JACQUARD MECHANISMS

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Developments in jacquard weaving

- Many developments in jacquard weaving took place to catch up with the high weft insertion rates of shuttleless looms:
  - **Returning raised warp ends** (new pulldown elements)
  - **Electronic jacquards**
  - **CAD systems** (developed to cut short the process of weaving a desired pattern
  - **Variable density jacquard harness**
    - The flexible comber board with changeable width, made of pieces that can be moved to increase or reduce the width by means of inserted spacers between the pieces (ITMA 95)
  - **Individual control of warp ends** (two new innovations by Staubli and Grosse, ITMA99)

General characteristics of advanced type mechanical jacquards

- Until recently mechanical jacquards of advanced design were capable of coping with the speed requirements of weaving machines of all three weft insertion systems: projectile, rapier and air-jet.
- The following are the established **practical running speeds** of **jacquards** of operating on the **mechanical system**.

	Type	Speed(rpm)
Grosse	Unirapid 4.1344	450
Stäubli Verdol	CR. 720	420
Schleicher	3-08	420
Stäubli Verdol	CR .620	620

General characteristics of advanced type mechanical jacquards

- The Stäubli CR620, a double-lift open shed machine with endless paper in Verdol pitch and a capacity of pattern-card of 9000 picks.
- It is claimed to be suitable for all weft insertion systems.
- The CR620 can meet the speed requirements of weaving machine of double-width configuration, WIR up to 2046m/min, but could not match the current practical speeds of single width air-jet machines.
- However, speed is not the only restriction for the mechanical jacquards for their use on shuttleless weaving machines.

Limitations of mechanical jacquards

- Modern microprocessor controlled weaving machines cannot work with mechanical jacquards as all machine controls and timing sequencing is done via the weaving machine's microprocessor.
- At speeds in excess of 700 rpm problems of selection and shedding control make the use of electronic machines essential both from operational and integrated control considerations.

Electronic jacquards

- Developed recently to overcome the limitations of mechanical jacquards. The recognized advantages of electronic jacquard are:
  - **High speed hook selection and high speed weaving.**
  - **Elimination of the cylinder, needles and design card.**
  - **Can be interfaced directly to a CAD system. This allows automatic pattern change.**
- The maximum practical speeds of electronic jacquards are:

Electronic System	Type	Speed (rpm)
Grosse	EJP2.1344	700
Bonas	AGJ	700
Stäubli Verdol	CX960	720
Schleicher	6-29	600 (limited experience)

Electronic jacquards

- The CAD programming systems greatly simplify the procedures involved in both the production and processing of jacquard patterns.
- The cardboard or pattern cards are replaced by magnetic tapes for the electronic machines.
- The data required for shed formation is processed on one of the available programming systems, which provides CAD and processing of all weave and pattern data.

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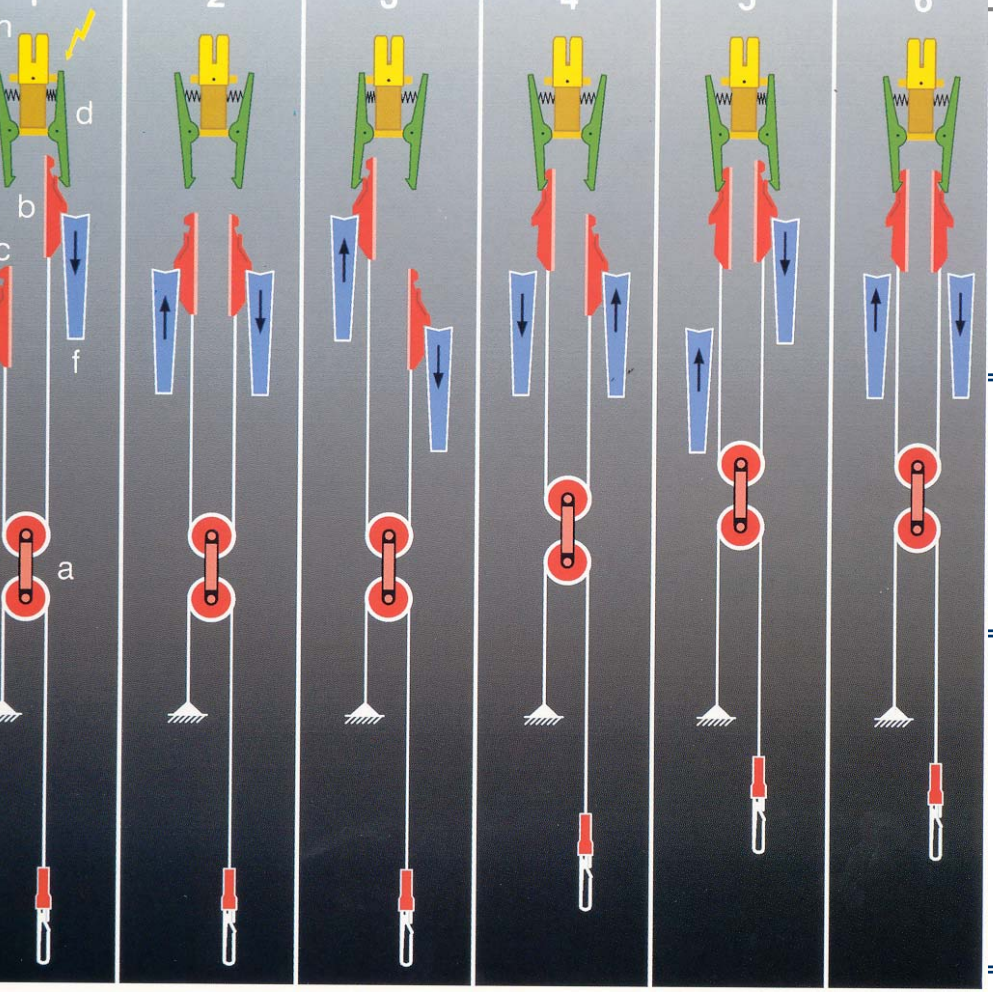
Stäubli CX860

- The Stäubli CX860 is an electronically controlled synchronously reversible machine which incorporates the CX module, the connecting link between the electronic control and the lifting mechanism
- The CX module is located in an accessible position in the machine frame.
- The high speed of operation is a result of the combination of **electronic control of selection and transmission of motion to the lifting elements by a play-free cam system.**



1 Lower Shed Position :
Hook (b) in its uppermost position has placed retaining hook (d) against electromagnet (h). This magnet is activated according to the pattern, briefly retains retaining hook (d) and prevents hook (b) from hooking onto retaining hook.

2 Lower Shed Position :
Hooks (b) and (c) follow the knives (g) and (f) moving up or down. Double roller (a) offsets th motion of hooks (b) and (c).

3 Lower Shed Position :
By the rising motion of knife (g), hook (c) has placed retaining hook (e) against electromagnet (h). According to the pattern, the magnet is not activated, causing hook (c) to catch onto retaining hook.

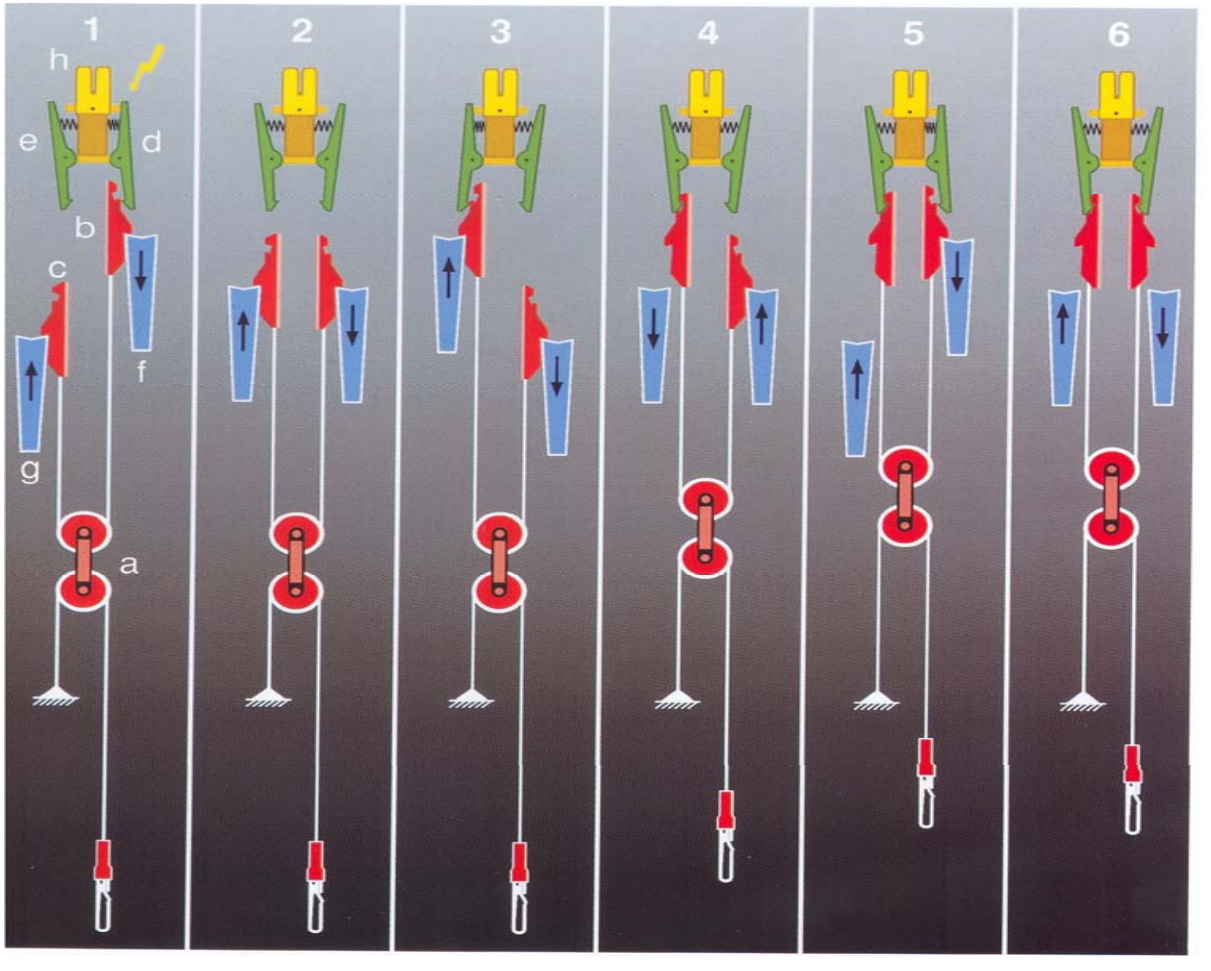
Shed Motion :
ook (c) is caught on taining hook (e). Hook) follows the rising knife) and thereby lifts the arness cord.

5 Upper Shed Position :
Hook (c) remains hooked onto retaining hook (e). Hook (b) has placed retaining hook (d) against electromagnet (h) by the rising motion of knife (f). According to the pattern, the magnet is not activated, causing hook (b) to be held by

6 Upper Shed Position :
hooks (b) and (c) remain held by retaining hooks (d) and (e). Knives (g) and (f) are in rising and descending motion, respectively.

CX 860 functional principl

Stäubli CX860

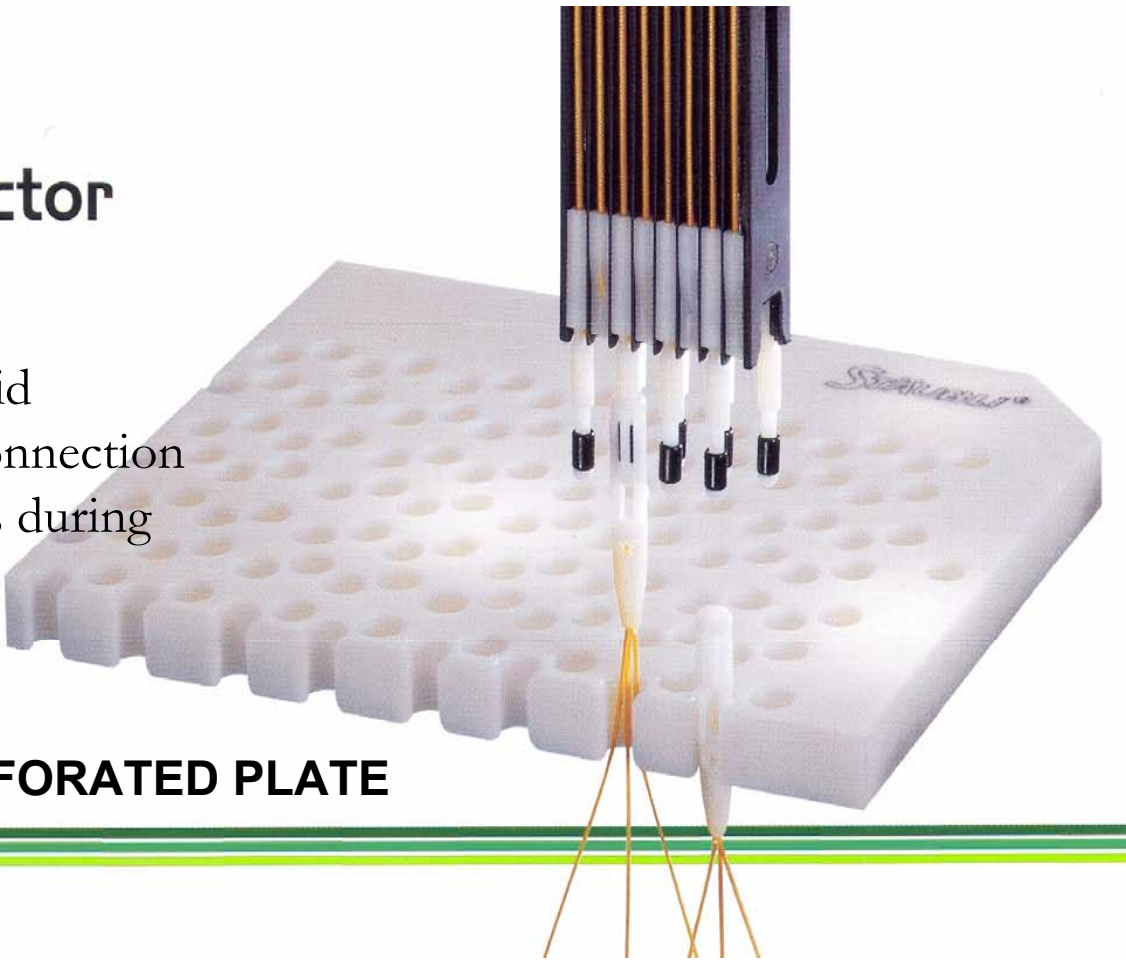


Quick locking hanness connector

CX module

Quick-locking harness connector QUICK LINK®

It ensures a reliable, neat, rapid and easy connection . This connection offers significant time savings during hooking and unhooking .



PERFORATED PLATE

Jacquard Machine CX 880

with electronic control

This double-lift Jacquard machine is a synthesis of its predecessors with the latest type CX modules and more than one hundred years of experience in the fields of shed formation.

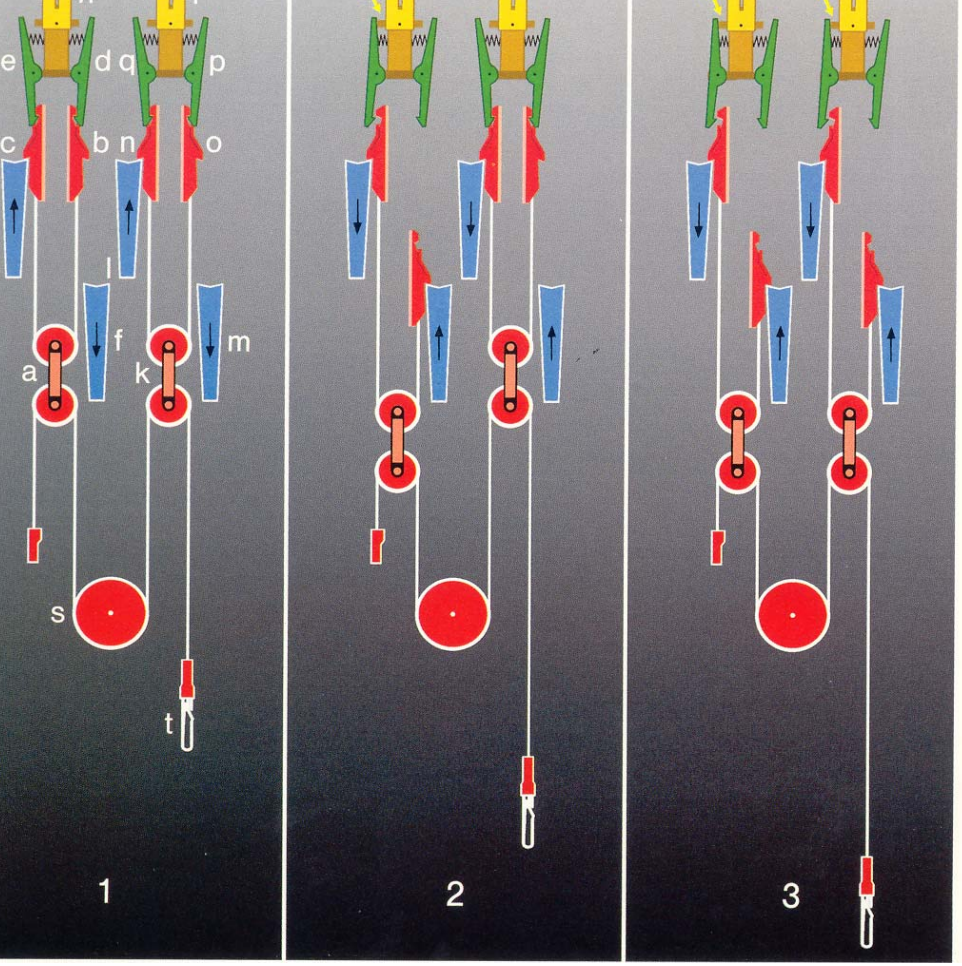
mands made by double-pile carpet weaving. The knives are driven on both sides through complementary cams that run in an oil-bath. Shed setting is fast and accurate. The knives run vertically on thrust bearings mounted on hardened and ground shafts. The consistent use of roller bearings at all pivot points ensures play-free, high precision transfer of the

CX module

- The 'CX module' replaces conventional hooks, **incorporates all the electromagnetic components for activation and control of the lifting units** as well as the **precisely guided double rollers for the double-lift motion.**

Advantages of electronic jacquard

- The machine has a low energy requirement, averaging 350 watts.
- The machine has a completely closed housing providing protection against dust, and the central lubrication of the knife-frame guides reduces maintenance requirements to a minimum.
- The electronic control enables the jacquard to be reversed in perfect synchronism with the weaving machine, greatly simplifying the pick finding procedure.
- The weaving programs are transferred by a magnetic tape, with a maximum capacity of 53000 picks, to a hard disc storage.
- The machine is extremely compact (935mm from harness board to the upper edge of the machine) which not only facilitates accommodation but reduces its center of gravity and, thereby, minimizes vibration.
- High speed operation without any difficulty.



Both the double rollers (a) and (k), together with th deflection roller (s), determine the upper, lower and middle position of the hook (t) for the harness. Kniv (f) and (m), as well as (g) and (l) work in the opposit direction. In working phase 1:

- Knives (f) and (m) are located at bottom dead cent

- Knives (g) and (l) are located at top dead centre

Hooks (c), (b), () and (o), in each case in their uppermost position, place the retaining hooks (e), (d (q) and (p) positively against electromagnets (h) and (r). If electromagnets (h) and (r) are not activated, a determined by the pattern, the hooks (c), (b), (n) and (o) catch onto the retaining hooks (e), (d), (q) and (p The following three working phases are possible :

Phase 1:

Electromagnets (h) and (r) are, as determined by the pattern, not activated:

- Retaining hooks (e) and (q) hold hooks (c) and (n) their upper position.

The hook (t) for the harness remains, or moves into the upper position.

hase 2:

ectromagnet (h) is activated as determined by the ttern. Electromagnet (r) is not activated.

Hooks (n) and (o) are held together in their upper sition. The retaining hook (e), hold momentarily electromagnet (h), releases hook (c), which llows the downward motion of knife (g).

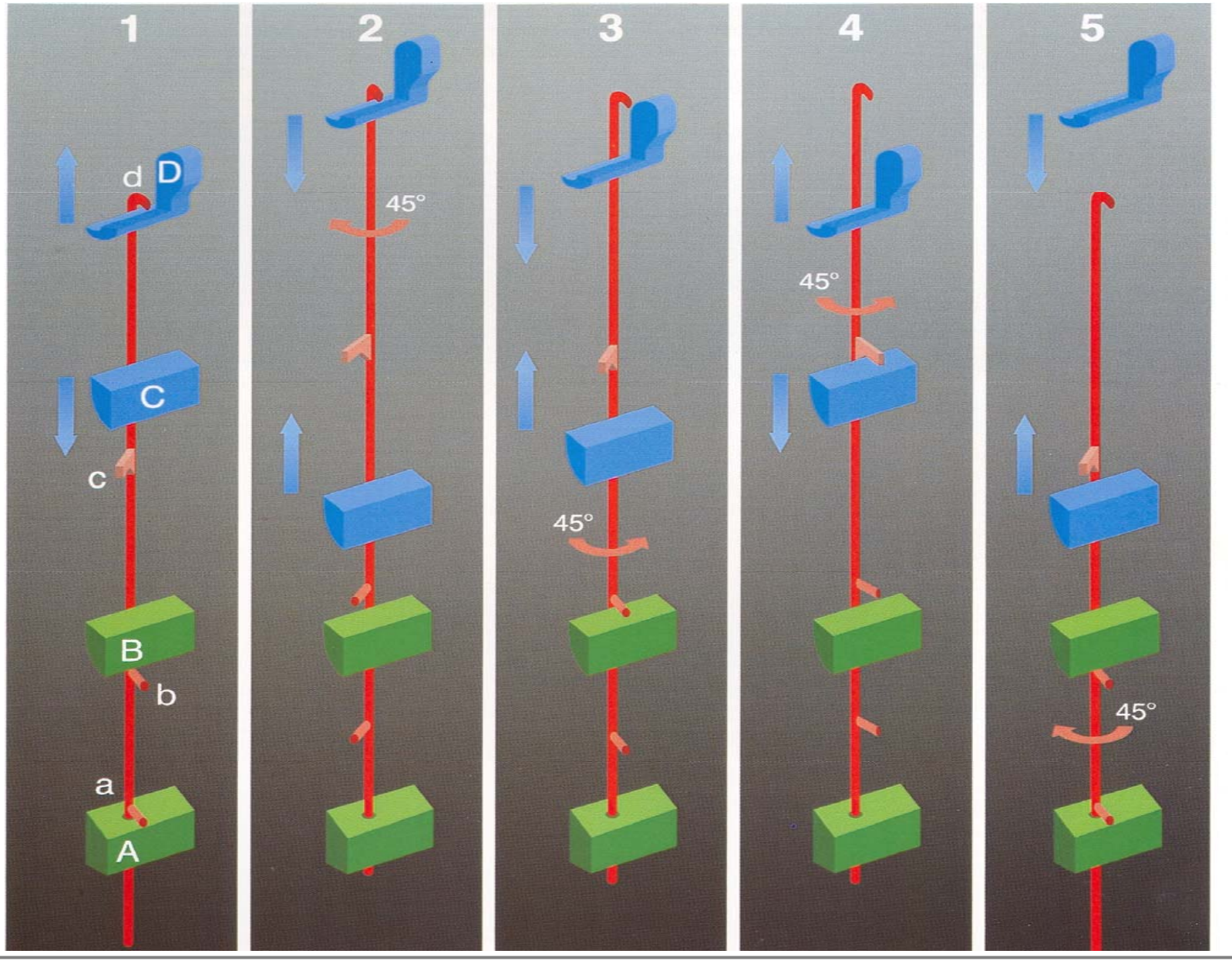
he hook (t) for the harness remains, or moves into e middle position.

Phase 3:

Electromagnets (h) and (r) are simultaneously activated, as determined by the pattern:

- The retaining hooks (e) and (q), momentarily held by activated electromagnets (h) and (r), release hooks (c) and (n) which follow the downward motion of knives (g) and (l).

Hook (t) for the harness remains, or moves into its lower position.


1
d
D
C
c
B
b
a
A
2
45°
3
45°
4
45°
5
45°

New Jacquard Concept

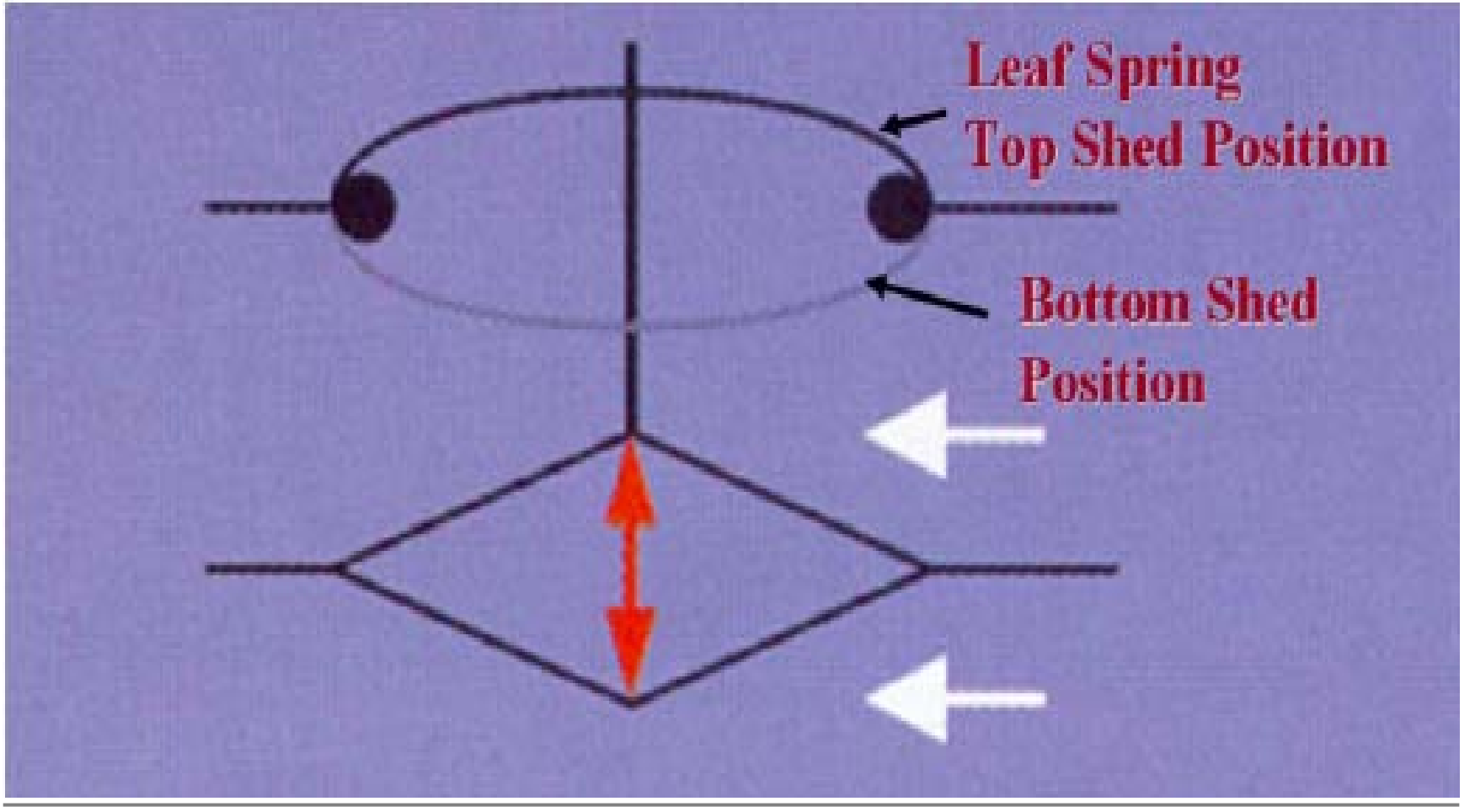
- At ITMA' 99 Grosse and Staubli exhibited completely two new approaches in Jacquard shed formation:
  - the prototypes UNISHED and the UNIVAL 100.
- At this ITMA' 2003 they continued to show their jacquard machines.
- While the Grosse's UNISHED is still at the prototype stage, the UNIVAL 100 has been made available for sale.

New Jacquard Concept

- The principle of shed formation of the two new machines is different.
- They have however common goals:
  - Reduction in the jacquard engine parts (hooks, magnets, pulleys and pulldown springs) and
  - Elimination of the gantry.
- Both of these machines are based on individual control of each warp yarn.

Grosse's UNISHED Jacquard

Shed formation principle of the UNISHED

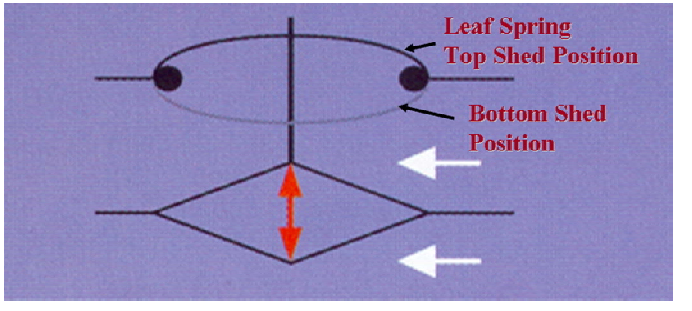


UNISHED

- The shed formation in is achieved by **leaf springs**. Each leaf spring is connected to a heddle that controls one warp end.
- The leaf springs, which are controlled by **actuators**, control the bottom shed as well as the top shed (positive jacquard shed type).
- The configuration of the jacquard head and the individual control of each heddle (or warp end) allow the heddles to be set vertically.
- These settings permit the elimination of harness cords, magnets, hooks, pulleys, springs, and the gantry.
- This results in lower building and air conditioning costs.
- The Jacquard head is mounted directly on the side frames of the weaving machine thus making Quick Style Change (QSC) possible in jacquard weaving since it is easy to exchange the entire jacquard head including the heddles.

NEW JACQUARD MACHINES

Grosse's UNISHED Jacquard

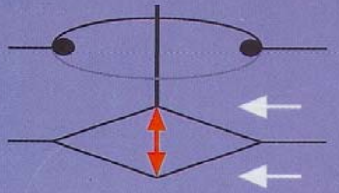


Principle of Shed formation (positive shed)

Elimination of:

- Harness cords
- Magnets
- Hooks
- Pulleys
- Springs
- Gantry

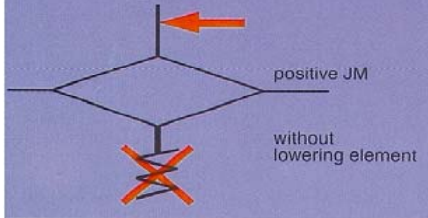
Principle of the UNISHED



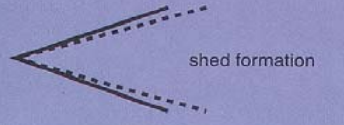
The principle of the UNISHED is based on a leaf spring which positively carries the warp end into the upper and lower shed positions.

Features of the UNISHED

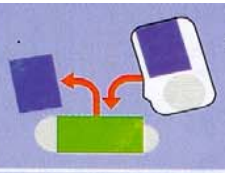
Open shed Jacquard machine
The shed remains open for several picks depending on the weave.



Positive Jacquard machine
Contrary to conventional Jacquard machines, no lowering elements are required to carry the warp end to the lower shed position. The warp end is moved positively into the upper or lower shed position as determined by the weave.

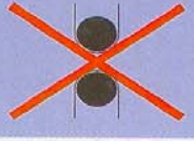


Shed formation / shed geometry
The shed formation system meets all requirements with regard to the shed geometry, the shed lift and the shed stop of modern weaving installations, and permits individual adjustments.



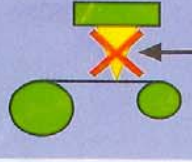
quick style change

Quick style change system - QSC
Fast change of the UNISHED from one warp construction to another can be accomplished by exchanging the complete unit, just by removing a few screws.



without pulleys

No pulleys
The system contains no pulleys.

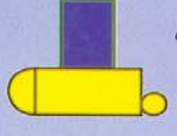


harnessless

Without harness
No harness device is used to connect the hooks and warp ends.
The heddle is directly connected by the actuator.

small number of moving components

Number of components
A small number of moving parts are required for the hook selection and shed formation.



compact

Compact design
The UNISHED and weaving machine form an integrated and compact unit. Therefore, the installation requires a considerably lower ceiling height than that of a conventional Jacquard machine.

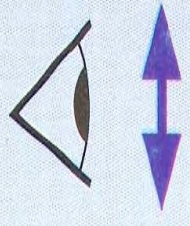
high speed range

Speed
The unique engineering features of the UNISHED make it conducive to high speed operation.

optimal
energy balance

Energy balance

The UNISHED optimally meets all requirements with regard to lowest energy consumption. The electrical input is temporarily stored and then fed back to the system. The actuators show almost no energy consumption in the static state.



continuous change

Control

Continuous control of the hooks and actuators as well as of the remaining electronic components.

NEW JACQUARD MACHINES

UNISHED: ITMA'99 versus ITMA '2003

Item	ITMA '99	ITMA 2003
Weaving Machine	Dornier LWV6/J air jet	Dornier LWV6/J air jet
Fabric	Upholstery	Upholstery
Warp Yarn	Cotton/Polyester	Cotton/Polyester
Warp Yarn Count	N_m 70/2	N_m 70/2
Warp Density	40 ends/cm	40 ends/cm
Filling Yarn	Cotton/Polyester	Cotton/Polyester
Filling Yarn Count	N_m 70/2 and 32/2	N_m 70/2 and 32/2
Pick Density	Variable	Variable
Width in Reed	142 cm	142 cm
Speed	800 picks/min	800 picks/min
RFI	1,136 m/min	1,136 m/min
Total Ends	5,580	5,580

UNIVAL 100 Jacquard machine

UNIVAL 100

- The shed formation is achieved by controlling each individual warp end by a stepping motor.
- The harness cord (or warp end) selection is performed electronically and hence fabric design is achieved in the same way as any current electronic jacquard system.
- The dimensions of the jacquard head (**the jacquard head and tie width is the same as the width in reed**) and the control of individual warp end by a stepping motor permit the harness cords to be set vertically.
- The design of the UNVAL 100 permits the elimination of hooks, knives, magnets, and pulleys since each harness cord or heddle is directly attached to a stepping motor.

NEW JACQUARD MACHINES

Staubli's UNIVAL 100 Jacquard

Each harness cord (warp end) is controlled by a stepping motor

Simple shed height setting

Multiple sheds

Elimination of:

- **Magnets**
- **Hooks**
- **Pulleys**
- **Gantry?**

Available in capacity range of 5,120-20,480 warp threads (stepping motors)

NEW JACQUARD MACHINES

UNIVAL 100: ITMA'99 versus ITMA '2003

Item	ITMA '99	ITMA 2003
Weaving Machine	Picanol Omni-4-J 250 air jet	Picanol OMNIplus-6-J 250 air jet
Fabric	Mattress Ticking	Mattress Ticking & Table Cloth
Warp Yarn	Polyester	Polyester/Cotton
Warp Yarn Count	167 dtex, 150 den	50/2 N_m
Warp Density	32 ends/cm	33 ends/cm
Filling Yarn	Polypropylene	Polyester/Cotton & Nylon
Filling Yarn Count	367 dtex, 330 den	50/2 N_m & 2100 dtex
Pick Density	21 picks/cm	25-28 picks/cm
Width in Reed	220 cm	240 cm
Speed	950 picks/min	1,025 picks/min
RFI	2,090 m/min	2,460 m/min
Total Ends	7,100 (stepping motors)	7,920 (stepping motors)

Muller’s new jacquard multi-color label machine MDL/C