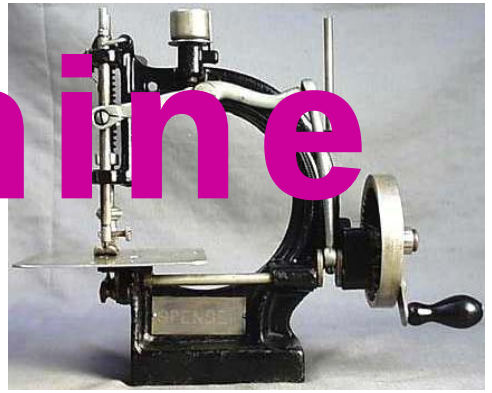
Sewing

Process + machine



Sewing machine

- sewing machines can make a great variety of plain or patterned stitches
- they include means for gripping, supporting, and conveying the fabric past the sewing needle to form the stitch pattern
- most home sewing machines, and some industrial machines, use a two thread stitch called the lockstitch (less chainstitch)
- the fabric shifting mechanism may be a simple workguide or may be pattern-controlled
- some machines can create embroidery-type stitches, some have a work holder frame, some have a workfeeder that can move along a curved path, while others have a workfeeder with a work clamp

History of the sewing machine

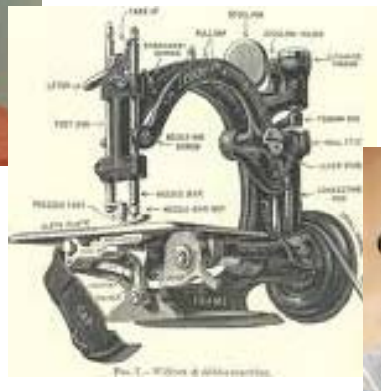
- before the invention of a usable machine for sewing dress , everything was sewn by hand
- most early attempts tried to replicate this hand sewing method and were generally a failure
- some looked to embroidery where the needle was used to produce decorative, not joining stitches
- this needle was altered to create a fine steel hook
- this was called a *crochet* in France and could be used to create a form of chain stitch

- this was possible because when the needle was pushed partly through fabric and withdrawn, it left a loop of thread

- the following stitch would pass through this first loop whilst creating a loop of its own for the next stitch, this resembled a chain – hence the name





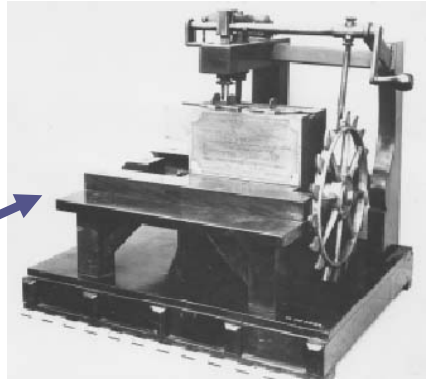



The first known attempt

- the first known attempt at a mechanical device for sewing was by the German-born Charles Weisenthal
- he was awarded British Patent in 1755 for a double pointed needle with an eye in the middle
- this needle was designed to be passed through the cloth by a pair of mechanical fingers and grasped on the other side by a second pair
- this method of recreating the hand sewing method suffered from the problem of the needle going right through the fabric, meaning the full length of the thread had to do so as well
- the mechanical limitations meant that the thread had to be kept short, needing frequent stops to renew the supply

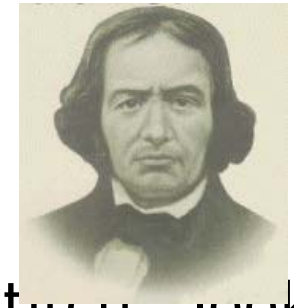
- in 1790 British Patent was awarded to Thomas Saint
- due to several other patents dealing with leather and products to treat leather, the patent was filed under "Glues & Varnishes" and was not discovered until 1873 by Newton Wilson
- Wilson built a replica to the patent's specifications and it had to be heavily modified before the machine would stitch – suggesting that Saint never actually made a machine of his own
- saint's design had the overhead arm for the needle and a form of tensioning system, which was to become a common feature of later machines

The replica of Saint's machine with which Newton Wilson taunted Howe in 1776



Way of finding a stitch that could be made quickly and easily

- there were various attempts and patents awarded for chain stitch machines of varying types from 1795-1830, none of which were used to any degree of success – many of which didn't work correctly at all



- a French tailor Barthelemy Thimonnier made the next major breakthrough
- he did not try to replicate the human hand stitch, looking instead for a way of finding a stitch that could be made quickly and easily by machine
- his machine worked by using a horizontal arm mounted on a vertical reciprocating bar, the needle-bar projected from the end of the horizontal arm

- the cloth was supported on a hollow, horizontal fixed arm, with a hole on the topside, which the needle projected through at the lowest part of its stroke
- inside the arm was a hook, which partly rotated at each stroke in order to wrap the thread (fed from the bobbin onto the hook) around the needle at each stroke
- the needle then carried the thread back through the cloth with the upward motion of its stroke
- this formed the chain stitch, which held the cloth together

The machine was powered by means of a foot pedal

- the easiest way to describe this is to picture the machine working upside-down from how sewing machines are generally thought of today – the stitch was formed on the top of the cloth, not the bottom as which most other chain stitch machines made since

- Thimonnier was awarded a French patent in 1830 and 1840 of these machines were installed in a factory in Paris to stitch soldiers' clothing

- other tailors concerned for their livelihood invaded the factory and smashed the machines

Lock Stitch & Singer

- chain stitch has one major disadvatage – it is very weak and the stitch can easily be pulled apart
- a stitch more suited to machine production was needed, it was found in the lock stitch
- a lock stitch is created by two separate threads interlocking through the two layers of fabric, resulting in a stitch that looks the same from both sides of the fabric
- Walter Hunt in 1834 – his machine used an eye-pointed needle (with the eye and the point on the same end) carrying the upper thread, and a shuttle carrying the lower thread

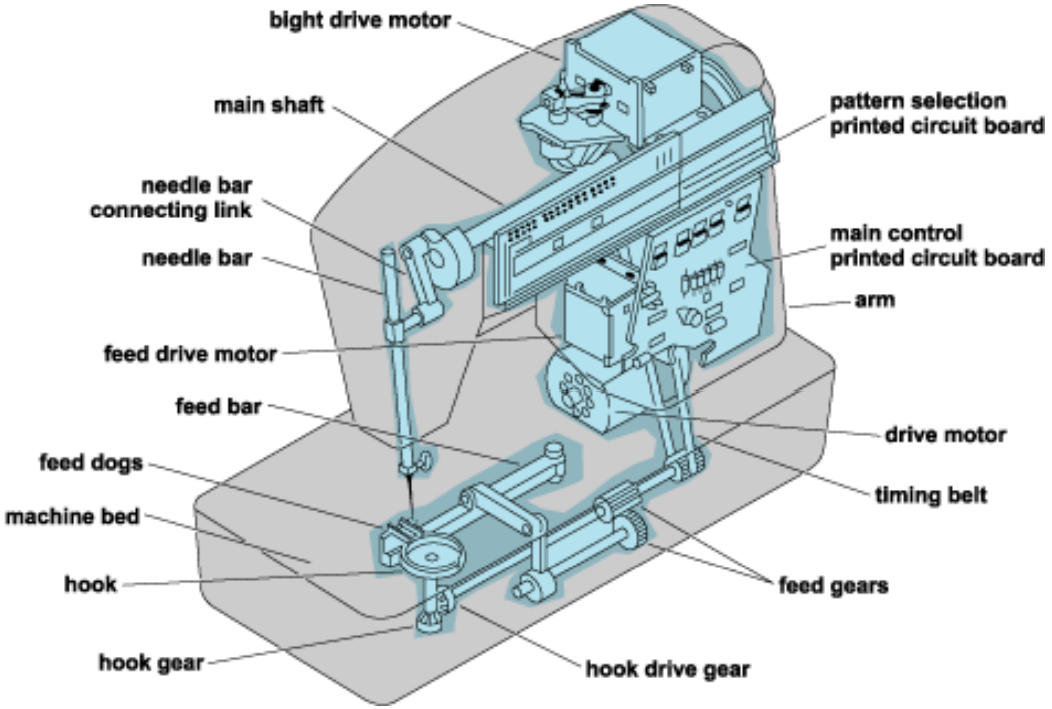
- in 1854 Isaac Merritt Singer has become synonymous with the sewing machine
- trained as an engineer, he saw a rotary sewing machine being repaired in a Boston shop
- he thought it to be clumsy and promptly set out to design a better one
- his machine used a flying shuttle instead of a rotary one; the needle was mounted vertically and included a presser foot to hold the cloth in place
- it had a fixed arm to hold the needle and inc tensioning system

- meanwhile Allen Wilson had developed a reciprocating shuttle, which was an improvement over Singer's and Howe's
- Wilson decided to change track and try a new method - he went into partnership with Nathaniel Wheeler to produce a machine with a rotary hook instead of a shuttle
- this was far quieter and smoother than the other methods, and the Wheeler and Wilson Company produced more machines in 1850s and 1860s than any other manufacturer
- Wilson also invented the four-motion feed mechanism; this is still seen on every machine today., this had a forward, down, back, and up motion, which drew the cloth through in an even and smooth motion

- this machine combined elements of Thimonnier's, Hunt's, and Howe's machines
- he was granted an American patent in 1851 and it was suggested he patent the foot pedal (or treadle) used to power some of his machines; however, it had been in use for too long for a patent to be issued
- when Howe learned of Singer's machine he took him to court. Howe won and Singer was forced to pay a lump sum for all machines already produced
- Singer then took out a license under Howe's patent and paid him $15 per machine. Singer then entered a joint partnership with a lawyer named Edward Clark, and they formed the first hire-purchase (time payment) scheme to allow people to afford to buy their machines

- through the 1850s more and more companies were being formed and were trying to sue each other
- Charles Miller patented the first machine to stitch buttonholes (US10609)
- in 1856 the Sewing Machine Combination was formed, consisting of Singer, Howe, Wheeler and Wilson, and Grover and Baker
- these four companies pooled their patents, meaning that all the other manufacturers had to obtain a license and pay $15 per machine
- this lasted until 1877 when the last patent expired

Components of a home sewing machine



Historical type sewing machine with all the most important parts

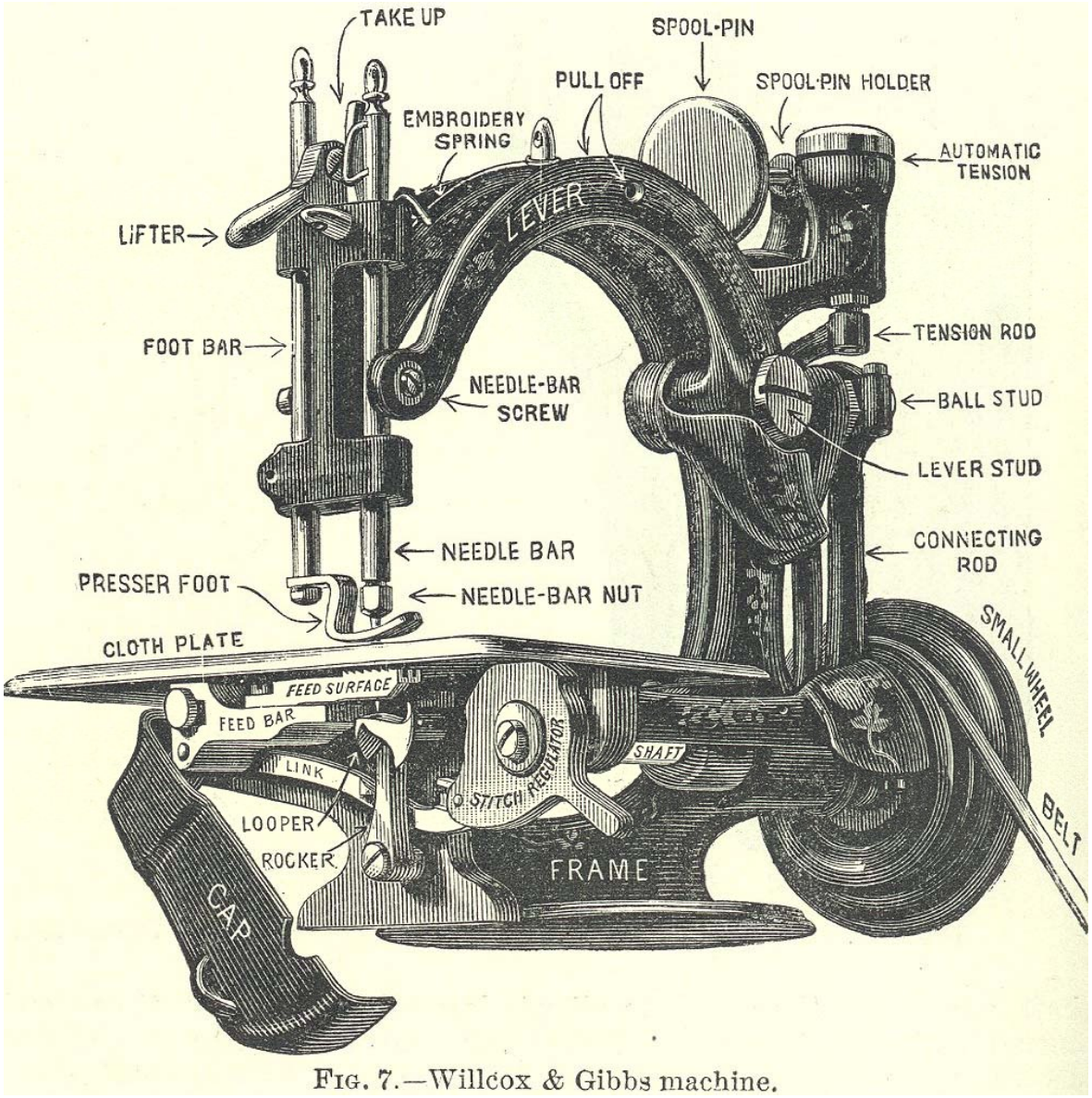
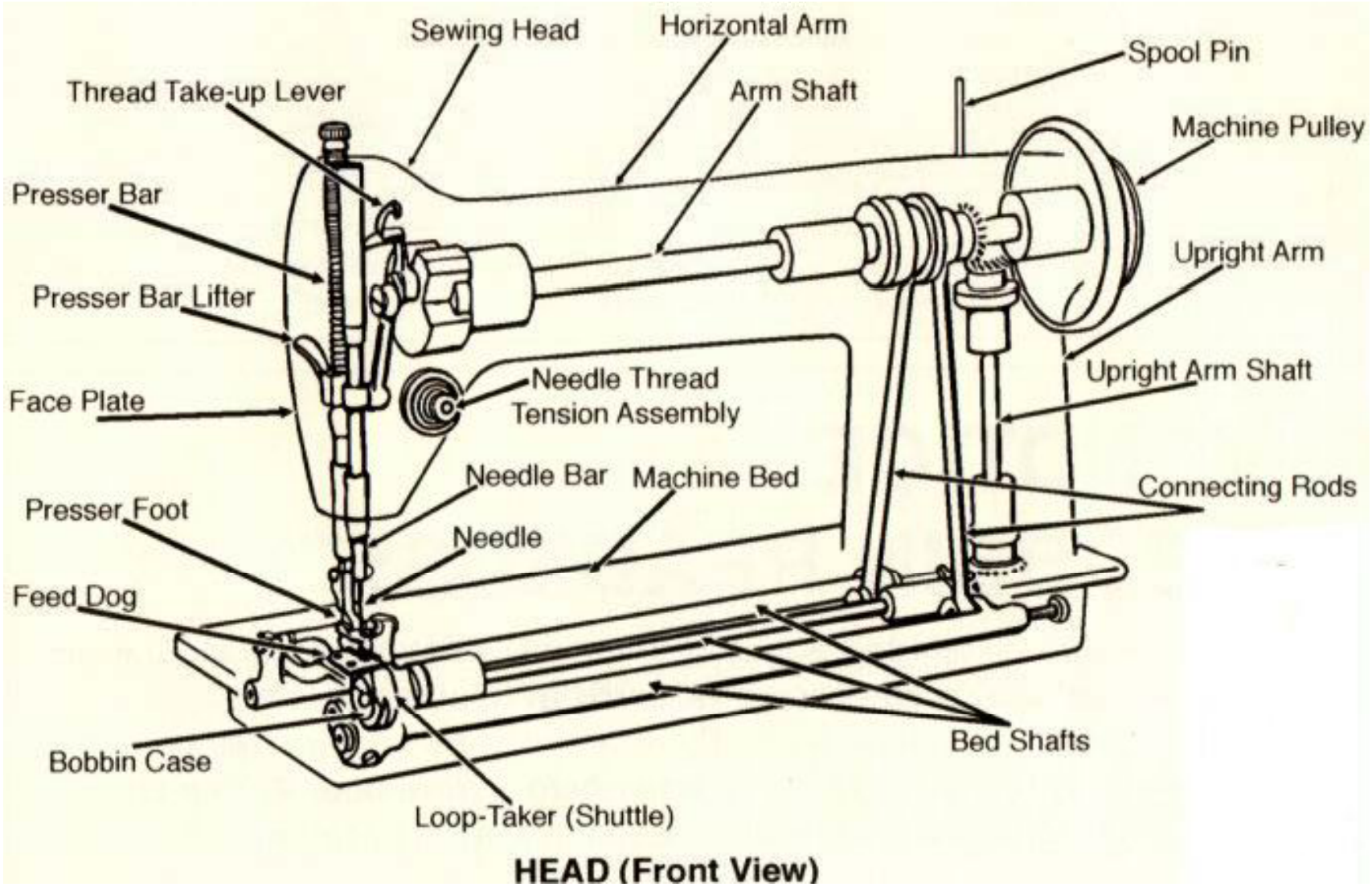


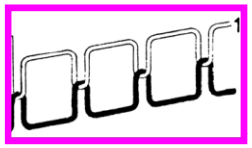
Fig. 7.—Willcox & Gibbs machine.

Scheme of sewing machine

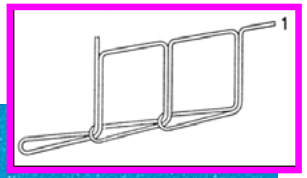


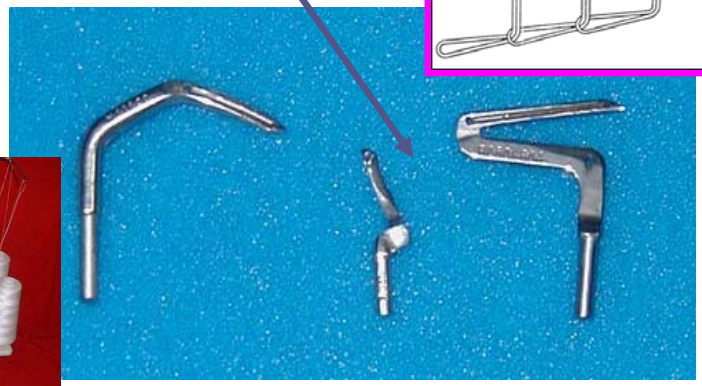
Timing the Hook

Rotary Hook

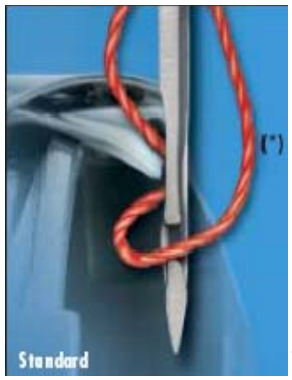


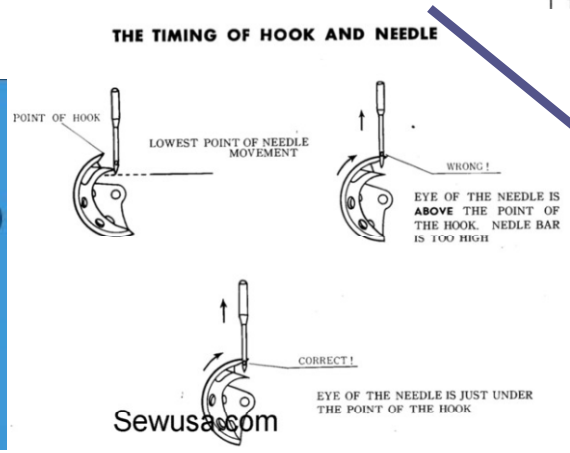
Looper



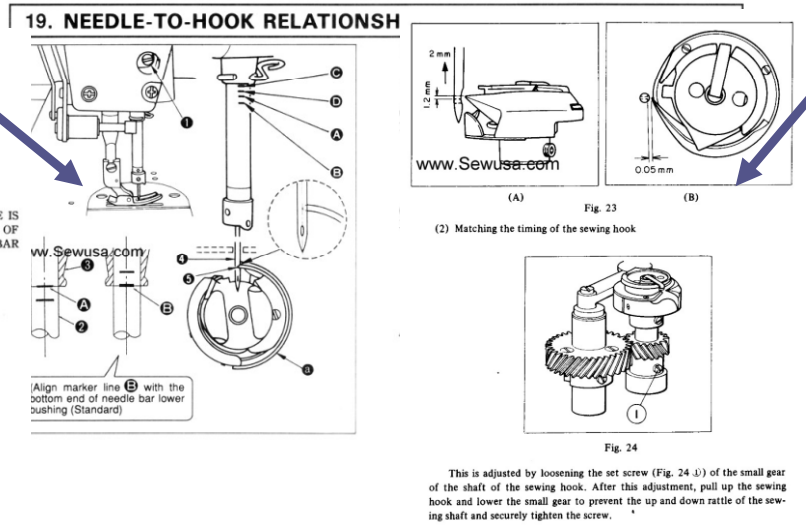


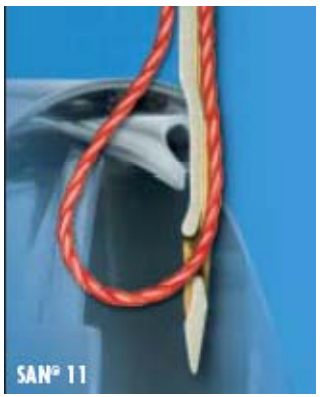
Rotary Hook (Vertical)





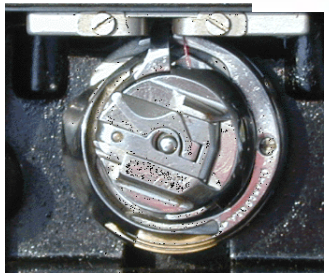
Rotary Hook (Horizontal)



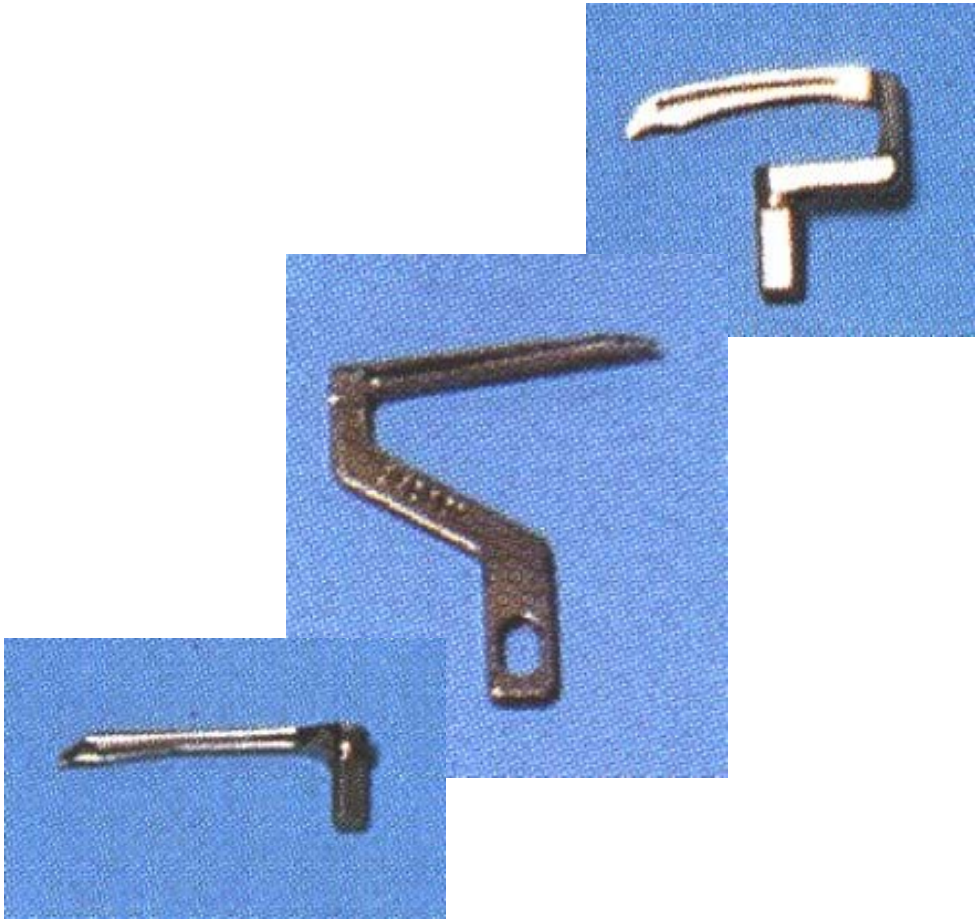


Video

Rotary Hook



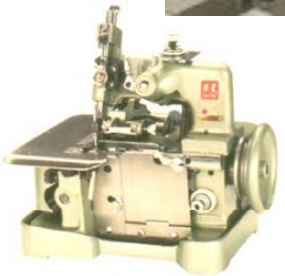
Looper



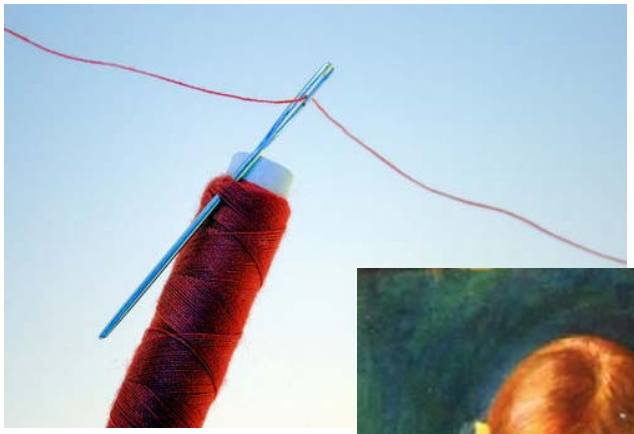
Modern Sewing Machines

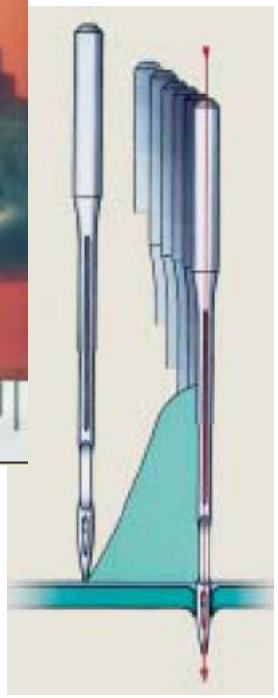
- the usage of sewing machines has grown over the years and is generally now used far more than sewing by hand

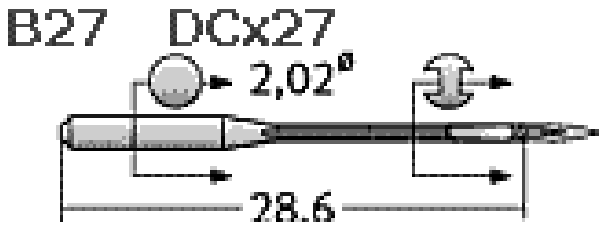
- the industrial market has come to be dominated by several large brands such as Juki, Brother Industries, Merrow, Durkopp Adler, Pfaff, Consew to name a few



Sewing



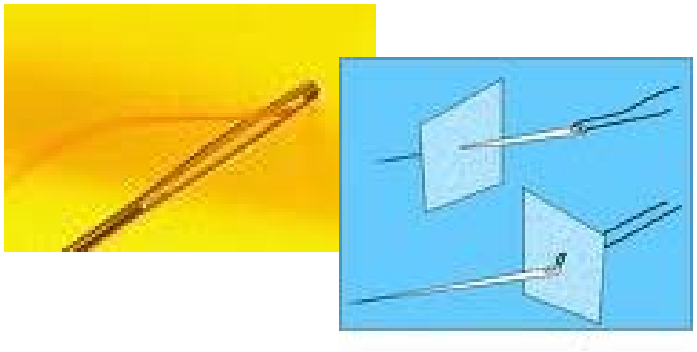




needle

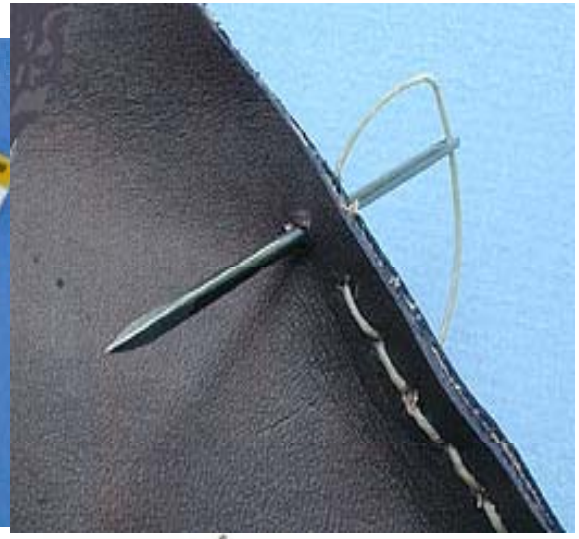
Sewing needle

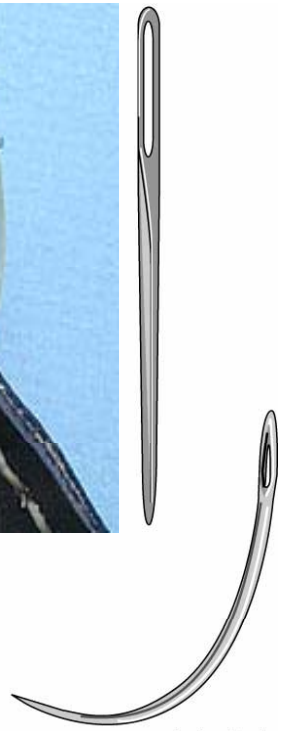
- a sewing needle is a long slight object with a pointed tip
- the first sewing needles were made of bone or wood
- modern ones are manufactured from high carbon steel wire, nickel- or gold plated for corrosion resistance
- the highest quality embroidery needles are made of platinum



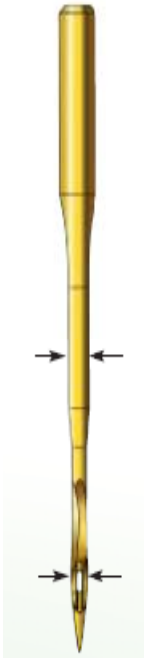
Hand sewing needle

- a needle for hand sewing has a hole at the non-pointed end to carry thread or cord through the fabric after the pointed end pierces it
- little reserve of yarn





Machine sewing needle



- needle size is denoted by a number on the packet
- the convention for sizing is that the length and thickness of a needle increases as the size number decreases
- for example, a size 1 needle will be thicker and longer, while a size 10 will be shorter and finer

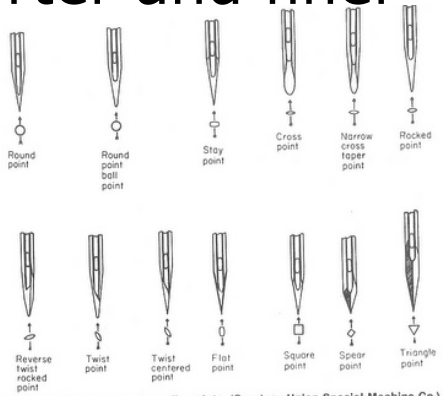
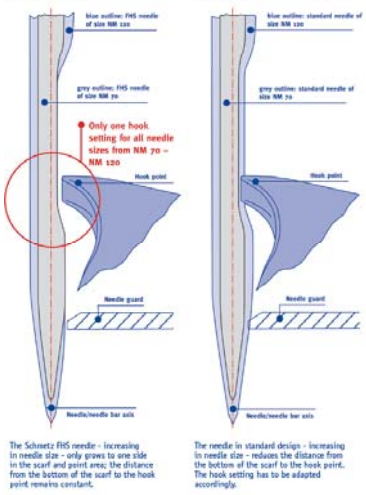
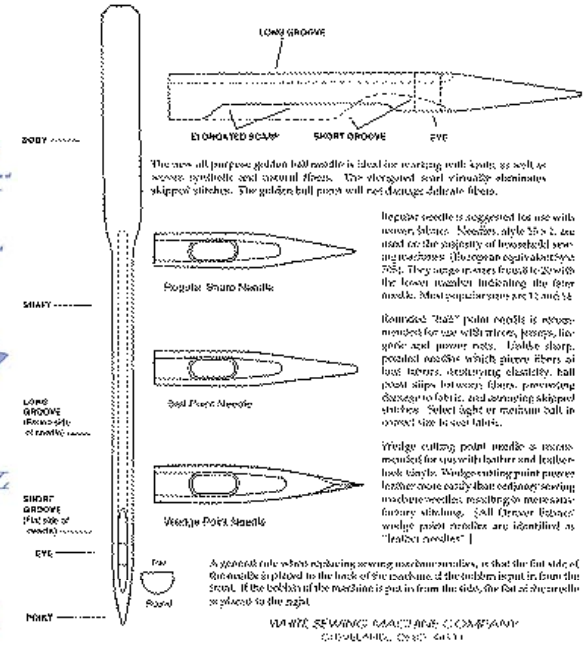


Fig. 5–12. Some types of needle points. (Courtesy Union Special Machine Co.)



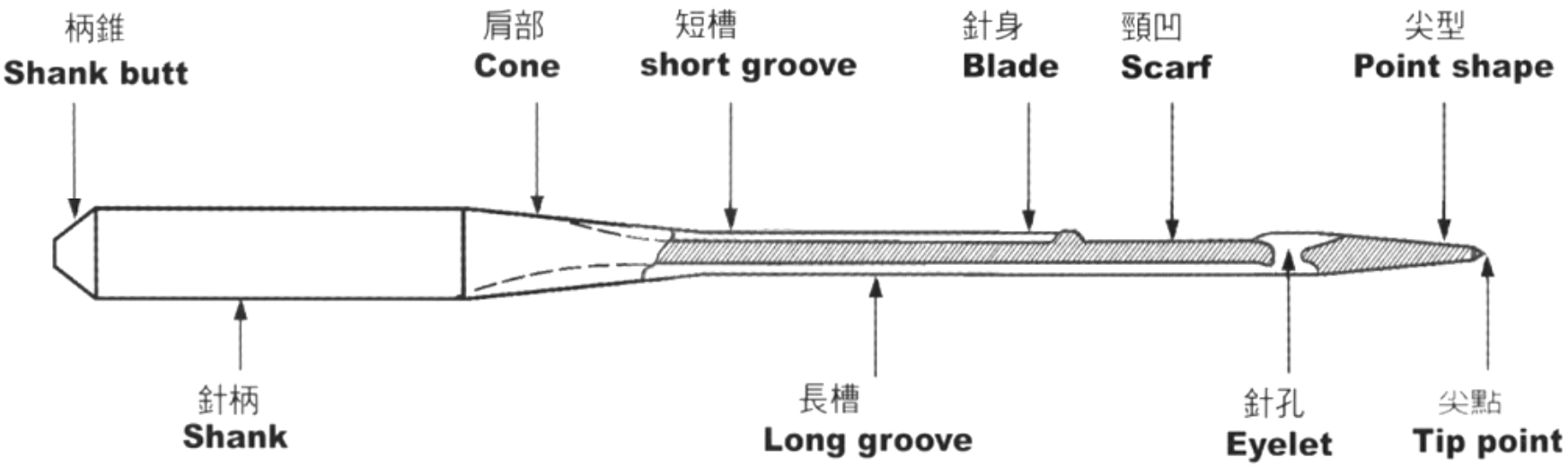
The Schmetz FHS needle - increasing in needle size - only grows to one side in the scarf and point area; the distance from the bottom of the scarf to the hook point remains constant.

The needle in standard design - increasing in needle size - reduces the distance from the bottom of the scarf to the hook point. The hook setting has to be adapted accordingly.



Needle

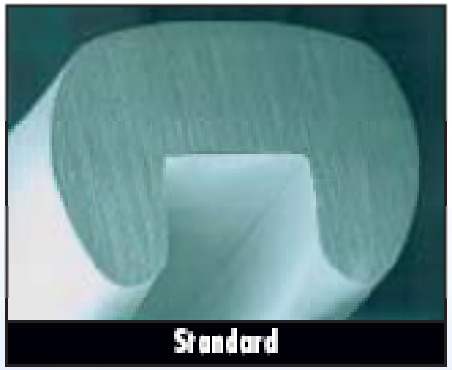
車針主要部位名稱 / Needle positions description

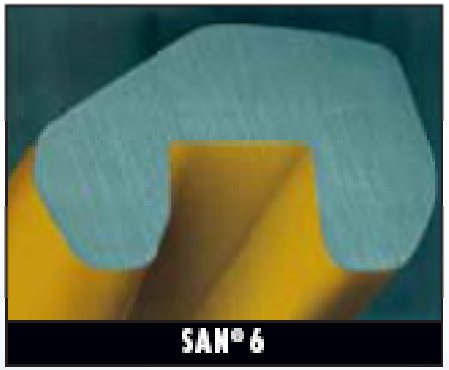


Needles are mechanical strain for buckling and bending

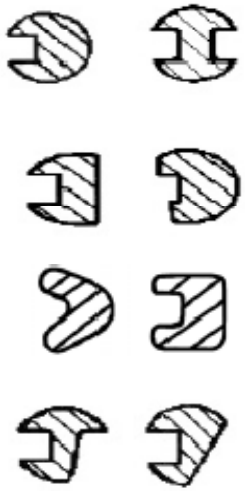
SCARF CROSS SECTION

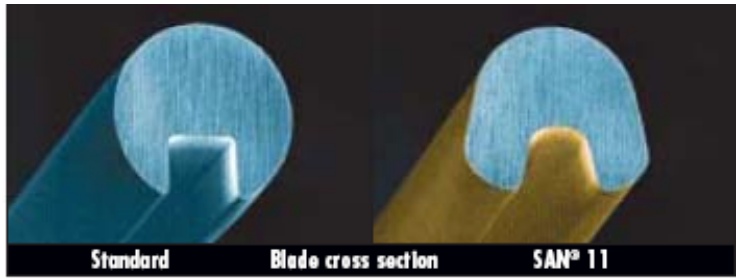
The special shape of the scarf cross section gives the SAN® 6 needle a higher stability in the scarf area. The lateral chamfer on the scarf protecs the looper point from being damaged.

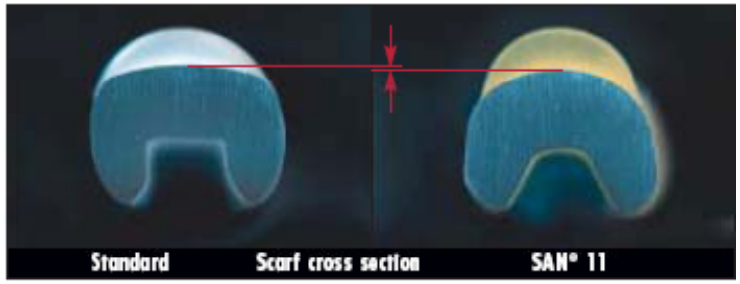




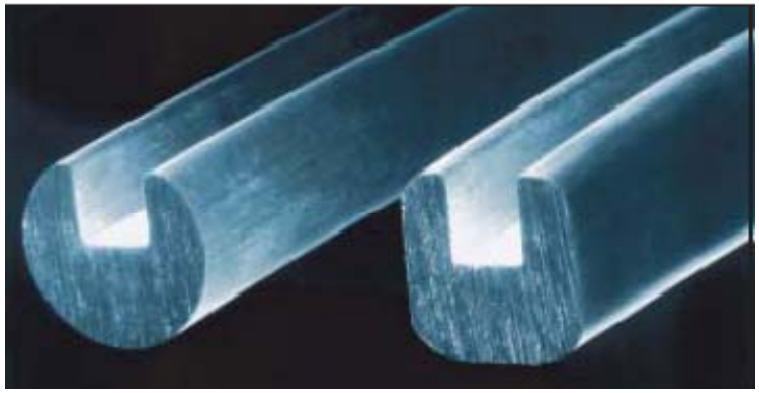
Scarf cross section







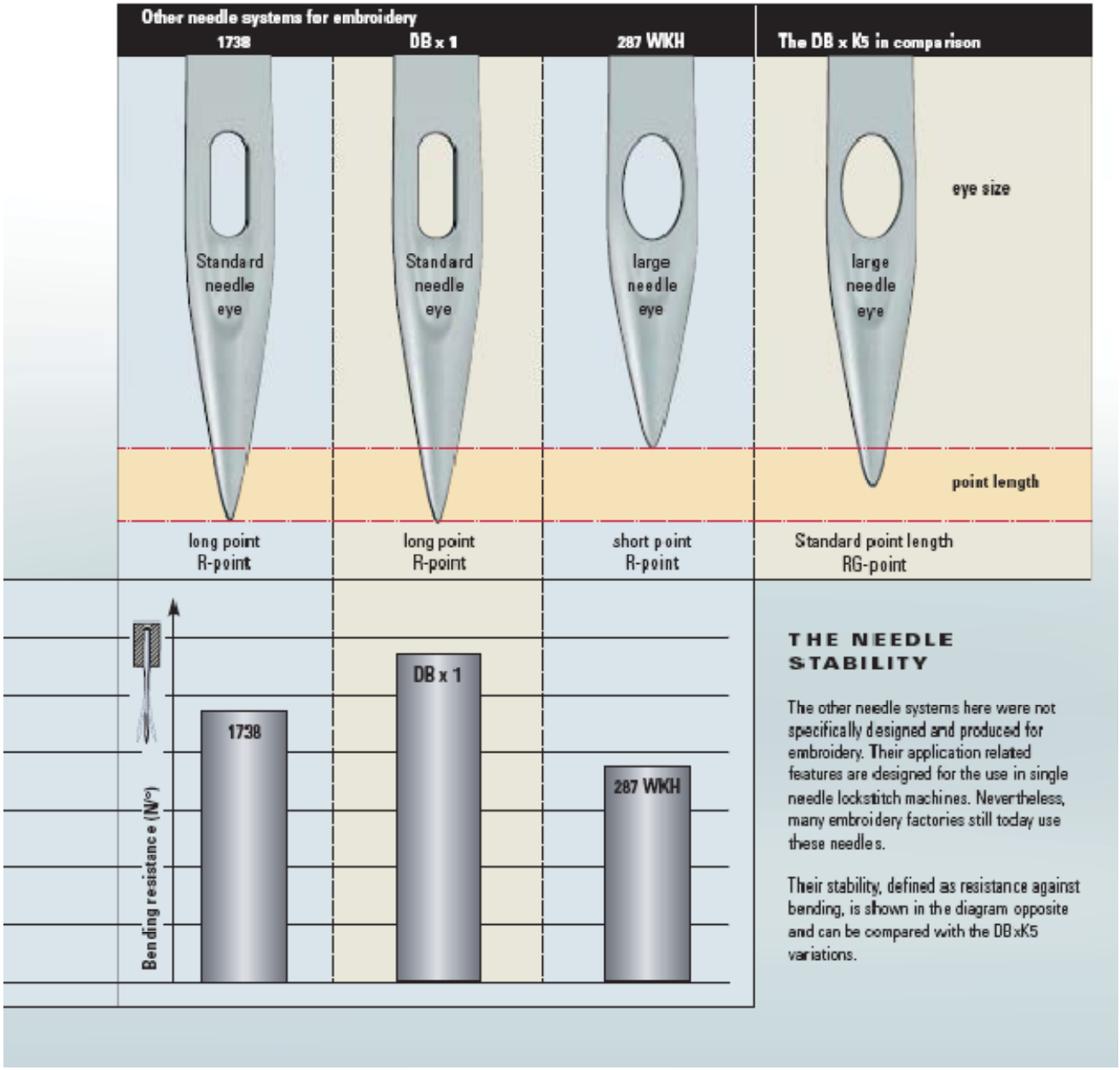
$$F_{cr} = \frac{\pi^2 E J_y}{4 l^2}$$

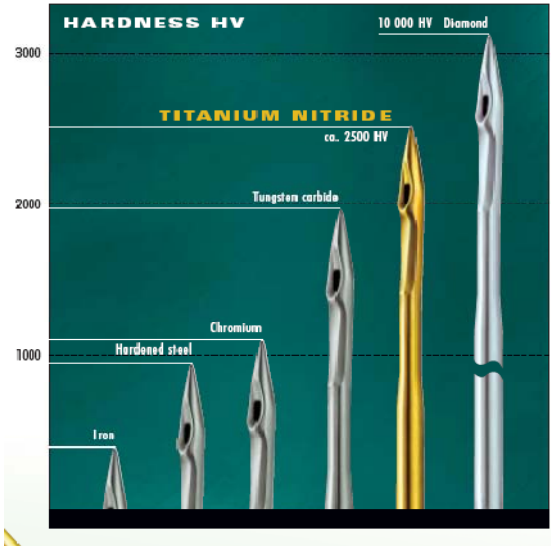


$F_{c.}$ …critical force

J_y …central moment of inertia

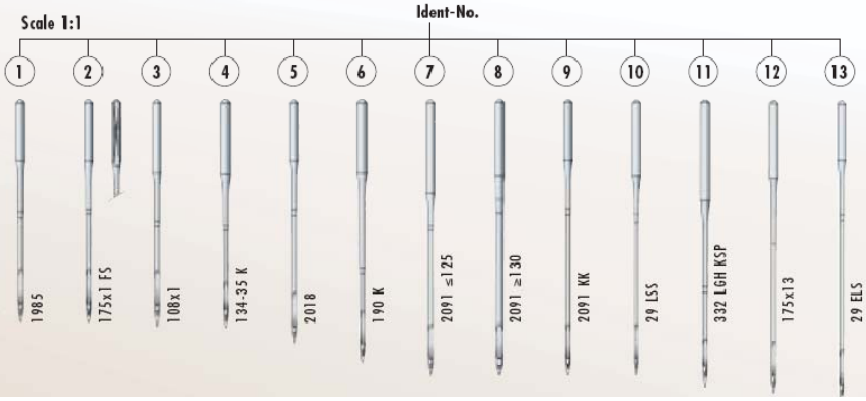
E…..Young‘s modulus of elasticity


Other needle systems for embroidery
1738
DB x 1
287 WKH
The DB x K5 in comparison
Standard needle eye
Standard needle eye
large needle eye
large needle eye
eye size
point length
long point R-point
long point R-point
short point R-point
Standard point length RG-point
Bending resistance (N°)
1738
DB x 1
287 WKH
THE NEEDLE STABILITY
The other needle systems here were not specifically designed and produced for embroidery. Their application related features are designed for the use in single needle lockstitch machines. Nevertheless, many embroidery factories still today use these needles.
Their stability, defined as resistance against bending, is shown in the diagram opposite and can be compared with the DBxK5 variations.


HARDNESS HV
10 000 HV Diamond
3000
TITANIUM NITRIDE
ca. 2500 HV
2000
Tungsten carbide
Chromium
1000
Hardened steel
Iron

PROGRAM BUTTON SEWING NEEDLES:

System	Size-Range	Ident-No.	GB-designation
29 ELS	100 - 130	13	517.174 AC01 RG
29 L	60 - 125	7	470.174 AC01 RG
29 L	130 - 150	8	470.174 AC01 RG
29 LES	60 - 150	9	470.174 AC02 RG
29 LSS	60 - 125	10	470.174 AC03 RG
29 LSS	130 - 150	8	470.174 AC01 RG
29 S	60 - 150	1	371.174 AC01 RG
108 x 1	60 - 140	3	373.163 AC02 RG
108 x 3 FFG	60 - 140	3	373.163 AC02 RG
134 - 35 K	50 - 200	4	381.200 AC02 RG
175 x 1	60 - 150	1	371.174 AC01 RG
175 x 1 FR	60 - 150	2	371.174 AC02 RG
175 x 1 FS	60 - 150	2	371.174 AC02 RG
175 x 3	60 - 150	5	412.174 AC01 RG
175 x 5	60 - 150	1	371.174 AC01 RG
175 x 7	60 - 125	7	470.174 AC01 RG
175 x 7 KK	60 - 150	9	470.174 AC02 RG
175 x 9	60 - 125	10	470.174 AC03 RG
175 x 9	130 - 150	8	470.174 AC01 RG
175 x 13	100 - 140	12	502.174 AC01 RG
175 x 15	60 - 125	7	470.174 AC01 RG
175 x 15	130 - 150	8	470.174 AC01 RG
175 x 25	100 - 140	12	502.174 AC01 RG
175 x 31	60 - 150	5	412.174 AC01 RG
175 x 33	60 - 150	5	412.174 AC01 RG
178 H	60 - 150	5	412.174 AC01 RG
190 K	60 - 140	6	445.200 AC02 RG
332 LGH KSP	90 - 140	11	485.198 AC02 RG
1661	60 - 150	1	371.174 AC01 RG
1661 ELG	60 - 125	10	470.174 AC03 RG
1661 ELG	130 - 150	8	470.174 AC01 RG
1661 EXT LG	60 - 125	10	470.174 AC03 RG
1661 EXT LG	130 - 150	8	470.174 AC01 RG
1661 LG	60 - 150	5	412.174 AC01 RG
1661 M	60 - 150	1	371.174 AC01 RG
1985	60 - 150	1	371.174 AC01 RG
1985 SAN® 1	60 - 150	2	371.174 AC02 RG
1986	60 - 150	5	412.174 AC01 RG
1987	60 - 125	10	470.174 AC03 RG
2018	60 - 150	5	412.174 AC01 RG
2091	60 - 125	7	470.174 AC01 RG
2091	130 - 150	8	470.174 AC01 RG
2091 K	60 - 125	7	470.174 AC01 RG
2091 K	130 - 150	8	470.174 AC01 RG
2091 KK	60 - 150	9	470.174 AC02 RG
2091 LGK	60 - 125	7	470.174 AC01 RG
2091 LGK	130 - 150	8	470.174 AC01 RG
2134 - 35 K	50 - 200	4	381.200 AC02 RG
SY 2851	60 - 150	1	371.174 AC01 RG
SY 2852	60 - 150	1	371.174 AC01 RG
SY 3049	60 - 140	3	373.163 AC02 RG
SY 4051	60 - 150	5	412.174 AC01 RG
SY 4052	60 - 150	5	412.174 AC01 RG
SY 4531	60 - 125	7	470.174 AC01 RG
SY 4531	130 - 150	8	470.174 AC01 RG
SY 4533	60 - 125	10	470.174 AC03 RG
SY 4533	130 - 150	8	470.174 AC01 RG
SY 4536	60 - 125	7	470.174 AC01 RG
SY 4536	130 - 150	8	470.174 AC01 RG
SY 4538	60 - 125	10	470.174 AC03 RG
SY 4538	130 - 150	8	470.174 AC01 RG
SY 4539	60 - 125	7	470.174 AC01 RG
SY 4539	130 - 150	8	470.174 AC01 RG
SY 4631	100 - 140	12	502.174 AC01 RG
SY 4632	100 - 140	12	502.174 AC01 RG
SY 7226	50 - 200	4	381.200 AC02 RG
SY 7585	60 - 150	9	470.174 AC02 RG
SY 7586	60 - 150	9	470.174 AC02 RG
SY 7587	60 - 150	9	470.174 AC02 RG
SY 7700	100 - 130	13	517.174 AC01 RG
SY 8138	60 - 150	5	412.174 AC01 RG
SY 8661	60 - 150	5	412.174 AC01 RG
SY 8662	60 - 150	5	412.174 AC01 RG
SY 8701	50 - 200	4	381.200 AC02 RG
SY 8724	60 - 150	1	371.174 AC01 RG
SY 8727	60 - 150	5	412.174 AC01 RG
SY 8728	60 - 125	7	470.174 AC01 RG
SY 8728	130 - 150	8	470.174 AC01 RG
BQ x 1	60 - 140	3	373.163 AC02 RG
DP x 35 K	50 - 200	4	381.200 AC02 RG
LS x 18	60 - 125	10	470.174 AC03 RG
LS x 18	130 - 150	8	470.174 AC01 RG
MT x 190 K	60 - 140	6	445.200 AC02 RG
TQ x 1	60 - 150	1	371.174 AC01 RG
TQ x 3	60 - 150	5	412.174 AC01 RG
TQ x 5	60 - 150	1	371.174 AC01 RG
TQ x 7	60 - 125	7	470.174 AC01 RG
TQ x 7	130 - 150	8	470.174 AC01 RG
TQ x 9	60 - 125	10	470.174 AC03 RG
TQ x 9	130 - 150	8	470.174 AC01 RG
TQ x 13	100 - 140	12	502.174 AC01 RG
TQ x 14 N	60 - 150	9	470.174 AC02 RG

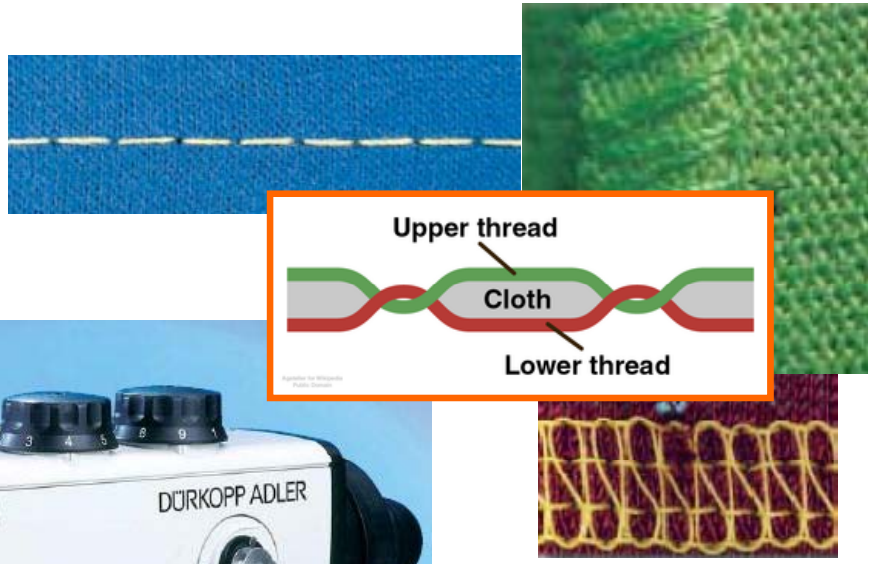


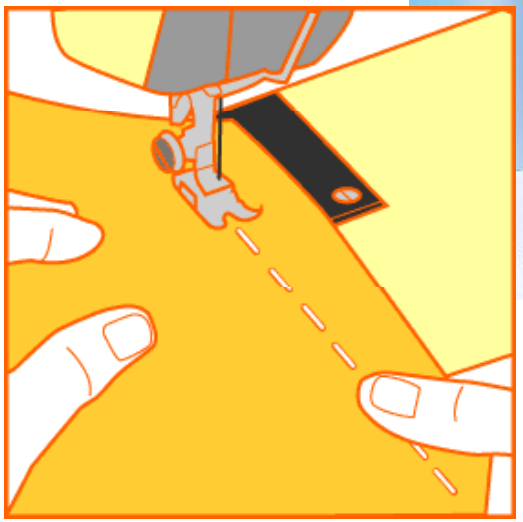
PROGRAM - NEEDLE SYSTEM 118:

Variation	Blade/Grooves	Looper-contact area	Point	Application
118 GAS*	• double groove • no scarf	• close looper adjustment not possible	RG	For fine and medium knitted fabrics and for woven cloth. For uncritical sewing threads with low elasticity.
118 GAS FFG	• like GAS, but with ball point	• like GAS	FFG	For coarser knitted structures and for superelastic fabrics.
118 GKS*	• double groove • with scarf	• for closest looper adjustment • safe loop pick-up • avoidance of skipping	RG	Universal application for fine and medium knitted fabrics. For texturised sewing threads.
118 SAN® 10	• double groove • tapered blade • scarf providing hook protection	• like GKS • high stability • fabric protection	RG	For fine and critical to sew knitted fabrics and for woven cloth.
118 GKS FFG	• like GKS, but with ball point	• like GKS	FFG	For fine and medium knitted fabrics and for woven cloth.
118 GBS*	• one groove only • with scarf	• sturdier needle, but higher thread tension required	RG	For fine and medium knitted and woven fabrics. Reduced deflection on cross-seams.
118 GHS*	• like GBS, but with ball point	• like GBS	FFG	For coarser knitted structures and for high elastic fabrics. Reduced deflection on cross-seams.
36211	• without eye	• blind needle	RG	Holds the bobbin thread during stitch formating and prevents lateral forces to the needle.

*also available in GEBEDUR®-Version.

Stitch types

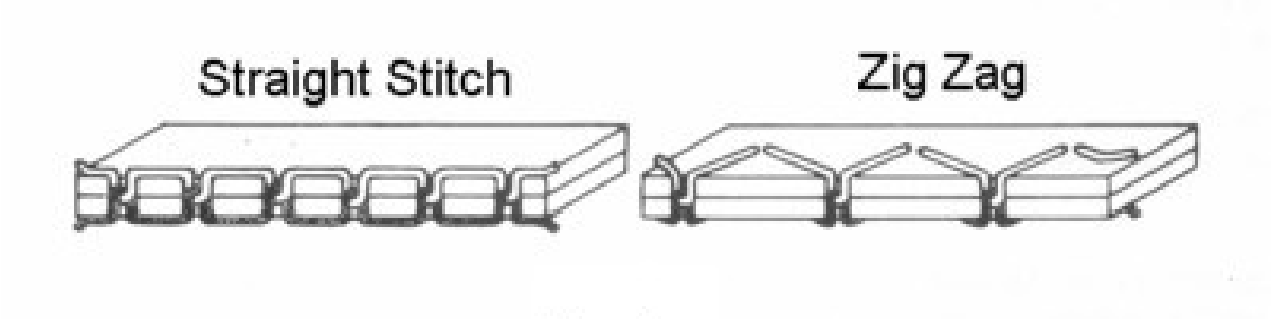


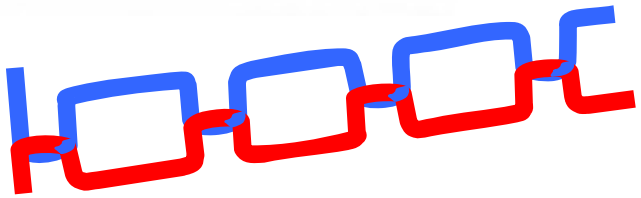


Stitch

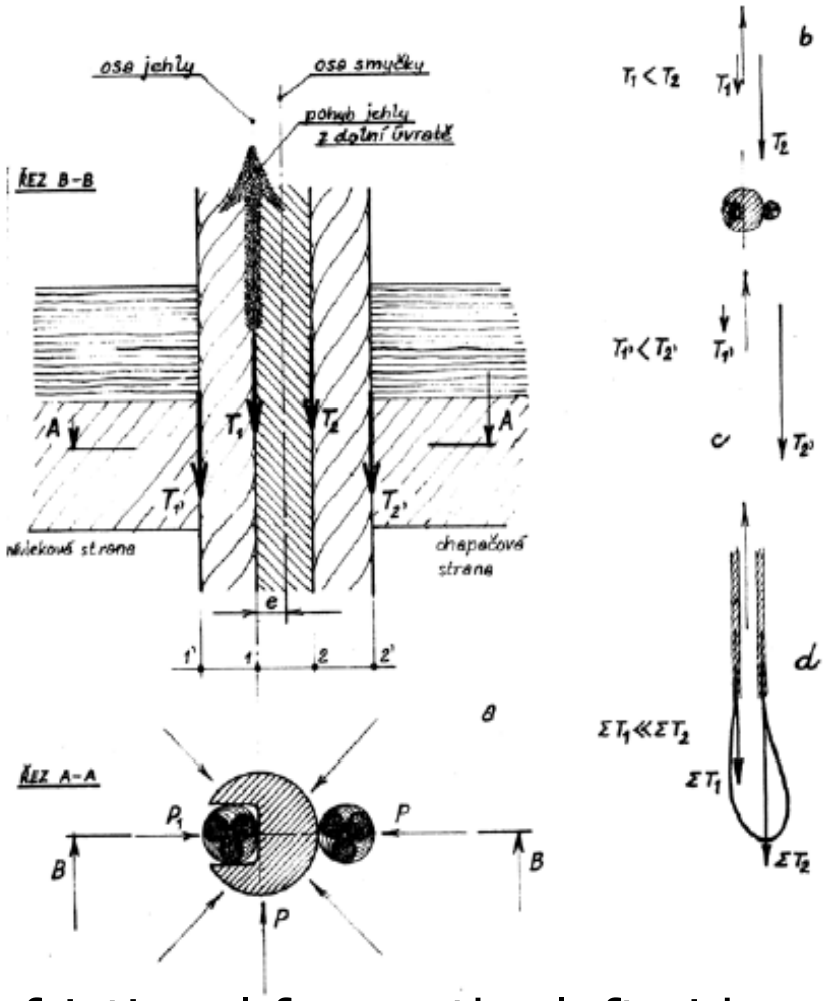
Definitions:

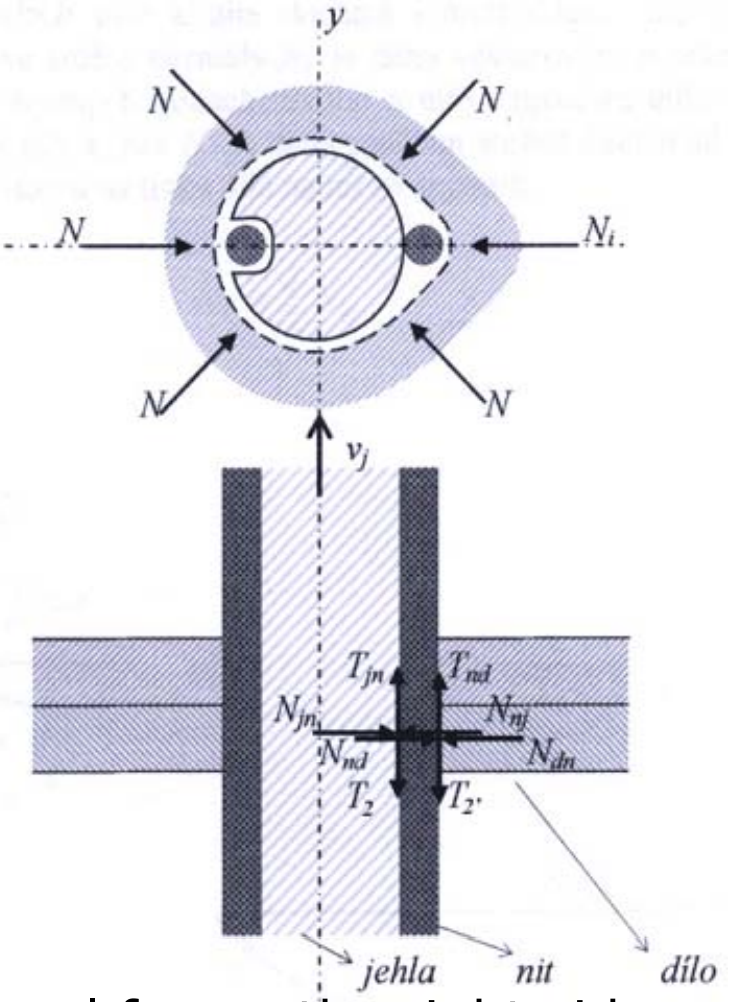
One unit of conformation resulting from one or more strands or loops of thread intralooping, interlooping or passing into or through material





Theoretical analysis of sewing process



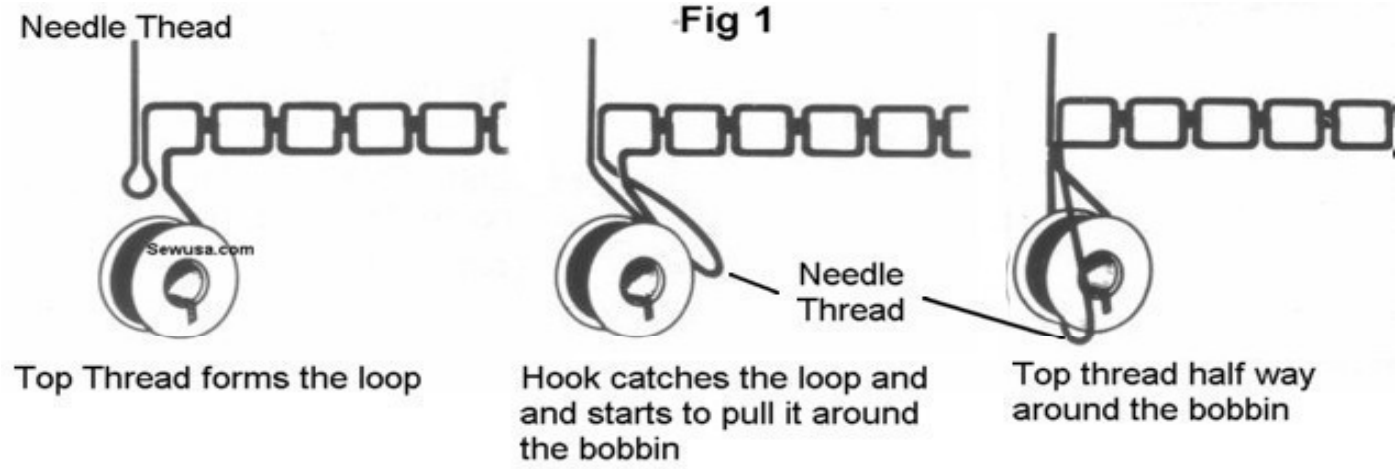


Σ frictional forces the left side << Σ frictional forces the right side

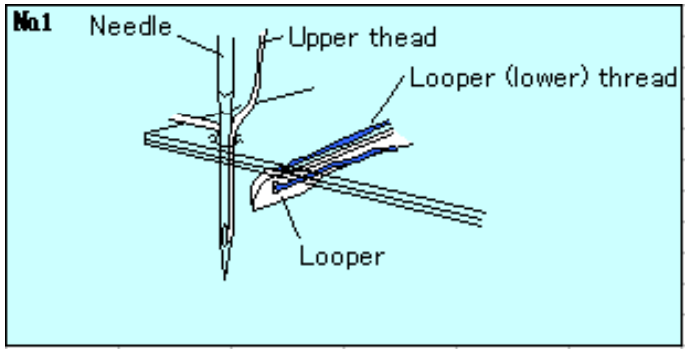
(long groove) **(scarf)**

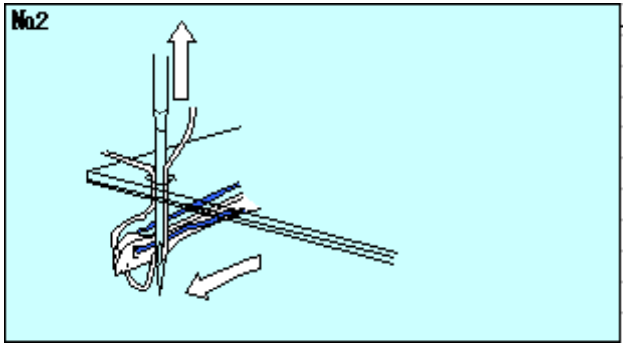
result is loop on the right side

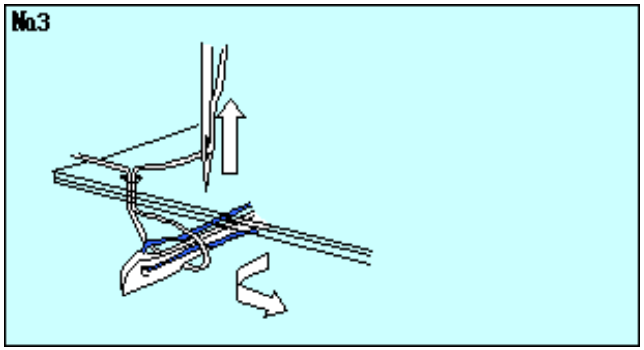
Creation of stitch - lockstitch

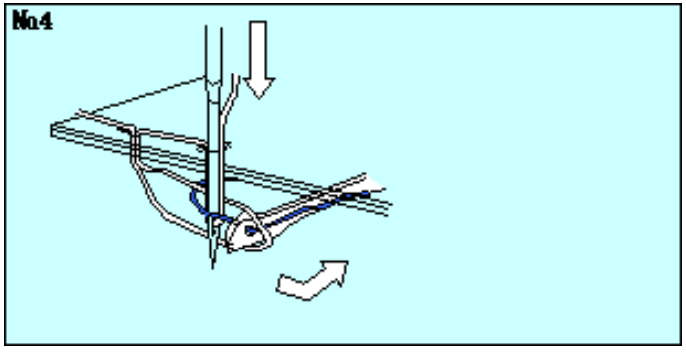


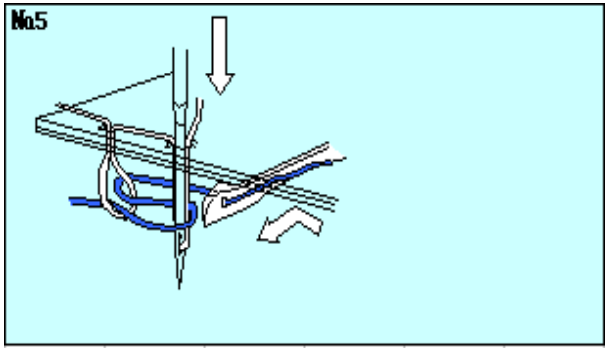
Creation of stitch - chainstitch

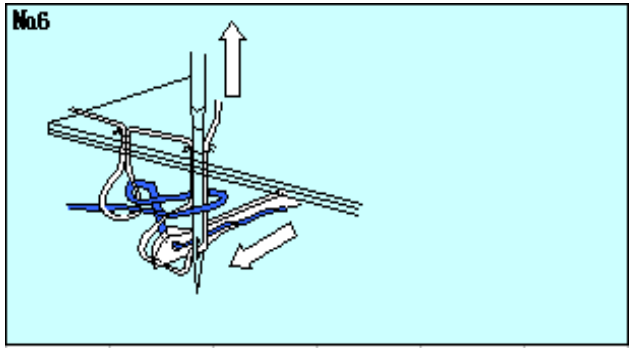










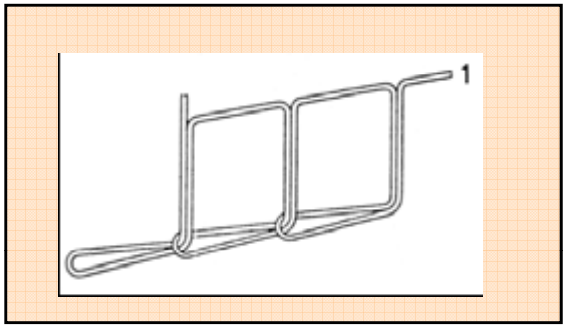


Stitch types – ISO 4915

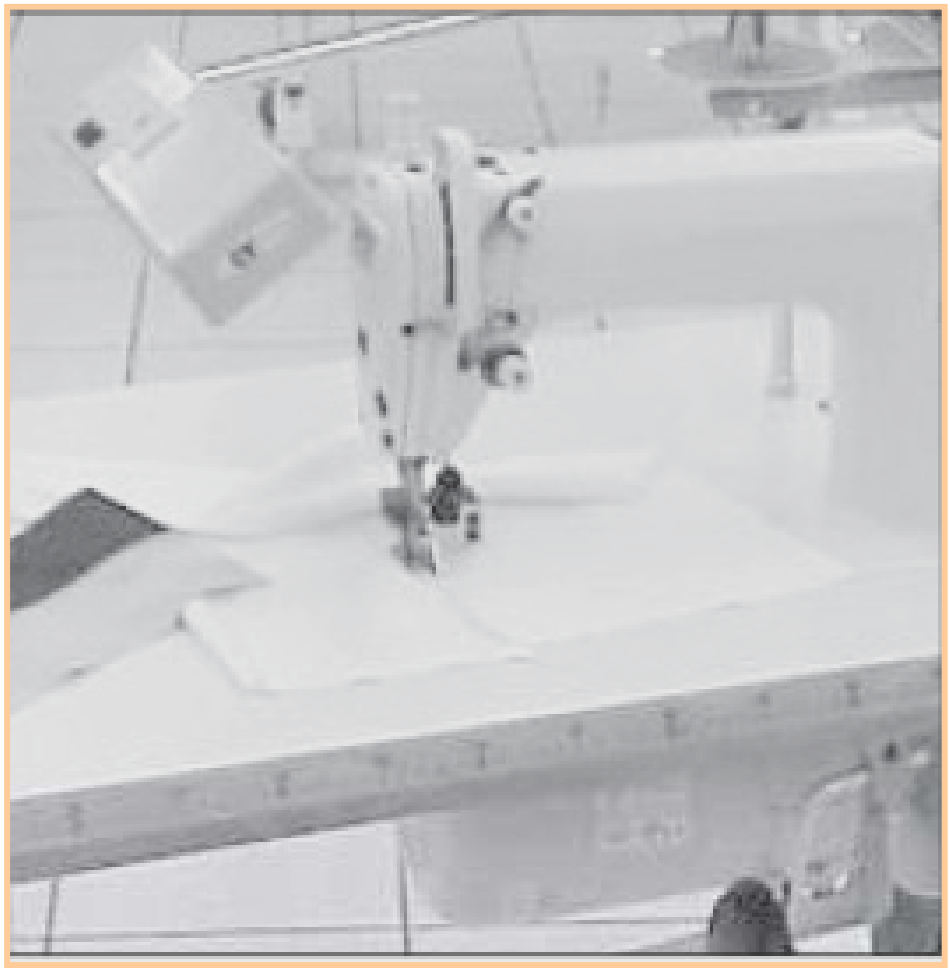
Stitch types are divided into six classes.The characteristics of these classes are indicated below.

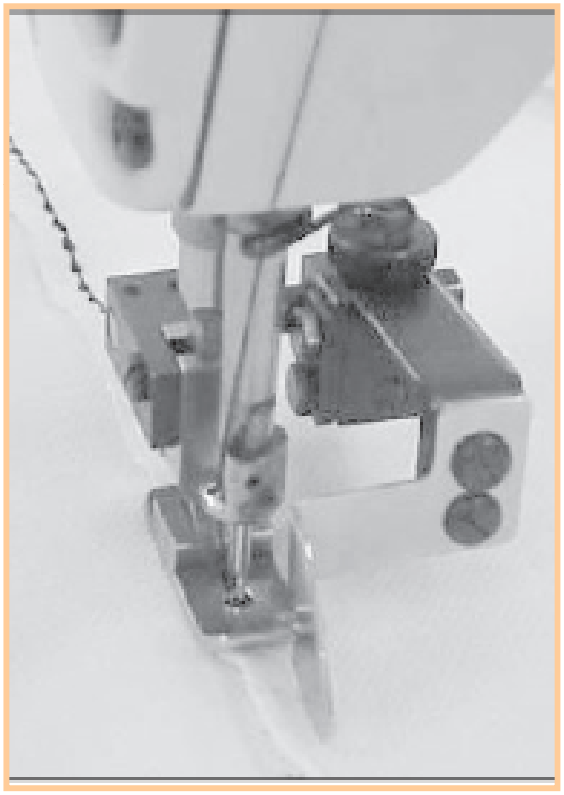
Class 100 – Chain stitches

In this class, stitch types are formed with one or more needle threads, and are characterized by intralooping. One or more loops of thread are passed through the material and secured by intralooping with a succeeding loop or loops after they are passed through the material.



Class 100 – sewing machine

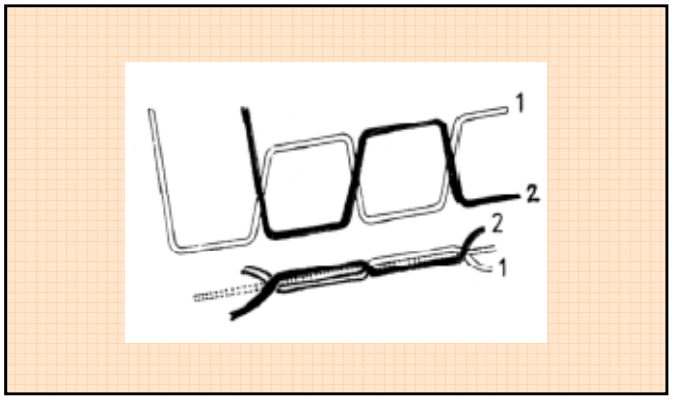




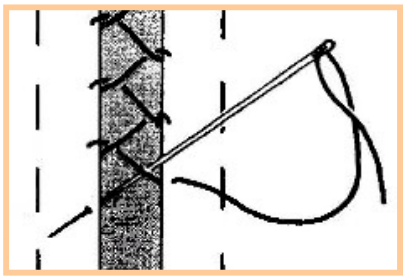
Stitch types – ISO 4915

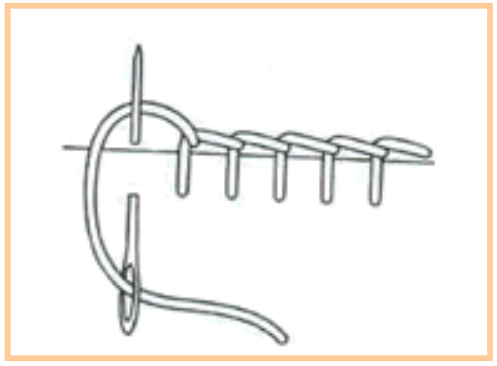
Class 200 – Originated as hand stitches

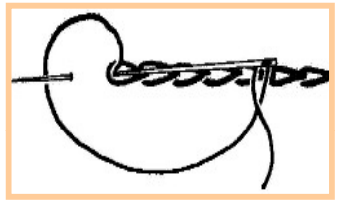
In this class, stitch types which originated as handstitches are characterized by a single thread, which is passed through the material as a single line of thread and the stitch is secured by the single line of thread passing in and out of the material.

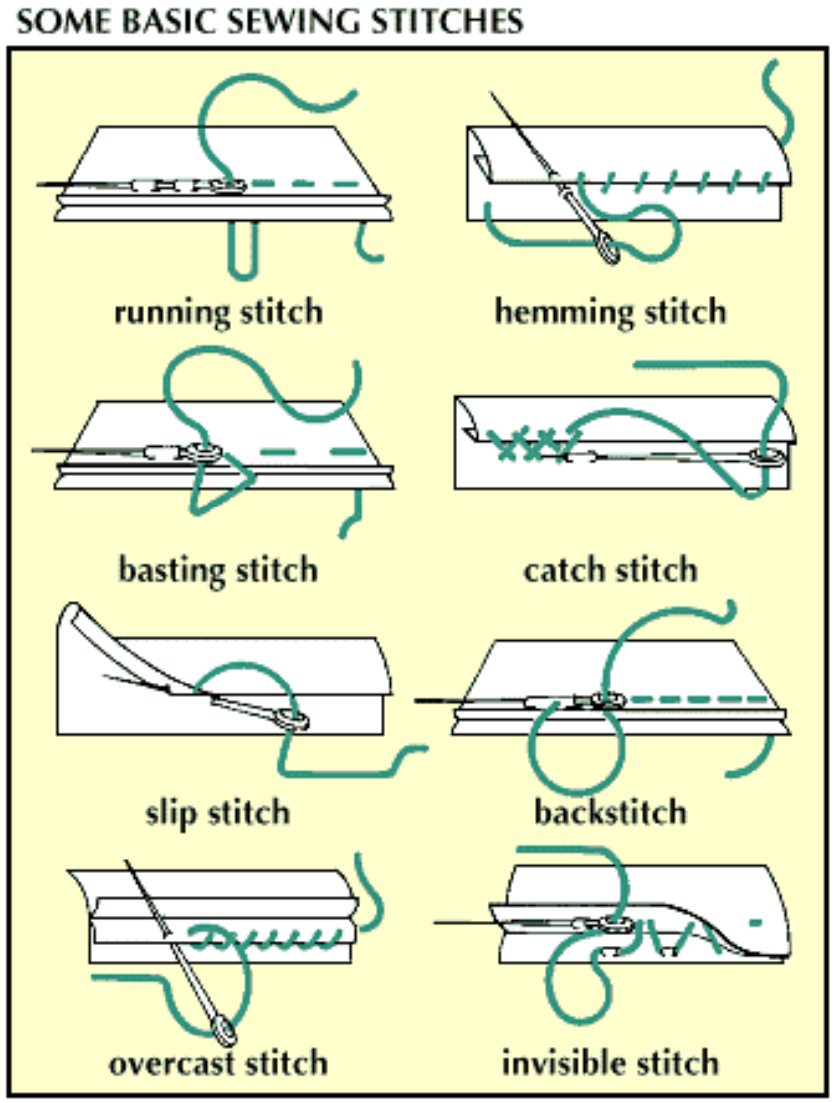


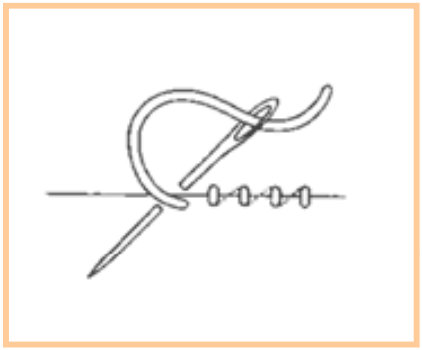
Class 200







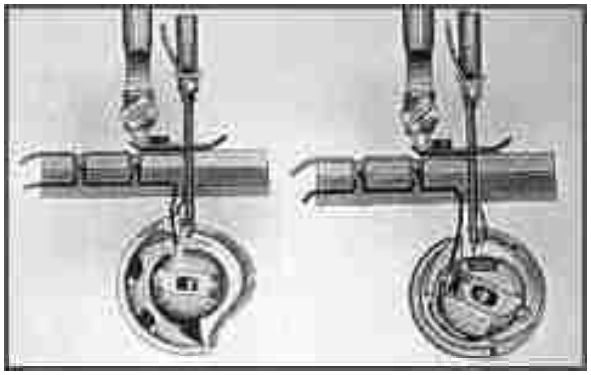

SOME BASIC SEWING STITCHES
running stitch
hemming stitch
basting stitch
catch stitch
slip stitch
backstitch
overcast stitch
invisible stitch

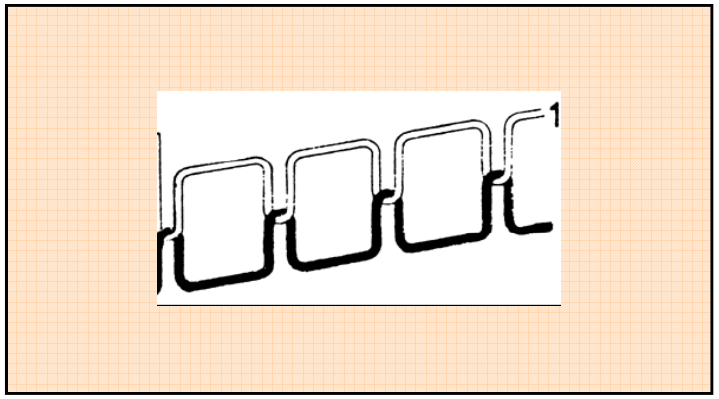


Stitch types – ISO 4915

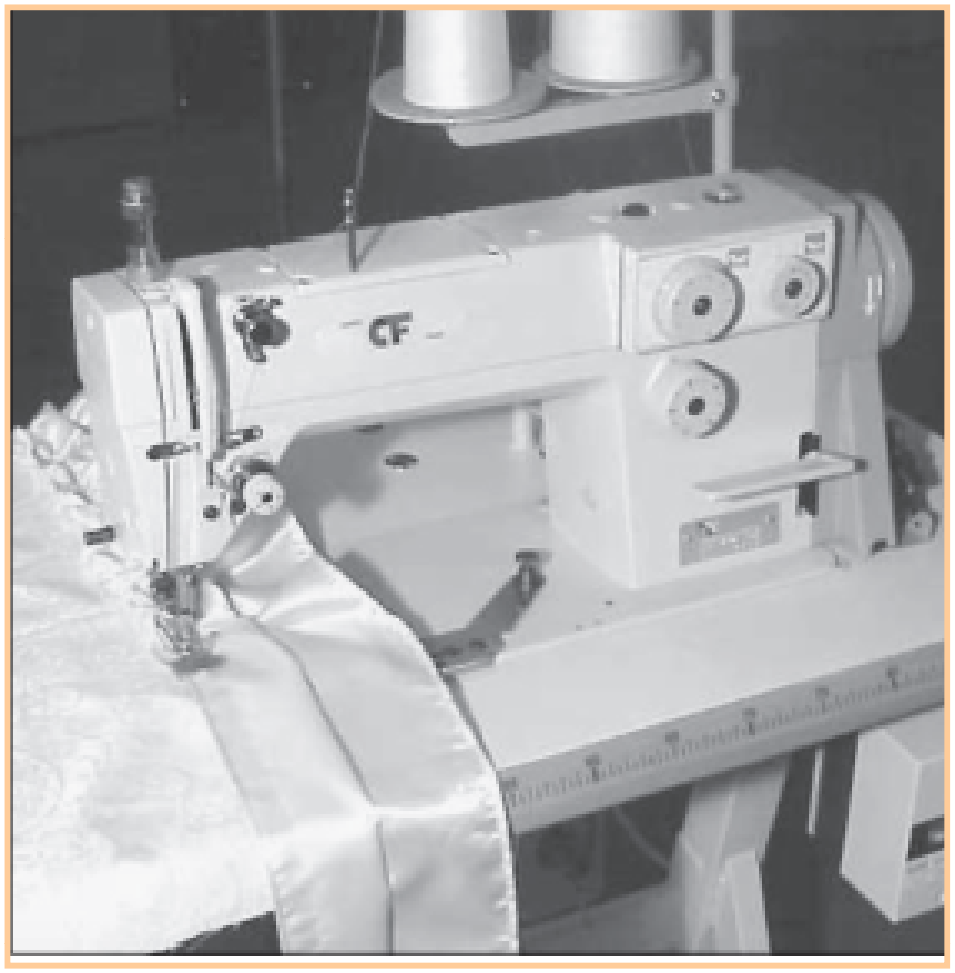
Class 300 – Lockstitches

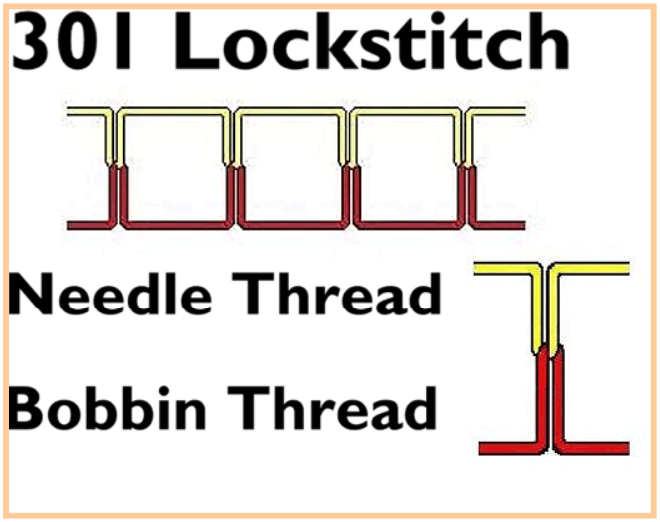
In this class, stitch types are formed with two or more groups of threads, and have for a general characteristicthe interlacing of the two or more groups. Loops of one group are passed through the material and are secured by the thread or threads of a second group.





Class 300 – sewing machine

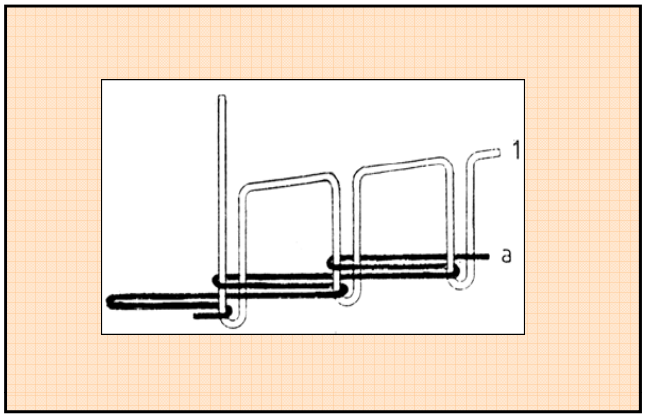




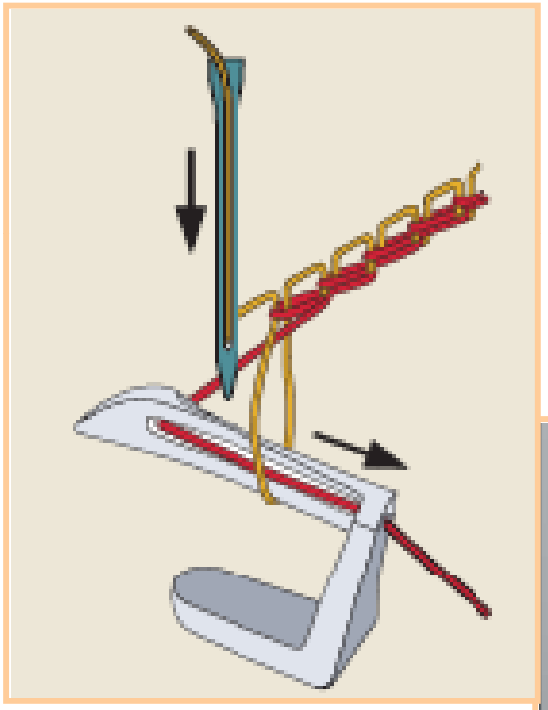
Stitch types – ISO 4915

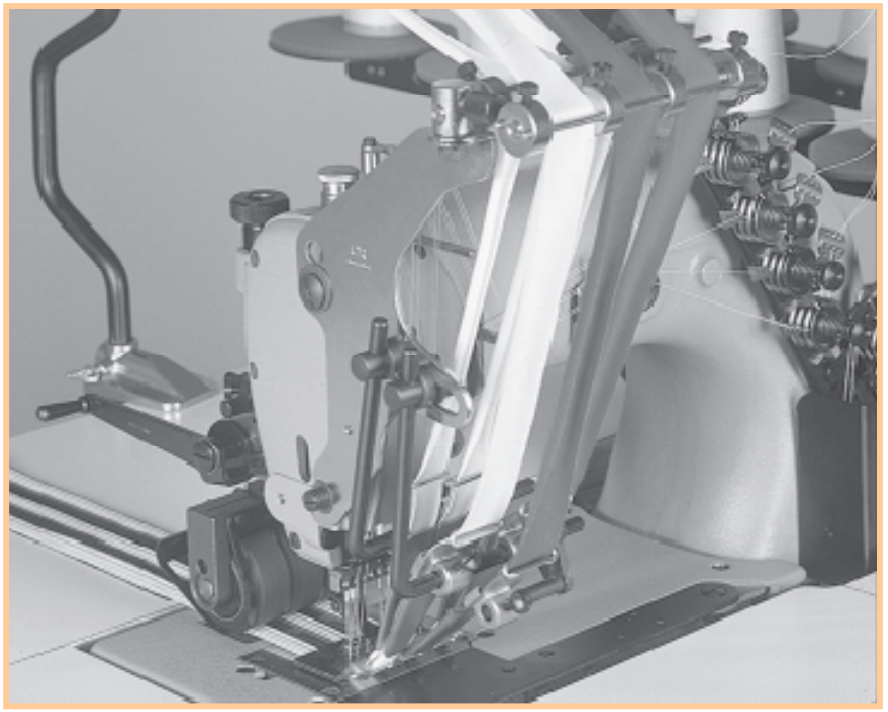
Class 400 – Double-thread chain stitches

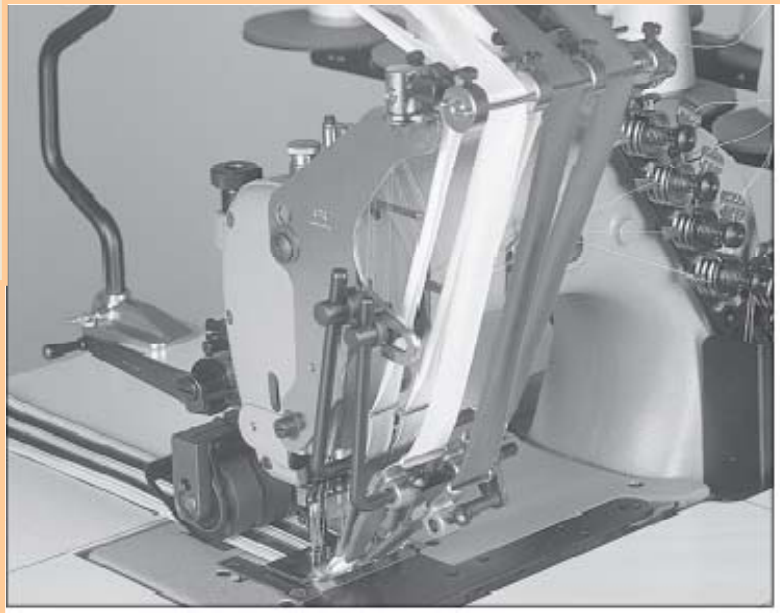
In this class, stitch types are formed with two or more groups of threads, and have for a general characteristic the interlooping of the two groups. Loops of one group of threads are passed through the material and are secured by interlacing and interlooping with loops of another group.

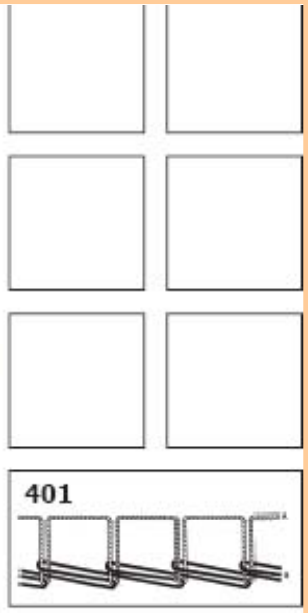


Class 400 – sewing machine





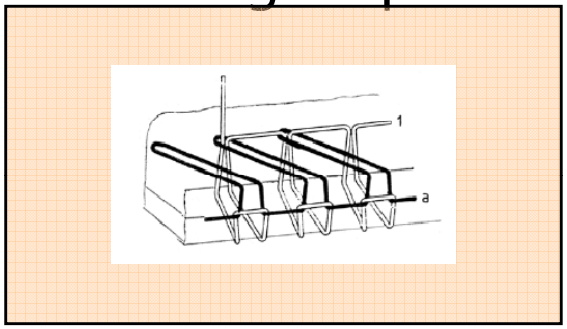




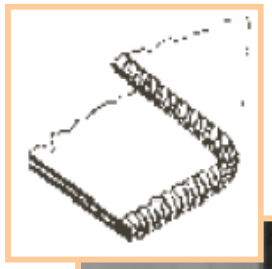
Stitch types – ISO 4915

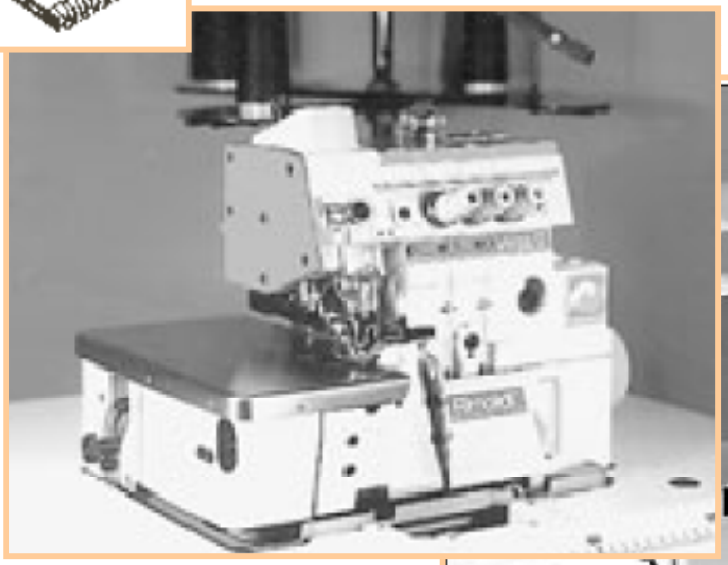
Class 500 – Overedge chain stitches

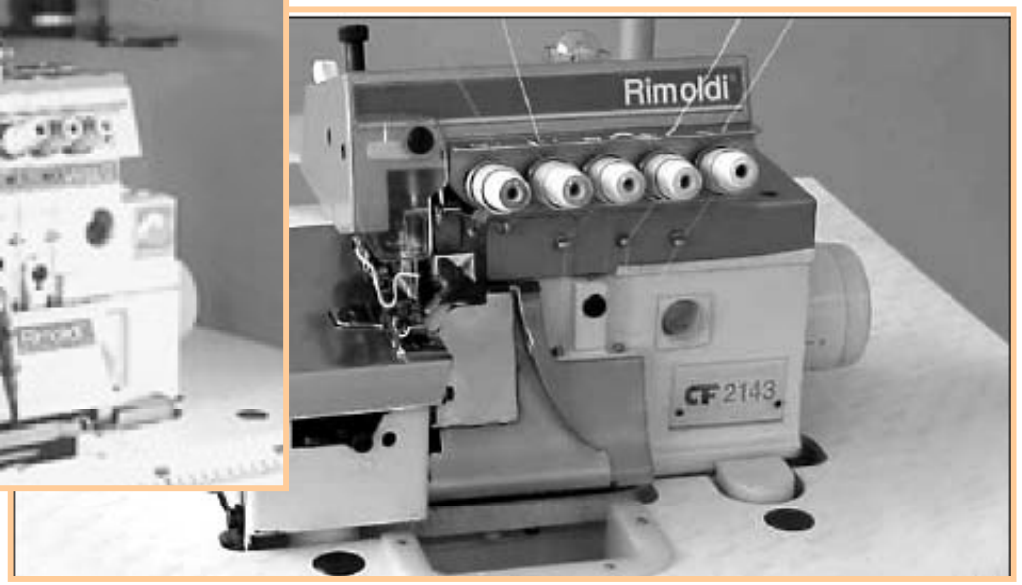
In this class, stitch types are formed with one or more groups of threads, and have for a general characteristic that loops from at least one group of thread pass around the of the material. Loops of one group of threads are passed through the material and are secured by intralooping before succeeding loops are passed through the material, or secured by interlooping with loops of one or more interlooped groups of threads before succeeding groups of the first group are passed through the material.

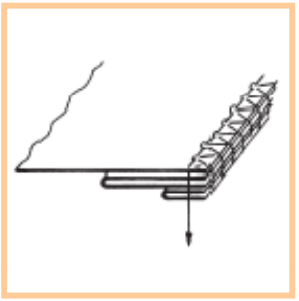


Class 500 – sewing machine





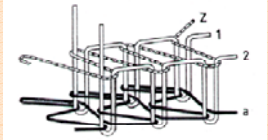




Stitch types – ISO 4915

Class 600 – Covering chain stitches

In this class, stitch types are formed with three or more groups of threads, and have for a general characteristic that two of the groups cover surfaces of the material. Loops of the first group of thread are passed through loops of the third group already on the surface of the material and then through the material where they are interlooped with loops of the second group of thread on the underside of the material. The one exception to this procedure is stitch type 601 where only two groups of threads are used and the function of the third group performed by one of the threads in the group.



Class 600 – sewing machine