SHEDDING

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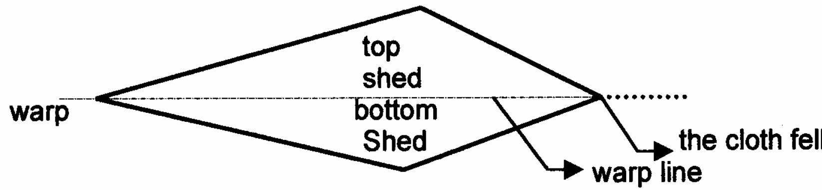
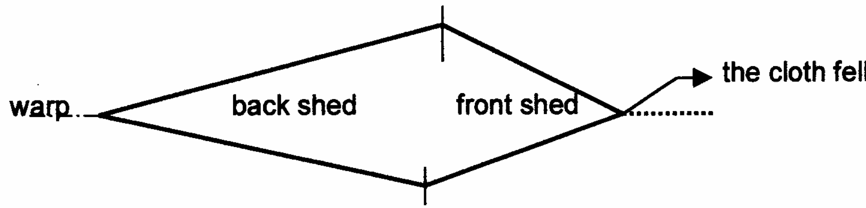
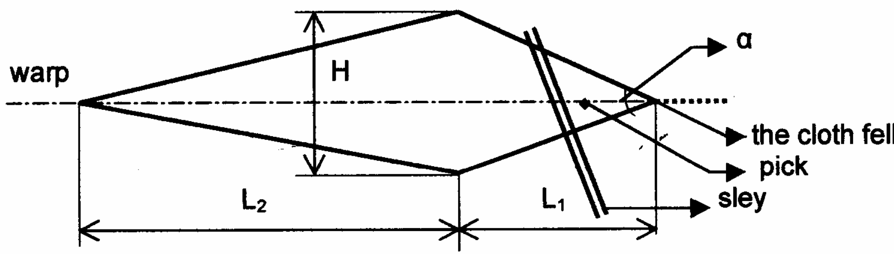
Shedding Motion

- The motion forms "the shed" by dividing the warp ends into two sheets, thus providing a path for the weft.
- This is done by raising and/or lowering frames.
- **Shed geometry** and **shed characteristics** require a great consideration and precision because it is the zone in which the yarns are converted into the fabric.
- The basic functions of weaving are performed in this area.

Geometry of Shed







H: the shed height	L_1: the length of front shed
α : the front shed angle	L_2: the length of back shed

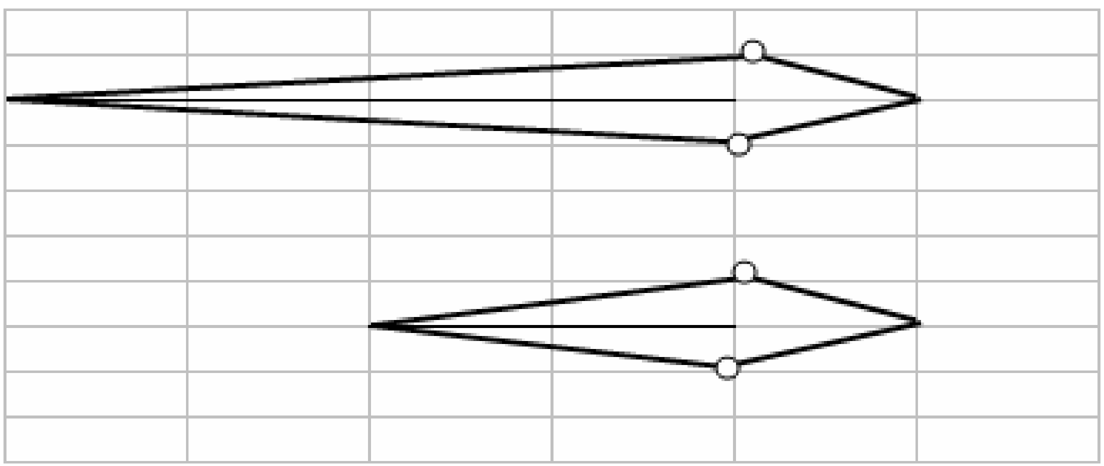
Shedding parameters

Geometry of Shed

- The path followed by the warp threads in an open shed is longer.
- The additional length required for warp ends should be taken either by the warp extension, as in many of the elastic textile material, or by the regulation of the yarn delivery.
- For the first case, the warp yarns are withstood the higher tension forces when the shed is opened.
- For the latter case, tension acting on the warp yarn is constant but position of the cloth fell is moveable.

Geometry of Shed

- Using the longer back shed length is preferable to obtain a less degree of warp extension or tension in the open shed, essential for silk weaving.
- The shorter back shed length assists in separation of the upper and lower warp sheets and formation of a clear shed, preferable for weaving fabrics from hairy coarse yarns.



Size of shed

- Size of shed is very critical. It should allow a secured weft insertion.
- The requirements of shed opening are determined by
  - **the means of weft insertion** and
  - **beat up motion**.
- It is desirable to have a small shed opening (H) in order to reduce the lift of heald frames and therefore to reduce the stress on the warp.
- However, the magnitude of H is mostly determined by the **size of weft insertion device**.

Size of shed

- **C:** the depth of the shed at the front wall of the shuttle (the important dimension)
- **A:** the width of the shuttle
- **B :** the distance from the cloth fell to the reed
- **D:** the depth of the shed at the reed
- During the passage of the shuttle, B and D both vary because of the motion of the reed, and D will also vary owing to the movement of the heald shafts unless the passage of the shuttle coincides with the period of dwell.

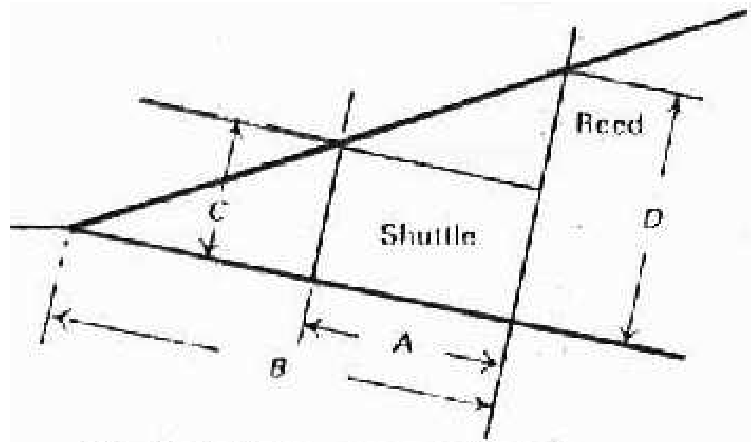


Fig. 4.2 The geometry of the shed

Size of shed

- Shed size can be expressed in terms of the front shed angle.
- Te shed angle may be as low as 15^0 to 18^0 on a gripper projectile weaving machine .
- In general, the reduced shed may be used with the smooth warps, for example, with the filament warps.
- It cannot be used with low grade warps, because the sticking warp ends cannot be separated in a small shed.
- Shed angle should not exceed 25^0 with very poor warps, because it would require excessive lift of the farthest heald shafts from the beat-up line.

Timing of the shed opening

- Timing of the shed opening is also critical.
- **Healds cross at 0^0.**
  - Heald shafts become level when the reed is at its most forward position.
- **Healds cross at 270^0.**
  - Heald shafts become level well before the reed reaches its most forward position.
  - When the reed is at the front dead, a new shed is partly opened.
  - The timing of shed opening is earlier than the former one.
- Relative timing of 'the shed change' with respect to the reed beat up can be adjusted.

- The depth of the shed at the front wall of the shuttle is plotted against the angular position of the crank shaft for a particular loom.
- Shuttle enters at 110 ^{0} and leaves at 240 ^{0}

	Depth of the shed (cm)	
	Entering	Leaving
Curve A: healds cross at 270^{0}	2.44	0.94
Curve B: healds cross at 0^{0}	2.36	2.54

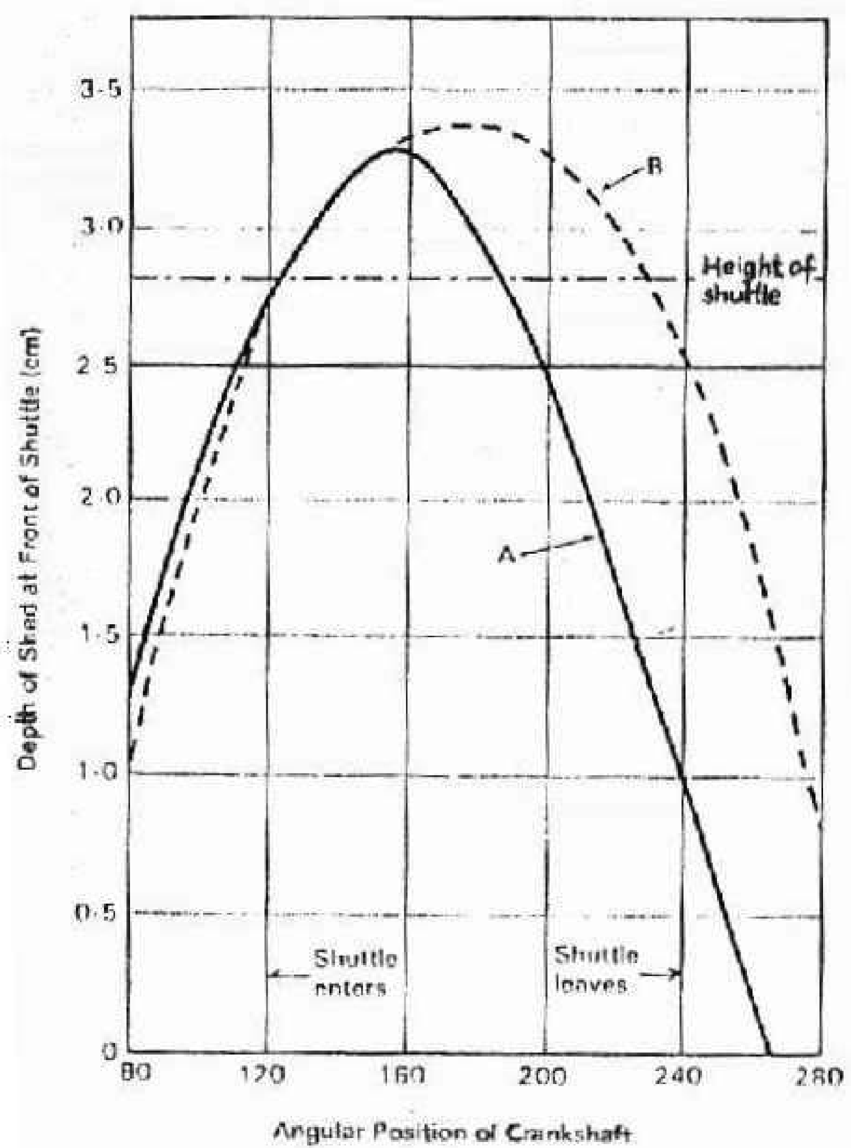
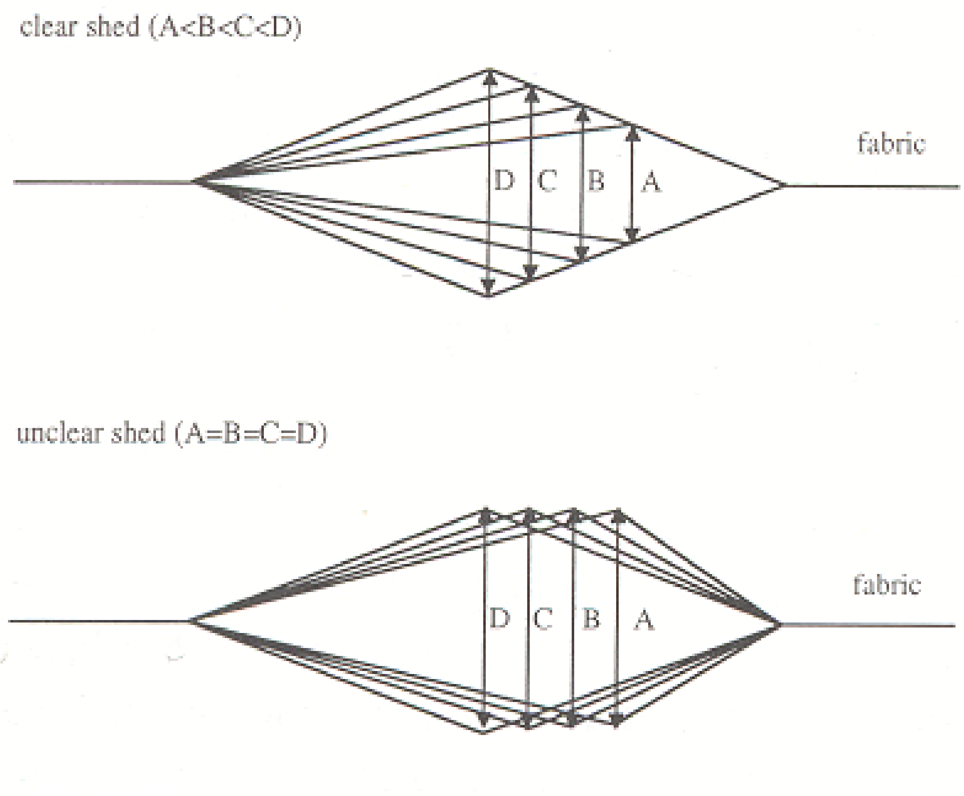


Fig. 4.3 Shed-depth curves

Shed characteristics

Regarding top and bottom shed positions of the heald shafts in an open shed, the shed which is built up may be in different forms.



Clear and unclear shed openings.

Clear Shed: suitable for any type of weft insertion, especially jet

Semi clear shed: rigid rapier, shuttle

Unclear shed (irregular shed): equal heald shaft lift and equal warp tension

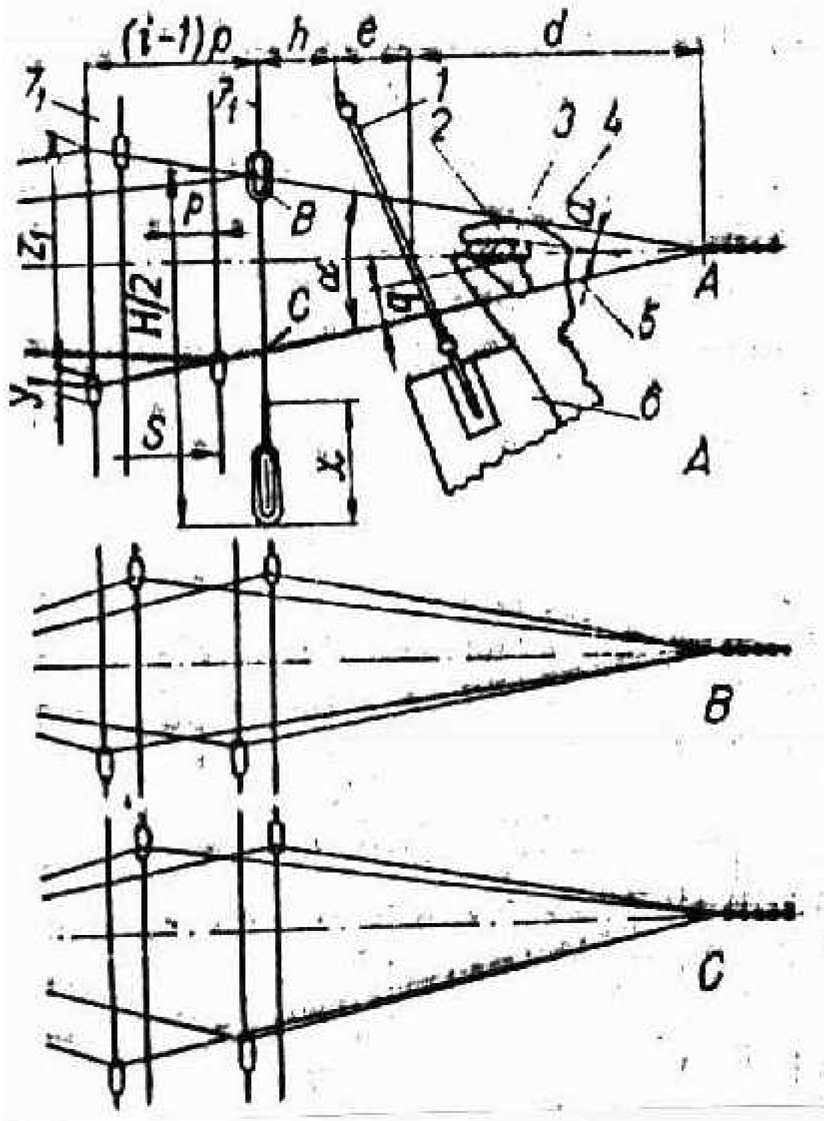


Fig. 4.4 The shed parameters

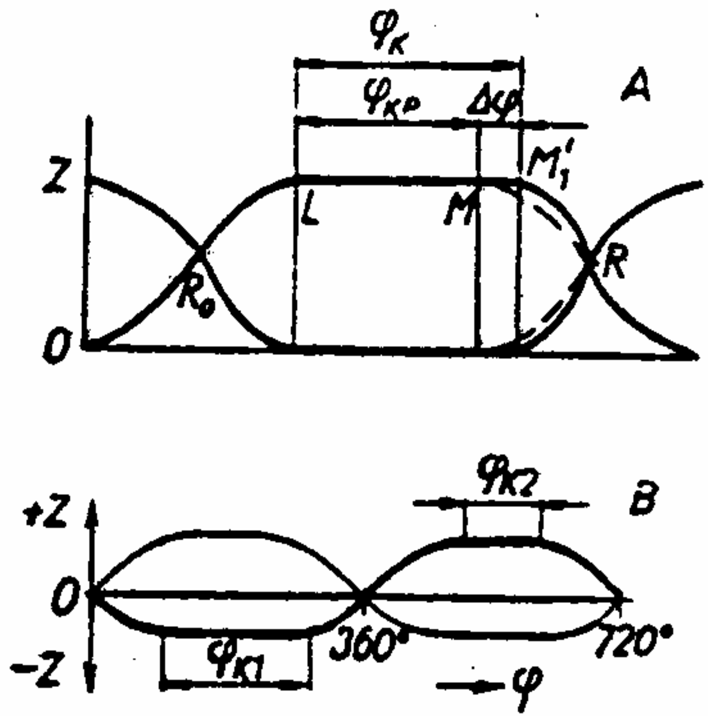
Shed characteristics

- **Symmetrical Shed**
  - **Shed geometry**
    - Top and bottom sheds are identical.
    - It is is advantageous for picking because it gives a similar warp tension in both shed levels, but it is disadvantageous, for the same reason, for the beat-up.
    - The air-jet weaving machines have been provided with a cradle which secures a symmetrical shed during the picking and different warp tensions in the shed levels during the beat-up.
  - **Course of heald shafts**

Shed characteristics

- **Asymmetrical Shed**
  - **Shed geometry**
    - Top and bottom sheds are not identical.
  - **Asymmetrical course of the heald shaft lift**
    - asymmetrical to the vertical axis
    - asymmetrical to the horizontal axis

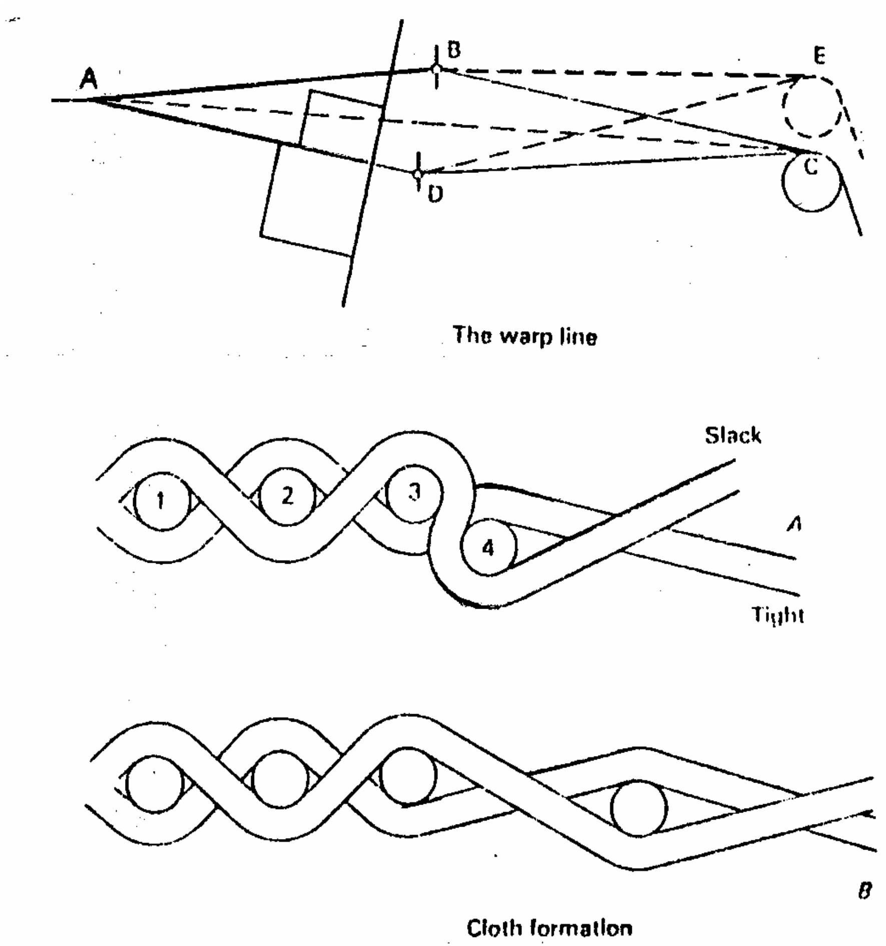
Asymmetrical Sheds



The asymmetrical sheds

Due to the open shed filling insertion, independent of shed closing, the friction of the filling on the warp ends is decisively reduced. This results in fewer broken picks, no over tensioning, no jumpback picks, clean left and righthand selvedges and a consistent inserted pick length, all contributing to best fabric quality.

Raising Back Rest (for spun yarns, esp. cotton)



Early shedding

- An early shedding prevents the pick from springing back when the reed recedes and develops a substantial friction between ends and picks which helps
  - obtain a closer pick spacing,
  - redistribute of the warp threads more evenly.
- Furthermore, if the back rest is above its normal position, alternate warp threads will be relatively slack and therefore free to move laterally to achieve a more uniform spacing.

Raising Back Rest & Early Shedding (for spun yarns, esp. cotton)

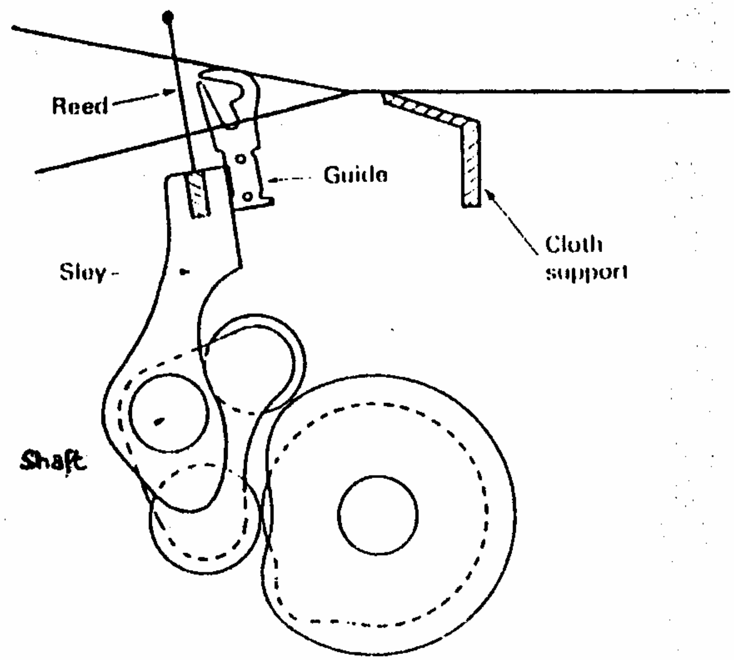
- It seems likely that the combination of these two effects
  - helps obtain a closer pick spacing
  - improves the warp cover, giving fabric a better appearance
  - helps remove reed marks, giving fabric a better appearance

Raising Back Rest & Early Shedding (for spun yarns, esp. cotton)

- This is very common in cotton weaving.
- It offers advantages in widely different circumstances.
  - In weaving closely set cloths like typewriter ribbon, poplin, and canvas, it helps to achieve a close pick spacing, where the warp cover factors are high enough to ensure a good cover anyway.
  - In weaving more openly set plain cloths, pick spacing is not a problem, but warp cover is, and here again the combination of early shedding and a raised back rest is likely to be beneficial.

- The projectile does not ride on the race board, and the height of the fell (instead of the back rest) can be adjusted without affecting weft insertion.
- The distance from the healds to the fell is much less than the distance from the healds to the back rest.
- So a given little movement to the fell produces the same effect obtained by the large displacement of the back rest.

Altering the height of the fell the Sulzer weaving machine



A cam-driven sley

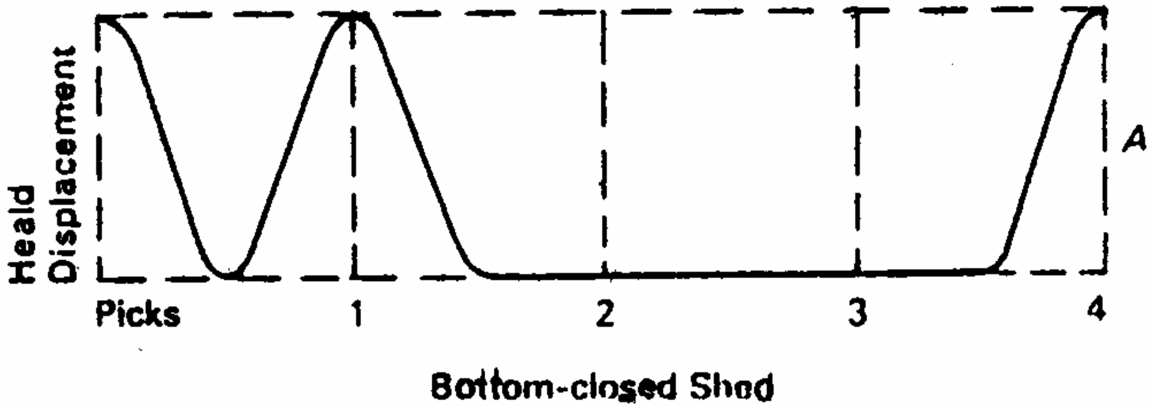
Types of Shed

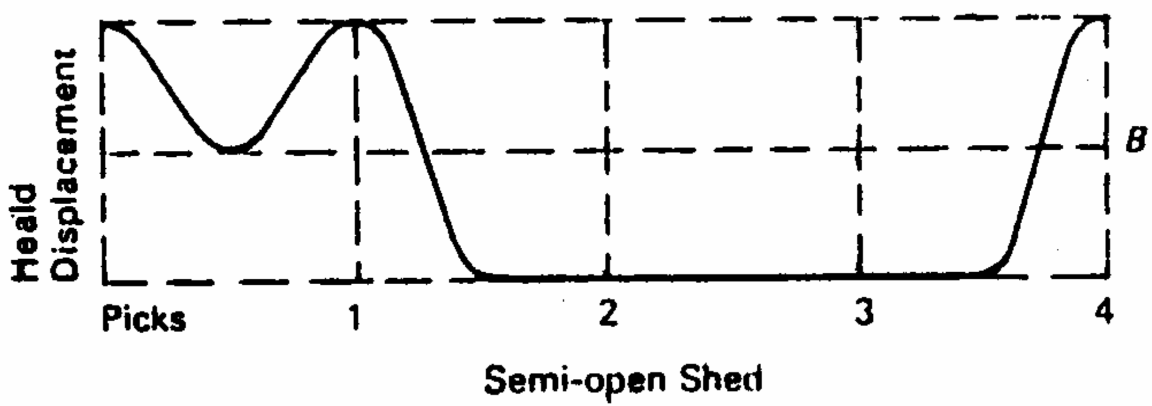
- Type of motion given to the heald shafts or heddles by different types of shedding mechanism.
- We may classify the shedding action or the type of shed produced according to
  - **the position the ends between successive picks** and
  - **the nature of the movement given to the ends**.

Types of Shed

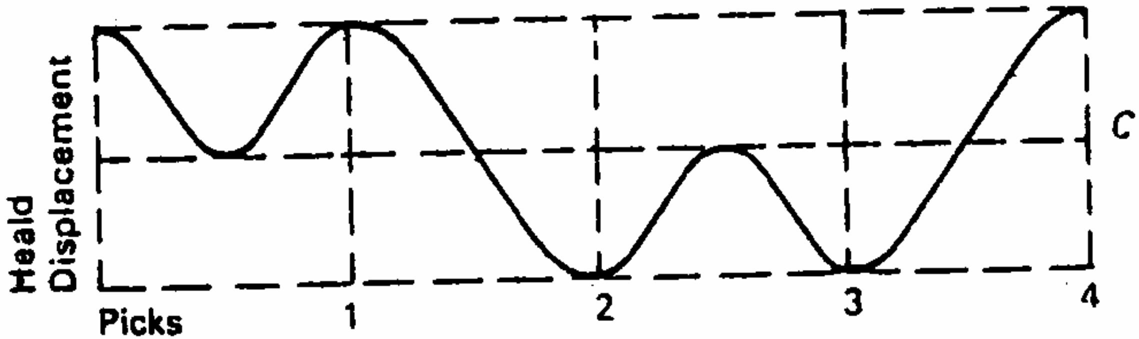
- Bottom closed shed: too much wasted movement, used in hand looms and single lift jacquards
- Semi-open shed: double lift jacquards.
- Center closed shed: for leno fabrics, still used in some jacquards.
- Open shed: for most purposes, ideal type of shed, no wasted movement.

Types of Shed

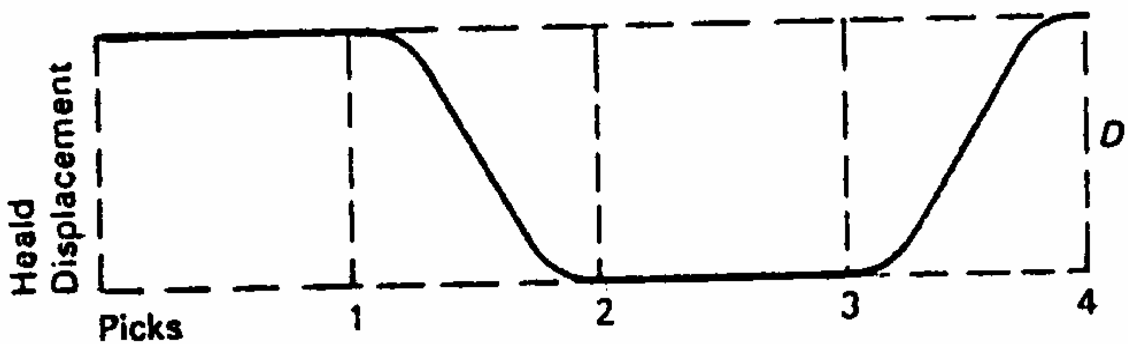




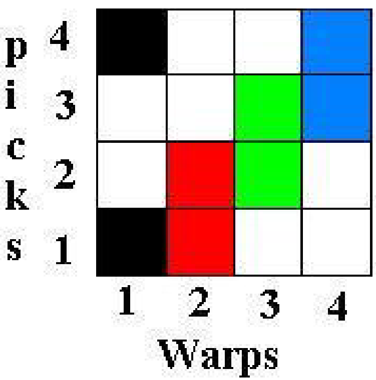
Types of Shed



Centre-closed Shed



Open Shed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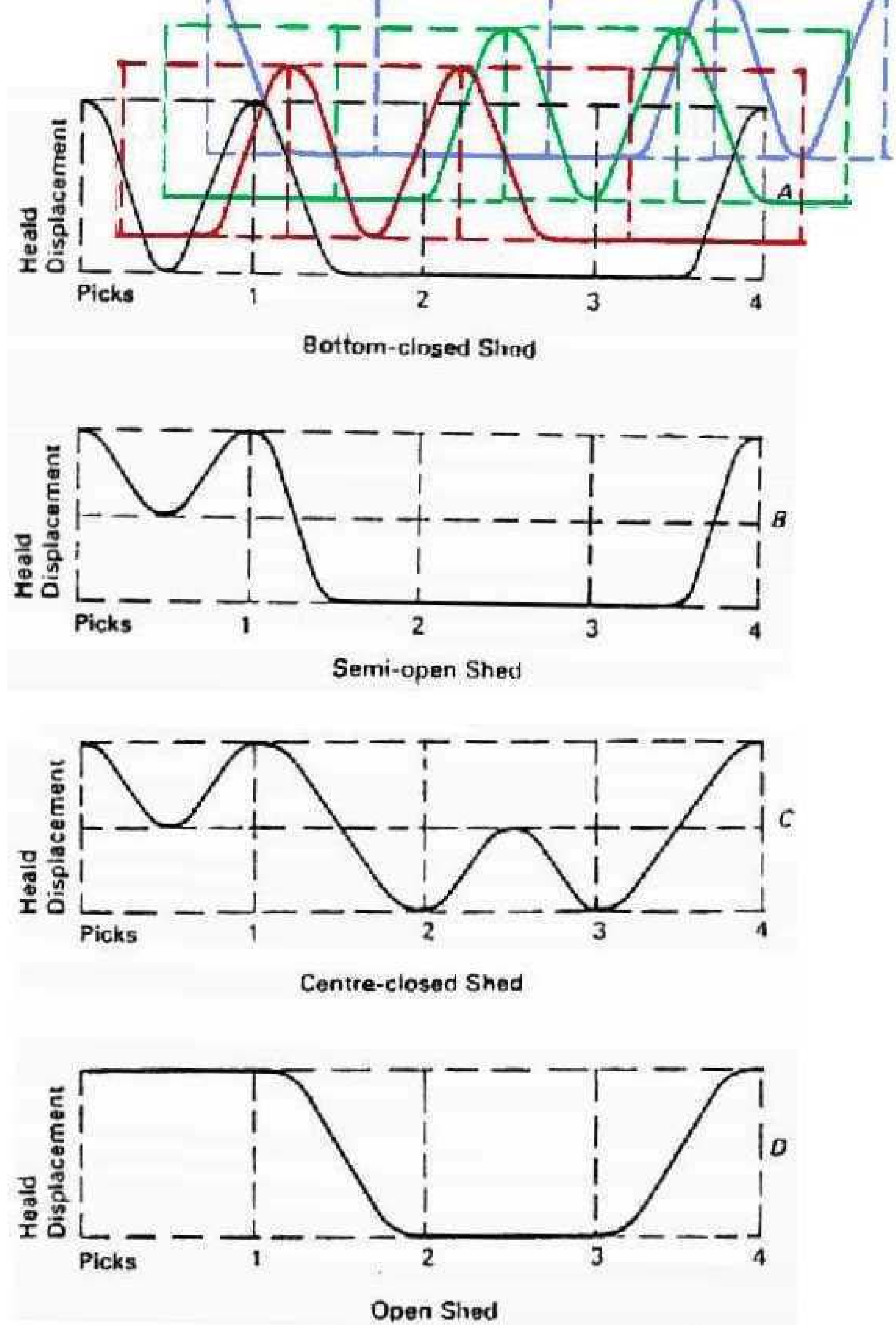
Heald Displacement
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2
3
4
A
Bottom-closed Shed
Heald Displacement
Picks
1
2
3
4
B
Semi-open Shed
Heald Displacement
Picks
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2
3
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Centre-closed Shed
Heald Displacement
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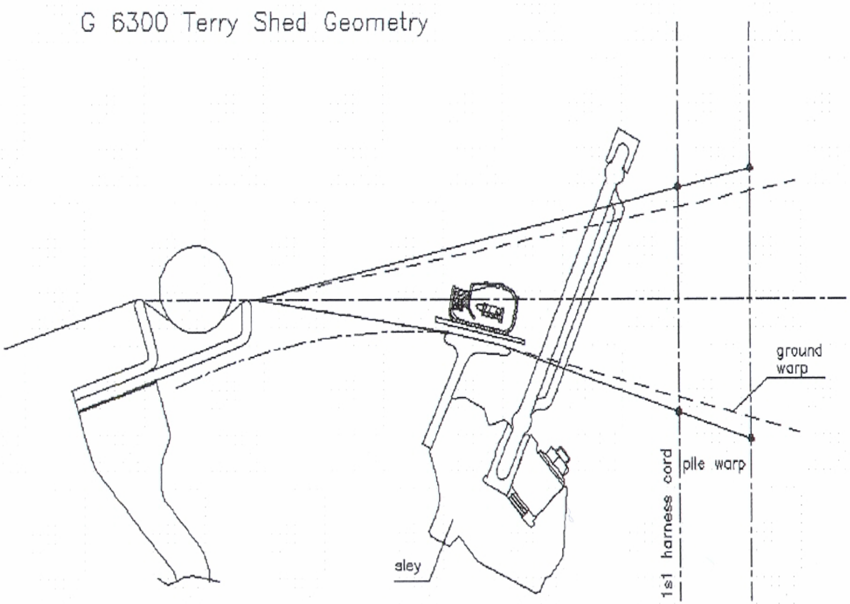
Open Shed

G6300 F - Terry Weaving Machine
Shed geometry with race board



Customer benefits

Application of double reeds with profile dents possible

Less expensive than supporting teeth solution

Extended ribbon life

Terry shed geometry with race board

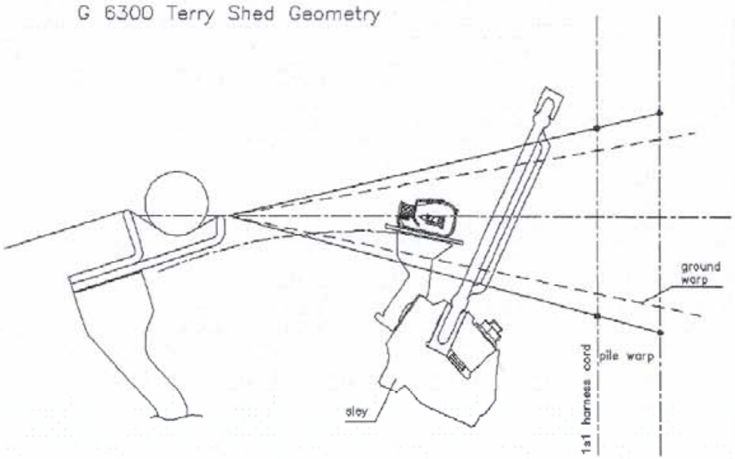
Sley with race board

No tools passing through warp bottom shed

Reed dimensions: 8 mm socket

G6300 F - Terry Weaving Machine
Shed geometry with supporting teeth

SMIT TEXTILE



Customer benefits

- No interference between pile and ground sheds
- Very little friction of rapier on sheds
- Application of double reeds with profile dents possible
- Excellent fabric quality

Terry shed geometry with supporting teeth

- Sley with supporting teeth
- Symmetrical front and rear shed, pile shed opens equally beyond ground shed
- Bottom shed is below rapier path
- Reed dimensions: 8 mm socket

Sales Tools October 2003
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The Terry Weave or Slack- Tension Pile Method

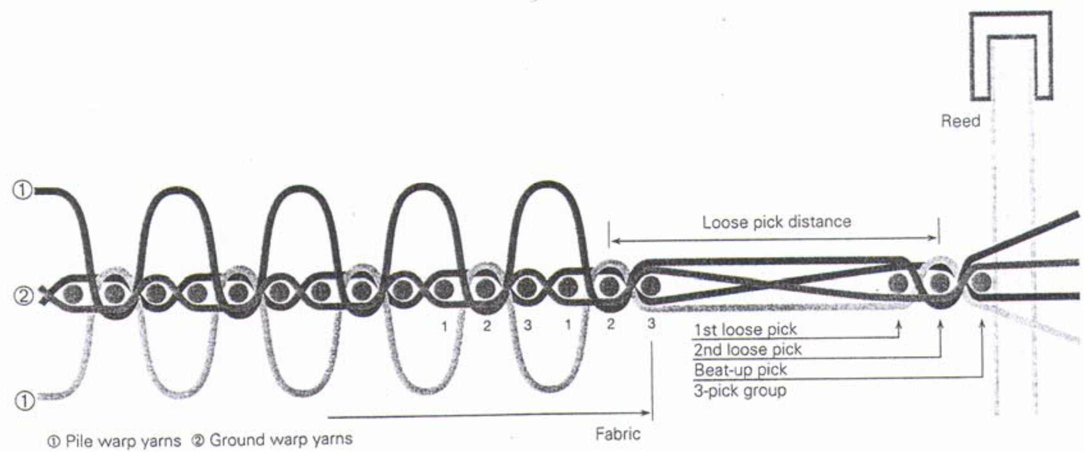
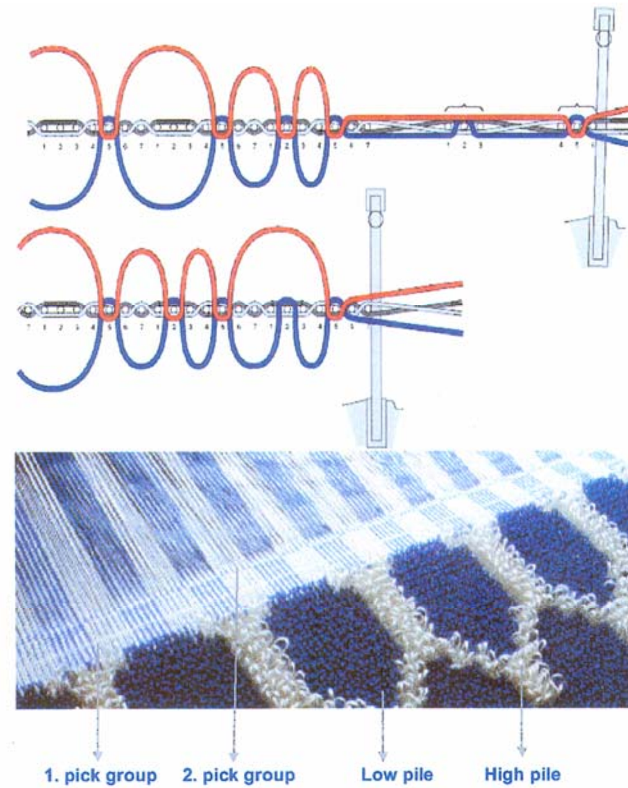


FIGURE 12.2 Structure and origin of a three-pick terry fabric.



Types of Shedding Mechanisms

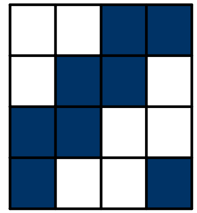
- Three main types of shedding mechanism are
  - 1. Cam (tappet),
  - 2. Dobby, and
  - 3. Jacquard
- Their characteristics should be mentioned both technically and operationally.

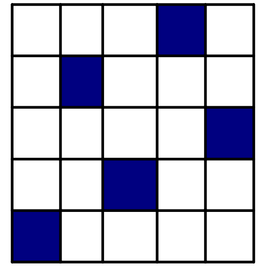
General characteristics of cam mechanisms

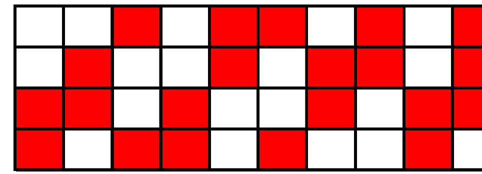
- <u>TECHNICAL (Design Capability)</u>
- Simple weaves

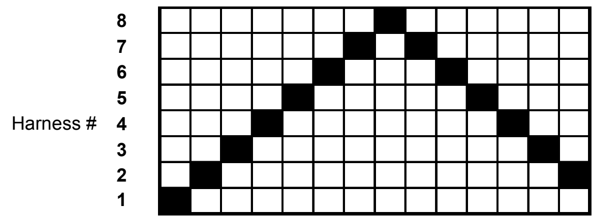
A. No. of picks/repeat
   - **limited to 8 or 10 picks/repeat**

B. No. of heald frames (or no. of ends/repeat)
   - **limited to 8, 10 or 12 heald shafts**



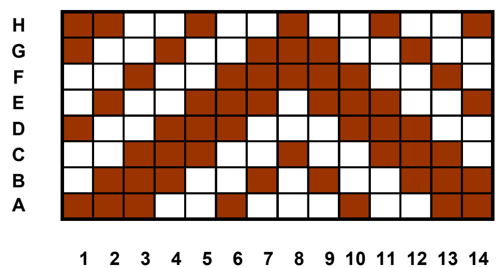






DID (Pointed Draft)

Weave Design (Pointed Twill)



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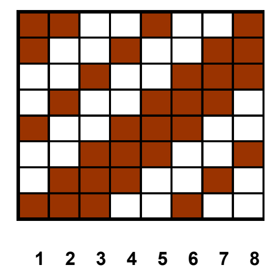


General characteristics of cam mechanisms

- <u>OPERATIONAL</u>

- <u>ADVANTAGES</u>

1. Simple and robust,
2. inexpensive with regard to both initial cost and maintenance,
3. not likely to cause faults in the fabric (reliable) and
4. impose no limitation on the speed of the loom (up to 1000, 1500 rpm).

- <u>DISADVANTAGES</u>

1. restricted design possibilities,
2. inconvenient for frequent pattern changes
   - to change the cams, or
   - at least to rearrange them,
   - to change the gearing of cam shaft if the new weave repeats on a different number of picks.

General characteristics of dobby mechanisms

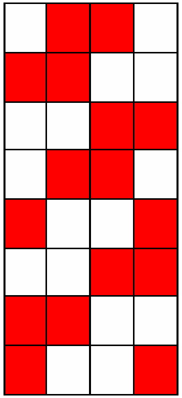
- <u>TECHNICAL (Design Capability)</u>
- Dobbies are much more versatile

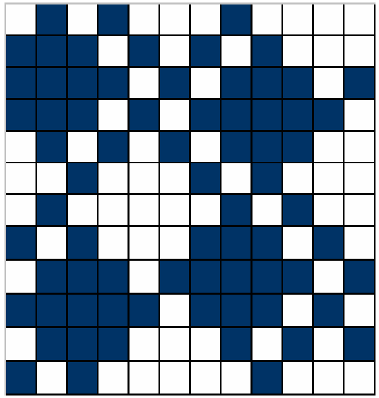
A. No. of picks/repeat
  - **virtually no limit to the number of picks /repeat (i.e. 5000 picks)**

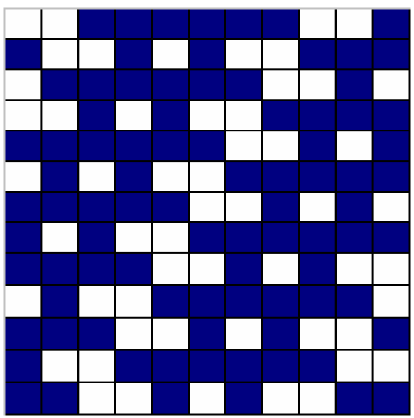
B. No. of heald frames (or no. of ends/repeat)
  - **normally built up to control 20-28 shafts**

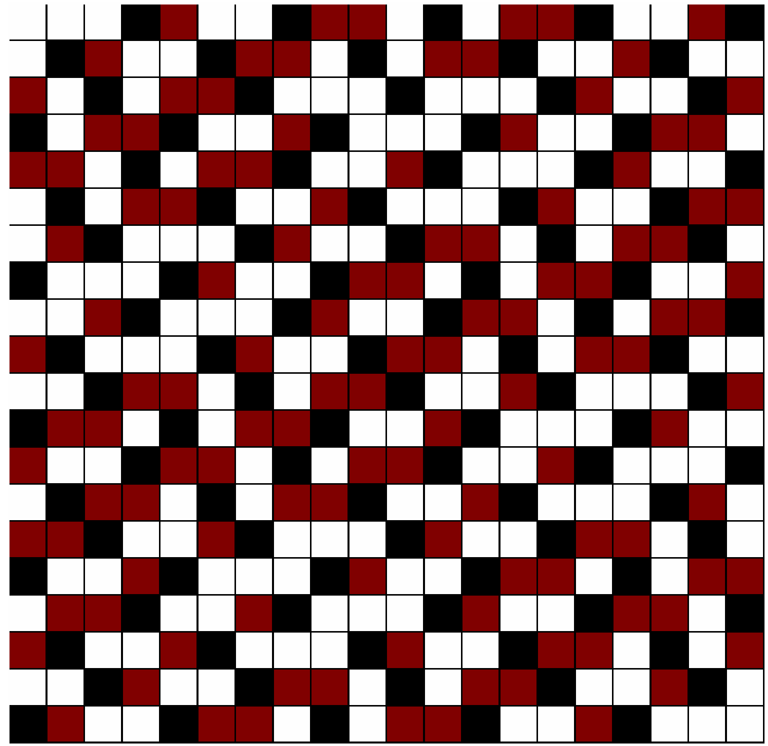
- Together with the use of fancy DID, sufficient to produce weave or combination of weaves arranged to give stripes, checks or designs of geometrical character.
- Handkerchiefs, tablecloths, and towels with contrasting pattern in the borders.

General characteristics of dobby mechanisms









General characteristics of dobby mechanisms

- OPERATIONAL

- ADVANTAGES

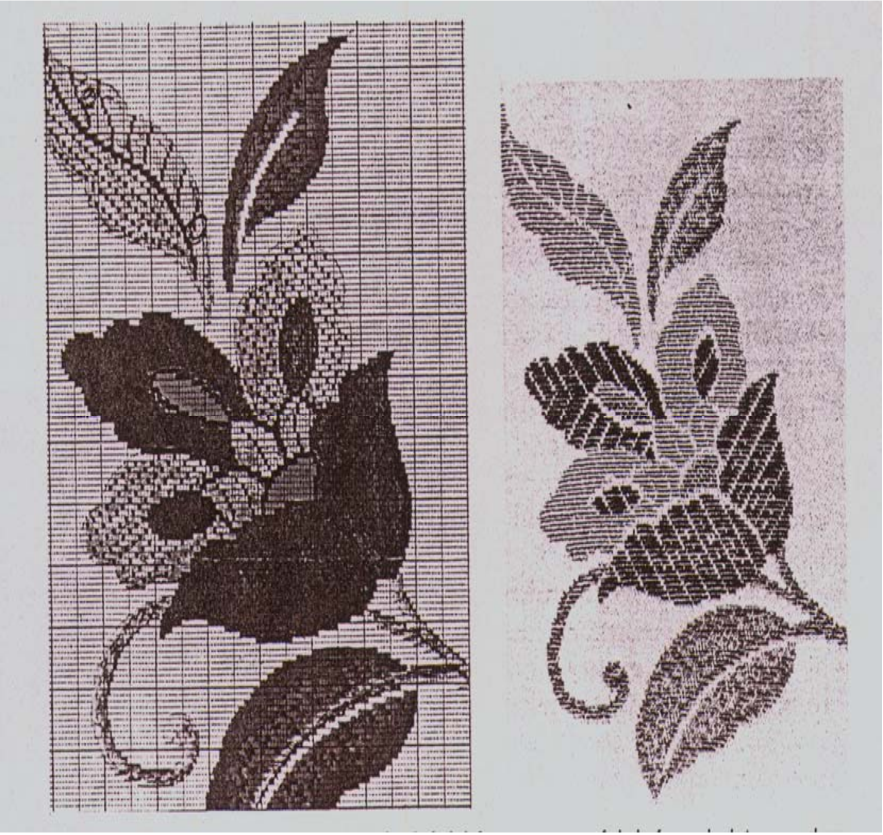
1. Versatile
2. Pattern change is easy: pattern chain is prepared in advance so that less time is lost when the change is made.

- DISADVANTAGES

1. more complicated & much more expensive initially,
2. dobby fabrics are naturally more costly to produce.
3. Hattersley dobbies
   - more liable to produce faults in the fabric than cams,
   - impose a limit to the speed of the loom (up to 500 picks/min).
   - maintenance costs are higher: :many more parts are replaced owing to wear
4. New generation rotary dobbies
   - maintenance costs are reduced,
   - impose no limitation on the speed of the loom (up to 1000, 1500 rpm).

General characteristics of jacquard mechanisms

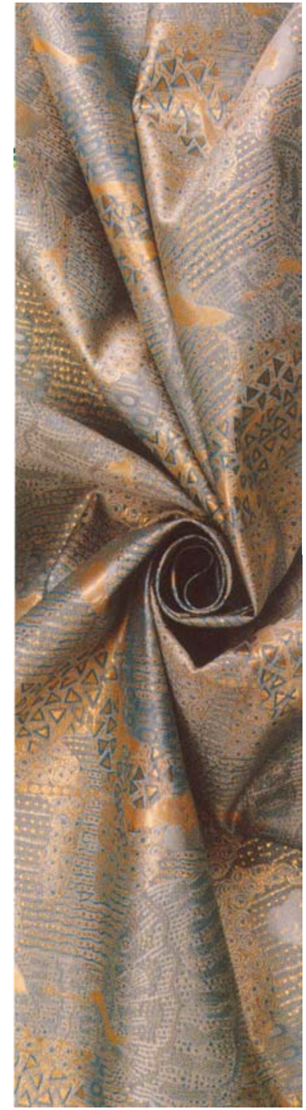
- <u>TECHNICAL(Design Capability)</u>
- For designs that require the **reproduction of freely drawn shapes**, it is usually necessary for each end in the repeat to be separately controlled.
- Jacquard machines are used for a wide variety of purposes from ties to carpets.
- Their patterning possibilities virtually unlimited.



JACQUARD WEAVE

- The most elaborate designs (reproduction of freely drawn shapes, i.e. floral designs) are woven on an intricately constructed loom called the Jacquard loom, and the weave of these fabrics is called the jacquard weave.

JACQUARD WEAVE



- Elaborate designs could not be made on the regular harness loom. Because intricate designs require many variations in shedding.

General characteristics of jacquard mechanisms

- TECHNICAL (Design Capability)

A. No. of picks/repeat

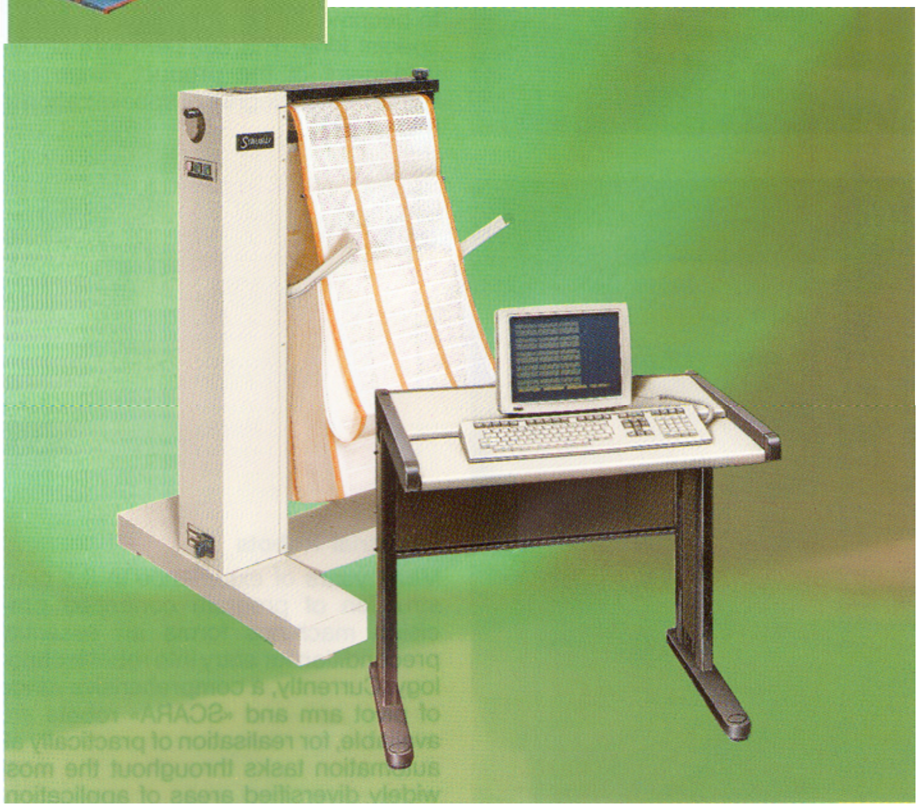
- **virtually no limit to the number of picks /repeat (i.e. 5000 picks or more)**
- **the length of the repeat is limited only by the cost and inconvenience of a very long pattern chain**

B. No. of heald frames (or no. of ends/repeat)

- **Jacquard machines are made in a wide variety of sizes to control from 100 to 2000 or more ends per repeat.**
- **In conventional jacquard machine field, the spectrum now ranges from 192 through 3200 to 6144 hooks.**
- **When a higher no.of independent lift is required two or three jacquard machine is placed side to side.**

Punching the cards for a Jacquard pattern.

Loops of pattern papers placed in jacquard head .



General characteristics of jacquard mechanisms

OPERATIONAL

ADVANTAGES

1. Tremendous design possibilities,
2. simpler in principle than dobbies

The largest machine with 12288 hooks,running at 515 rpm on a Dornier rapier weaving machine. One type with 576 hooks and 10 repeats at a speed of 1400 rpm on a prototype air-jet weaving machine

DISADVANTAGES

1. Large scale moving parts makes the machine and its harness relatively costly to install and maintain.
2. Jacquard fabrics are much more costly to produce.
3. Jacquard machines are even more liable to produce faults in the fabric than dobbies.
4. Pattern change is a time consuming process.
5. Until recently, the jacquard machine had tended to impose limitations (300 picks/min)
6. jacquard shedding is normally used only when the cloths to be woven are outside the scope of dobby shedding

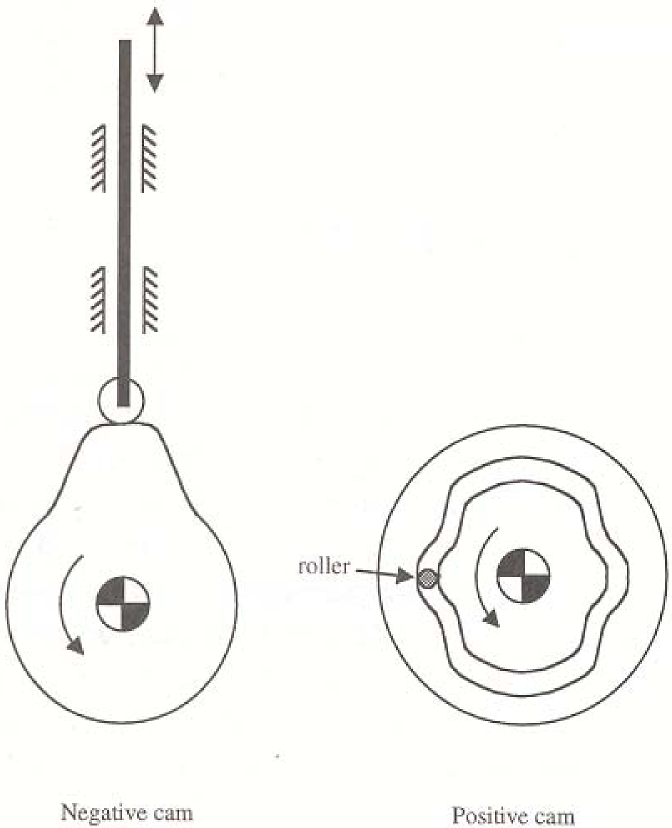
Shedding Mechanisms (Staubli)

	Repeat Length	No. of Harnesses	Pitch (mm)
Cam:			
1. Positive cam motion	up to 8 picks	12	18
2. Negative cam motion			
Dobby:			
1. Positive mechanical dobby	6000 picks	28	12
2. Negative mechanical dobby	150 picks	16	12
3. Mechanical rotary dobby	4700 picks	28	18
4. Electronic negative dobby	6400 picks	16	12
5. Electronic rotary dobby	6400 picks	28	12
	Program Memory Capacity		**No. of Hooks**
Jacquard:			
1. Mechanical double lift jacquard			2688
2. Electronic double lift jacquard	1,800,000 picks		2688
3. Electronic CX jacquard			6144

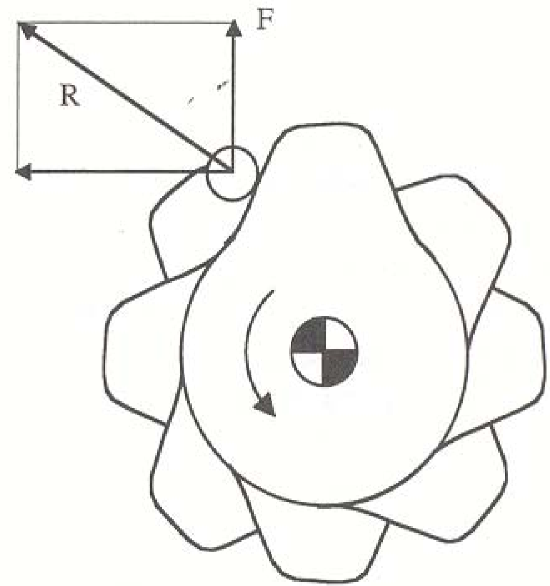
Cam Shedding

- The heald shaft motion is operated by cams or eccentrics.
- These motive cams convert the rotary motion of the main shaft of the weaving machine into the reciprocating motion of the heald frames.
- Cam operated shedding mechanism may be positive or negative in action.
  - **Positive shedding**: heald shafts are both raised and lowered by the cams or eccentric system of the shedding mechanism.
  - **Negative shedding**: heald shafts are either raised or lowered by the mechanism, but are returned by the action of some external device, such as springs, hence, they must be provided with reversing motion.

Cam Shedding

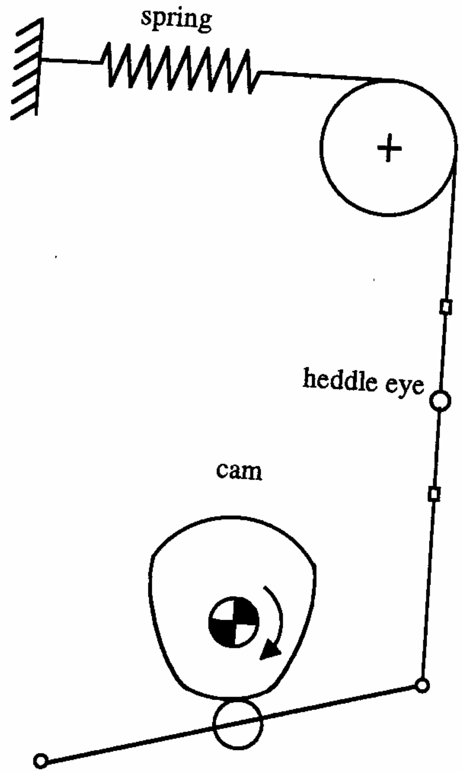


Cam design.

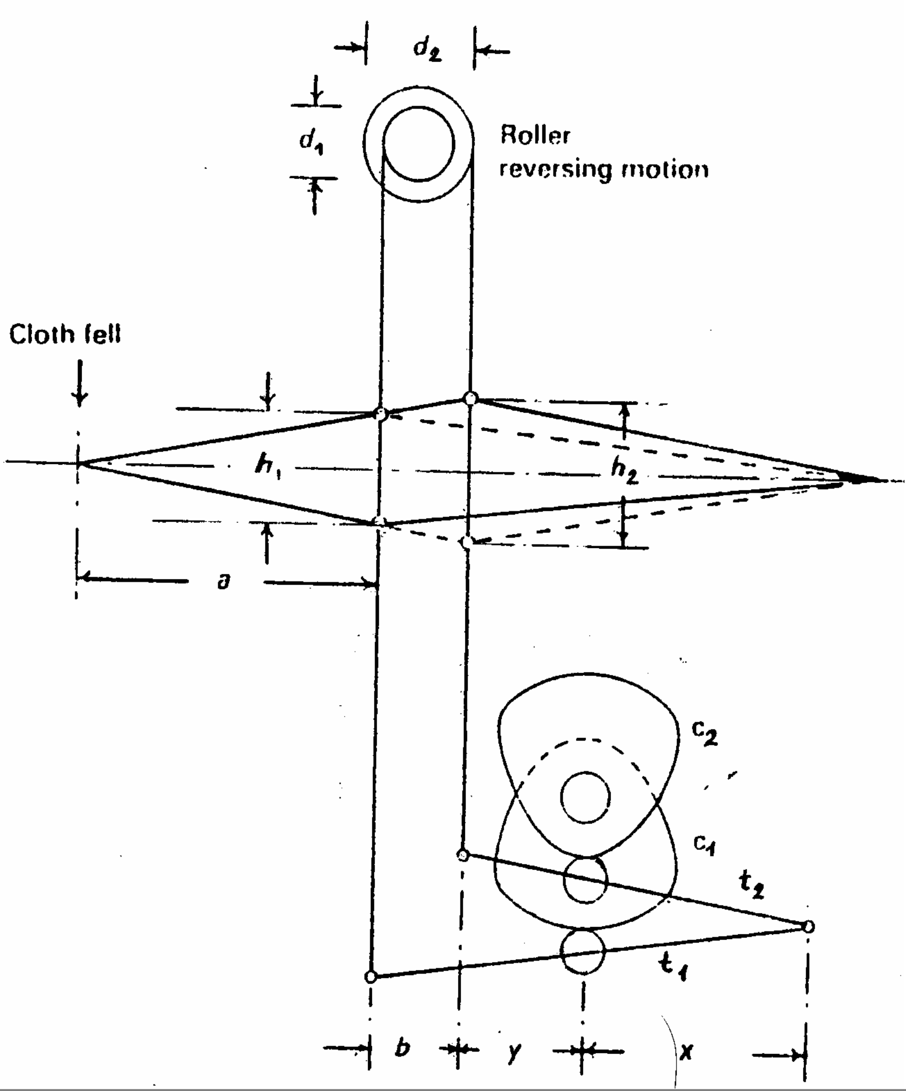


Arrangements of cams on a shaft.

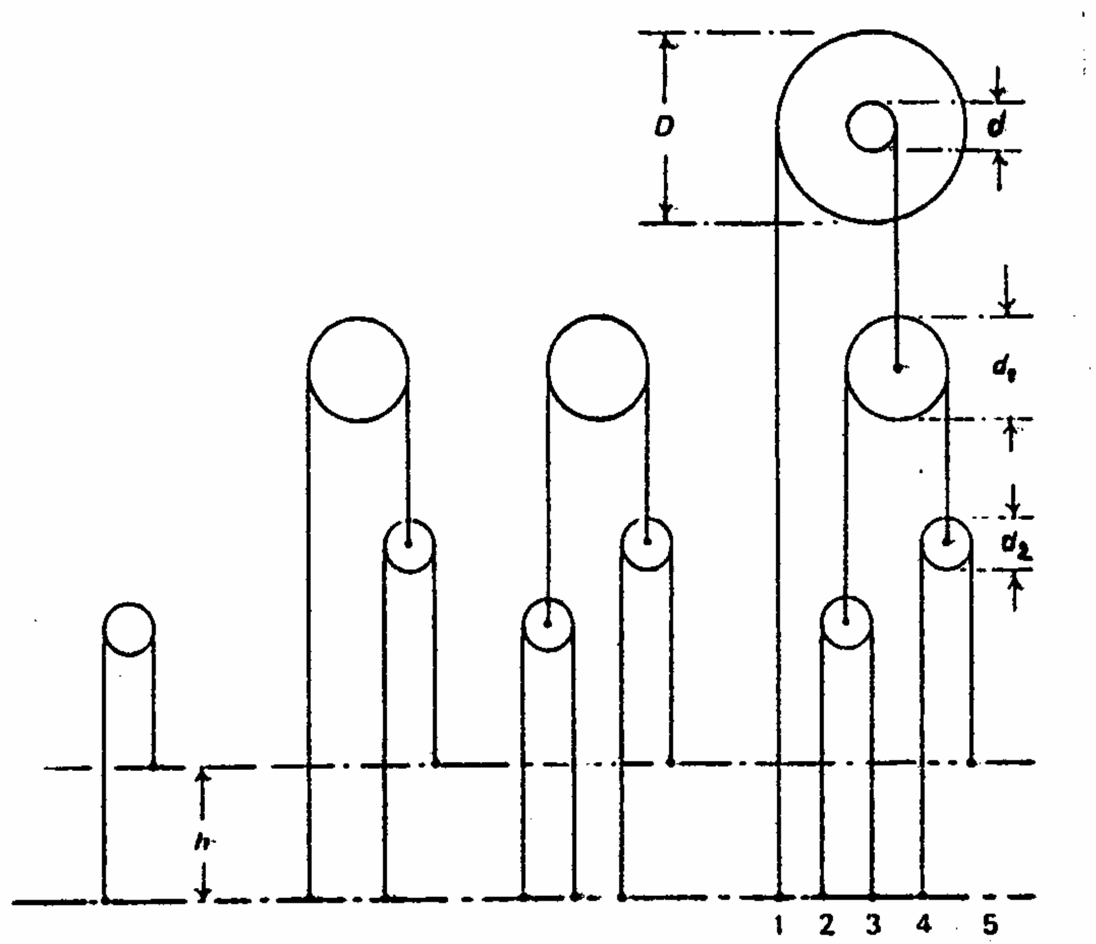
Negative Cam Shedding



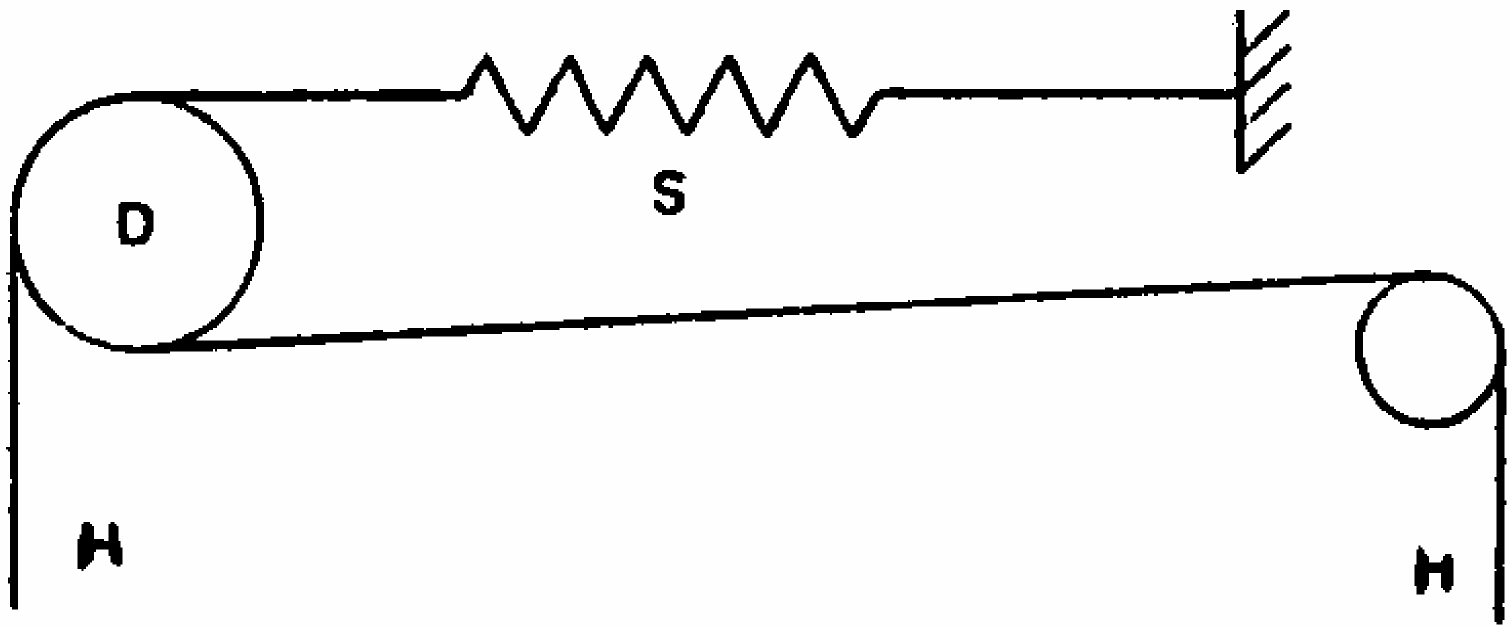
Negative Cam System



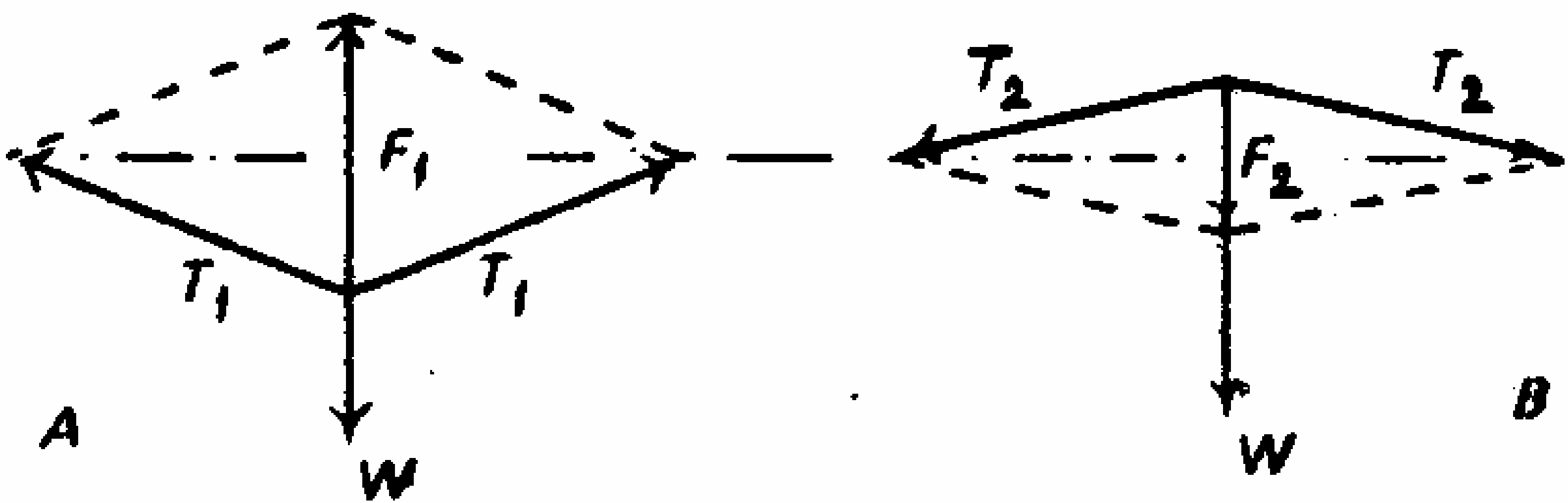
Roller Reversing Motion



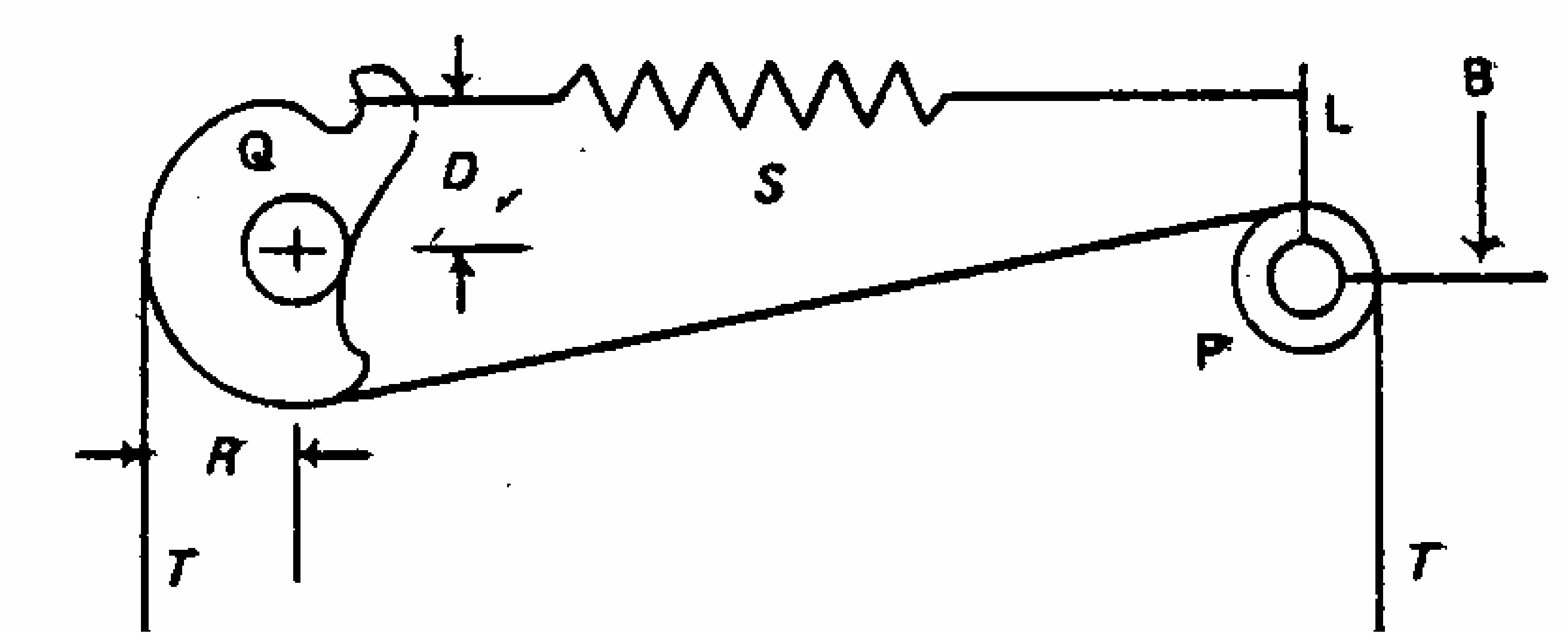
Hypothetical Reversing Motion



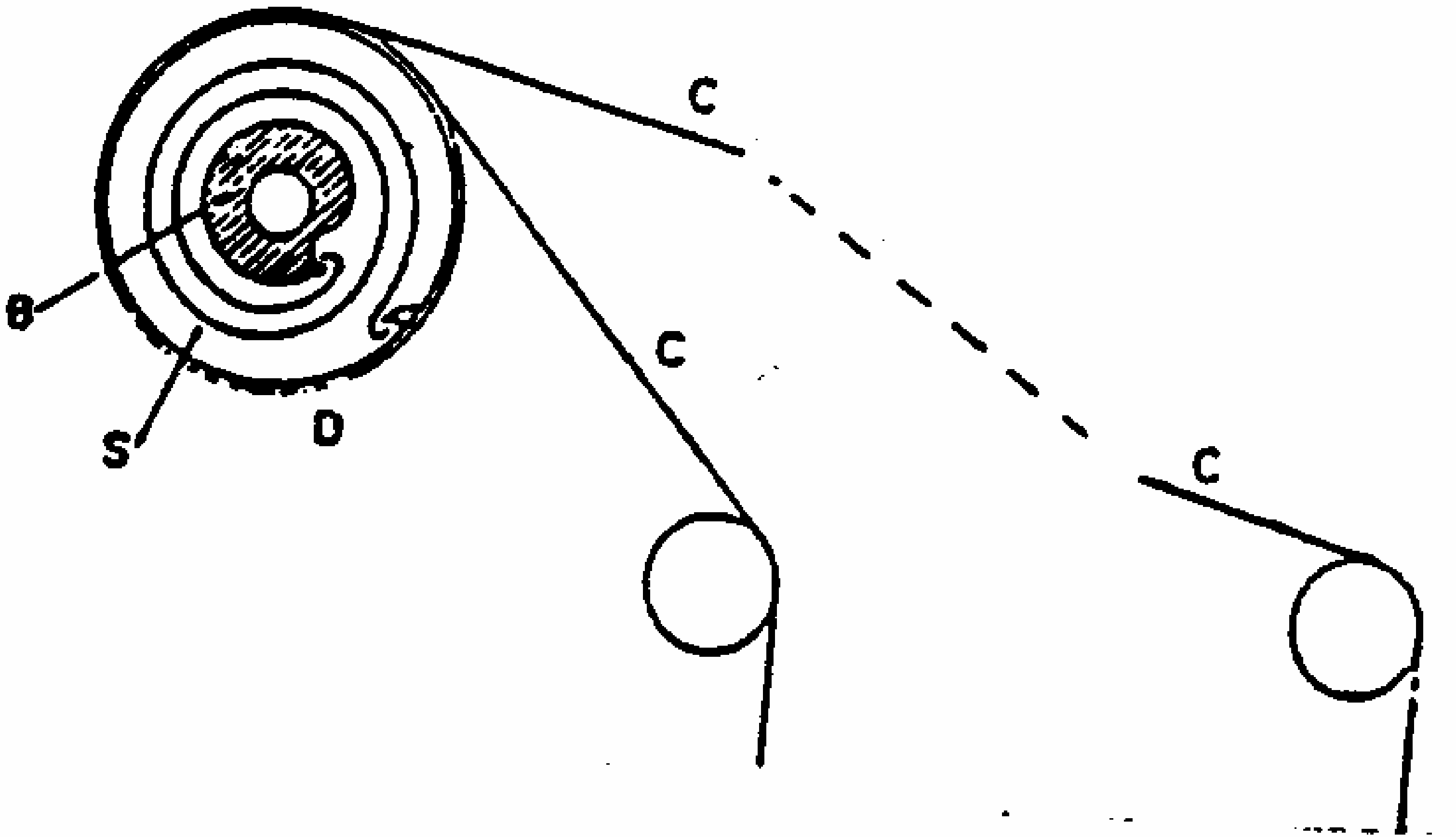
Forces Acting on the Warp Sheet



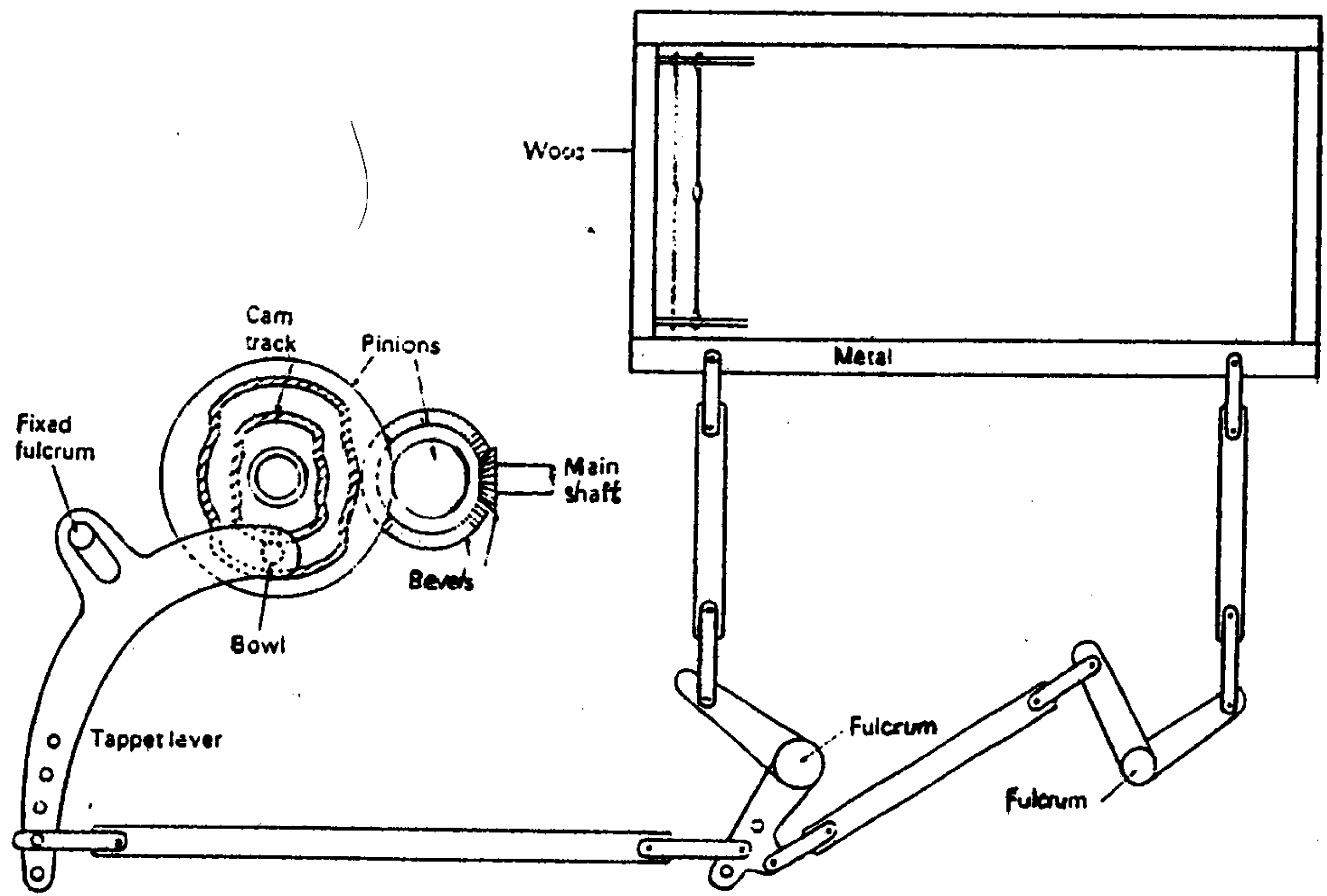
Practical Reversing Motion



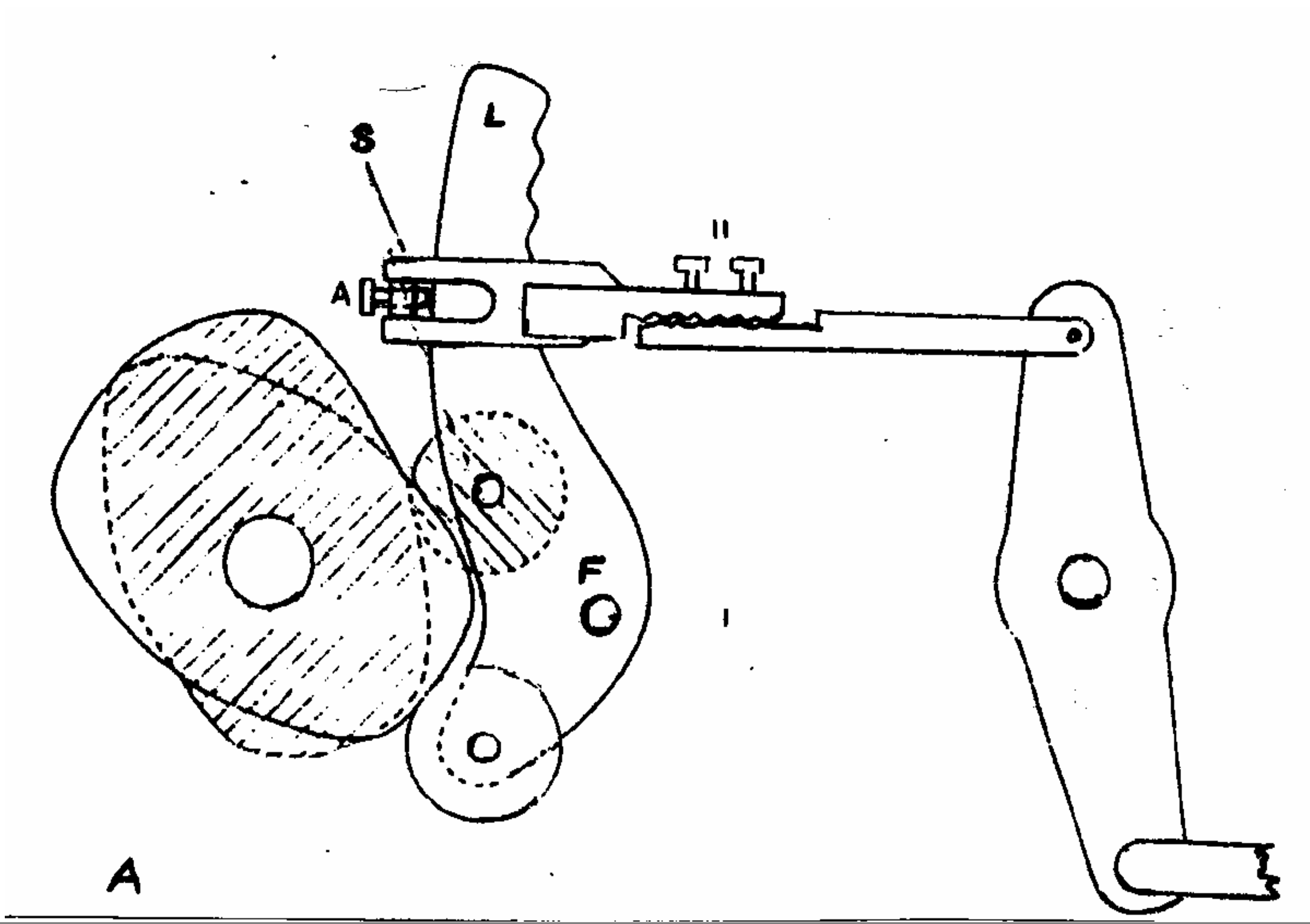
Clockspring Reversing Motion



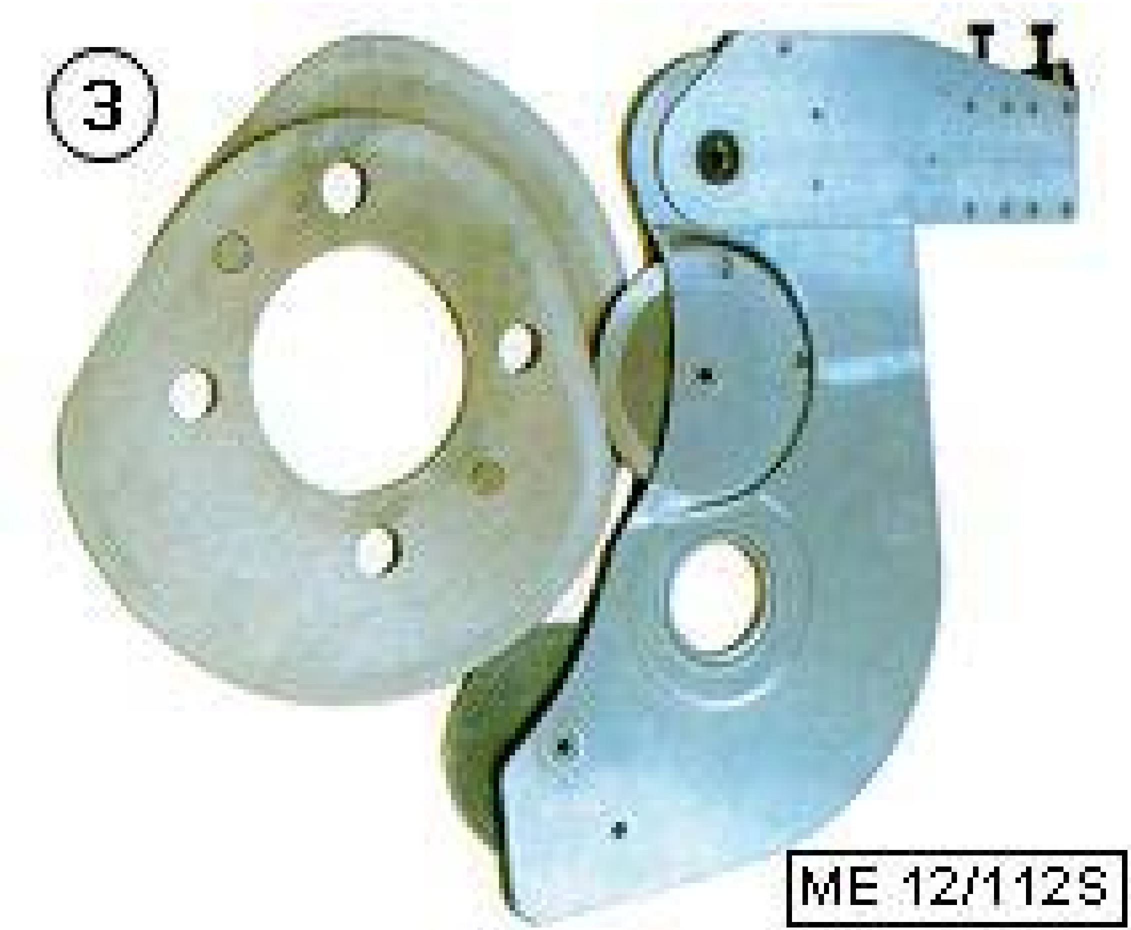
Positive Cam Shedding



Complementary Cam System



Positive Cam System

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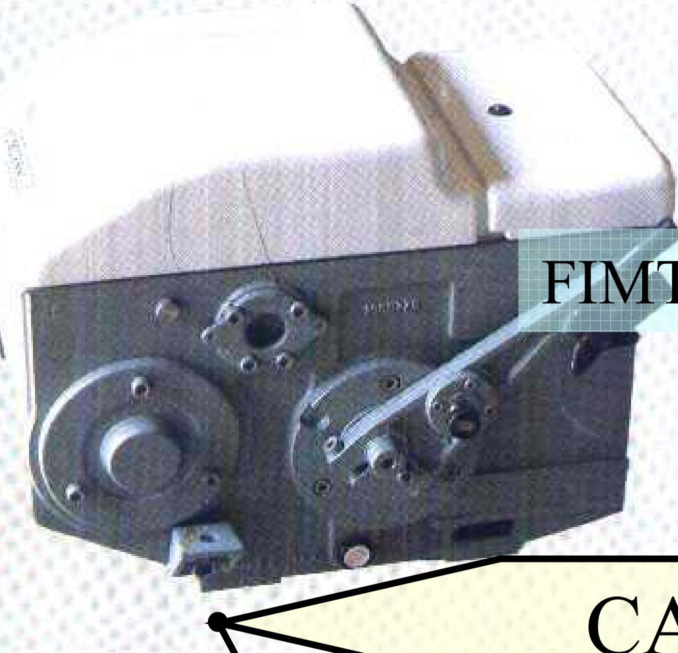

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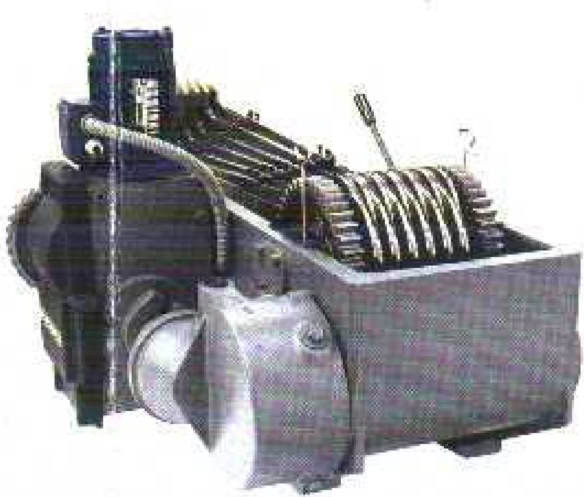
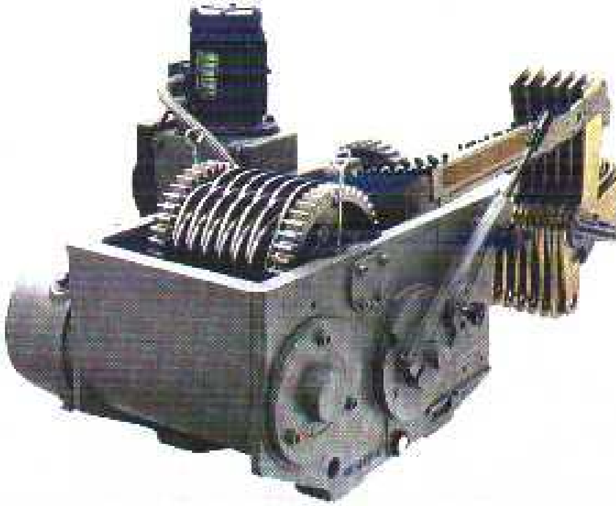
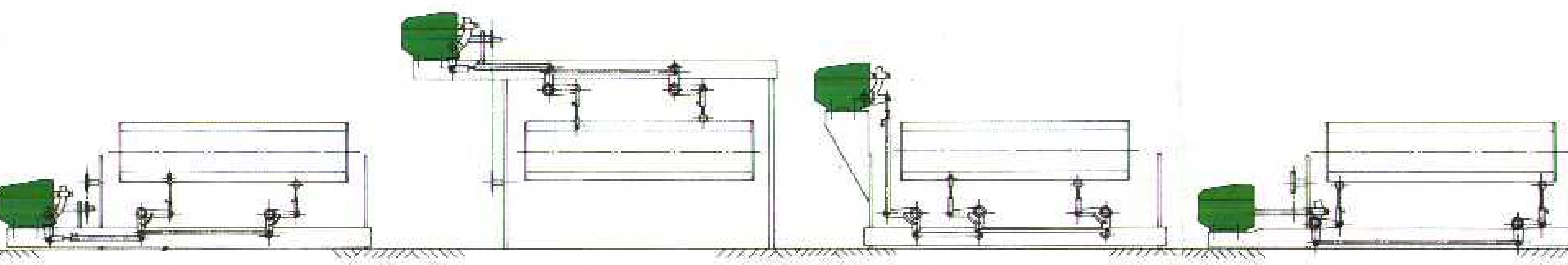
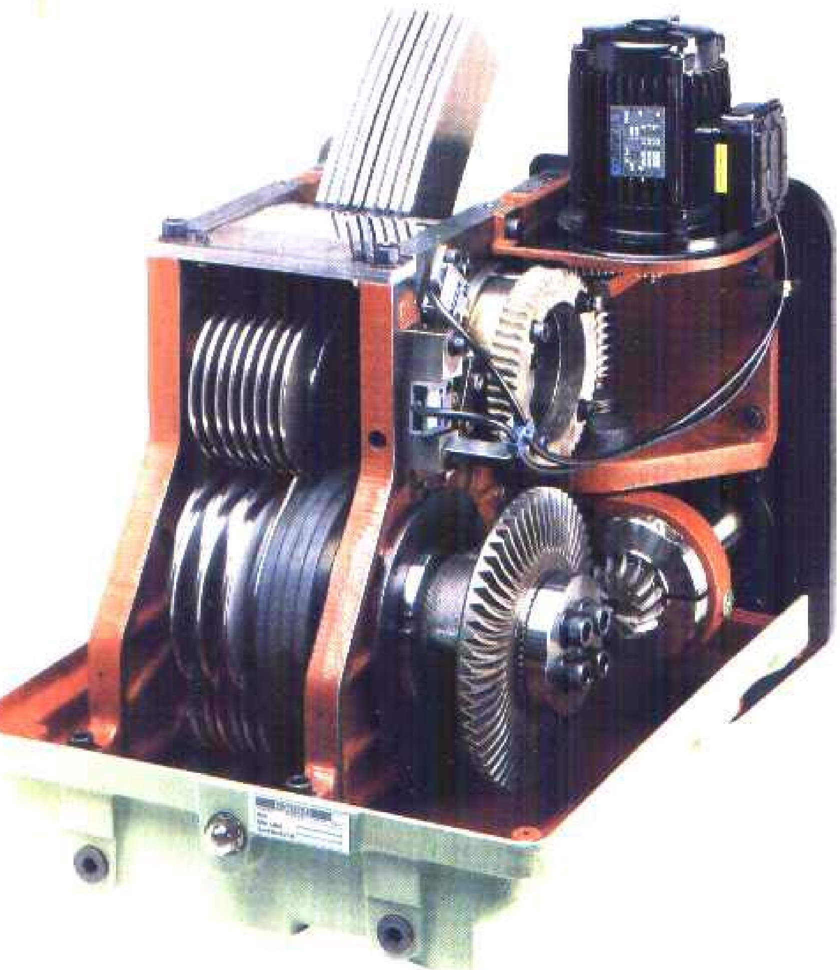
CAM MACHINES

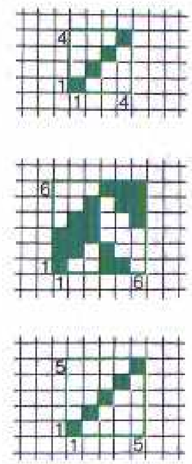
FIMTEXTILE ME 2001











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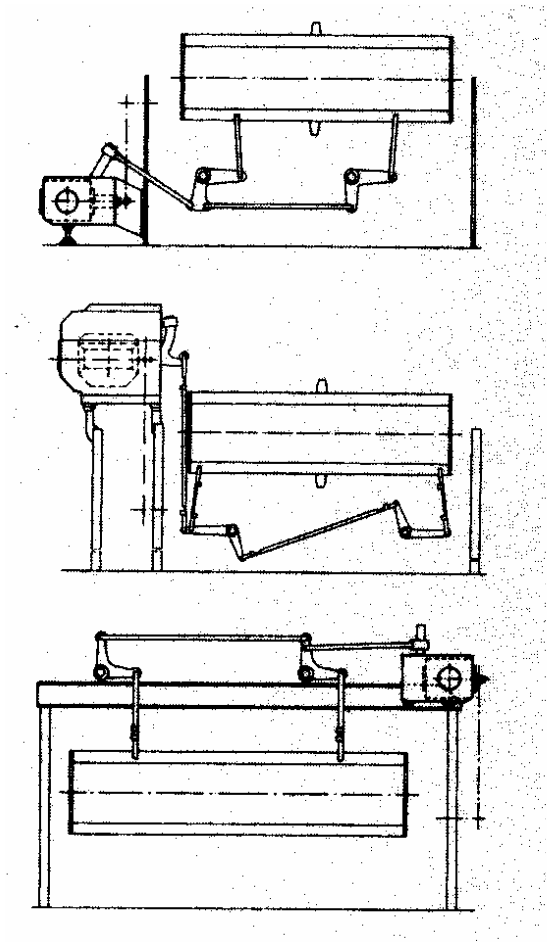
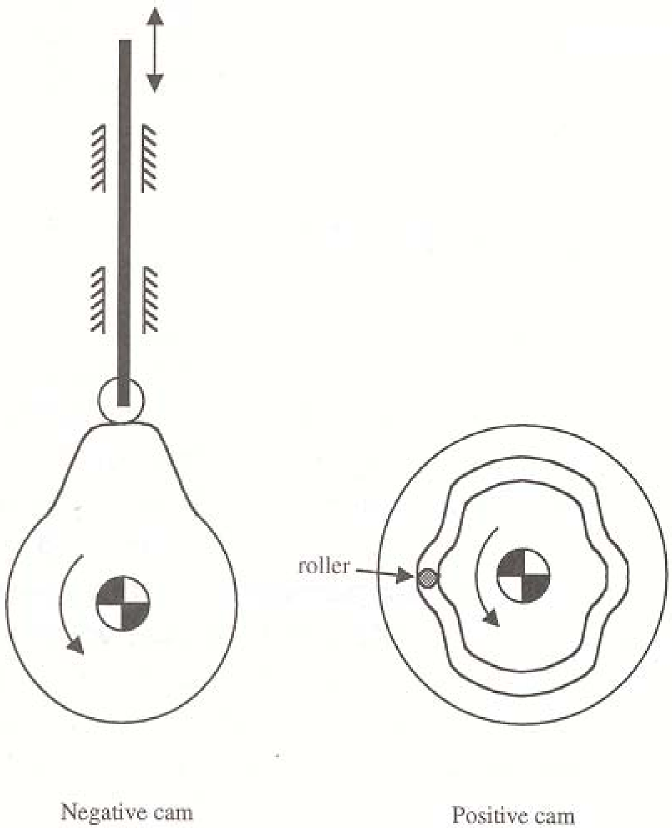
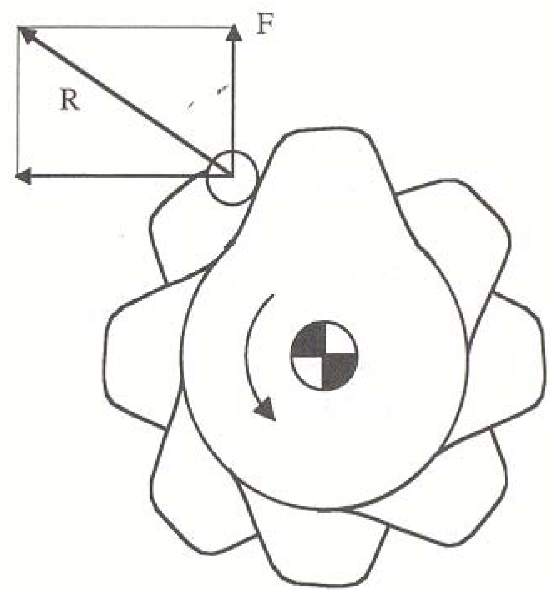
Mounting Possibilities of Positive Cam Systems



Cam Design



Cam design.



Arrangements of cams on a shaft.

Cam Design

- Design cams can control the arbitrary course of the heald shaft movement to suit the given technological process and the dynamics of the mechanism.
- A cam mechanism can
  - operate the **warp opening of the necessary size**

    lifting and lowering or **position change**

    and
  - keep the **heald shafts at rest during picking**

    at top or bottom shed positions.

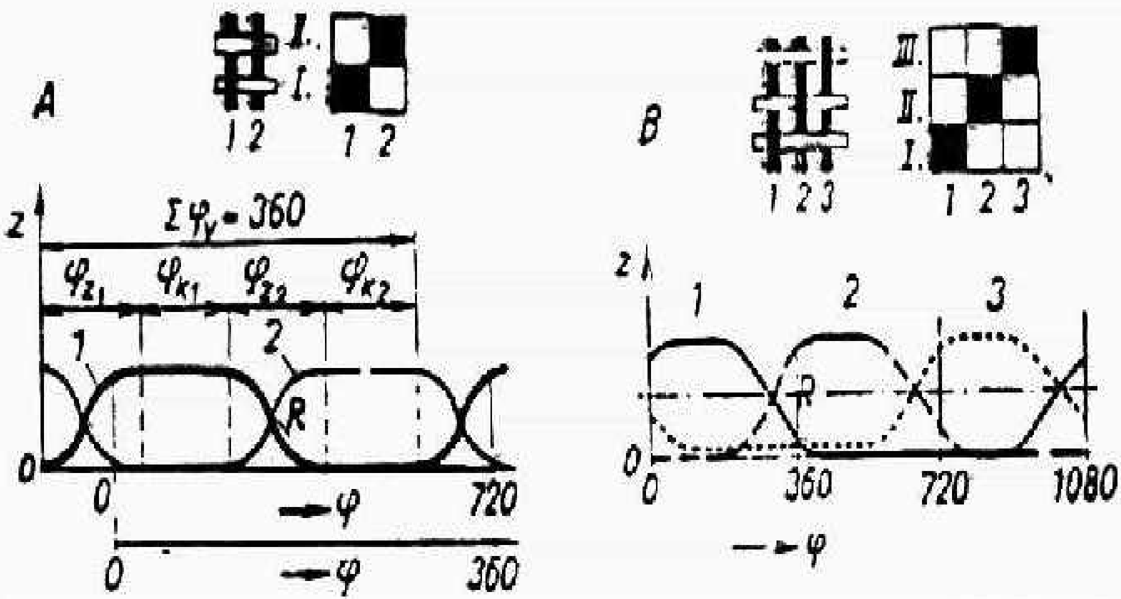


Figure 4.18 Basic weave types

The parameters which affect the cam design (cam contour):

1. **Lifting plan (or weave)**
   - How many times the heald shaft is to be lifted or lowered and their sequence
   - It is machined all around the cam surface, hence, the cam contour includes all design information given in the lifting plan (or weave repeat)
2. **No. of picks in the lifting plan (or in the weave)**
   - Angular portion or segment on the surface of the cam allocated for each pick
   - The part of cam contour to be followed by the roller in each weaving cycle.

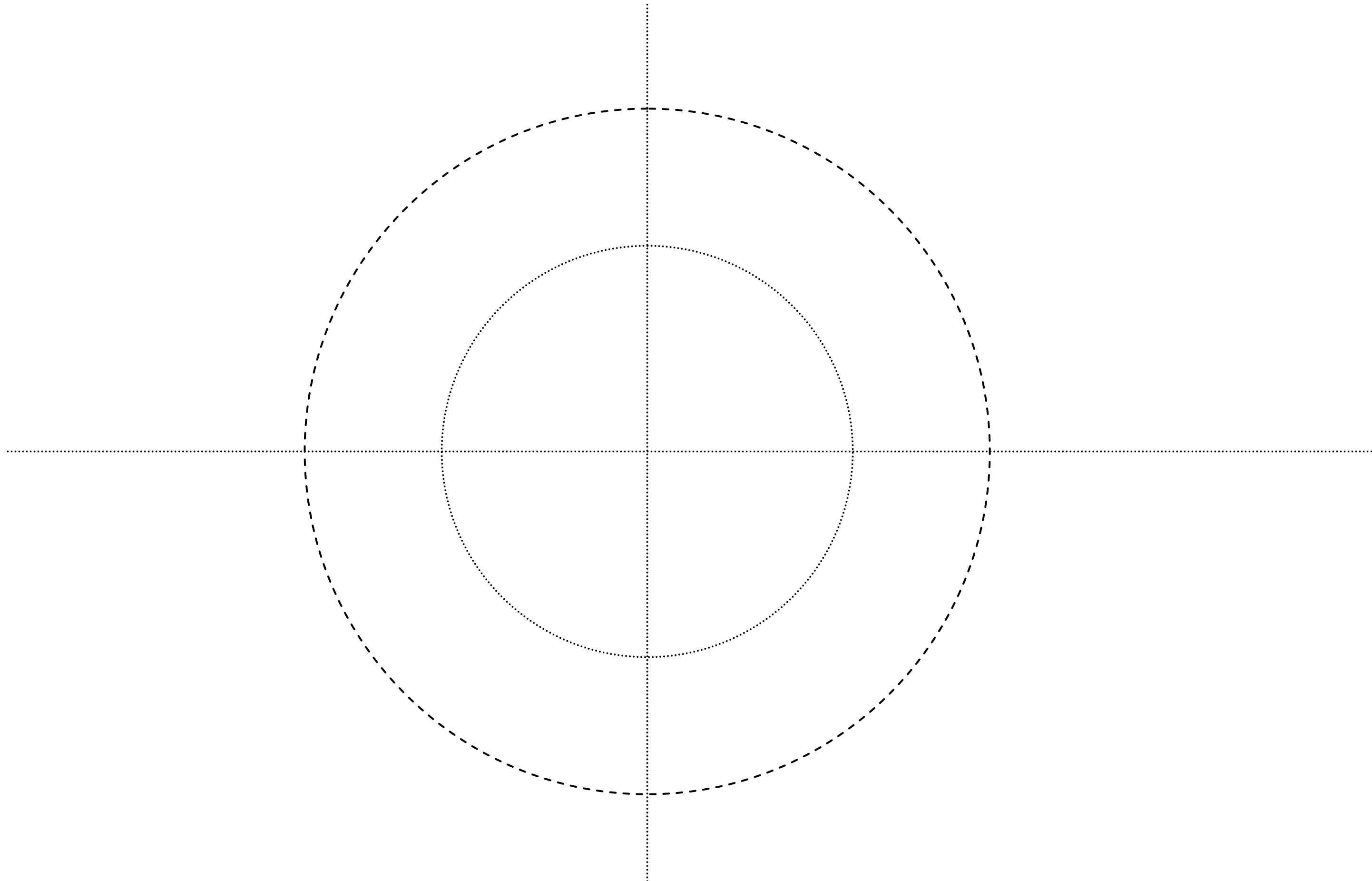
The parameters which affect the cam design (cam contour):

3. **Dwell period of the heald shaft**
   - It is normally determined by the type of weaving machine (the given parameter of weaving machine related to its type and width).
   - This given dwell period in terms of angular rotation of the main shaft is converted to a particular cam angle
4. **Shed type**
   - Open, center-closed sheds, etc.

The parameters which affect the cam design (cam contour):

5. **Cam throw**
   - It depends on the size of shed or the movement given to the heald shaft and the leverage between the cam and the heald shaft
   - Related to the size of cam
6. **Transition curve**
   - For the position change type of curve considered is important to obtain a smooth operation.

Cam Design



Cam Design

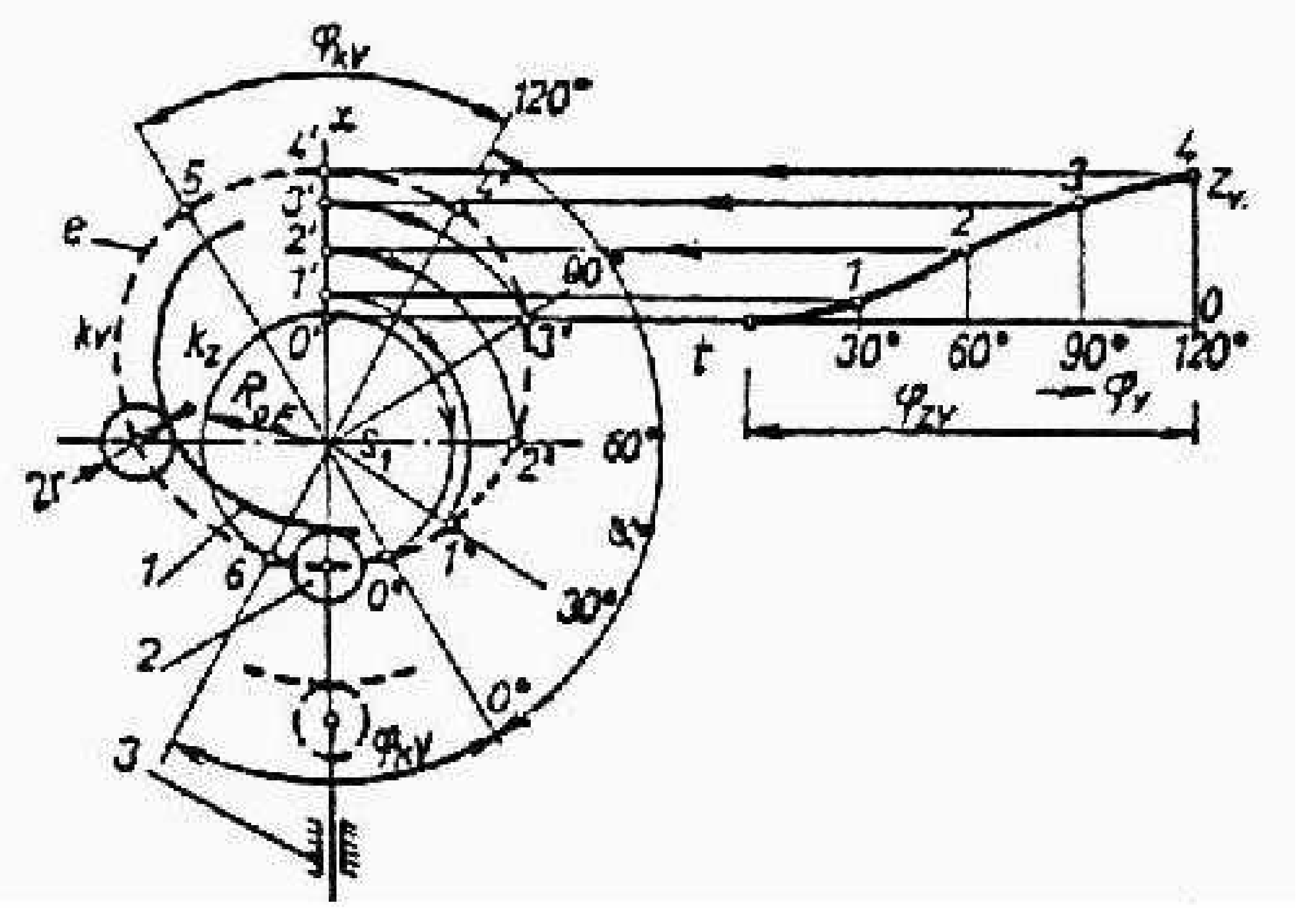


Fig. 4.19. The cam design for the 1: 1 weave

Setting design cams for a particular job

- A new cam arrangement requires to check and change, if necessary, the following parameters

1. **Design cams:** suitable for a particular job (or weave)
2. **No. of cams:** each cam or a pair of cams can control one of the heald shafts.
3. **Transmission ratio of the rotary motion between the main shaft and the cam shaft**: It depends on the number of picks in the lifting plan(or design)
4. **The relative positions of cams in the set:** It depends on the weave.

Cam Design