

# Survey of high production carding machines

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The invention of the metallic or serrated saw tooth wires in 1924 was a major development. It was not long before metallic wires were adapted for application to the licker-ins, cylinders, flats and doffers of the carding machines replacing the flexible wires throughout the textile industry of the world.

The advantages of using the metallic wire are well known, some of them include, easy mounting, elimination of cylinder stripping, less frequent grinding, freedom from loading and possibility of close settings between carding elements because of the rigidity of metallic wire as compared to the flexible wire. The metallic wires opened up opportunities for the development of high production cards as well as delivery of well carded sliver. Almost all major textile machinery manufacturers started research and development work in order to produce carding machines capable of achieving high output rates and delivering good quality sliver. The research and development work continues unabated. However, the progress achieved so far in the development and marketing of models of modern carding machines is reported below.

## 1. MK 5 Series Crosrol Cards

MK 5 card is a developed version of MK 4 card exhibited by Crosrol at Milan in 1983. MK 5 series was introduced in 1991. MK 5C model was developed to suit the conditions in U.S.A. whereas, MK 5D model was developed specifically to suit Pakistani conditions. Mr. Paul Jackson<sup>(1)</sup> explained technical, mechanical and electronic features of the machine as follows:

- ❖ Number of major suction points incorporated in MK 5D card is 11. These are individually linked with suction tubes.
- ❖ Integrated Vari-feed chute with dial-in settings from the card controller.
- ❖ New web belt facilitating upto 350 MPM delivery speed.
- ❖ Taker-in speed range from 660 to 1500 RPM with Dial- in speed change facility.
- ❖ Adjustable mote-knives and waste control bar in the Taker-in region.
- ❖ Optional pinned segment after mote knives.
- ❖ Improved dust extraction through tubular ducting.
- ❖ Improved front and rear design incorporating reinforced trash knife blades for more efficient trash extraction.

- ❖ Cylinder speed range from 425 to 770 RPM
- ❖ Redesigned belt driven coiler balanced to ensure smooth high speed running with improved access and easier piecing.
- ❖ Electronic closed-loop long term and mid-team autolevelling.
- ❖ Proven electronic control system with huge range of card data instantly accessed via simple key pad with only 7 touch sensitive keys.
- ❖ Image grabbing facility based on Digital Camera Technology with the several applications, such as Nep counting, Trash content analysis, waste removal checking, foreign matter, detection, wire life monitoring, continuous feed / automatic line balancing, flat setting measurements, images can be uploaded to mill server via card controller.

MK 5D card is capable of an output rate of about 100 kg per hour and producing well-carded sliver. The IPI values of 20Ne yarn spun from this sliver were reported to be lower by about 80% as compared to the yarn spun from the sliver produced from earlier card models. This is mainly due to the following attributes of the sliver delivered by MK 5D card:

- ❖ Maximum cleaning efficiency involving removal of motes, foreign contaminations and dust.
- ❖ Selection and removal of short fibres.
- ❖ Fibre individualization and parallelisation.
- ❖ Maximum nep reduction.
- ❖ Sliver weight regulation.
- ❖ Maximum fibre yield.

## 2. Trutzschler Card TC 03

The development of high production carding machines has been briefly described by Hermann Selker<sup>(2)</sup> and may be reviewed as follows: DK 715 card with sophisticated mechanics and good carding efficiency was introduced in Milano in 1979 with production rate upto 30 KG per hour. It was the forerunner of subsequent DK model cards. DK 740 was the first computer controlled high production card of the world presented in Paris in 1987. Long term autoleveller Correcta Card CCD, the short term autoleveller Correcta Feed Card CFD and intensive cleaning unit Web-clean were integral parts of this card. Production rate of 40 KG per hour could be achieved with this carding machine. Card DK 760 was the result of further development of DK 740. It was presented at ITMA in 1991.

Sophisticated devices included in this card were high precision aluminum flats and covers as well as maintenance free AC servo motors. Card model DK 760 has been reported to be most successful Trutzschler card so far. Subsequently, Trutzschler presented DK 803 card at ITMA 1995 and DK 903 Card in 1999. Innovations included in these models are listed below:

- ❖ Direct-Feed which is an integrated tuft feeder in to the card.
- ❖ Senso feed links the Direct feed with the Taker-in System.
- ❖ Flat control FCT is an electronic measuring flat used in place of there normal aluminum flats and provides exact measurement of the distance between the cylinder and flat clothing.
- ❖ Web clean consists of six stationary carding elements and three intensive cleaning units at the cylinder which separate smallest trash particles as well as seed coat fragments.
- ❖ Web Formation / Web Speed comprises of brush roll, stripper roll, squeeze roll, calendar roll, web bridge, guide rail and suction arrangement for released dust.
- ❖ Cards DK 803 and DK 903 are capable of achieving an out put rate of 100KG per hour and producing well-carded sliver with trash content of only 0.03% Suitable for spinning of high quality yarns required for manufacture of value-added products.

The **TC 03 card** is the latest high production machine developed by Trutzschler with an out put rate of 150 KG per hour. As stated in the Sliver Technology Manual<sup>(3)</sup> experience gained by Trutzschler in the operation of DK 803 and DK 903 cards on industrial scale formed the basis the for development of TC 03 card. Primary development targets which considerably influenced the design of TC03 were simplicity of operation, easy accessibility for maintenance, low energy consumption and low exhaust air volume to achieve low operating cost. In addition to the proven components of DK 803 and DK 903 cards following innovative devices have been incorporated in the TC 03 card:

- ❖ Precision knife setting system PMS.
- ❖ Thick place monitoring and metal detector.
- ❖ Precision Flat Setting System PFS and Flat control TC-F C T.
- ❖ Fibre Length Measuring System - LENGTH CONTROL.



Card TC 07 for combed and finely carded ring yarns

- ❖ Nep Sensor NEP CONTROL TC- NCT.
- ❖ Variable speed drive for flats.
- ❖ Waste Sensor Waste CONTROL TC - WCT.
- ❖ Pre-carding and post carding areas larger than those in DK 903 card.

It is obvious from the foregoing account of development that TC 03 card has been completely redesigned. Longer length of the pre-carding and post-carding areas is the most prominent feature. Consequently, TC 03 card achieves more effective cleaning, nep removal, short fibre extraction and delivery of a much cleaner sliver with higher degree of fibre parallelization.

It is claimed by Trutzschler that the carding area of TC 03 which has been extended by 30% facilitates reduction in waste quantity and better use of cotton upto 2%<sup>(4)</sup>. This is equivalent to the savings in the purchase of cotton of approximately 60 bales per annum as well as investment on the card.

Subsequent to the launch of highly successful TC 03 card, Trutzschler developed following models for special applications:

- ❖ Card TC 06 for combed and finely carded ring yarns.
- ❖ Card TC 07 for high production applications upto 200KG per hour.
- ❖ Card TC 07 S for man-made fibres.

The above listed models were exhibited at ITMA 07 Munich held from 13th to 20th September, 2007.

### 3. Rieter Card C60

The C51 card developed by Rieter was a highly successful high production machine. The distinctive features of this machine were described by Hans Roosli<sup>(5)</sup> at a symposium held in Karachi in September, 2001. The C60 card represents further development of C51 card and includes its innovative features.

The C60 card was displayed at the Rieter booth at ITMA Asia in Singapore in

2005. Since its launch in 2003 more than 1100 units of this card are reported to have been sold worldwide because of the technological and economical advantages associated with its operation.

The unique feature of this card is working width of 1500 m.m. and its capability to achieve a production rate of 150 KG, per hour. Some of the innovative devices of C60 card which facilitate delivery of a well carded clean sliver at the highest possible production rate are briefly described as under:

- ❖ The integrated chute feed system comprising of a fine opener with adjustable feed trough to open the fibres gently. The nipping distance is adjustable according to staple length to avoid fibre damage.
- ❖ The lickerin module consists of a feed roll and 3 rollers with gradually increasing wire densities and speeds. Fibre opening is gentle. Carding segments and mote knives extract trash particles from the material efficiently. The web is transferred to the cylinder by the third larger taker-in.
- ❖ In the pre-carding area trash, dust and short fibres are extracted by 6 carding units. The central suction system of the card with 16 suction points removes the extracted dust, trash, short fibres, etc.
- ❖ The flat module in the main carding area consisting of 79 precise flats guarantees a high degree of nep and impurity removal. The modular construction allows a complete exchange of flat module in a very short time.
- ❖ The remaining tiny trash and dust particles are removed from the material by a combination of 2 carding elements, one guiding element and a mote knife in the post-carding zone.
- ❖ The Integrated Grinding System (IGS) eliminates production losses due to cylinder grinding. With this system carding is always performed with sharpened points. The grindstone traverses the cylinder clothing automatically during production 400



Rieter C60 card

times with in the useful life span of the clothing. Similarly, the points of the flat wire are kept sharp by automatic cycles 100 times higher than that in manual grinding. The life of the cylinder clothing is prolonged by 10 to 20% as a result of elimination of manual grinding. The control electronic system ensures the grinding of all flats in one cycle. The grinding mechanism is then out of action until the commencement of cycle. The IGS reduces the level of trash and nep content of sliver and improves the quality of carding.

- ❖ Exchange of lickerin, flat and doffer modules with optional reserve modules is possible because of modular construction of the C 60 card. The loss of production time of the card for rewiring of these modules is eliminated.
- ❖ For medium term leveling, the feeding trough measures the mat thickness of the incoming fibre mat. The feed roller speed is automatically altered for optimum sliver quality.
- ❖ For long term autolevelling, the sliver thickness is measured by the Step Roller pair. The measured signals are processed and used for chute system adjustment.

The foregoing survey of high production carding machines is by no means exhaustive. Some other important textile machinery manufacturers are also marketing high production cards e.g. Bonino, Marzoli C501, Graf R 50, Meikin, Toyoda, Howa etc.

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