle funnel revolving tubes.

Two different processes were formerly used to produce worsted yarn: In the English method, suitable for oiled tops made from long, plain wools, cohesion of the slubbings in the processing stages after the gill boxes is obtained by twisting. What is fed to the ring spinning frames is therefore a speedframe roving.

In the continental or French method, suitable for dry tops with little oiling made from finer, crimped wools, cohesion of the slubbings after the gill boxes is obtained by rubbing due to the crimping. What is fed to the ring spinning frames is therefore a rubbed, i.e. twist-free roving.

The growing importance of manmade fibres and blends such as wool/polyester has resulted in the increasing use of speedframes in the French process, too. As a consequence the English method is now being replaced worldwide by the French method, working with rubbed or twisted rovings, depending upon the content of manmade fibres.

Rieter has never manufactured machines for all stages of the long-staple spinning process. The following comments can be made on the individual Rieter components of the long-staple systems:

Gill box/intersecting

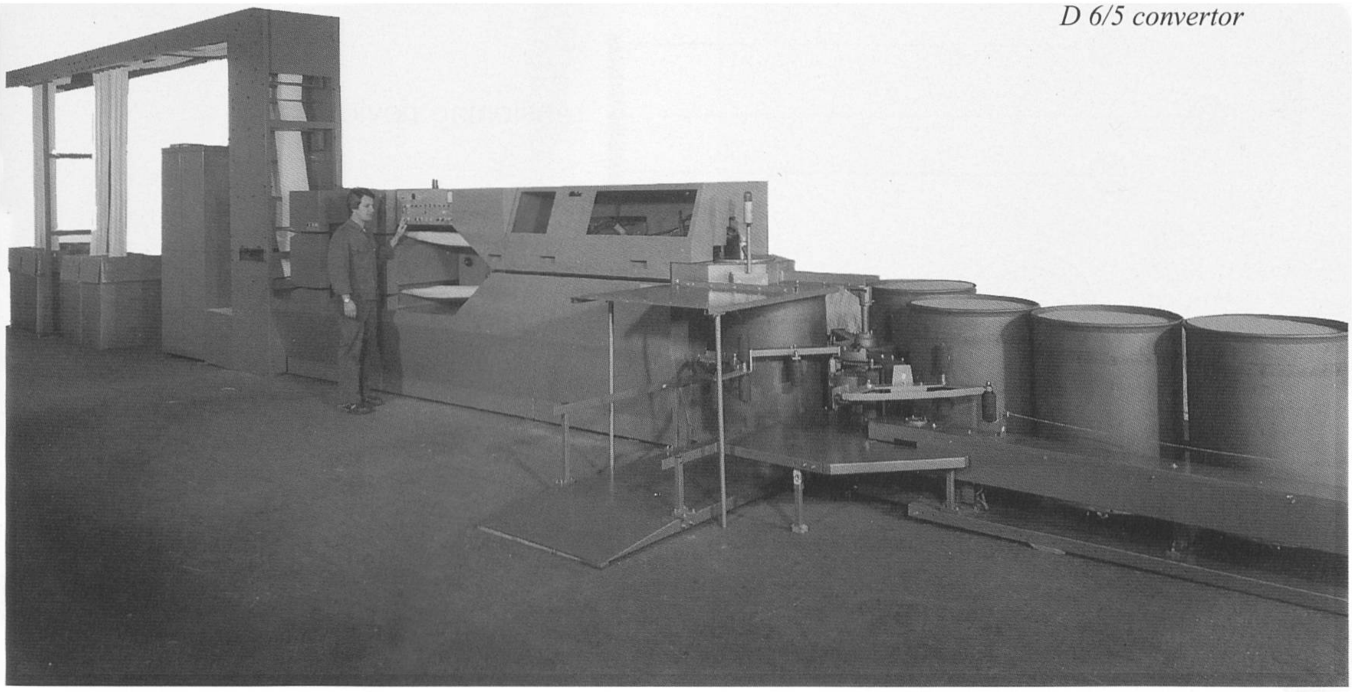
Rieter's double gill box, the intersecting unit, has produced remarkable results as a component part of long-staple preparation. For example, very promising results have been achieved in processing schappe silk with its gill box for long fibres.

Hardened advance spindles were used for feeding the fallers. These elements were produced by the Federal arms and munitions works in Berne (Switzerland), which were ideally equipped for manufacturing special items of this kind.

Intersecting room at the Kriens schappe spinning mill, ca. 1955

D6 convertor

The conversion of continuous filaments into staple fibres has been of particular interest since manmade fibres began to be produced. Machine manufacturers used stretch-breaking or cutting processes for this purpose. Rieter decided in favour of the cutting process at the beginning of the nineteen-fifties, and an appropriate patent licence was obtained from Warner & Swasey. Initial prototypes operated with spiked «porcupine» rollers in the drawing zone, but these proved unserviceable due to their delicate needles. The improvement of these prototypes resulted in the installation of the Rieter double gill boxes, which achieved high performances at various stages of development. Intersecting convertors D6/2 to D6/4 then evolved from the D6/1 spiked roller convertor. These were further developed into the D6/5 Series, with output some three



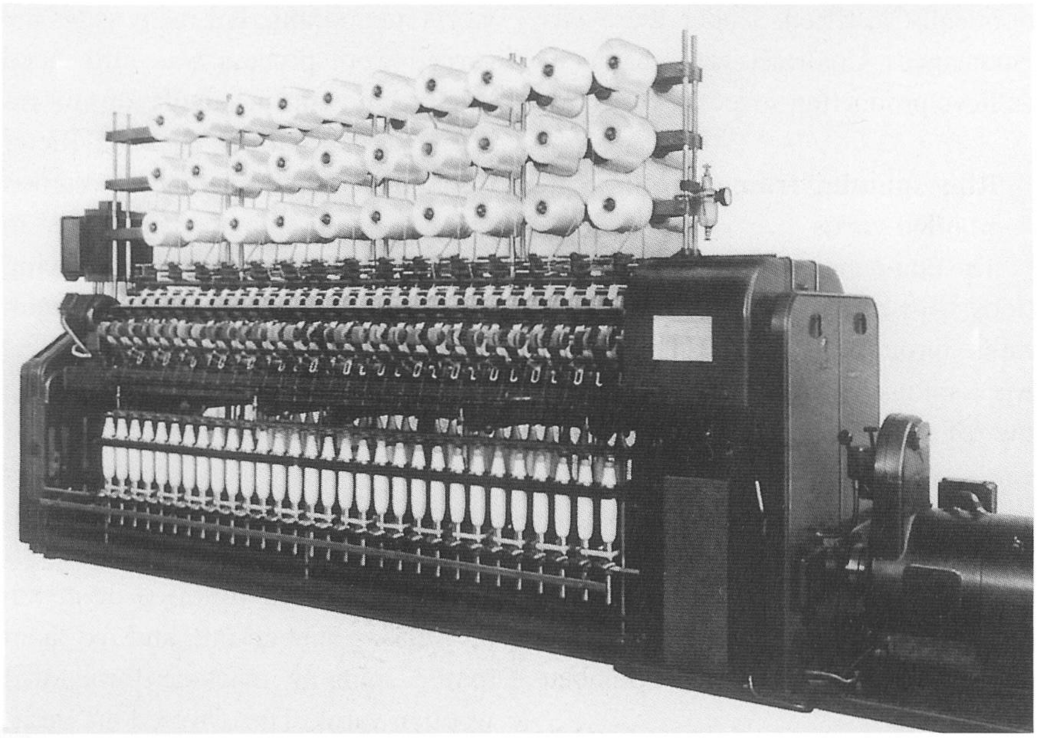
D 6/5 convertor

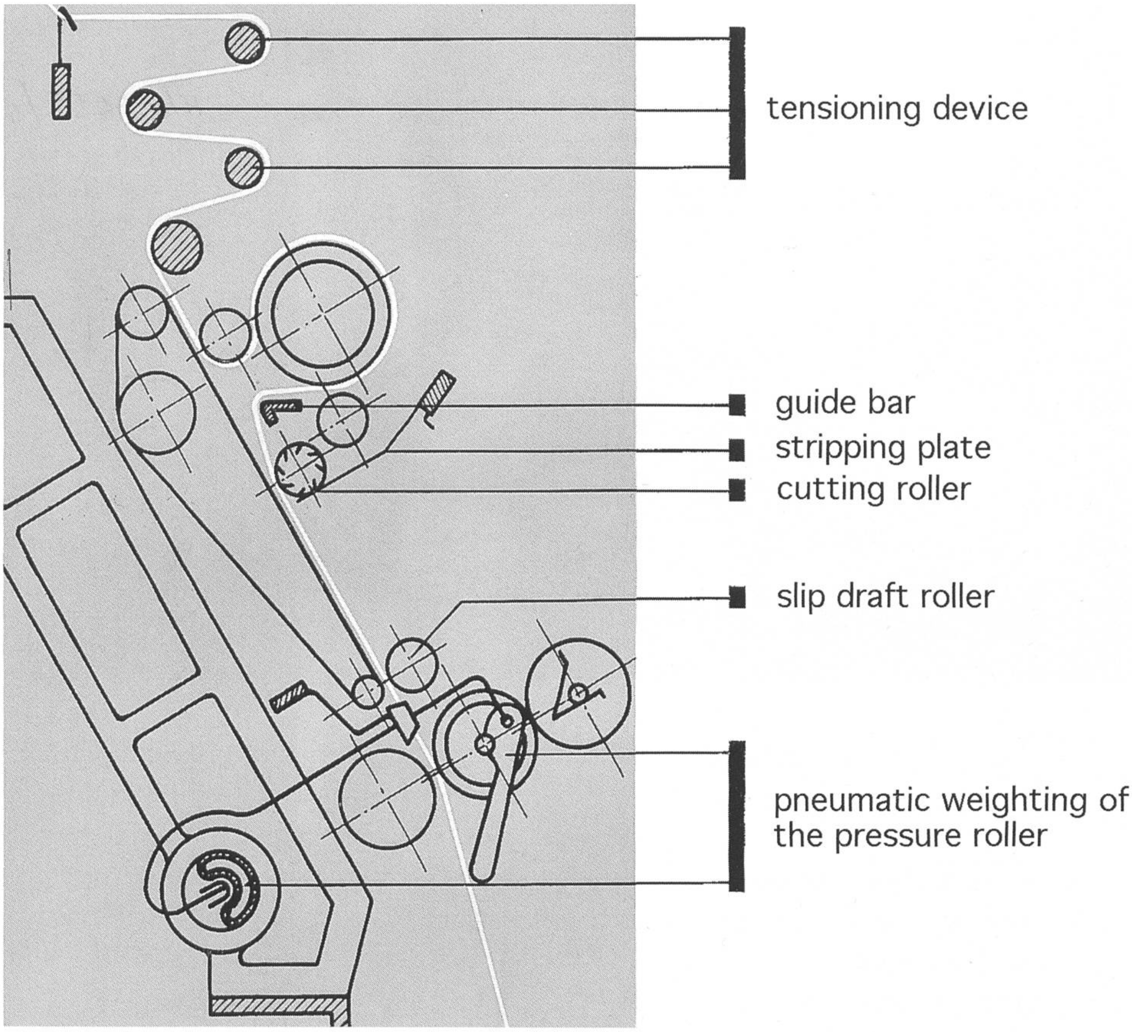
times higher, using Hanseatische Maschinenbau-Gesellschaft's HMG chain gill intersector. Finally, in order to simplify its product range, Rieter sold its latest convertor model to Schlumberger, which replaced the HMG intersector with its own NSC drawframe and achieved remarkable production data with this machine. The history of Rieter's line of convertors therefore continues in the Schlumberger machines.

«Cutdrafil» cut-and-spin process

At the beginning of the nineteen-fifties Rieter took a close interest in the Cutdrafil cut-and-spin process, which produced long-staple yarns from fine filament strands. The cut-and-spin process was based on existing worsted ring spinning frames, which were equipped with a cut-and-draw mechanism with a rotating fibre cutter. This process imposed very high standards on the quality of the fila-

Cutdrafil ring spinning frame: 240 spindles, 90 mm gauge, 60 mm ring diameter, 250 mm traverse





Cutdrafil spinning machine.
Cross-section diagram of the cutting and drawing system

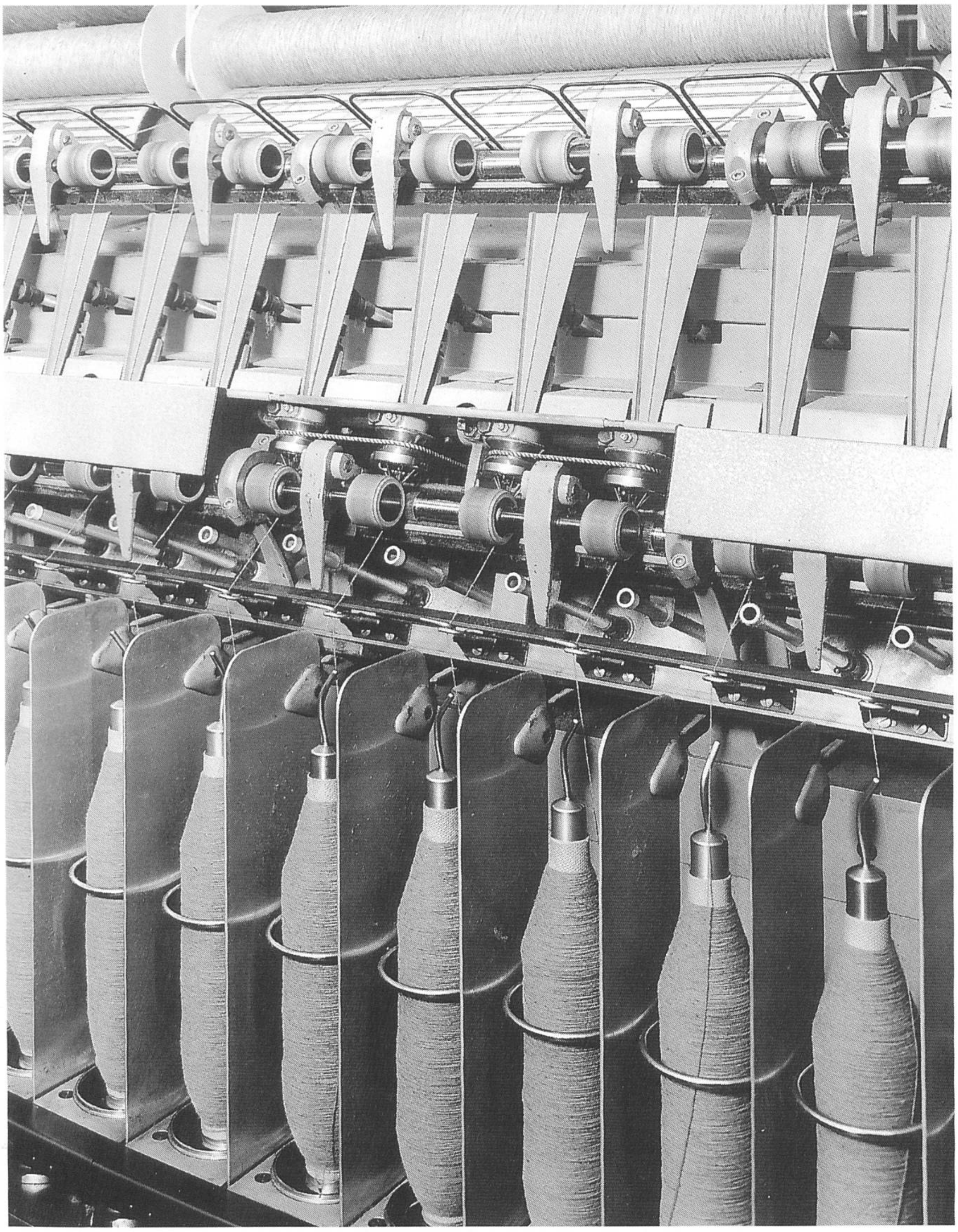
ment strands, requiring a level of performance which could not be economically justified. Under these circumstances Cutdrafil was unable to achieve production success.

Ring spinning frames for woollen yarns

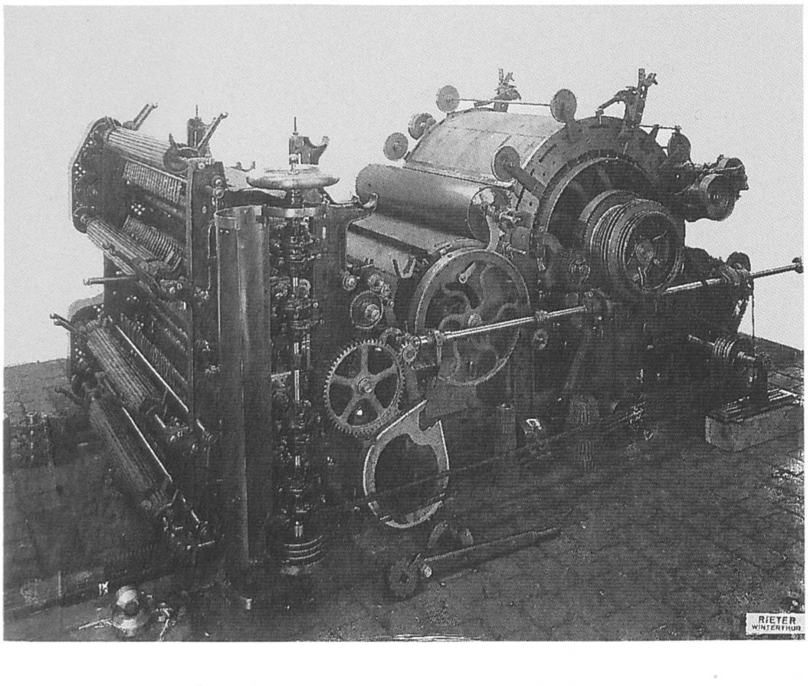
The company developed close relations with blanket and cloth weaving mills through its interest in carded wool spinning. An outstanding example of this was undoubtedly army cloth, which required carded yarns of very high quality. Due to these requirements and the demands in respect of home textiles, Rieter was not in favour of the latest mules, such as those manufactured by MAK and Spinnbau (Germany).

Ring spinning machine series 37, H1 and H3 from this product line are worth mentioning. For many years the carded wool process was influenced by developments in spindle tops for reduced thread balloon tension. Rieter discontinued production of carded woollen yarn spinning machines in 1971, again with a view to simplifying the product range. In this case the relevant know-how was not sold. In this context it is also worth mentioning a sideline from the early days of carded woollen yarn systems, the Schorsch Rieter System, which processed spinnable strands to slubbings with a roller card, followed by a web divider and rubber unit, and fed them to the spinning machine for carded woollen yarns. This covered the occa-

H3 woollen spinning frame; drawing system with needle tubes and spindles with spindle top devices for reduced yarn tension



Fillet card with web divider



sional orders in market niches for mixed shoddy yarns, which never assumed any great importance, however.

F2/1 long-staple speedframe

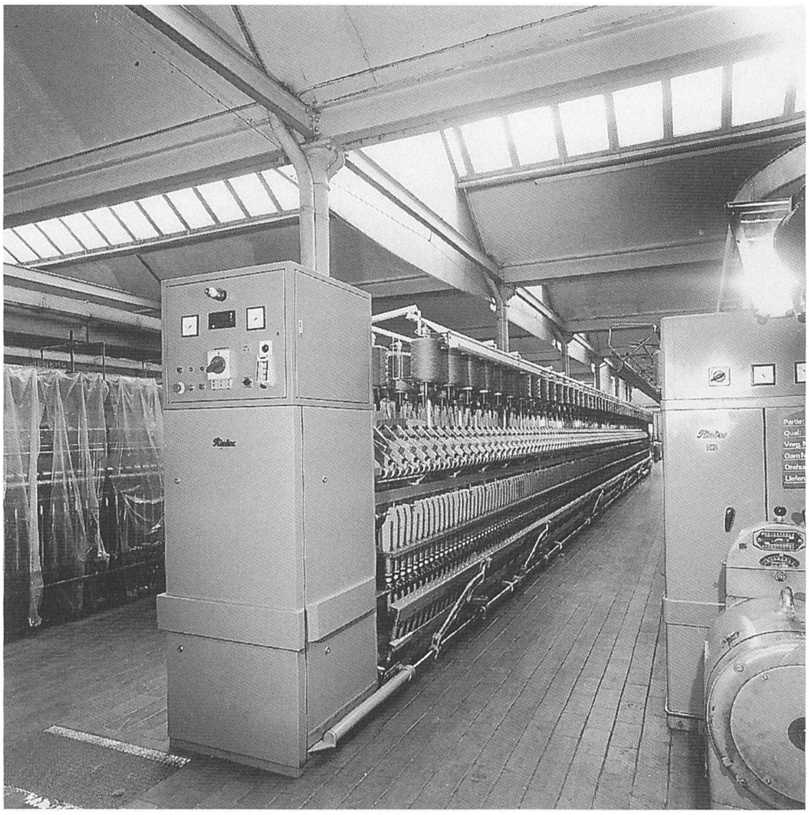
The 35 Series short-staple speedframe could be equipped with a long-staple drawframe which was one of the best in the sector with double aprons and servo drive for adjusting the nip gaps. This system failed to make a break-through due to small production volumes and correspondingly high prices. Finally, new designs such as that by Schlumberger-NSC with overhead-drive flyers squeezed the F2/1 out of the market.

Worsted ring spinning frames

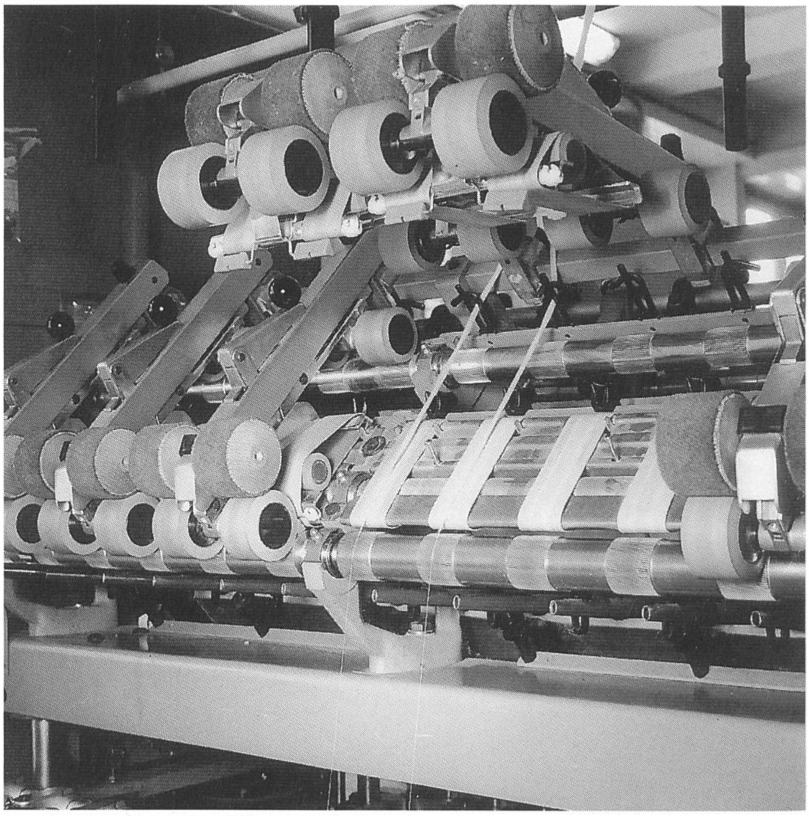
After initial trials with the 31 Series ring spinning frame in the early nineteen-thirties, a long-staple drawframe was grafted on to this short-staple ring spinning frame with moving spindle rails. This version attracted a remarkable amount of interest, finally leading to the new design of the 37 Series, which became available in about 1938. The 37 Series, the first machine with automatic yarn underwinding and stop motion when packages were full, was sufficiently versatile to operate in the carded wool spinning process, in the worsted process as the H2 Series, in ring twisting, and finally also in early draw-twisting of continuous filaments. The integrated doffer for package change was introduced to the worsted process with the development to the H6 Series. The Sempione brand name also helped to make customers throughout the world familiar with Swiss quality products through the H6 machine. The last new design of worsted ring spinning frames, the H0/1 Series, produced yarns featuring absolutely outstanding quality characteristics with the patented Rieter K2RM drawframe. Unfortunately, manufacturing costs were also high due to the low volumes produced. In a shrinking worsted market even the unique K2RM drawframe of the H0/1 was only an insufficient guarantee of future success. As Rieter concentrated its resources, therefore, further development and production of worsted ring spinning frames was discontinued after 1985.

Long-staple OE rotor spinning processes

The Rieter/Schubert & Salzer product range includes the RL10 long-



H0/1 ring spinning frame with doffer

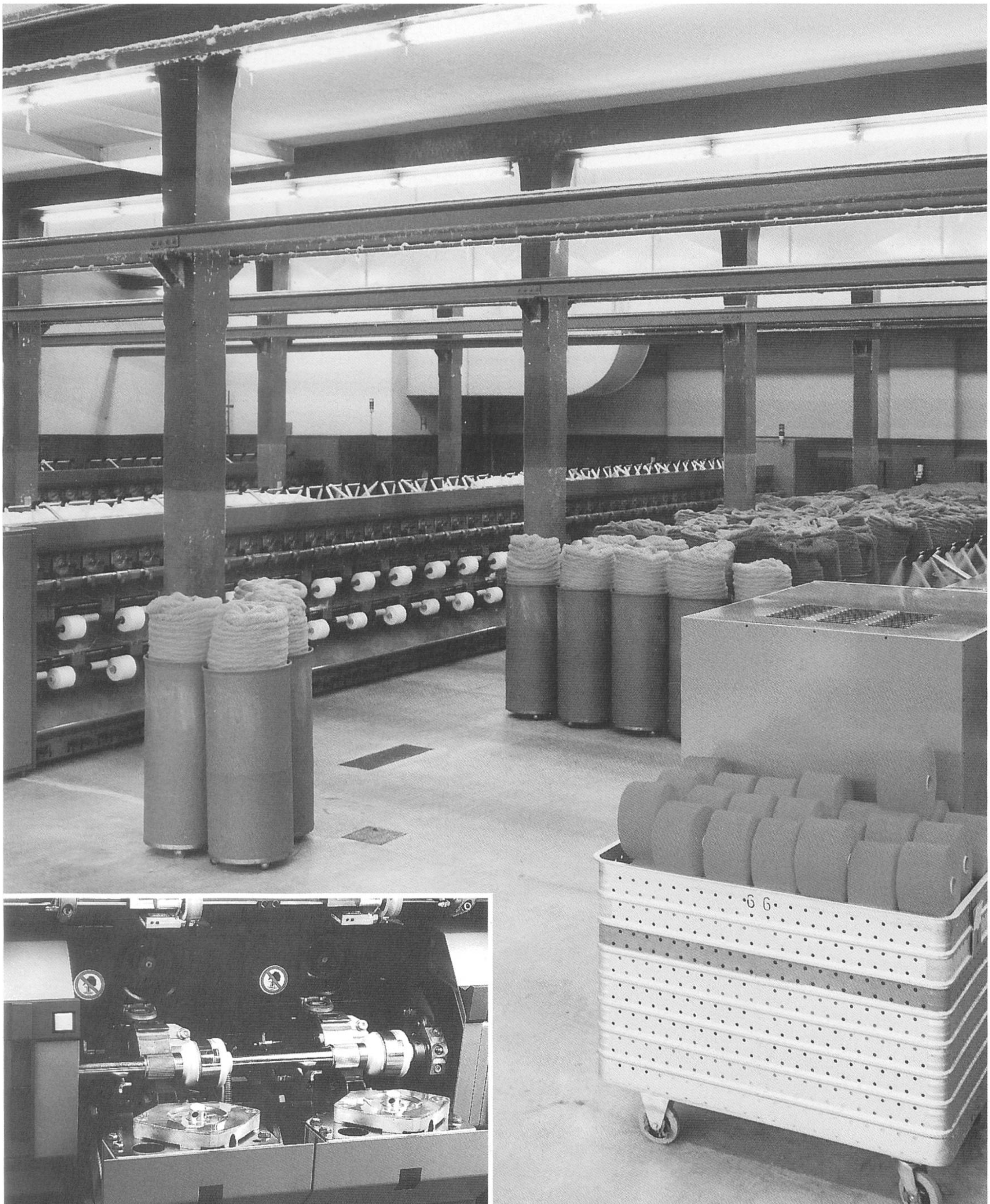


K2RM long-staple drawframe

staple rotor spinning machine, which is well positioned in the field of blanket and carpet yarns. Unfortunately, it also serves a market niche, so that marketing efforts have to take account of the priorities of these textile sectors.

New long-staple spinning processes

The REPCO System developed by Australian inventors has repeatedly been a subject for discussion since the nineteen-seventies. Here eight rovings



RL10 rotor spinning machine.
Bottom: open spinning box

are grouped into two slubbings and processed via rubber drawing systems with phase-shifted false twist into four yarns. This process, which would certainly be useful for fine, twisted worsteds, has not made a breakthrough.

In the cover spinning field, processes for medium and coarser yarns are currently offered by Leesona, Süssen and NSC-Schlumberger, for example. Developments for finer yarns have not been crowned with success to date. Cover spinning seems to confirm its qualities on a small scale rather than making its mark across the whole spectrum.

Based on its assessment of the overall situation, Rieter has hitherto refrained from reacting to new long-staple developments with production machines.

Long staple: appraisal and forecast

Blends, for example of wool and polyester, opened up significant market potential some years ago for worsted and semi-worsted in particular.

It must not be assumed that the increase in sheep breeding for meat will increase the supply of wool, since meat and fibre production do not develop in parallel. For planning purposes it is as well to allow a square metre for the manufacture of an annual ton of fibres of chemical origin, 26 000 m^2 for the agricultural production of cotton, and finally some 700 000 m^2 for wool production as a by-product of animal husbandry. In view of the growth in world population and the corresponding demand for food, fibres of chemical origin therefore offer the best potential.

Production levels in the classical outerwear manufacturing countries reflect a declining trend in Europe, no change in the USA, and a rising share in Asia. The general shift in textiles in the direction of the Far East is also becoming increasingly apparent in the long-staple sector.

Conventional long-staple spinning, either for wool or for synthetic staple, is a thing of the past for Rieter. It was continued into the nineteen-eighties with the ring spinning frames, and then abandoned.

All options are still open for unconventional long-staple spinning with long-staple rotor spinning machines, and here group management will have to decide accordingly on the action to be taken.

Manmade fibre machinery and systems

Spiders and silkworms demonstrate a process whereby fine filaments are spun from liquids. However, chemical research only developed the ability to produce rayon filaments around 1890, thanks to the work of Count Hilaire de Chardonnet. However, the actual process of draw-spinning manmade fibres was only described in patent publications around 1900. Research work on artificial fibres was later boosted in particular by World War II; for example, considerable effort was put into the manufacture of parachute silks. In the history of this area of fibre research the large-scale projects of the global chemical groups play an especially prominent role. Names such as Du Pont, Hoechst, ICI, Ems, Toray and Viscosuisse stand for developments in the USA, Germany, Britain, France, Japan and Switzerland. Polyamides were initially of special importance in these projects. The triumphal progress of the nylon stocking, which officially appeared on the market for the first time in the USA on May 15, 1940, is referred to here as an example of the detours and black market influences involved.

It is a well-known fact that direct and indirect conflicts make resources available for research efforts which normal world trade could never afford. High-strength polyamides, Perlon, polyester and various other fibres therefore emerged in the course of World War II. At a later stage it was space technology which, for example, speeded up the development of aramids such as Kevlar.

While these synthetic filaments were initially used only in the textile sector, their applications were later also extended, for example, to the optical field, where outstanding results have recently been achieved, especially in medical technology.

Meanwhile, glass fibres are among those in use in telecommunications,

Technical terms used in connection with filament yarns

Description of yarn		Unwind speed (m/min.)	Further processing	
LOY	Low oriented yarns	<1000	➧ DTY	Draw texturised yarns
MOY	Middle oriented yarns	<2500	➧ ATY	Air jet texturised yarns
POY	Partially oriented yarns	<5500	➧ FDY	Fully drawn yarns
HOY	Highly oriented yarns	<5500		
FOY	Fully oriented yarns	<8000		
FDY	Fully drawn yarns	–		

repeatedly breaking records when used as fibre optic waveguides. Last but not least, manmade fibres opened up independent fields of application for the technology of geotextiles and the manufacture of artificial leathers. In the field of observed and reproduced nature, fibre reinforced plastics are now used in lightweight structures which only a short time ago were the stuff of technical dreams. The Airbus rudder unit made by Dornier, a German aircraft manufacturer, is an impressive example of this.

Links between fibre research by the chemical groups and textile machinery manufacture by Rieter

In large-scale, government-subsidized projects the chemical groups developed fibres vital for use in wartime or satisfied the needs of aerospace engineering. However, in the postwar years the costs involved increasingly outstripped government resources. The subsequent need to raise private capital therefore taught chemical research personnel to seek partnerships with noted engineering companies. They made their secret and patented technical processes available to them and called for first-rate machinery and equipment. Rieter's reputation as a machinery manufacturer thus brought the company into direct contact with manmade fibre research.

In the course of time, Rieter was gradually able to move on from this kind of contract design arrangement. The exclusive technologies and process know-how of the chemical groups was replaced by Rieter technology, which was also based on the know-how of consultant engineering firms such as that put on the market by Ems Inventa, Zimmer, Karl Fischer and others. Rieter's specialists increased their know-how through in-house trials and became increasingly conversant with the processes involved.

Manmade fibre lines and systems

The manufacture of manmade fibres starts with the process from which the spinning dopes emerge. After solidifying, these are processed into chips and can then be stored or transported. They are liquefied again in the spinning process by the action of pressure and heat, and pressed into filaments via spin-die manifolds and extruders with spinnerets. They solidify as fibres in cooling shafts, are lubricated with spinning dope, drawn over drawing rollers and fed to winding elements. Depending upon the system, the smooth filaments spun in this way are textured and processed further as continuous filament or cut into staple.

The figures for processing these fibres as filament or staple were as follows in 1992:

Fibre	Filament	Staple
- Polyamide (Nylon)	82 percent	18 percent
- Polyester	46 percent	54 percent
- Polyacrylic		100 percent

Incidentally, less than two percent of the crude oil produced worldwide is processed into fibres. Of the various stages of the manmade fibre process, texturing for home textiles, carpets and outerwear is especially important. Smooth fibres are used mainly for technical applications, such as those required in tyre cord.

Rieter's customers in the manmade fibre sector

In the development phase described to date, Rieter's customers in the manmade fibre sector were originally a research and quality elite who installed lines with a high degree of security. The top quality required of the machines and the attention paid to the companies' special requirements were also rewarded accordingly.

In the nineteen-sixties this special situation was superseded by the current concern for price/performance ratios. Contract machine manufacture using the customer's confidential technology was transformed into high-quality machine manufacturing with advice from Rieter on systems and technology. Rieter developed from a contract manufacturer into a systems supplier. The strategy of supplying complete systems was clearly underlined by the acquisition of Automatik AG.

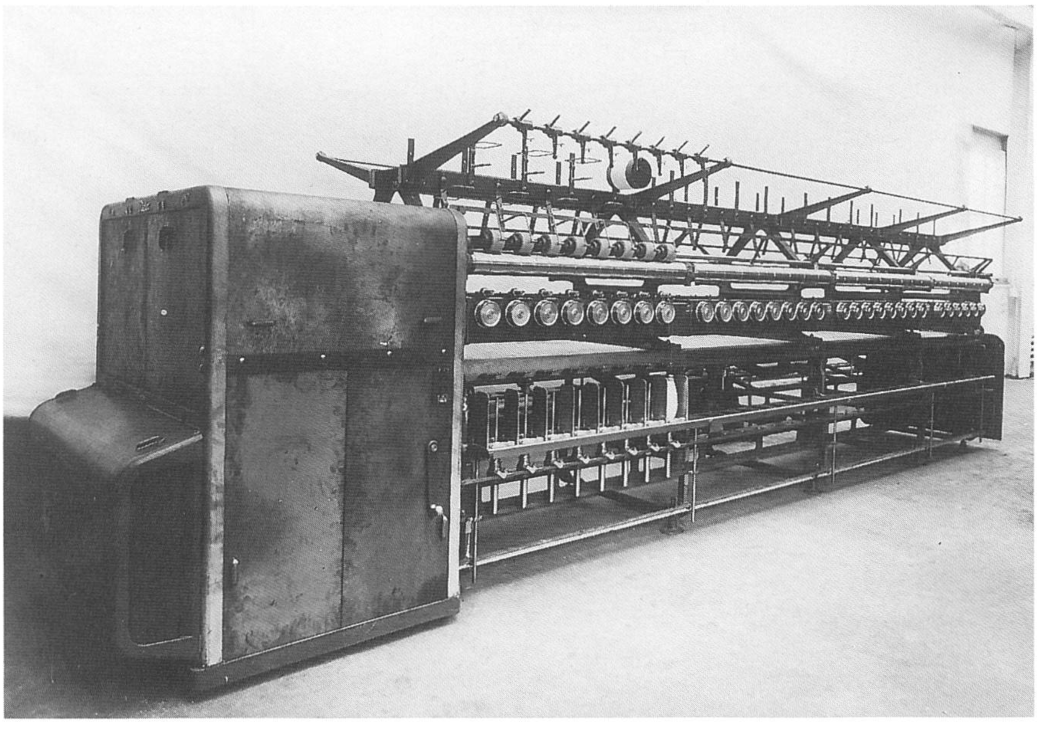
These ideas were already behind the construction of Rieter's research centre in Niedertîss at the beginning of the nineteen-sixties, since the buildings made provision for modifications which would have enabled a complete filament spinning mill to be operated at a later date. However, going it alone in the fields of chemistry, spinning and filament manufacture would clearly have been too costly, and would not have been conducive to further contacts with the industry.

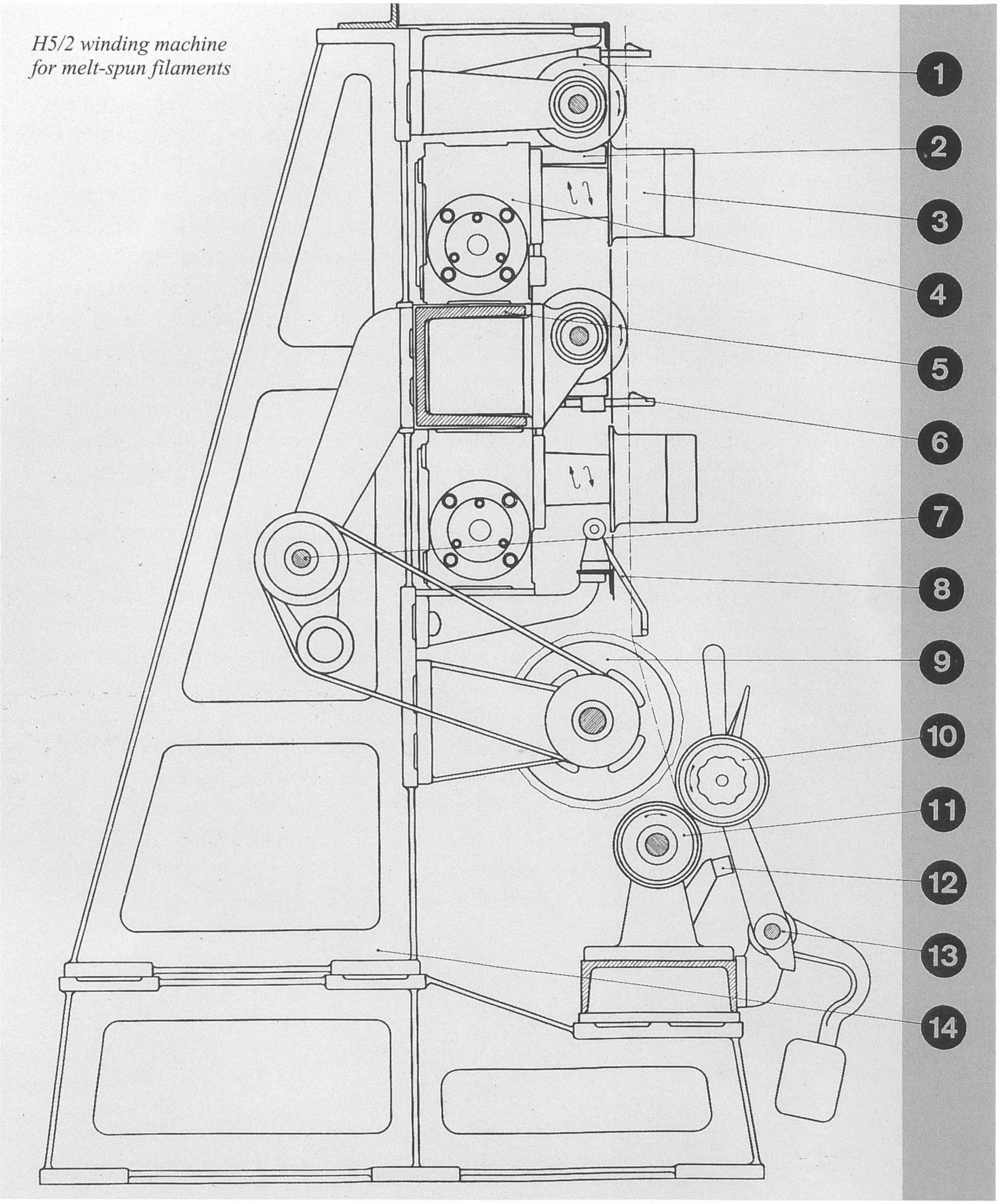
Special features of machine manufacture for manmade fibre technology

At the beginning of the manmade fibre era field trials with major European customers were still realistic and could be performed at short notice, but these opportunities have become much rarer due to changes in the markets. The focus on the Far East also affects the locations for trials, and monitoring over such long distances does not make development work any easier.

In mechanical engineering as such, filament lines saw the decline of the gearwheel and its replacement by variable-speed drives. This considerably increased the importance of electrical engineering in manmade fibre machinery, and it is not exceptional for this to account for 70 percent of the value. Rieter's own electrical engineering operations, Schaltag in Switzerland and Abbey in the UK, thus assume particular importance.

J5/1 draw-twister based on RB37 ring spinning frame, ca. 1950





1 Two-row, sintered corundum preparation discs
2 Adjustable mesh troughs with overflow nozzles
3 Two-row steel galettes with hard chrome plated surfaces and tapered ends
4 Oiltight enclosed cast housing with helical gearing for the galettes
5 Longitudinal supports for the gear boxes
6 Sintered ceramic thread guides, before and after each preparation disc
7 Intermediate transmission shaft for driving the grooved drums
8 Swivelling thread guides over the grooved drums
9 Grooved drums for thread traverse with V-belt controlled drive
10 Tensioning drum with internal and external tensioning discs for cylindrical, straight-sided spinning bobbins
11 Friction rollers with elastic, easy-to-release coupling
12 Permanent magnets for improved pressing of the packages on to the friction rollers (when starting spinning)
13 Swivelling package holders with handbrake and counterweights to regulate contact pressure
14 Heavy frame with two-part intermediate plates

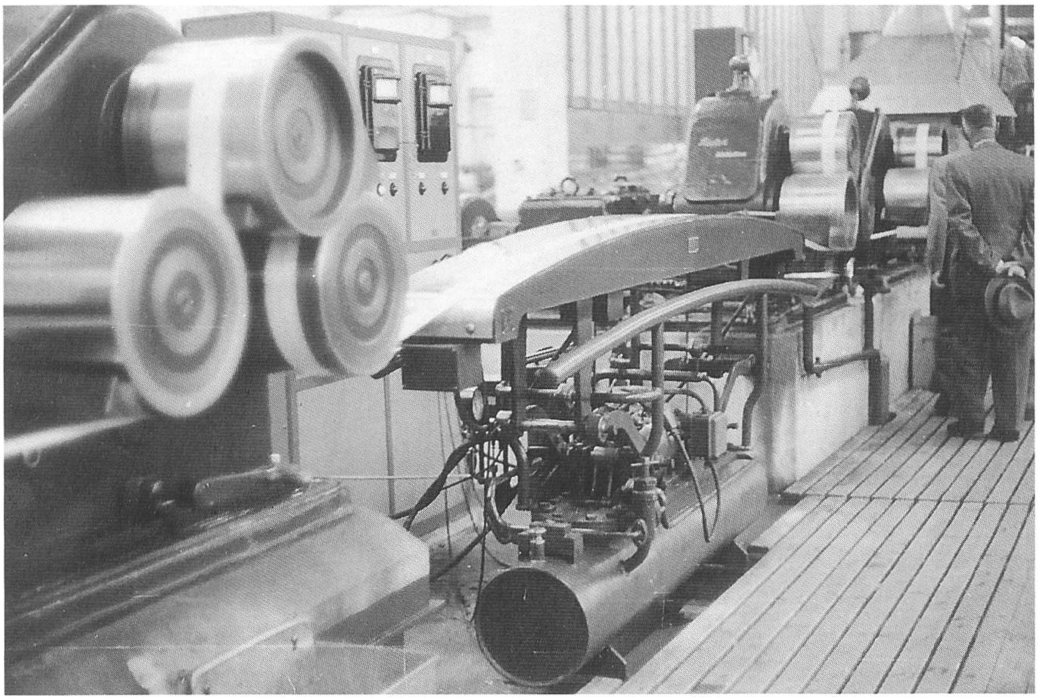
Manmade fibre machinery and systems

As we have already mentioned, Rieter was invited by the Ems company in 1948 to build the first draw-twisters for fibre manufacture. Rieter also started in 1949 with the design of the H5 winder, which was developed in various stages from the H5/0 prototype to the advanced H5/4 production machine. The first draw-twister, the J5/1, was produced at the same time on the basis of the RB 37 worsted ring spinning frame. This basic machine was equipped with gear troughs in its upper section, in which the draw rollers were mounted on bearings. The J5/1 to J5/12a Series was developed in several stages. History was made here by the J5/5 for fine yarn counts (with 846 machines) and the J5/10 (with 1596 machines). The recommended working speed of the J5/10 was set at 1200 to 1500 m/min., while that of the J5/12 was a remarkable 1500 to 1800 m/min. For heavy yarn counts, which were processed with two rows of draw rollers, outstanding sales figures were achieved with the J5/6 Series (81 machines) and the J5/7 Series (201 machines).

For the manufacture of cut staple fibres the continuous strands from the winding machines were assembled into cables, known as tows, which were conveyed together to drawing lines for drawing. Staple cutters produced by other companies then cut the continuous filaments to the required staple length. These fibres were then supplied to spinning mills in the form of pressed bales.

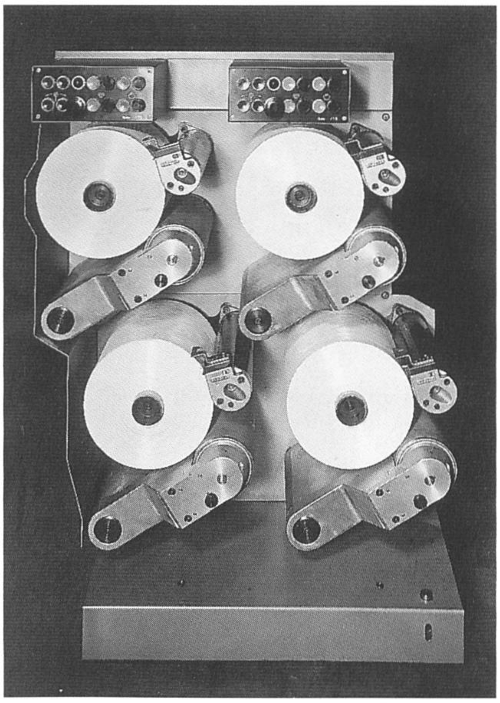
Drawing lines were produced under the model designation H4 between 1951 and 1965. However, as large-scale, very high precision gears they did not correspond to Rieter's manufacturing capabilities. The company therefore contracted out initial, smaller lines to Schweizerische Lokomotiv- und Maschinenfabrik (SLM) in Winterthur. Large machines were later built by Wülfel in Hanover. The drawing lines operated with cold drawing rollers, so that their drawing force made them suitable only for polyamide. The drawing of polyester would have required oil-heated rollers. Instead of devoting resources to this major design effort, Rieter concentrated on the extremely successful draw-twister and left drawing lines to its

H4/1 tow drawing line, mid-nineteen-fifties

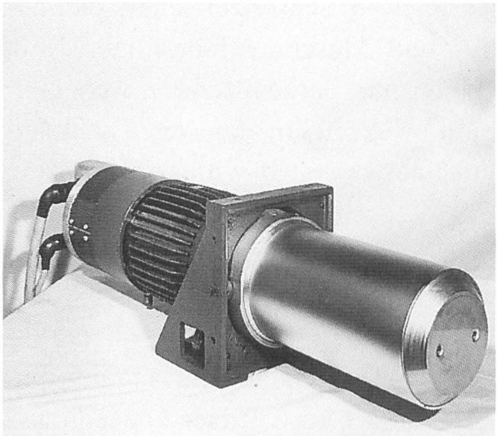


competitors. Successes in draw-twisting were accompanied by the J6 draw-winding machines, with the first J6/1a model appearing in 1966. However, only 52 machines of the succeeding models, the J6/1, J6/2 and J6/2a, were built up to 1975. Here, too, the version with one row of drawing rollers was used for polyamide, that with two rows of draw rollers for polyester. The two-row machine included «a» in its type designation.

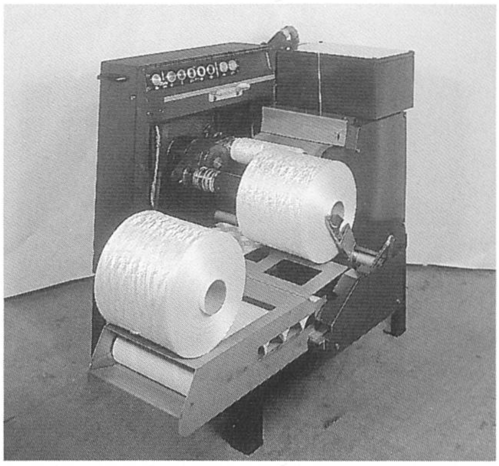
The mid-nineteen-sixties saw a move to new and much faster man-made fibre technology. The classical draw-twisters and draw-winders, Rieter's proven and highly successful models, were superseded by highly advanced drawing devices with heated rollers and superfast winders, with which working speeds were increased initially to some 2500 m/min. and later to 3000 m/min. and more, thus doubling output at the very beginning of the process. Hand winders for manual operation with working speeds of up to 4000 m/min. were produced as models J7/E, J7/G and J7/H. Parallel with these, Rieter developed automatic winders, starting with the J7/A1 Series for single-yarn operation in a very simple design, but with relatively large dimensions. The J7/A2, again single-yarn but with a compact design, was the next stage of development and could also be operated at up to 4000 m/min. Its successor, the J7/A3 Series, then operated with two yarns at 4000 m/min. The subsequent J7/A4 Series was designed for four yarns at 6000 m/min., but could not be operated with the required reliability at these high



J7/G hand winder

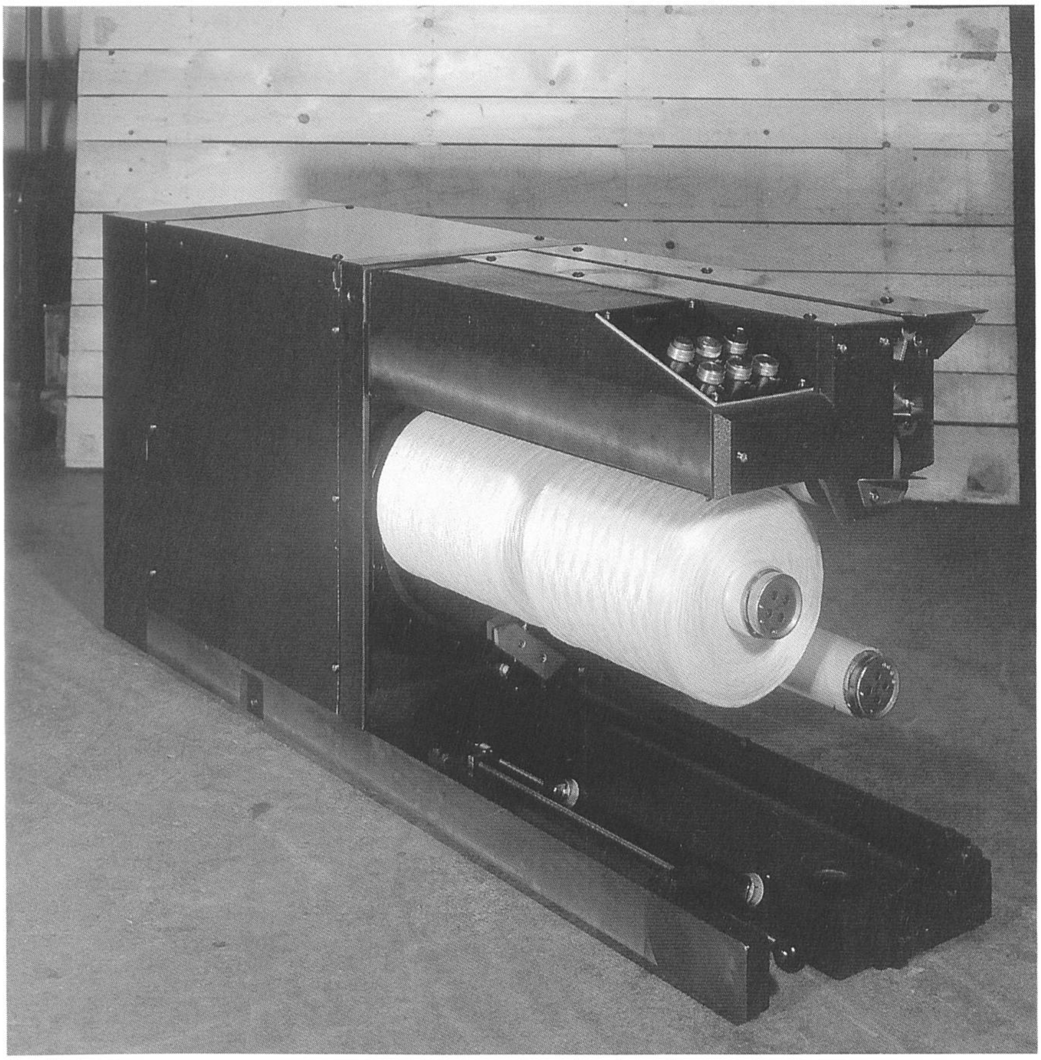


J7/32 dual-shell draw roll unit



J7/A2 automatic winder

J7/A4-33 automatic winder, for max. 4000 m/min.

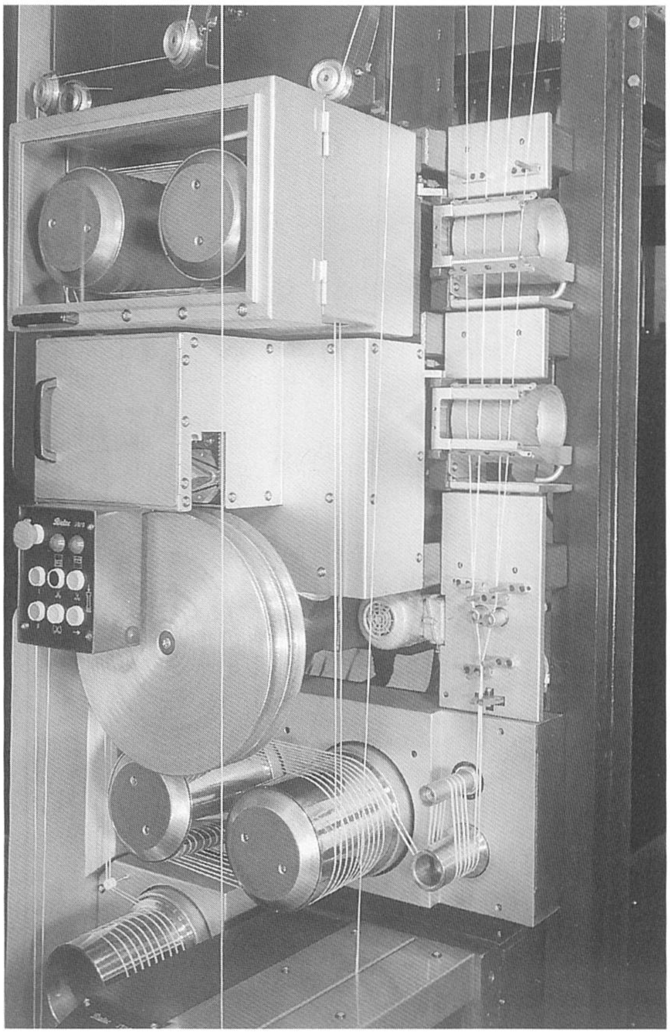


speeds in mill conditions. The J7/A4-21 Series was limited to 4000 m/min. for BCF and cord applications. With the latest J7/A6 Series winders, a modular design is currently in development which is intended to create a new generation of 6000 m/min. automatic winders for up to eight yarns.

The use of fast, automatic winders enables working speeds to be increased further, and has been exploited most successfully to date by Japanese competitors. As mill operations and operating risks show, there are wide differences between theoretical peak speeds and the operating figures actually achieved. This leaves the machine manufacturer with plenty to do.

The standard processes in use today include high-speed, heated drawing rollers. Rieter entered this field at the end of the nineteen-sixties with Dienes products, and later took up the challenge with its own J7 rollers. The units with working speeds of 6000 m/min. showed Rieter the practical risks of make-or-buy policies in the case of such advanced requirements. In the course of development to the 8000-metre roll, Rieter recalls its experience with FAG aircraft bearings, whose high quality then helped to extend bearing service lives significantly.

These combinations of J7 drawing roller units and J7/A automatic winders led Rieter to the development of spin/draw texturing machines for coarse yarn counts, starting with J0/1 carpet yarn lines. At present the J0/10 machine is available for two-yarn operation and the J0/12 for four-yarn operation. This sector also includes



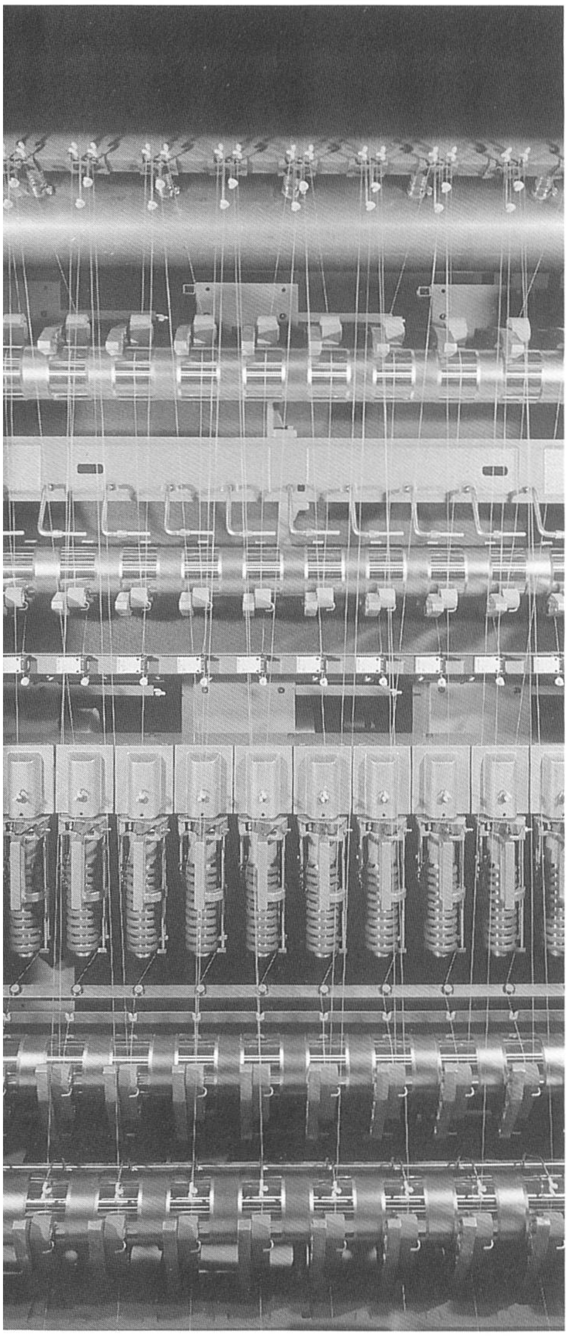
J0/10 spin/draw/texturing machine

the spin/draw winding machines, which with the J7/3A drawing device and the J7/A4 or J7/A6 automatic winder form the J3/1 and J3/10 modules, respectively. Unfortunately, modular theories often differ from the actual assembly potential, since the fixed structural pillars in existing spinning mill premises tend to create obstructions.

For the high content of electrical equipment in manmade fibre systems, Rieter produces its own control units, which monitor and control speeds and temperatures in the process with Rieter Texinvert.

Fine-count texturing – a complex process

The range of machinery and equipment produced would be incomplete without the sector of fine-count texturing. Initially going it alone, Rieter sought to solve the problem of fine-count texturing with its J 8/20 and J8/21 experimental machines in 1972 and 1981. The three one-sided prototypes which were built provided ideal material flow for yarn texturing and



J8/21 draw texturing machine; single-sided model with 120 positions

Rieter-Scragg DCS-1200 single-heater false-twist draw texturing machine

heater operation. However, penetrating the market in competition with Rieter's main rival would have been a very costly business, and an ideal solution was found in the acquisition of Ernest Scragg & Sons in Macclesfield (England) in 1982. Scragg's two proven machines, the SDS 700/900/1200 with twin heaters and the DCS 1200, covered Rieter's market needs ideally. With the new Rieter-Scragg company, which celebrated its centenary in 1989, Rieter has made a very valuable and cost-effective addition to its range of manmade fibre machinery.

Finally, the product range in the field of spinning, pelletizing, plastics technology and spinning preparation was significantly expanded with the acquisition of Automatik AG in Grossostheim (Germany) in 1992. Rieter thus became a full-range supplier and can now compete with the best in the field without any technological handicap.

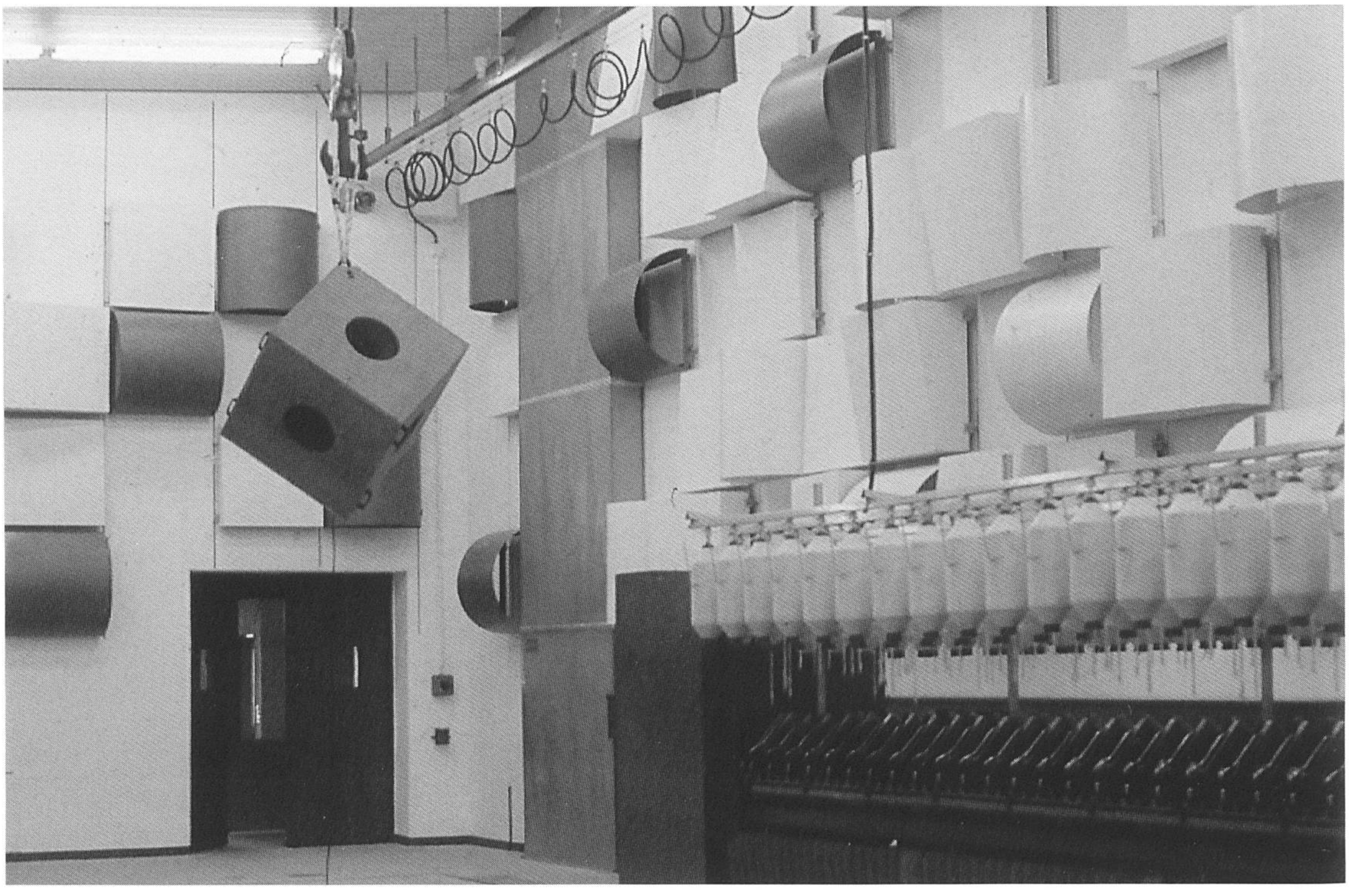
Outlook

Rieter became a full-range supplier in manmade fibre technology with the acquisitions of Scragg in 1982 and Automatik in 1992. As in the field of staple fibre technology, the company can thus offer filament technology and know-how advisory services.

In process development, an increase in working speeds from the current 5000 m/min. to 8000 m/min. and more is imminent.

In special filaments the requirements of aramids such as Kevlar and suchlike will have to be met in future. In classical manmade fibres, demands for very fine yarn counts for silky fabric effects will have to be satisfied.

In new, unconventional processes the strengths and weaknesses of bundle drawing processes, for example, must be studied and translated into what is industrially feasible. Last but not least, the shift in the market's focus to the Asian region must also be included in such calculations.



The acoustic laboratory at Niedertöss

The Unikeller Division

As early as the mid-nineteenth century, Rieter sought to improve the capacity utilization and profitability of its spinning and associated machinery manufacturing operations by entering other sectors; this has been described in more detail in Volume I of this history.

More than a century later it seems that a similar transformation is taking place. The number of competing spinning machinery manufacturers has grown continually and pressure on prices is severe. In intellectual property disputes many rivals do not hesitate to take legal action. Instead of seeking a useful balance of competing interests, hot-shot lawyers in the USA, for example, have influenced market shares through court rulings. The call for diversification into sectors with different cyclical patterns therefore became ever louder. After systematic studies, Rieter decided in 1984 to seek a better balance in its markets by purchasing the Unikeller Group. At that time Unikeller mainly manufactured noise control and thermal insulation products. Successful sidelines were pursued in paints, varnishes and plasters, and in sheet metal working.

Rieter had exchanged ideas with noise control specialists at Unikeller since 1962 through contacts between their research units. These findings were useful to Rieter, for example, in the construction of its acoustic laboratory in Niedertöss.

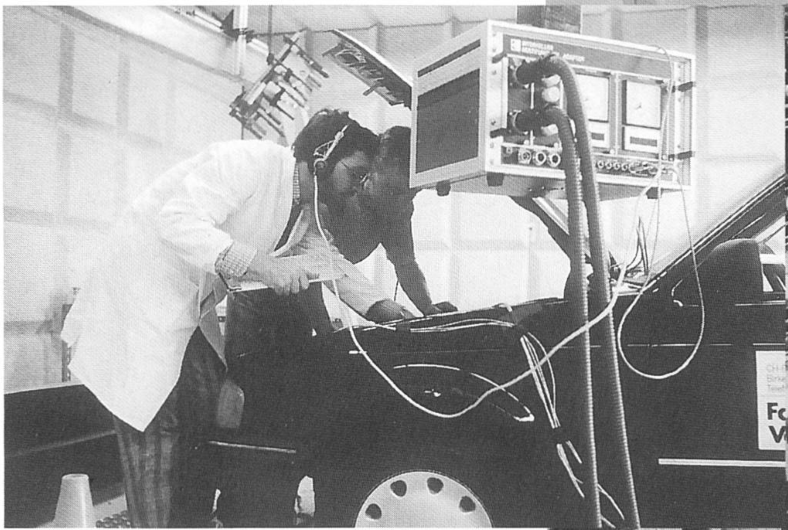
At the time of the acquisition in 1984, Unikeller had sales of some 300 million Swiss francs, about 2200 personnel, and owned a group of companies in Germany, France, England, Italy, the Netherlands, Sweden and Switzerland. It had joint ventures in Spain and licensing relationships with companies in Argentina, Brazil, Japan, South Africa, the USA and Canada. Individual products and integrated systems were produced in the field of noise control and thermal insulation. These were used in passenger cars, trucks, coaches and tractors. Their technical potential opened up the possibility of applications in railways and buildings.

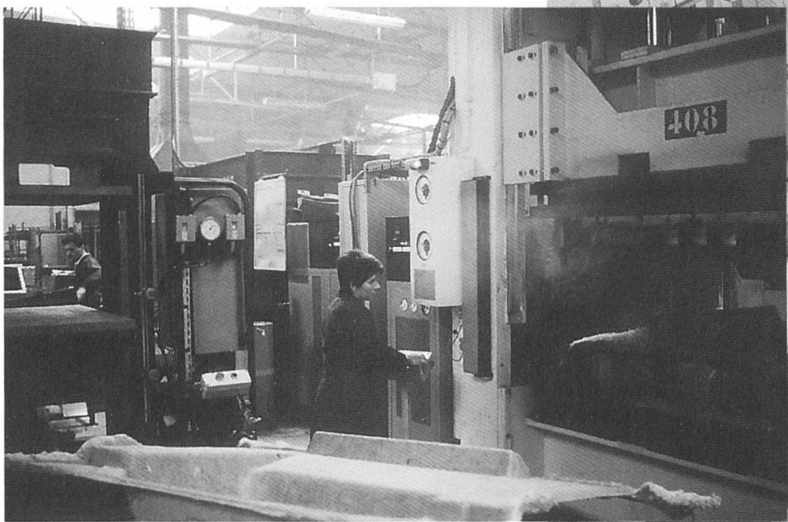
The products

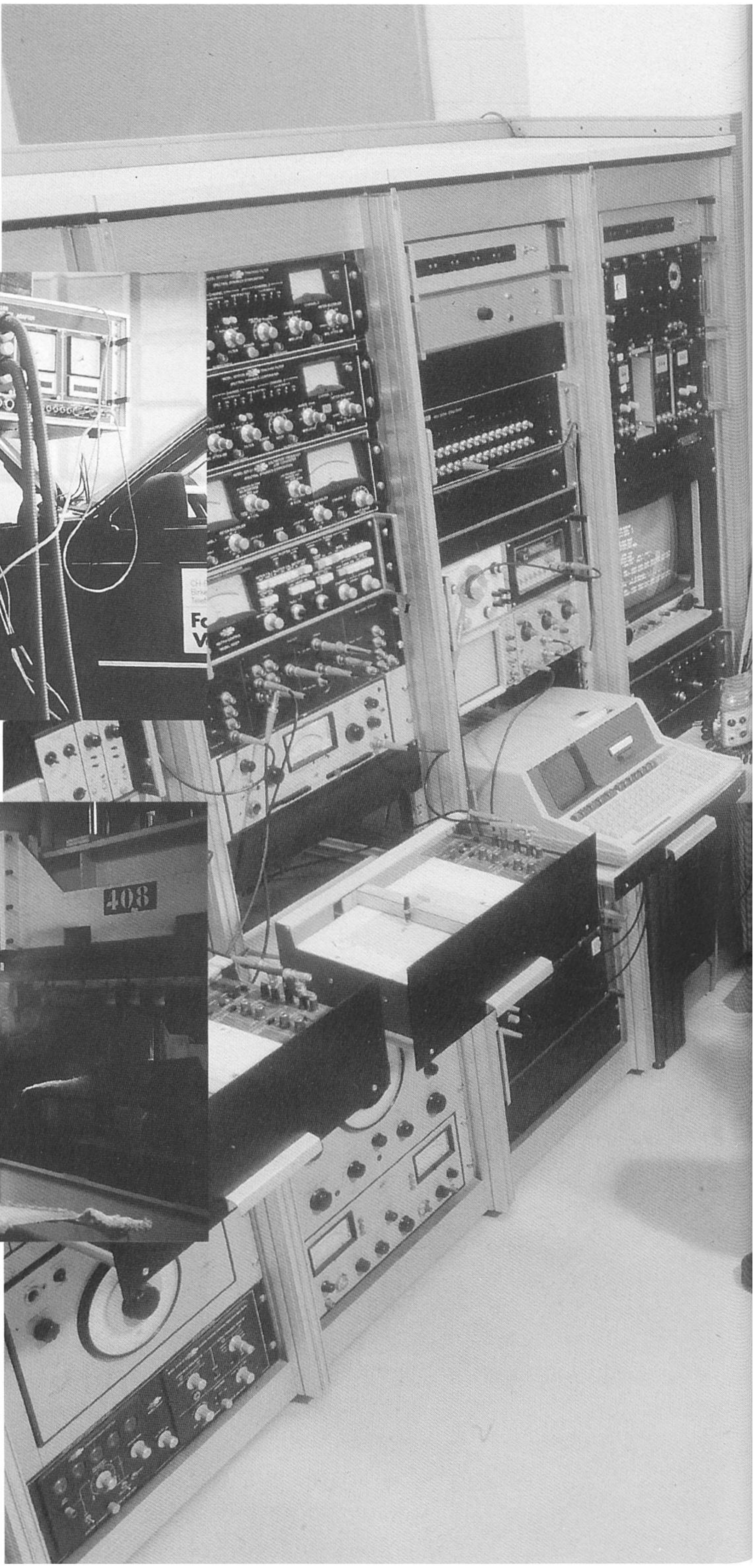
While noise and engine heat were part and parcel of the motor car's early years, the development of this sector soon brought demands for ways to protect people against both noise and heat. Noise control improves the quality of life and security of human beings and animals. Thermal insulation improves the energy balance and the service life of heat-sensitive structural components. Both products enable urgent needs to be satisfied which arise in connection with passenger cars, trucks, coaches, mobile and stationary machines, railways, buildings, etc. Insulation materials have to be used if these products cannot be designed to be low-noise or noise-free.

These elements can follow two main approaches: fabrics made from textile fibres and/or reprocessed textiles using secondary raw materials from recycling. The mats produced are bonded in different ways. As a result of systematic research, Unikeller knows the insulation values of the

Examples from Unikeller's sphere of activities

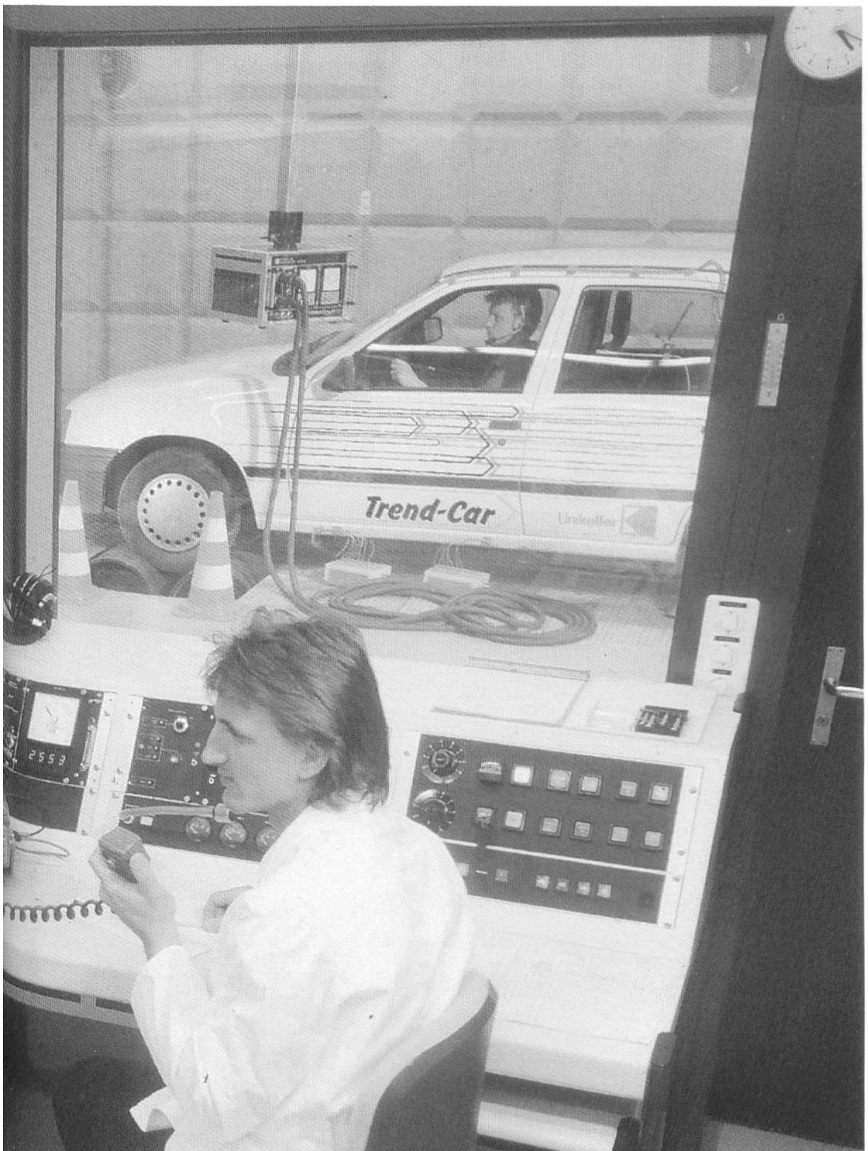






The scientific measurement of noise and heat transfer provides guidance for Unikeller's engineers in their development work.

different systems, depending on their structure. Readily processable «insulation sandwiches» are produced with bonded synthetic rubber or plastic films. Alternatively, foamed plastics or rubbers in the form of mats can be used. These foamed plastics can be used with open or closed pores, and



In «Trendcars» Unikeller implements new ideas which help the automotive industry to develop serviceable and cost-effective products.

A rear shelf as an example of a multifunctional insulation component

usually also have synthetic rubber or plastic films glued over them to facilitate further processing.

Unfinished elements of both types are suitable for the installation of accessories such as lights, door handles, window winders, ashtrays, etc. Designed as systems and preforms, they can be supplied direct to vehicle manufactures, for example, for use in their lean production operations.

The potential synergy with textile technology resulting from the use of textile secondary raw material is obvious. Experience in carpet manufacture and preforms also has to be seen in this context.

The market

Similar to the textile industry and textile machinery manufacture, the automotive industry also goes through changing economic cycles. These fluctuations generally follow a different pattern from those in the textile industry. Since the automotive industry usually brings out new models every five to seven years, Unikeller has to be a proficient R&D partner with its products for this manufacturing sector. Despite the economies which could be achieved by combining production facilities, it must maintain a visible presence close to its customers and in the marketplace.

For example, Volkswagen, Audi, Ford, Opel and Mercedes in Germany, Citroën, Peugeot and Renault in France, and Alfa, Fiat and Lancia in Italy are among Unikeller's main customers, so it is important for the company to be present either in the immediate vicinity of these customers, or in a suitable, central location.

The future

In order to secure and develop good contacts with customers and their research facilities, it is especially important for the division to demonstrate its scientific credentials at the Unikeller conferences. The company's own research specialists and selected university professors provide the customers' research personnel with information about the latest state of the art. «Trendcars», which need to be «grasped» in intellectual and physical terms, are also shown, for example. Such demonstrations of expertise cement Unikeller's partnership with research staff in their capacity as representatives of the customers and thus assure it of a consultative voice in model changes.

Its experience and success to date give Unikeller cause to believe in a healthy future in which the insulation needs in all forms of transport can be satisfied. Its links with machine manufacturing can also be expanded. Improved building services could, for example, offer unsuspected potential as regards the comfort of living and working conditions. Concentration on the essentials is of vital importance for these major future assignments. The Unikeller Group therefore disposed of its structural metalworking operations in 1987, and of the paints, varnishes and plasters interests in 1988. Chemiegesellschaft Gundernhausen with its foamed manufacturing process was acquired in 1988 in order to complement the division's technical expertise. The long-term goal of becoming a universal systems supplier was also brought a step nearer in 1994 with the acquisition of Firth Furnishings Ltd. (England), a company specializing in preformed carpets and interior trim.

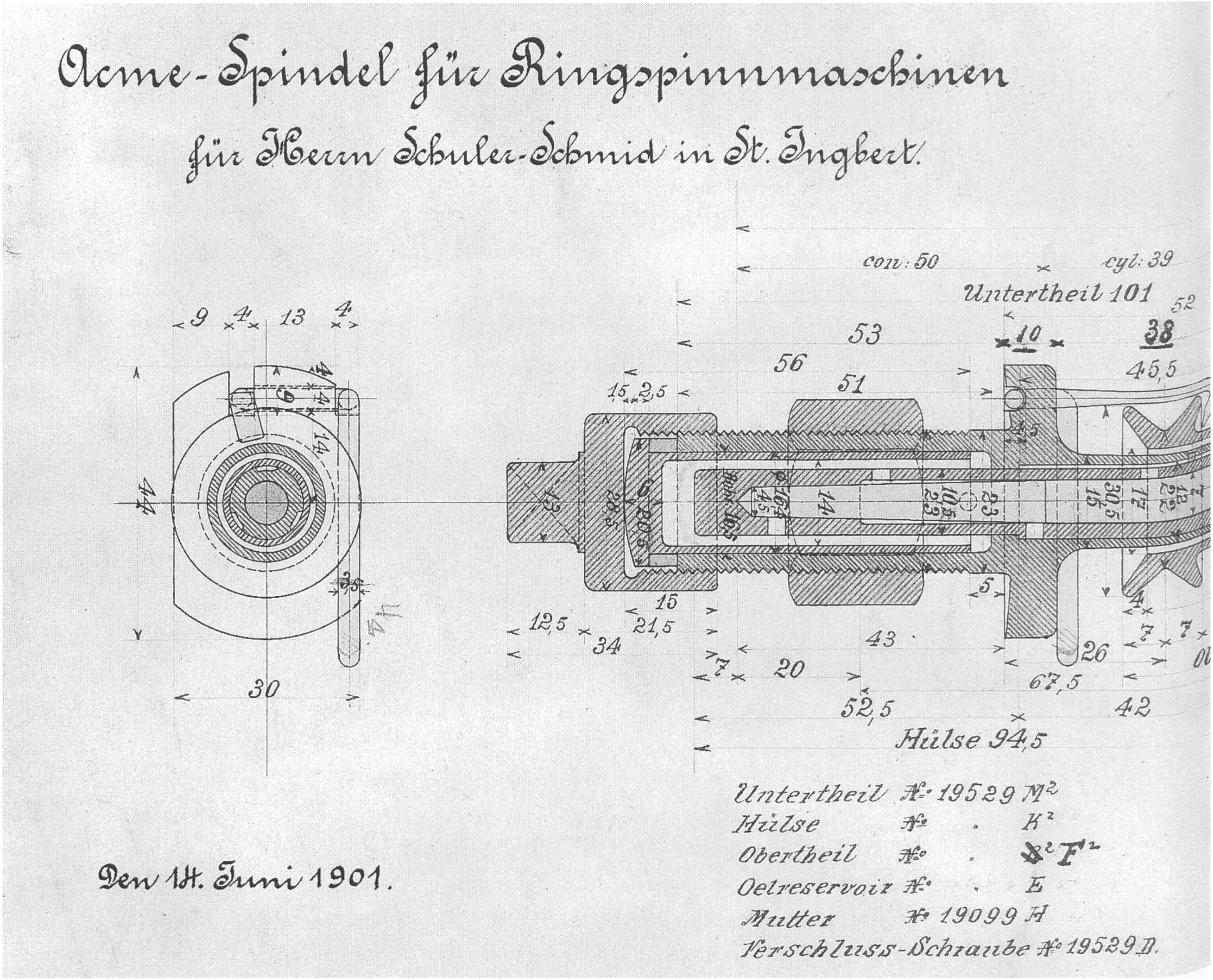
The main partners in coordinated projects in the changing field of research and development

Rieter's machine manufacturing activities in the early 19th century were initially characterized by individual achievements in the sphere of the craft-based operations which were usual at that time. Over the years group-based activities developed, in which partners from different disciplines focused their joint efforts on the project target.

For the early Rieter designs the representation and drawing of the components was in itself a special challenge. For example, parts were then depicted life-size on boards, which were then used as working guides in the workshops. The detailed engineering drawing customary today did not evolve until the beginning of the 19th century. Incidentally, the Swiss engineer and inventor Johann Georg Bodmer (1786–1864) played a major part in this. He developed the fundamentals for this innovation during his engineering work in Bolton (England), thus opening up completely new potential for structural design. As the historical archives of Maschinenfabrik Rieter AG show, drawings of masterly precision were produced, which in line and colouring were reminiscent of Zurich's minor masters such as Johann Heinrich Füssli. A single drawing was used for sales and marketing. It was also used for manufacturing the component, specified checking procedures, was the basis for assembling the workpiece together with neighbouring components, accommodated instructions and modifications, and finally was used for the spare parts service. In this versatile form it could be described as the forerunner of modern information technology, which stores all the available data on a component in a central database.

In the development of textile machines Rieter progressed from empirical craftsmanship (based on experience) to systematic, scientific research and development, which was characteristic of the state of the art, especially from the nineteen-fifties onwards. Originating from the goldsmith's craft, the company's founders had a deep appreciation of the craftsman's art and the personal nature of manufacturing tolerances. Technical development followed the historical route from the «cylinder house» in Obertöss to the research centre in Niedertöss. The research centre was built and came into operation in 1963 in Niedertöss, where Rieter's spinning development had started in 1825 in a modern fine spinning mill.

From the business point of view, first-rate products are an excellent insurance for the future. Specialist research work has to be performed for this purpose, and imaginative personnel are often extremely sensitive, appreciating a good supply of information but wishing to be left in peace to pursue their projects. It was precisely this vital environment which was created so successfully in Niedertöss. Since the saying «time is money» also applies to research work, demands for shorter development lead times are ex-

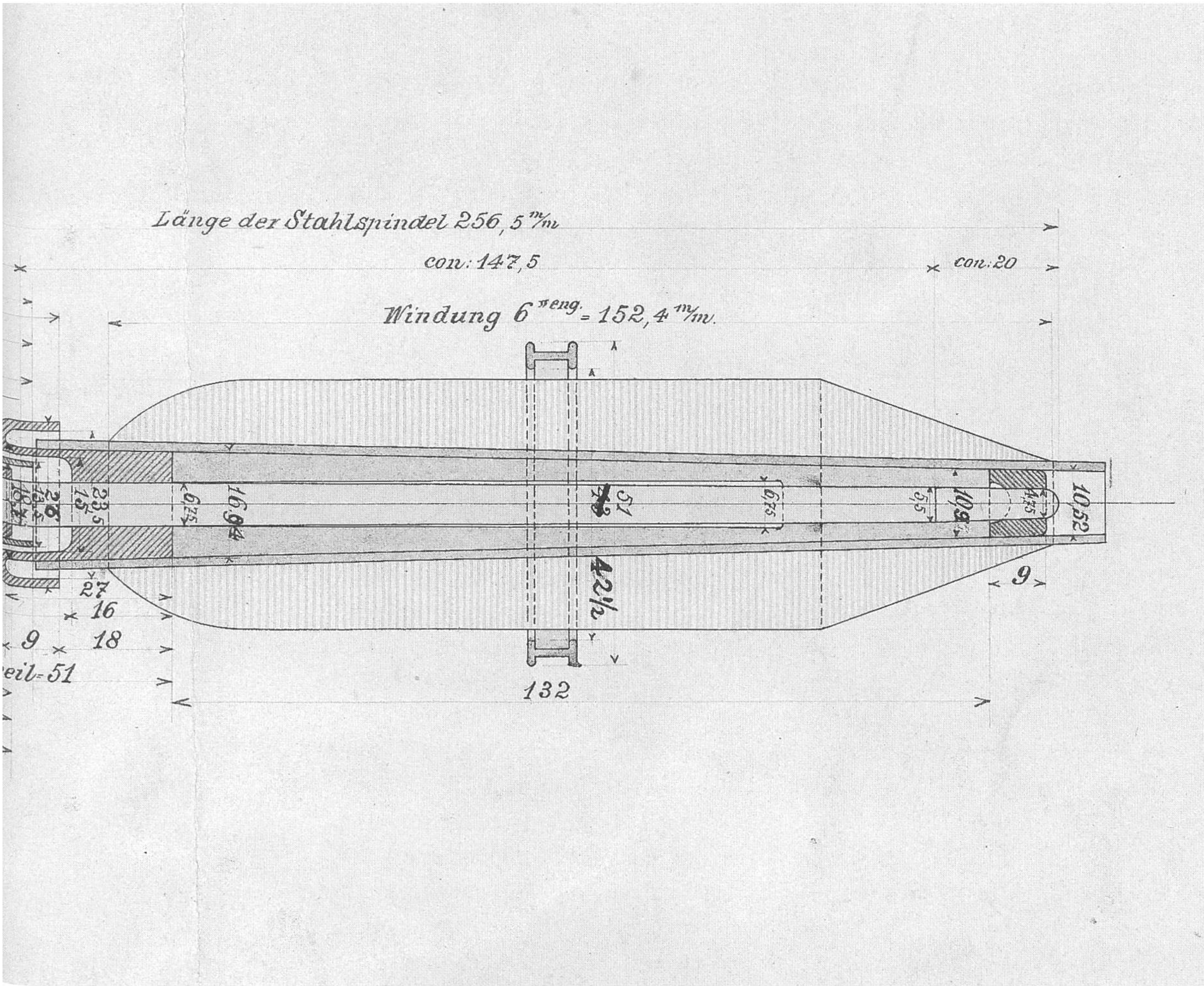


This drawing of a spindle dating from 1901 was used as a design drawing, a document for discussions with customers and tube manufacturers, and as manufacturing documentation.

pressed more or less loudly, depending upon the overall business situation. While recognizing the competitive demands of the market, it must not be forgotten that it is also essential for advanced engineering products to be subjected to the necessary long-term tests.

Long-term endurance tests are especially important in developing textile machinery for three-shift operations. A thorough knowledge of the effects of textile dust, for example, is also essential. Momentary observation often indicates dust emissions of virtually zero, but accumulated over a period of months they can bring machines to a standstill.

From the outset, textile machines have consisted of long-lived basic elements, wearing parts and accessories. In all development considerations, wearing parts in particular are dependent on a well-organized spare parts service. Accessories such as tubes should be obtainable worldwide and therefore defined in good time on the basis of international standards. First-class standards are therefore of particular ecological importance for the successful long-term operation of machinery and systems. Leading companies therefore have every reason to strive for a leading role in international standards bodies.



Patents and industrial property rights

Technical development is often measured by the number of patents and industrial property rights issued. According to these statistics, technical knowledge actually increased only insignificantly in the first half of the 19th century. Technical progress only began to gather pace as surges in development in manufacturing technology took place in the mid-twentieth century. Perhaps the financial advantages of industrial property rights were responsible for the explosive growth in patent applications. While technology transfer and the exchange of industrial property rights in Rieter's early history were mainly based on «handshakes between gentlemen», «contracts between legal entities» later became much more frequent. Even as late as the nineteen-sixties, patent applications were submitted almost exclusively when the proposed approach had proved effective. The patent lawsuit was then a rare event in textile machinery manufacture. Modern judicial practice, and especially rulings by American courts, have resulted in an increasing number of tactical or strategic applications, especially for modern spinning processes (for example openend). Inventors are therefore ill-advised to exercise polite restraint in their claims for patent protection nowadays. In the author's view, excessive litigation demands on financial and market issues put the gentlemanly practices of earlier days in an even more favourable light; a return to these methods would be desirable, but nevertheless extremely risky. The patent lawyer is thus an essential partner in technical development. He protects intellectual property and through his skill in broadly defining claims creates scope for projects to be developed further. Patent and legal advisory services also provide significant support for technical work through agreements covering, for example, exclusive rights and claims for protection.

Production

The company's development history places on record the major importance of manufacturing technology and production engineering. These have been influenced significantly by personalities such as Henri Daniel Gross (1871–1945), Dr. Oskar Halter (1883–1939), Heinrich Steiner (1895–1954), Dr. Kurt Hess (1910–1984), Max R. Epprecht (*1916), Hans Probst (1926–1993), Dr. Kurt E. Stirnemann (*1943), Erwin Stoller (*1947) and Rolf Häfliger (*1932). These production managers have always been supported by outstanding supervisory personnel and advisers, among whom Samuel Bagdasarjanz and Dr. Gustav Stähli deserve special mention. While Bagdasarjanz paid particular attention to manufacturing and assembly technology, and was also involved in the pictorial arts, Stähli – in his scientific work on wear-resistant surfaces, fatigue strength and ring/traveller technology – successfully tackled challenges which were recognized worldwide. In partnership with foundry manager Eugen Sinner, Rieter's castings achieved top quality standards which also enabled sales to be maintained in shrinking markets.

This publication cannot by any means do justice to every aspect of Rieter's production engineering achievements. Milestones in production engineering are therefore summarized briefly below.

When Rieter celebrated its 150th anniversary in 1945, the company was at the level of a pioneer operation in the large-scale metalworking trade. Average piece weights were then 4.8 kg. Machine components and subassemblies were produced in complete workshop operations. Production lines were only used in the Effretikon machine works for special know-how components such as spindles, top rollers and rings. Similar methods have been used since the nineteen-seventies in the manufacture of fluted rollers in Winterthur. Product quality was influenced significantly by personnel. These working methods were ideally suited to Rieter's craftsmen. However, the signs of a transition from man to machine were becoming increasingly obvious. The main targets were defined in the new production concepts of 1983: cut workshop costs, reduce inventories, reduce set-up times and batch sizes, plan manufacturing cells, define standard tool kits, bring dispatch and assembly closer together, make assembly planning more detailed.

These ambitious targets could only be achieved by significant developments in tools and manufacturing processes. The cutting tool made from hardened tool steel therefore soon became a thing of the past. New carbide alloys produced markedly higher cutting performance with longer service lives. Finally, these successes were again overtaken by ceramics technology.

In sheet metal processing, laser technology became an obvious competitor for oxyacetylene cutting apparatus. While the rough edges produced

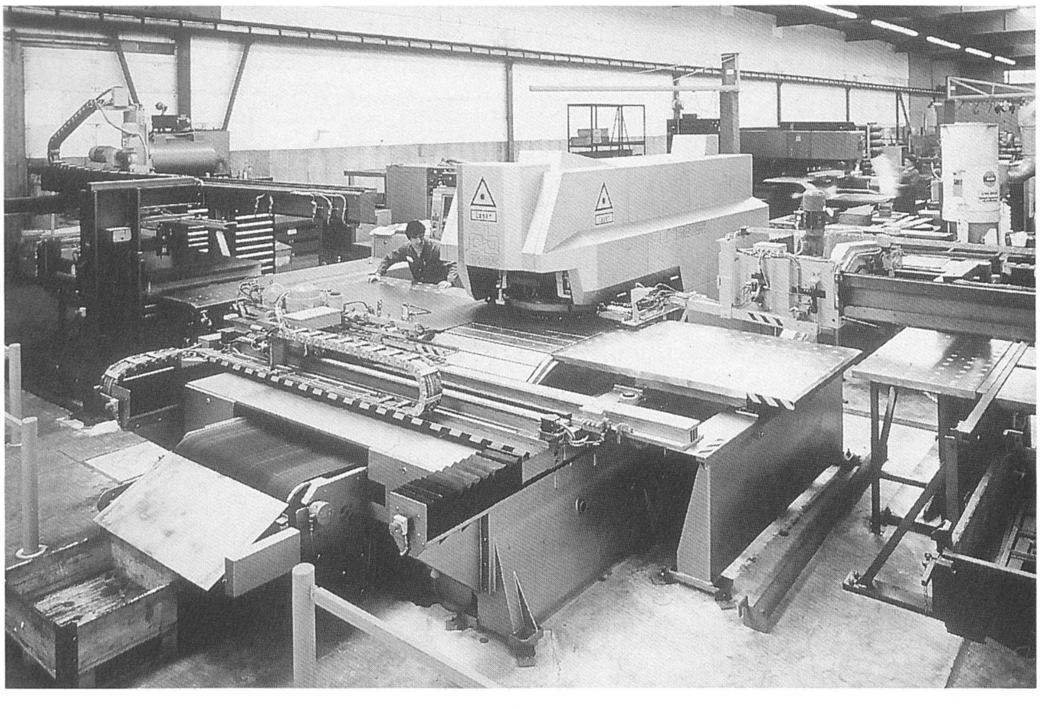
Assembly line for E7 combers in Sirnach

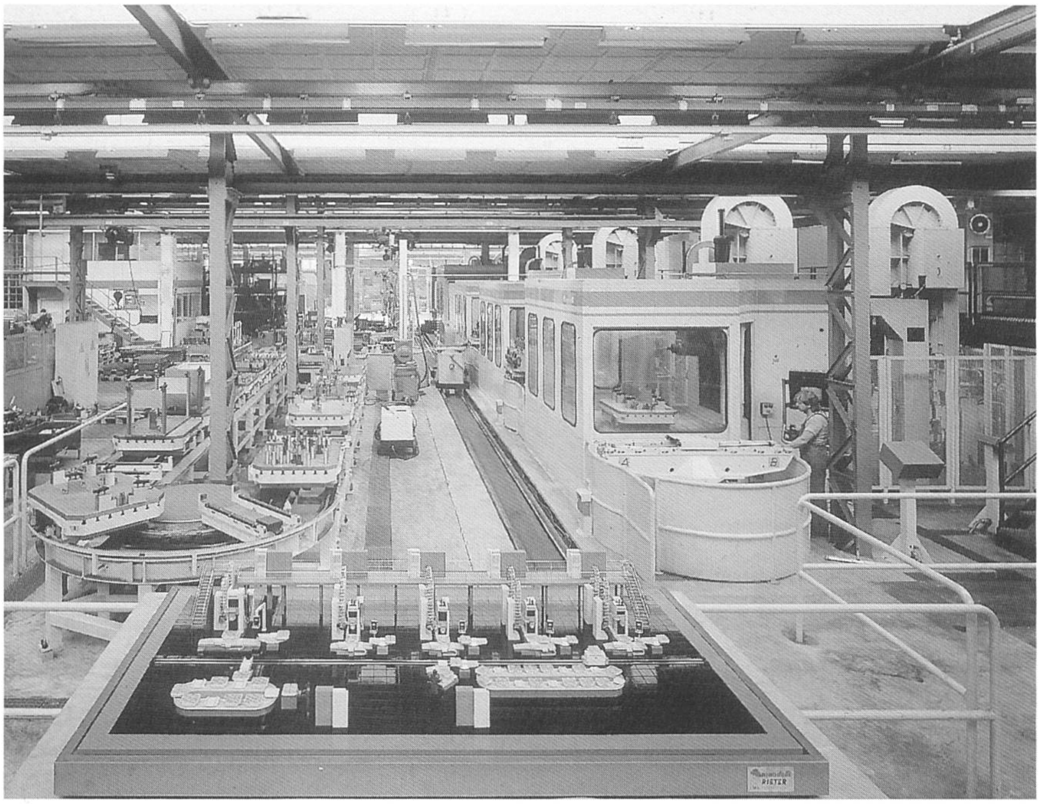
by oxyacetylene cutting were ill-suited to textile technology, laser technology produced almost clinically clean edges, which were ideally suitable for textile machinery manufacture.

In the mid-nineteen-seventies plasma coating was a process which enabled noble materials to be applied to rotating elements, especially in filament machinery manufacture. Conditions of high quality and long service life could therefore be created for the area of contact between the fibre and the processing element. This opened up new horizons for manufacturing technology.

NC/CNC technology brought a genuine leap in development for efficient manufacturing tolerances in the early nineteen-sixties. As Max Epp-

Behrens sheet metal stamping and laser cutting machine, 1980





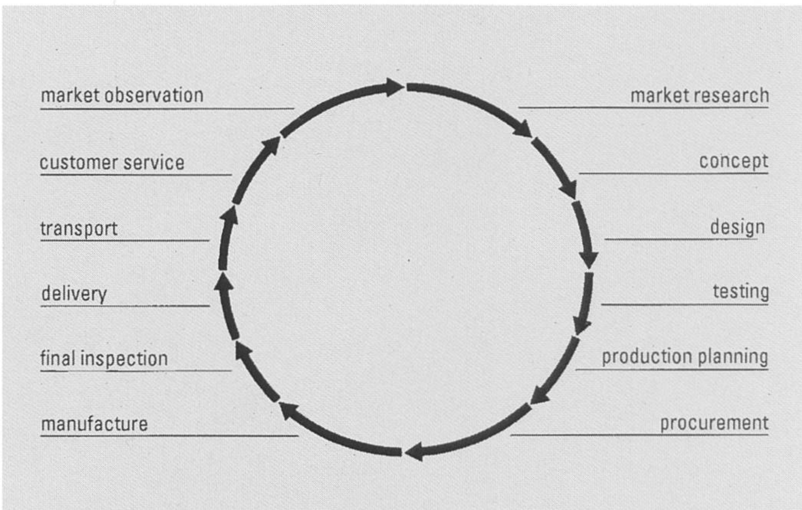
Mandelli flexible manufacturing system, 1988

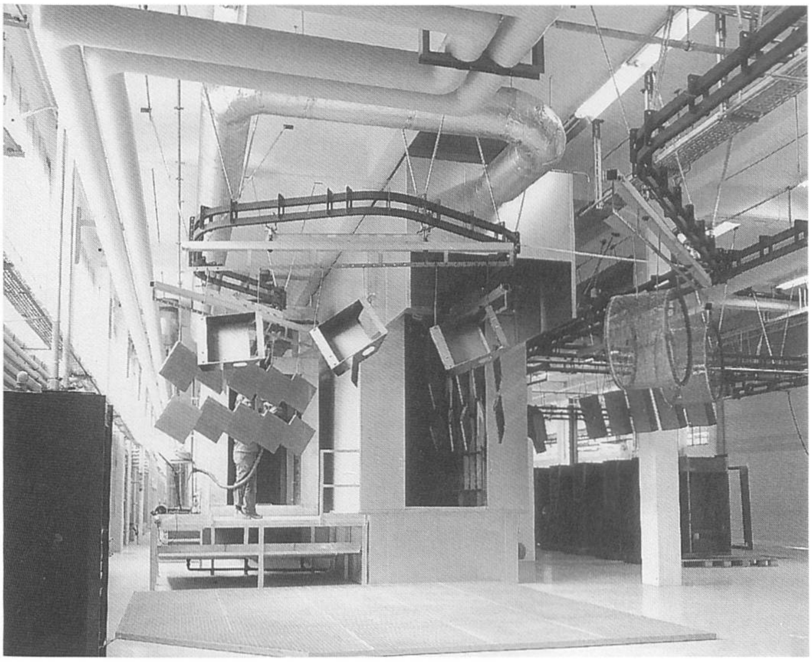
recht liked to recall, so many salesmen advised him against CNC machine tools in those days that in 1965 he decided to order an NC drill from Cincinnati to be used for study purposes at Rieter. The subsequent trials were the equivalent of pioneer work, which finally also provided the basis for ordering Moriseiki automatic lathes from Japan. After 1975 these replaced the classical manual capstan and turret lathes. Further advances then resulted in the award of a large order for FFS-Mandelli flexible manufacturing systems, which satisfied the requirements of Rieter's 1987 manufacturing concept in full. At the celebrations of 20 years of NC technology, Rieter's speakers pointed out that NC technology upgrades the workshop trades and even improves component quality at lower manufacturing cost due to good process control.

CAD/CAM/CIM technology was introduced to the Rieter workshops at the same time as the Behrens laser metal-cutting system. CAD geometry could then be transferred from the drawing board to the production machine by telecommunications, and a two-dimensional metal component cut to size with high precision within minutes by means of the automatic NC machines. This technology has been available to manufacturing operations since the early nineteen-eighties, and has attained a high level of perfection in Trumpf systems such as those used by Rieter in Ingolstadt.

According to the tenets of modern manufacturing technology, quality must be achieved during the manufacturing process itself. Subsequent improvement is uneconomic and destroys

The quality circle shows the relationships at all stages of product development. Quality must therefore also be effectively assured at all these stages.





Powder coating metal components with environmentally friendly total utilization of colouring materials

productive time. In this context reference must be made to the further development of tolerances, which at Rieter were aimed at the system of the standard shaft from an early stage. Earlier, one-sided tolerances were first transformed into average values, thus markedly improving the interchangeability of components. In an effort to enable machines to be assembled without using files, in the nineteen-seventies Rieter aimed for rough tolerances corresponding to the system of the Swiss Working Party for Quality Assurance (SAQ) of Dr. E. Soom. With this important step Rieter abandoned previous standard assembly methods in which almost every component had exhibited individual fine dimensions as a result of adjustment.

The quality of the spinning machines is significantly influenced by the ability to produce surfaces which are free of fibre drag and protected against corrosion. The application of coatings is very important for these efforts. As early as the nineteen-forties, production operations had, for example, incorporated the wet spray technology used in the automotive industry. A valuable advance in the seventies was the electrophoretic coating bath for castings. In the late eighties came powder coating with its especially environmentally friendly features. At the same time Rieter continued to develop and use electroplating and plasma coating methods.

A sound knowledge of materials data is essential for innovative machine manufacturing and production technology. Rieter's materials research team under Dr. Gustav Stähli and Fritz Goebe successfully tackled the core problems in this field. Important know-how on new materials was gathered, especially on castable metals, and the results enabled giant steps in development to be taken for material combinations in mangle lubrication operations. This enabled ring/traveller combinations to be found for the ring spinning frames which produced outstanding operating data. In partnership with the watch industry and Sulzer-Medica, highly wear-resistant metal surfaces were developed which offered new potential in textile machinery manufacture, for example in the production of yarn guides. Progress was also made in the localized hardening of metal components. In cooperation with universities and engineering colleges, the knowledge of long-term alternating load behaviour – among other things – has been expanded to such an extent that it paved the way to objective findings in the search for the cause of shaft breaks.

The past fifty years have also brought marked advances in development in the field of component design technology. The enormous potential opened up by flexible manufacturing systems resulted in the combination of individual parts into multiple components which can be machined very precisely in a single chucking on five levels. Closer tolerances have simplified assembly techniques. Production

Ring spinning assembly operations in 1945 (top) and 1987

Concept 91 also provided the basis for «Just in Time» (JIT) delivery and lean production. This involved producing only what was immediately required, if necessary with batch size 1, and keeping the amount of working capital to a minimum by maintaining minimal or zero inventories.

When considering systems in the context of assembly philosophy, the close relationship with the requirements of dispatch operations was identified. Although the traditional, solid Swiss box was in heavy demand from spinning mill personnel, especially abroad, the transition to pallets, cartons, polystyrene and crates was inevitable. The new shipping unit, the container, set new standards and helped to cut costs. In this concept the dispatch of fully assembled machines and subassemblies also assumed greater importance. The use of suitable cushioning elements and actual transport settings opened up opportunities which were worth seizing.

These development steps and the comprehensive specialist know-how in production and manufacturing technology were utilized increasingly in engineering projects. The designer at the computer screen and his manufacturing partner thus developed into a coordinated technical environment (a «technotope») without which it is impossible to imagine successful project management. An easy-to-manufacture design improves the quality of the products, thus enhancing reliability and forming the basis for demonstrating the value of our machines and systems in practical operations.

Finally, the efforts to conclude licensing agreements involving technology transfer, and more recently joint ventures, must not be forgotten when writing the history of Rieter's production operations. Lakshmi Machine Works (LMW) has been a clear example of this since the mid-nineteen-sixties. Rieter Elitex in the Czech Republic, part of the Rieter Group since 1994, could assume similar importance. In the field of technology transfer, cross references to international standards are very important. Rieter's commitment to this field of activity is therefore well-founded. Clear manufacturing drawings as a basis for unequivocal understanding and up-to-date manufacturing documents are also extremely useful. Experience with LMW has also underlined the value of Rieter liaison specialists on the spot for technology transfer. With a view to future developments, technology transfer assumes considerable importance in «make-or-buy» decisions, issues of the extent of in-house manufacture, and decisions on lean production.

Marketing, service and training

Marketing partners are very important for project management, especially to ensure close contacts with the market and service operations. They incorporate the customer and his needs in the project, thus ensuring the feasibility of innovative plans. Manufacturer's warranties for key technological and output statistics in the form of guarantees of performance are a precondition for the successful operation of spinning mills. Rieter has been able to collect valuable experience here through its trial plant for customers. Processing customers' raw materials in the customers' presence with subsequent scientific evaluation of the results reinforces mutual confidence. This policy of cooperation started at Rieter around 1825 with the Niedertöss fine spinning mill and has been continued successfully in various forms. Finally, the Rieter research and development centre was set up in the converted Niedertöss spinning mill in

Customer training in the Training Centre: «grasping» things, physically and mentally

Training on the card

Training in machine control and electrical engineering

Training on the ring spinning drafting system

Training on the OE rotor spinning machine and its technology

1963, and also fulfils these requirements.

The training of specialists and supervisory personnel is very important for confidence and customer contact. The proper operation of Rieter systems is assured by the special know-how passed on to them. Specialist know-how prevents incorrect operation and thus eliminates complaints. Rieter training also boosts the standing of the trainees. The training centre in Obertöss was built for this purpose.

As the volumes of correspondence preserved in Rieter's archives clearly show, the company's founders themselves were most concerned to establish close contacts with their customers and earn their confidence. The efforts in this direction have been intensified, and in the nineteen-sixties a «complaints unit» was set up. This developed into customer service, which collected and evaluated reports from the front line of spinning operations, organized by issue, machine and system. These data were used for prompt, on-the-spot service, and also provided the factual basis for the constructive further development of Rieter products. Valuable experience from the used car market was also utilized at Bertschinger AG, a company trading in used machinery.

Electrical engineering

Between 1890 and 1906 the Rieter Machine Works took an intense interest in electrical engineering in the shape of motors, generators, electric-powered rail vehicles, etc. When production of these products was discontinued, Rieter's electrical engineering activities were reduced to maintaining the factory installations. On the company's 150th anniversary in 1945 only one electrician was still employed for the factory's needs and to meet the requirements of research and design work. Modern drive technology, process control, security systems, and especially the potential offered by electronics, boosted the number of personnel employed in new electrical activities to some 200 at the company's 200th anniversary. Development surged with the purchase and expansion of Schaltag AG and the integrated electronics of the filament machines. The manufacture of switching and control units has become a definite in-house operation as choices are made between in-house manufacture and purchase. Meanwhile, motors and rotation electronics have continued to be largely bought-in items. The integration of control technology in the data processing operations of control units has become increasingly close with the help of networks and telecommunication links. This mixture of different systems is in line with the development trend of artificial intelligence, for which a potentially wide field of development remains.

Information technology (EDP/CIM)

Rieter's first steps in data processing go back to September 1943, when a first system was ordered from Kardex/Powers AG; this came into operation in 1947. Rieter bought a «UCT 1 Univac Calculation Tabulator» from Remington Rand AG as early as 1957. This set new standards with a printout speed of 36 000 lines per hour. The rapid development of data processing resulted in its expansion to the UCT II model, and in 1965/66 the follow-up model Univac 1004 came into operation, to be upgraded to the Univac 1005 one year later. In 1968 Rieter built its computer centre with the Univac 1108 system, which was designed in partnership with Sperry Rand AG and operated for the joint needs of Sperry and Rieter.

Keen competition between the computer manufacturers led to the merger between Sperry and Burroughs to form UNISYS, whose mainframe computers and networks gave excellent service to Rieter. An NCR computer was also used for financial management assignments and for Schaltag management until 1992.

Rieter kept an extremely critical eye on the important fields of CAD/CAM, i.e. the entire CIM complex, and encountered many a queer fish. Finally, suppliers with interesting names joined the familiar manufacturers to form a short-list of competitors. Rieter's decision to choose the products of Digital Equipment Corp. (DEC) in 1985 was based on the fact that at that time more than sixty percent of the NC machine tools were equipped with DEC computers and the CAD software was already of the very highest standard. Assurances given by DEC's development engineers also indicated that software programs could be expected which would satisfy in full Rieter's needs for machine manufacturing and electrical software. Since Rieter was planning to enter the field in a big way after many years of observing the market and carefully evaluating its needs, and aimed to transfer data from CAD to CAM from the outset, this project involved heavy financial expenditure. The first workstations came into productive operation by mid-1986. Acceptance by the personnel concerned was encouragingly high, since this system represented the first steps towards an IT-focused future.

In its continuing efforts to keep pace with short IT life cycles and to make improvements, Rieter also sought to concentrate on a uniform, top-flight system in this field. Finally, IBM's turn came, and a 3090 mainframe commenced operations in 1988, superseding the UNISYS, NCR and other systems, which were progressively taken out of service by 1993. As this text was being written the global economy was in the grip of a severe recession. Rieter's home base did not escape the consequences of this market situation, and in 1994 studies conduct-ed into outsourcing had produced definite results. Rieter disposed of its information technology activities in July 1994. Generally speaking, special software developed in-house will be the exception in future. Bought-in standard software with individual extensions marks the way into a future in which data processing needs will have to be satisfied with fewer personnel.

Financial management and controlling of projects

Since development engineers can probably be allocated to the artistic professions, their partners from the controlling field complement the project teams very well for the financial management of their assignments. Since inventors usually substantially underestimate the cost of their own work, the financial specialists have the important task of drawing up realistic cost estimates. Calculation of expenditure on components, machines and systems must be very prudent and neutral. Key figures for cost effectiveness must also be defined together with the marketing organization. The reliable calculation of the return on investment is especially important. This assumes the function of a «third pillar» alongside process technology and engineering warranties. Nicolas Henggeler and Kurt Feller have focused special attention on this important issue.

The changing face of quality assurance

The start of machine manufacturing at Rieter reflected the attitude to work in the 19th century. Quality was characterized by reliability in the craft and trade context. This basic attitude resulted in the manufacture of good machines with individual features. Individual components were adjusted manually relative to each other, using hand tools. The fitting of spare parts also required adjustment procedures. Over the years the principle has developed that quality must be produced directly by first-class manufacturing processes, and should not be «tested into the product» by subsequent checking procedures. The processes typical of today's lean production practices only became possible with this change in philosophy.

This concept of high quality was by no means only applicable to the manufacture of machine components. Metaphorically, it also provided a guideline for all partners involved in the creation of a product. A project team was therefore well advised to submit to inspections by quality specialists and utilize the findings from these for purposes of product reliability, operating simplicity, etc.

Recycling and disposal

Steel, castings, light and non-ferrous alloys, paints and varnishes, electroplating products, glass and many other materials are used in building textile machines. Operation of the machines and installations generates dust, exhaust gases and waste water, which can also contain the usual service-related products such as lubricating oils and chemicals. These accompanying phenomena can have an adverse effect on human beings and the environment and create cumulative ecological problems. The project partners must therefore seek to identify these situations at an early stage and select materials for use in construction and operation which impose the least possible burden on the environment. Besides using suitable structural materials and bearing in mind their disposal and the opportunities for recycling, special encouragement must be given to thinking in terms of entire systems. An example worth imitating in textile machinery manufacture are, for example, the plastic tubes of Gretener AG in Cham, where the plastic covers are removed from textile tubes, shredded and dyed, and formed into new shapes.

In order to advise the project team, Rieter set up a chemical unit in its material research team which applied its full-time expertise to these issues. These services performed important partnership functions in development procedures.

The route to the future – summing-up and forecast

For many years in the days of the Töss convent, the tower clock reminded the Dominican nuns of the time for prayer and called them to meals. Its precision mechanism has meanwhile made way for modern technology. In retirement this gem now decorates the Rieter Training Centre and gives special pleasure to admirers with an eye for artistic beauty.

In retrospect, people are ultimately responsible for how companies perform, in the present and the future. At the time when Rieter celebrated its bicentenary emancipation was on the advance. The female urge to tackle management assignments was unmistakable, perhaps more obviously in politics than in the management of a machine works.

The coming generation

First-class products and qualified personnel are vitally important for a company's future. Attention must therefore be paid to the training and development of the coming generation of personnel. The company first presented the Rieter Award in 1989 in recognition of the work of especially gifted university graduates, thus making its contribution to furthering the cause of education.

The rising generation of Rieter personnel comes largely from a wide range of craft trades, finding its way to engineering schools via vocational secondary education and higher vocational qualification after completing its general education. The engineering schools in Switzerland are currently developing from the status of higher technical education institutions into specialist technical colleges. Secondary education graduates and outstanding students from the higher technical education institutions become the students of the colleges. These institu-

The Rieter Award is presented annually to between eight and ten successful graduates of colleges, universities and engineering schools specializing in textile technology.

tions are currently accused of having obsolete curricula and excessively long training courses. The only breath of fresh air at present is being brought in by post-graduate courses, for example for biochemistry or MBA studies.

Prominent industrial leaders warn of a fossilization of the school system in light of the fact that eighty percent of new companies are being founded by non-graduates. This suggests a link between an academic education and the loss of entrepreneurial drive; creativity and the readiness to take risks must therefore be encouraged systematically in education in all subjects. Technology transfer offers special opportunities for cooperation be-tween business and education. The aim must be to promote these opportunities for the benefit of both partners.

Lessons for Rieter's machine manufacturing operations

Assuming a critical attitude in group and divisional management, a company of Rieter's calibre always has a large number of pending tasks. Listing these projects is no problem, but setting priorities and obtaining funds requires entrepreneurial patterns of thought and action, and painstaking implementation. As we know from surveys by the Association of German Engineers (VDI), no more than five percent of all innovative ideas result in genuine market success. A particularly important task in research and development is therefore the early identification of potential failures. During Rieter's history this fate befell the card and the speedframe, on which projects were discontinued in 1844. In the nineteen-sixties it was the Hebucofil combined fibre and dust extractor for ring spinning frames which was too complex to hold its own on the market. Finally, in the early nineteen-eighties the F3/1 speedframe project was abandoned. This enabled resources to be concentrated on the demanding D1 drawframe and the M1 rotor spinning machine. The acquisition of Schubert & Salzer AG in Ingolstadt (Germany) with similar products meant that the M1 and D1 projects were abandoned and their scientific findings incorporated in the products from Ingolstadt.

Finally, in the filament sector the excellent new J8/21 draw-texturing machine was on the point of an expensive launch on the market at the end of the nineteen-seventies. The purchase in the UK in 1982 of Ernest Scragg & Sons, which had good products in the fine texturing field and was fully conversant with the relevant process technology, reduced the number of competitors and saved the heavy cost of promotion.

In slightly different economic sectors, Rieter's textile machines and systems were subject to similar cyclical fluctuations. When business activity was healthy, for example, combers, speedframes and ring spinning achieved higher sales. Depressed markets opened up special opportunities for high-volume opening operations and drawframes.

The company was therefore especially interested in finding products with business cycles different from that of textiles. This objective was achieved with the purchase of Unikeller AG in the noise control and thermal insulation sector.

It has been pointed out on various occasions that advanced and efficient new designs are important means of assuring the survival of a machine manufacturing company. They are also the only insurance against the loss of know-how through licensing agreements and joint ventures. New designs are usually subject to the laws of advanced technology. The associated know-how therefore has a half-life of five to seven years. Twenty percent of working time should therefore be devoted to the further training of personnel in order to keep them up to the mark.

Rieter's competitors at the beginning of the nineteen-nineties

As this text was being written, the incorporation of the Schlafhorst and Zinser companies in the Saurer Group was still new, for example. Zellweger, in a monopoly position as market leader in all aspects of textile measurement, was feeling the pressure on the market in the same way as Rieter's order books were reflecting it. Looking a little further back in the history of textile machinery manufacturing, Rieter's major competitors Platt International (UK), Roberts and Whitin (USA) and many others have disappeared from the market. Many large groups which had workforces of several thousand in the nineteen-fifties have in the meantime shrunk into small organizations conducting spare parts business with a few dozen employees. The inexorable laws of the market economy have repeatedly demonstrated that a strong company cannot afford to economize on research, and that real innovations are not obtained merely by purchasing licences. Recent decades have also taught the lesson with pitiless clarity that in modern business fleetness of foot can certainly open up realistic opportunities relative to richer competitors, and computers rarely offer business decisions.

Outstanding products – a reliable vehicle for the route to the future

In his farewell lecture at Zurich's Federal Institute of Technology in 1992, Professor Hans W. Krause took the trouble to list textile development trends and products with an assured future. Without judging or categorizing, the end products include, for example, bullet-proof vests for security services and armed forces, superlight parachute silks, sportswear and geotextiles. In new textile yarns, water absorption properties and texturing open up great potential for hollow fibres. In the production of fabrics and in recycling, nonwovens and knitted materials are keywords. Finally, the recycling of textile products can release secondary raw materials for new applications, in which Unikeller is also especially interested for its insulating mats. In fibre development, wide horizons are open for chemical-free natural cotton, and natural coloured cottons are also growing in importance. New microfibres with gauges of less than one denier (unit of thread thickness) enable «silk qualities» to be produced in fabrics which are sought after on the market. Rieter's high-quality carded or combed yarns therefore still have good chances of participating in further development and meeting fashion requirements.

Decisions on future production sites

Decisions on future production sites have to be guided by the markets. At the planning stage they must therefore first satisfy global needs, then European requirements, and finally Swiss needs. Rieter followed this decision-making model at the beginning of the nineteen-sixties in its licensing negotiations and the development of Lakshmi Machine Works. The plants in southern India satisfy the basic, local needs of the subcontinent. Supplies of high-technology, precision machine components from Switzerland ensure the required quality standard.

When acquiring companies it is advisable to create order by proceeding systematically, to cast off old ballast, to assess costs realistically with uncompromising strategic planning, and not to rush into things. Close contact with customers and concentration on the customer's needs hold great opportunities for all concerned. Since the manufacture of high-quality products is shifting increasingly away from human operatives to CNC machine tools, the make-or-buy issue, the clear definition of the extent of in-house manufacture and sensible outsourcing are growing in importance. With Switzerland's standard of living feeding the trend towards high wages, the opportunities offered by global – and at least European – markets and production sites must be exploited systematically. This will make conditions harder for Swiss personnel if jobs are to be preserved. However, these requirements cannot be ignored in the efforts to keep costs in line with the market.

While acknowledging all the business arguments which can be advanced, attention must also be paid to secure communications between assembly, development and service for the manufacture of high-technology components. Customer service in the fields of installation, maintenance and spare parts supplies is especially important for maintaining good Swiss traditions. These tasks must be given special attention and encouragement.

Concluding remarks

A whole range of unwritten business practices contributes to good contacts between customers and manufacturers. This well-known fact is in conflict with the goal of building mammoth companies in the textile machinery sector in order to cover all manufacturing stages, virtually without competition. Tempting as the thought may be of utilizing the financial strength of large companies to meet the heavy expenditure on high-tech projects, such a monopoly would have an adverse impact on sales. A number of major competitors have attempted to create textile empires during Rieter's 200 years, but never with long-term success. Comparison with events in world history may seem far-fetched, but there is no disputing the similarity of the results. Realistic opportunities for success in the future lie rather in the continuous development of products and systems, the timely development of innovations, the early recognition of promising new technologies, the protection of intellectual property and the exploitation of optimum manufacturing sites.

Recent engineering management

Oskar Halter	phD h.c.	*1883	EVP	Staple-fibre engineering
Heinz Keller	DSc	*1907	EVP	Engineering and service; staple fibres and filaments
Nicolas Henggeler	BSc (Eng.) FIT	*1923	EVP	Sales, Engineering and Service Division
Alfred J. Furrer	BSc (Eng.) FIT	*1929	EVP	Staple-fibre and filament engineering with Schaltag, information technology and service
Walter Wanner	BSc (Eng.) FIT	*1920	EVP	Staple-fibre and filament research & development
Kurt E. Stirnemann	DSc	*1943	EVP	Staple-fibre engineering with Schaltag and information technology
Urs Meyer	DSc	*1942	EVP	Staple-fibre engineering
Felix Graf	BSc (Eng.) FIT	*1932	VP	Filament machinery engineering
Hans-Jakob Graf	BSc (Eng.) FIT	*1947	VP	Filament machinery engineering
Malcolm Hinchliffe	BSc (Eng.)	*1943	EVP	Rieter Scragg engineering (texturing machinery)
Klaus N. Müller	DSc (Eng.)	*1941	EVP	Rieter Ingolstadt engineering

The names listed above are representative of the many managerial and supervisory personnel in engineering who deserve personal respect.

In 1992 the classical divisional and departmental structures were replaced by business units; current management in the Spinning Systems Division is as follows:

Blowroom/carding	Winterthur	Hans Baumgartner	DSc	*1946
Combing	Winterthur	Peter Gnägi	BSc (Eng.) FIT	*1954
Drawframe	Ingolstadt	Henning Bähren	DSc (Eng.)	*1956
Roving frame/ring spinning	Winterthur	Angelo Lucca	BSc (Eng.) FIT	*1944
OE/new spinning processes	Ingolstadt	Alois Wittmann	PhD (EPS)	*1946

Engineering activities in the Chemical Fiber Systems Division are pursued individually in the group companies and coordinated by group management.

Terminology

Carousel	Opening machine in the shape of a carousel
Chucking	Clamping a workpiece on the machine workbench
Contimeter	Continuously measuring and operating flock blending machine
Cycloid	A cycloid is a geometric curve which always describes equal circles, with its centre moving continuously on a preset circle. Textile slivers can thus be laid in spinning cans
Diversification	In Rieter's case: manufacture of non-textile products, for example, rifles, electric motors, noise control products, etc.
Doffing aid	Doffing = exchanging full yarn packages for empty tubes Aid = integrated mechanical apparatus for automating this process
Drawframe	Machine which usually extends 6-8 fibre slivers to 6-8 times their length, thus improving sliver uniformity
Ecological	In the overall economic process (ecology)
Electrophoresis	Dye bath containing emulsified paint which is bonded firmly to castings in an electric field
Fabrics	Textile structures such as weaves, knits and nonwovens
Joint venture	Cooperation with a company which manufactures the partner's products under a special agreement
Lean production	Only what is required immediately is produced; i.e. no intermediate stocks of any kind are maintained
Market niche	Speciality which is only rarely needed. Only economic for monopoly manufacturers of niche products
Mechatronic	Close integration of mechanical and electronic functions
Mule	First mechanical, multi-spindle spinning machine
Nips	Short fibres are combed out in the combing machine by means of rotating and stationary combs. 1 cycle = 1 nip
Nonwovens	Fabrics made from randomly organized fibres which are bonded by adhesive or a heat process
Online	Directly affecting the working process => measuring and control => quality assurance without waste
Outsourcing	Use of external sources => services provided by third parties, for example in data processing
Process module	Individual element of a process which can be utilized optionally
Promotion	Marketing with efficient advertising and information
Rieter Award	Annual Rieter presentation recognizing special achievements by young scientists and promoting contacts
Robotics	Automation using mechanical devices and electronics
Synergy	Indirect improvement in neighbouring fields as a secondary consequence of specific action
Technology	The technical knowledge for a process or method
Technology transfer	Communication or transfer of technology

Technotope	Optimally coordinated conditions for several technical faculties
Texinvert	Electronic control device developed by Rieter
Texturing	Crimping smooth fibres. This increases the friction between fibre and skin and improves wearing comfort
Trendcar	A possible car of the future
Yarn count	The unit of measurement is the denier (den), which expresses the specific weight of the individual fibre in grams/kilometre

Abbreviations

BCF	Bulked Continuous Filament (bulked = textured)
CAD	Computer Aided Design
CAM	Computer Aided Machining
CIM	Computer Integrated Manufacturing (CAD + CAM)
CNC	Computerized Numerical Control
DREF	Dr. E. Fehrer AG (Austrian textile machinery manufacturer)
FAG	Roller bearing manufacturer in Germany
R&D	Research & Development
HMG	Hanseatische Maschinenbaugesellschaft, Lübeck (Germany)
ISO	International Standardization Organization
LMW	Lakshmi Machine Works, Coimbatore (India)
Nm	Metric yarn count; 1 Tex = 1g/1 km
NSC	N. Schlumberger & Cie., Guebwiller (France)
OE	Open end = spinning process, e.g. using spinning rotors

Acknowledgments

Rieter Historical Archives.
Rieter Ingolstadt Archives.
Unikeller Archives.
Rieter Jubilee Publication 1945 (150th anniversary).
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Rieter house magazines since 1956.
Rieter leaflets for machines and systems.
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Dr. Peter Dudzik: Innovation and investment – technical development and corporate decision-making in the Swiss cotton spinning industry, 1800–1916.
Werner Klein: Various publications on textile technology.

Photo credits

Archives at Rieter Winterthur, Rieter Ingolstadt, Unikeller.

Thanks

The author wishes to thank the following Rieter personnel, past and present, for their valuable support:
Kurt Büchi, Niklaus Gartenmann, Felix Graf, Rolf Häfliger, Emil Hauser, Willi Müller, Emil Munz, Eduard Nüssli, Ernst Ott, Willy Soland, Georg Theiler and Kurt Tischhauser.

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29 Prof. Dr. H. Müller-Thurgau
30 Dr. M. Schiesser, Dr. E. Haefely
31 Maurice Troillet
32 Drei Schmidheiny (out of print)
33 J. Kern, A. Oehler, A. Roth
34 Eduard Will
35 Friedrich Steinfels
36 Prof. Dr. Otto Jaag
37 Franz Carl Weber
38 Johann Ulrich Aebi
39 Eduard und Wilhelm Preiswerk
40 Johann Jakob und Salomon Sulzer
41 5 Schweizer Brückenbauer (out of print)
42 Gottlieb Duttweiler
43 Werner Oswald
44 Alfred Kern und Edouard Sandoz
45 Johann Georg Bodmer
46 6 Schweizer Flugpioniere (out of print)
47 J. Furrer, J. A. Welti-Furrer, C. A. Welti
48 Drei Generationen Saurer
49 Ernst Göhner
50 Prof. Dr. Eduard Imhof
51 Jakob Heusser-Staub
52 Johann Sebastian Clais
53 Drei Schweizer Wasserbauer
54 Friedrich von Martini
55 Charles E. L. Brown und Walter Boveri
56 Philippe Suchard
57 Brauerei Haldengut
58 Jakob und Alfred Amsler
59 Franz und August Burckhardt
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61 Von Schmidheiny zu Schmidheiny
62 Rieter (Band 1 Geschichte, Band 2 Technik)

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Cover:
A modern ring spinning mill


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