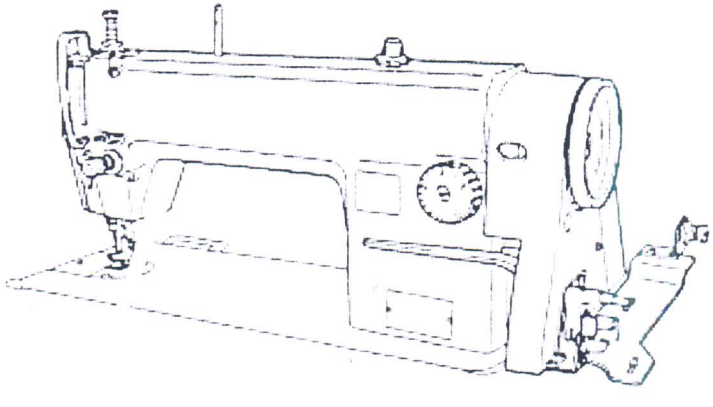
HENDERSON
Sewing Machine Co.
SERVICE OUR No 1 PRODUCT

BASIC KNOWLEDGE OF SEWING



HENDERSON
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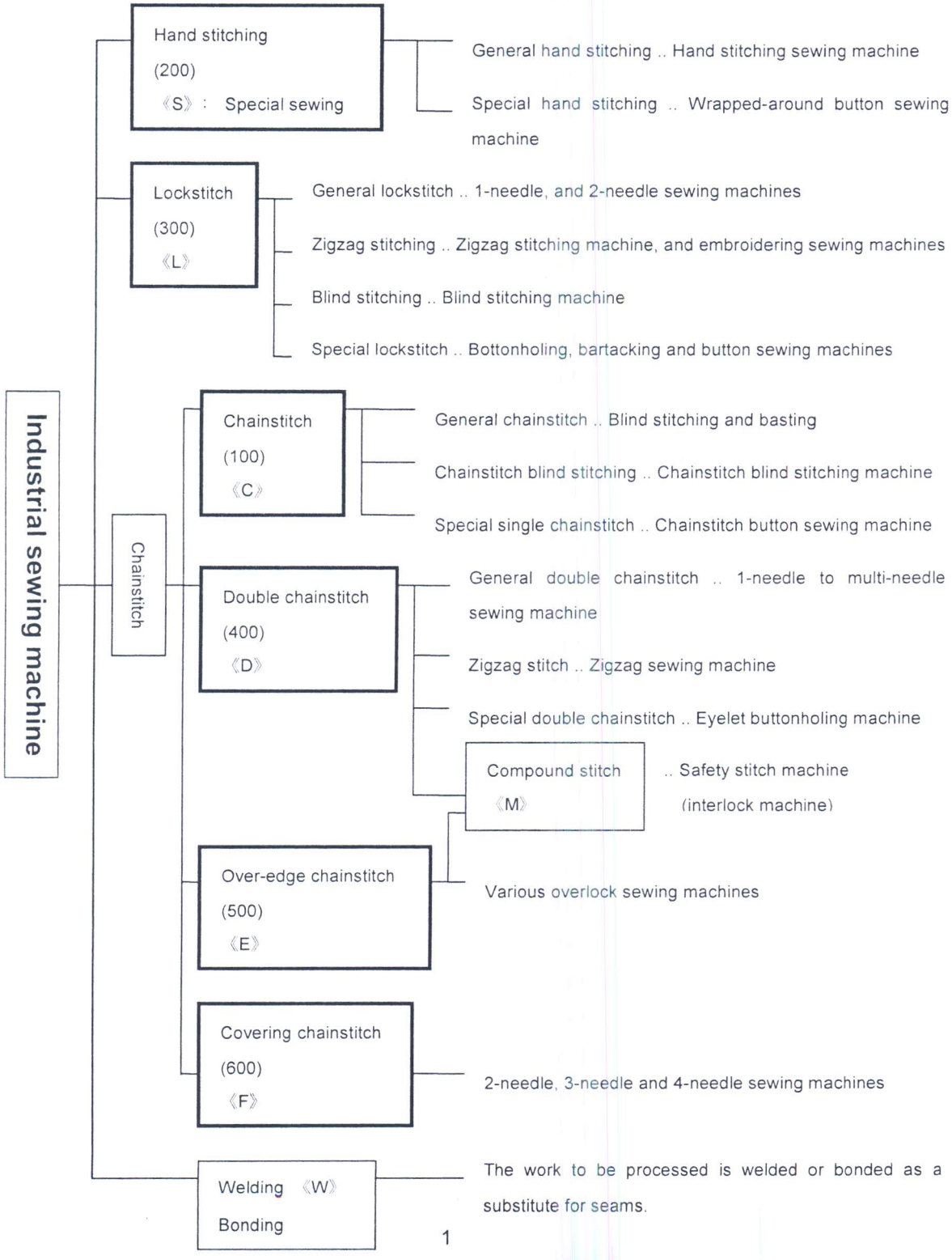
【CONTENTS】

I) Classification of the industrial sewing machine

- Mark (class) of classification of the stitch type based on JIS L0120 : ( ) 6 classes
- Mark of large classification (stitch style) of classification of the industrial sewing machine based on JIS B9070 : 《 》 8 classes ⇒medium classification (application), small classification (shape of machine bed)



Ⅱ) Kind of the stitch

1. Classification of stitch (stitch type) based on JIS L0120 <Table Ⅱ-1>

Class	Stitch type	Number of subdivided classes
100	Chainstitch	7
200	Hand stitch	13
300	Lockstitch	27
400	Double chainstitch	17
500	Over-edge chainstitch	15
600	Covering chainstitch	9

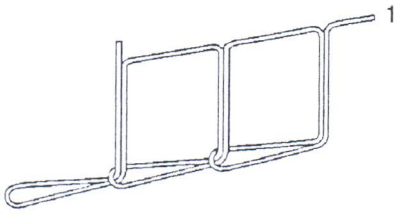
The stitch is sorted by 6 classes and each class is subdivided. Number of subdivided classes is 88 in total.

2. Stitch type and the feature

1) Chainstitch

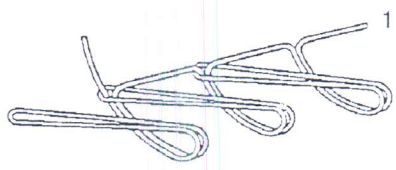
① Example of stitch formation

JIS mark 101 ... Chainstitch



<Fig. Ⅱ-1>

JIS mark 103 ... Blindstitch



<Fig. Ⅱ-2>

② Feature

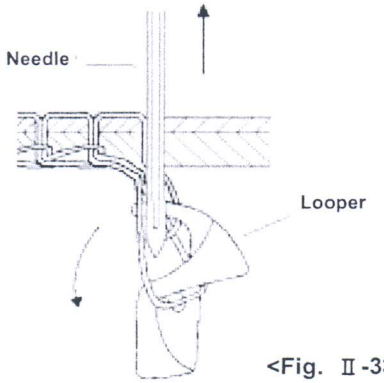
A piece of thread is interlaced like a chain under the cloth and the stitches are formed as knitted.

The constructive feature is that the stitches are untied one after another when the interlacement at the end of sewing comes off.

③ Application

Basting (ML-111), button sewing (AMB-189N), (MB-377), chainstitch buttonholing (MBH-180S), blindstitch and closing of bag opening

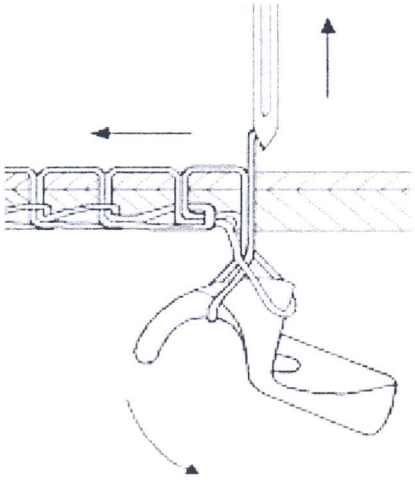
④ Stitch formation



<Fig. Ⅱ-3>

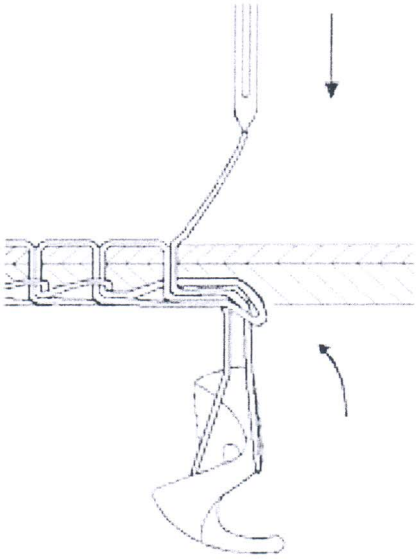
a : Needle thread slacks at the position where needle slightly goes up from its lowest position, and looper catches the needle thread which has become like a loop.

Also, the needle enters the circle of needle thread which is widened by the looper.



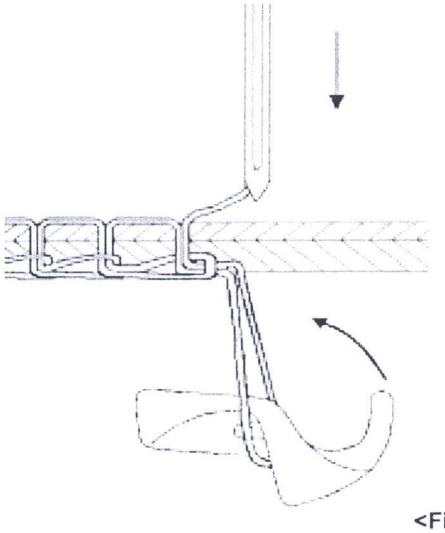
b : Needle comes off the cloth and the cloth is fed. Looper rotates and removes the thread which the looper caught before while pulling in the needle thread. Needle bar continues going up and needle thread take-up lever lifts the thread.

<Fig. Ⅱ4>



c : Looper continues rotating and pulls in the thread in the center of the looper and thread take-up lever tightens the thread which the looper removed before.

<Fig. Ⅱ-5>



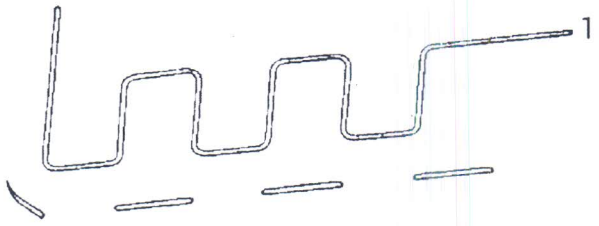
d : Cloth feed is finished and a stitch is formed. Needle penetrates the cloth to continue to next stitch, a : .

<Fig. Ⅱ-6>

2) Hand stitch machine

① Example of stitch formation

JIS mark 209 ... Hand stitch



<Fig. Ⅱ-7>

② Feature

Same stitch as that of hand stitch is formed by a piece of thread. Thread is drwan in every stitch or every other stitch and the length of stitching is limited. Since friction is given at the same position of the sewing thread many times, the thread is untwined during sewing resulting in thread breakage unless the thread is a high-durable one. Even when the sewing is made, the stitch looks broken.

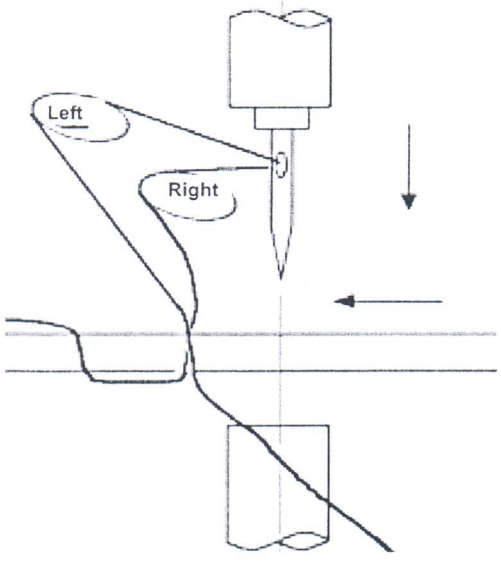
Therefore, the thread that can be used is limited.

③ Application

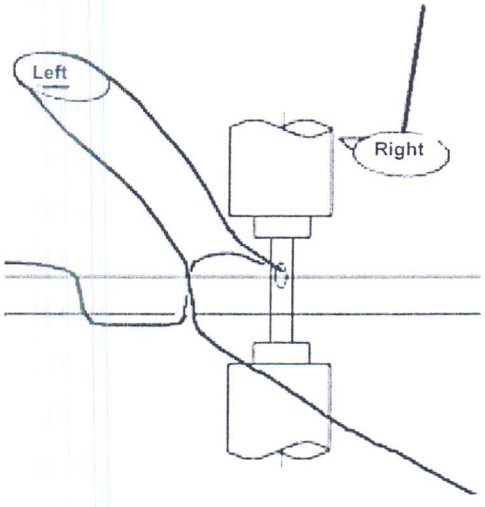
Decorative stitch of suits or the like (FLS-350N), kimono (Japanese national dress) (FLS-351N)

Button sewing of coats, suits, etc. (FBS-340N-1)

④ Stitch formation



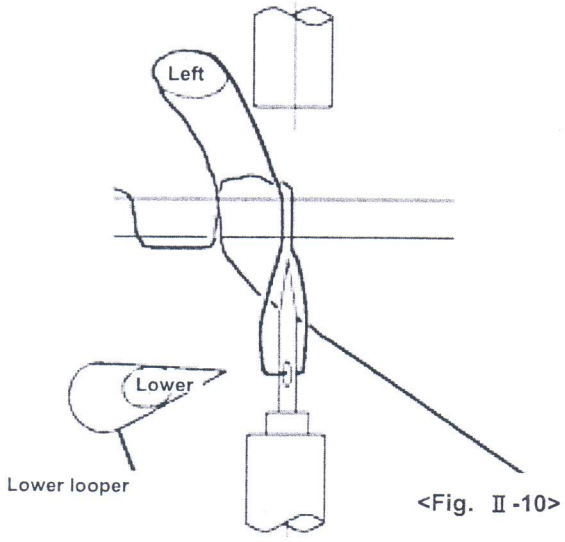
<Fig. Ⅱ-8>



<Fig. Ⅱ-9>

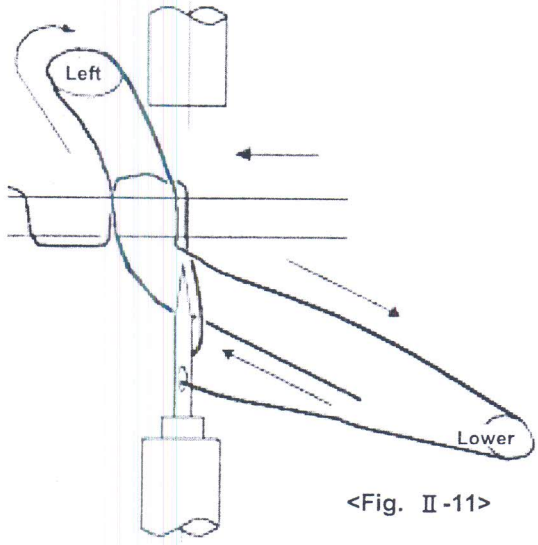
a : Needle is fixed to upper needle bar, and left-hand and right-hand loopers draw and retain the thread. Cloth is fed and the needle comes down.

b : Needle penetrates the cloth and is delivered to the lower needle bar. Thr right-hand looper returns to its home place.



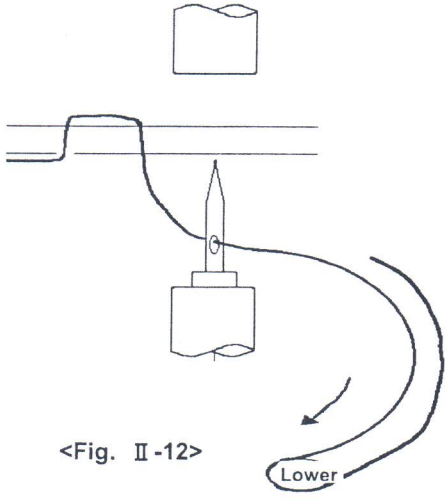
<Fig. Ⅱ-10>

c : Lower looper catches the thread loop at the position where the lower needle bar slightly goes up from its lowest position.



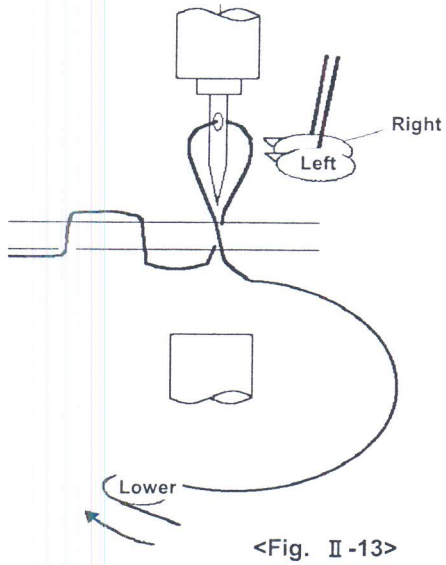
<Fig. Ⅱ-11>

d : Lower looper draws out thread which enters under the cloth one stitch before from the above left-hand looper. Simultaneously the cloth is fed.



<Fig. Ⅱ-12>

e : Needle goes up and penetrates the cloth. Lower looper further pulls in the thread downward.



<Fig. Ⅱ-13>

f : Needle penetrates the cloth, and is delivered to the upper needle bar and goes up. Thread is wiped out by the lower looper. Next, the above left-hand and right-hand loopers catch the thread to continue to a : .

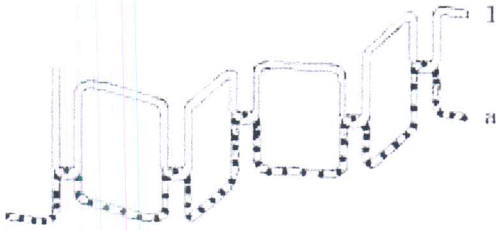
3) Lockstitch

① Example of stitch formation

JIS mark 301 ... 1-needle lockstitch

<Fig. Ⅱ-14>

JIS mark 304 ... 1-needle lockstitch zigzag stitch



<Fig. Ⅱ-15>

② Feature

Two threads of upper thread (needle thread) and lower thread (bobbin thread) are used. Every stitch upper thread and lower thread interlace each other and the stitches on right and wrong sides are the same. This stitch is widely used since it is not easily frayed and securely joins plural pieces of cloth.

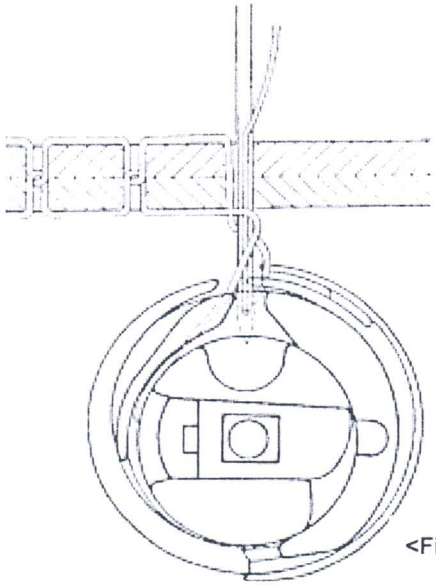
It is necessary to replace the bobbin thread since stitch formation is obtained by rotation of the needle thread around the bobbin case.

③ Application

General sewing (DDL-5550N, DDL-5700-7, DLU-5490N-7, DLN-5410N-7), Shirring (DLU-5494N-7), 2-needle lockstitch (LH-3128-7), Zigzag stitch (LZ-2288N-7), Plain stitch, Decorative stitch, Bartacking (LK-1900), Lockstitch buttonholing (LBH-790RS-1), Button sewing (LK-1903/BR25), Pockect sewing (APW-196) and Pattern sewing (AMS-210D)

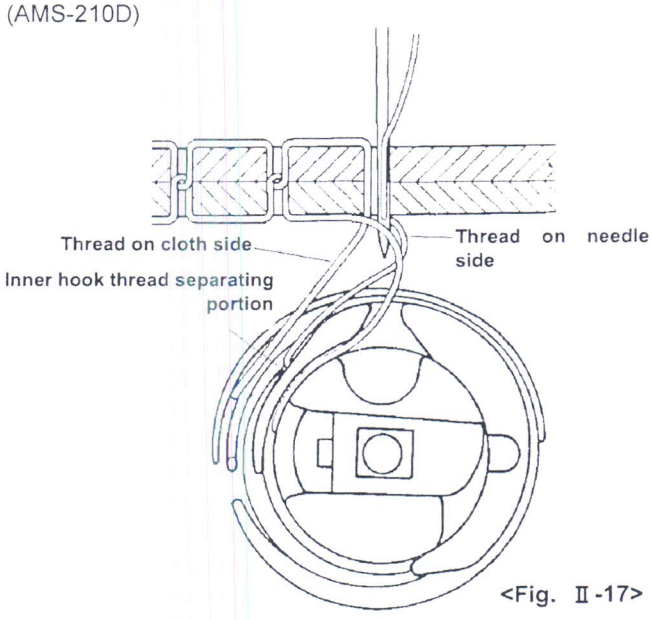
④ Stitch formation

④-1 Horizontal full-rotary hook



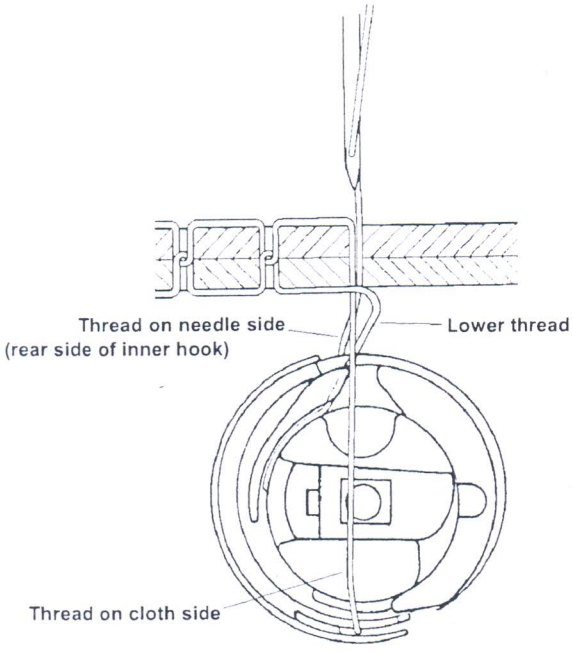
<Fig. Ⅱ-16>

a : Upper thread slacks at the position where the needle slightly goes up from its lowest position, and blade point of outer hook catches the loop-shaped upper thread and pulls in the upper thread.



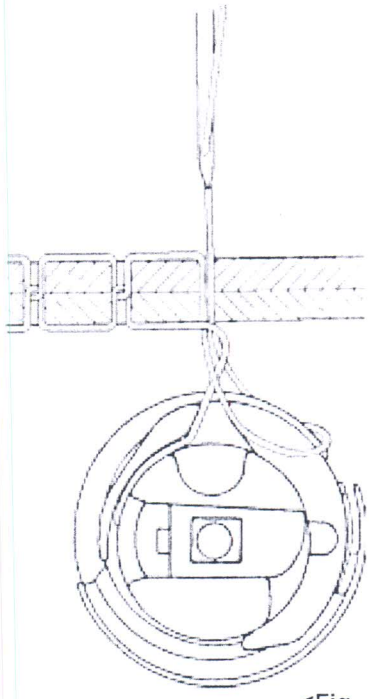
<Fig. Ⅱ-17>

b : Upper thread which is pulled in by the blade point of outer hook is separated at the inner hook thread separating portion so that the upper thread on the needle side is separated to the rear side of inner hook and the upper thread on cloth side is separated to the right side of inner hook.



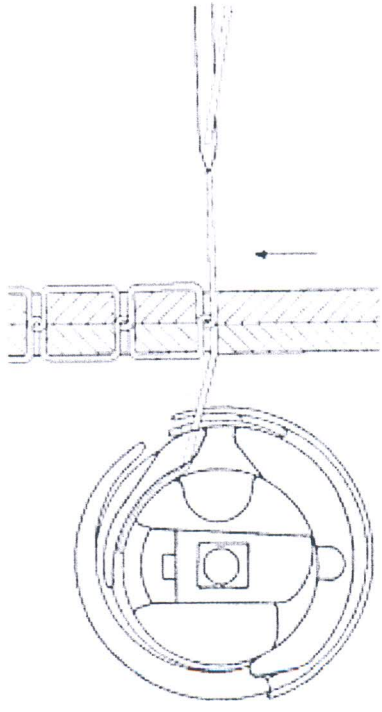
<Fig. Ⅱ-18>

c : Outer hook rotates, while pulling in upper thread, around the periphery of bobbin case containing lower thread set in inner hook. Thread take-up lever supplies upper thread which is necessary to rotate around inner hook. (Suppose that inner hook is a human being, and it looks like doing rope-skipping.)



<Fig. Ⅱ-19>

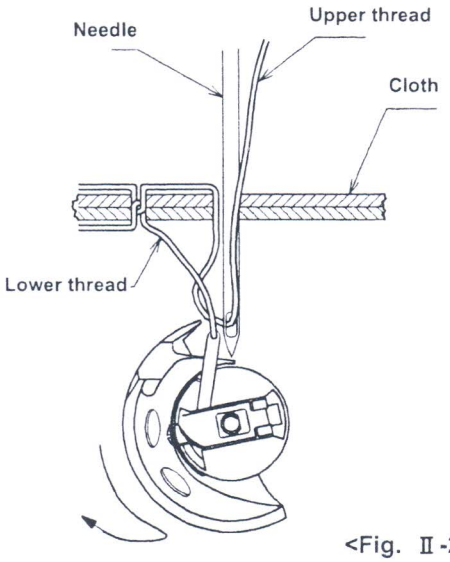
d : Immediately after upper thread has rotated around inner hook, thread take-up lever lifts upper thread and the upper thread is interlaced with the lower



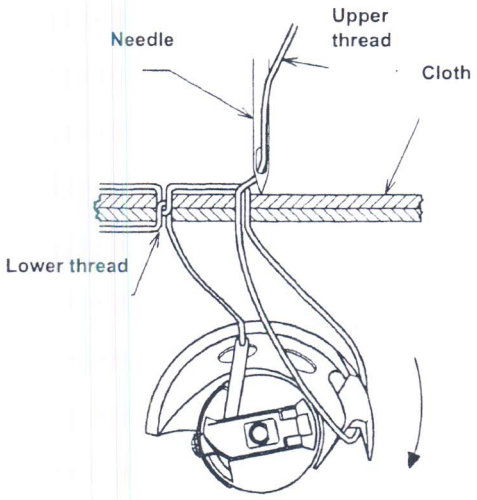
e : Stitch is formed when the upper thread lifts the lower thread and cloth is fed at the end. Next, needle comes down and penetrates cloth to continue to a : .

<Fig. Ⅱ-20>

④-2 Semi-rotary hook



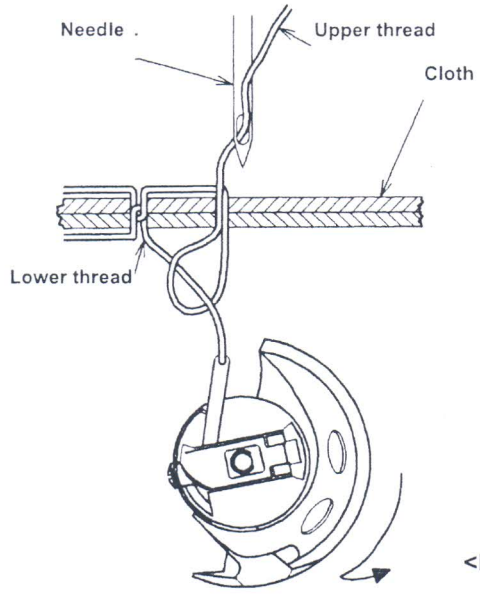
<Fig. Ⅱ-21>



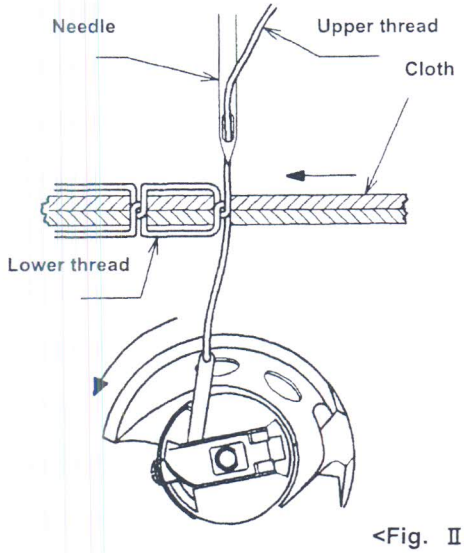
<Fig. Ⅱ-22>

a : Blade point of semi-rotary hook catches loop-shaped upper thread.

b : Upper thread rotates around the periphery of bobbin case by rotation of the hook.



<Fig. Ⅱ-23>



<Fig. Ⅱ-24>

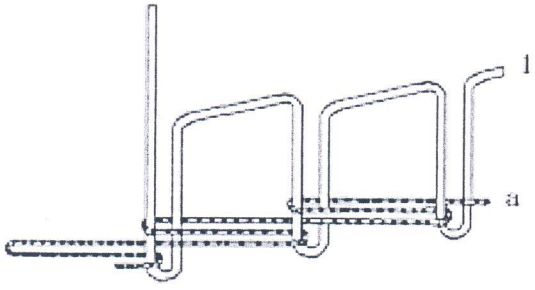
c : After 1/2 rotation of the hook, upper thread is lifted by thread take-up lever and is interlaced with lower thread.

d : Stitch is formed when the upper thread lifts the lower thread and cloth is fed at the end. To be continued to a : .

4) Double chainstitch

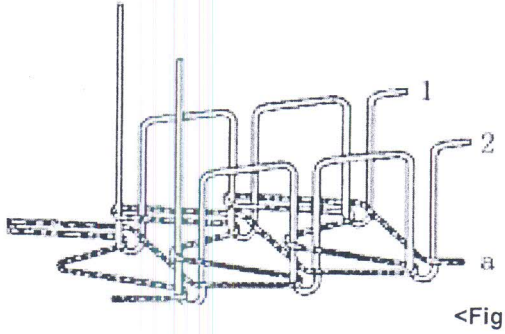
① Example of stitch formation

JIS mark 401 ... 1-needle double chainstich



<Fig. Ⅱ-25>

JIS mark 406 ... 2-needle double chainstitch



<Fig. Ⅱ-26>

② Feature

Upper thread (needle thread) and lower thread (looper thread) are interlaced with each other like a chain under cloth, and the stitches look like knitted.

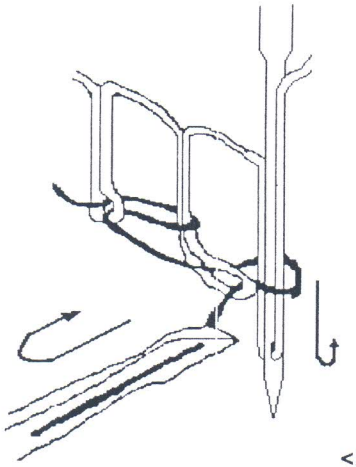
The stitches look the same as those of lockstitch when observing from the surface of cloth. Sewing can be performed continuously for a long time since lower thread as well as upper thread can be supplied continuously. Stitches are full of elasticity, and widely used for the elastic cloth and places to which shock is applied. Defect, when compared with the lockstitch, is that the stitch is easily frayed.

③ Application

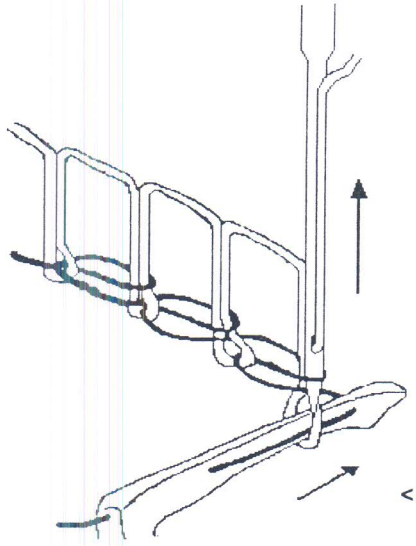
General sewing (MH-481-5) Rubber tape attaching, Lace attaching to underwear, swim-suit, etc.

Eyelet buttonholing (MEB-2688), Side seam (MS-1190), Belt loop making (MFB-2600)

④ Stitch formation



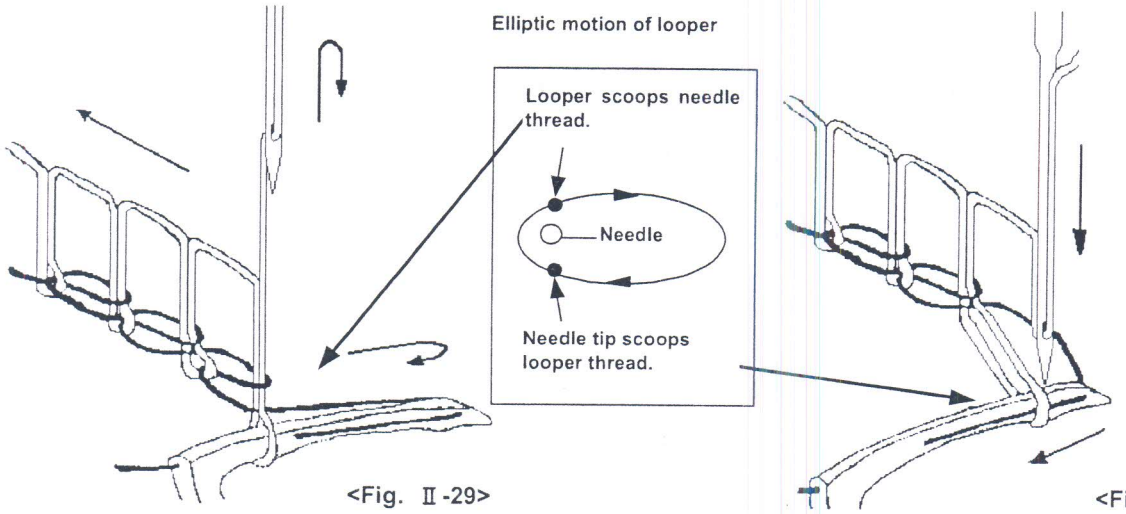
<Fig. Ⅱ-27>



<Fig. Ⅱ-28>

a : Needle thread comes off looper and is tightened. Then, looper scoops needle thread at the position where needle slightly goes up from its lowest position.

b : Needle continues to go up and looper thread comes off needle. Looper advances in the state that it has scooped needle thread.



<Fig. Ⅱ-29>

<Fig. Ⅱ-30>

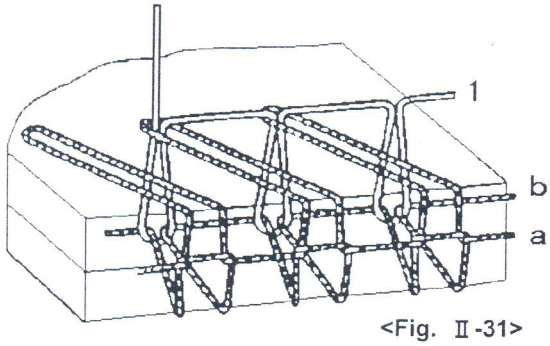
c : Cloth is fed when needle is in the highest dead point and looper is in the most advanced state, and the final tightening of needle thread is performed.

d : Needle comes down and the needle tip scoops looper thread. Looper performs elliptic motion. Then, stitch formation is continued to

5) Over-edge chain stitch

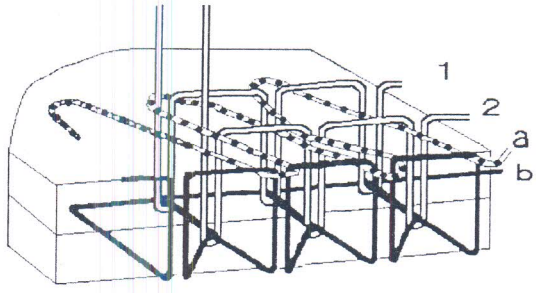
① Example of stitch formation

JIS mark 504 ... 1-needle overlock



<Fig. Ⅱ-31>

JIS mark 506 ... 2-needle overlock



<Fig. Ⅱ-32>

② Feature

In many cases, three threads of upper thread (needle thread) and lower threads (upper looper thread and lower looper thread) are interlaced with one another so as to hem material end, and the stitches look like knitted.

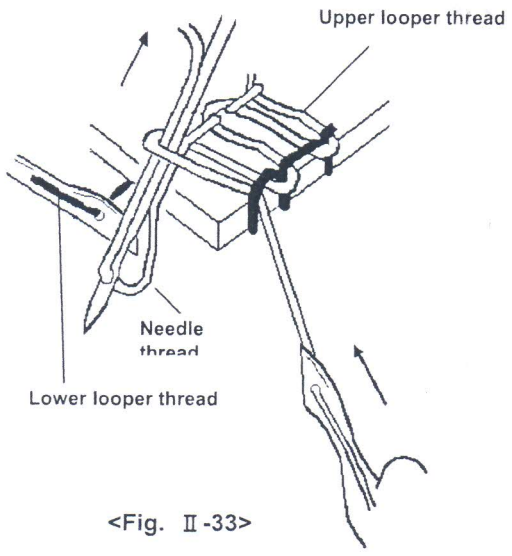
This stitch belongs to the classification of chainstitch. The stitch itself can expand following the expansion of cloth. Accordingly, this stitch is mostly used for the cloth which is largely expanded (knit or the like).

③ Application

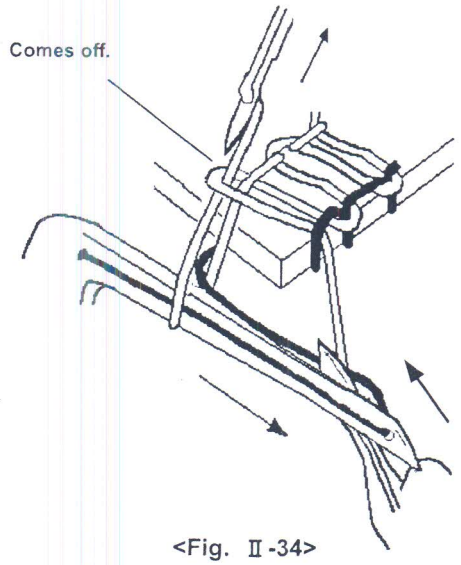
Cloth which is largely expanded, blind over-edging, prevention of fray at material end (ASN-397/serging machine)

Overlock sewing machine (MO-3904), 2-needle overlock machine (MO-3914), Cylinder-bed overlock sewing machine (MOC-3914)

④ Stitch formation



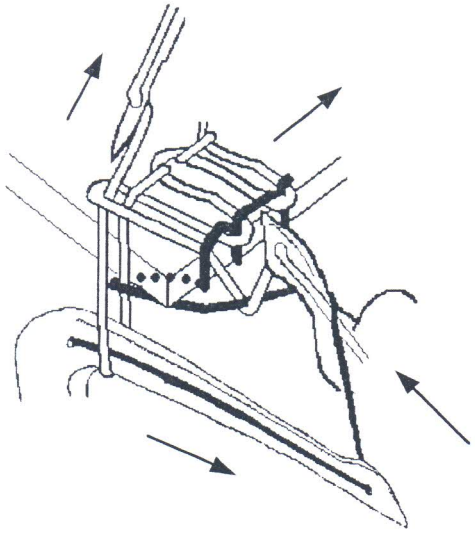
<Fig. Ⅱ-33>



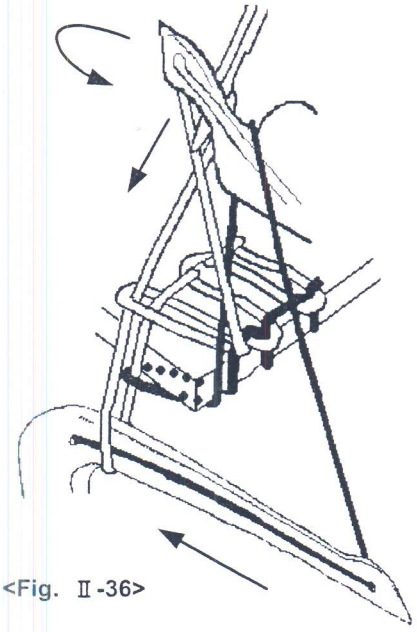
<Fig. Ⅱ-34>

a : Lower looper scoops needle thread loop.

b : Upper looper thread comes off needle and upper looper scoops lower looper thread.



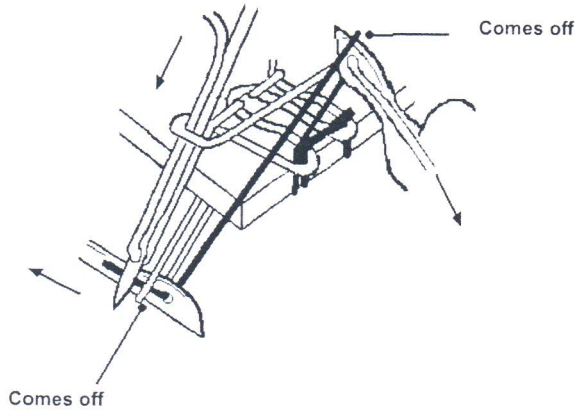
<Fig. Ⅱ-35>



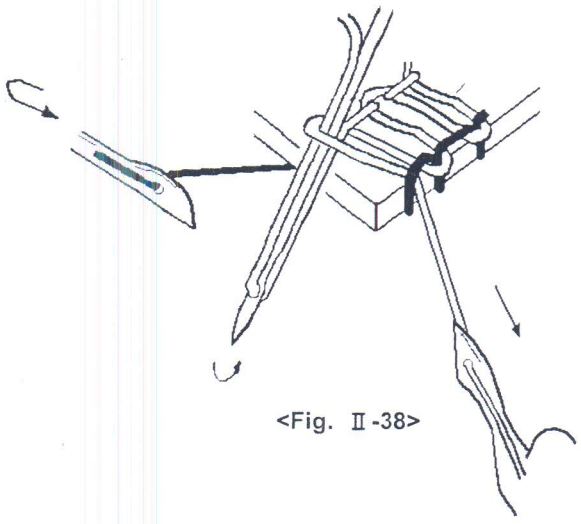
<Fig. Ⅱ-36>

c : Cloth is fed.

d : Needle tip scoops upper looper thread.



<Fig. Ⅱ-37>



<Fig. Ⅱ-38>

e : Lower looper thread which is caught on upper looper comes off. Then, needle thread which is caught on lower looper comes off.

f : Needle thread which is before one stitch is tightened at the lower dead point of needle. Stitch formation is continued to a : .

《Extra : Compound stitching》

Feature

This stitch is favourable to the productivity since double chainstithing and over-edge chainstitching are simultaneously performed (safety stitch).

The machine is called "Interlock machine". (MO-3916)

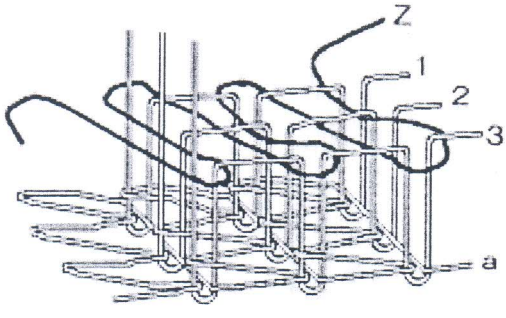
Application

General runstitching, side joining of shirts, slacks, etc.

6) Covering chainstitch

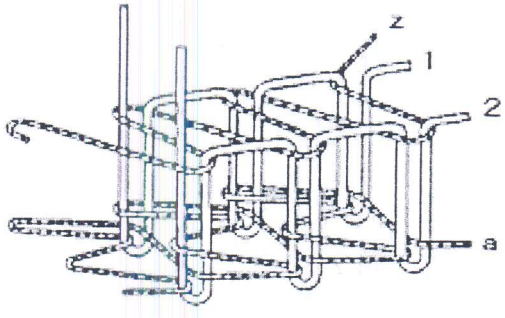
① Example of stitch formation

JIS mark 605 ... 3-needle covering chainstitch



<Fig. Ⅱ-39>

JIS mark 602 ... 2-needle covering chainstitch



<Fig. Ⅱ-40>

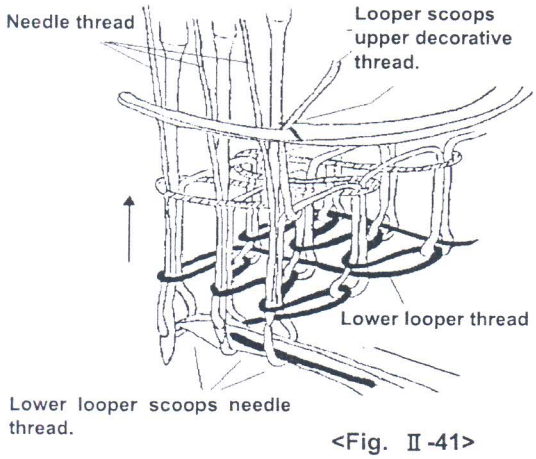
② Feature

There are two or more needle threads and decorative threads on both the right and wrong sides of cloth (generally, upper decorative thread is attached to 2-needle or 3-needle double chainstitch). The stitch is full of elasticity and looks nice.

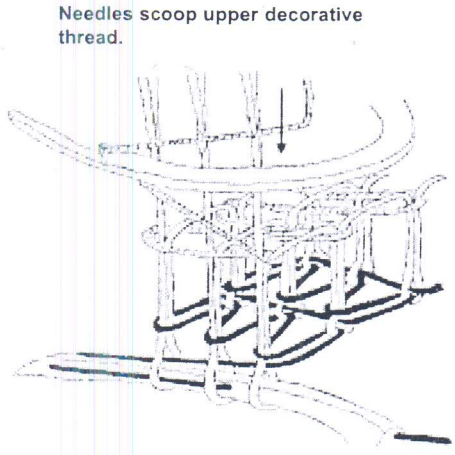
③ Application

Hemming (MFC-7605/AH-1) Decorative stitch for lace attaching to underwear, swim-suits, etc.

④ Stitch formation



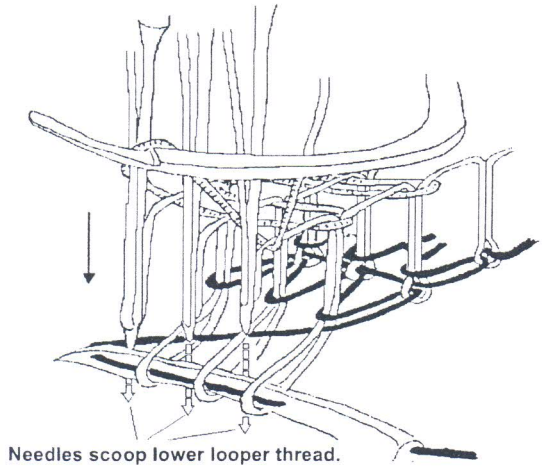
<Fig. Ⅱ-41>



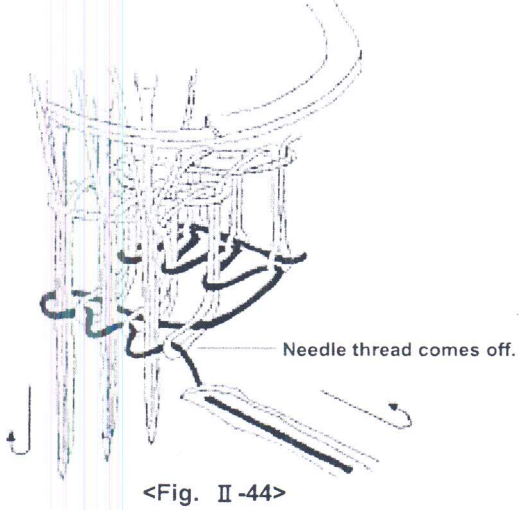
<Fig. Ⅱ-42>

a : Lower looper scoops needle thread loop, and simultaneously upper decorative looper scoops upper decorative thread.

b : Cloth is fed and only right-hand needle is positioned in the outside of decorative thread. Two left-hand needles come down and scoop upper decorative thread.



<Fig. Ⅱ-43>



<Fig. Ⅱ-44>

c : Needles further come down and scoop lower looper thread. And, two right-hand needles enter in between the respective needle threads as shown in the illustration.

d : Needle thread comes off lower looper and needle comes down in its lowest position. Lower looper and upper decorative looper are in the most retracted positions. Stitch formation is continued to a : .

Ⅲ) Six major elements of sewing

The industrial sewing machine as well as machine tool is the productive goods. The machine has special functions (the functions are largely seen in automatic machines) in addition to the sewing aiming efficiency promotion and deskilling. Also, there are many kinds of the machine.

Basic function of the sewing machine is, however, to stitch using thread whatever the equipment may be. Namely, the first purpose is to form stitches on the cloth and to secure satisfactory quality.

Stitch formation consists of the following six factors. These are called "Six major factors or mechanisms of sewing".

1. Needle bar
2. Hook (looper for chainstitch)
3. Thread take-up lever
4. Feed
5. Presser foot
6. Thread tension

1. Needle bar

1) Function

① Needle bar makes needle up and down, and upper thread penetrate into the material to be sewn.

② Needle bar makes hook or looper scoop the penetrated upper thread.

③ Needle bar scoops looper thread at the needle tip. (For chainstich)

2) Momentum (stroke) of needle bar

The momentum of needle bar is not one kind since the sewing machine sews cloths of various thicknesses. There are three kinds (for heavy-weight, medium-weight and light-weight materials) of momentum for 1-needle lockstitch machine.

When the needle bar stroke is large, there are such merits as ① penetrating force is improved, ② distance from throat plate to upper dead point of needle tip becomes larger and thick material is easily entered, etc. Demerits are ① inertia force is increased and vibration or noise is likely to occur, ② mechanical load is increased and it is not fit to high speed, ③ needle heat rises, etc.

Light-weight materials → small stroke Heavy-weight materials → large stroke

Example : DDL-5550 = 30.5 mm/DDL-5550H = 35 mm/DDL-5550A = 29 mm/LG-158 = 46.88 mm

H type = for heavy-weight materials A type = for light-weight materials

3) Needle

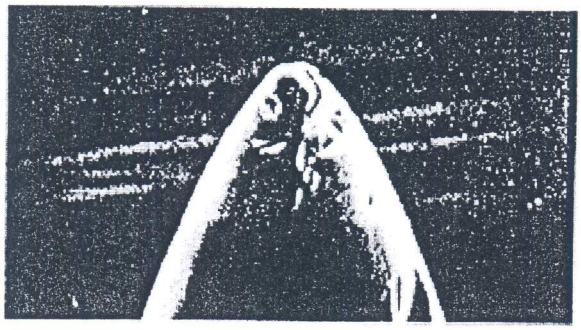
Needle is attached to the top of needle bar and is one of the most important parts to sew materials.

If needle is not good, it will be the cause of various troubles such as thread breakage, material breakage, puckering (wrinkle by sewing), etc.

If there is any problem related to the sewing, it is general to check whether threading is proper, then to check whether needle is defective.

Example of blunt needle tip

<Normal>

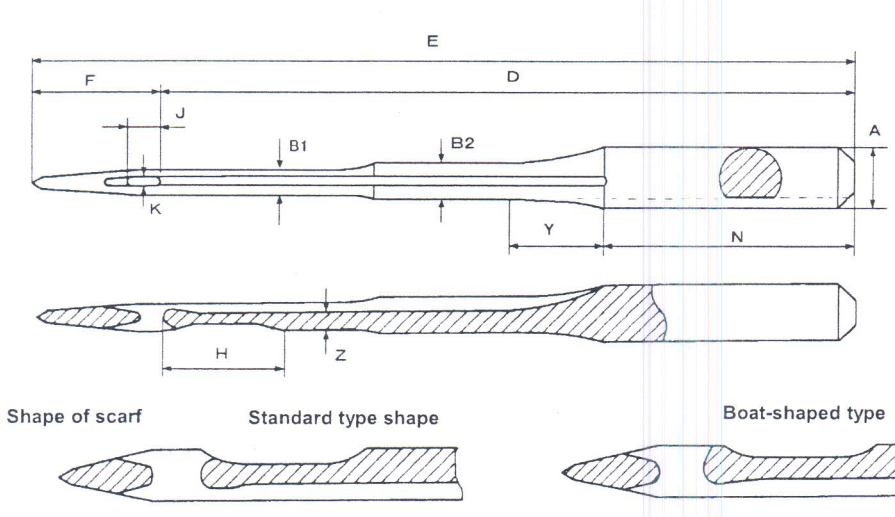


<Photo. Ⅲ-1>

<Blunt needle tip>

<Photo. Ⅲ-2>

① Symbol of dimension and name



A : Shank diameter
B : Shoulder diameter
E : Length of needle
D : Butt to eyelet
J : Length of eyelet
K : Width of eyelet
N : Length of shank
H : Length of scarf
Z : Detpth of groove
F : Length of point

<Fig. Ⅲ-1>

② Shank diameter : A = Mainly divided into the following three systems.

For overlock system	DC x 1, DC x 27	... 2.02 mm
For lockstitch system	DA x 1	... 1.62 mm (#7 to #22)
	DB x 1	... 1.62 mm (#7 to #18)
		... 1.90 mm (#19)
		... 2.02 mm (#20 or more)
For special sewing machine system such as straight buttonholing or the like	DP x 5	... 2.00 mm

* For the shank diameter to be used in overseas, refer to "Reference data 1" in the end of this volume. (P.61)

③ Butt to eyelet (Length between top end of eyelet and top end of shank) : D

This is the most important dimension for hook or looper to scoop thread loop, and the length of D is fixed even when thickness of needle (needle size No.) varies.

④ Length of needle : E

For DB x 1, DP x 5, etc., whenever the shank gets thicker, the length of needle gets longer. DC type needles are for overlock and chainstich and the total length is fixed since it is required to scoop looper thread at the needle tip.

⑤ Thicknes (needle size)

Thickness is dimension B1 and shown as needle size. Generally, a needle consists of 2-step stretched wire in which there is the trunk B2 thicker than the trunk B1. (DC x 1 and DC x 27 consist of one-step stretched wire since the whole length is short.)

Dimension B1 (needle size) prevents the needle from vibration and protects the rise of needle heat by reducing friction when the needle comes off cloth.

Conversion table of needle size of various countries **<Table Ⅲ-1>**

Sizes			Needle trunk sizes	Sizes			Needle trunk sizes
ORGAN (Japan)	GERMANY	UNION (U.S.A.)	ORGAN (Japan)	ORGAN (Japan)	GERMANY	UNION (U.S.A.)	ORGAN (Japan)
5	45	/	0.47	16	100	040	1.02
6	50	/	0.52	17	105	042	1.07
7	55	022	0.57	18	110	044	1.12
8	60	/	0.62	19	120	048	1.22
9	65	027	0.67	20	125	049	1.27
10	70	029	0.72	21	130	/	1.32
11	75	030	0.77	22	140	054	1.42
12	80	032	0.82	23	160	/	1.62
13	85	034	0.87	24	180	078	1.82
14	90	036	0.92	25	200	080	2.02
15	95	038	0.97	26	230	090	2.30

* For the SCHMETZ (Germany) version, refer to "Reference data 2" in the end of this volume.(P.61)

⑥ Length of shank : N

If the length of shank N gets longer, it is better for needle-wobbling or needle-bent. However, if the shank portion enters material, it will cause material breakage or puckering. As a result, the length within the range that the shank does not enter material is good.

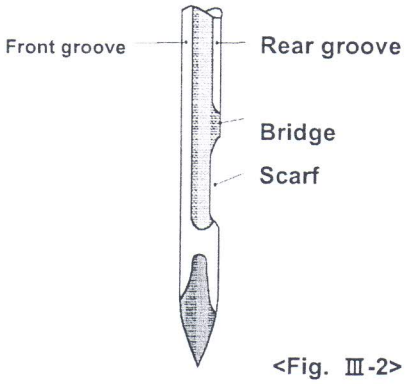
⑦ Shape of scarf

The typical shapes of scarf are of standard type and of boat type. The boat type shape is good for making needle thread loop and effective to protect stitch skipping. However, the blade point to scoop needle thread should be positioned at the height where it does not come in contact with the lower portion of scarf. In addition, resistance at upper and lower angle portions of the scarf slightly increases when raising or lowering material.

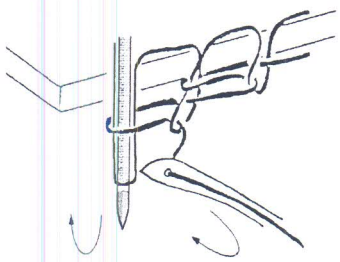
⑧ Rear groove on needle

Needle with rear groove is used for overlock and double chainstitch sewing machines (MO, MF, MH, etc.). It reduces resistance of thread that occurs when needle penetrates material and improves thread tightness when needle is in its lowest position.

However, there is a bridge (no-groove portion) to improve loop making since resistance of thread due to material is reduced when needle goes up from its lowest position. (Length of bridge varies in accordance with needles.)



<Fig. Ⅲ-2>



<Fig. Ⅲ-3>

⑨ Shape of needle tip

Shape of needle tip **<Table Ⅲ-2>**

Tip point	Symbol	Shape of needle tip	Shape of point	Application and feature
Sharp and slim type point	SPI			Light-weight fabrics, light-weight leather
Regular type point	R			General fabrics
Butt type point	BUT			Mainly for button sewing
Slim point	S			Slim shape and J point at needle tip, for high-gauge knit
J ball point	J			For general knit, suitable for standard material as well
B ball point	B			For relatively coarse knit, Ball is ϕ 1/5 of trunk
U ball point	U			For knit and power-net, Ball is ϕ 1/3 of trunk
Y ball point	Y			For elastic materials, Ball is ϕ 1/2 of trunk
Flat tip shape	LL LR			45° twisted type knife needle Mainly for leather goods 45° reversely twisted knife needle

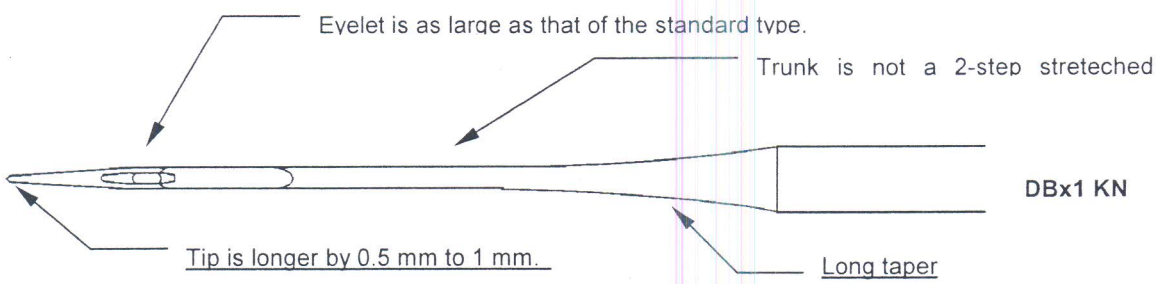
* For the overseas version of the needle tip point, refer to "Reference data 3" in the end of this volume.(P.63)

⑩ Exclusive needle for knit

This is a needle that does not break material with its tip, and this is improved penetration of needle to material.

It is effective against material breakage and protection of puckering.

-1 : KN needle (for high-gauge knit material)



<Fig. Ⅲ-4> Slim shape and ball point (regular point J, optional points B, U and Y)

-2 : SF needle (for ultra fine-gauge knit)

This needle is slimmer by one size than KN needle from needle tip to near to eyelet.

⑪ Needle for new synthetic fiber (NS needle)

This is a needle that resistance of needle penetration of the exclusive needle for knit is further recuced, and is useful for puckering prevention.

Shape is almost the same as that of SF needle, but sharp-pointed from needle tip which makes resistance of needle penetration the least.

⑫ Surface treatment

-1 Nickel plating

This plating is full of corrosion resistance and generally used for the home-use sewing machine.

-2 Chrome plating

Generally, hard chrome plating is made on the needle, and the needle is superior in heat-proof and wear proof. The needle is used for the industrial sewing machine.

-3 Teflon coating

Slide is the best, but durability of coating effect is low.

-4 Titanium coating

Wear proof and heat-proof are best, and this needle is used for extra heavy-weight material or the like.

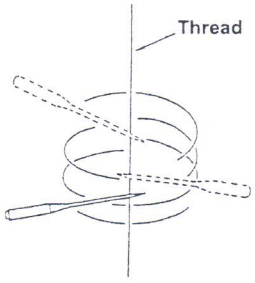
⑬ Needle-to-thread relation

【 How to check proper needle size 】

Pass thread used of an appropriate length (approx. 50 cm) through needle, hold both ends of the thread, stretch it vertically as shown in the illustration and slide the needle.

When the needle slides down while slowly turning, it can be said that the size of needle is proper for the thread.

If the needle does not slide down or slides down without any resistance, stitch failure (stitch skipping, thread breakage or stitch looseness) is likely to occur.



<Fig. Ⅲ-5>

Table of proper relations between needle and thread **<Table Ⅲ-3>**

Needle size	Spun thread	Filament thread	Main application
#5 to #6	#120	#100	Extra light-weight nylon material and blouses
#7 to #8	#100	#80 to #100	Shirts, knit wear
#9 to #10	#80	#60 to #80	Ladies' dress, pyjamas
#11 to #12	#60	#50 to #60	Gents' suits, students' uniform
#13 to #14	#40 to #50	#40 to #50	Wool fabrics, gents' suits
#16	#30 to #40	#30 to #40	Working wear, jeans
#18	#20 to #30	#20 to #30	Jeans, coat
#19	#10 to #20	#10 to #20	Heavy-weight materials such as denim, sheet, etc.
#20 to #21	#8 to #10	#5 to #10	Heavy-weight materials such as tent, sheet, etc.
#22 to #26	#8 or less	#5 or less	Extra heavy-weight materials such as canvas or the like

⑭ Kind of needle and applicable model <Table III-4>Kind of needle and applicable model **<Table Ⅲ-4>**

Kind	Size and shape of needle tip	Main application	Applicable model
DB x 1	#7 to #25	General sewing	General 1-needle lockstitch sewing machine DDL-5530N DDL-5550N DDL-5700
DB x 1738	#8 to #22	Ditto, Scarf is longer than that of DB x 1.	
DB x 1KN	#8 to #14 (J)	For knit, trunk is smaller by one size and needle tip is slim.	
DB x 1SF	#9 to #11 (J)	For ultra fine knit, resistance of penetration is smaller than KN.	
DB x 1NS	#8 to #11 (SPI)	For new synthetic fiber, resistance of penetration is the least.	
DB x K5	#9 to #18	For embroidery and thick needle, eyelet is larger by two sizes.	
DB - K23	#9 to #12 (J)	For knit stitch, eyelet is larger than that of KN.	
DB - N20	#11, #14, #16	For heavy-materials, Shank is shorter by approx. 3 mm than that of DB x 1.	
DB x A20	#19 to #23	For heavy-materials, shank diameter is 1.62 mm.	
DB x 1ST	#20, #22 (J)	For decorative stitch, trunk is smaller by one to two sizes and eyelet is larger by two to three sizes.	DDL-201S, DU-141S
DB x 3ST	#11 to #22 (J)	For decorative stitch, shank of #19 or less is 2.02 mm. Trunk is smaller by one to two sizes and eyelet is larger by two to three sizes.	
DA x 1	#7 to #22	For light-weight materials sewing by 1-needle lockstitch sewing machine	DDL-5550NA or the like
DA x 1KN	#8, #9 (J)	For light-weight materials sewing, trunk is smaller by one size and needle tip is slim.	For knit
DP x 5	#6 to #25	For general special machines, N = 11.50 to 12.50	LK-1900 LBH-790RS-1 LH-3128-7 LZ-2280N-7 AMS
DP x 5KN	#9 to #12 (J)	For knit, trunk is smaller by one size and needle tip is slim.	
DP x 134	#9 to #18	Shank is longer by 1 mm and scarf is of boat type.	
DP x 7	#8 to #25	Shank is shorter by 1 mm and N = 11 mm fixed.	
DP x 17	#9 to #26	For 2-needle lockstitch, it is longer by 5 mm than DP x 5.	
DP - N31	#14, #16, #18	For 1st process of lockstitch button sewing, Shank is shorter by 4.5 mm than that of DP x 17.	LK-1851-555
DC x 27	#6 to #24 (J up to #11)	For overlock machine, Scarf is of boat type (stitch skipping prevention)	General overlock machines MO MOR MOC MOF
DC - J27	#9 to #16	No rear groove on needle (stitch skipping prevention)	
DC x 1	#7 to #25 (J up to #11)	For overlock machines, No scarf on #7 to #8	
DC x 1KN	#8 to #14 (J)	For knit, Scarf is of boat type. Trunk is smaller by one size and needle tip is slim.	
DC - N17	#6 to #19	For blind overedging, Shank is longer by 3 mm (needle vibration prevention).	
DC - N25	#7 to #11	For blind overedging, Shank is longer by 1.5 mm (needle vibration prevention).	

*For the common needle symbols to SCHMETZ and others, refer to "Reference data 4" in the end of this volume.(P.64)

Kind	Size and shape of needle tip	Main application	Applicable model
DC x 3	#6 to #22	For needle gauge 1.6 mm Shank diameter : 1.22 mm	2-needle overlock
DC - C46	#7, #9, #11	For needle gauge 0.8 mm Both sides of shank are cut, and others are same as DCx1.	
DC - C47	#7, #9, #11	For needle gauge 1.2 mm Both sides of shank are cut, and others are same as DCx1.	
TV x 64	#8 to #22	Scarf is of boat type (stitch skipping prevention).	MOG
TV x 64 NY	#8 to #22	Tapered shape (needle vibration prevention)	MS-1190
TQ x 1	#9 to #22 (BUT)	Length is shorter by 10 mm than that of TQx7 (needle vibration prevention).	MB-377
TQ x 7	#9 to #24 (BUT)	For chainstitch button sewing Whole length : 51 mm	MB-372.373
TF x 2	#7 to #25 (LL)	Knife needle for 1-needle lockstitch	
TF x 2 LR	#8 to #25 (LR)	Knife needle for 1-needle lockstitch	
DB x F2	#9 to #25 (LR)	Knife needle for 1-needle lockstitch	
DD x 1	#16 to #29	For leather and canvas	LG-158
DI x 3	#12 to #25	For heavy-weight materials Shank is shorter by 3 mm than that of DPx17.	LU-562/563
DN x 1	#18 to #27	For extra heavy-weight materials Diameter of shank is same as that of trunk.	LU-563-3
TV x 1	#8 to #23	For double chainstitch Scarf is not provided up to #18 and provided from #19.	
TV x 7	#8 to #25	For double chainstitch Shape is same as TVx1 and scarf is provided.	ML-111, MH-380/481 LT-591
UY x 128 GAS	#6 to #23	For covering stitch	MF,MFC. MFB
MT x 190	#9 to #24	Trunk portion is long and used for automatic welting machine.	APW-194
MT - G79	#16	Feed direction : #16, Lateral direction : #14	

* Shape of needle tip

No mark means R point. There are various ball points and super needles as optional.

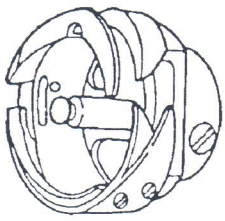
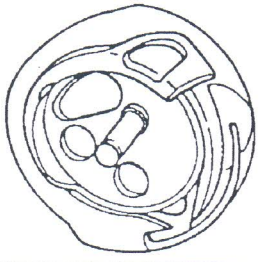
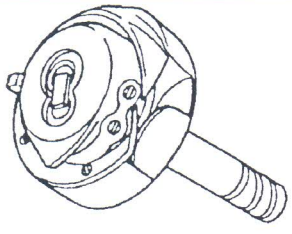
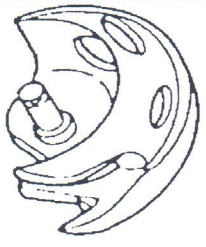
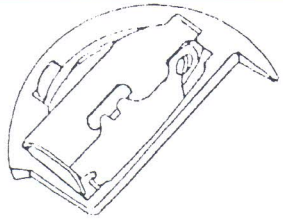
2. Hook

1) Function

① Hook is divided into outer hook and inner hook. Outer hook scoops upper thread from needle, rotates periphery of inner hook and interlaces with lower thread (bobbin case) which is set to inner hook to form stitches.

② Semi-rotary hook scoops upper thread with the inner hook.

2) Kind of hook **<Table Ⅲ-5>**

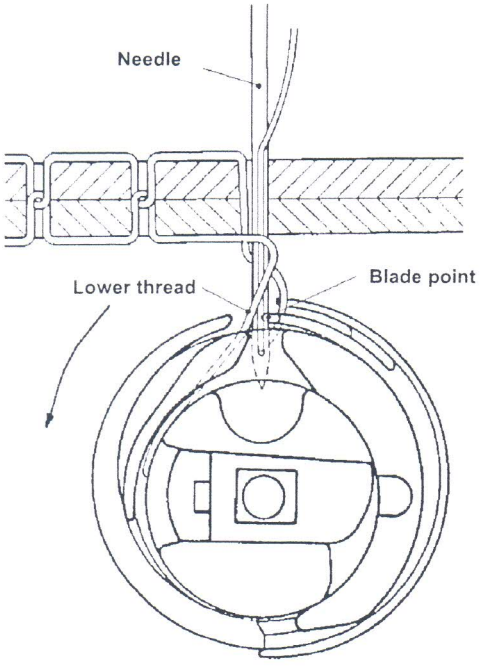
DB type Horizontal full rotary hook (Horizontal 2-rotation hook)		DDL-5550N, LZ-586U, etc. This hook is vertically set to hook driving shaft, and hook driving shaft rotates two times when needle bar travels one time. This hook is used the most for the industrial sewing machine and there are many kinds. • Normal feed : perfect stitch • Reverse feed : hitch stitch
DP type Horizontal full rotary hook (Horizontal 2-rotation hook)		LBH-770-1, LBH-790RS-1, LZ-2280N-7 This hook is used for zigzag sewing and embroidery sewing machines since perfect stitch can be obtained regardless of sewing direction. • Rotation is reverse to that of DB type. • It is apt to occur that thread is caught on race surface.
Vertical full rotary hook (Vertical 2-rotation hook)		LH-3128-7, LU-563N, LU-2210N-7, etc. This hook is developed for 2-needle sewing machine, but used for sewing machine with 1-needle to sew heavy-weight materials. • Regardless of sewing direction, perfect stitch can be obtained. • Opener (thread handling) is required to improve slide of upper thread.
Horizontal semi-rotary hook (Inner hook)		LK-1900, LK-1850, AMS Series • This hook is suitable for heavy-weight materials since correspondence to change of material thickness is good. • This is not suitable for high-speed because of oscillating motion. • Perfect and hitch stitches are made.
Shuttle hook		TSU-471, 421, 441 • Stitches are well-tightened. This is suitable for sewing shoes, bags, etc. • Perfect and hitch stitches are made.

3) Full rotary hook

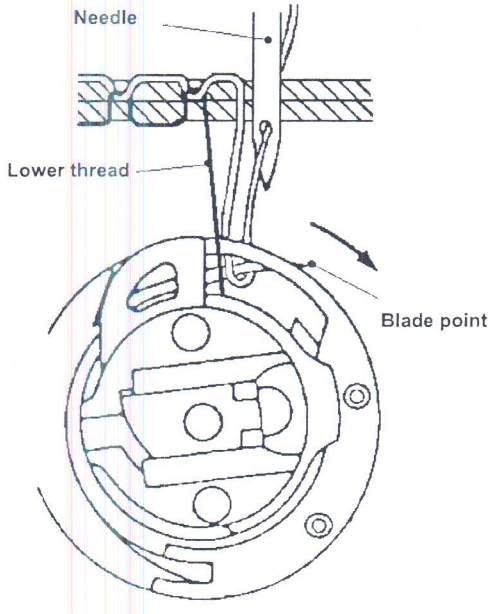
Full rotary hook is roughly divided into DB type and DP type.

① Difference between DB type and DP type **<Table Ⅲ-6>**

	DB type	DP type
Rotating direction as observed from the front of hook	Left-hand rotation	Right-hand rotation
Position of needle thread and blade point in terms of bobbin thread	Bobbin thread, needle, blade point	Bobbin thread, blade point, needle
Needle thread pulled in hook (needle side)	Needle thread rotates around rear side of inner hook.	Needle thread rotates around front side of inner hook.
Normal feed	Perfect stitch	Perfect stitch
Reverse feed	Hitch stitch	Perfect stitch

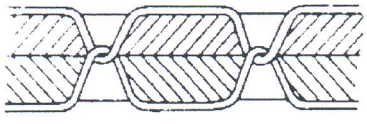


<Fig. Ⅲ-6>



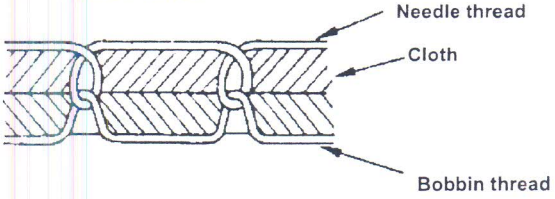
<Fig. Ⅲ-7>

Perfect stitch

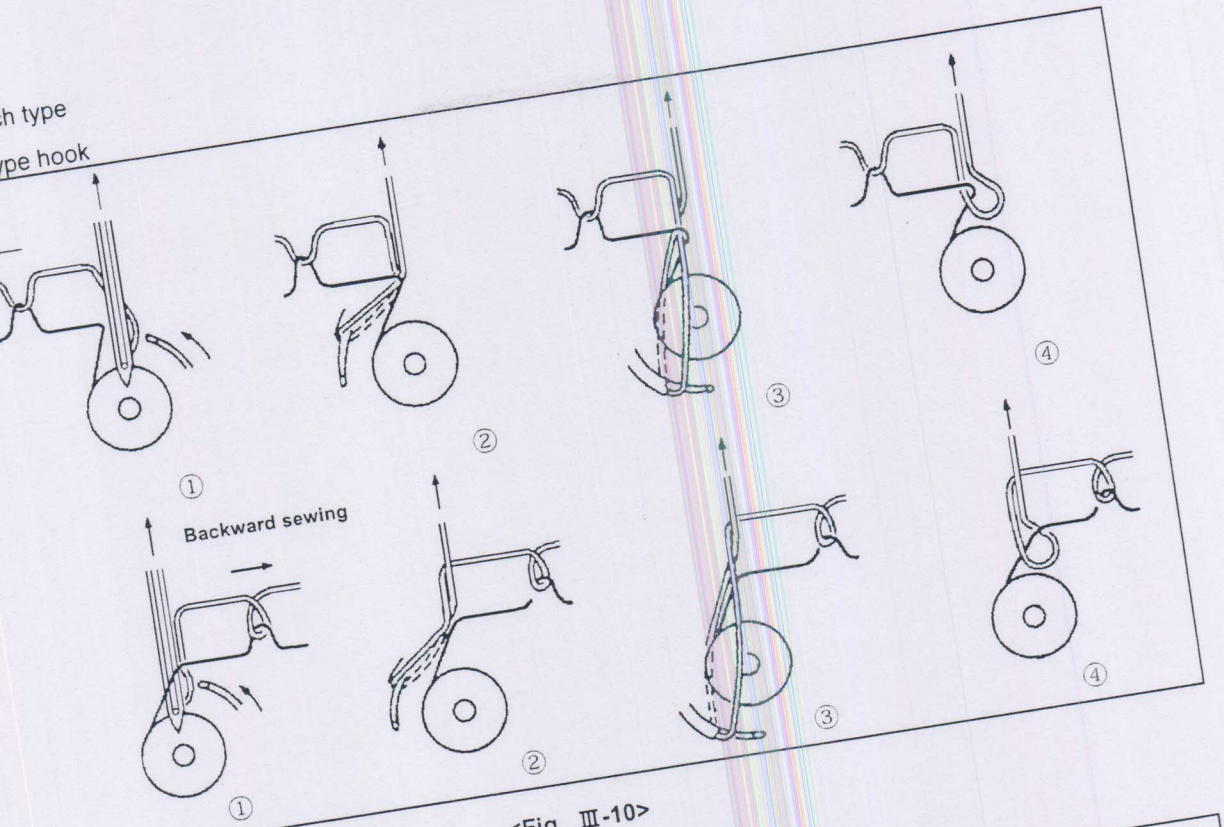


<Fig. Ⅲ-8>

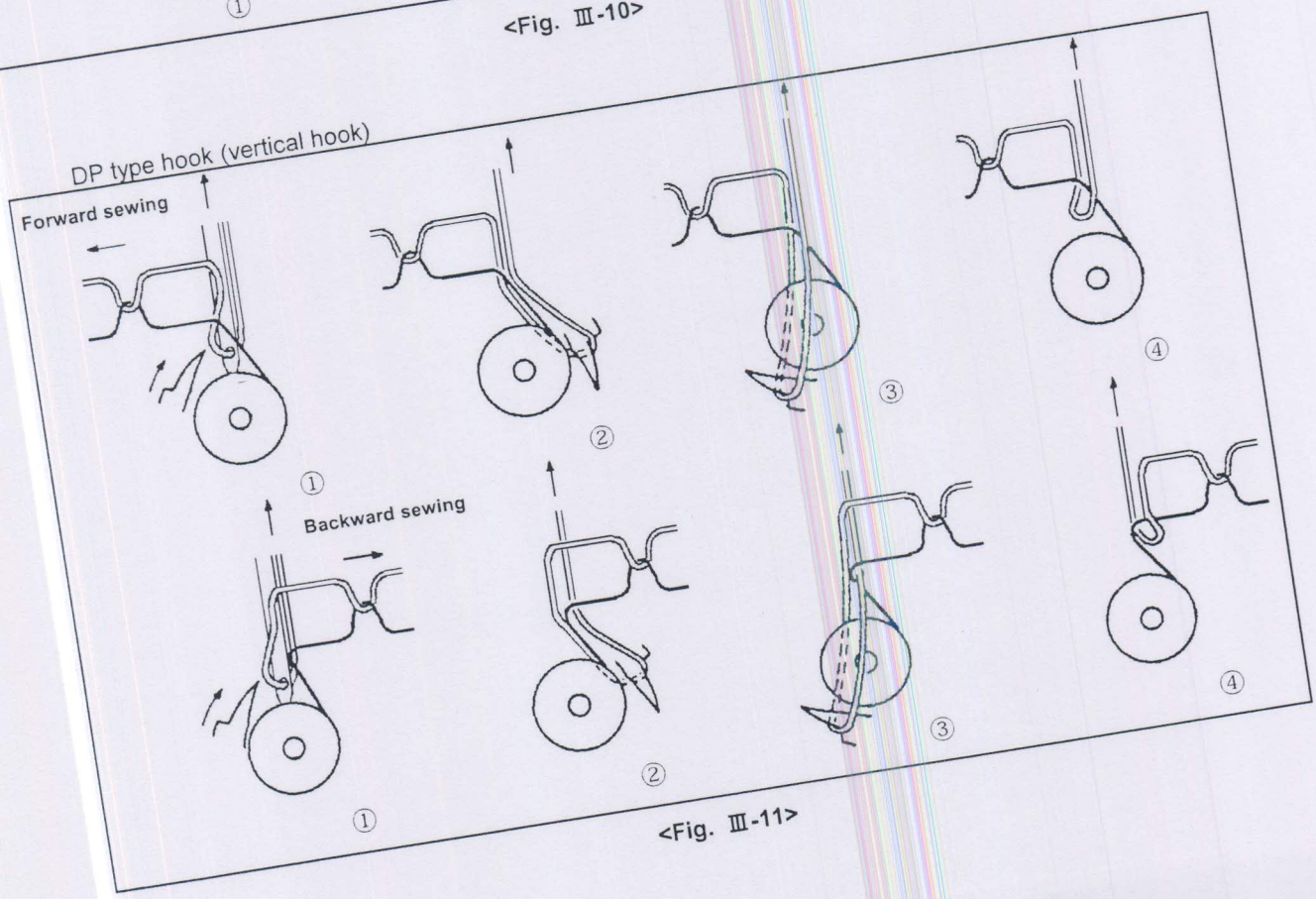
Hitch stitch



<Fig. Ⅲ-9>



<Fig. Ⅲ-10>

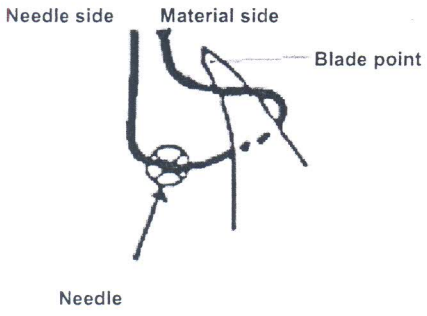


<Fig. Ⅲ-11>

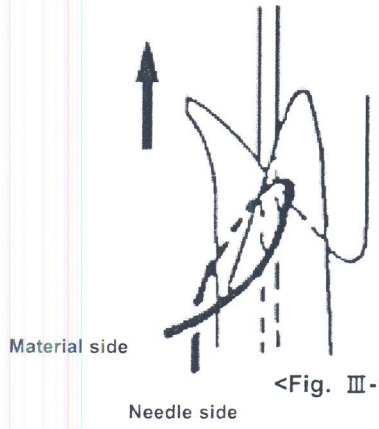
③ Upper thread motion of DB hook

a : Blade point of outer hook catches upper thread (loop).

b : Upper thread moves into the inner side of blade point following the rotation of hook.

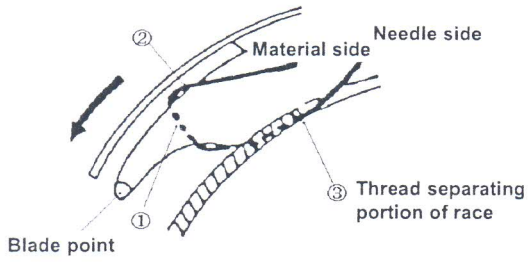


<Fig. Ⅲ-12>

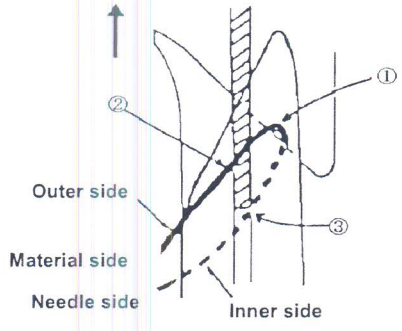


<Fig. Ⅲ-13>

c : Upper thread is separated to inner side and outer side of inner hook at thread separating portion of race.

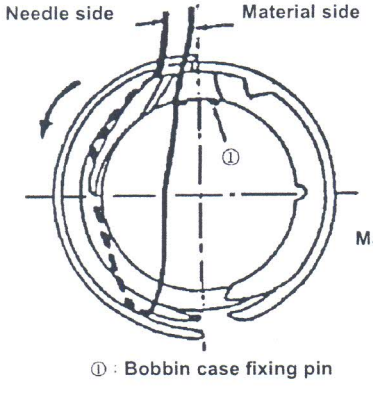


<Fig. Ⅲ-14>

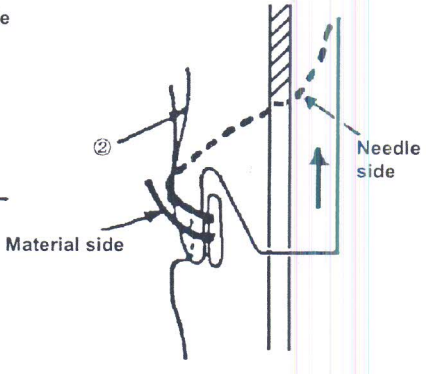


<Fig. Ⅲ-15>

d : Immediately before upper thread passes through inner hook



<Fig. Ⅲ-16>

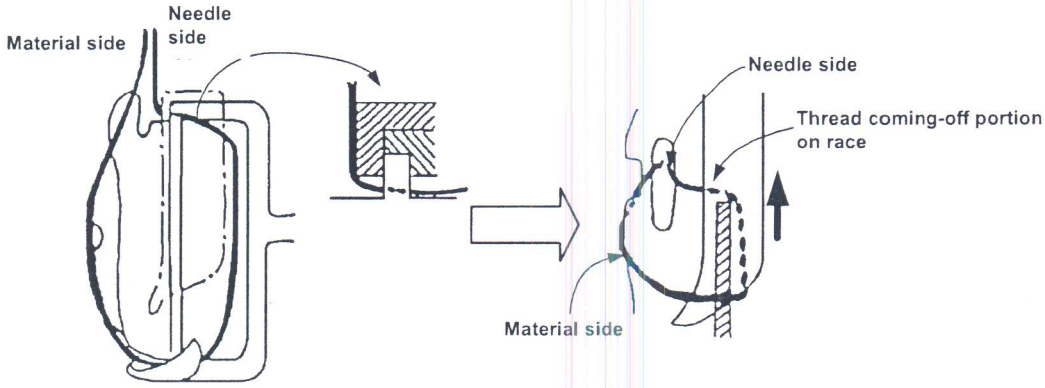


<Fig. Ⅲ-17>

Swell at portion ② of H type for thick thread and heavy-weight materials is largely swollen outward so as to improve crossover of thread on bobbin case. Thread is well-tightened at high-speed.

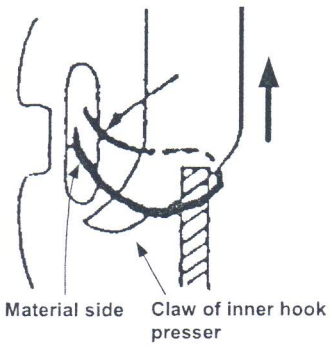
Also, lower thread is fed.

l : Thread take-up lever starts lifting upper thread.

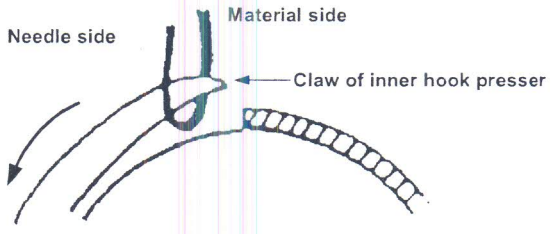


<Fig. Ⅲ-18>

f : Thread comes off hook and is caught on the claw portion of inner hook presser.



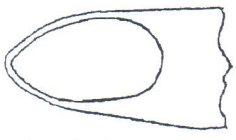
<Fig. Ⅲ-19>



<Fig. Ⅲ-20>

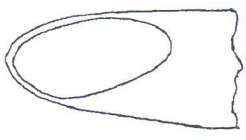
④ Blade point of hook

-1 Shape of blade point



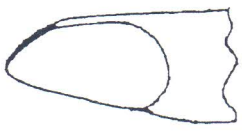
Standard type

<Fig. Ⅲ-21>



Tear-drop type It is hard to be blunt.

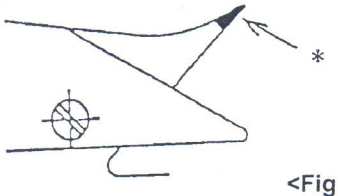
<Fig. Ⅲ-22>



SP type It is good for stitch skipping, but is apt to be blunt.

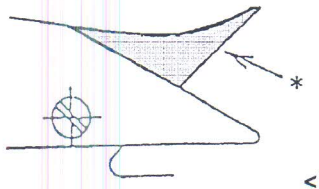
<Fig. Ⅲ-23>

Hard point hook (HP hook) * :
Reinforcing agent is welded at tip portion.



<Fig. Ⅲ-24>

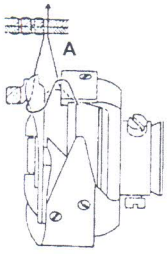
Hard chrome plating hook (CR hook) * :
Hard chrome plating is made on the whole outer hook.



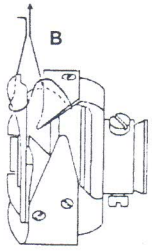
<Fig. Ⅲ-25>

⑤Type of DB hook

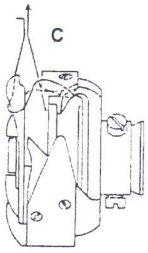
There are basic types of A, B, C, D, E, and F for DB hook. These types have the respective features.



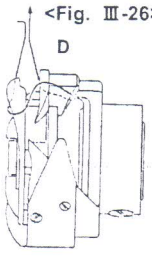
<Fig. Ⅲ-26>



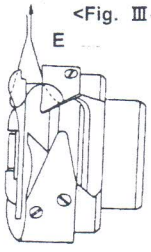
<Fig. Ⅲ-27>



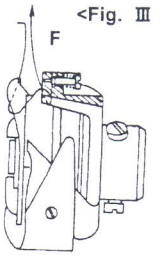
<Fig. Ⅲ-28>



<Fig. Ⅲ-29>



<Fig. Ⅲ-30>



<Fig. Ⅲ-31>

Type A <Fig. Ⅲ-26>

This is for heavy-weight materials or zigzag stitching, and thread coming-off timing is most advanced, comparing with other types. Accordingly, even when this is set at rather delayed timing, thread coming-off from hook is not so hard.

Type B <Fig. Ⅲ-27>

This is a general type covering from heavy-weight to light-weight materials. The feature is that the claw of inner hook presser is stretched long.

This claw holds needle thread for a relatively long period of time when the thread comes off from hook and works to get rid of the excessive slack.

Accordingly, it is effective to protect looping (towel face which often occurs at the wrong side of material) when using tightly-twisted thread or hard-to-slide thread.

Type C <Fig. Ⅲ-28>

This is used for both medium-weight and light-weight materials and has a projection to protect thread bite which prevents needle thread from entering into the gap between outer hook groove and hook race when the thread comes off from hook. As shown in the illustration, thread rides on this projection to prevent from being bit, and simultaneously is held to a certain extent by this projection to get rid of the excessive slack.

Further, whole length of outer hook gets long with this projection resulting in increasing durability and protecting occurrence of hook noise.

Type D <Fig. Ⅲ-29>

This combines the merit of type B and type C. Similar to type B, this has the claw of inner hook presser to hold the slack of needle thread, and similar to type C, this has a projection to protect thread bite. Further, another feature is that this is designed to reduce as much as possible the resistance when thread comes off from hook by lightening weight of inner hook and reducing moment of inertia. Therefore, better stitching can be obtained even for hard-to-sew thread such as slim and weak thread, synthetic thread, etc.

Type BOH <Fig. Ⅲ-30>

This is for medium-weight and heavy-weight materials and designed so that even when using thick and less-twisted soft thread, thread smoothly comes off and looping does not occur by shortening the claw of inner hook presser.

Type F <Fig. Ⅲ-31>

This is developed for semi-industrial sewing machine. The type belongs to type A. However, the feature is that inner hook presser is constructed (jam proof) to be assembled with a screw through coil spring. Even when thread bite occurs during sewing, thread bit in hook can be taken out without disassembling the hook. There is a hook in this type that can perform zigzag stitching of home-use sewing machine.

Type HSM (double-capacity hook)

Bobbin is made large to improve sewing efficiency and amount of thread winding is double as much as the standard when using thick bobbin thread or the like. This can be used for heavy-weight material, stitch sewing, etc.

Type HST (3-fold capacity hook)

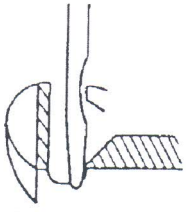
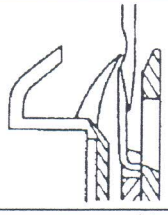
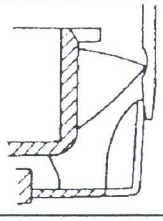
Amount of bobbin thread winding is approximately three times as much as the standard to improve further sewing efficiency of extra thick thread or extra heavy-weight materials. There are two kinds of type A and type B which can be used for the exclusive sewing machine to sew pattern stitching or the like in accordance with the application.

4) Needle guide of hook

Needle guide is attached to hook excluding exception. Needle guide is the most important part to protect blade point of hook and keep hook from damage, and also plays an role of protecting needle breakage.

The following table gives typical examples of needle guide.

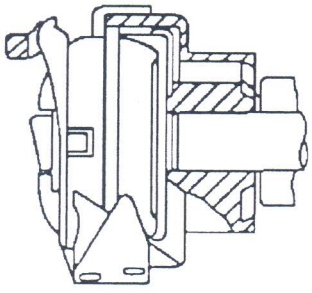
Type and characteristics of needle guide **<Table Ⅲ-7>**

Type	Illustration	Description
DB series		Generally, this needle guide is used without applying needle guard (up to #21). However, there is a needle guard type needle guide corresponding to thin needle (up to #11) as well.
DP series		This needle guide is attached to DP series hook and the portion of needle guide can be adjusted in accordance with thickness of needle.
12 series 11 series		This needle guide is attached to hook for relatively light-weight materials of 2-needle vertical hook. Portion of needle guide can be adjusted in accordance with thickness of needle.

5) Lubricating hook

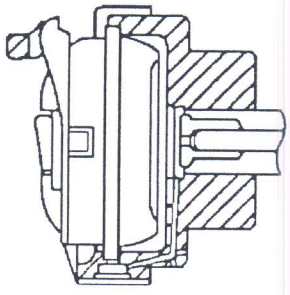
① Lubricating mechanism of DB hook

For the DB series hook, there are semi-high speed type, mechanism of which is to absorb a part of oil lubricated to hook driving shaft bushing into inside hook, and automatic lubrication type to forcibly lubricate from a hole in the center of hook driving shaft. There are closed type and open type for the automatic lubrication type.



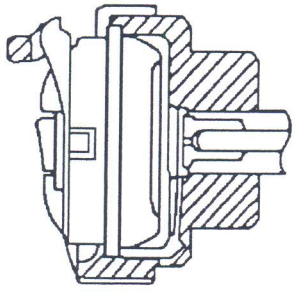
Semi-high speed type

<Fig. Ⅲ-32>



Closed automatic lubrication type

<Fig. Ⅲ-33>



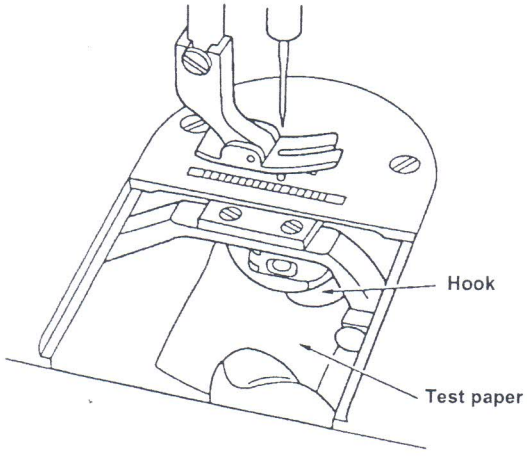
Open automatic lubrication type

<Fig. Ⅲ-34>

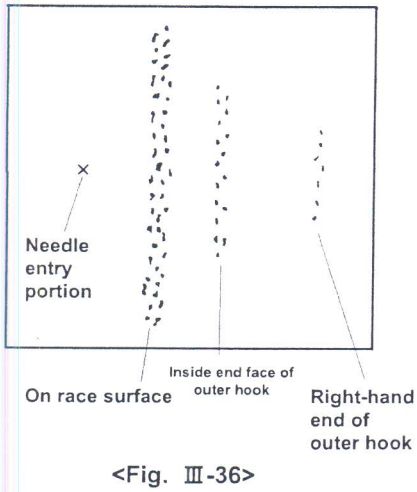
② Amount of lubrication

-1 Way of confirmation

After making the sewing machine run idle for approximately 10 seconds, place test paper while making the machine run idle for 5 to 10 seconds, and judge the amount of lubrication by the splashes of oil on the test paper.



<Fig. Ⅲ-35>



<Fig. Ⅲ-36>

-2 Appropriate amount of oil

Appropriate amount of oil for 5 seconds is such an extent as shown in the above right-hand illustration. Necessary places of oil are especially on race surface and oil splashes slightly in the inside end face of outer hook and right-hand end of outer hook.

* When thick thread or hard-to-slide thread is used.

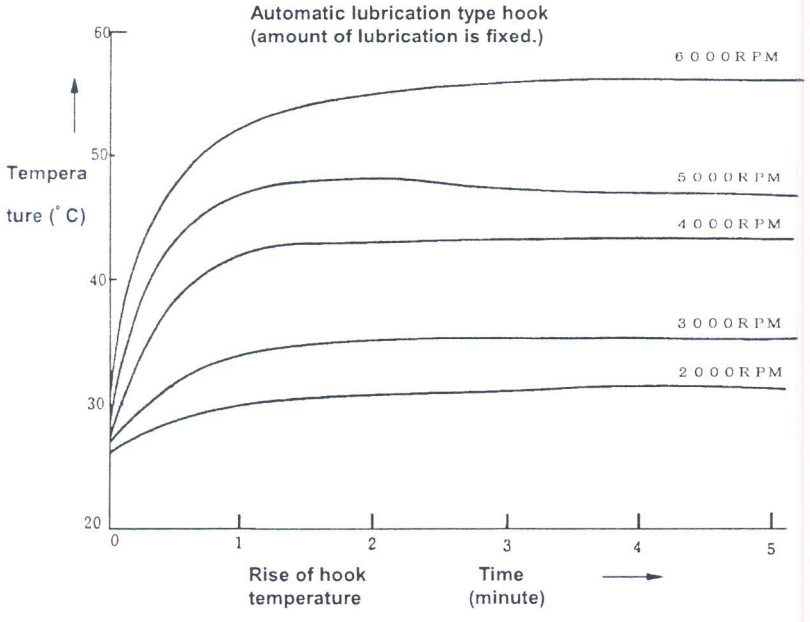
Thread tightness is improved when increasing the amount of lubrication to such an extent that oil is not attached to the sewing products.

* When thin thread or especially, synthetic thread is used.

It is better to decrease amount of lubrication to such an extent that hook is not seized. However, seizure of race surface occurs if amount of oil is excessively decreased.

As a result, motion of inner hook is deteriorated, and hook noise or hook temperature is increased. Also, dirt of needle thread (thread gets dark) may occur.

-3 Rise of hook temperature



<Fig. Ⅲ-37>

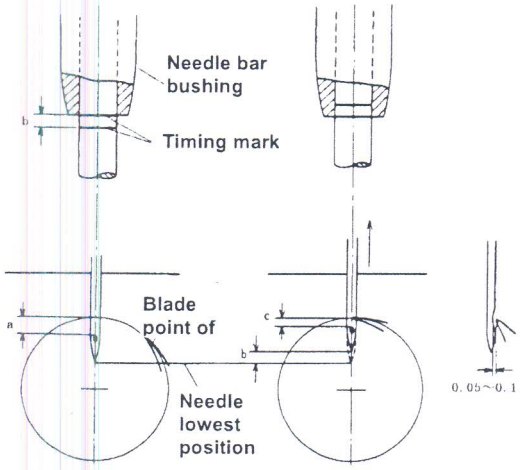
Temperature of hook which rotates at high speed rises, however, the extent of rise of temperature varies in accordance with number of revolutions, continuous rotating time and amount of lubrication.

Rise of hook temperature should not be worried except for abnormal cases. However, it should be careful about the lubricating condition

6) Hook timing

When timing marks are attached to needle bar, make sure that upper line of timing mark is aligned with lower end of needle bar bushing in the state that needle bar is lowered to its lowest position.

When they are not aligned with each other, adjust the position of needle bar. Next, when needle bar goes up from its lowest position and lower line of timing mark is aligned with lower end of needle bar bushing, adjust blade point of hook to the center of needle to attach the hook.



<Fig. Ⅲ-38>

b = Hook timing (phase)

c = Position of needle bar (height)

a = b + c

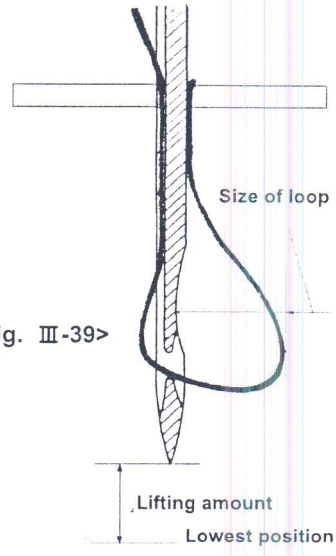
When DDL-5550N is adjusted to the timing marks, the respective values are :

a = 3.0 mm, b = 2.0 mm, and c = 1.0 mm.

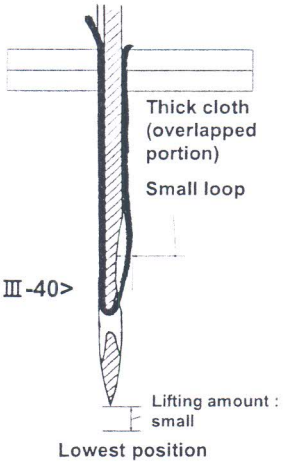
It may be required to change the adjustment values in accordance with materials (cloth and thread).

7) Needle thread loop

-1 When needle goes up from its lowest position, loop is formed by resistance of cloth.



<Fig. Ⅲ-39>

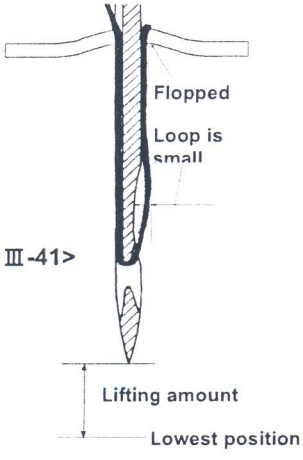


<Fig. Ⅲ-40>

-2 Size and shape of loop

a : Loop is small.

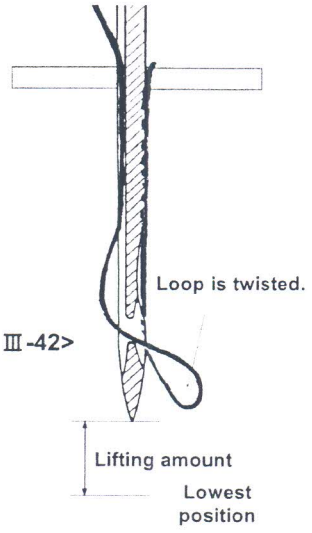
- Lifting amount is small.
- Thread is bad. → Stretch of thread is excess
- Cloth is flopped → Fixing of cloth is bad. (Overlapped portion or the like)
  Resistance is excessively strong. (Needle pierces material yarn, or the like.)
- Resistance of cloth is small. → Texture is coarse.
  Extra light-weight materials.
  Needle is too thick.
- Resistance of cloth is excessive. (Since thread is stretched.)
  → Extra heavy-weight materials
  Resistance of penetration is high.



<Fig. Ⅲ-41>

b : Loop is twisted.

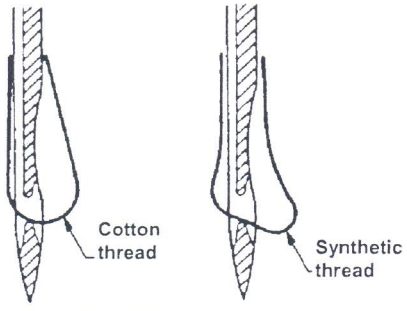
- Lifting amount is large.
- Thread is bad. → Thread is easily twisted (twist is strong.).
- Shift of twist of thread is many.



<Fig. Ⅲ-42>

c : Shape of loop according to thread

- Synthetic thread is apt to make a large loop of lower swollen shape.



<Fig. Ⅲ-43>

8) Thread-winding amount of various bobbins **<Table Ⅲ-8>**

	DB For DB hook	HSM Lockstitch double capacity hook	DBL Lockstitch 3-fold capacity hook	DP For DP hook	12 to 15 Vertical hook	12 to 15 Vertical double capacity hook
Spun #80	60m	110m	165m	65m	70m	120m
#60	45m	80m	120m	50m	60m	110m
#50	40m	70m	110m	40m	50m	90m
#30	23m	40m	65m	25m	25m	45m
#20	15m	27m	40m	17m	17m	30m
#8	10m	17m	25m		12m	20m
Filament #80	135m	210m	365m	140m	180m	320m
#60	110m	200m	300m	120m	145m	260m
#50	75m	135m	200m	75m	90m	160m
#30	32m	57m	85m	35m	45m	80m
#20	20m	35m	55m	25m	25m	45m
#8	15m	27m	40m		20m	35m

* Numerical values given in this table show when thread is wound around the bobbin by 80 to 90 %.

3. Thread take-up lever

1) Function

① Provides needle with upper thread.

② Supplies necessary amount of thread so that hook can scoop upper thread and so that the upper thread can pass through inner hook.

③ Lifts upper thread quickly when upper thread passes through inner hook.

④ Feeds out upper thread to be consumed for stitches together with feed dog.

⑤ Performs thread-tightening.

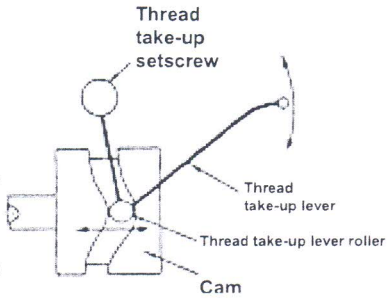
2) Kind of thread take-up lever

① Cam type thread take-up lever **<Fig. Ⅲ-44>**

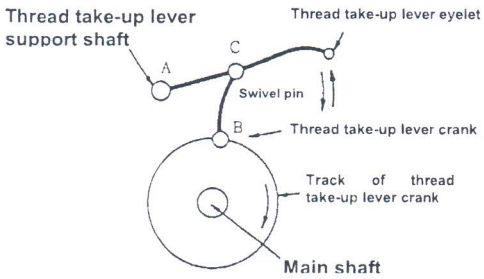
Thread take-up lever moves up and down by means of cam fixed on main shaft.

Thread tightening is very finely performed, and this type is largely used for leather and heavy-weight materials.

This is used for the old home-use sewing machines. In addition, this is not suitable for high-speed.



<Fig. Ⅲ-44>



<Fig. Ⅲ-45>

② Link type thread take-up lever **<Fig. Ⅲ-45>**

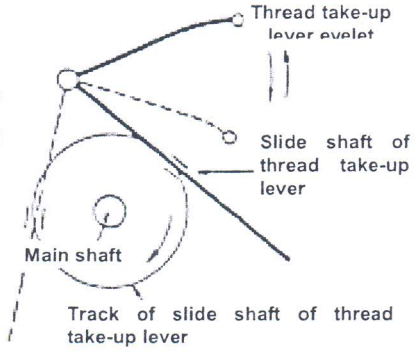
Thread take-up lever crank is rotated by means of rotary motion of main shaft and thread take-up lever moves up and down.

This type is used the most for general lockstitch sewing machines.

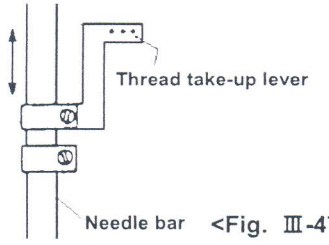
③ Slide type thread take-up lever **<Fig. Ⅲ-46>**

Slide shaft of thread take-up lever is rotated by means of rotary motion of main shaft and thread take-up lever moves up and down. This makes good thread tightening and is used with vertical hook for heavy-weight materials.

However, this is not suitable for high-speed. (Approx. up to 3,500 spm)



<Fig. Ⅲ-46>



<Fig. Ⅲ-47>

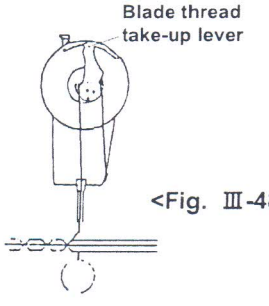
④ Needle bar type thread take-up lever **<Fig. Ⅲ-47>**

This is directly mounted to needle bar and performs same motion as that of needle bar. This is used for chainstitch sewing machines.

⑤ Rotary thread take-up lever **<Fig. Ⅲ-48>**

Blade-like thread take-up lever is rotated by means of rotation of counter weight mounted to main shaft and loosening and lifting of upper thread can be performed.

This makes good-looking stitch tightness and is used largely for zigzag stitching (foundation).

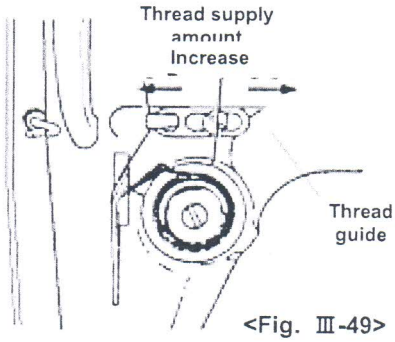


<Fig. Ⅲ-48>

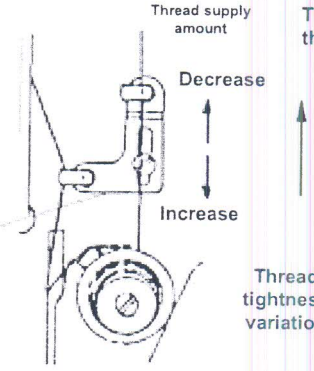
3) Stroke of thread take-up lever (Thread supply amount)

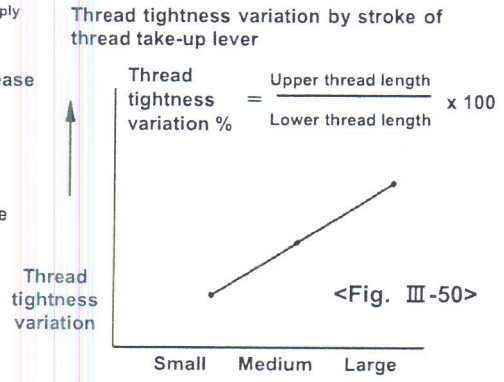
Thread supply amount from upper dead point to lower dead point of thread take-up lever is called stroke of thread take-up lever. Normally, the stroke is small for light-weight materials and large for heavy-weight materials. When the stroke is small, thread tightness is improved.

For the adjustment of stroke of thread take-up lever, it can be performed by moving arm thread guide laterally or vertically.



<Fig. Ⅲ-49>





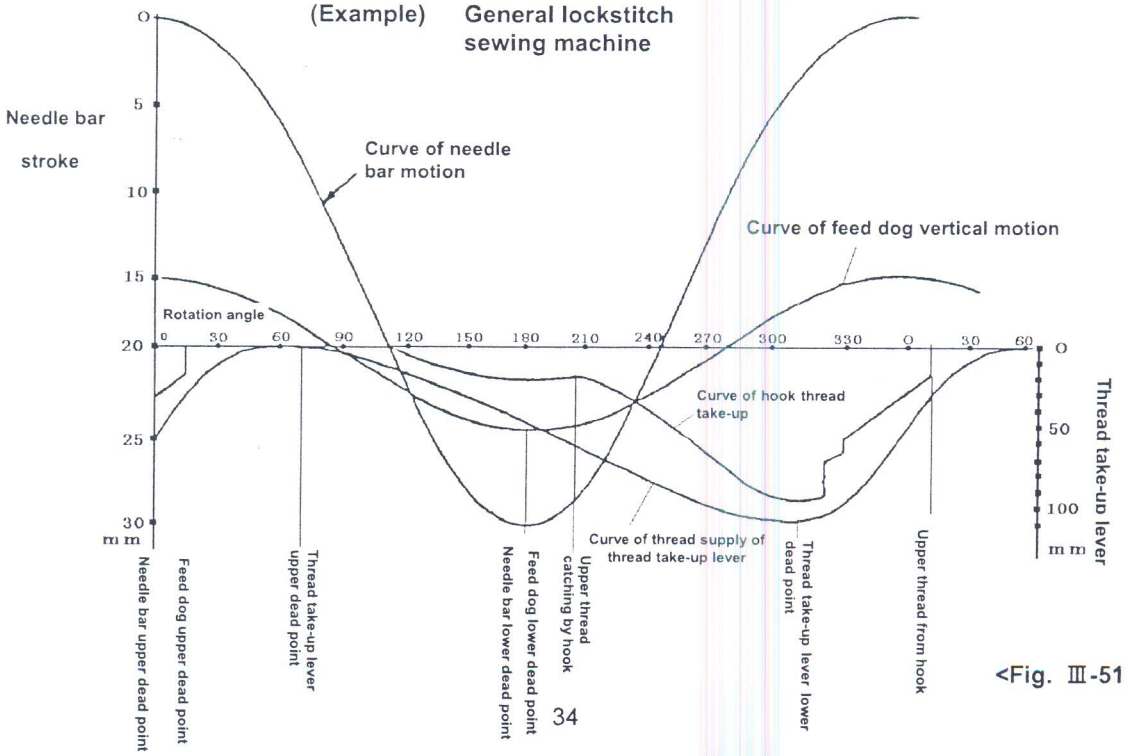
<Fig. Ⅲ-50>

Stroke of thread take-up lever

When sewing heavy-weight materials, move thread guide to the left or lower direction to increase thread supply amount. When sewing light-weight materials, move thread guide to the right or upper direction to decrease thread supply amount. For the standard adjustment of thread guide, thread guide should be positioned in a way that engraved marker line is aligned with the center of screw.

4) Motion diagram

This diagram shows the static motion of 360° per rotation, while making needle bar upper dead point as 0°, regarding the motion of needle bar and feed dog, how hook draws needle thread, how needle thread passes through hook, and how thread take-up lever supplies and lifts needle thread.



<Fig. Ⅲ-51>

4. Feed dog

1) Function

① Makes the sewing product move per stitch.

② Can change amount to move and forms stitches suitable for the sewing product.

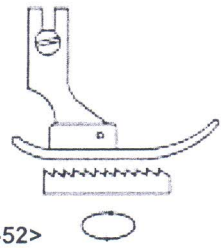
③ Stretch stitching or gathering stitching can be performed by means of feed mechanism, and prevention of puckering, gathering, etc. can be performed.

2) Kind of feed mechanism

① Bottom feed

This is the most standard feed mechanism, which feeds material with lower feed dog only.

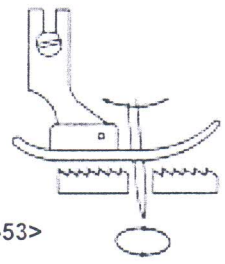
Uneven material feeding is likely to occur because of bottom feed only. However, sharp curve stitching can be easily performed and material handling is easy.



<Fig. Ⅲ-52>

② Needle feed (Bottom feed + needle feed)

This is the feed mechanism which needle bar moves in synchronization with bottom feed. Feeding force is strong, and this type can feed material more precisely than the aforementioned bottom feed type sewing machine. Uneven material feeding is reduced, but, stitch shrinking due to thread tightness is likely to occur.



<Fig. Ⅲ-53>

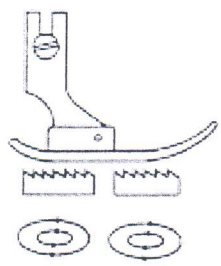
③ Differential feed (Front bottom feed + rear bottom feed)

This is the bottom feed mechanism, but feed dog is divided into front and rear. This is the feed mechanism which is possible to intentionally stretch material or gather material by changing feed amount of front feed dog and rear feed dog. This is suitable for sewing elastic knit.

Differential feed ratio of MO (overlock sewing machine)

Gathering 1 : 2 (Max. 1 : 4)

Stretching 1 : 0.7 (Max. 1 : 0.6)

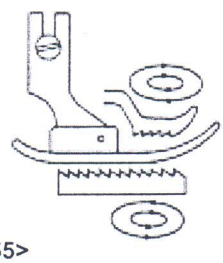


<Fig. Ⅲ-54>

④ Bottom and variable top feed (bottom feed + top differential feed)

There is a feed dog on the top side in terms of bottom feed, and top feed amount can be adjusted simultaneously together with adjustment of material feed from the bottom side.

Accordingly, this is the feed mechanism which is possible to prevent sewing slippage, and to perform edging contracting or gathering.

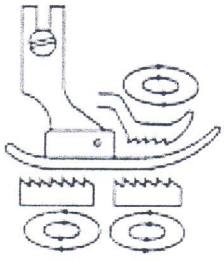


<Fig. Ⅲ-55>

⑤ Differential bottom feed and variable top feed

(differential feed + top differential feed)

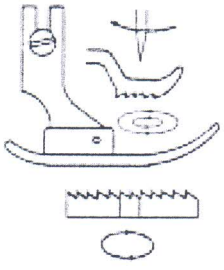
Bottom feed is differential feed, and top feed amount can be adjusted simultaneously together with adjustment (stretching and gathering) of material feed from the bottom side. Accordingly, this is the suitable mechanism which can give most suitable feed amount to the upper and lower materials.



<Fig. Ⅲ-56>

⑥ Unison feed (bottom feed + top feed + needle feed)

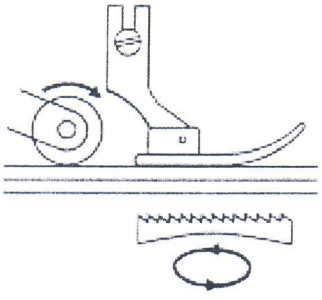
Feed force of this mechanism is most superior and this feed mechanism is largely used for extra heavy-weight materials or the like.



<Fig. Ⅲ-57>

⑦ Others

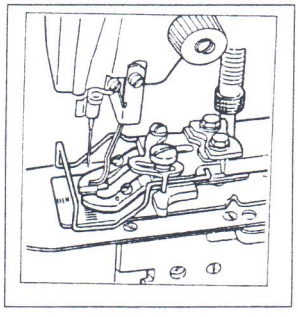
· With cloth pulling roller ... Roller located in the rear of presser foot pulls materials and sewing is performed. Uneven material feeding is reduced and working property is improved.



<Fig. Ⅲ-58>

· Fixed feed ... This is the feed mechanism to feed materials in a fixed state by holding materials between lower plate and upper plate.

(Example : cycle machine and automatic machine)



<Fig. Ⅲ-59>

3) Kind of feed dog

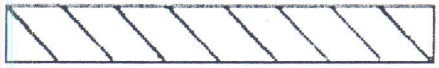
① Angle feed dog ... This is a feed dog generally used in large. The shape is strong in feed force of normal feed.

<Fig. Ⅲ-60>

② Double-cut feed dog ... It is good to fix materials laterally. This is used for upper feed dog of zigzag sewing machine, and top and bottom feed sewing machine.

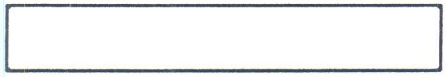
<Fig. Ⅲ-61>

③ Slant tooth (helical tooth) feed dog ... The shape is hard to make feed dog defect on materials. This is used for top and bottom feed sewing machine (cloth puller type).



<Fig. Ⅲ-62>

④ Urethane rubber feed dog ... Feed dog defect is not made on materials. This is suitable for materials on which feed dog defect is easily made or yarn of cloth is caught with feed dog.



<Fig. Ⅲ-63>

4) Shape of feed dog (with respect to angle feed dog)

① Shape of top end

- Sag at the top end of tooth (width is 0.1 mm or more and rounding)

Catching of material is deteriorated and decrease of feed force, uneven pitch or material slippage will occur.

Corrective measure : Grind the top end using grind stone or the like.

- Top end of tooth is sharp as a blade.

Scratch on material, thread breakage or chain-off thread breakage will occur.

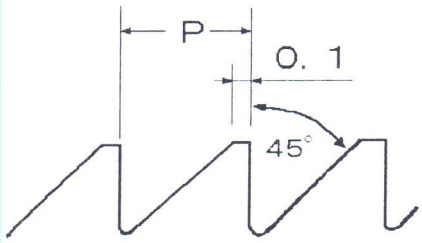
Corrective measure : Lightly grind the surface of tooth using grind stone or the like and buff there.

- Surface of feed dog is not even. Or, it is not levelled.

Corrective measure : Correct it using grind stone or the like.

Feed dog comes in single-side contact with materials and straight feeding is deteriorated.

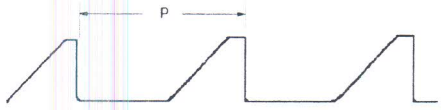
Corrective measure : correct using grnid stone or the line.



<Fig. Ⅲ-64>

② Pitch (P)

- For lockstitch : Slim pitch 1.15 mm Standard 1.5 mm Coarse pitch 1.8 mm
- For MO : Slim pitch 1.15 mm Standard 1.6 mm Coarse pitch 2.0 mm
- For extra heavey-weight materials : 2.5 mm to 4.5 mm



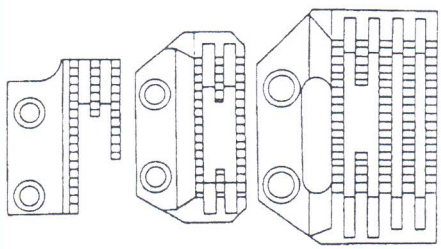
<Fig Ⅲ-65>

◎ Slim pitch : This is suitable for light-weight and soft materials. If this pitch is used for heavy-weight materials, bite to materials is deteriorated and feed force becomes insufficient.

◎ Coarse pitch : This is suitable for thick and hard materials in some degree. If this pitch is used for light-weight material sewing, it will be a cause of puckering.

③ Number of teeth (rows)

- The less the number of teeth (rows) is, the better the sharp curve stitching becomes.
- The more the number of teeth (rows) is, the better straight feeding, feed force and stability of materials become.
- When feed dog is located at this side of hole of throat plate, feeding to overlapped section and bite at the start of sewing are improved.



<Fig. Ⅲ-66>

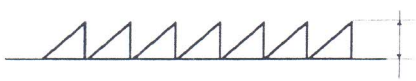
- For the elastic materials such as knit or the like, it is likely to be good to feed materials at the front or rear of needle entry. If there is no feed dog on this side, the material is in the state that it is pulled by the feed dog located in the rear of needle, and the material is sewn while it is somewhat stretched.

5) Tilt and height of the feed dog

① Height

Adjust the height to 0.5 mm to 1.2 mm (standard : 0.8 mm) in accordance with materials to be sewn.

For sewing machines for extra heavy-weight materials = adjust to 1.2 mm to 1.5 mm.



<Fig. Ⅲ-67>

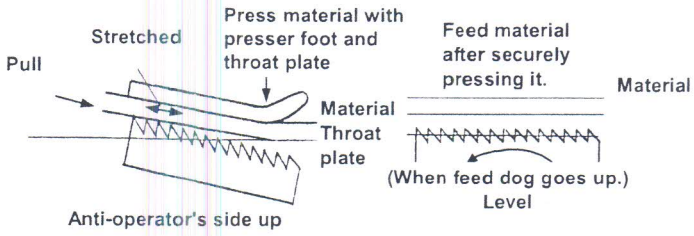
If the height is too high : Feed force is good. However, puckering may easily occur.
⇒ This is suitable for heavy-weight material sewing.

If the height is too low : Feed force is bad. However, puckering may not easily occur.
⇒ This is suitable for light-weight material sewing.

① Tilt

Generally, it is the standard that the feed dog is flush with throat plate surface when the feed dog goes up from throat plate surface or it comes down from throat plate surface.

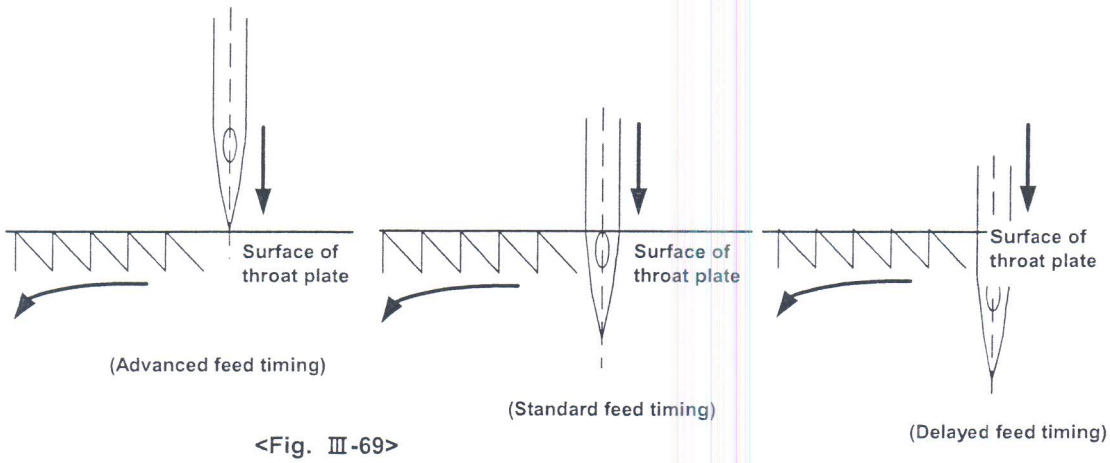
When tilting the feed dog with its anti-operator's side up (up in the opposite side of needle), cloth puller effect appears and puckering decreases.



<Fig. Ⅲ-68>

6) Feed timing

Check the timing at the position where needle tip ((needle eyelet) is when feed dog comes down.



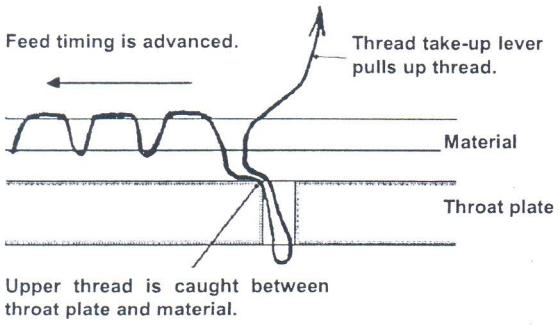
<Fig. Ⅲ-69>

① When feed timing is advanced **<Fig. Ⅲ-70>**

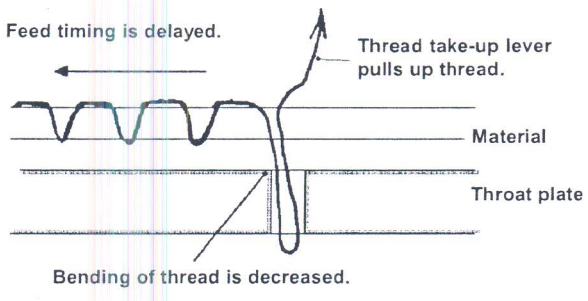
If the feed timing is advanced when thread is pulled up with thread take-up lever, thread is caught between throat plate and material and thread tightness is deteriorated.

② When feed timing is delayed **<Fig. Ⅲ-71>**

Bending of thread is decreased and upper thread tightness is improved. However, if feed timing is excessively delayed, needle wobbling occurs, resulting in needle breakage.



<Fig. Ⅲ-70>



<Fig. Ⅲ-71>

5. Presser foot

1) Function

① Stabilizes materials to sew jointly on the surface of throat plate, and determines the sewing position.

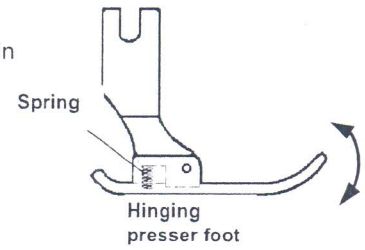
② Presses the materials so that materials are not lifted with the needle when needle comes out of materials.

③ Makes materials come in close contact with teeth of feed dog with adequate pressure so that the sewing direction is not disturbed when feed dog feeds materials forward or backward.

2) Kind of presser foot

There are many kinds of presser foot so that it can be used properly in accordance with kind of material or sewing process.

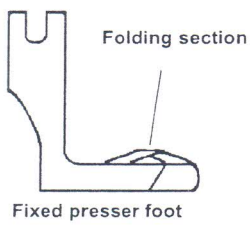
Kinds of the typical presser foot are described as follows.



<Fig. Ⅲ-72>

① Hinging presser foot

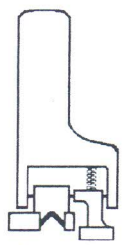
This is the most standard presser foot, and a spring is mounted in the rear of the presser foot so that its front part is up. This corresponds well to materials and feeding at overlapped section is smooth.



<Fig. Ⅲ-73>

② Fixed presser foot

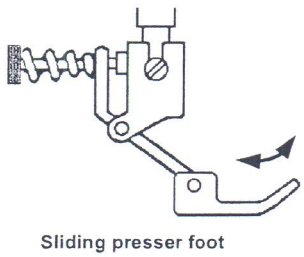
This is largely exclusively used for 2-fold, 3-fold piping, etc. Stability of folding or the like is good, however, feeding at overlapped section is deteriorated.



<Fig. Ⅲ-74>

③ Compensating presser foot

This is a guide presser exclusively used for stitch sewing. There are three shapes for left-side overlapped section, right-side overlapped section and use of both sides. There are many kinds so as to correspond with numerous stitch widths.



<Fig. Ⅲ-75>

④ Sliding presser foot

This presser foot moves forward or backward by means of up/down of feed dog, and it is effective to prevent uneven material feeding.

(MH-481 : B1524-481-CD0)

(For general lockstitch sewing machine : B1524-227-AA0)

(For general lockstitch sewing machine : MAA-015000A0

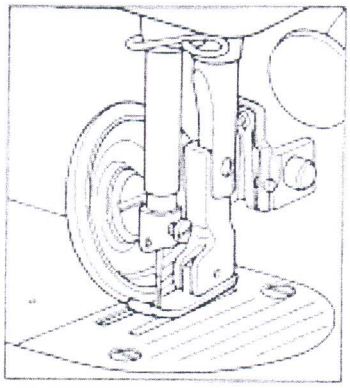
= Front/rear adjutment of foot sole type)

⑤ Other special presser feet

• Roller presser :

This is used for leather sewing. Rotating roller synchronizing with bottom feed instead of presser sole is located at the side of needle entry, and presses and feeds materials to be sewn.

This can be called a kind of top and bottom feed.

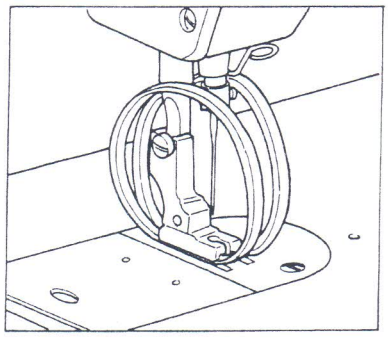


<Fig. Ⅲ-76>

• Ring roller presser :

Nylon rings attached to both sides of presser rotate in synchronization with bottom feed, and feed materials.

This can be called a kind of top and bottom feed.



<Fig. Ⅲ-77>

3) Thread path recess

Recess on the wrong side of presser foot is made to decrease resistance and lift the thread smoothly when thread take-up lever lifts upper thread.

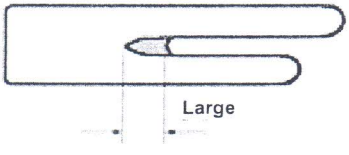
Length of this recess varies according to the kind of presser foot. It is necessary to use a proper presser foot in accordance with thickness of thread or stitch length.

① Large recess

(DDL-5530N, DDL-5550N standard : B1524-012-0BA)

This type does not press stitch (knotting point of upper and lower threads), and thread tightness is improved. However, if this presser foot is used when stitch length is small or sewing light-weight materials, puckering may occur.

Recommended feed pitch is approximately 4 mm.



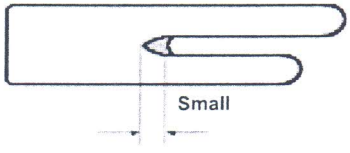
<Fig. Ⅲ-78>

② Small recess

(DDL-5550NA for light-weight materials : D1524-555-DBA)

When feed pitch 3 mm exceeds, defective thread tightness is apt to occur. It is necessary to replace the presser foot with one with large recess or to grind the recess to make it longer.

Recommended feed pitch is 2 mm to 3 mm.

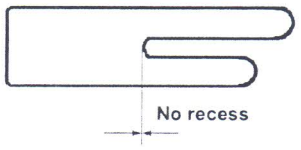


<Fig. Ⅲ-79>

③ No recess

(For extra light-weight materials : B1524-012-TBA)

This is effective for preventing puckering caused by excessive thread tightness when sewing extra light-weight materials. Be careful about sudden defective thread tightness.



<Fig. Ⅲ-80>

4) Surface treatment

① Standard presser foot : Nickel plating, chrome plating

② Special presser foot : Teflon presser foot ... This is effective to prevent uneven material feeding because of smooth sliding. However, it is inferior in the wear proof since the presser sole is teflon itself. (Presser sole only : D1524-126-W0B)

(For lockstitch sewing machine : D1524-126-WBA)

Teflon treatment presser foot ... Smooth sliding presser sole of special light alloy including teflon is used, and this is effective to prevent uneven material feeding. And, this is superior to the teflon presser foot in the wear proof.

For lockstitch sewing machine

MAA-05000AA0 (PF-1) = For standard sewing

MAA-05000BA0 (PF-2) = For medium- and heavy-weight material sewing

MAA-05000CA0 (PF-3) = For light-weight material sewing

5) Pressure of presser foot

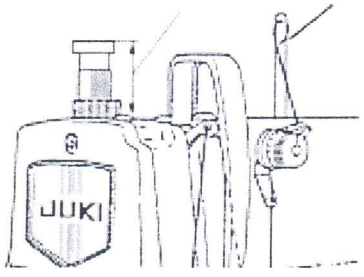
① Relation between height of presser foot and pressure of presser foot <Table Ⅲ-9>

Pressure of presser foot : Kg		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Height of presser spring regulator mm	For light-weight materials B1505-227-T00A	40	36	33	30	27	24	21	19			
	For standard B1505-227-000A		42	40	38	37	35	34	32	30	28	26

Distance from top surface of sewing machine arm to top end of presser spring regulator (mm)

When the pressure of presser foot is high, feeding force is increased. However, uneven material feeding or feed dog mark on the cloth is likely to occur. Adjust the pressure to the lower level especially for the light-weight material sewing or the like to sucn an extent that the material feeding is not difficult.

Height of presser spring regulator



<Fig. Ⅲ-81>

② Kinds of presser spring

For standard sewing machine : B1505-227-000A (ϕ = 1.4 mm)

Pressure at the time of delivery : 4Kg When the strength ratio of this spring is regarded as [1],

For sewing machine for light-weight materials : B1505-227-T00A (ϕ = 1.2 mm) Pressure at the time of delivery : 4Kg (type A)

1.5Kg (type E) Strength ratio to standard spring [0.57]

For sewing machine for extra light-weight materials : 111-62104 (ϕ = 1.0 mm) optional Strength ratio to standard spring [0.28]

For NF sewing machine : 111-05202 (ϕ = 0.9 mm)

Pressure at the time of delivery : 1Kg Strength ratio to standard spring [0.19]

6. Thread tension

1) Function

This gives a proper tension to upper thread and lower thread among the various sewing conditions, and interlaces upper thread and lower thread in the approximate center of cloth to form beautiful stitches.

2) Adjusting points of thread tension

First, adjust the lower thread tension.

Low tension ... it is effective for reduction of puckering, wobbling prevention, and improving appearance.

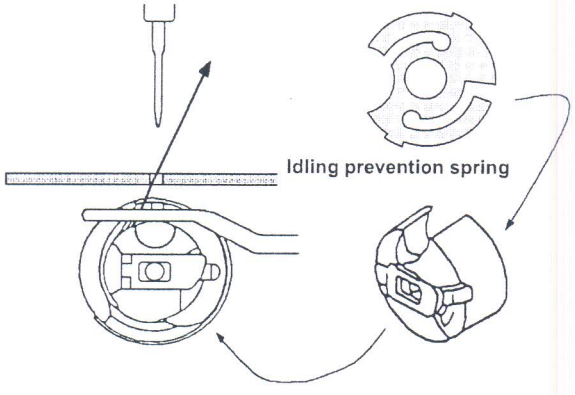
High tension ... it is effective for reduction of uneven stitches and decrease of bobbin idling.

① Measuring bobbin thread tension

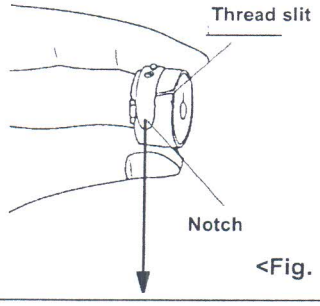
Set bobbin case to the sewing machine as shown in the illustration, and draw up bobbin thread from the needle hole in throat plate in the slanting upper direction of this side. Then, measure the tension at the unit of gf (effective numerals : two digits) using tension gauge.

Set draw-out speed of thread to 10 to 30mm/sec.

Be sure to measure it in the state that the needle bar is near its upper dead point so that bobbin thread does not come in contact with the outer hook.



<Fig. Ⅲ-82>



<Fig. Ⅲ-83>

In case of springless bobbin case, measuring may be performed at the position of the above illustration.

* Notch for spring rotation prevention is attached to bobbin case with idling prevention spring, and the depth of the case is wider than the standard as deep as the thickness of the spring (0.1 mm).

Thread tension adjustment value **<Table Ⅲ-10>**

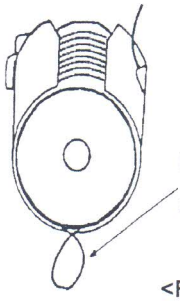
	Bobbin thread tension	Thread take-up spring tension	Stroke (thread absorption amount)
Spun #80 Tetoron #80, #60	10 to 25 g	5 to 15 g	9 to 14 mm
Spun #50, #60 Tetoron #50	15 to 30 g	10 to 20 g	8 to 13 mm
Spun #30 Tetoron #30	20 to 40 g	20 to 30 g	6 to 11 mm

- Adjustment value of bobbin thread tension in terms of thread used for 1-needle lockstitch sewing machine, thread take-up spring tension, or stroke (thread absorbing amount) slightly varies in accordance with the sewing machines. Especially, stroke of thread take-up spring varies.

For the respective adjustments, refer to V) Adjustment procedures.

② Idling of bobbin

Idling bobbin causes the bobbin thread to come off as shown in the illustration and thread breakage or irregular stitching occurs.



<Fig. Ⅲ-84>

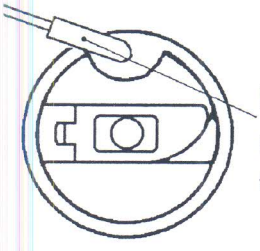
Corrective measures :

- Reduce bobbin thread winding amount.
- Replace with a lighter bobbin. (Aluminum bobbin or the like)
- Use a bobbin case with idling prevention spring.
- Decrease sewing speed.
- Use a bobbin case and a bobbin which are in the state that the clearance between them is small. (Do not use the market-available ones.)

◎ Cause that idling occurs

-1 Idling at the time of thread trimming

Idling occurs since bobbin thread is quickly pulled when the moving knife handles bobbin thread.



<Fig. Ⅲ-85>

[Corrective measure other than the aforementioned corrective measures]

Adjust so that the bobbin positioning finger securely presses the bobbin at the time of thread trimming.

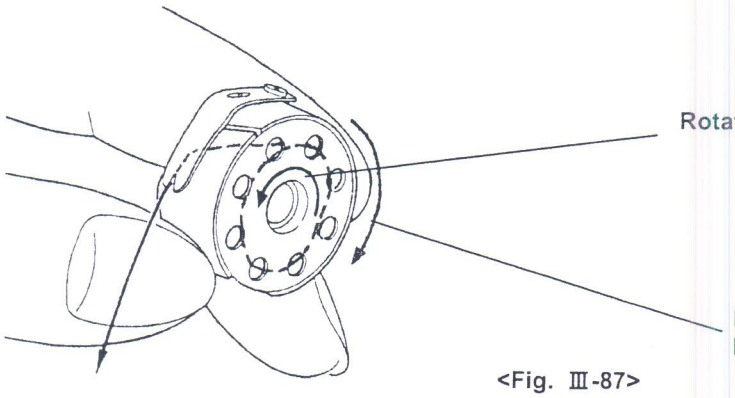
— 2 Idling due to vibration of sewing machine rotation

Bobbin of almost every sewing machine rotates in the hook rotating direction by the vibration. Therefore, idling occurs.

<Fig. Ⅲ-86>

[Corrective measure other than the aforementioned corrective measures]

Set bobbin to bobbin case in the direction where bobbin thread is pulled by the rotating force of the bobbin.



<Fig. Ⅲ-87>

-3 To form stitches

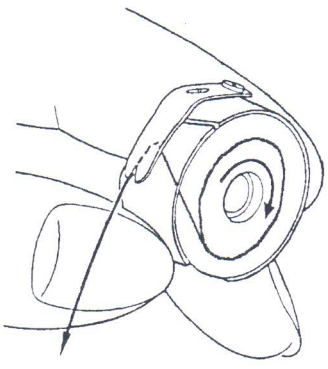
Idling occurs when forming stitches or when bobbin thread is fed by the feed dog and thread tightenning.

This is a phenomenon that is likely to occur in case of thread that is easily twisted or thread the move of twist of which occurs easily.

[Corrective measure other than the aforementioned corrective measures]

Set bobbin so that the bobbin thread does not come off even when the bobbin idles.

Generally, setting as shown in the right illustration is proper for bobbin thread come-off prevention. However, there are some threads which are proper when setting the bobbin in the reverse direction.



<Fig. Ⅲ-88>

③ Change of bobbin thread tension due to bobbin thread remaining amount (when idling prevention spring is used.)

The higher the idling prevention spring pressure is, the larger the change of bobbin thread tension due to bobbin thread remaining amount is. Accordingly, a phenomenon that the less bobbin thread remaining amount is, the worse thread tightening is occurs.

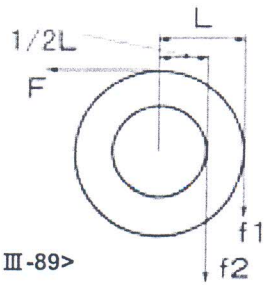
(The bigger the hook is, the larger change of the tension is.)

Accordingly, it is desired that the pressure of idling prevention spring should be low to such an extent that bobbin thread does not idle.

[Remarks] Why such a phenomenon occurs when the pressure of idling prevention spring is high.

F = Force the bobbin thread comes out

f1, f2 = Force bobbin thread desires to stay there



<Fig. Ⅲ-89>

(Pressure of idling prevention spring)

L = Distance from the center when bobbin thread is fully wound

1/2 L = 1/2 distance of L

F > f1 x L ... ①

The above force is necessary when bobbin thread comes out from bobbin.

And, if the sewing continues, the bobbin thread remaining amount continues to decrease.

Even when the bobbin thread remaining amount reaches 1/2 L, the force,

F > f2 x 1/2 L .... ②

is necessary. In addition,

f1 x l = f2 x 1/2 L ... ③

is formed even the same bobbin since the same sewing is being performed. Accordingly, a formula,

F > f1 x L = f2 x 1/2 L

is introduced from ①, ② and ③.

If f1 = 1 g (pressure of idling prevention spring = 1 g), f2 = 2 g.

The difference is 1 g (2 g - 1 g = 1 g). However, if f1 = 10 g (pressure of idling prevention spring = 10 g), f2 becomes 20 g, the difference is 10 g (20 g - 10 g = 10 g).

The difference of 10 g is not much for the thick thread heavey-weight material sewing. However, for the thin thread light-weight material sewing, sewing quality differentiates.

<<Conclusion>>

When considering the sewing stability, the ideal is sewing without idling prevention spring. However, the idling prevention spring is absolutely necessary to prevent sewing from trouble due to bobbin thread idling. It is needless to say that thorough control of spring pressure is necessary to protect demerit due to the idling prevention spring.

3) Thread controller

① Function

Adjusts the needle thread tension so that the stitchs are formed in the approximate center of the cloth.

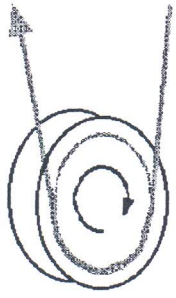
② Kinds

* Tension disk type ... This is used for almost all sewing machines.

  Thread is passed between two pieces of tension disk and spring pressure is changed from one side to give tension to thread.

  Accordingly, if thickness of thread changes, tension changes since contact strength between tension disk and spring changes.

  The defect is that shift of thread twist is apt to occur since thread is stripped off by frictional resistance.



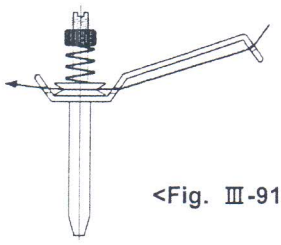
<Fig. Ⅲ-90>

* Rotary tension type ... This is used for LZ-2280N series.

This type winds thread one turn around roller, gives spring pressure from one direction and gives tension to thread by frictional torque of spring pressure and roller.

Change of tension due to thickness of thread is small, and thread can be supplied under stable tension. Further, shift of thread twist due to frictional resistance is small.

The defect is that when this type is compared with the thread tension disk type, thread is apt to come off from roller and difficult to be passed. Readjustment of tension may be necessary in accordance with the change of thickness of thread.



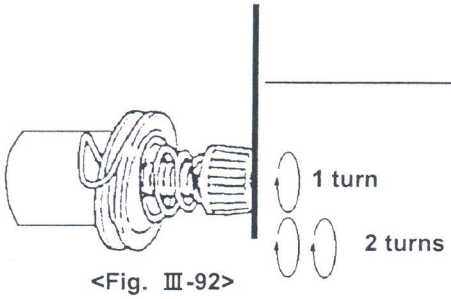
<Fig. Ⅲ-91>

* 1st tension (thread guide post) ... (Part No. : D1113-126-WA0))

This is effective for prevenstion of thread fluctuation, irregular stitch and balloon stitch. Especially, effect appears for sewing under low tension of thin thread.

③ Relation between tightening position of tension nut and tension **<Table Ⅲ-11>**

Position of tension nut (turn)		0	1	2	3	4	5	6	7	8	9	10
Tetoron #80	Type A : D3129-555-D00	90g	15	30	40	55	75	85	105	120	150	190
	Standard : B3129-012-A00	10g	24	48	75	105	120	150	180	240	—	—
Spun #80	Type A : D3129-555-D00	12g	15	25	40	50	65	80	100	120	145	190
	Standard : B3129-012-A00	12g	22	45	65	85	110	135	160	210	—	—

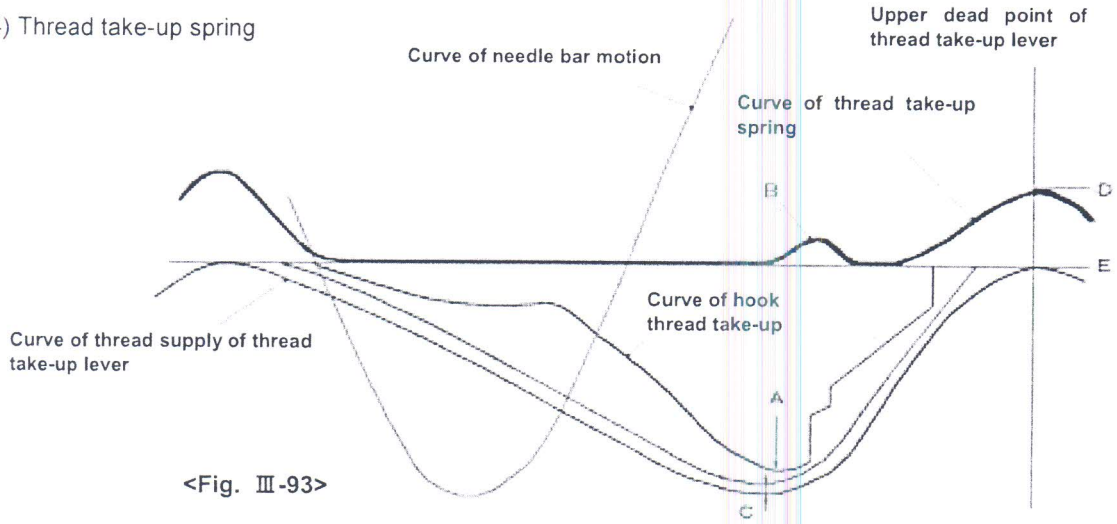


<Fig. Ⅲ-92>

Regard as "0" the place where end face of tension nut on this side is aligned with end of tension post.

Regard tightening of 1 turn as "1", and that of 2 turns as "2".

4) Thread take-up spring



<Fig. Ⅲ-93>

① Function

This spring gives elasticity between hook and thread, and absorbs the resistance force at point A where a large resistance is applied to thread. At this time, the motion of thread take-up spring works such a shape as B. Thread supply amount (slack) of thread take-up lever is absorbed as much as amount C by the thread take-up spring.

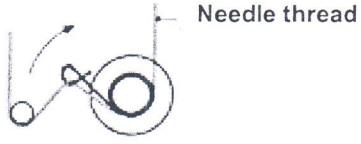
② Motion

The spring moves a little as B at point A (when hook pulls in needle thread at its maximum.) and moves to its maximum stroke as D at the upper dead point of thread take-up lever (when thread take-up lever is lifted to its maximum.).

· State of thread take-up spring at the time of D
(Thread supply state)

<Fig. Ⅲ-94>

· State of thread take-up spring at the time of E
(Thread absorption state)

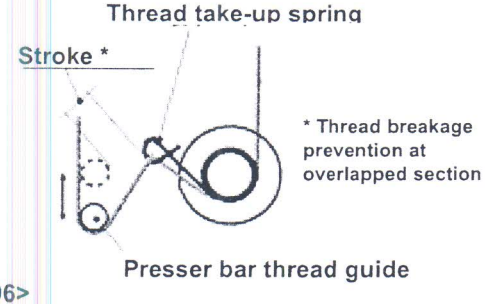


<Fig. Ⅲ-95>

③ Presser bar thread guide

This is connected to presser bar and moves up or down in accordance with up/down motion of feed dog and change of thickness of cloth to change the stroke of thread take-up spring.

When cloth gets thicker, presser bar thread guide goes up and stroke of thread take-up spring automatically becomes smaller.



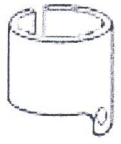
<Fig. Ⅲ-96>

5) Needle bar thread guide

① Standard **<Fig. Ⅲ-97>** ... (Part No. : 110-05303)

This thread guide decreases thread fluctuation around needle tip, and is suitable for the feed pitch 3 mm or less with thin synthetic thread.

This guide may be the resistance when performing thread tightening by thread take-up lever at the time of thick thread and large feed pitch.

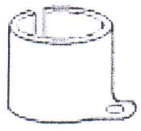


<Fig. Ⅲ-97>

② For thick thread and large feed pitch (H type) **<Fig. Ⅲ-98>** ...

(Part No. : B1418-415-H00)

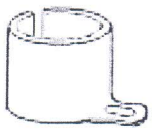
Thread hole protrudes to this side and when using this guide, resistance is small at the time of thick thread and large feed pitch. In addition, thread tightening is improved.



<Fig. Ⅲ-98>

③ For extra thick thread **<Fig. Ⅲ-99>** ... (Part No. : 114-01619)

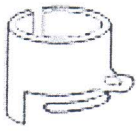
Thread hole protrudes to this side further than the aforementioned ②. This guide is suitable for extra thick thread and feed pitch 5 mm or more.



<Fig. Ⅲ-99>

④ For uneven stitch prevention **<Fig. Ⅲ-100>** ... (Part No. : B1418-227-T00)

This guide makes needle thread approach the needle as near as possible and stability of thread is good. Also, this guide is good for thread breakage prevention at the time of needle bent, uneven stitch, reverse feed stitching and idle stitching, and is suitable for synthetic thread and thin thread. However, threading is rather difficult and thread tightening is deteriorated with thick thread.



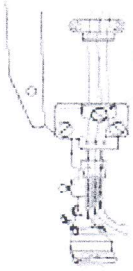
<Fig. Ⅲ-100>

6) Needle thread tension disk (weak spring or felt)

① Function ... Prevention of thread fluctuation at needle portion

- Prevention of piercing thread at needle tip
- Prevention of bite to hook (thread tension in terms of blade point of hook is increased.)
- Prevention of stitch skipping (when blade point of hook scoops needle thread, this disk gives resistance to thread to easily form loop. ... it is effective for idle stitching or drop stitching.)

* Set the tension to 3 to 5 g since thread tightening by thread take-up lever is deteriorated

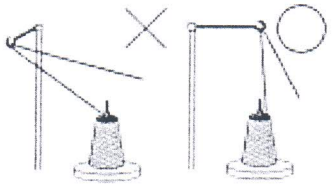


<Fig. Ⅲ-101>

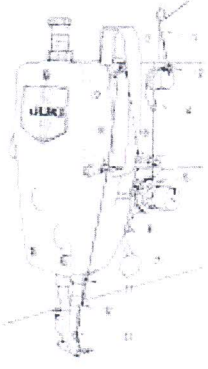
7) Threading

Pass thread properly as described in the Instruction Manual. And, set vertically "spool rest" and "spool pin".

Unevenness of thread tension occurs, resulting in irregular stitch or thread breakage.



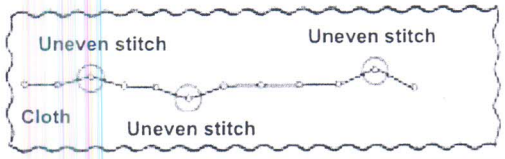
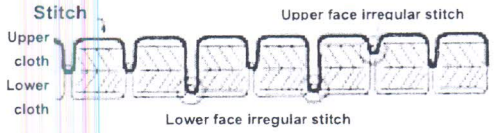
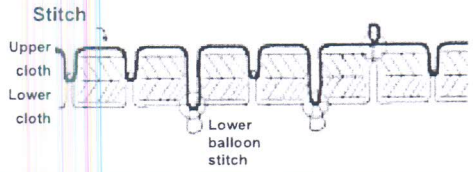
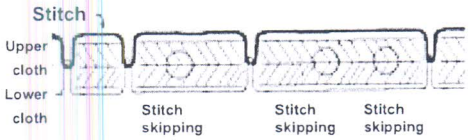
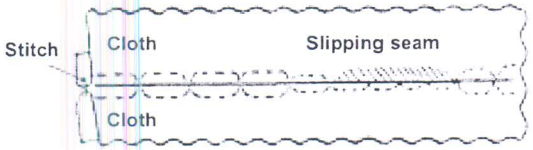
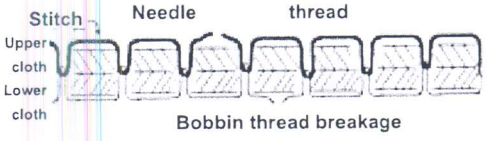
<Fig. Ⅲ-102>

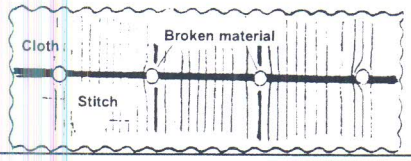
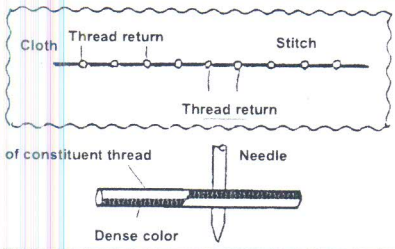
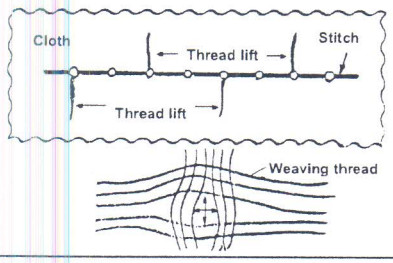
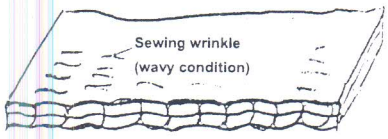
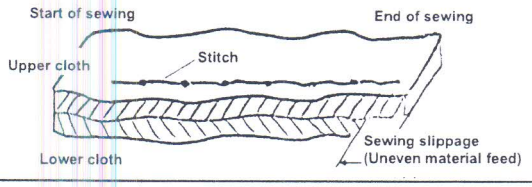
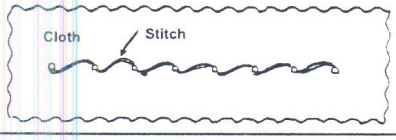
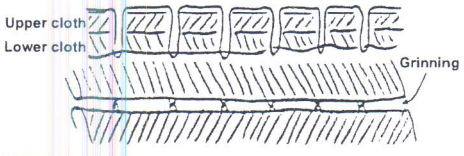


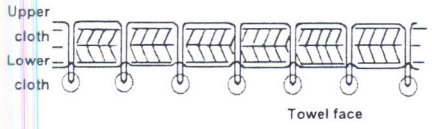
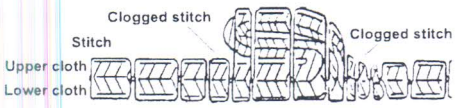
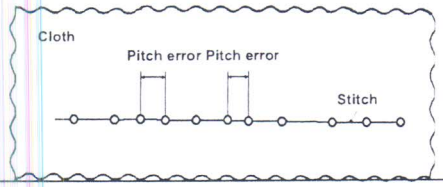
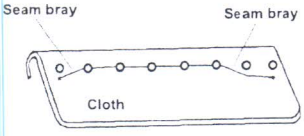
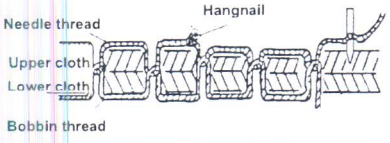
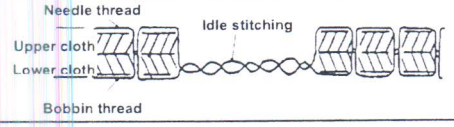
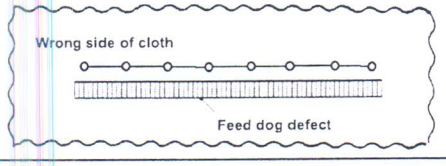
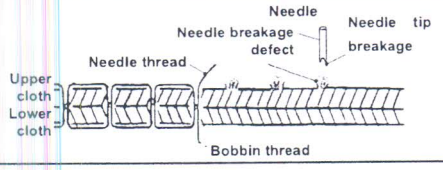
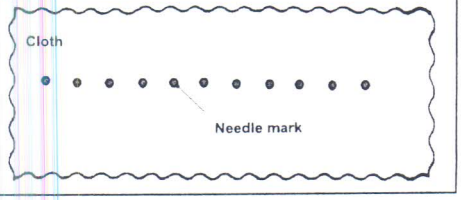
<Fig. Ⅲ-103>

Ⅳ) Defects of sewing that occur in sewing process and definition of terms

<Table Ⅳ-1>

No	Term	Definition (contents)	Contents of defect
1	Uneven stitch	Stitching is not performed straight and a part of stitches is sewn in disorder.	
2	Irregular stitch	Irregular knotting points of thread occur on upper and lower faces of cloths under a certain tightness	
3	Balloon stitch	Large or small thread loop suddenly occurs on upper or lower cloth from knotting point of sewing thread.	
4	Stitch skipping	Stitches of sewing thread partially skip and stitching is not performed completely.	
5	Missing stitch	Stitches are out of the sewing line.	
6	Slipping seam (slipping) (slip-out)	When the force is applied to stitch, the constituent thread of the part moves and stitch opens or slips.	
7	Thread breakage	When the force is applied to stitch, sewing thread is cut.	

No	Term	Definition (contents)	Contents of defect
8	Broken material	Constituent threads of cloth are cut by sewing machine needle at the time of sewing.	
9	Thread return (Reverse)	The line that occurs when constituent thread of cloth turns and thread on the wrong side faces the right side by the shock force at the time of penetration of sewing machine needle.	
10	Weaving thread lift	The state that defective gloss or defective pattern occurs when a part of weaving threads is shifted by stitch, sewing machine needle, awl, etc.	
11	Seam puckering (Small puckering) (Small shrinkage)	Wrinkle that occurs near stitches by shrinking by sewing, sewing slippage, etc.	 * Cloth shrinks and becomes wavy.
12	Sewing slippage (Uneven material feed)	Upper and lower cloths slip each other in the feeding direction.	
13	Left-to-right inclined stitch of bobbin thread	Left-to-right inclined stitches are formed.	
14	Seam grinning	Stitch opens since tension of sewing thread is insufficient.	

No	Term	Definition (contents)	Contents of defect
15	Towel face	Knotting positions of sewing thread continuously occur on the lower side of cloth in the state of large thread rings.	
16	Clogged stitch	A certain resistance force is applied to the sewing product and stitch pitch becomes irregular.	
17	Pitch error	Stitch length is changed by change of feed force, cloth slippage, etc. This phenomenon is apt to occur between high and low speed sewings.	
18	Seam bray (Thread looseness)	Sewing thread gets loose and the state of stitch skipping occurs.	
19	Hangnail	The state that several pieces of yarn of sewing thread are cut during sewing.	
20	Idle stitching (Drop stitching)	Knotting point of thread is formed without sewing product.	
21	Feed dog defect (Rasp-cut defect)	Scratch (trace of teeth) made by feed dog when feeding cloth.	
22	Needle breakage defect	Scratch on sewing product made by needle tip when several stitches are performed in the state that needle is broken during sewing.	
23	Needle mark (Trace of needle))	Trace of hole of sewing machine needle due to re-sewing, basting, etc.	

V) Adjustment procedure

1. Bobbin thread tension

To properly operate the sewing machine, it is important that needle and bobbin thread tensions should be well balanced. Generally, it seems that bobbin thread tension is not so carefully adjusted as needle thread tension. Comparng with needle thread tension, bobbin thread tension is lower and fine adjustment for the tension is necessary.

1) Adjustment procedure **<Fig. V-1>**

Adjust the tension by tightening the screw in bobbin case. Slight moving of the screw only makes the tension change greatly.

Turning the screw in the direction A increases the tension, and turning in the direction B decreases the tension.

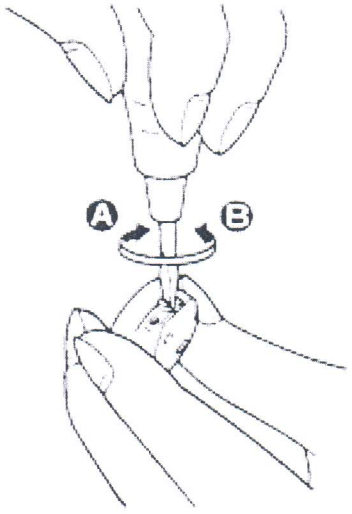
2) How to measure the tension **<Fig. V-2>**

Measure the tension when slowly drawing out thread from bobbin case using the sector tension gauge or the dial tension gauge (market-available).

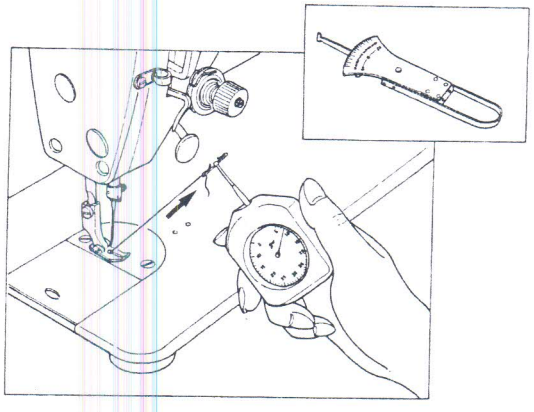
Advice :

When using the bobbin case with idling prevention spring, there is no meaning even if measuring the tension in the state that the bobbin case is taken out from the hook.

In this case, set the bobbin case to the hook, draw out bobbin thread from the throat plate and measure the tension while pulling out the thread in the slant direction to this side. **<Fig. V-2>**



<Fig. V-1>



<Fig. V-2>

2. Needle thread tension

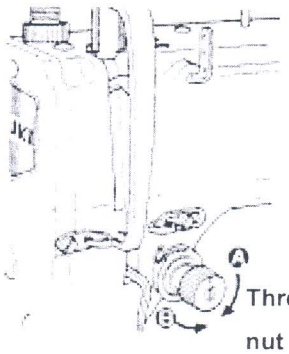
1) Adjustment procedure **<Fig. V-3>**

Perform the adjustment using the thread adjustment nut. Turning the nut in the direction A increases the tension and turning in the direction B decreases the tension.

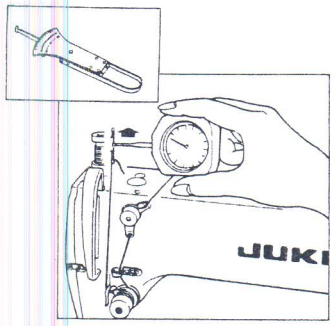
When performing the adjustment, it is important to balance the tensions of needle and bobbin threads. Adjust the needle thread tension to the bobbin thread tension after adjusting the bobbin thread tension.

2) How to measure the tension **<Fig. V-4>**

Measure the tension in front of the thread take-up lever using the sector tension gauge or the dial tension gauge.



<Fig. V-3>



<Fig. V-4>

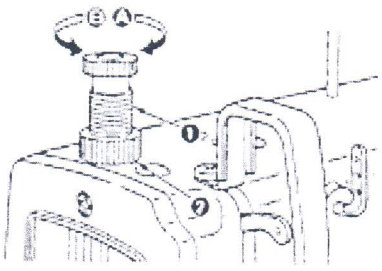
3. Presser foot pressure

Height of the presser spring regulator which is called "chimney" is generally referred to the presser foot pressure. However, even when the presser foot pressure is the same, the height of this regulator will change in accordance with the kind of presser foot or presser spring.

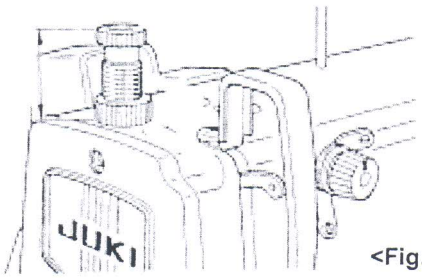
1) Adjustment procedure

Loosen nut ② of presser spring regulator ① shown in **<Fig. V-5>** and screw in screw ① in the direction A to increase the presser foot pressure. To decrease the pressure to 1 to 3 kg, replace the presser spring with the following ones.

For light-weight materials	:	B1505-227-T00A
For extra light-weight materials	:	111-62104
For NF	:	111-05202



<Fig. V-5>



<Fig. V-6>

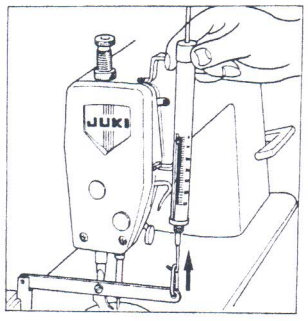
2) How to measure the pressure

Measure the height to adjust the pressure using the slide calipers or the scale. **<Fig. V-6>**

· Presser foot pressure measuring jig **<Fig. V-7>**

Hook a market-available spring balancer to the string in the top end and slowly lift it.

Double of the value when the top of the presser foot leaves from the throat plate is the presser foot pressure.



<Fig. V-7>

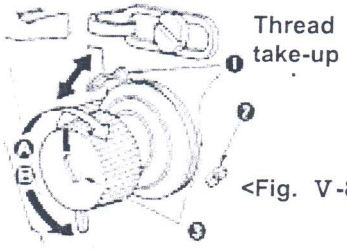
4. Thread take-up spring

The basic adjustment of the lockstitch sewing machine is performed in the three places of the aforementioned bobbin thread, needle thread and presser foot pressure. However, the part to be confirmed next is the thread take-up spring **<Fig. V-8>**.

A problem occurs when the thread take-up spring functions excessively or does not function.

1) How to adjust the stroke (thread absorption amount)

Slightly loosen setscrew ② shown in **<Fig. V-8>**, turn tension post ③ in the direction A to increase the stroke and turn it in the direction B to decrease the stroke.



<Fig. V-8>

2) How to measure **<Fig. V-9>**

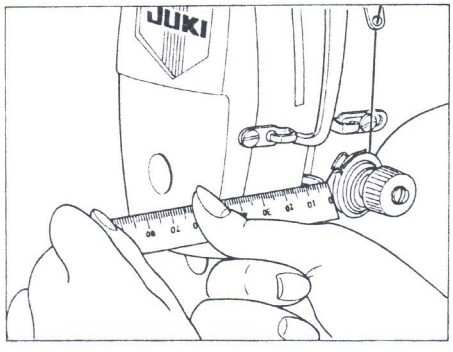
Measure the moving amount of needle thread with a ruler or the like when the needle thread is drawn out to the maximum from the presser bar thread guide. Fix the needle thread in front of the tension disk and measure the stroke in the state that the presser foot is lowered and the feed dog is sunk.

3) How to adjust the tension

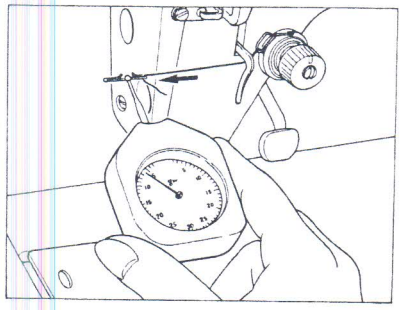
Adjust the tension with tension post ③ located in the center of needle thread tension nut **<Fig. V-8>**. Turn the tension post in the direction A to increase the tension and turn it in the direction B to decrease the tension.

4) How to measure **<Fig. V-10>**

Press and draw out the needle thread from presser bar thread guide and measure the tension when the thread take-up spring moves by approximately 1 mm.



<Fig. V-9>



<Fig. V-10>

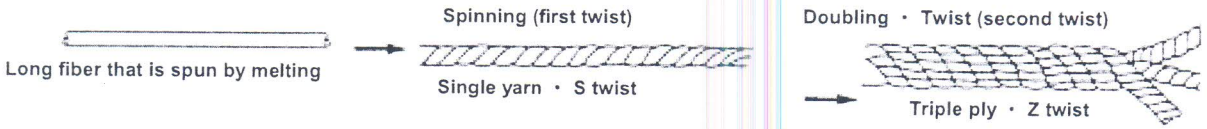
Ⅵ) Knowledge of the sewing thread

1. Construction and manufacturing process of the sewing thread

Natural textile products such as cotton thread, silk thread, etc. have been used as sewing thread before. Nowadays, however, chemical fiber products such as polyester thread, nylon thread, etc. are largely used. Filament thread, spun thread, woolly thread, mono-filament thread, etc. are properly used in accordance with materials or applications. These threads are different from one another in construction and manufacturing process as given below.

Filament thread

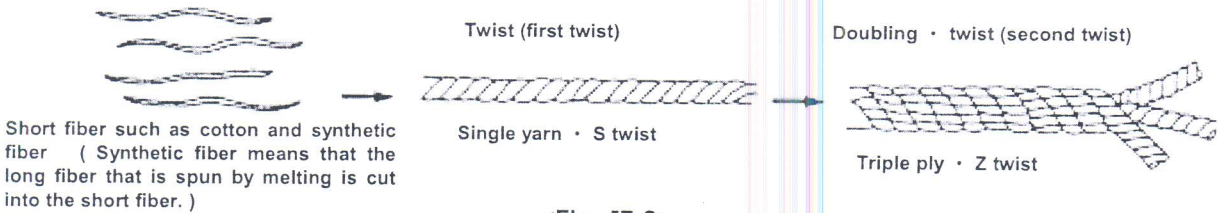
Filament thread means that left twist (Z twist) is applied to the thread after right twist (S twist) is applied to the filament (long fiber) that is spun by melting and doubling of 2 to 3 filaments is performed.



<Fig. Ⅵ-1>

Spun thread (cotton thread, synthetic spun thread)

Spun thread means that left twist (Z twist) (second twist) is applied to the staple (short fiber) after doubling (first twist) of right twisted single yarn and doubling of 2 to 3 yarns is performed.

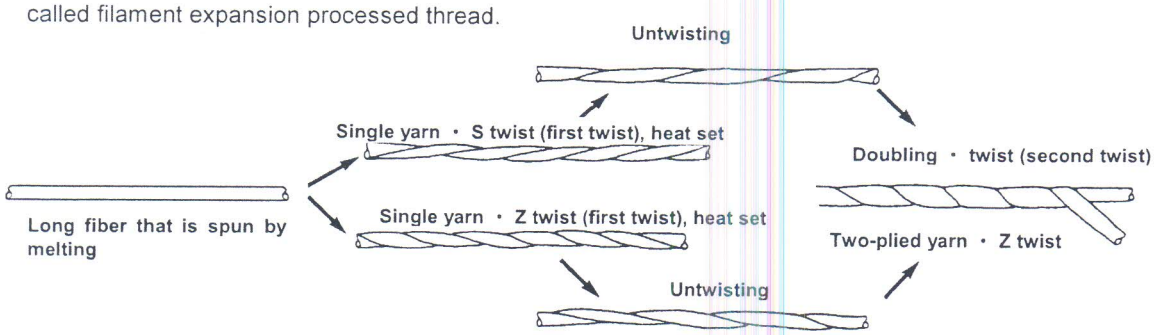


<Fig. Ⅵ-2>

Wooly thread

Filament yarn is performed the first twist and the twist is returned after superheating setting in the state that the yarn is strongly pulled.

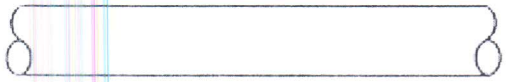
Wooly thread is a thread that doubling of these two yarns is performed and the twist is applied. This thread is called filament expansion processed thread.



<Fig. Ⅵ-3>

Monofilament thread

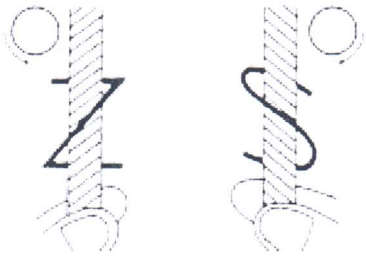
This thread is just the same as long fiber that is spun by melting and a long yarn without twist.
In addition to sewing thread, this thread is used for fishing thread or the like.



<Fig. Ⅵ-4>

2. Twist of the sewing thread

Twist of the sewing thread is normally carried out by doubling 2 to 3 yarns and applying left twist (called second twist) to the yarns after applying right twist (called first twist) of single yarn.
The reason is that return of the twist due to the rotaion of the hook should be protected and that in case of normal stitching, the form becomes stable since friction between needle eyelet and thread is small and return of twist of thread is difficult to move. On the contrary, when the right twisted thread is used in normal stitching, friction between needle eyelet and thread is large, and the twist is easy to move. Then, the thread loop in the state of return of twist is formed, resulting in stitch skipping or thread breakage.



Z (left twist) **S (right twist)**

<Fig. Ⅵ-5>

To distinguish the twist direction, although the right twist is called S twist and the left twist Z twist, when picking up the thread with thumb and first finger of your right hand, the twist line flowing from upper left to lower right along the thumb is seen if it is the right twist. On the contrary, when holding it with your left hand, the twist line flowing from upper right to lower left is seen if it is the left twist.

3. Numbering of the thread thickness

Thread thickness is calculated from the mutual relations between length and weight. The thickness is not represented by the diameter since the cross section of fiber is not a circle. Therefore, the thickness is represented from the relations of "length" and "weight". There are "length numbering system" based on the length and "weight numbering system" based on the weight for the representation.

1) Length numbering system

There are mainly Decitex (dtex) and Denier (D)

-1 Decitex

Decitex is called "1 dtex" when a piece of yarn, weighing 1 gram, is 10,000 meters long, and "2 dtex" when weighing 2 grams. This numbering is the numbering system for the thickness of sewing thread for industrial sewing machine to be applied to all threads.

-2 Denier

Denier is called "1 Denier" when a piece of yarn, weighing 1 gram, is 9,000 meters long, and "2 Denier" when weighing 2 grams.

This numbering is used for silk thread, synthetic filament thread (polyester thread, nylon thread, etc.)

2) Weight numbering system

There are mainly metric number, English number, etc.

-1 Metric number

Metric number is called "Nm 1" when a piece of thread, weighing 1,000 grams, is 1,000 meters long, and "Nm 2" when the thread is 2,000 meters long. This numbering is used for worsted and woolen yarn.

-2 English number for cotton

English number for cotton is called "Ne 1" when a piece of thread, weighing 1 pound (453.6 g), is 840 (768.1 m) yards long, and "Ne 2" when the thread is 1,680 yards long. The thickness of cotton single yarn is represented by English numbering. This numbering is used for cotton thread, silk spinning and staple fiber.

3) Nominal count (thread count)

For "nominal count" (thread count) of the respective filament thread and spinning thread, the nominal count that can be used in JIS (Japanese Industrial Standard) and the range of total size are normalized. Filament thread and spinning thread are different in the total size although "nominal count" is the same. So, be careful.

-1 Conversion table of sewing thread count

Filament **<Table VI-1>**

Nominal count (Thread count)	Construction	Total size of thread used dtex (D)	Nominal count (Thread count)	Construction	Total size of thread used dtex (D)
#1	3 x 3	2100 to 2520(1890 to 2250)	#40	1 x 3	300 to 370(270 to 330)
#3	2 x 3	1750 to 2000(1575 to 1800)	#50	1 x 3	220 to 267(200 to 240)
#5	2 x 3	1400 to 1700(1260 to 1500)	#60	1 x 3	155 to 190(140 to 170)
#6	2 x 3	1167 to 1333(1050 to 1200)	#80	1 x 3	117 to 150(105 to 135)
#8	2 x 3	978 to 1100(880 to 1000)	#100	1 x 3	99 to 112(90 to 100)
#10	2 x 3	822 to 955(740 to 860)	#120	1 x 2	78 to 90(70 to 80)
#20	2 x 3	660 to 801(600 to 720)	#140	1 x 2	56 to 66(50 to 60)
#30	1 x 3	440 to 534(400 to 480)	#150	1 x 2	44 to 50(40 to 45)

* For the indication method of the thickness of sewing thread for industrial sewing machine, indication of "Decitex" and "Nominal count" is compulsory.

Spinning thread **<Table Ⅵ-2>**

Nominal count (Thread count)	Count of original thread (dtex)	Number of doubling threads	Total size	Nominal count (Thread count)	Count of original thread (dtex)	Number of doubling threads	Total size
# 8	20s(300)	4	1200dtex	# 50	50s(120)	3	360dtex
# 20	20s(300)	3	900dtex	# 60	60s(100)	3	300dtex
# 30	30s(200)	3	600dtex	# 80	80s(74)	3	222dtex
# 40	40s(145)	3	435dtex	# 100	64s(92)	2	184dtex

4. Melting point and softening point (° C) of sewing thread

Both points are the indication of thermal resistance. Melting point means the temperature that sewing thread melts by heat. Softening point means the temperature that the thread starts softening by heat. Especially, in case of synthetic thread, stitch skipping or thread breakage occurs according to the circumstances. Accordingly, the thermal resistance is one of the important points. In addition, the thermal resistance affects the temperature setting of iron and press in the rear process. It is necessary to select a proper sewing thread after considering these factors.

Melting point and softening point of general sewing thread **<Table Ⅵ-3>**

	Polyester	Nylon 6	Nylon 66	Vinilon	Cotton
Melting point	255 to 260° C	215 to 220° C	250 to 260° C	Unknown	Decomposed at 150° C
Softening point	238 to 240° C	180° C	230 to 235° C	220 to 230° C	None

As to the cotton, temperature at which the carbonization starts is described.

5. Strength and ductility of the sewing thread

The force that is required to cut sewing thread by applying a load to the sewing thread in a certain direction is called "strength". Percentage of elongation at this time is called "ductility".

Both the strength and the ductility are essential basic quality of sewing thread. For example, as to the strength, when sewing heavy-weight materials, it is necessary to sew with sewing thread having high strength since thread breakage is apt to occur. It is the same in case of preventing thread breakage or puncture when wearing the clothes. As to the ductility, if it is excessive, it will be the cause of seam puckering or stitch skipping, and if it is too low, it may be the cause of thread breakage.

In addition, when wearing clothes, thread breakage may occur unless there is the proper ductility.Both strength and ductility depend on material, processing method and count of sewing thread. Accordingly, it is necessary to select a proper sewing thread after considering sewing conditions, application of sewing products, etc. Normally, when the strength and the ductility are simply used, they mean "pull strength and pull ductility". For other items, there are "hook strength and hook ductility" and "knotting strength and knotting ductility".

Strength and ductility of the sewing thread (Strength conforms to JIS and ductility is shown low.)

<Table Ⅵ-4>

Kind No.	Strength Ductility	Polyester sewing thread		Nylon sewing thread		Cotton sewing thread
		Filament	Spinning	Filament	Wooly	
50	gf	1010	1110	950		710
	%	22	18	30		8
110d (1x2) High ductility	gf				850	
	%				35	

* The above figures slightly differ among the respective thread manufacturers. Use them as reference values

Reference data 1

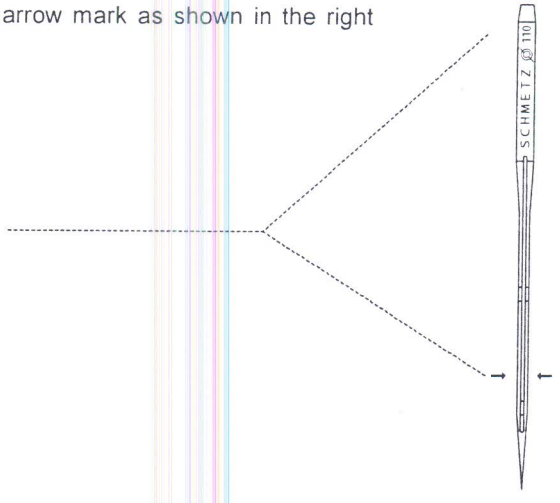
Shank diameter : A = divided in the following three systems for the most part.

Overlock series	DCx1, DCx27	... 2.02 mm
Lockstitch series	DAx1	... 1.63 mm (#6 to #22)
	DBx1	... 1.63 mm (#6 to #18)
		... 2.00 mm (#19 or more)
Special sewing machine series such as straight buttonholing or the like	DPx5	... 2.00 mm

Reference data 2

* All needle sizes of SCHMETZ needle are described by the metric system (1/100). Measuring position is engraved in the place of arrow mark as shown in the right illustration.

Diameter		
in	mm	Nm
0.65 mm	x 100=	Nm 65
0.90 mm	x 100=	Nm 90
1.10 mm	x 100=	Nm 110
1.30 mm	x 100=	Nm 130
2.50 mm	x 100=	Nm 250



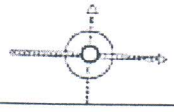
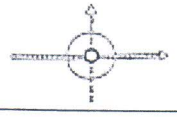
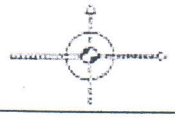
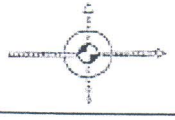
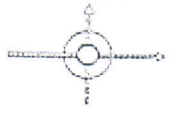
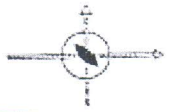
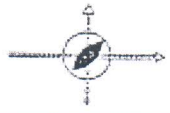
Comparison of needle sizes

(This table is made according to DIN (German Industrial Standard.)

SCHMETZ Metric system indication Nm = needle size	Japan # = needle size	Other size															
		Columbia		Lewis		Merrow	Reece	Singer	Union Special	Wilcox and Gibbs	Embroidery	Special size needle					
												81.88	292	332	339	459R
35	2												23			22
40	3							3					22			21
45	4							4					21			20
50	5							5					20			19
55	6					3/0		6	022				18			18
60	7 8					2/0		8		2/0		3/0	16		8	17
65	9			2 1/2		0		9	025	0			14			16
70	10				10	1	3/0	10	027	1	2/0	2/0	13	2/0	10	15
75	11	1	10	3				11	029				12			14
80	12	1 1/2	15		12	2	2/0	12	032	2	0	0	11	0	12	13
85	13	2	20					13				1/2	10			
90	14	2 1/2	25	3 1/2	14	3	0	14	036	3	1	1	9	1/2	13	12
95	15	3	30					15					8			
100	16	3 1/2		4	16	4	1	16	040	4	2	2	7	1	14	11
105	17							17								
110	18	4		4 1/2	18	5	2	18	044	5	3	3	6	2	16	10
120	19				19	6	3	19	048	6		4	4	3	17	9
125	20	4 1/2		5	20			20	049							
130	21	5				7	4	21		7	4	5	3	4		8
140	22			5 1/2			5	22	054	8	5		2	5		7
150				6		8			060	9		6	1			6
160	23						6	23		10	6		0	6		
170						9			067		7	7				
180	24						7	24	073					7		
190												8				
200	25							25	080			9		8		
230	26							26	090					9		
250								27	100							
280								28								
300								29	120							
330								30								
350								31	140							
380								32								
400								33	156							
430								34	172							
460								35								
480								36	188							

Reference data 3

Shape of needle tip

Cross-section	Abbreviations	Designation	ORGAN
	R SET	normal round point	R
	SPI S SET RS	acute round point	SPI
	SES L BALL FFG SIN R-K	light ball point	J
	SUK M BALL FG SI R-KB	medium ball point	B
	SKF H BALL G	heavy ball point	U
	SKL	speciaiball point	
	STU SET RT	big rounded point for sewing on buttons	BUT
	LL, LLS TW , NTW	twist point	LL
	LR, LRS RTW ,NRTW	reverse twist point	LR

Reference data 4

Kind of needle and applicable machine

Japanese System	Schmetz Needle	Interchangeable Needle System	Remarks
DB x 1	DB x 1	DB x 95,287WH,16 x 257,1738, 16 x 95,16 x 231,SY2270 Common to DP x 5 and 134 (Nm 120 or more)	General lockstitch sewing machine
DB x K5	DB x K5	120	DBx1 for multi-head embroidery (thick needle eyelet)
DB-N20	1738KK		Same as DB x 1, but shank is short.
DB x A20	1738A	287WH,16 x 95	Same as DB x 1, but thickness of shank is same as that of #18 or less.
DA x 1	DA x 1	1128,88 x 1,88 x 9,SY1315	Lockstich sewing machine (for light-weight materials)
DP x 5(DP x 134)	DP x 5 134(R)	797,135 x 5,DP x 7,SY1901	For buttonholing and zigzag sewing. For European type lockstitch
DP x 17	DP x 17	135 x 17,SY3355	Lockstitch sewing machine for heavy-weight materials, auto-belter, etc.
DC x 27	B-27	RIM27,MY1023,SY6120	Overlock machine (flat scarf)
DC x 1	DC x 1	DM x 1,81 x 1,SY1225	General overlock machine
DC x 3	DC x 3	SY8538	Leather glove round stitching, 2-needle overlock machine, etc.
TV x 64	B-64	SY7045	Double chainstitch machine
TQ x 1	TQ x 1	29-S,1985,175 x 1,175 x 5 TQ x 5	Button sewing
TQ x 7	TQ x 7(2091)	175 x 7,SY8728	Button sewing, Longer by 10 mm than TQ x 1
TF x 2	34LL	16 x 2NTW	For leather (slant lens shaped point)
TF x 2LR	34LR	16 x 2NRTW,16 x 2RTW	For leather (reverse slant lens shaped point)
DB x F2	1738LR	16 x 230 NRTW Common to 134LR (Nm120 or more)	For leather (reverse slant lens shaped point)
DD x 1	328	214 x 1,SY4950	For extra heavy-weight materials and leather
DI x 3	332	29 x 3,SY3741	Exclusive for shoes and bag
DN x 1	UY143GS	MY1013,92 x 1,SY4261, U0 x 143G,UY x 143GS	For bag
TV x 1	TV x 1	149 x 1,SY2774	Hemming, welt seam
TV x 7	TV x 7(149X7)	SY2776	Hemming, welt seam, double chainstitch for medium- and heavy-weight materials
UY x 128GAS	UY x 128GAS	1280, UY128GSMY1044,DV x G9	Flat-bed 2/3-needle covering stitch machine
MT x 190	190(R)	SY7555	Basting, pad closing, welting for Eagle and others

<<Reference books>>

- HIROSE MFG., LTD. Technical manual
- ORGAN NEEDLE CO., LTD. Sewing Q and A
- Ditto Catalogue
- FERD. SCHMETZ GMBH Needle catalogue
- Bunka Fashion College Basic operation and knowledge of industrial sewing machine and iron
- TOKYO ITODONYA ASSOCIATION Sewing thread handbook
- JIS (Japanese Industrial Standard) Japan standard association
- JUKI CORPORATION Manual on sewing thread, hook and needle
- Ditto Basic knowledge of sewing machine