SERVICE MANUAL

FOR

MODEL 321 KNITTER

C O N T E N T S

I. Names of main parts

I-a Machine body

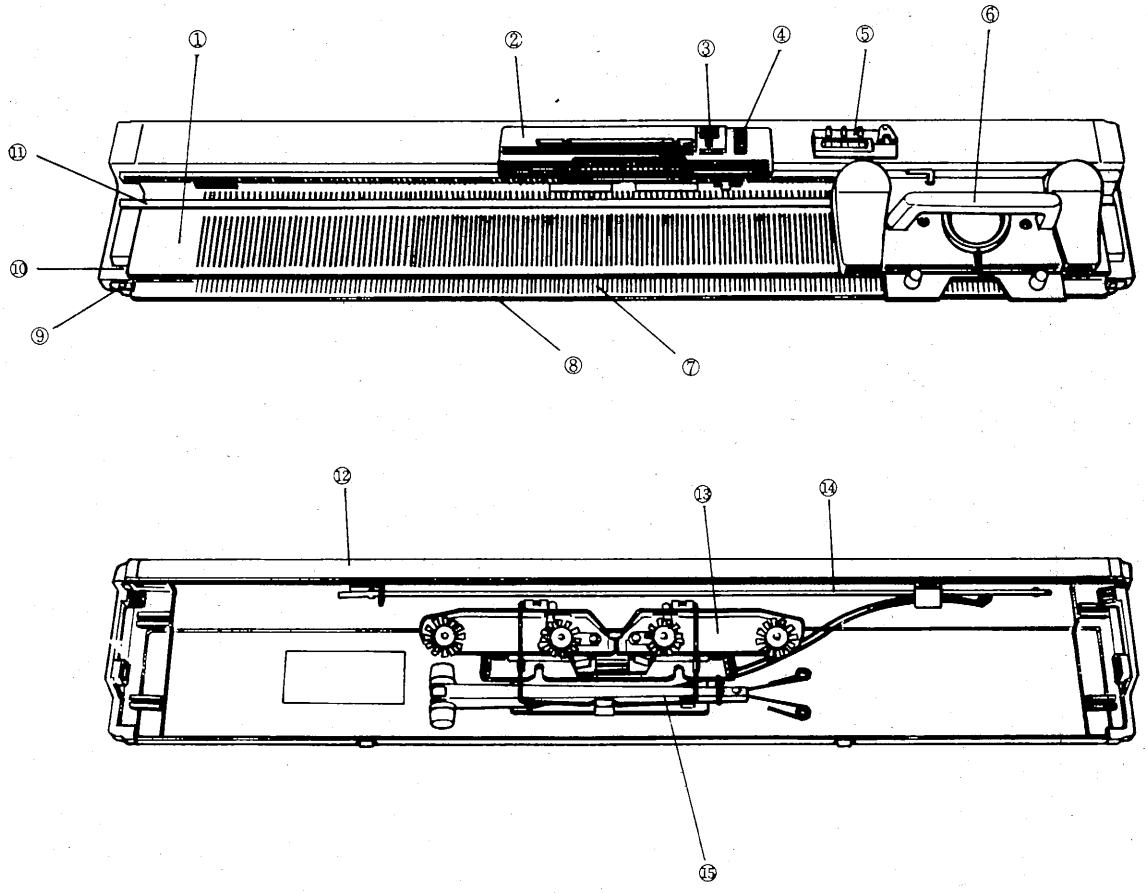


Fig. 1

1. Needle Bed
2. Pattern Panel
3. Stop Knob
4. Feed Dial
5. Row Counter
6. Carriage
7. Needles
8. Sinkers
9. Yarn Clip
10. Needle Retainer
11. Carriage Rail
12. Cover
13. Carriage Arm
14. Auto-Tension Rod

I-b Carriage (inside)

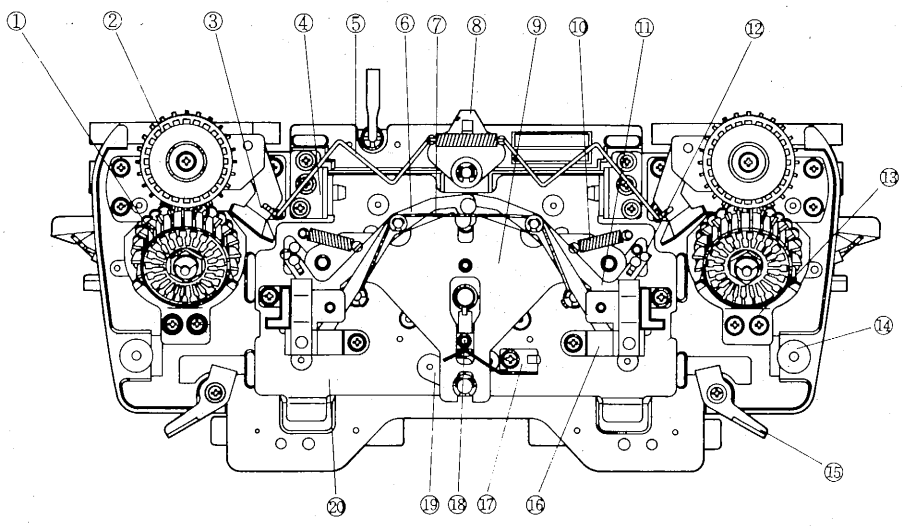


Fig. 2

1. Sub Drum
2. Main Drum
3. Sub Clear Cam
4. Carriage A Fulcrum
5. Clear Wire
6. Raising Cam Lever
7. Raising Cam Lever Spring
8. Clear Cam
9. Travelling Plate
10. Sub Lever Spring
11. Sub Lever
12. Cam Spring
13. Sub Drum Piece Holder
14. Fit Rubber
15. Russel Lever
16. Handle Holder
17. Dial Spring
18. Moving Plate Pin
19. Adjustment Plate
20. Carriage Frame A

I-c Carriage (back)

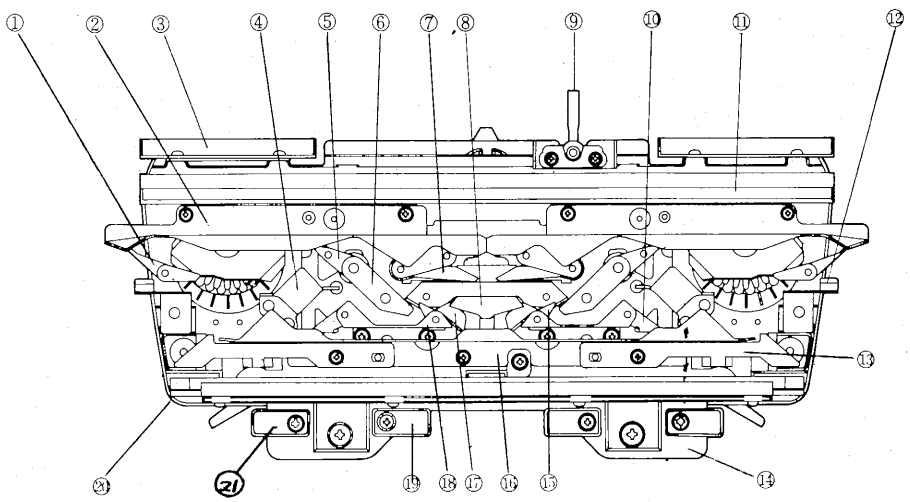


Fig. 3

1. Slide Cam
2. Guide Plate
3. Under Cam
4. Separation Cam
5. Sub Cam
6. Main Cam
7. Fairisle Cam
8. Center Cam
9. Row Counter Lever
10. Raising Cam
11. Carriage Pipe
12. Guide Cam
13. Russel Cam
14. Carriage Frame B
15. Lowering Cam A
16. Needle Guide
17. Lowering Cam B
18. Middle Course Cam
19. Magnet C
20. Slider
21. Magnet A

I-d Carriage Arm

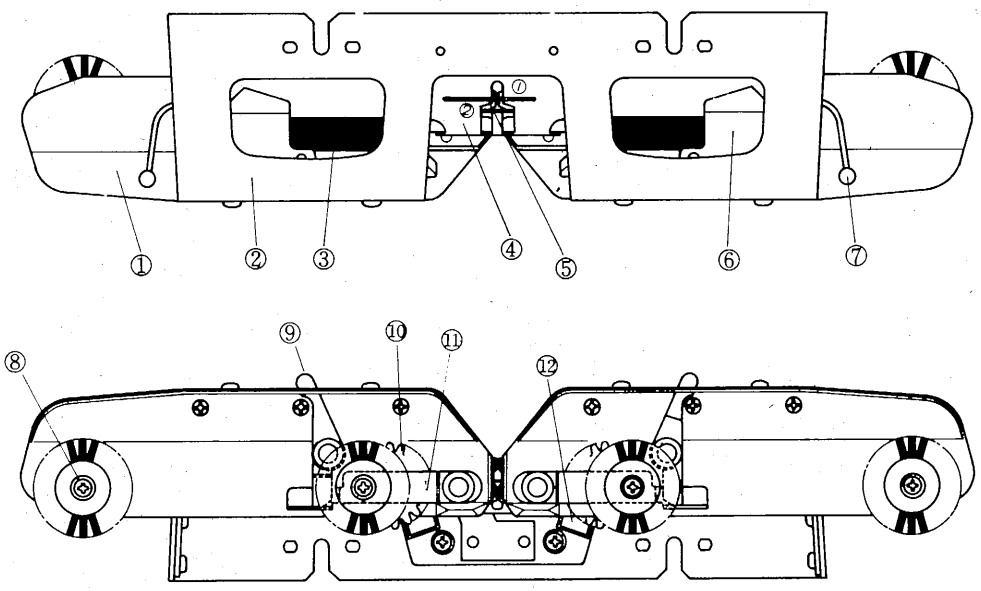


Fig. 4

1. Fabric Presser
2. Arm
3. Clearing Brush
4. Yarn Feeder
5. Yarn Guide
6. Latch Stopper
7. Yarn Holder
8. Round Brush
9. Arm Lever
10. Fabric Gear
11. Round Brush Holder
12. Magnet B

I-e Accessories

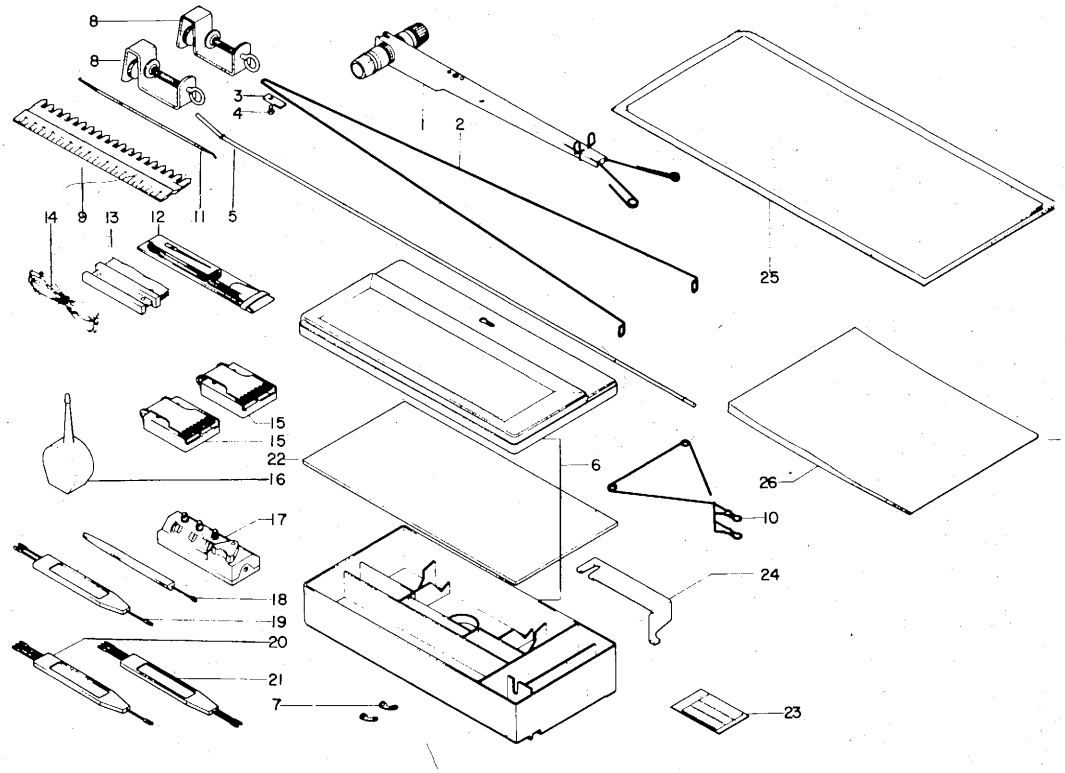


Fig. 5

1. Auto-tension Arm
2. Tension Spring
3. Tension Spring Nut
4. ⊕ Binding Head Screw 2.6x4
5. Auto-tension Rod
6. Accessory Box
7. Card Snaps
8. Clamps
9. Needle Pusher
10. Yarn Rod
11. Crochet Hook
12. Tapestry & Spare Needles
13. Brush
14. Ravelling Cord
15. Weights
16. Oil Container
17. Row Counter
18. Tappet
19. Transfer Tool (1-2)
20. Transfer Tool (3-1)
21. Transfer Tool (3-2)
22. Packing for Accessory Box
23. Name Paper
24. Carriage Fastener
25. Punched Card
26. Instruction Book

II. How a needle forms a stitch

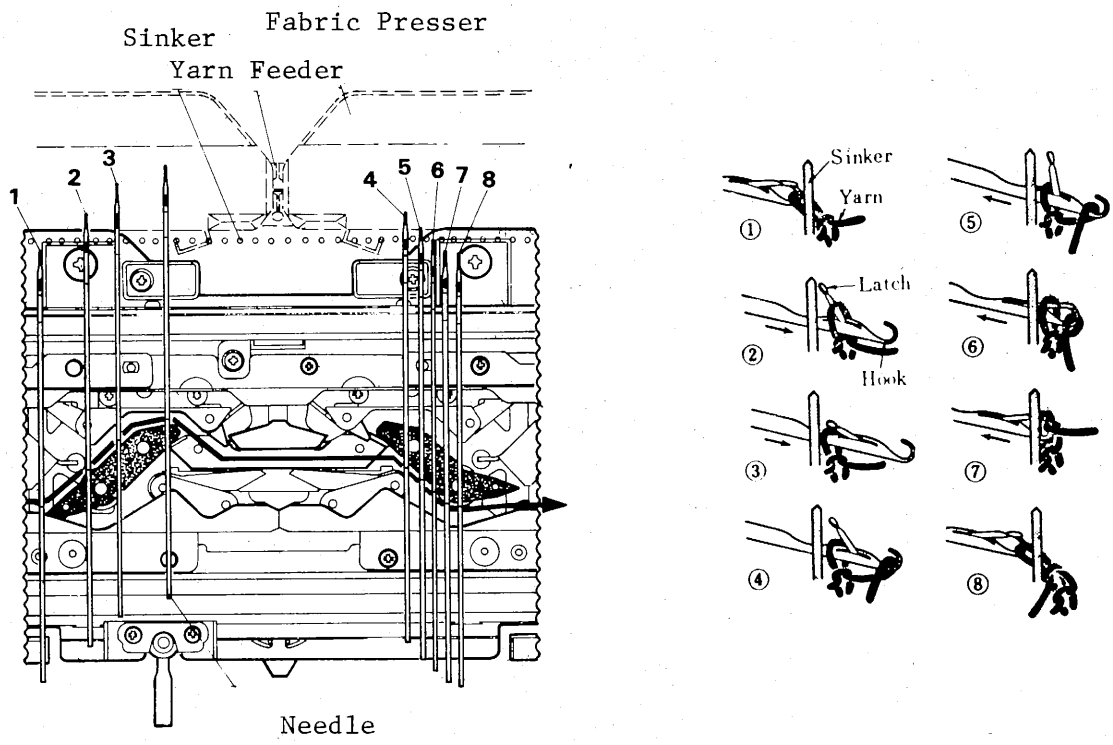


Fig. 6

(1) An old stitch is hanging on the hook of a needle.

(2) The needle is pushed out forward by Main Cam and Sub Cam, when the fabric is about to be carried forward also but is stopped by Fabric Pressor, and only the needle is brought forward getting its latch opened by the stitch.

(3) As the needle comes further forward, the stitch goes over and behind the latch.

(4) The thread is fed on the hook of the needle through Yarn Feeder to form a new stitch.

(5) The needle starts moving backward being pushed by another Main Cam.

(6) As the needle goes backward, the fabric pushes the latch causing it to close.

(7) When the needle is led further backward, the latch closes on the hook completely, confining the thread under it.

(8) When the needle is back completely, the old stitch slips off the hook passing over the latch. (The Sinker Needles serve to make even the sizes of stitches.)

Now, a new stitch is on the hook.

III. MECHANISM OF NEEDLE SELECTION AND FUNCTION OF EACH MAIN PART

III-a Punched Card

The punched card is made of vinyl chloride and has many round punched holes representing a pattern.

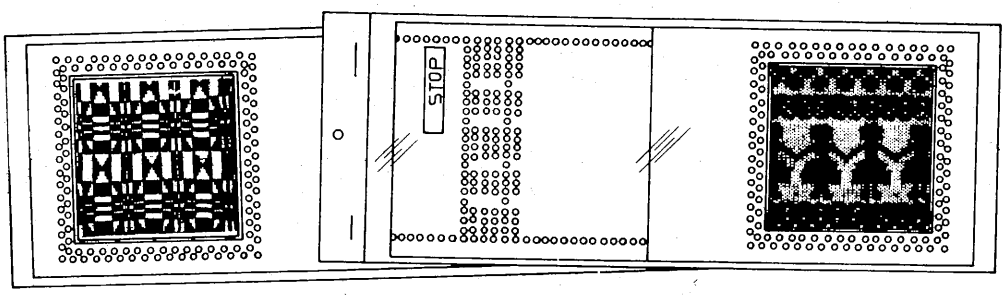


Fig. 7

III-b Pattern Unit

Pattern Unit reads a pattern on a punched card and conveys it to Drum on the carriage.
When the carriage is operated, Under Lever in pattern unit is lifted by Under Cams attached to the right and left sides of the rear of the carriage, with Touch Levers moving in the arrowmarked direction by spring action.

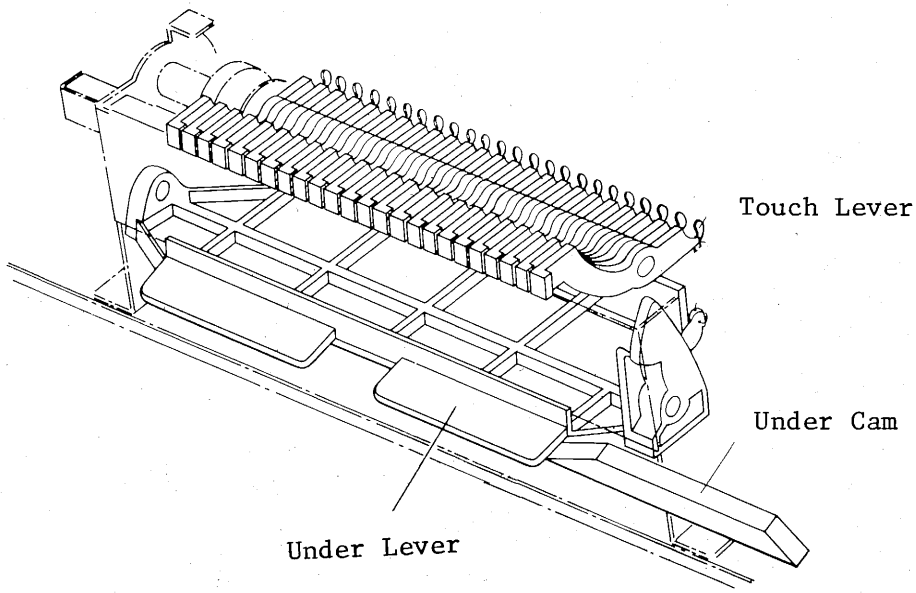


Fig. 8

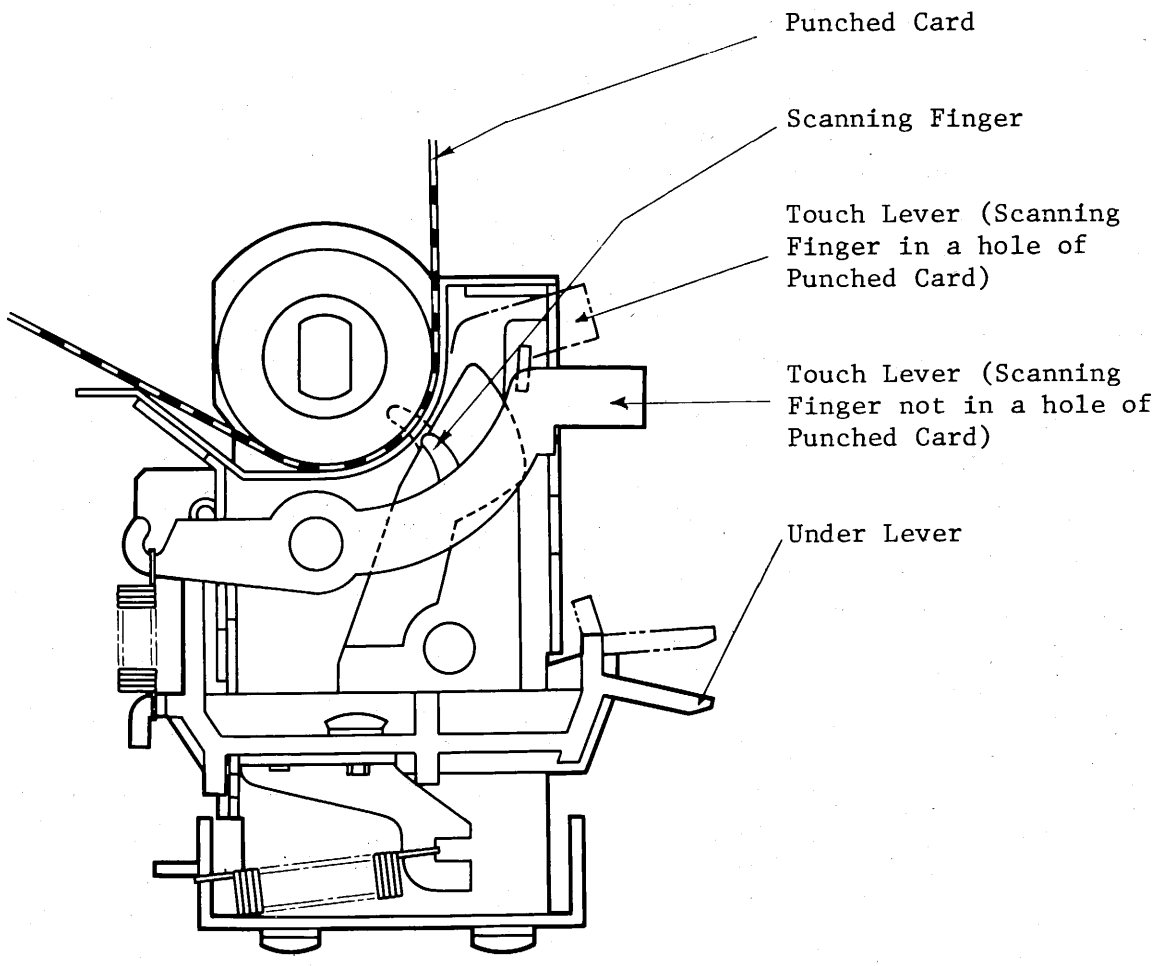


Fig. 9

III-c Drum

Drum reads and memorizes the pattern on a punched card conveyed by Touch Lever in Pattern Unit and according to its memory, gives the order to select needles.
Drum can memorize a pattern requiring up to 24 needles.
The range of needle selection available from a punched card is from two stitches to 24 stitches.
Some of the tips of Touch Levers staying in a lower position than others hit respectively the upper parts of their corresponding Drum Pieces located in Drum Unit, which brings about convex-concave condition around the lower part of Drum.

III-c-1 DRUM UNIT

Drum Unit reads the patterns transmitted by touch levers of pattern unit, and memorizes it, and then selects the needles according to the memory.

III-c-2 Main Drum

Main Drum transmits to Sub Drum the patterns registered by touch lever.

III-c-3 Sub Drum

Sub Drum memorizes the patterns transmitted from Main Drum, and selects the needles according to the memory.

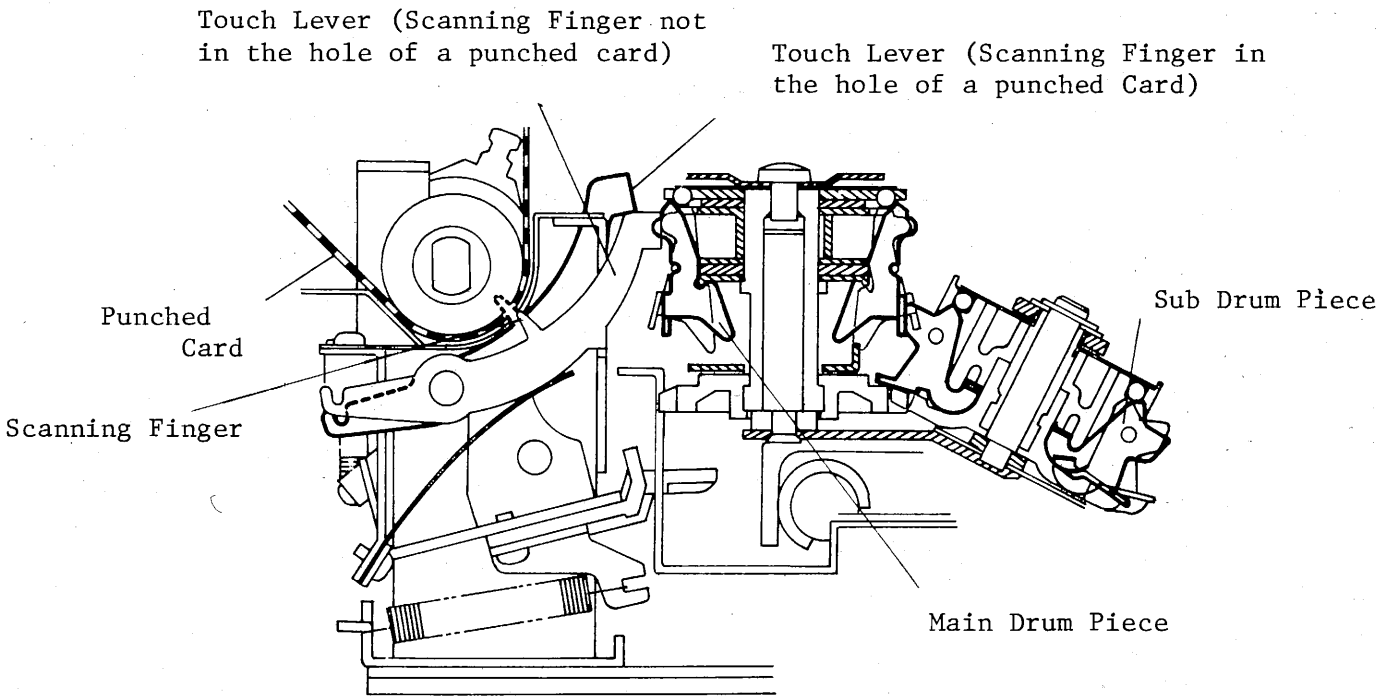


Fig. 10

The tip of a Touch Lever which has been lowered strikes and pushes the upper part of a Drum Piece inside Drum Unit. This concavo-convex situation is called "MEMORIZING"

III-d Mechanism of Needle Selection

III-d-1 When the scanning finger of a touch lever does not find a punched hole and can not come through, that touch lever will stay in lower position and push the upper part of Main Drum Piece making the lower part of Main Drum Piece come out to push the upper part of Sub Drum Piece. The lower part of the Sub Drum Piece will be up and off and does not touch the needle butt leaving the needle between the teeth of the Sub Drum Gear to be led behind the Separation Cam and backward.

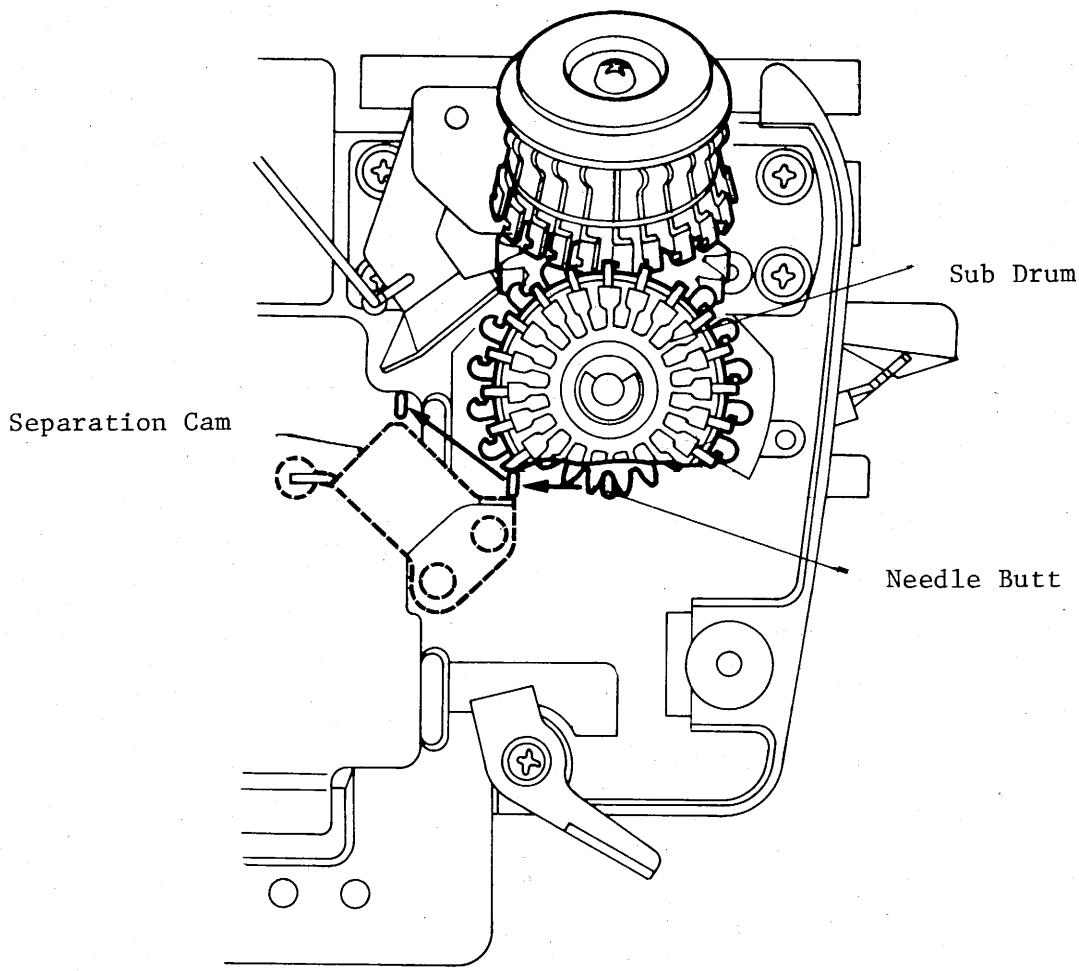


Fig. 11

III-d-2 When the scanning finger of a touch lever finds a punched hole and comes through it, that touch lever will be at higher position and does not push the upper part of Main Drum Piece leaving the lower part in inner position (inactive) and therefore does not activate (push) Sub Drum Piece. Accordingly the lower part of Sub Drum Piece remaining lower position will push the butt of a corresponding needle forward so that the needle will proceed along the front edge of Separation Cam to be pushed more forward to selected course.

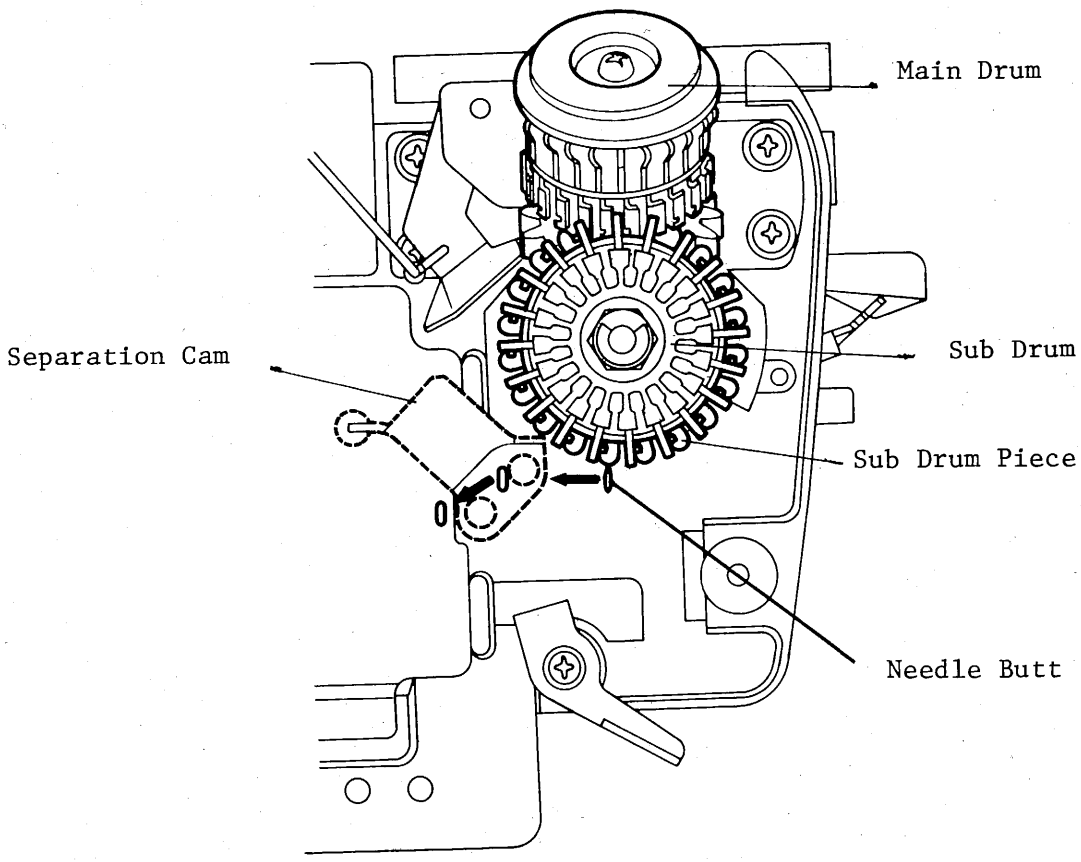


Fig. 12

IV COURSES AND MOVEMENT OF NEEDLES IN PATTERN KNITTING

IV-a SLIP STITCH PATTERN

(1) The needles are guided into needle selection course by Side Cam.

(2) The needles thus selected by Sub Drum are sent forward by Separation Cams and get their latches opened.

(3) The needles sent backward do not get their latches opened.

(4) The needles sent out forward get fed with the thread through Yarn Feeder and make new stitches, whereas those sent backward do not get fed.

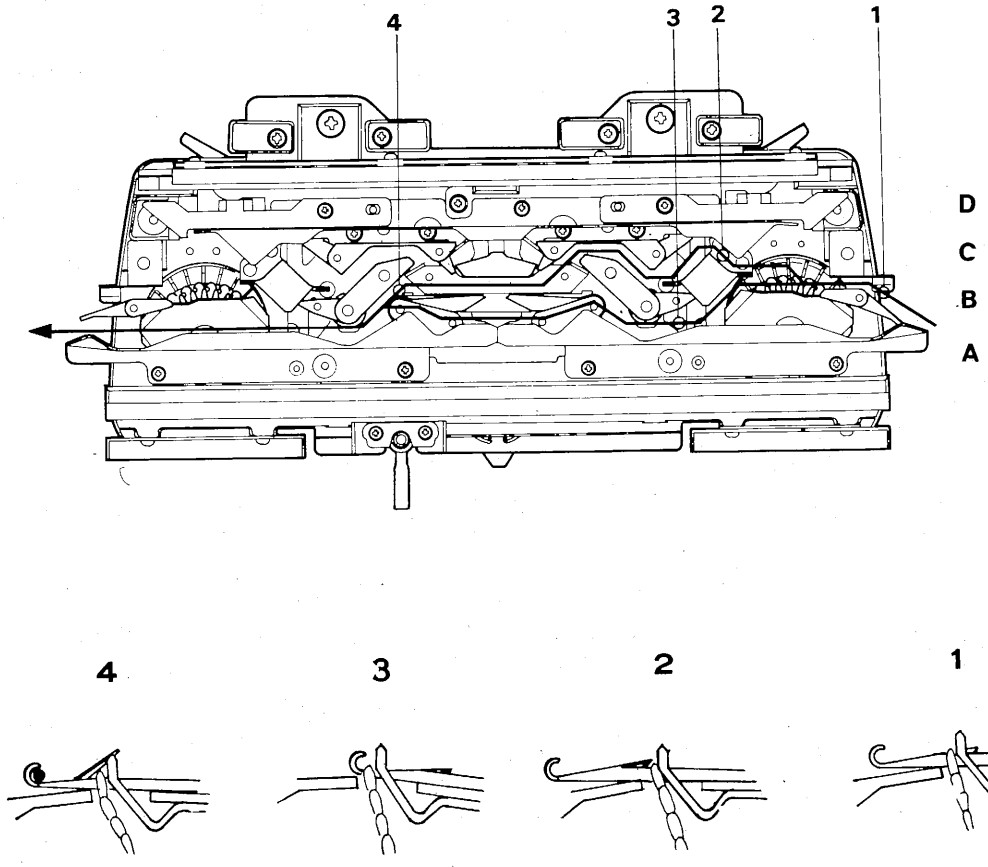


Fig. 13

VI-b TUCK PATTERN

(1) The needles are guided into needle selection course by Side Cam.

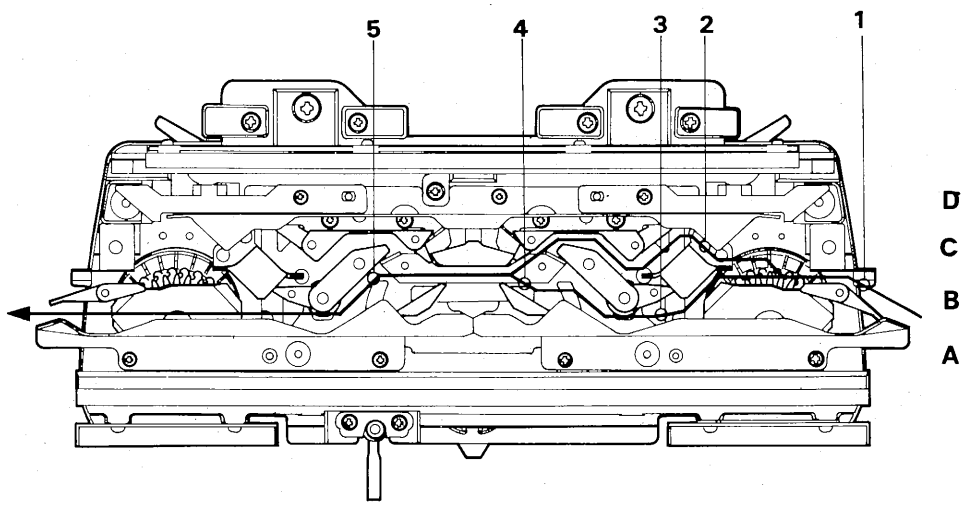
(2) The needles selected and sent forward along the Separation Cams get their latches opened.

(3) The needles selected and sent backward by Separation Cams do not get their latches opened.

(4) The Needles sent backward will be brought to "C" position by Knit-In Cams.

(5) The thread is fed into the needles which came out earlier and form new stitches.

(6) The thread is also fet with to the needles brought out to "C" position by Knit-In Cam. However, since the stitches had not moved behind their latches, both the old stitches and the new thread hang on the hooks without forming new stitches.



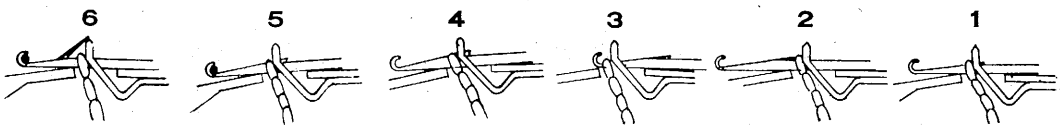


Fig. 14

VI-c KNIT-IN PATTERN

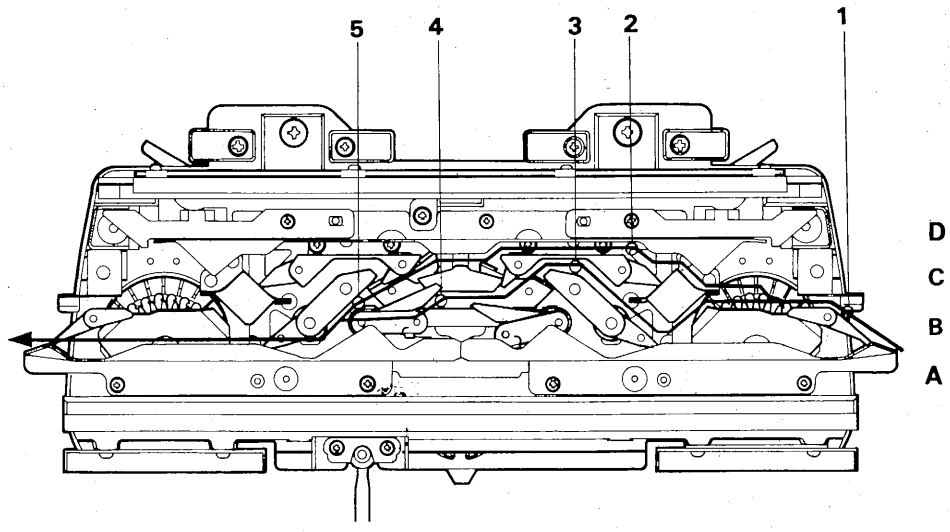
(1) The needles are guided into needle selection course by Side Cam.

(2) The needles selected and sent forward by Separation Cam are pushed more forward by Middle Course Cam.

(3) The needles selected and sent backward by Separation Cam are sent forward again and get their latches opened.

(4) The needles sent forward along Middle Course Cam are fed with the contrasting yarn.

(5) The needles sent forward by Main Cam are pushed backward by Knit-In Cam and fed with the Main Yarn.



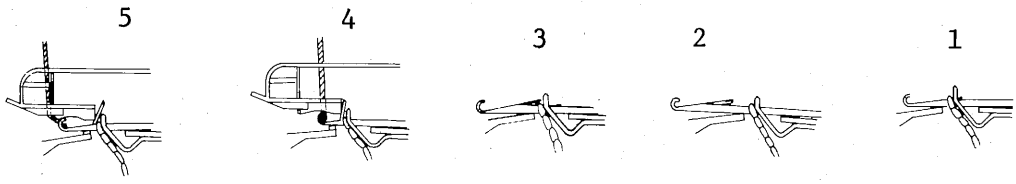


Fig. 15

VI-d PUNCH LACE

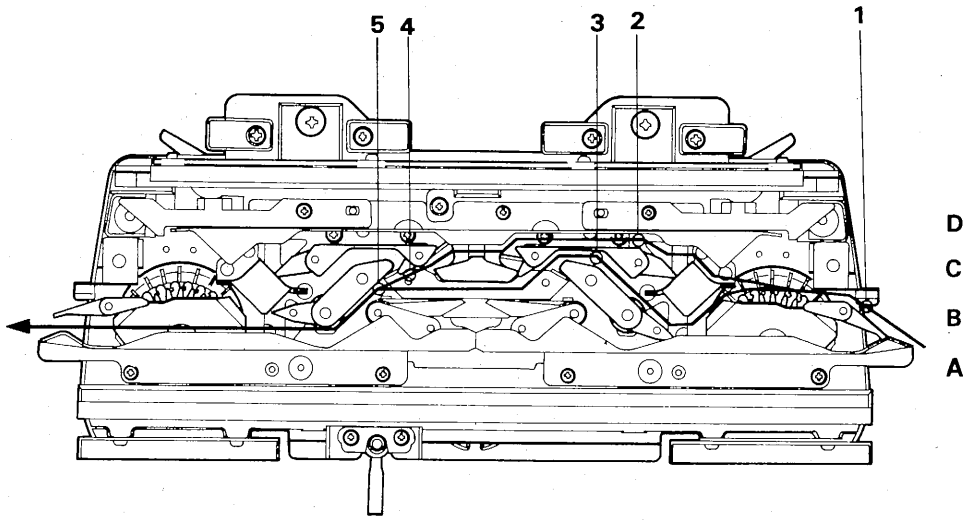
(1) The needles are guidedinto needle selection course by Side Cam.

(2) The needles selected and sent forward by Separation Cam get their latches opened and pushed forward further by Middle Course Cam.

(3) The needles sent backward by Separation Cam are sent forward by Main Cam and Sub Cam, and then get their latches opened.

(4) The needles sent forward by Separation Cam are fed with Nylon thread.

(5) The needles sent forward by Main Cam are fed with Nylon thread and Main Yarn.



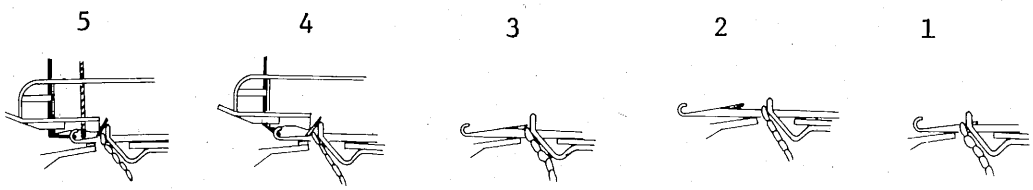


Fig. 16

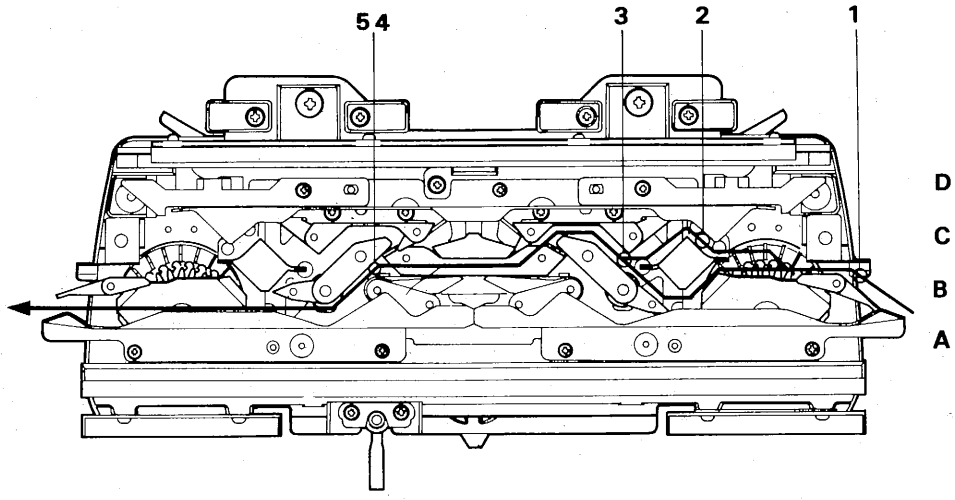
IV-e WEAVING PATTERN

(1) The needles are guided into needle selection course by Side Cam.

(2) The needles sent forward by Separation Cam get their latches opened.

(3) The needles sent backward are brought out forward by Sub Cam and Main Cam.

(4),(5) Both the needles sent forward by Separation Cam and those once sent backward get fed with thread through Yarn Feeder and form new stitches, but the weaving thread beneath the forward course needles and above the backward course needles.



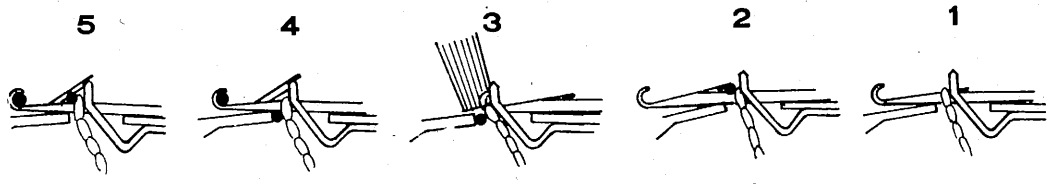


Fig. 17

V. SCREWS

V-a ISO screws stand for those conforming to the requirements specified by International Organization for Standardization. Clearly marked with (o), as shown in Fig. -87, they are easily identifiable.

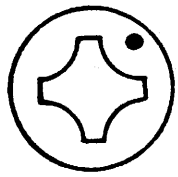


Fig. 18

V-b Designations for each dimension of a screw

Each dimension of a screw is designated as follows:

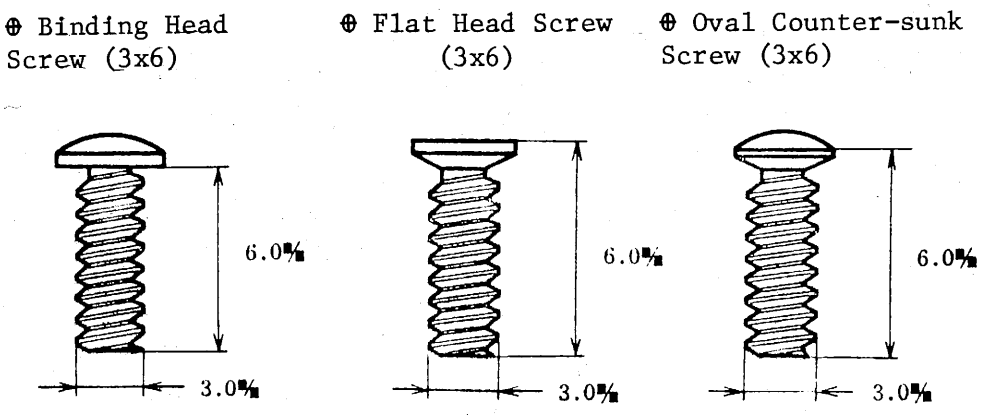


Fig. 19

V-c Kinds of a screw

The screws used for this model are all ISO.

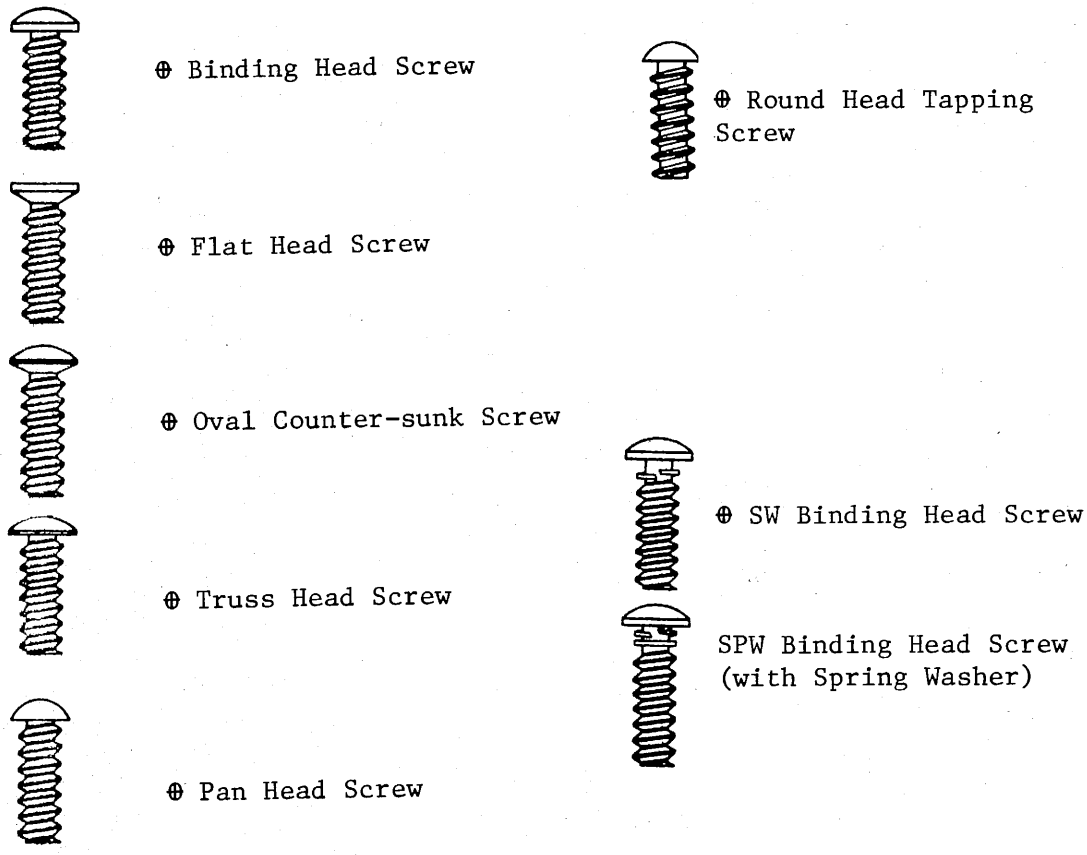


Fig. 20

VI METHODS OF DISASSEMBLING, REASSEMBLING AND ADJUSTMENT

VI-a Disassembling of Carriage (up to Carriage Cover)

(1) Fold Carriage Handle.

(2) Remove screws for Carriage Handle each located in a recess at each foot of the right and left sides of Carriage Handle with a Philip Driver as shown in Fig. 21

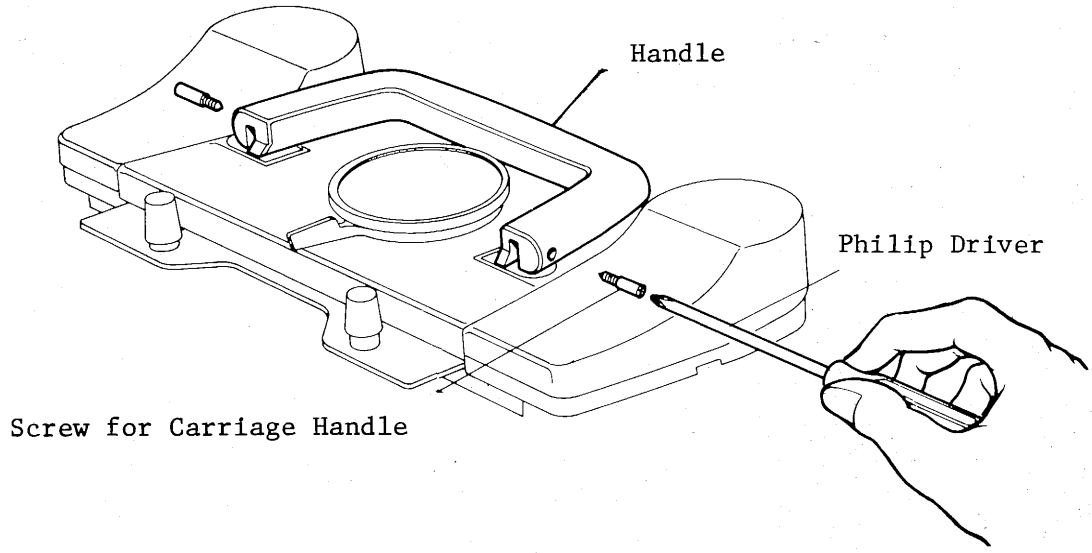


Fig. 21

(3) Turn Stitch Dial counter-clockwise till it stops, and just lift it straight up

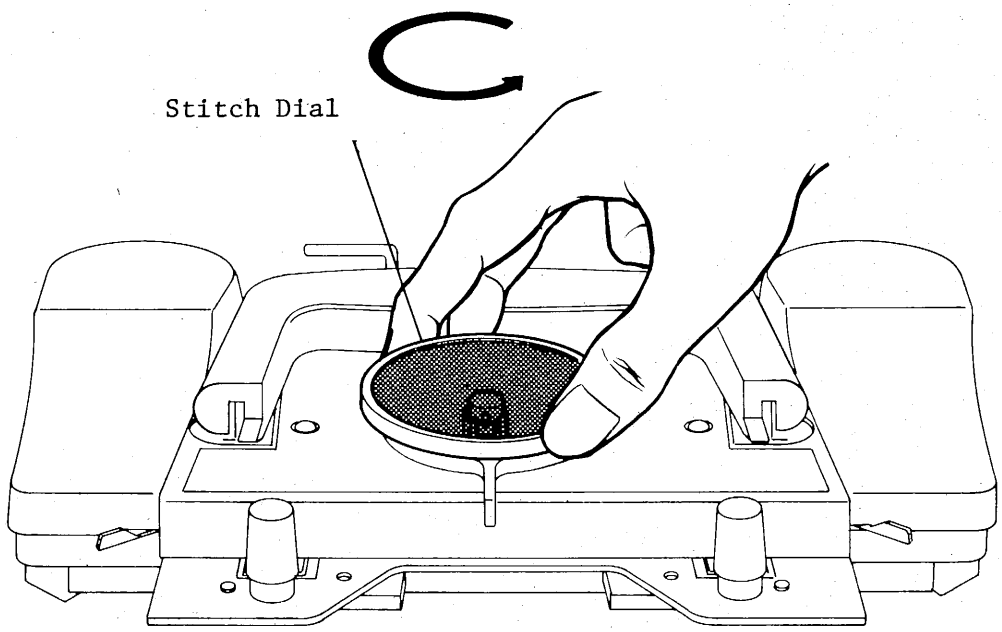


Fig. 22

(4) Remove two ± truss head screws (3x6) each inside right and left Handle Holders

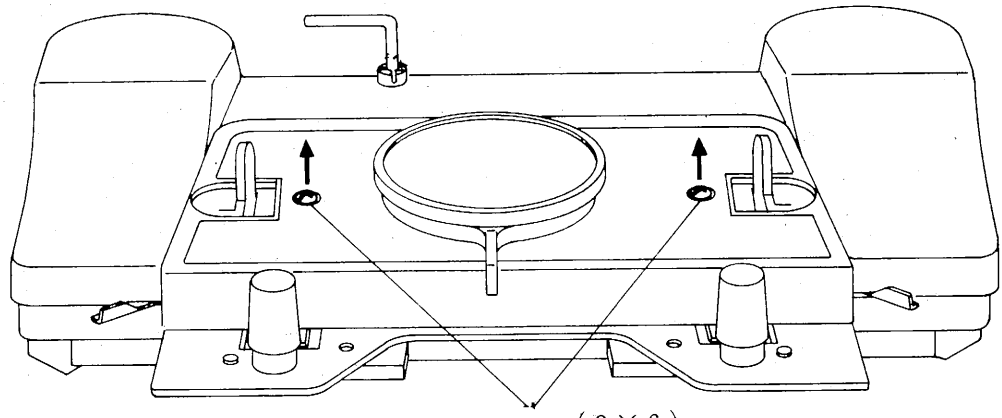


Fig. 23

(5) Remove Cam Lever upwards while pushing out Dial Spring with a screw driver tip, Dial Spring pressing against the wavy part at the bottom of Cam Lever, and Carriage Cover A comes off at the same time.

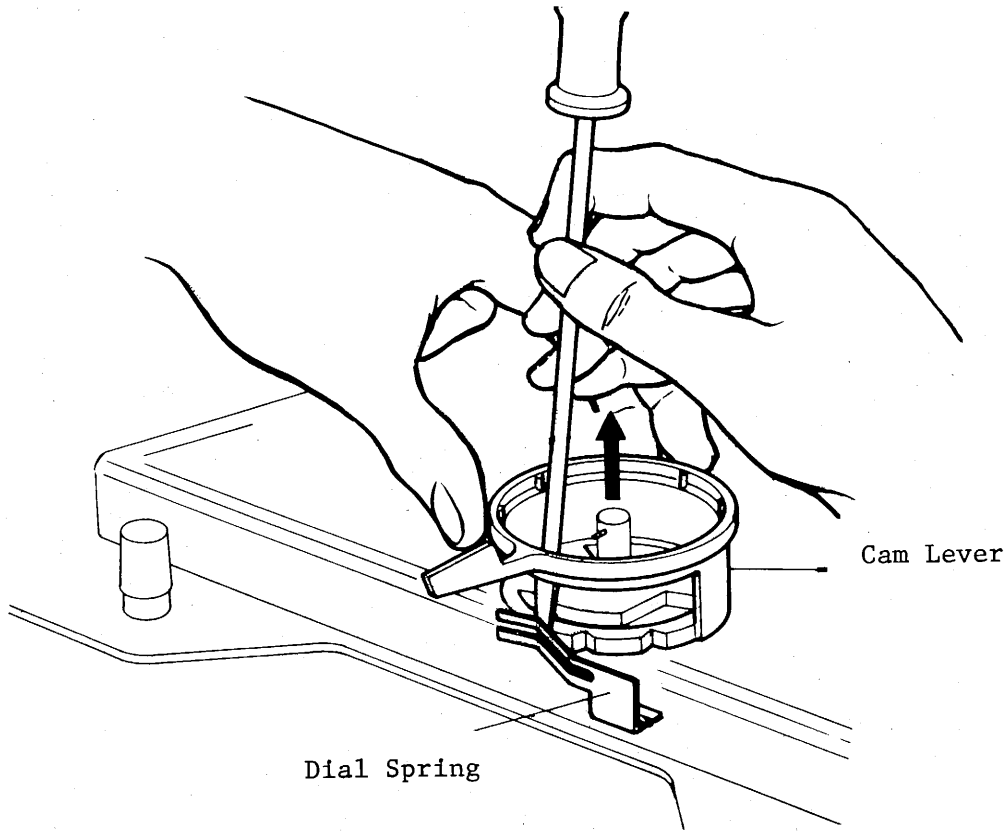


Fig. 24

(6) Remove Carriage Cover B upon loosening two small ⊕ truss head screws (3x6) which holds Carriage Cover B at its back side.

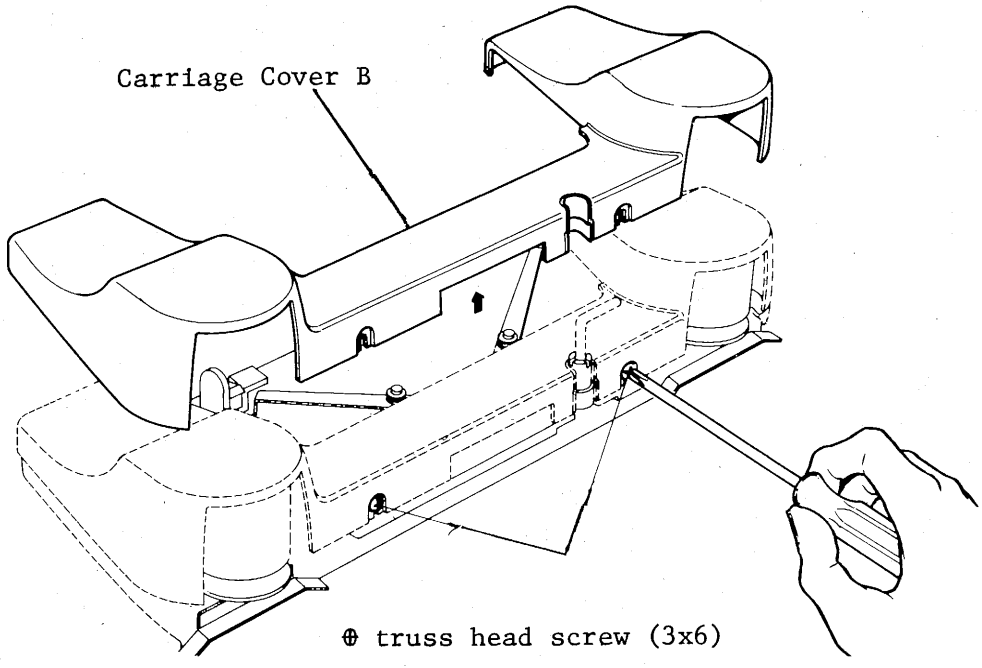


Fig. 25

VI-b DRUM ADJUSTMENT

(1) Remove the E ring (4Ø) which holds Sub Drum and two binding screws (3x5) which hold Sub Drum Piece Holder. Remove the Holder.

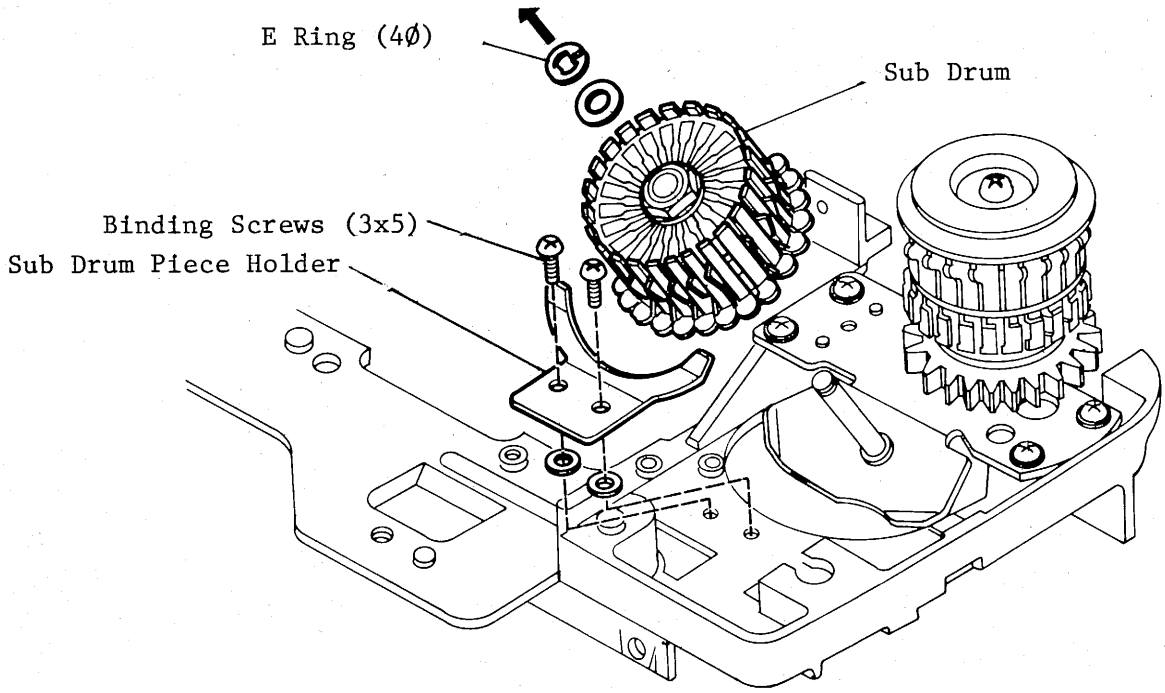


Fig. 26

(2) Remove Sub Drum and place Sub Drum Gear on Drum Base.

(3) Loosen four ± binding screws (3x7) which holds Main Drum.

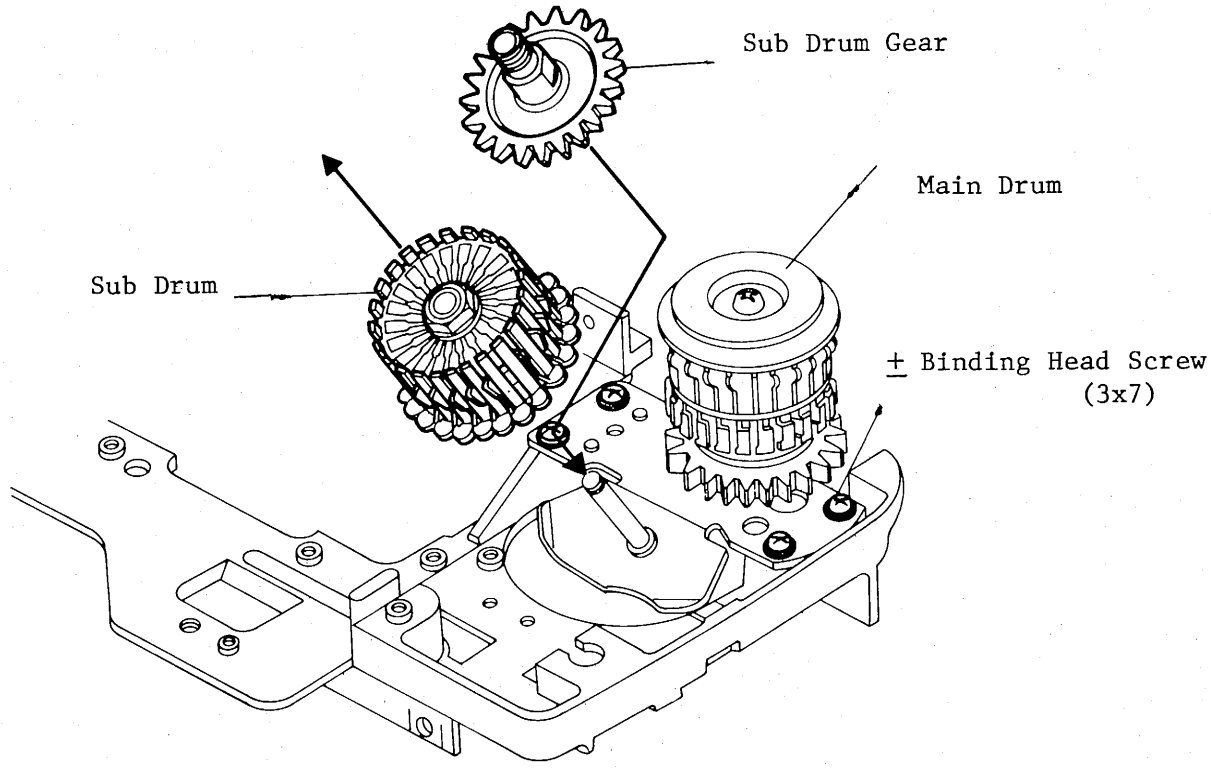


Fig. 27

(4) Adjust the position of Sub Drum to align the Needle Bed Slot, Sub Drum Aixis, and Sub Drum Gear on the straight line as shown in Fig. 28 by moving Drum Holder.

Note: The play of Main Drum against Rack of Needle Bed must be within 0.2 m/m on the circumferance of Main Drum. (Very little movement)

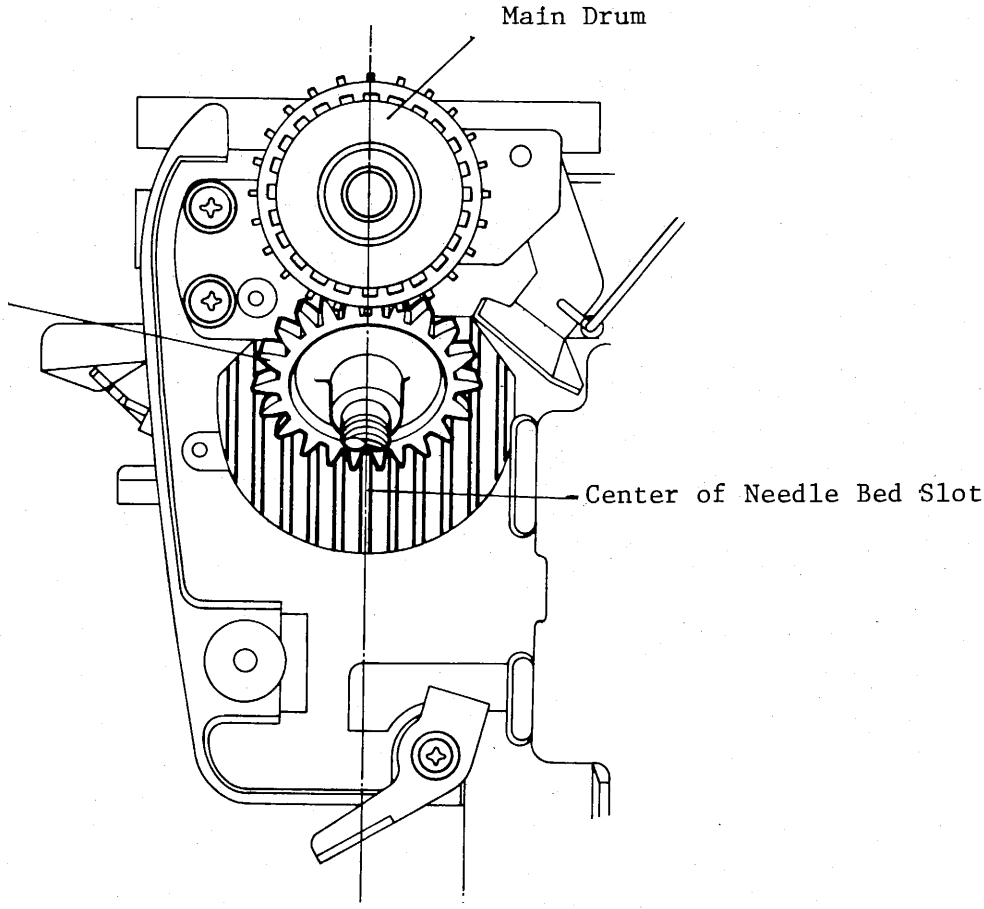
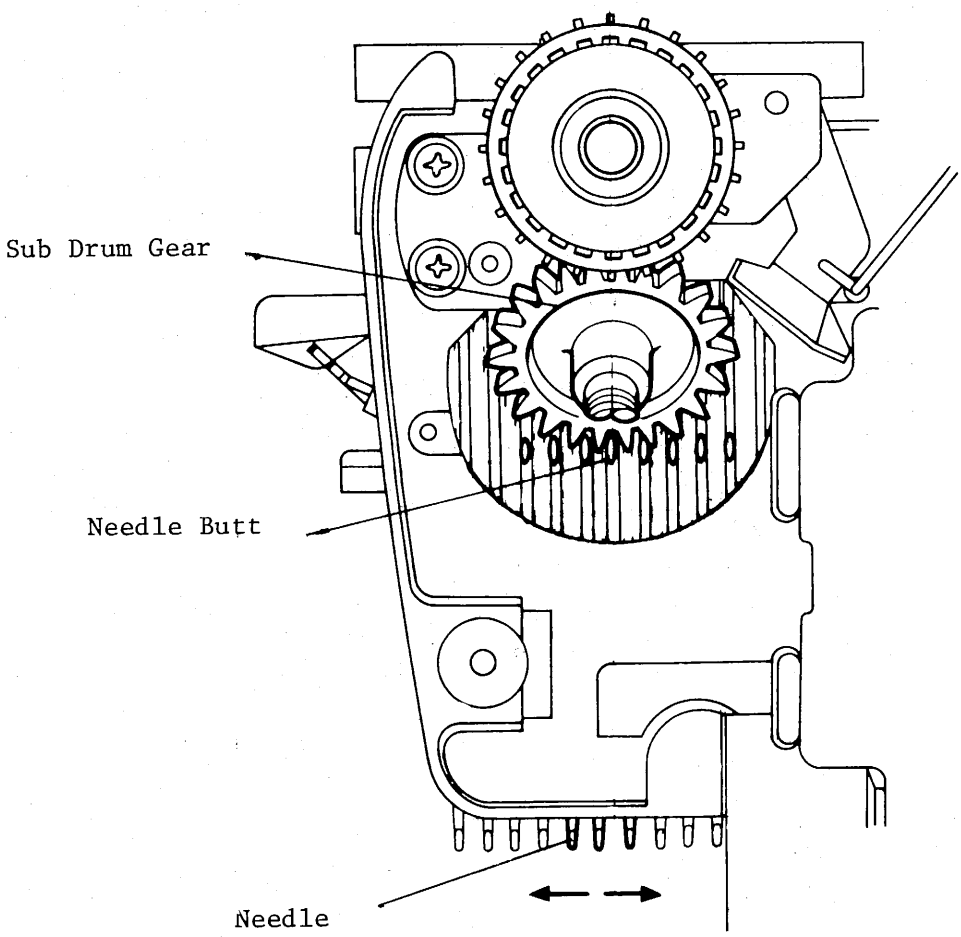


Fig. 28

(5) Fasten Main Drum with four binding screws (3x7) after adjustment. Push up some needles between B and C position on the Needle Bed to check the needles not to move laterally when Sub Drum Gear is engaged with the Needle Butts.



No lateral movement is allowed when Sub Drum Gear is engaged with Needle Butt.

Fig. 29

(6) Remove Sub Drum Gear and put back Sub Drum on the Axis and secure it with plain washer and E Snap Ring (4Ø)

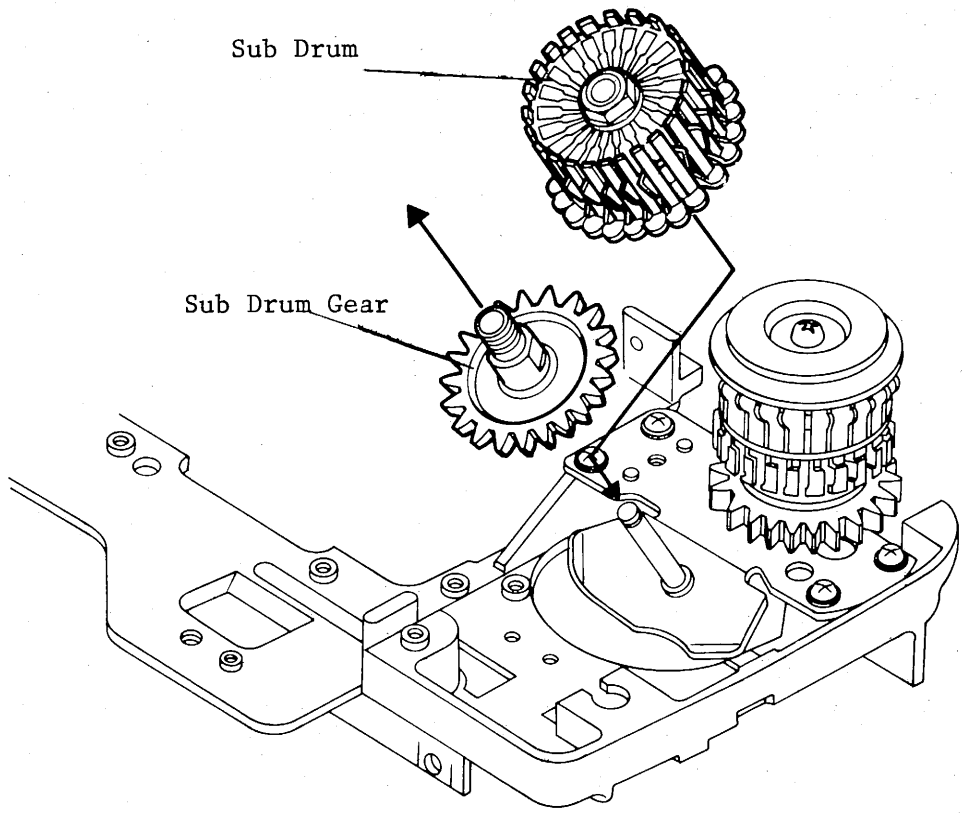


Fig. 30

(7) Set Sub Drum Piece Holder on Carriage Plate B, and then fasten with ⊕ binding screws (3x5)

Note: Sub Drum Piece Holder must not touch Sub Drum, Main Drum and Sub Drum must rotate smoothly.

(8) Move the Carriage slowly with Punched Card inserted in the pattern panel slit to check the condition of needle selection. If the carriage is moved too fast, the needle can not follow the speed and collide with Needle Guide.

* Sub Drum Gear can be used as Adjusting Gear when you disassemble Sub Drum.

VI-c CLEAR WIRE ADJUSTMENT

The length of Clear Wire which works to clear the stored memory of Sub Drum must be adjusted after fixing the position of Drum Unit.

Clear Wire comes in an active position by the function of Clear Cam when Carriage is moved past the middle of Needle Bed.
Adjust the length of Clear Wire by stretching or folding the bent portion of Clear Wire by means of holding with Needle Nose Plier or Duck Bill Plier as much as no clearance exists between Sub Drum Clear Cam and Sub Drum Piece.

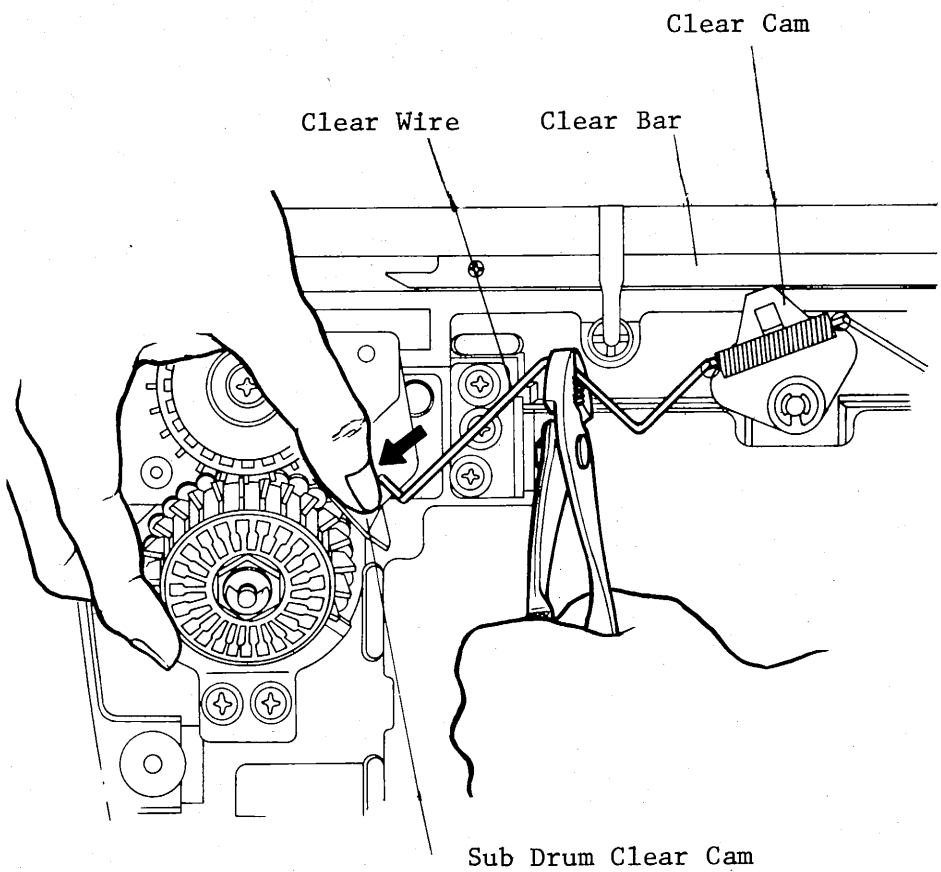


Fig. 31

VI-d HOW TO REMEDY TROUBLES ON DRUM UNIT

VI-d-1 Imperfect Positioning of Drum Unit.

Conditions: Wrong alignment of Drum Unit causes the needles which are guided by Sub Drum Gear to collide with Separation Cam as shown in Fig. 32

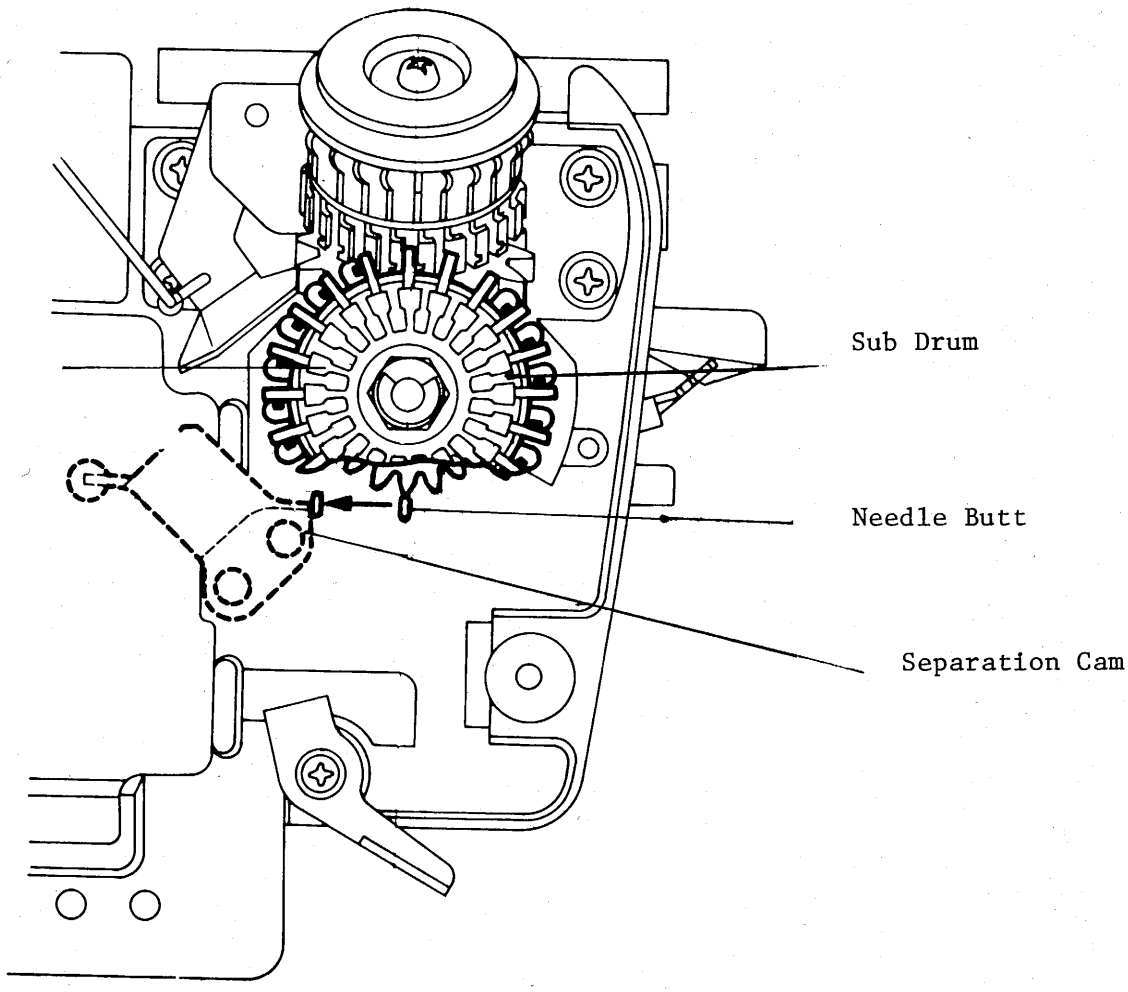
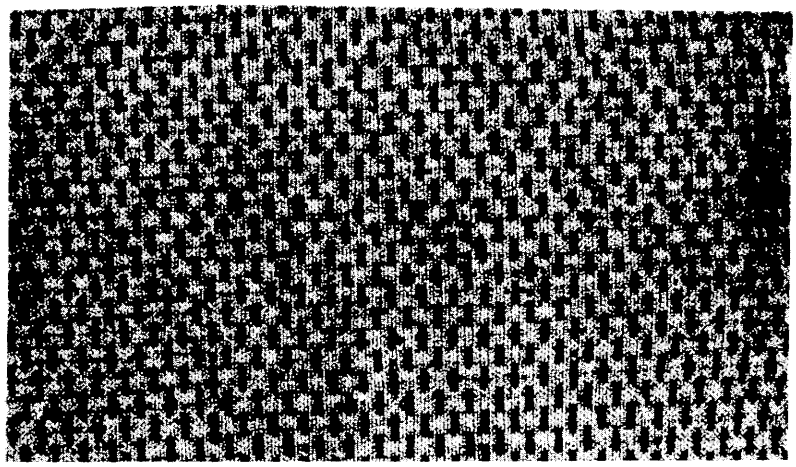


Fig. 32

Correcting Method: Readjust the position of Drum Unit.

VI-d-2 When the parts of Drum Unit are lost or broken.

Conditions: Patterns on knitted fabric show a failure every 24 stitches regularly.



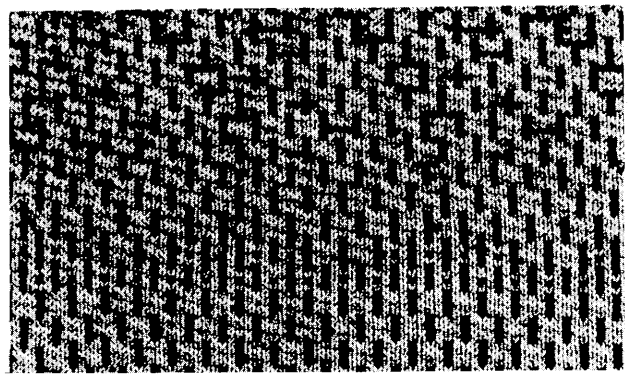
Picture 1

Causes:
a) Inactiveness of a Drum Piece.
b) Rebound Leaf for Steel Ball is bent.
c) The loss of Steel Ball
d) Breakage of a Main Drum Piece.

Correcting Methods:
a) Replace with new one if impossible to repair.
b) Bend back Rebound Leaf for Steel Ball
c) Refill Steel Ball
d) Replace Drum Unit and adjust the length of Clear Wire and the clearance between Main Drum Piece and Touch Lever.

VI-d-3 Incorrect Clear Wire Adjustment.

Conditions: Patterns on knitted fabric break at random.



Picture 2

Causes: Clear Cam can not clear the used memory of Sub Drum and Sub Drum can not memorize the new pattern correctly.

Correcting Method: Adjust the length of Clear Wire.

VI-e THE MEASUREMENTS OF EACH PART OF CARRIAGE

VI-e-1 The height of Carriage Plate B from the front edge of Needle Bed is 20.5 ± 0.2 m/m.

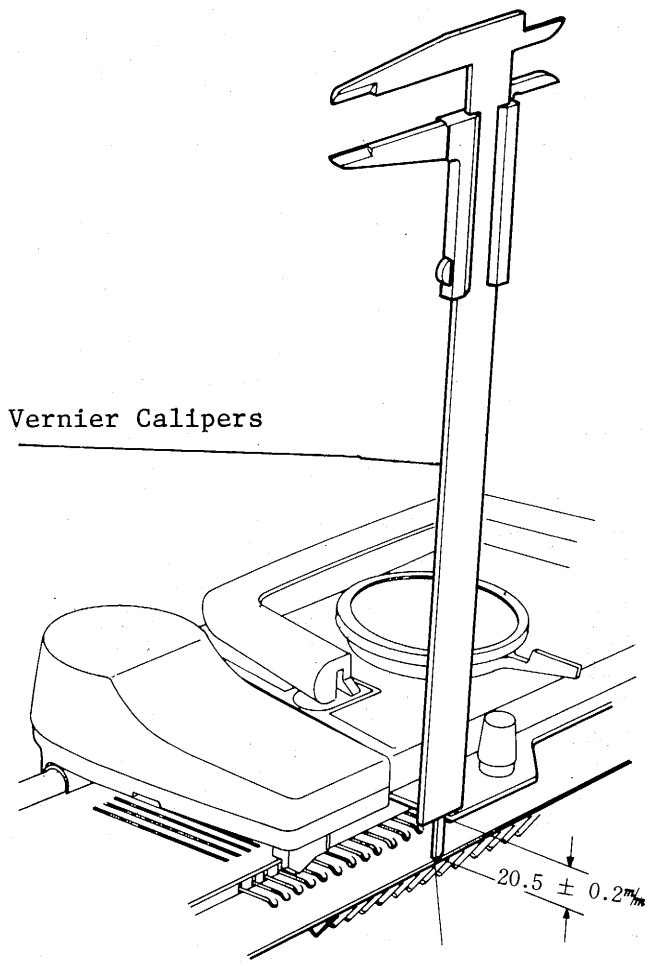


Fig. 33

VI-f ADJUSTMENT

VI-f-1 Loosen four ⊕ Pan head screws (2.6x10) fastening Slider to Carriage Plate B, and adjust the height by moving Slider up or down.

(A) In case Carriage Plate is too high.

Sub Drum Pieces become higher in position, and the distance of the selected needles are pushed out insufficiently. So the needle selected are apt to collide with the Separation Cam.

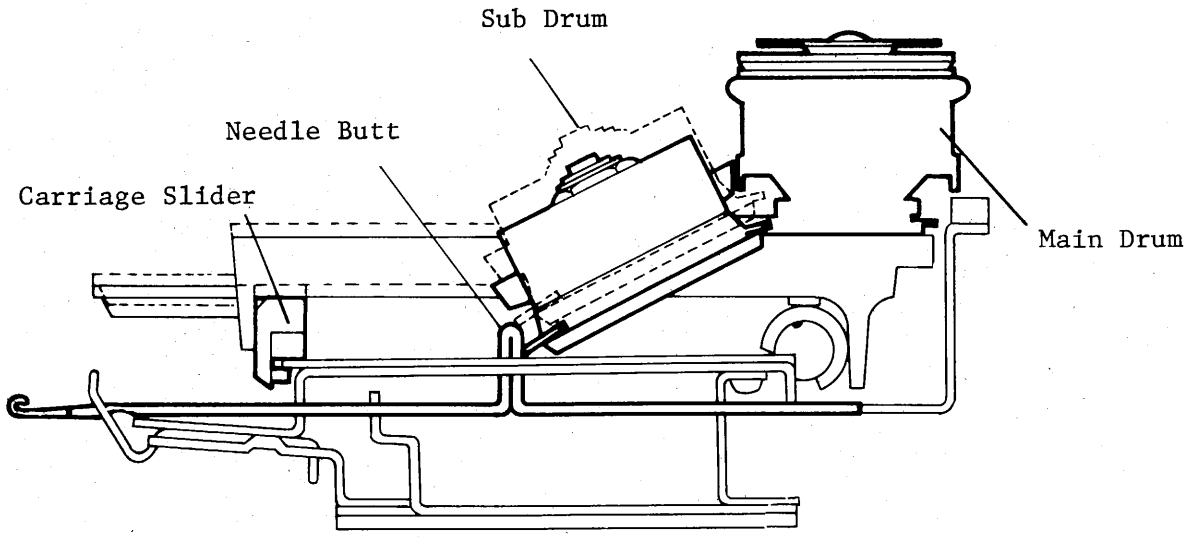


Fig. 34

(B) In case the Carriage Plate B is too low.

As the clearance between the bottom of cams on the back of Carriage and Needle Bed is about 0.3 m/m, if the Carriage Plate B is too low, the cams touch Needle Bed and make a scratch on it.

VI-g COURSE STRIPES

VI-g-1 The measurement between the inner surface of Carriage Pipe and both Main Cams must be 33.90 ± 0.2 m/m when Stitch Dial reads at 5.

The left and right Main Cams must be located at an equal distance from the inner surface of Carriage Pipe (Standard Level).

COURSE STANDARD GAUGE must be used to correct the distance.

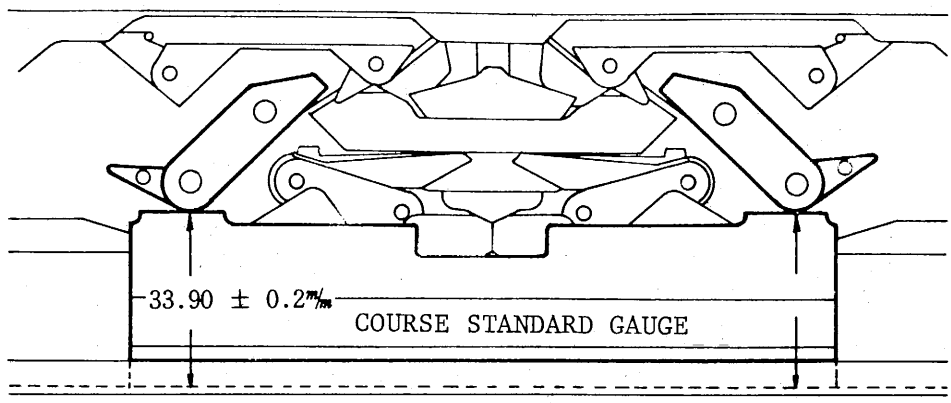
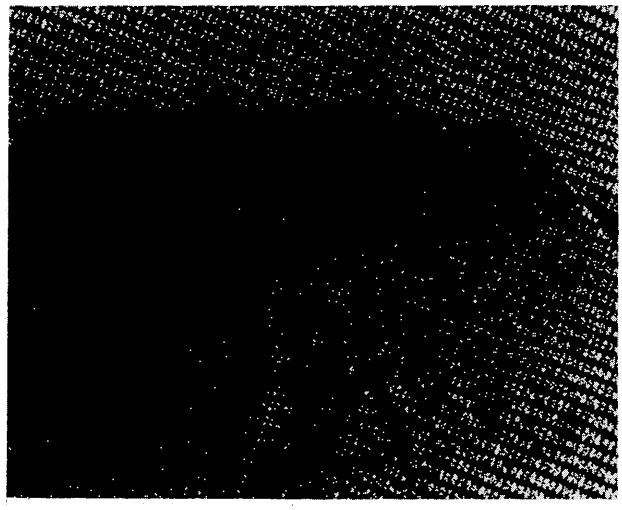


Fig. 35

(A) In case the distance between Carriage Pipe and one Main Cam differs from that between Carriage Pipe and another, course stripes (irregular traverse stitches) result as shown in the picture.



Picture 3

(B) When the distance from Standard Level (Carriage Pipe) to a Main Cam is larger, the amount of yarn pulled in by a Needle is smaller and stitches become smaller. Conversely, when the above distance is smaller, stitches become larger owing to the larger amount of yarn pulled in by a needle. If you continue knitting with two Main Cams unevenly positioned, the tightness of stitches by a stroke of carriage from left to right differs from that made by a right-to-left stroke. The tight row and loose row appear alternately. This is called "Course Stripes" (Irregular Traverse Stitches).

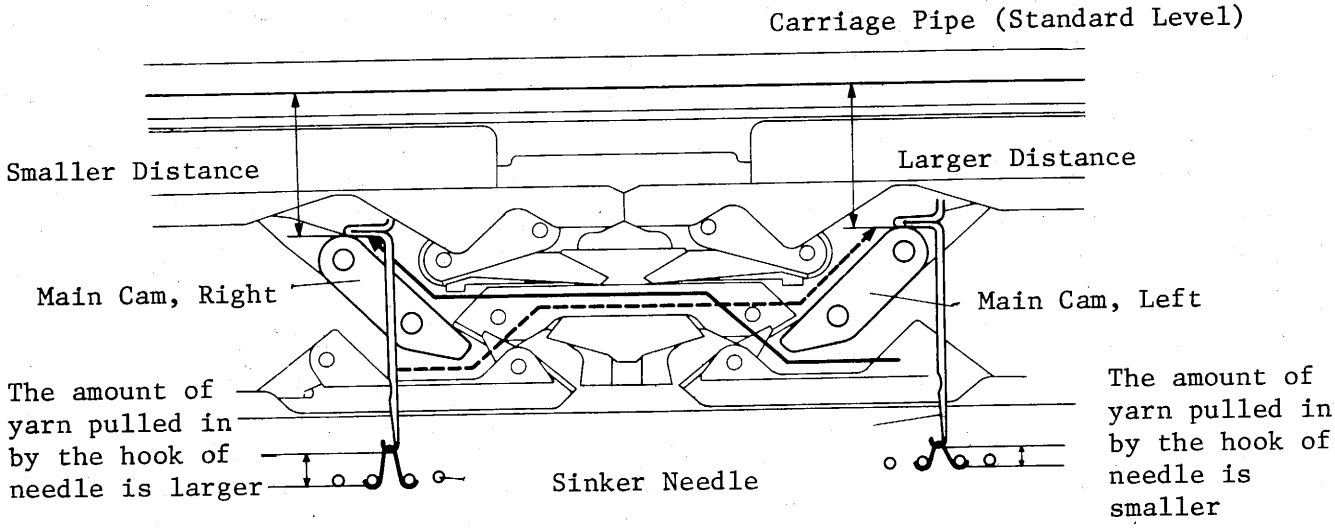


Fig. 36

VI-g-2 Correcting Methods:

(1) Turning over Carriage, loosen a small binding screw securing Stitch Adjusting Plate and adjust the position of a Main Cam by moving Stitch Adjusting Plate forward and backward so that Main Cams move forward and backward.

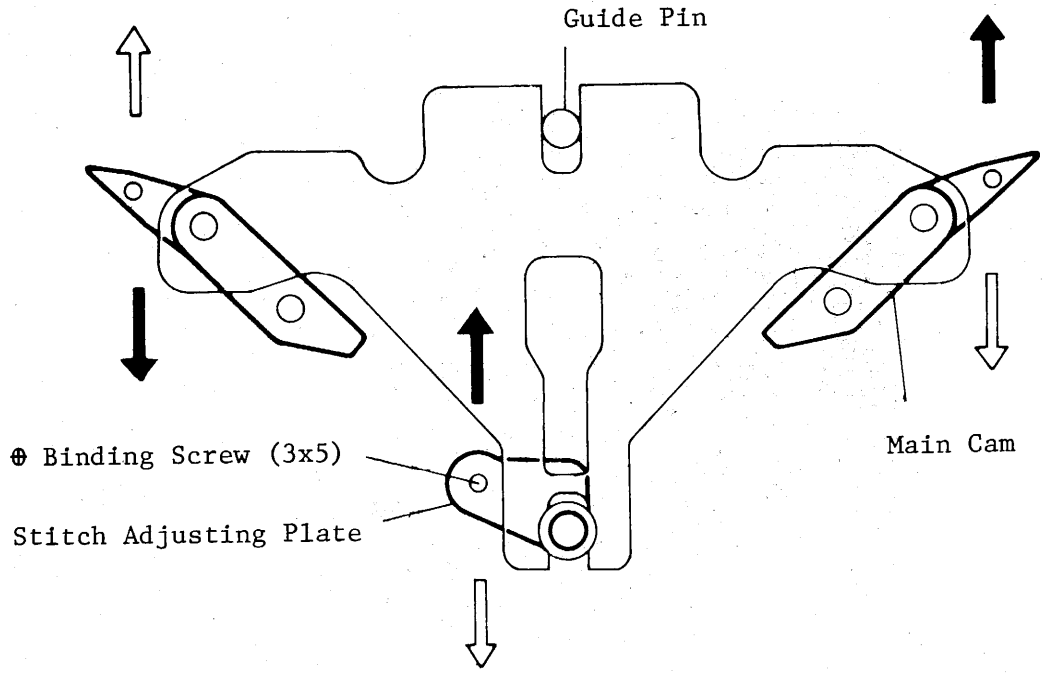


Fig. 37

Explanation of Fig. 37

Move Adjusting Plate in the white-arrow-marked direction, and Travelling Plate will move obliquely to the left centering around Guide Pin of Adjusting Plate. As Main Cams are fixed to Arbor for Cams, Main Cam on the left is also moved in the white-arrow-marked direction with Main Cam on the right moved opposite in the white-arrow-marked direction by the same amount Main Cam on the left moved.

(2) Adjusting Sub Cams as shown in Fig. 38 and setting Dial at a graduation No. 1, turn over Carriage and insert Course Standard Gauge into Carriage Sideward.

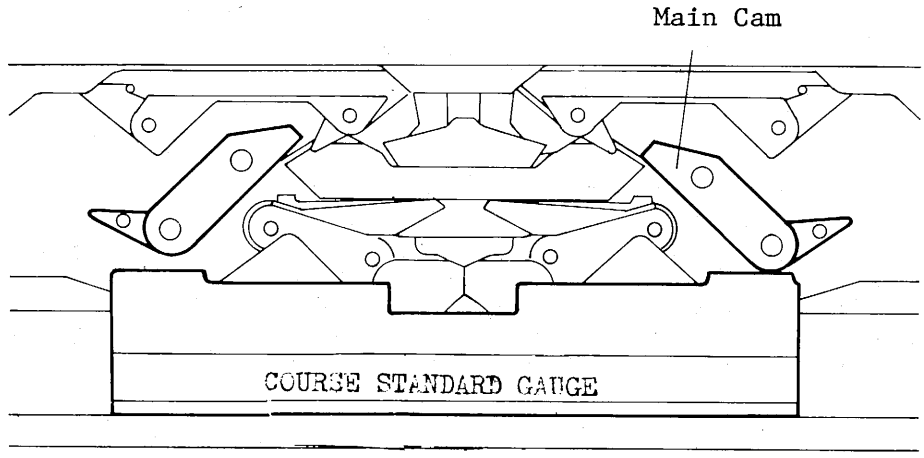


Fig. 38

(3) Move the right and left Cams to contact Course Standard Gauge by turning Stitch Dial, then fasten ⊕ binding head screw (3x5) securing Stitch Adjusting Plate.

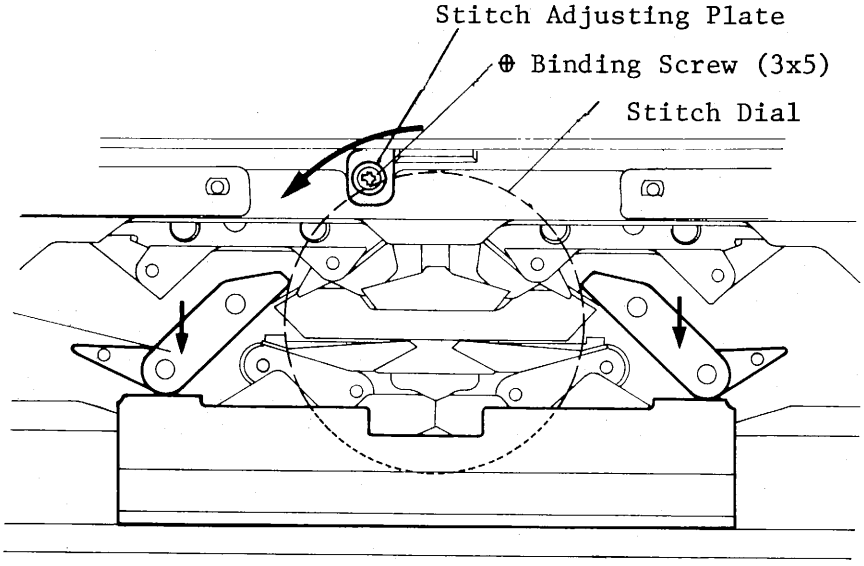


Fig. 39

VI-h THE MEASUREMENT BETWEEN NEEDLE GUIDE AND MIDDLE COURSE CAM

The clearance between Middle Course Cam and Needle Guide A must be more than 5 m/m and paralelly located.

In Knit-In pattern knitting and Punch Lace Knitting, the needles go through between Needle Guide A and Middle Course Cam. So if this clearance is too narrow, the needle butts can not go through between them.

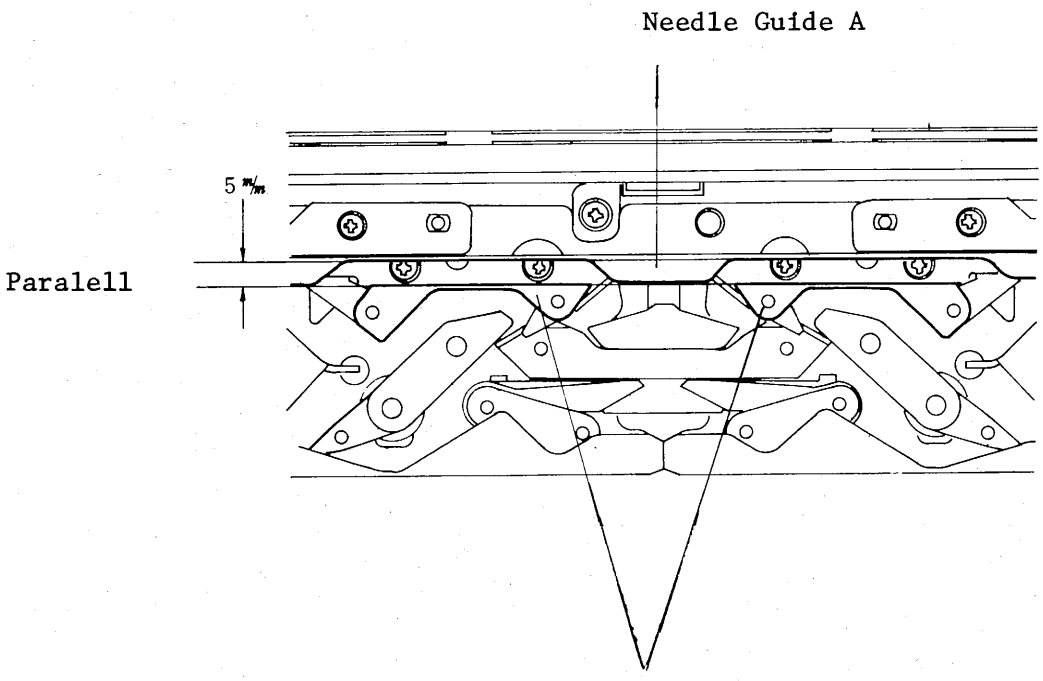


Fig. 40

VI-i THE PLAY BETWEEN CARRIAGE PLATE A AND B

VI-i-1 The play between Carriage Plate A and Carriage Plate B must be within 0.3 m/m.

If there is too much play between Carriage Plate A and Carriage Plate B, the position of each Cams for Yarn Feeder shifts to the right and left in operation of Carriage, and it causes the stitch-float and mis-knitting.

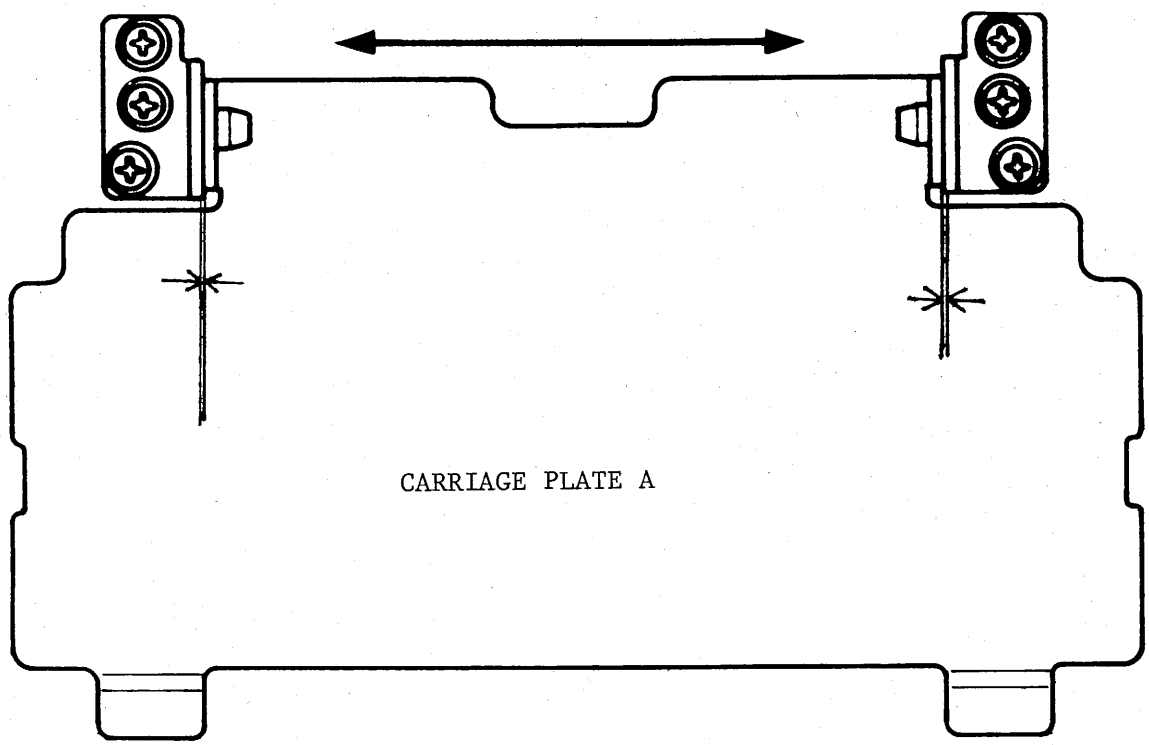


Fig. 41

VI-j Joining Carriage Plate A and B

In joining Carriage Plate A and Carriage Plate B, Cam Lever and Stitch Dial must be set in Dial Arbor, and Course Standard Gauge also must be set in Carriage Pipe. Then set Stitch Dial at 5, fasten Receiver for Carriage Plate A with six screws while pushing Carriage Plate A against Course Standard Gauge.

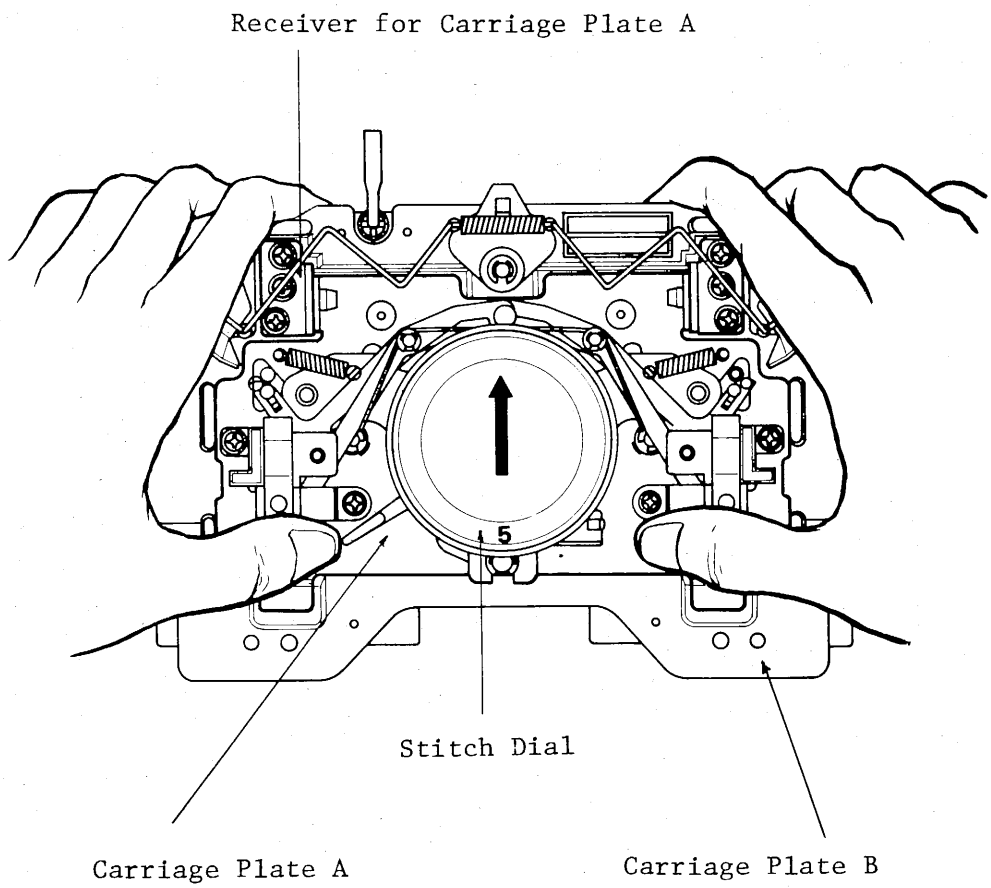


Fig. 42

VII ASSEMBLING CARRIAGE

(1) Aligning Fit Pin of Carriage Cover B with Fit Rubbers, place Carriage Cover B on Carriage (Drums) and tighten ⊕ truss head screws (3x6).

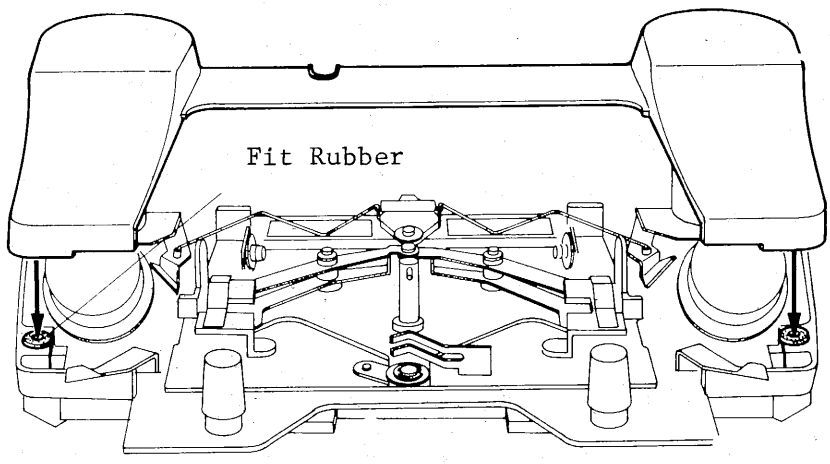


Fig. 43-1

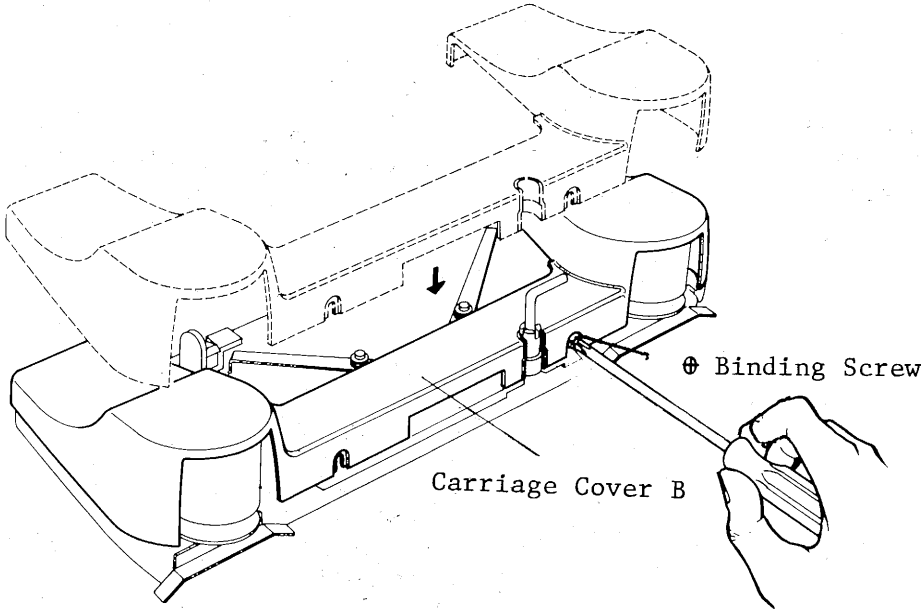


Fig. 43-2

(2) Put Cam Lever in Carriage Cover A and fix Cam Lever in Dial Arbor.

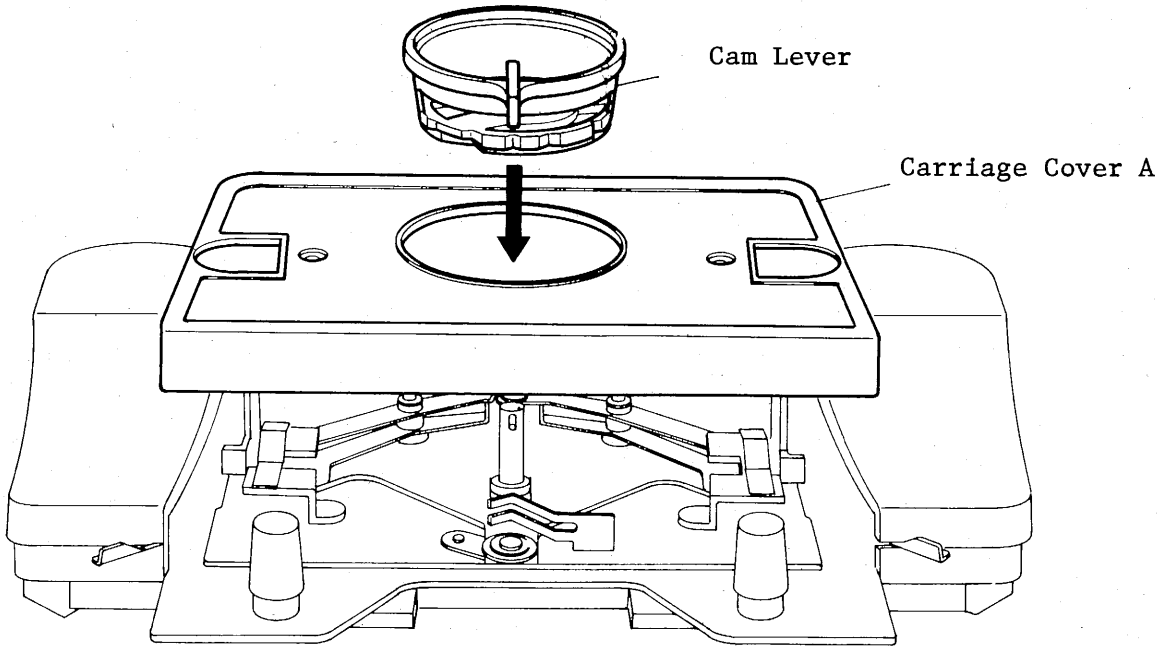


Fig. 44

(3) When Cam Lever is set at Lace Knitting, the upper leaf of Dial Spring meshes with the wavy part of Cam Lever, and then turn the Cam Lever to Stockinet while pushing down, the wavy part of Cam Lever goes between two leaves of Dial Spring.

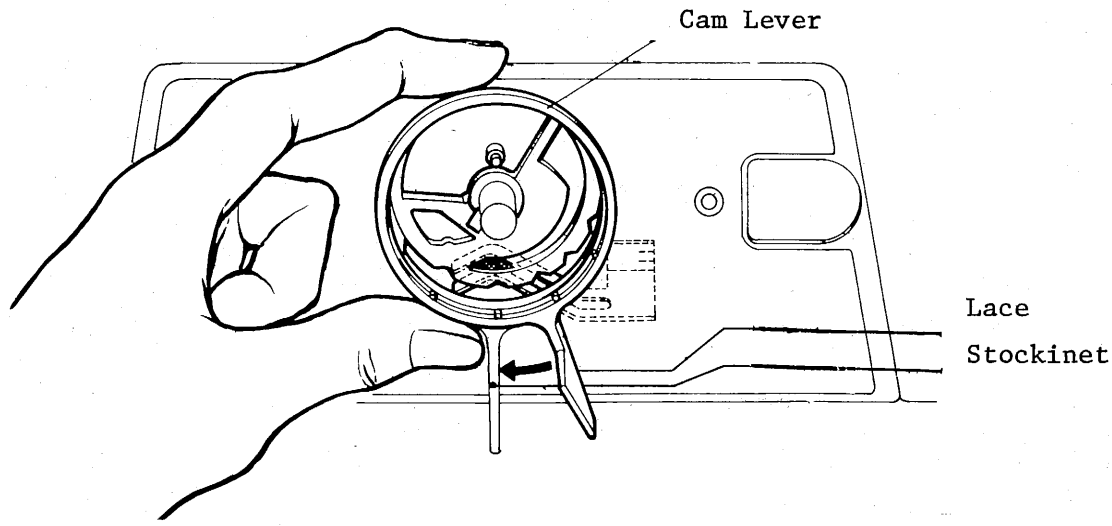


Fig. 45

(4) Turn the Cam Lever to Knit-In and push it down, so the wavy part of Cam Lever engages with the lower leaf of Dial Spring, and then turn the Cam Lever back to Stockinet.

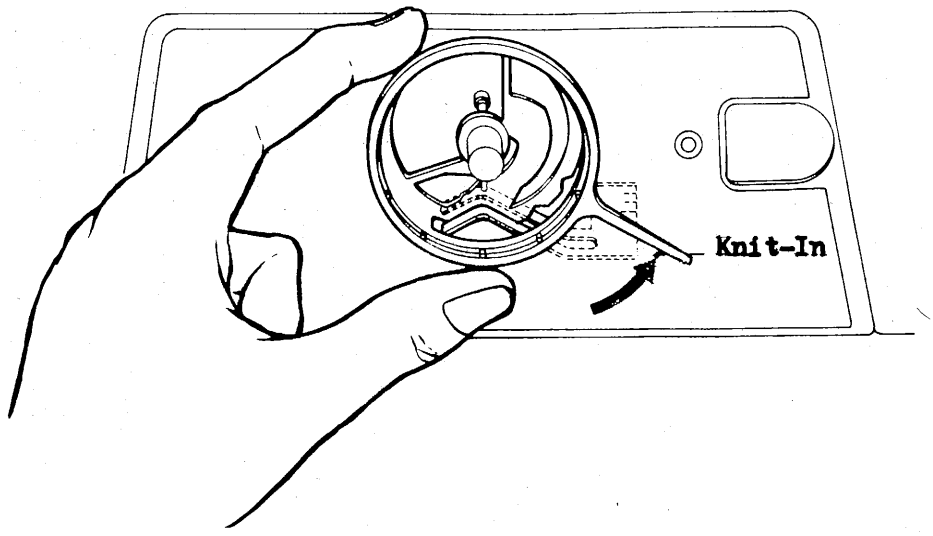


Fig. 46

(5) Secure Carriage Cover A with two ± truss head screws (3x6) as indicated in Fig. 47

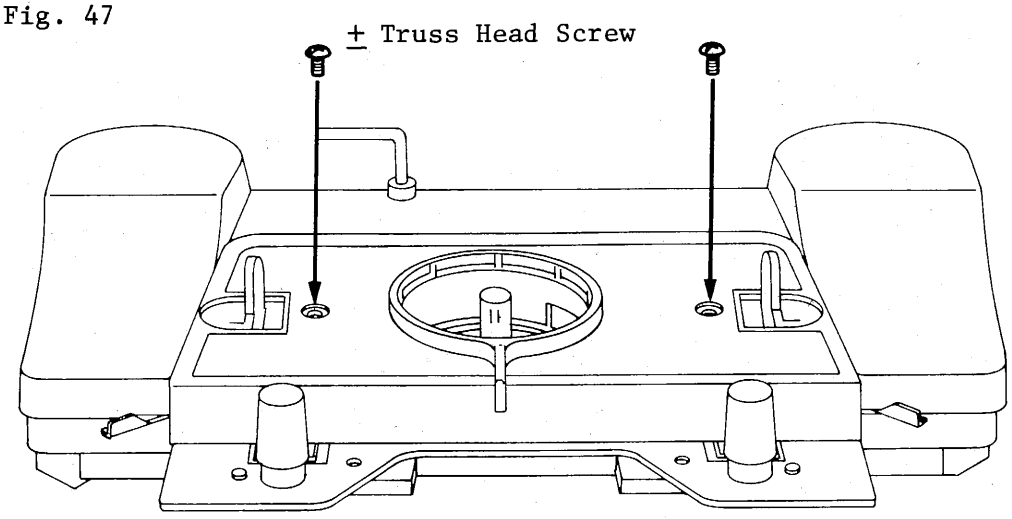


Fig. 47

(6) With Carriage Handle brought down as illustrated in Fig. 48, secure Carriage Handle by tightening two screws for Handle.

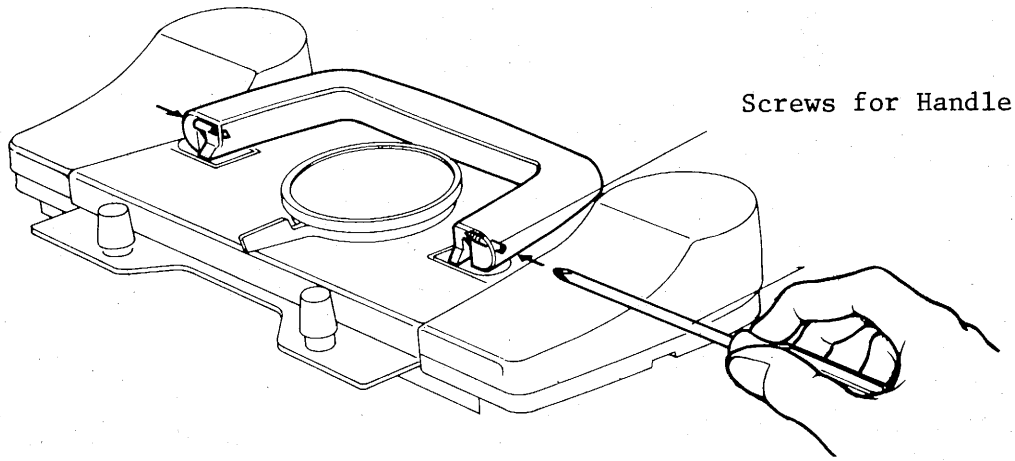


Fig. 48

(7) Push the Pin for Travelling Plate toward Dial Arbor.

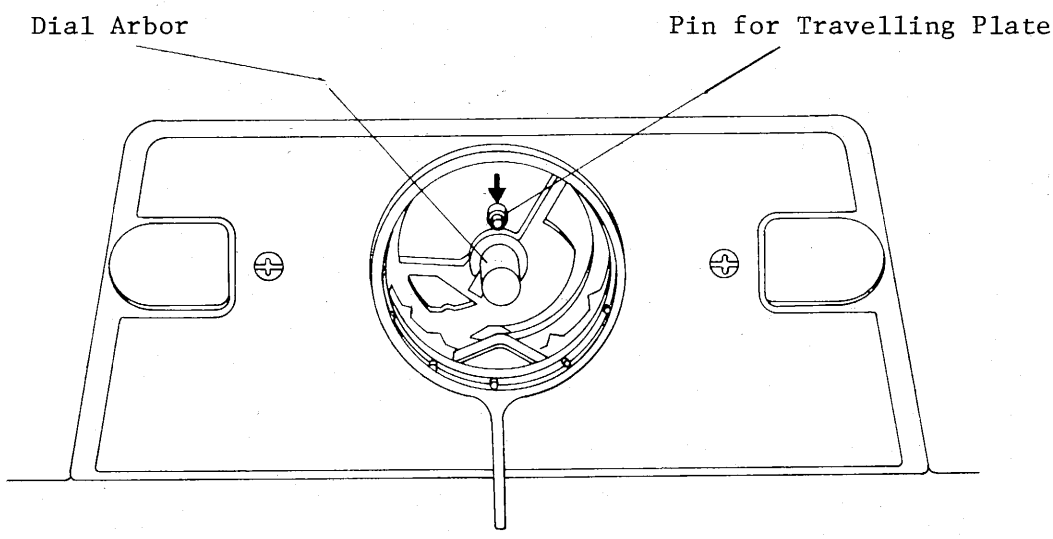


Fig. 49

(8) Install Stitch Dial with the pin of Dial Arbor clearing through the groove of Stitch Dial.

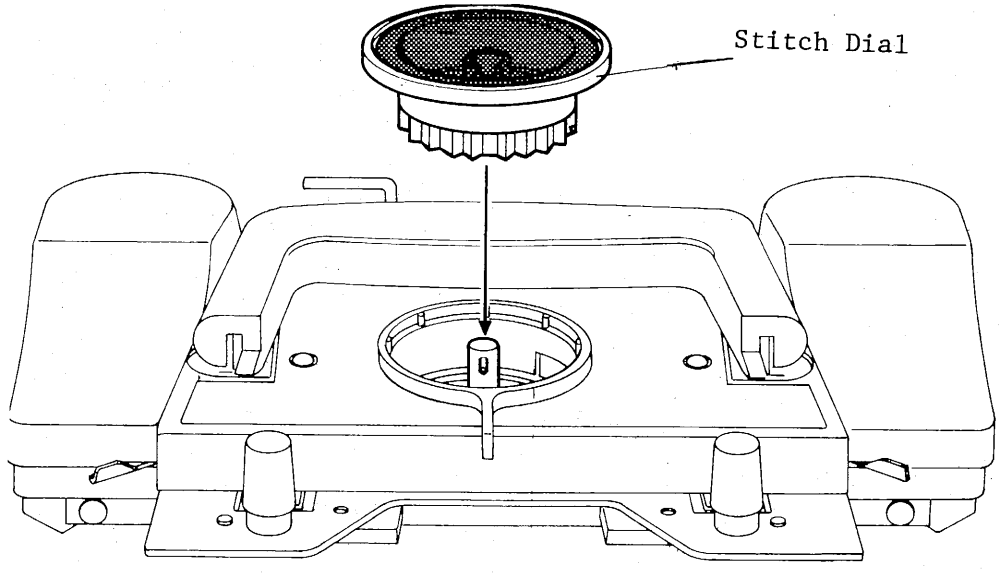


Fig. 50

VIII DISASSEMBLING OF MACHINE BODY (down to case cover)

(1) Turning over body as shown in Fig. 51-1, remove two ⊕ binding screws (3x6) located between two Rubber Pads as shown in Fig. 51-2

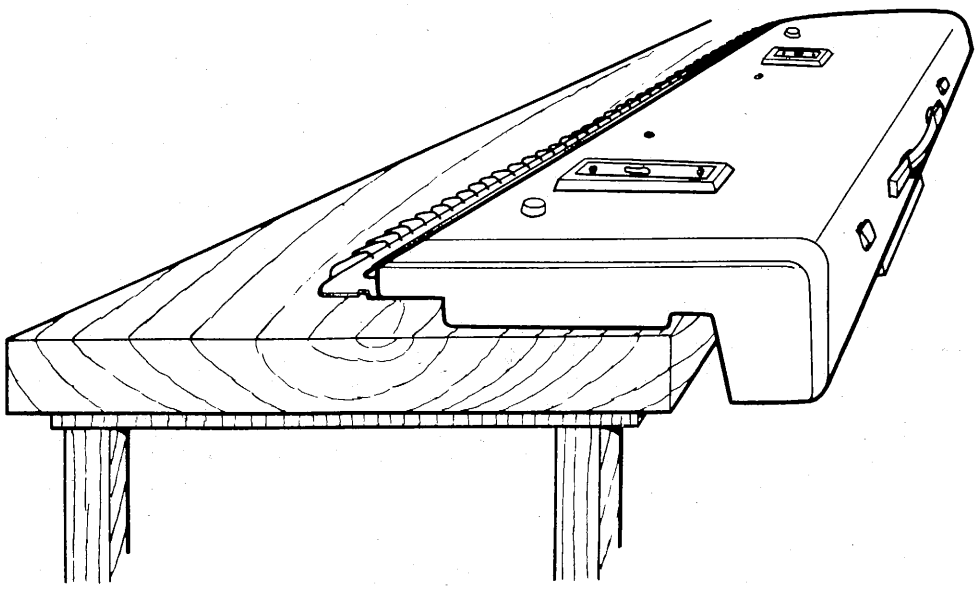


Fig. 51-1

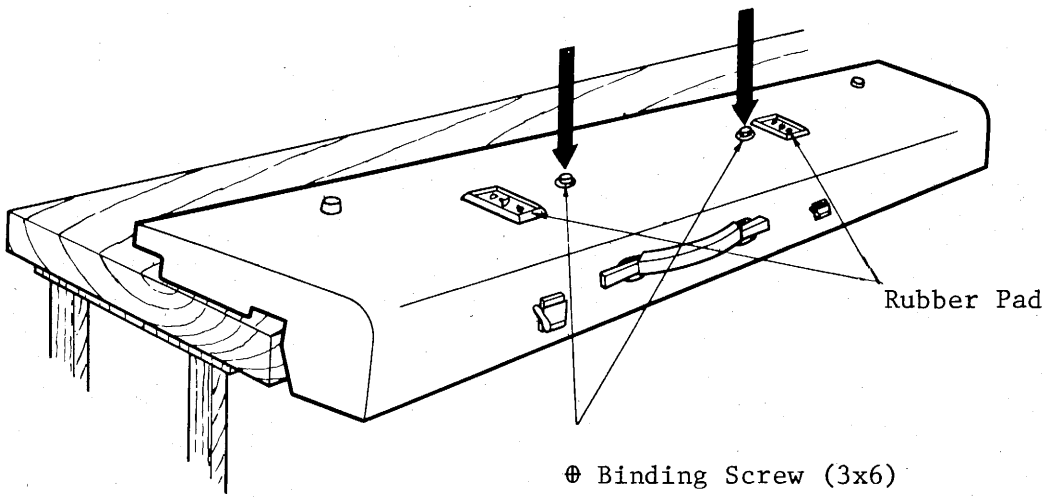


Fig. 51-2

(2) Remove four ⊕ Flat Head Tapping Screws (4x10) used to hold the both ends of Needle Bed and two ⊕ binding screws used to hold the both ends of front edge.

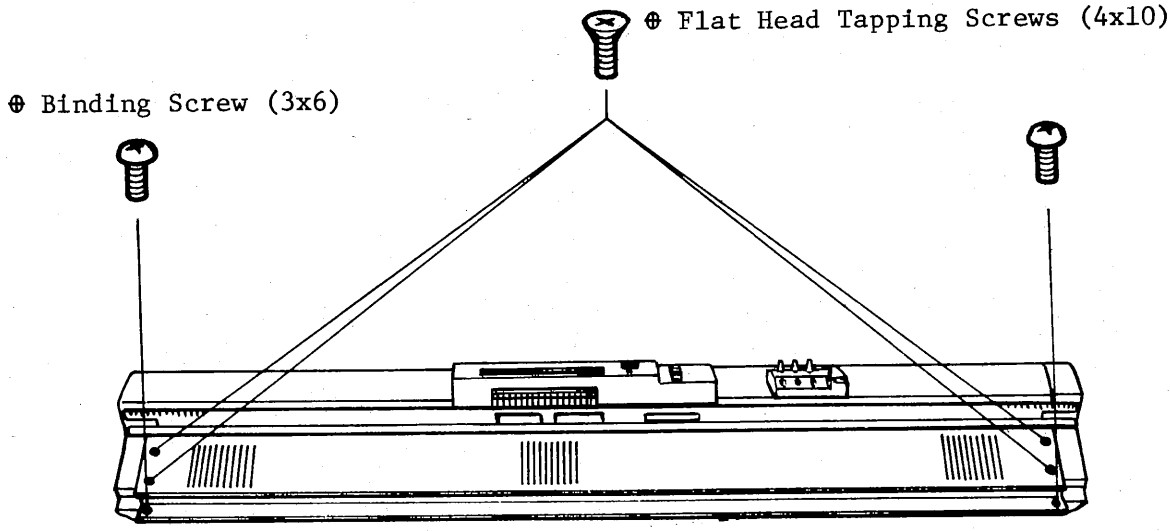


Fig. 52

(3) Move Needle Bed to left while lifting its front edge slightly and draw it towards you. Needle Bed will come separated from Case.

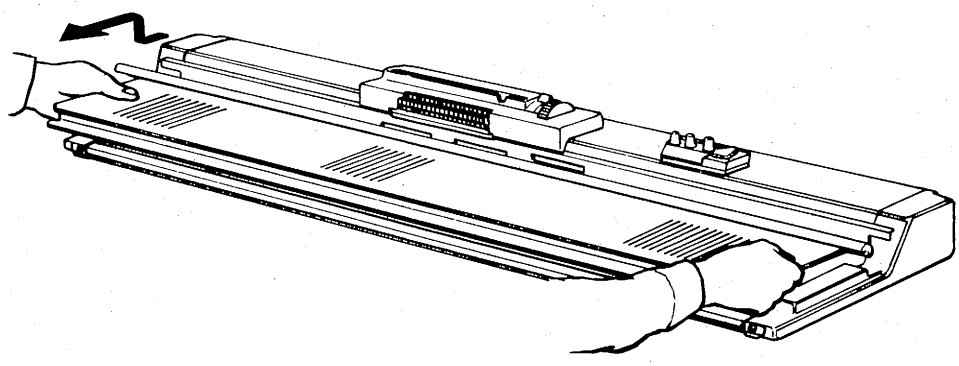


Fig. 53

(4) Turn over Needle Bed Body as shown in Fig. 54

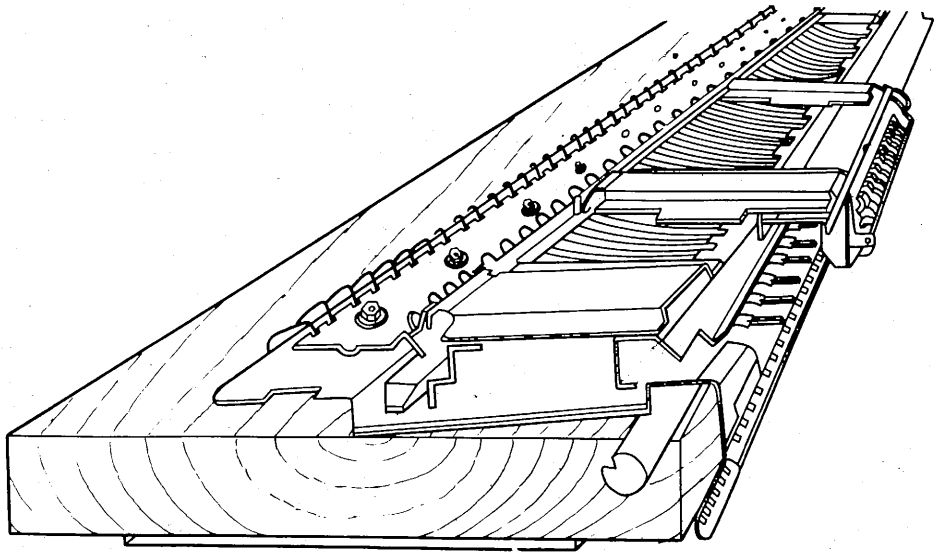


Fig. 54

(5) Remove ten ⊕ binding screws (3x5) used to fix Needle Bed Bracer (A) and Pattern Assembly will come separated from Needle Bed. Fig. 55

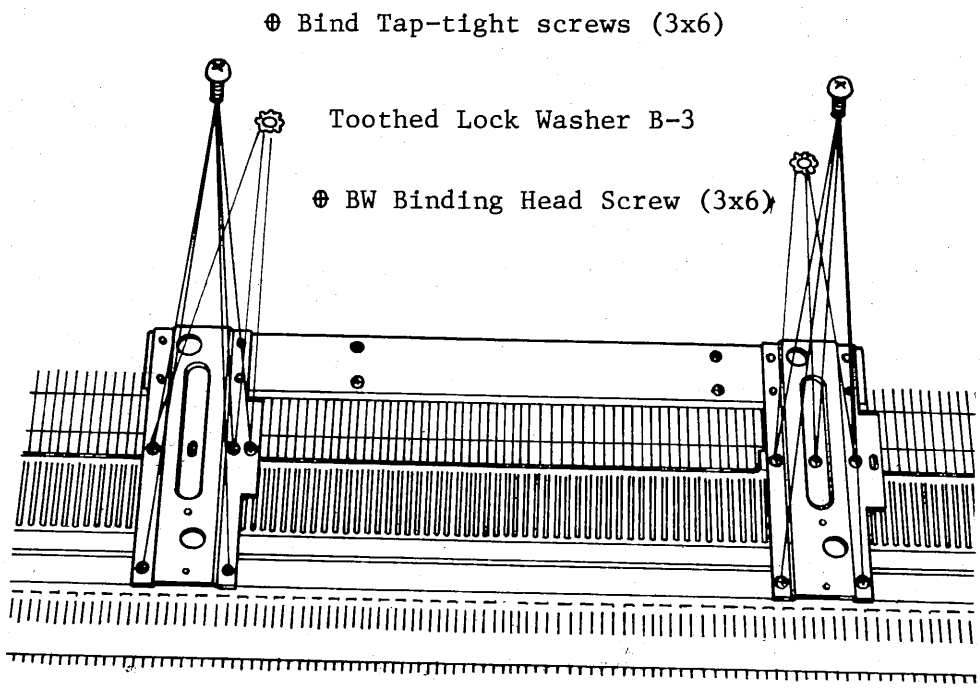


Fig. 55

IX THE MEASUREMENT OF EACH PART OF NEEDLE BED AND ADJUSTMENT

IX-a The dimension between the back surface of Rail and Rack of Needle Bed is 19±0.2 m/m.

The difference between the max. and mini.measurement should be within 0.2 m/m.

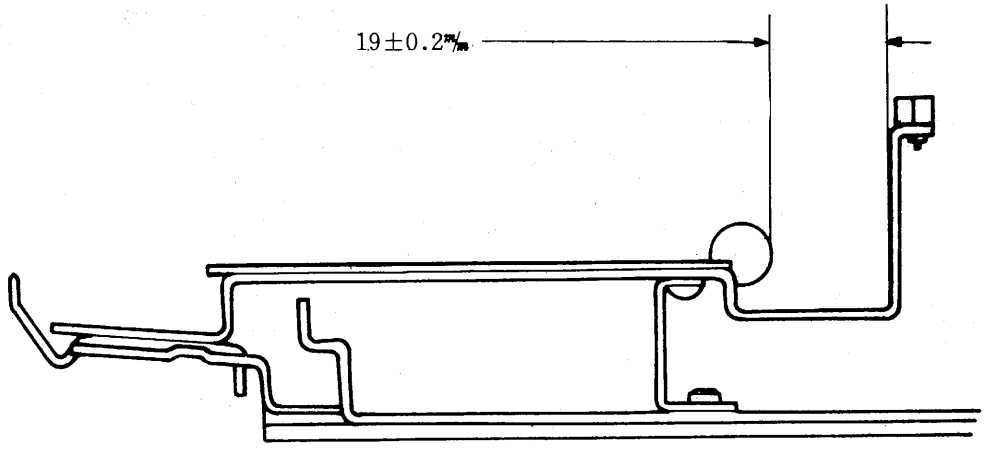


Fig. 56

IX-a-1 In case the dimension between Rail and Rack is too large.

(A) Larger dimension gives too much play to Main Drum engaged with Rack and causes the needles to collide with Separation Cam while pattern knitting.

(B) As the position of Drum Unit becomes more backward than the standard position, the needles selected by Sub Drum come out insufficient and collide with Separation Cam.

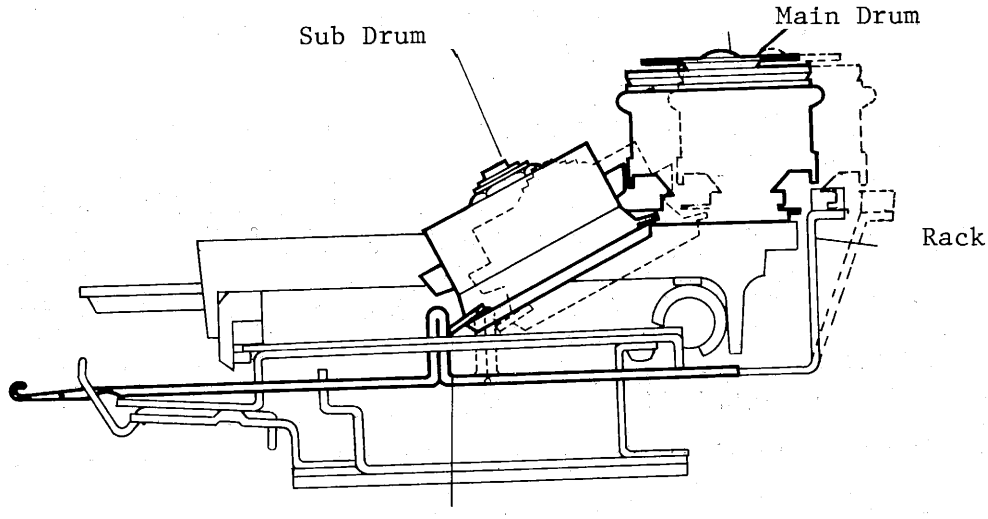


Fig. 57

IX-a-2 In case the dimension is too small.

(A) Main Drum Gear engages with Rack too tightly and it becomes heavy to operate Carriage.

(B) The position of Drum Unit becomes more forward than the standard position, so the needles selected and to move back will collide with Separation Cam.

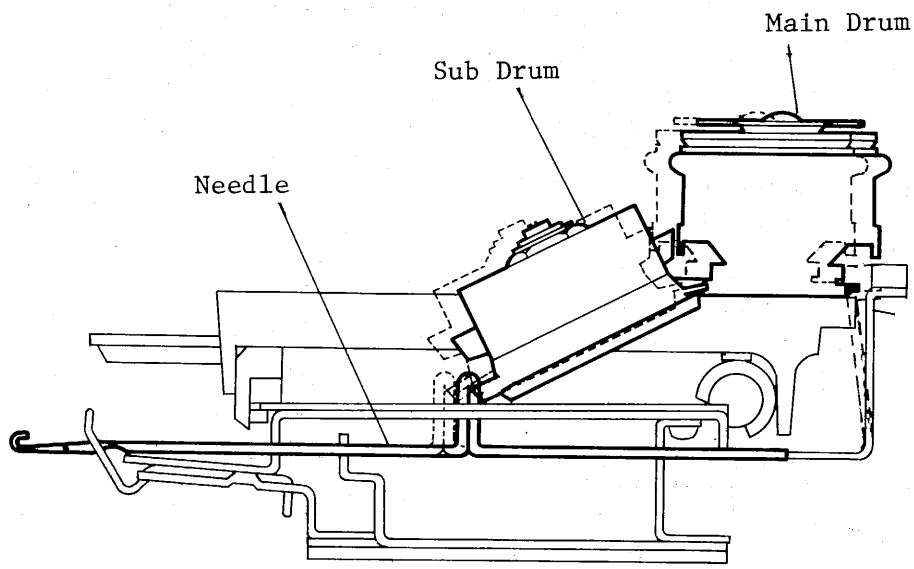


Fig. 58

IX-b Correcting Methods

IX-b-1 When the dimension is smaller than the standard.

Bend Needle Bed Rack backward with Rack Adjusting Tool as shown in Fig. 59. Check the eveness of Needle Bed Rack after adjustment.

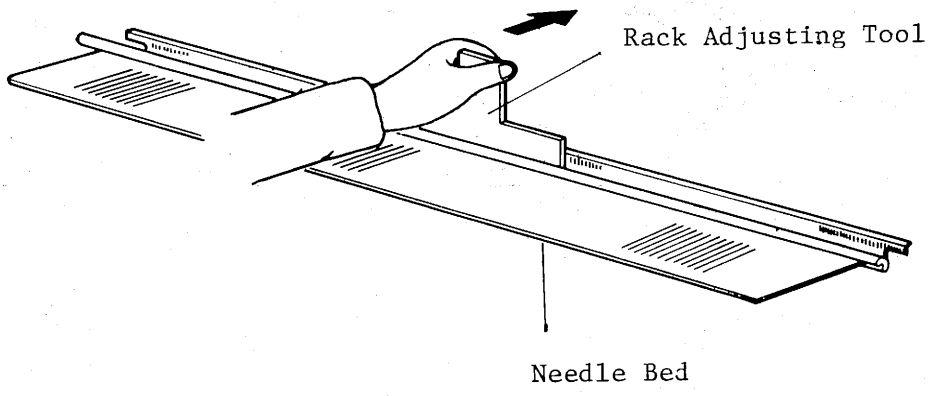


Fig. 59

IX-b-2 When the dimension is too large, stand Needle Bed and push the front edge of Needle Bed downward with your hands as shown in Fig. 60

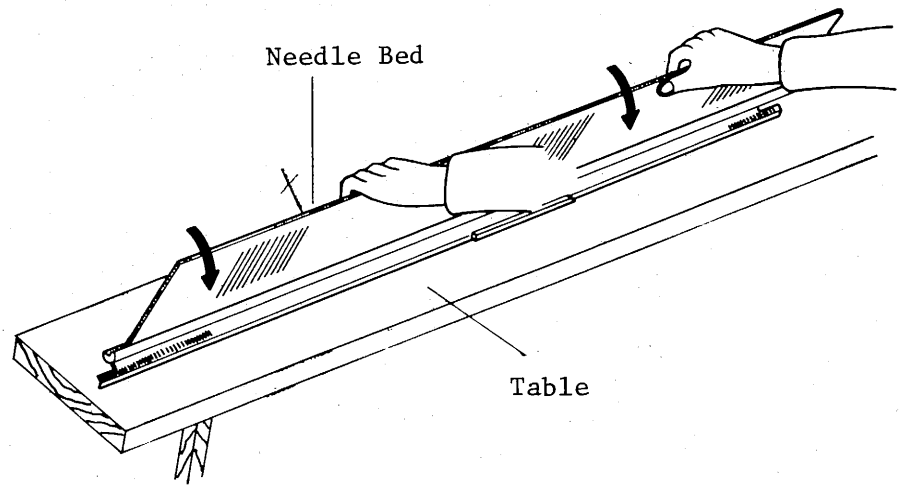


Fig. 60

IX-c DIMENSION L (From the Rail to the tips of Sinker)

L dimension is 121±0.25 m/m.

The range between the max. and mini. measurement should be within 0.2 m/m.

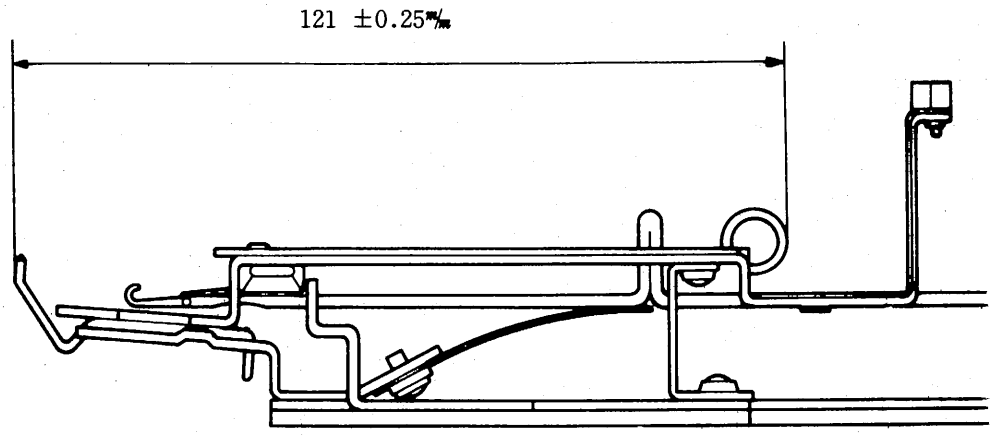
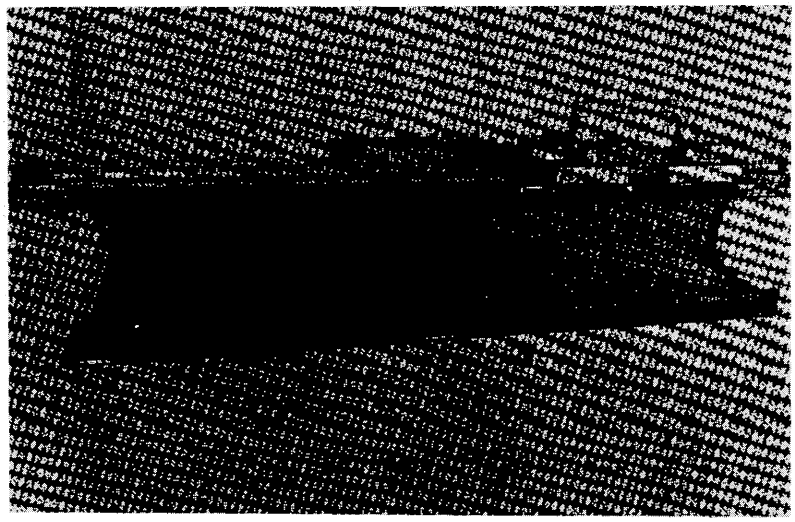


Fig. 61

IX-c-1 In case the Dimension L on the right side differs from that on the left

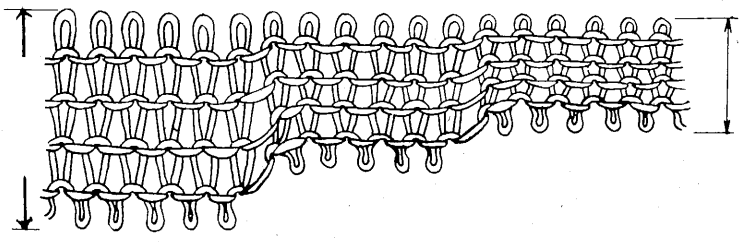
(A) If the Dimension L on the right side differs from that on left side, the fabric of right side will differ from that of left side in length as shown in the picture.



Picture 4

(B) Above picture is graphically shown as follows.

L Dimension is larger.



L Dimension is smaller.

Fig. 62

(C) If the Dimension L at five points (8, 4, 0, 4, 8 on Index Number for needles on Needle Bed) measured with vernier caliper showed the following results:

Range of measured values:

Max. 121.5 m/m
Min. 120.5 m/m

121.5 - 120.5 = 1

Range: 1 m/m

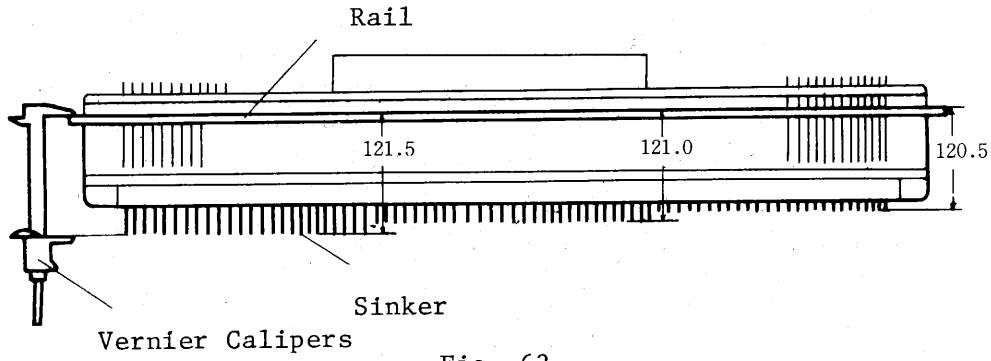


Fig. 63

As shown in Fig. 62, the length of the fabric coming from the part with a larger dimension L gets longer, while the length of the fabric coming from the part with a shorter dimension L gets shorter.
In other words, the left and right length of fabric will be equal if Dimension L is equal at both ends.

IX-d Correcting Methods

IX-d-1 The difference in right and left lengths of the fabric can be corrected by advancing or backing Sinker so as to reduce the difference of measurement to 0 - 0.2 m/m.

(A) In case Sinker is necessary to be pushed forward.

(1) Loosen a hexagon nut by a quarter turn which is located close to a Sinker.

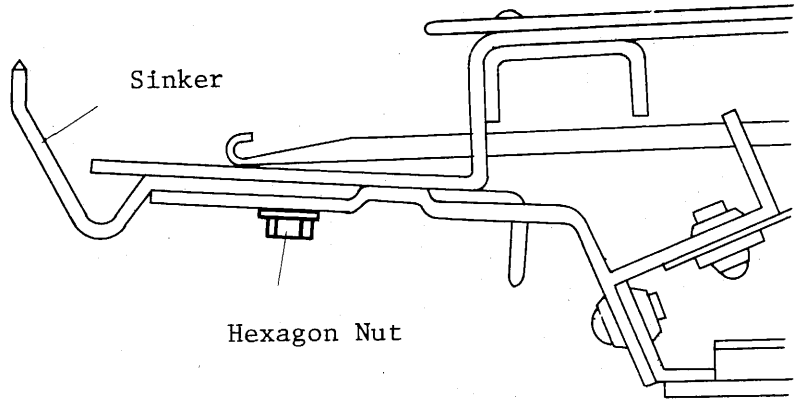


Fig. 64

(2) Loosen ⊕ binding head screws (3x6) used to fix four Needle Bed Bracers, A and B, to Supporting Plate for Needle Bed.

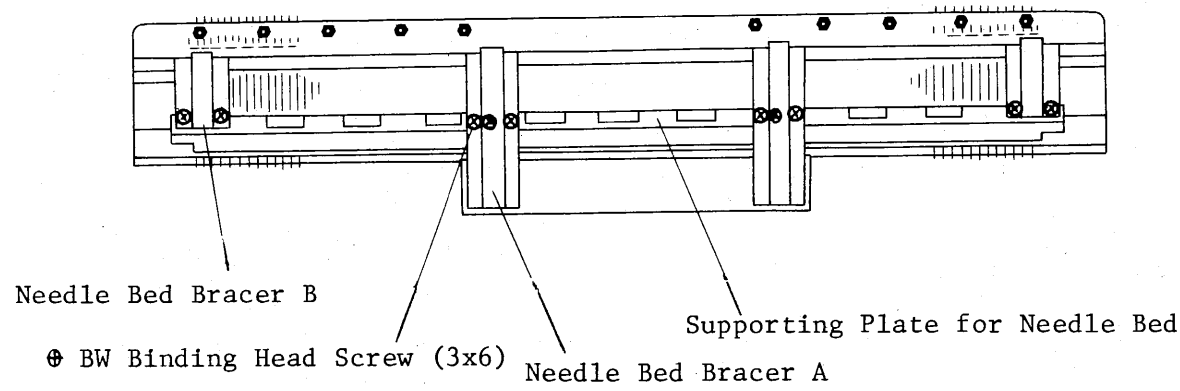


Fig. 65

(3) Insert about 1 m/m thick steel plate between the Sinker and the front edge of Needle Bed as shown in Fig. 66 with the steel plate kept pressed downward, bring it down in the arrow-marked direction, and the Sinker can be moved forward. Repeat the above action for correct alignment of the Sinkers.

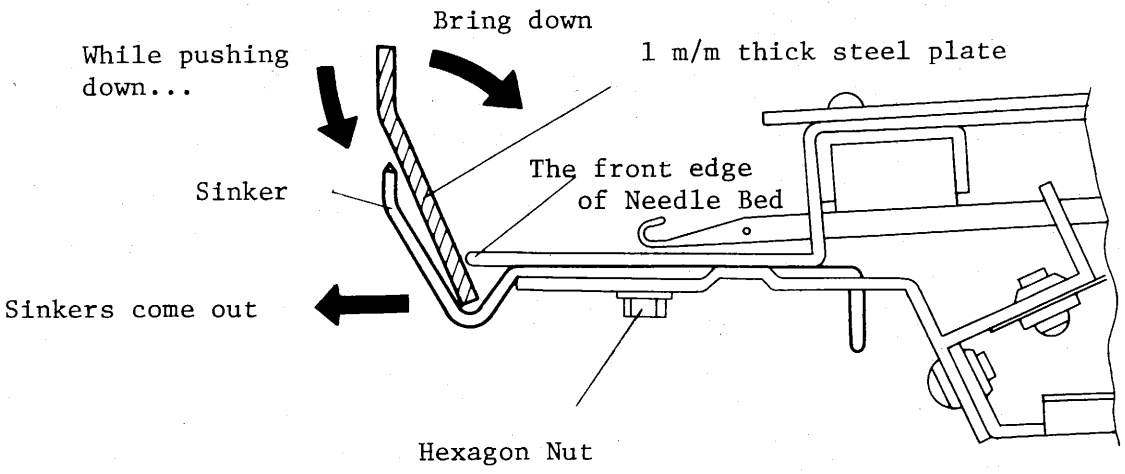


Fig. 66

(4) Measure the Dimension L after tightening the hexagon nut.

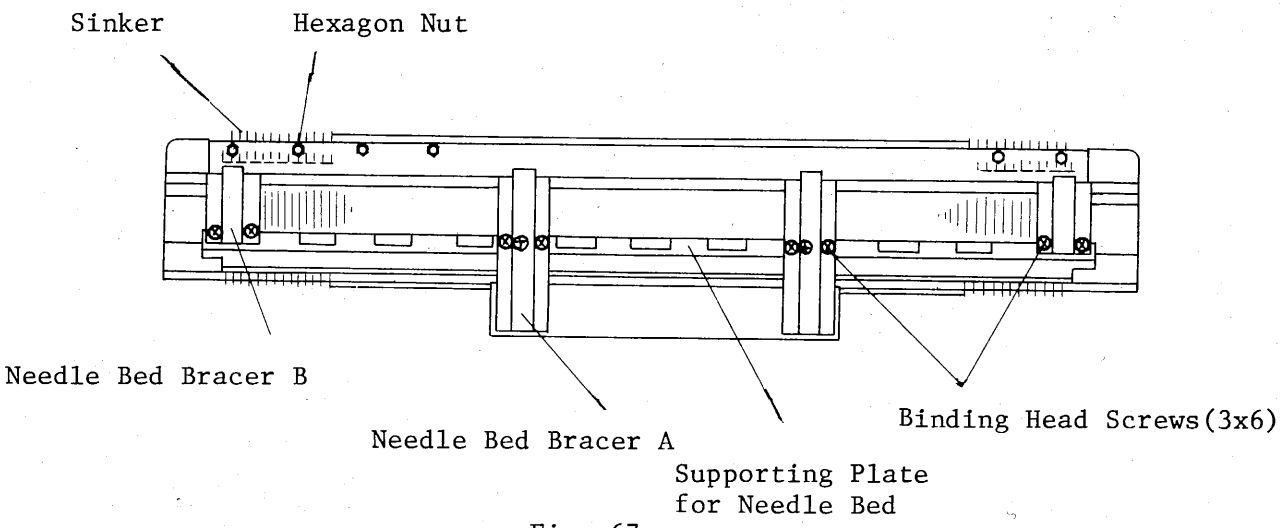


Fig. 67

(5) After the adjustment is over, tighten the ⊕ binding head screws (3x6) loosened in the preceeding step (2).

(B) In case it is necessary to move Sinker backward.

(1) Loosen a hexagon nut by a quarter turn which is located close to a Sinker which you find necessary to move inside.

(2) Loosen ⊕ binding head screws (3x6) used to fix four Needle Bed Bracers, A and B, to Supporting Plate for Needle Bed.

(3) Press the part of a Sinker as shown by a white arrow mark in Fig. 68 with rounded side of a wooden hammer or any wooden material with a rounded surface as if you were rubbing it, and the Sinkers can be moved inside.

(4) Measure the Dimension L after tightening the hexagon nut which has been loosened in the preceding step.

(5) After the adjustment is over, tighten the ⊕ binding head screws (3x6) loosened in the preceding step (2).

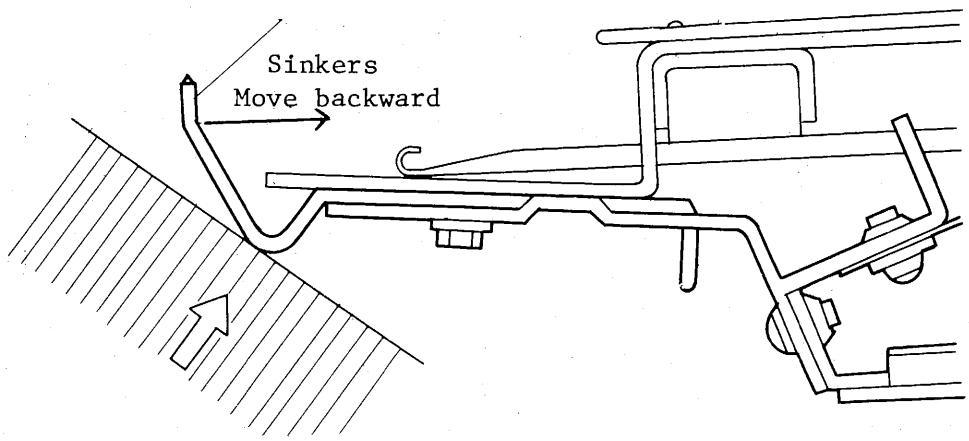


Fig. 68

X REMOVAL, ADJUSTMENT AND REMOUNTING OF PATTERN UNIT.

X-a Removal

(1) Refering to Fig. 55 remove the Pattern Unit from the main body, and remove the Stop Knob with a screw driver as shown in Fig. 66.

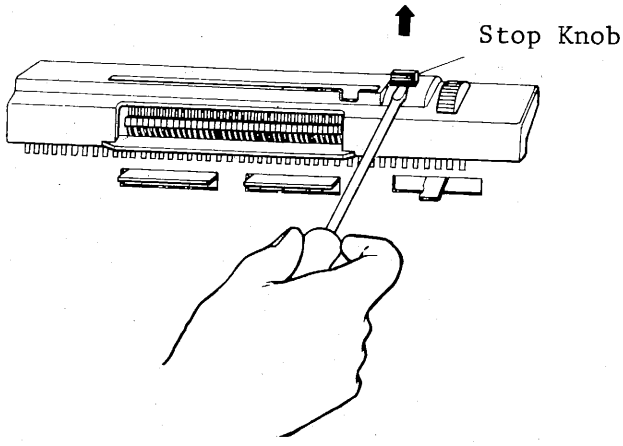


Fig. 69

(2) Remove two Pattern Panel Screws securing the both ends of Pattern Panel, take off Pattern Panel upwards.

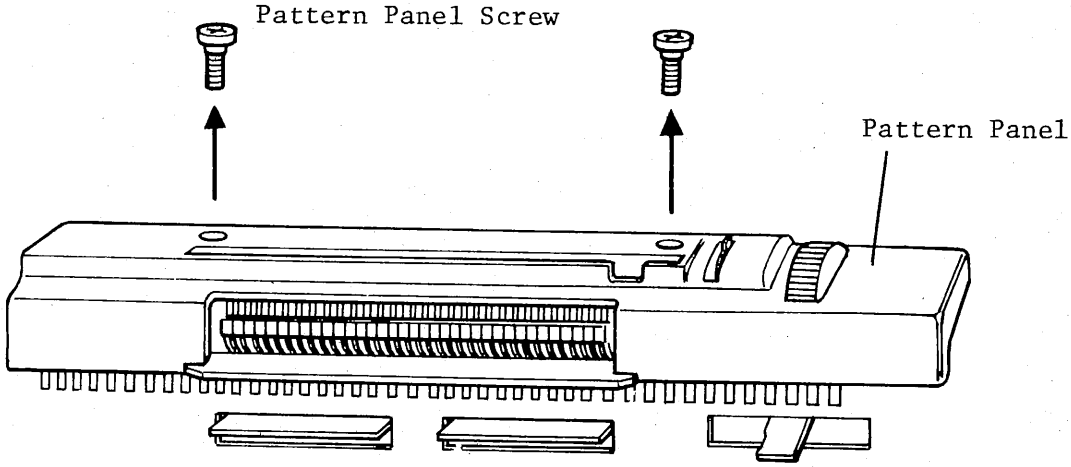


Fig. 70

(3) Holding Pattern Unit as shown in Fig. 71, remove four ⊕ binding head screws (3x6) at the back of Pattern Base.

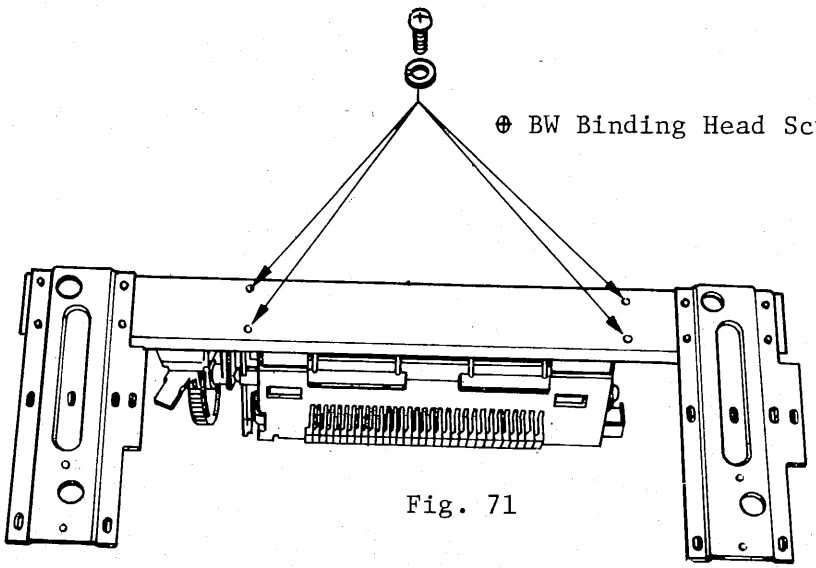


Fig. 71

(4) Take off Pattern Unit to the left, Pattern Unit will come off the Pattern Base.

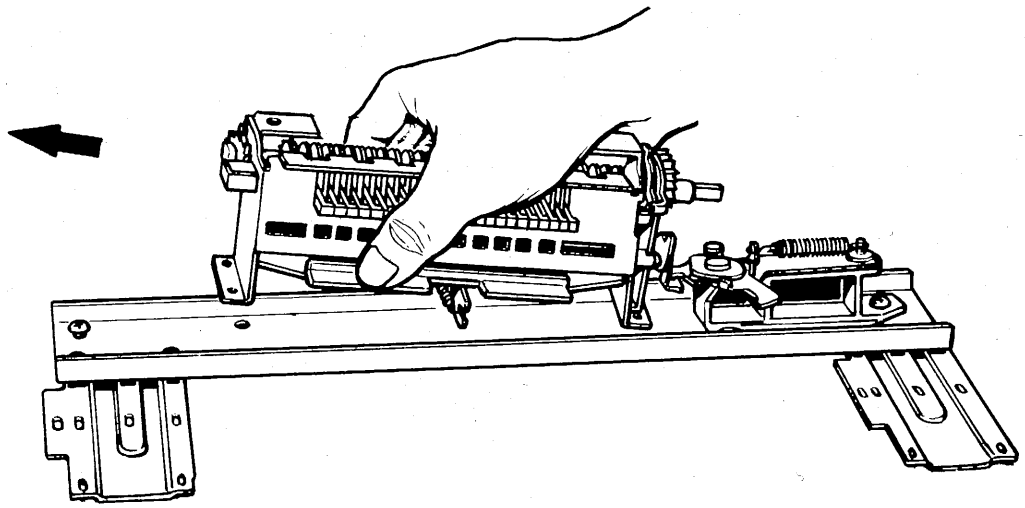


Fig. 72

(5) Disconnect Spring for Under Lever attached to the lower part of Pattern Unit from Under Spring Hanger.

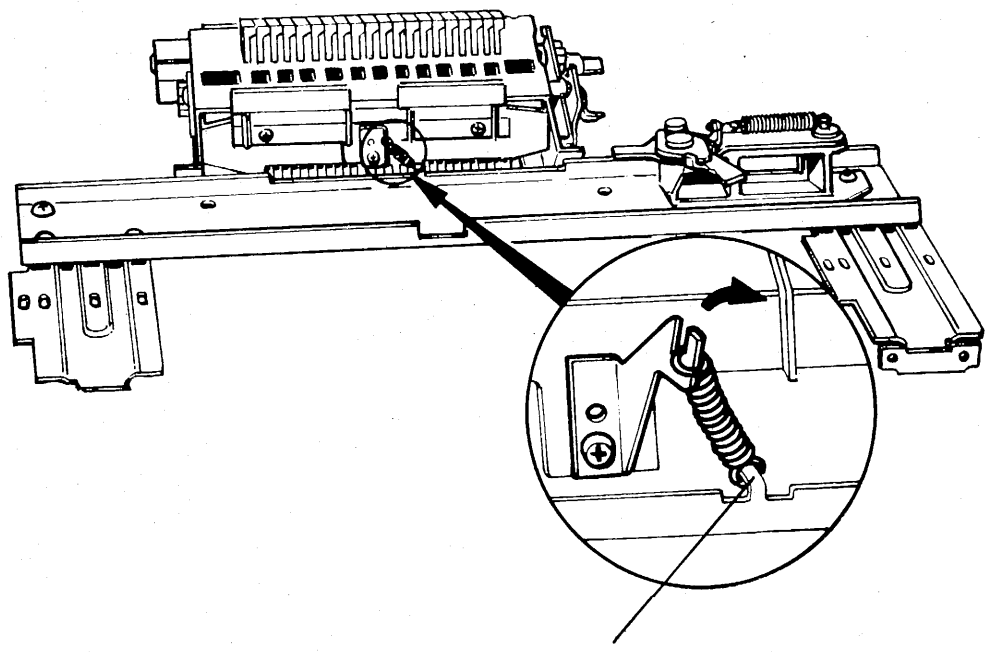


Fig. 73

X-b How to adjust or repair pattern unit.

* The Touch Lever Scanning Fingers go into the Punched Card Holes to read the pattern and transmit it to Main Drum. So if the Punched Card Holes are out of position for Touch Lever Scanning Fingers, Touch Levers can not work correctly and patterns will not be formed correctly on the fabric.

(1) Insert Punched Card No. 1 in Pattern Unit.

(2) Raising Under Lever, look through the first Adjustment Confirmation Aperture to see whether the Touch Lever Scanning Finger can smoothly enter into or come out of Punched Card Holes.

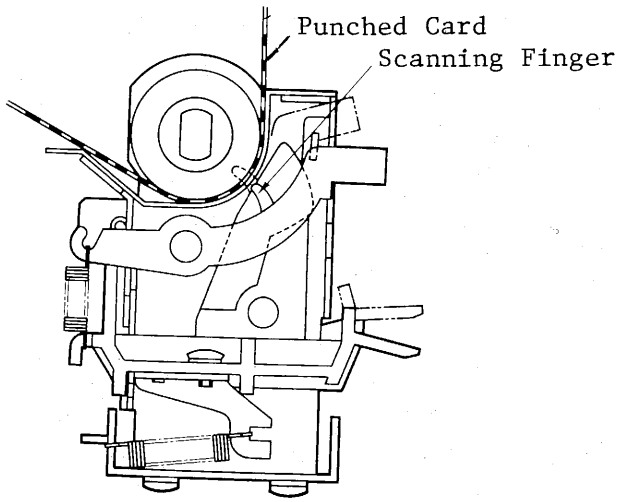


Fig. 74 - 1

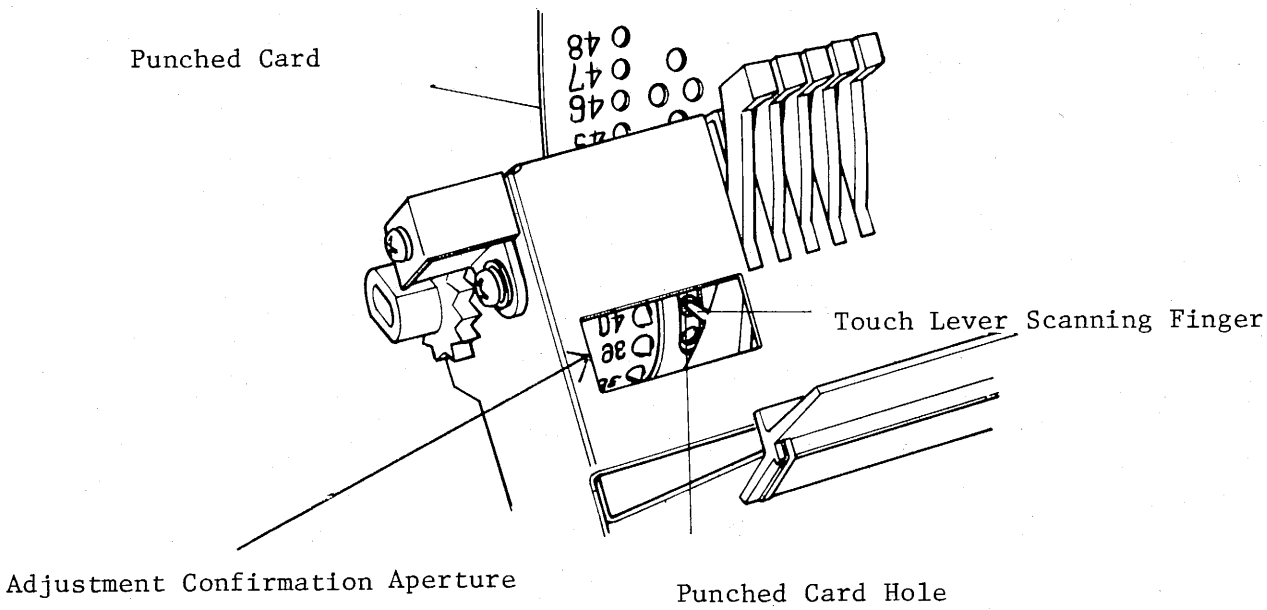


Fig. 74 - 2

(3) When the Touch Lever Scanning Finger is not in the center of a Punched Card Hole, loosen two ⊕ binding head screws on the left side of Pattern Box and adjust Card Drum Shaft Support while rotating it together with Stop Wheel around Pattern Shaft.

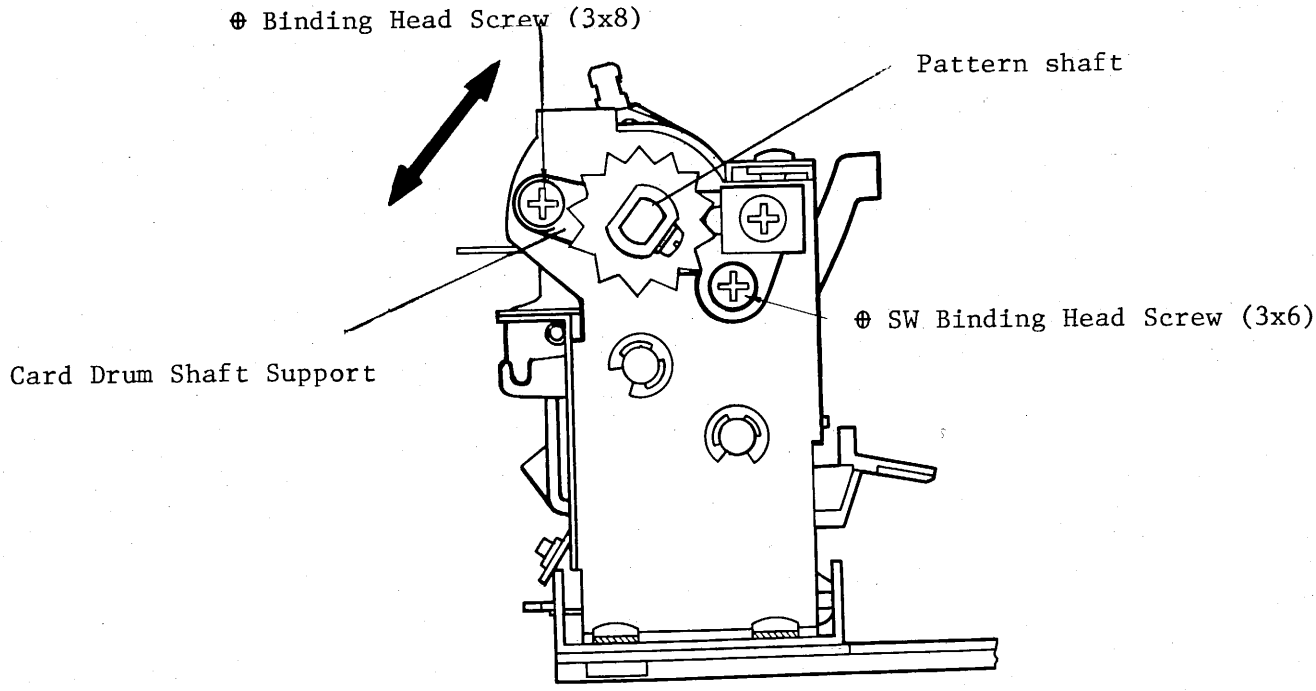


Fig. 75

X-c Adjustment of Feeding Amount of Punched Card

* The feeding amount of Punched Card must be consistent with an interval of Punched Card Holes.

(1) Loosen three ⊕ binding head screws used to fix Stop Lever Holder and Pattern Box together.

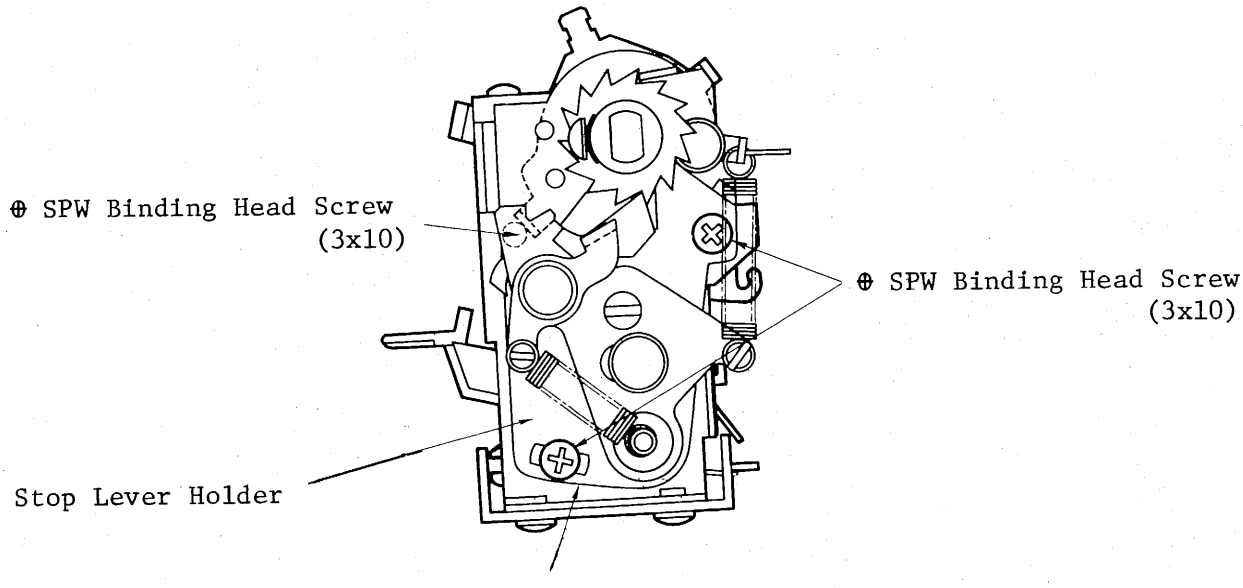


Fig. 76

(2) Moving Stop Lever Holder in the arrow-marked direction, adjust so that the end surface of a ratchet of Ratchet Wheel will get aligned on a straight line with the end plane of Feed Pawl Stopper.

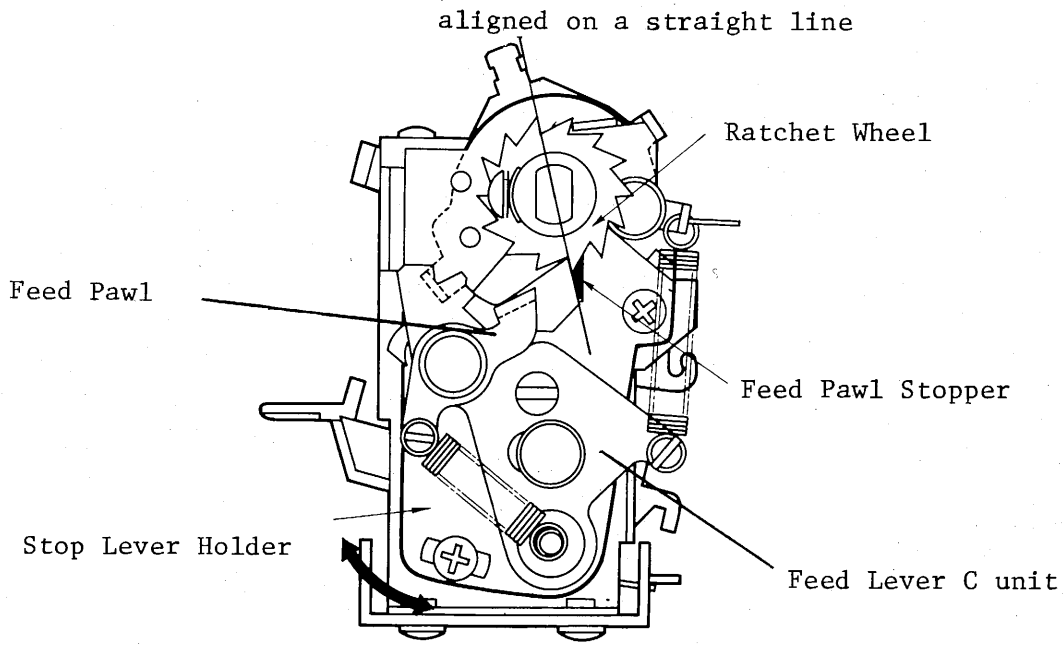
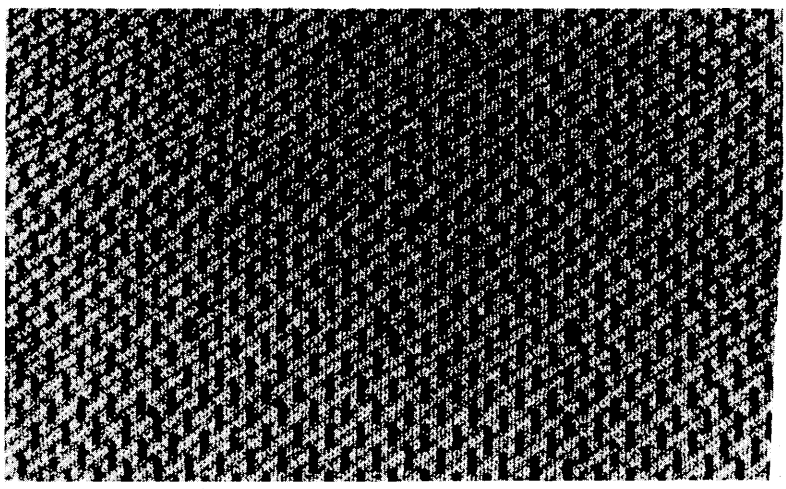


Fig. 77

X-c-1 In case Pattern Box was adjusted imperfectly.

This picture shows the fabric by imperfect adjustment of Pattern Unit.



Picture 5

This kind of fabric is caused by that a ratchet of Ratchet Wheel and Feed Pawl Stopper are not aligned on a straight line.

X-d Remounting Pattern Unit

(1) Set the Stop Lever at the arrow marked direction as shown in Fig. 78

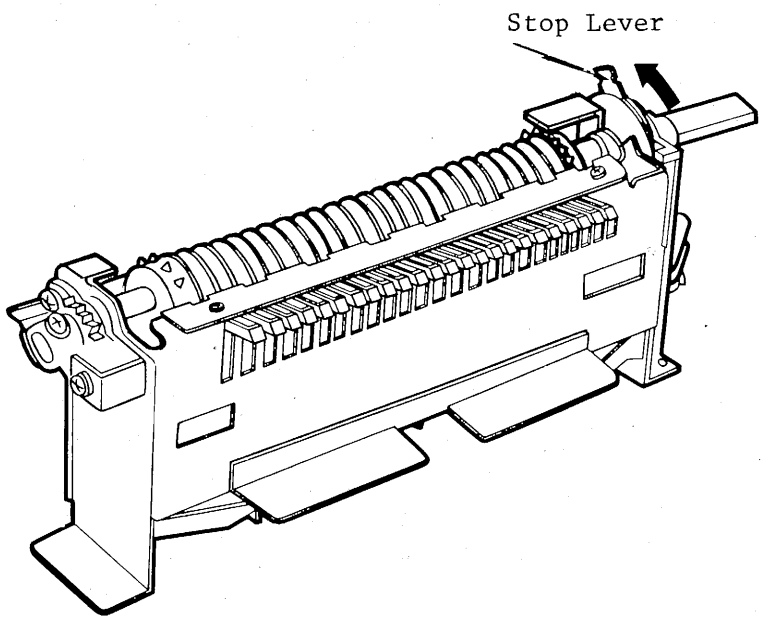


Fig. 78

(2) Hang Under Lever Spring on Under Lever Spring Hanger.

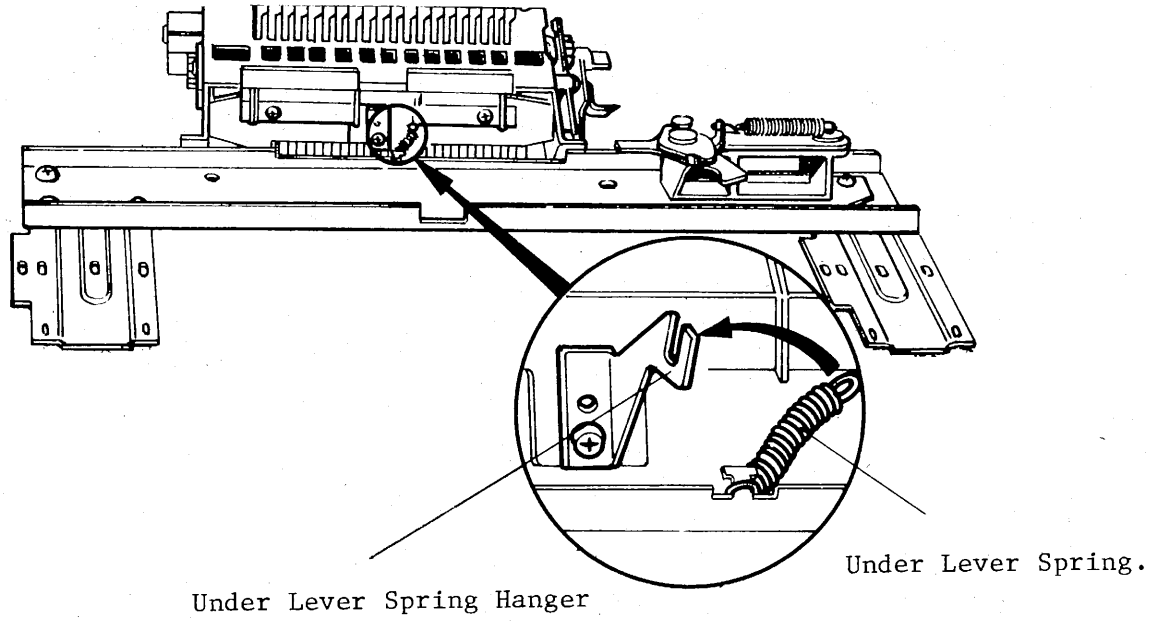


Fig. 79

(3) Aligning the four holes of Pattern Unit with the four holes of Pattern Base, fasten them together with four ⊕ binding head screws (3x6)

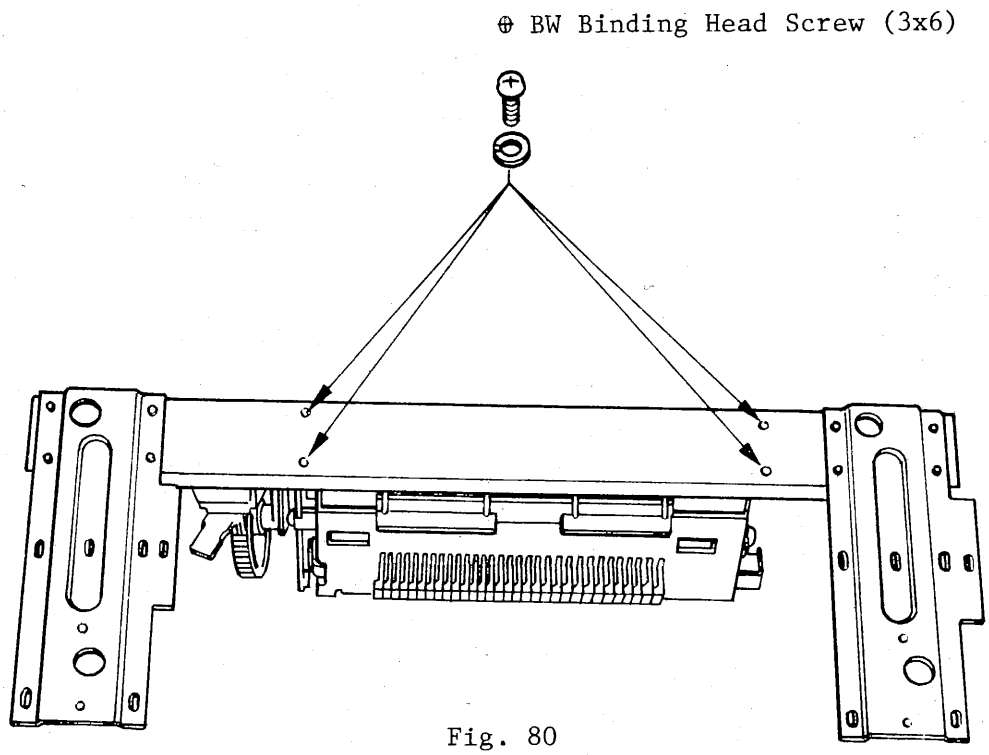


Fig. 80

X-e Adjustment of Feed Lever

* As the tip of Feed Lever B is connected with hole of Feed Lever C which is located on the right side of Pattern Assembly, if the amount of movement of Feed Lever B is changed, the rotating amount of Rachet Wheel gets changed and results the incorrect feeding for Punched Card.

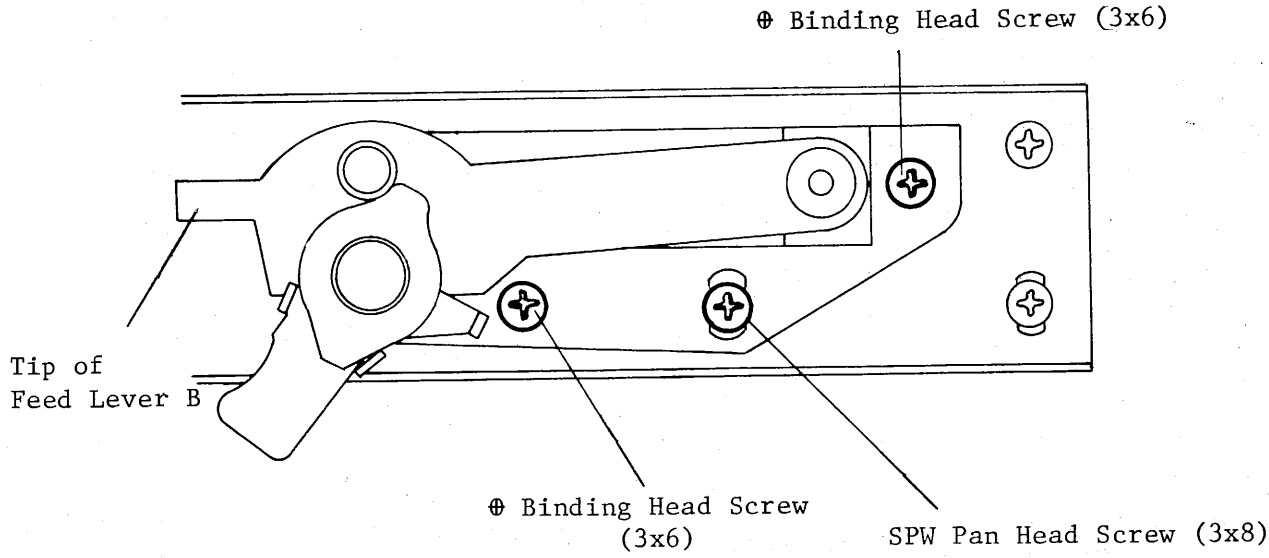


Fig. 81

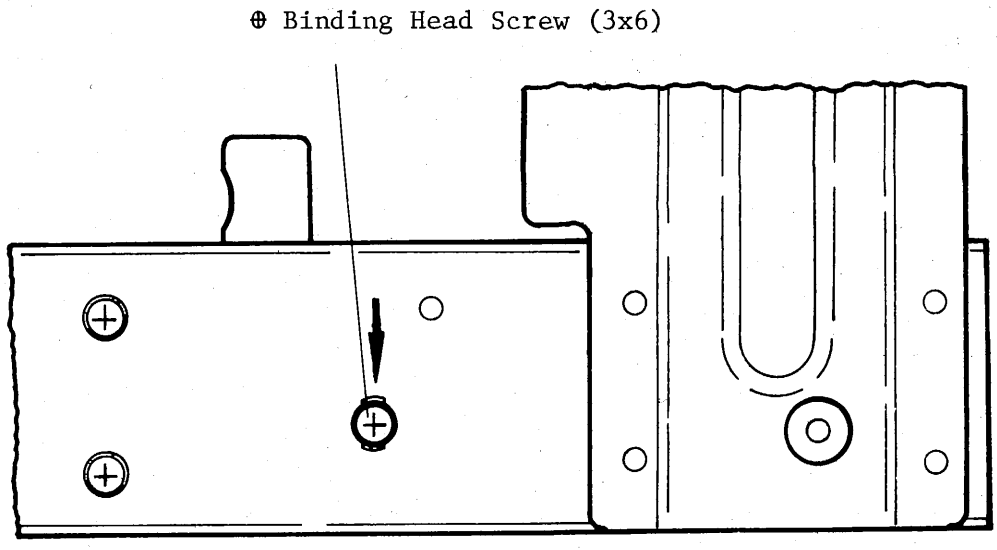


Fig. 82

(2) Setting Stop Lever to (o) mark, press Feed Pawl towards Ratchet Wheel with your left hand.

(3) Keeping Feed Pawl Unit pressed towards Ratchet Wheel, adjust Feed Lever Holder B by moving it back and forth in such a way that Feed Cam will gently touch Feed Collar.

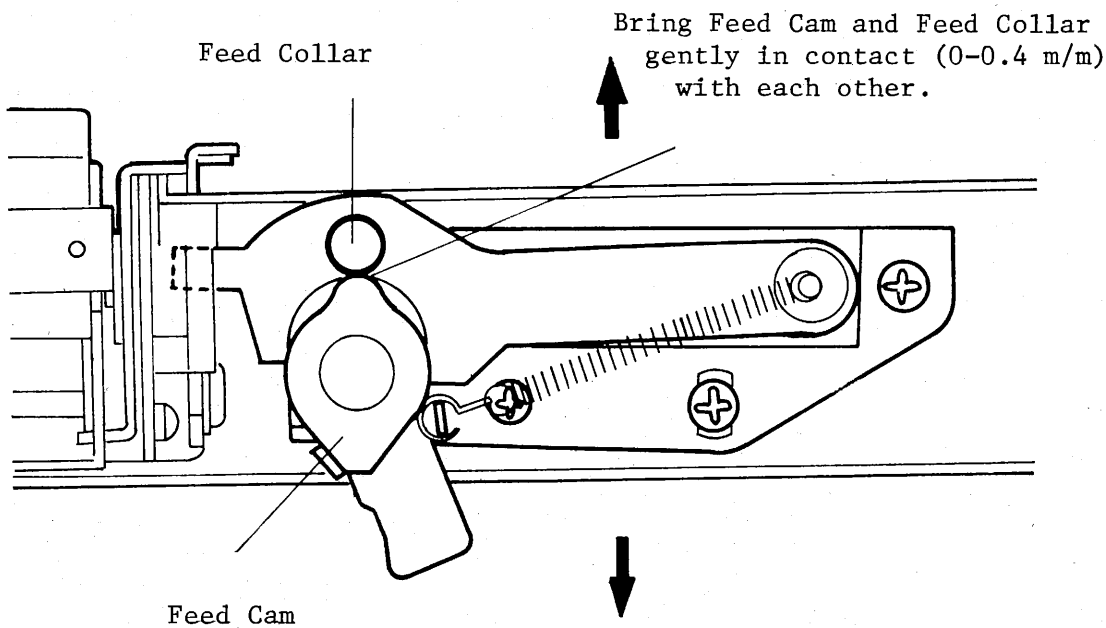
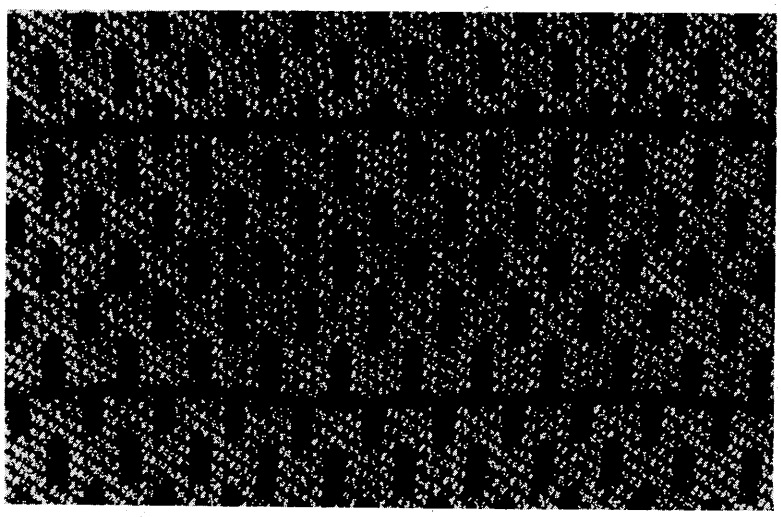


Fig. 83

X-e-1 Imperfect Adjustment of Feed Lever

(A) In case there exists clearance between Feed Cam and Feed Collar.

The horizontal line will appear on the knitted fabric as shown in the picture.



Picture 6

(B) In case the Feed Collar connects with Feed Cam too tight.

Feed Cam can not work correctly.

XI ATTACHING PATTERN ASSEMBLY TO MAIN BODY, AND ADJUSTMENT

XI-a Attaching Pattern Assembly to Main Body.

(1) As shown in Fig. 84, press in Pattern Assembly in the arrow marked direction while aligning Needle Bed Bracer A with the holes of Sinker Plate, and Under Lever with the openings of Needle Bed Rack.

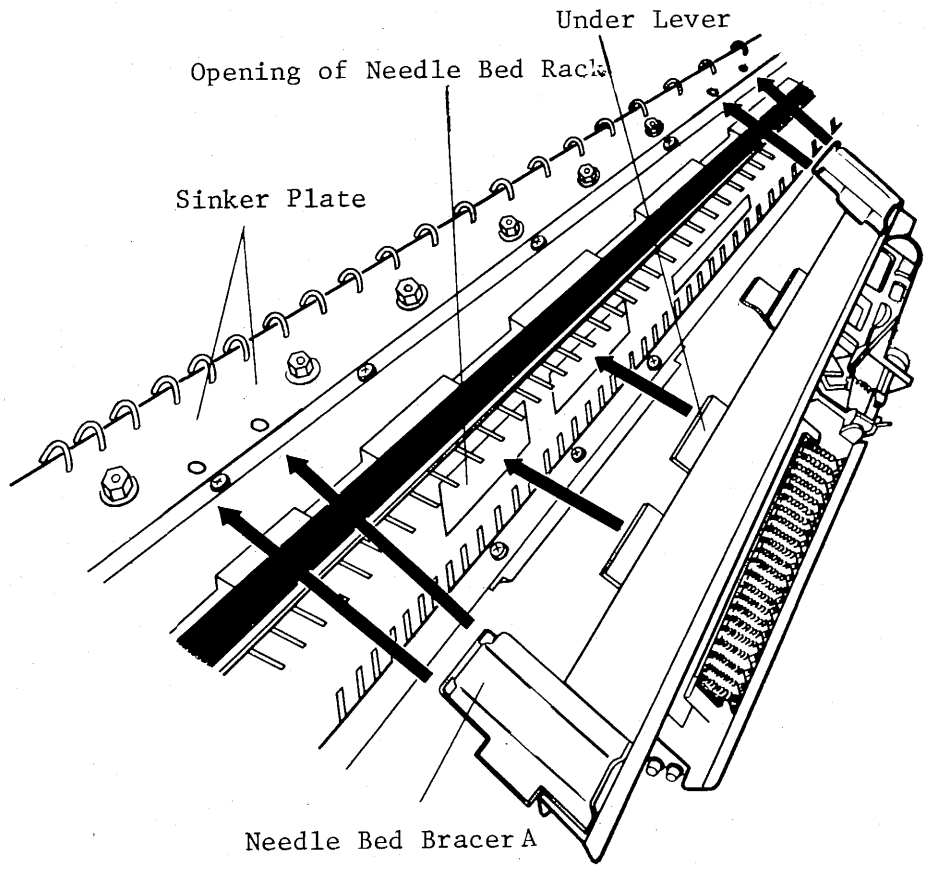


Fig. 84

(2) Secure Needle Bed Bracer A tightly with ten ⊕ binding Head Screws (3x6)

⊕ Binding Tap-Tight Screws (3x6)

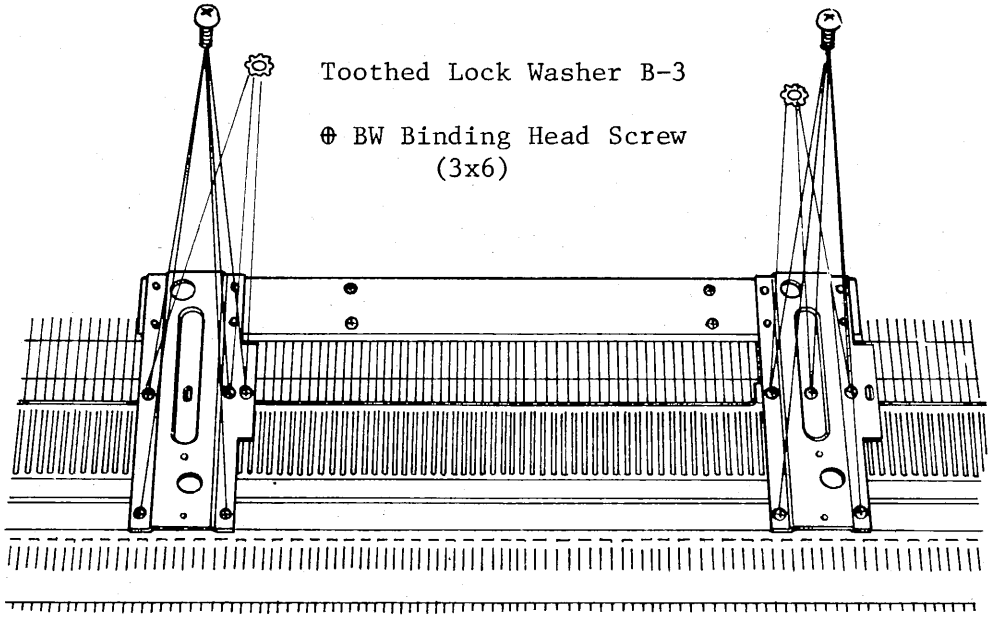


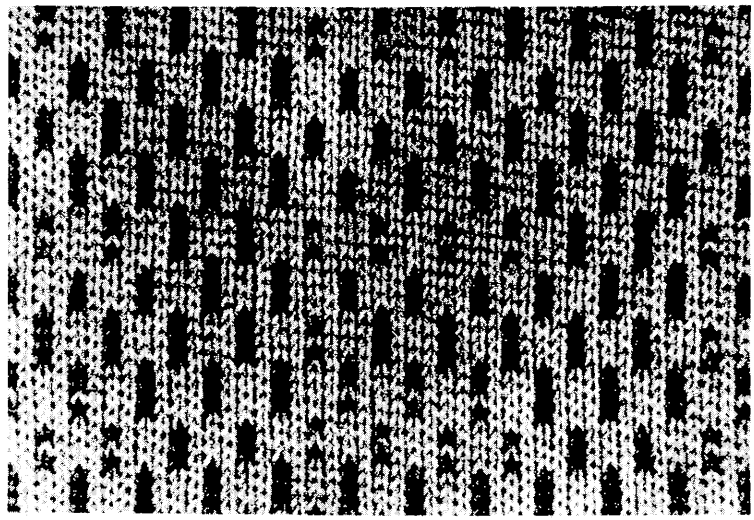
Fig. 85

XI-b Adjusting the clearance between Touch Lever and Main Drum Piece.

XI-b-1 In case of the imperfect adjustment of the clearance.

When Punched Card is inserted in the Slot of Pattern Panel, Touch Lever reads the patterns by pushing their scanning fingers into the Punched Card Holes. The Touch Levers remaining at the lower position push Main Drum Pieces. But in case there is much clearance between Touch Leveres and Main Drum Pieces, Touch Levers can not transmit the pattern to Main Drum.

Picture below shows the fabric with broken patterns caused by incorrect clearance between Touch Levers and Main Drum Pieces.



Picture 7

XI-c Correcting Methods

(1) Insert a non-punched card (or Stockinet Card of Model 313) in Pattern Unit. Loosen five ⊕ BW binding head screws (3x6) and one SPW Pan Head Screw (3x8) used to fix Needle Bed Bracer A and Pattern Base together as shown in Fig. 86

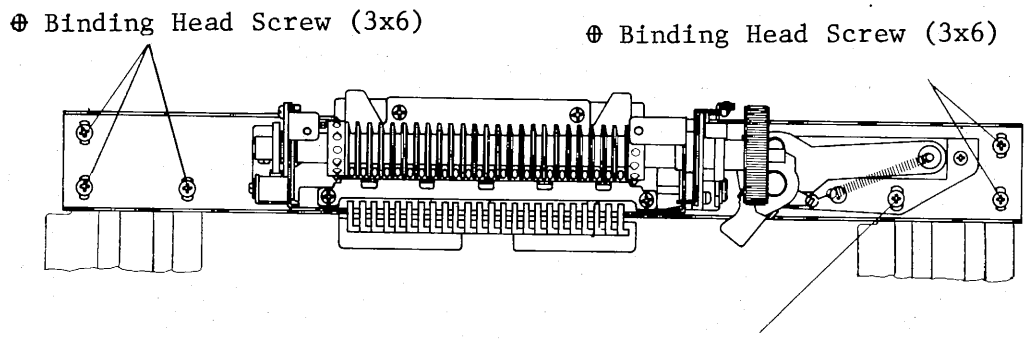


Fig. 86

(2) As shown in Fig. 87 moving Carriage in such a way as Main Drum will align with a Touch Lever, bring Pattern Assembly towards Drum Unit so that the clearance between Main Drum and a Touch Lever will fall within a range of 0 to 0.2 m/m.

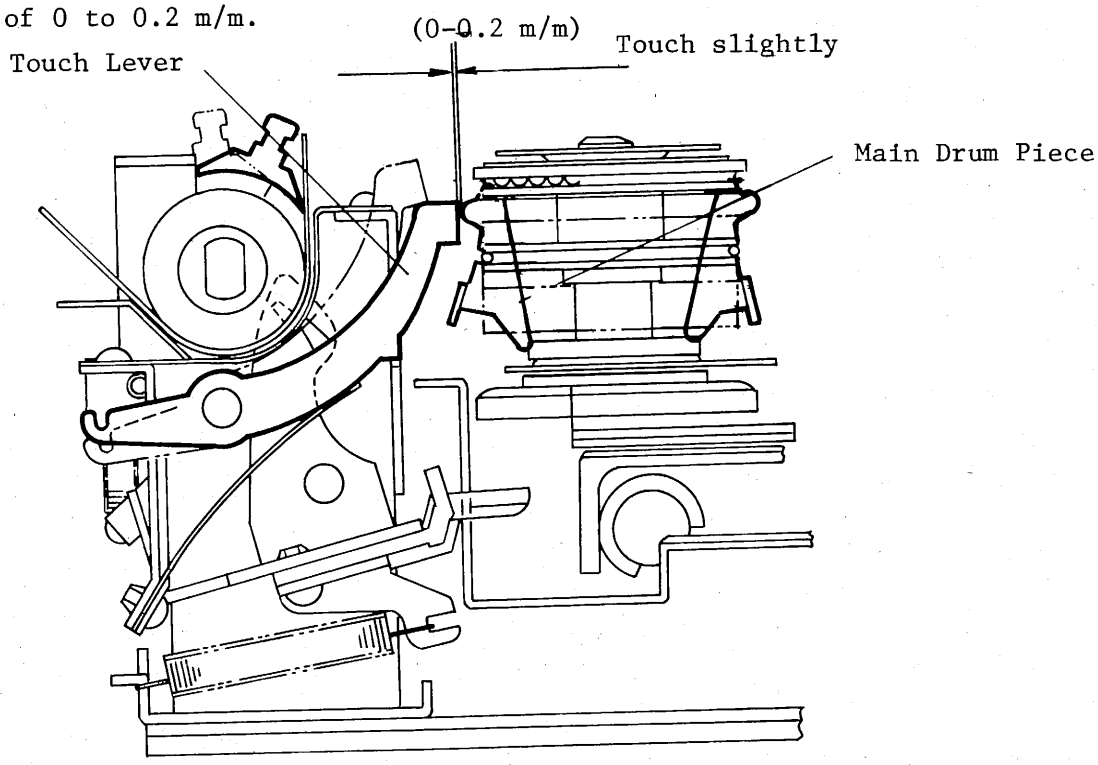


Fig. 87

(3) Fasten those screws after adjustment and examine whether Touch Levers work correctly.

Note: Whenever the Pattern Assembly was once removed from the Main Body, be sure to adjust the clearance from Touch Lever to Main Drum Pieces when remounted.

XII REMOUNTING TO CASEMENT

(1) Place Pattern Panel on Pattern Assembly as illustrated in Fig. 88

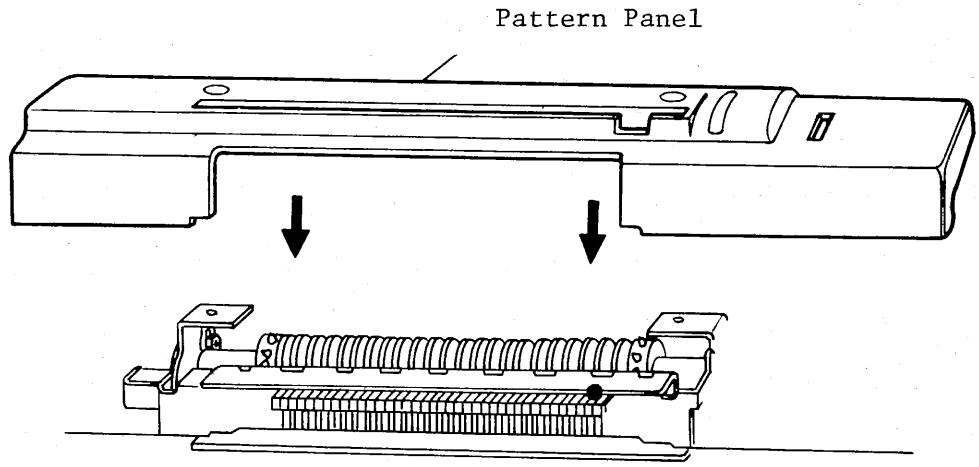


Fig. 88

(2) Secure the Pattern Panel with Pattern Panel Screws and cover Stop Lever with Stop Lever Knob.

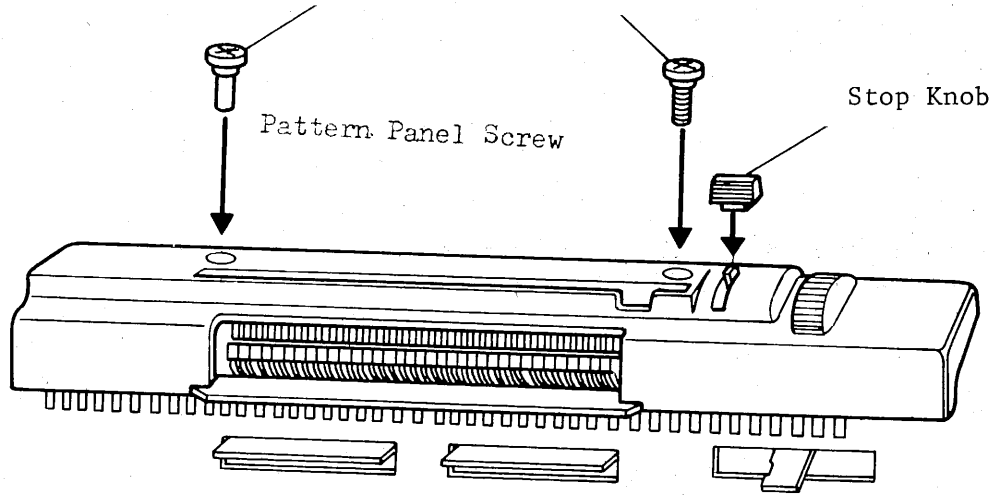


Fig. 89

(3) Fit Needle Bed Body into Casement.

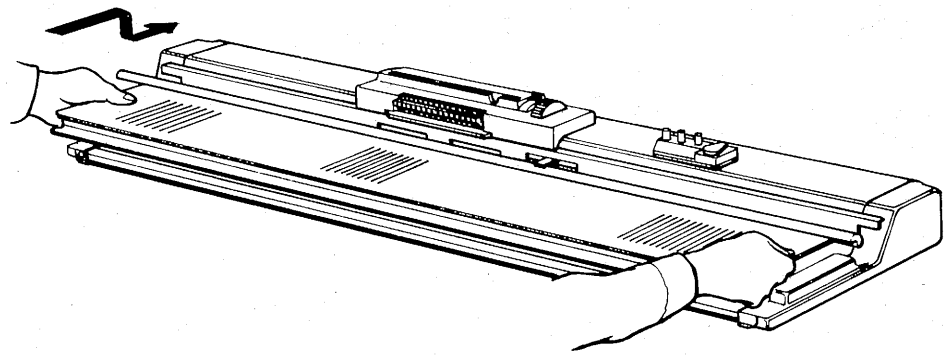


Fig. 90

(4) Secure both ends of Needle Bed with four Counter Sunk Head Tap-Tight Screws and two ⊕ binding head Tap-Tight screws.

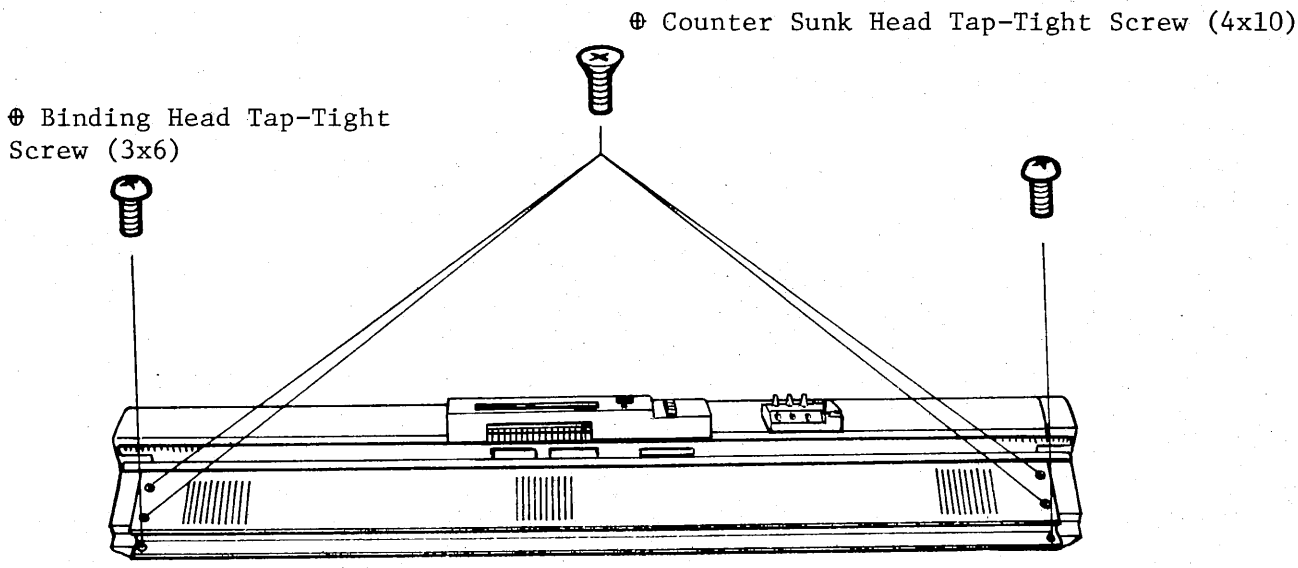


Fig. 91

(5) Turning over Body, secure Needle Bed and Casement together by tightening with two ⊕ binding head screws (3x6)

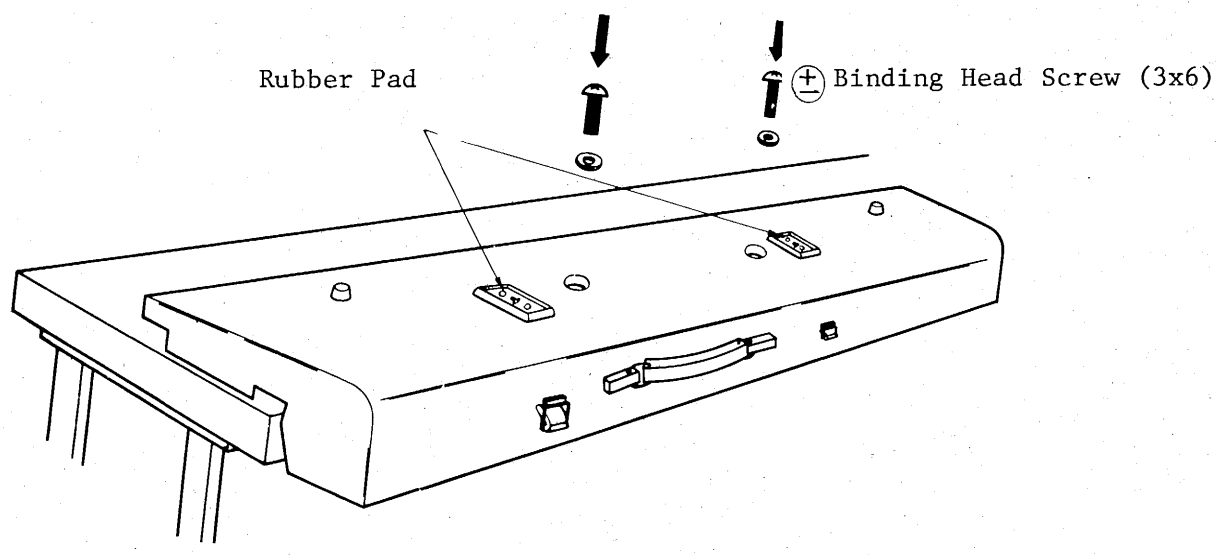


Fig. 92

XIII THE CORRECT POSITION OF ARM FOR NEEDLE BED AND NEEDLE

* P.N. ..... -0.5 - 0 m/m

(Fabric Presser touches the bottom surface of Needle)

* P.S. ..... 1.5 - 2.0 m/m

(Clearance between Sinker and the edge of Fabric Presser)

* Y.S. ..... 0.6 - 1.0 m/m

(Clearance between the rear edge of Yarn Feeder and Sinker)

* W.P. ..... -0.3 - 0 m/m

(Up and down clearance between Weaving Brush and Fabric Presser when Auxiliary Arm is set in a weaving position. See to it that the hair tip of Weaving Brush will fill up the clearance between Sinker and the edge of Fabric Presser)

* W.S. ..... 0 - 0.8 m/m

(The amount that Weaving Brush is engaged with Sinker)

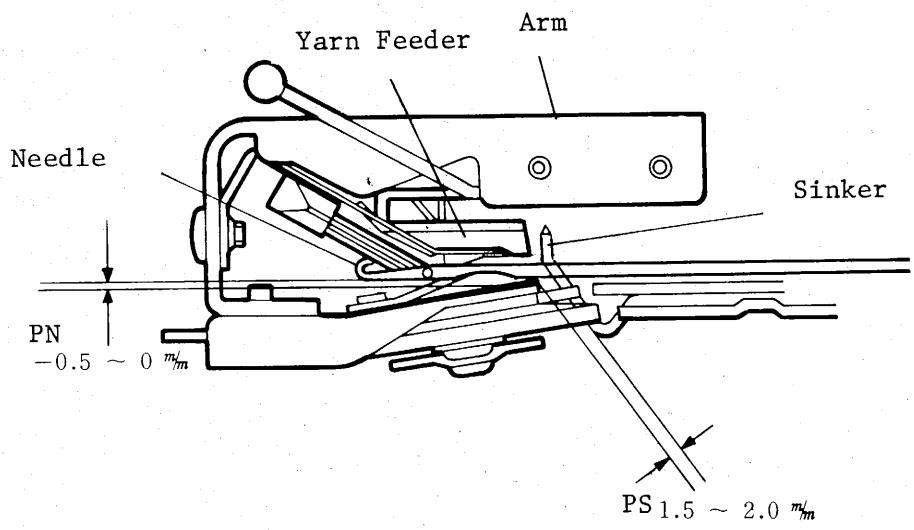


Fig. 93-1

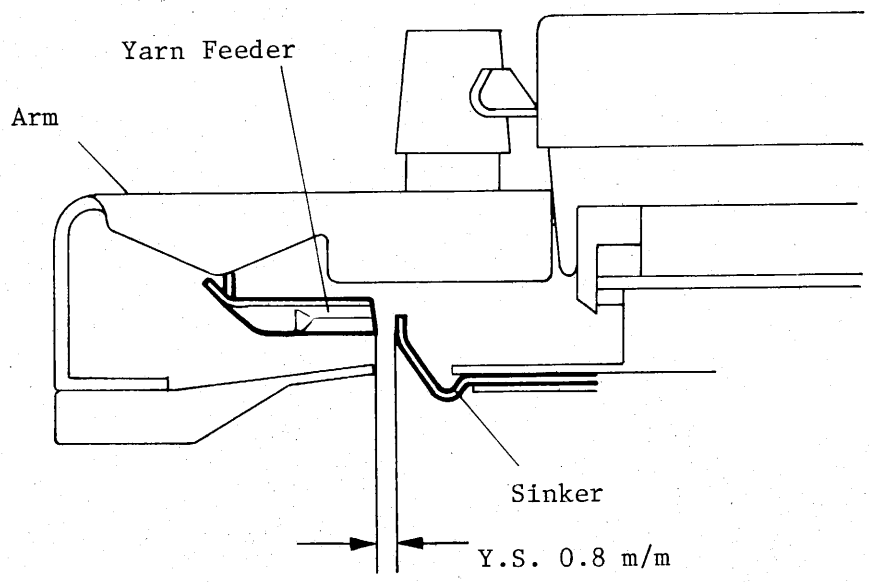


Fig. 93-2

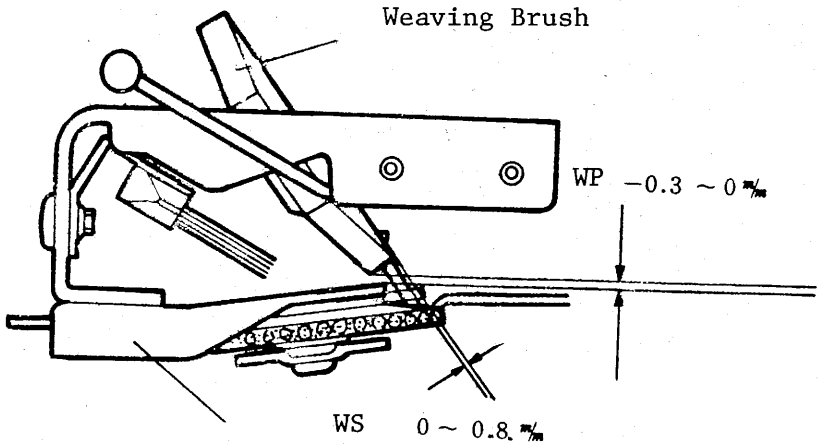


Fig. 93-3

XIII-a P.N. Clearance

(A) In case there exists a clearance between Fabric Presser and Needle, as shown Fig. 94, stitches float, making knitting sometimes impossible.

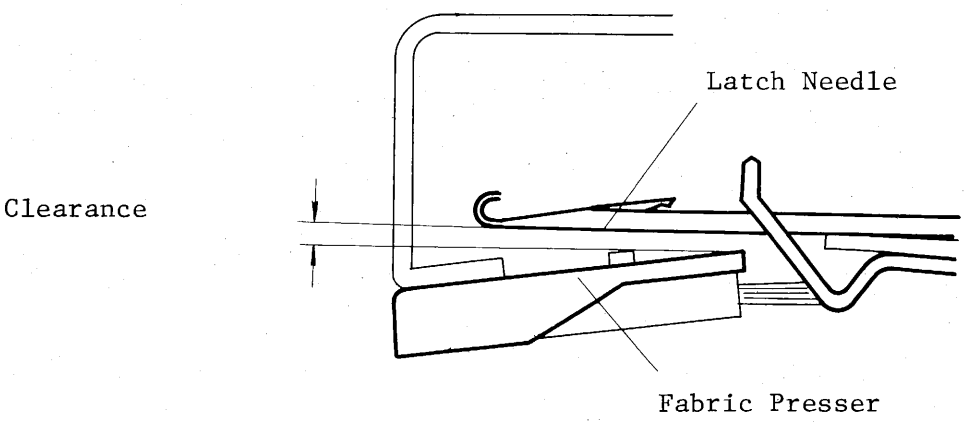
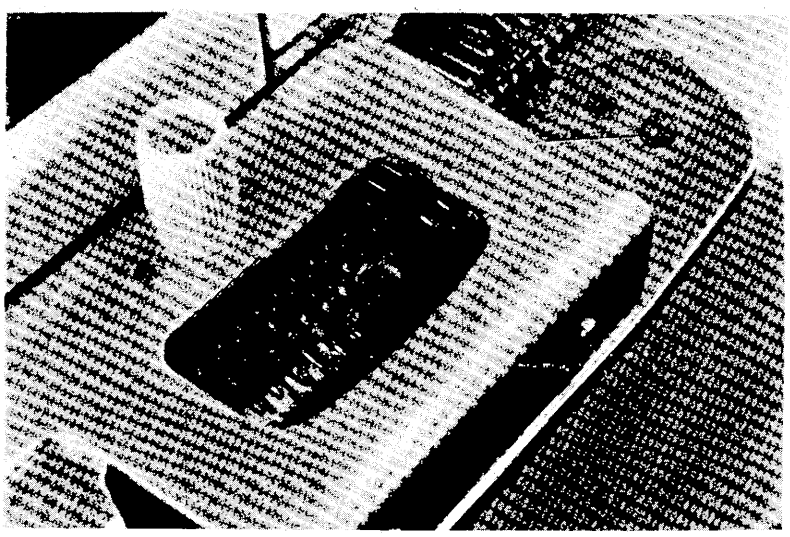


Fig. 94



Picture 8

The process in this case illustrated as follows:

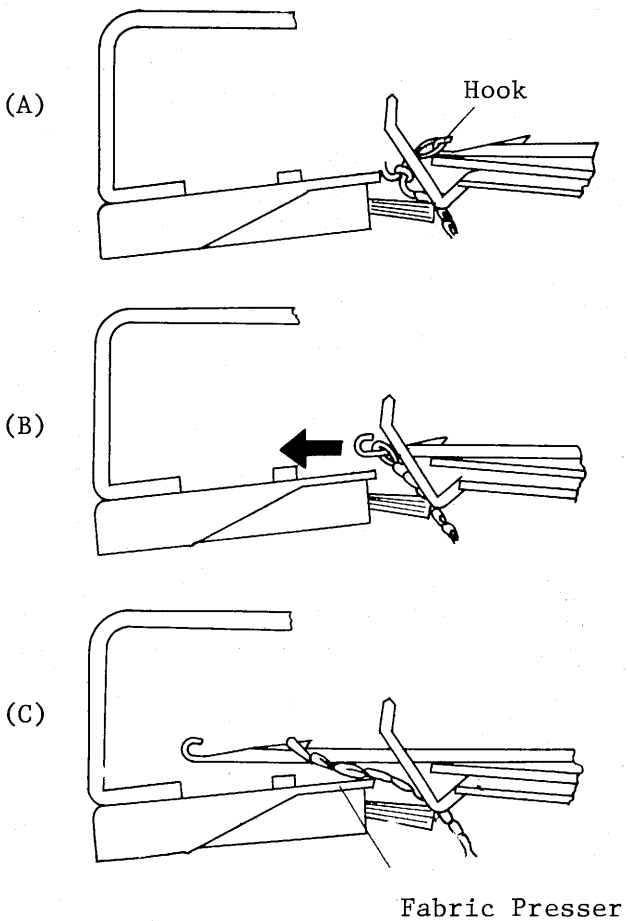


Fig. 95

(A) A Stitch is caught by the hook of a Needle.

(B) The stitch (with knitted fabric) advances along with the Needle as the latter advances in the arrow marked direction.

(C) Fabric Presser (Round Brush and Fabric Gear) serves to stop stitches (knitted fabric) advancing along with Needles and to push the fabric behind the latches of Needles. And yet, if there exists a clearance between the Fabric Presser and Needles (lower surface), the force to hold down the knitted fabric becomes too weak to stop the fabric perfectly, followed by the Needles which move backwards before the stitches have been pushed behind the latches of Needles, making it impossible to effect knitting.

(B) If the Fabric Presser is positioned lower than the standard, it can not press up the needles, so the relative position of needles become lower for Yarn Feeder, and that causes the stitches to drop or fail to knit.

(C) In case the edge of Fabric Presser push up Needles too much.

(1) Carriage becomes heavy in operation.

(2) The hooks and latches of Needles touch Yarn Feeder, and will be bent.

XIII-b P.N. Adjustment

Move Fabric Presser in such a way that its edge will get in touch with Needles and adjust it to push against the Needles to the extent not exceeding 0.5 m/m.

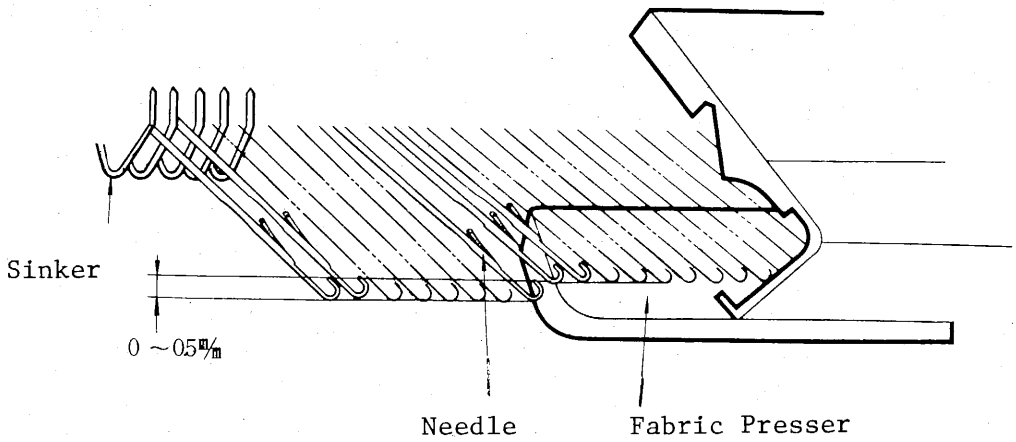


Fig. 96

(1) Push up as many as sixty Needles to D position and set the right and left Russel Lever at I

(2) Check how the edge of Fabric Presser contacts Needles while moving Carriage to right and left.

(3) When the edge of Fabric Presser is not in contact with Needles, remove Arm from Carriage, place the Arm with its face downward as shown in Fig. 97-1 and press downward with your hand.

Note: If unreasonable force is applied, Arm will get bent too much causing Needle to be pushed up to the extent more than necessary.
So, adjustment should be made so that the edge of Fabric Presser will be gently brought in to contact with Needles by degrees.

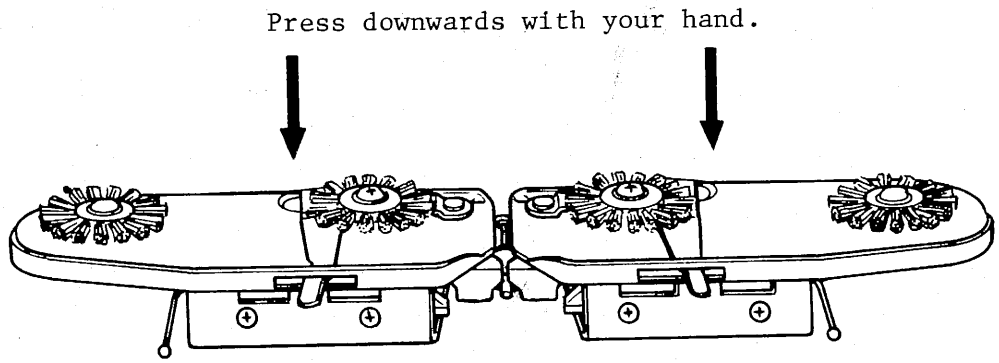


Fig. 97-1

(4) Adjust the P.N. Clearance within -0.5 - 0 m/m (to an extent the edge of Fabric Presser touches lower surface of Needles softly), and the same time, as shown in Fig. 97-2 there must be a clearance between Yarn Feeder and Needles.

Y.N. ..... 0.1 - 0.3 m/m (Clearance between Yarn Feeder and Latch of Needles)

(A) In case there exists a clearance over 0.4 m/m between Yarn Feeder and Needle, the stitches of contrasting yarn drops in Fairisle knitting.

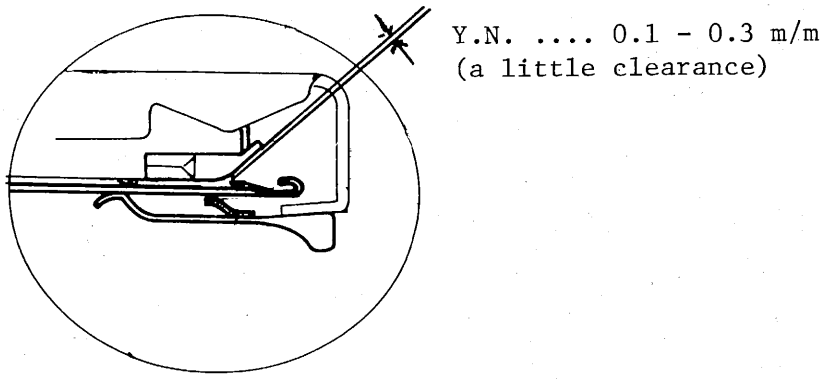


Fig. 97-2

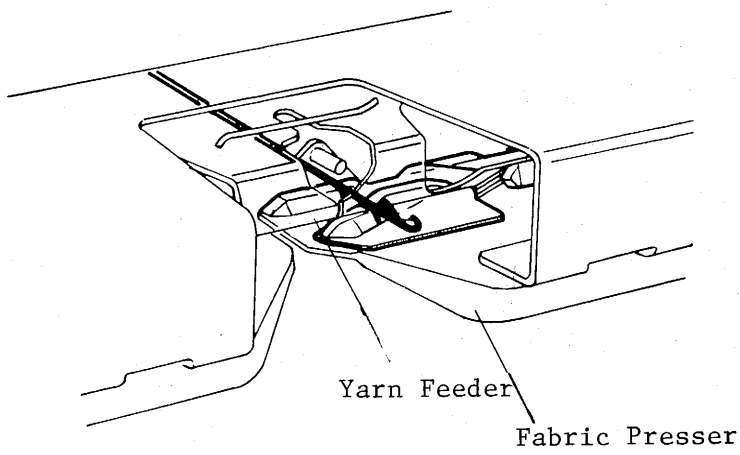


Fig. 97-3

(B) In case Fabric Presser touches Needles very hard (or to the extent more than 0.5 m/m.), move Carriage to the end of Needle Bed in the direction of that part of Fabric Presser (right or left) which requires adjustment, and lower the edge of Fabric Presser by holding Fabric Presser with hand as indicated in Fig. 98

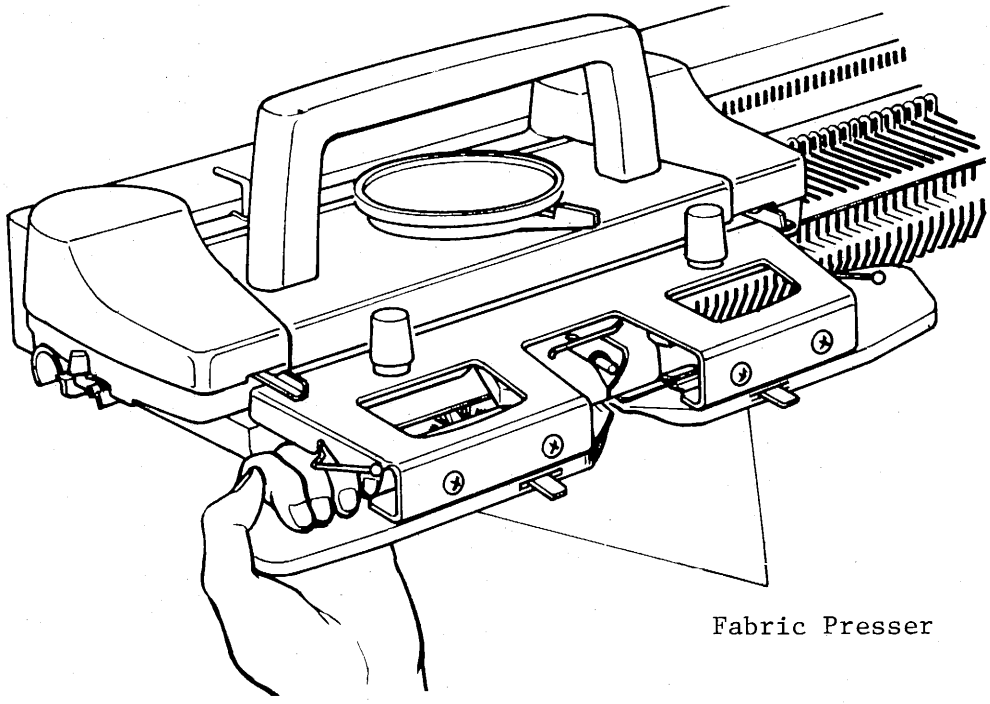


Fig. 98

* Adjust the Fabric Pressers to be horizontal as shown in Fig. 99

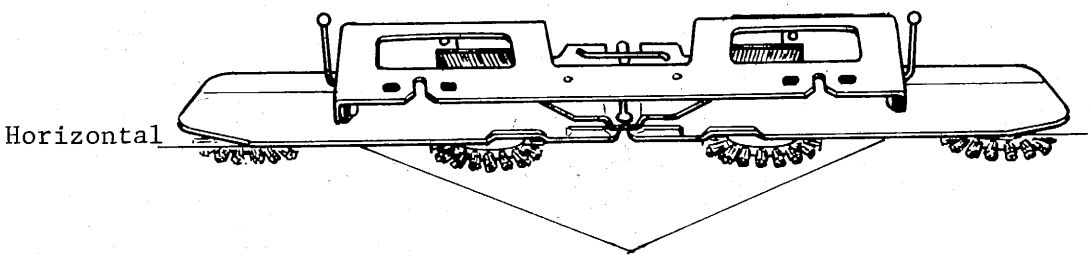


Fig. 99

XIII-c P.S. Adjustment

(1) In case there exists a clearance more than 2.0 m/m between the edge of Fabric Presser and Sinkers, the stitches become easy to float and can not be knitted.

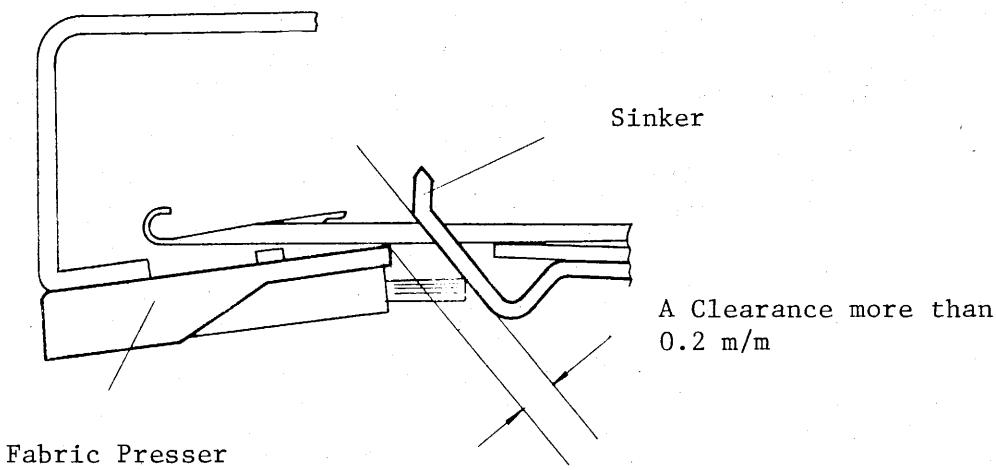


Fig. 100

XIII-c-1 How to adjust P.S. Clearance

* Adjust the clearance between the edge of Fabric Presser and Sinker so that it will fall within a range of 1.5 m/m to 2.0 m/m as shown in Fig. 101

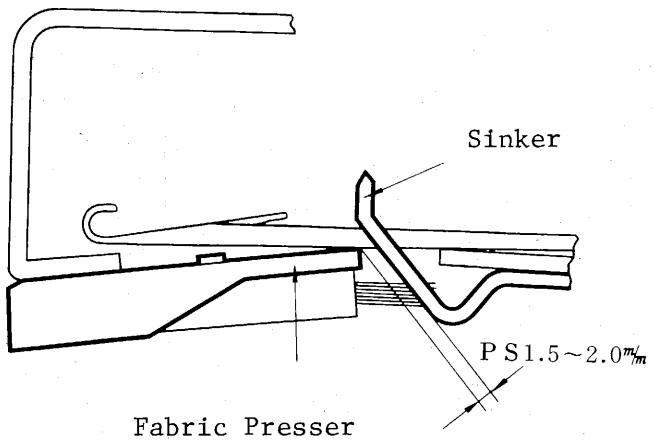
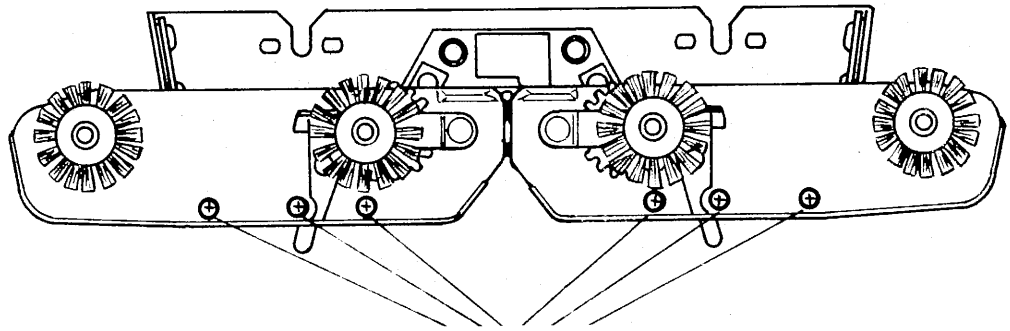


Fig. 101

(1) Loosen six ⊕ binding head screws (3x6) (three screws in case of one side) on the back of Fabric Presser, make the P.S. clearance more than 2.0 m/m and tighten them to an extent that you can adjust by tapping with a screw driver handle or a wooden hammer.



⊕ Binding Head Screw (3x6)

Fig. 102

(2) Adjust the P.S. clearance to be 1.5 m/m to 2.0 m/m while tapping Fabric Presser with a screw driver handle as shown in Fig. 103.
After adjustment is over, fasten those screws for Fabric Presser.

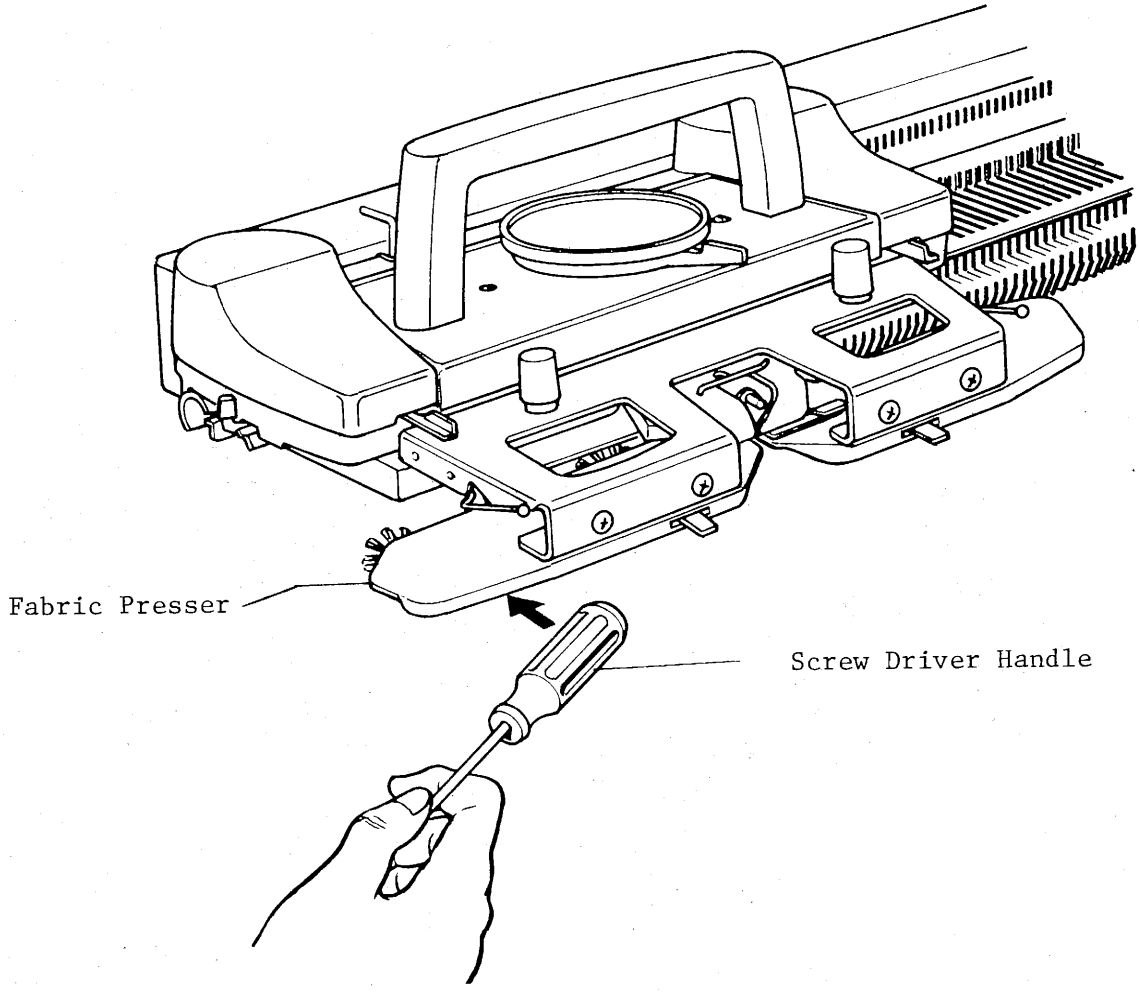


Fig. 103

XIII-d Y.S. Adjustment (the position of Yarn Feeder)

* The clearance between the rear of Yarn Feeder and Sinker is 0.6 - 1.0 m/m.

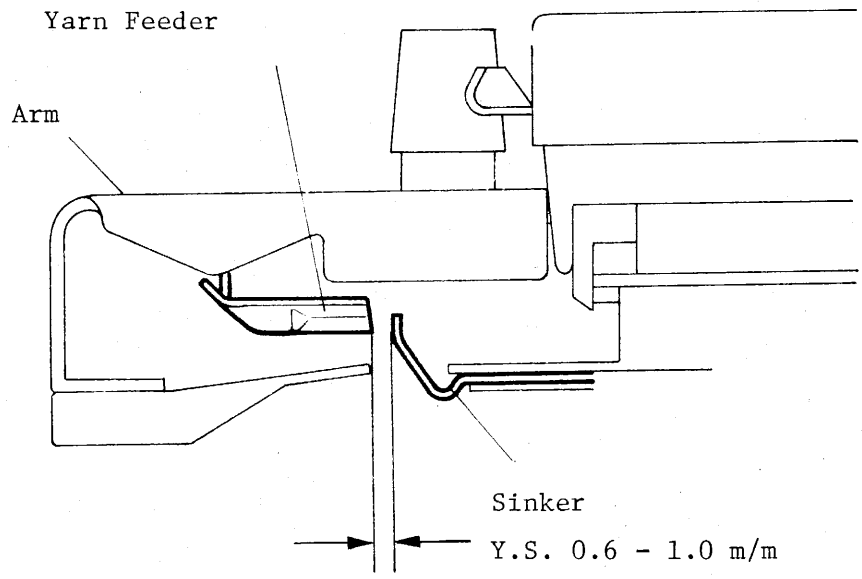


Fig. 104

(A) In case Y.S. clearance is narrower.

Yarn Feeder touches Sinker and it becomes heavy to operate Carriage.

(B) In case Y.S. clearance is more than 1.0 m/m.

(1) In punch lace knitting, Nylon thread can not be caught in the hook of Needles which are to knit main yarn.

(2) In knit-in and punch lace pattern knitting, the needle to knit contrasting yarn touch Yarn Feeder.

XIII-d-1 How to adjust Y.S. clearance

Loosen ⊕ binding head screws (3x4.5) and PW Pan Head screw (3x6) securing Yarn Feeder, and move it forward or backward and check the clearance with Feeler Gauge inserted as in Fig. 105

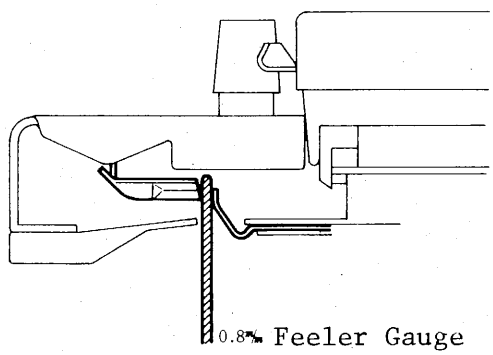


Fig. 105

XIII-d-2 * YARN FEEDER MUST NOT BE BENT up or down in adjusting. Adjust the Y.N. clearance by P.N. adjustment.

When the P.N. clearance is adjusted within the range of standard (-0.5 - 0 m/m), if the clearance between Yarn Feeder and Needle is still wider, adjust it by inserting a thin plate washer between Yarn Feeder and Arm.

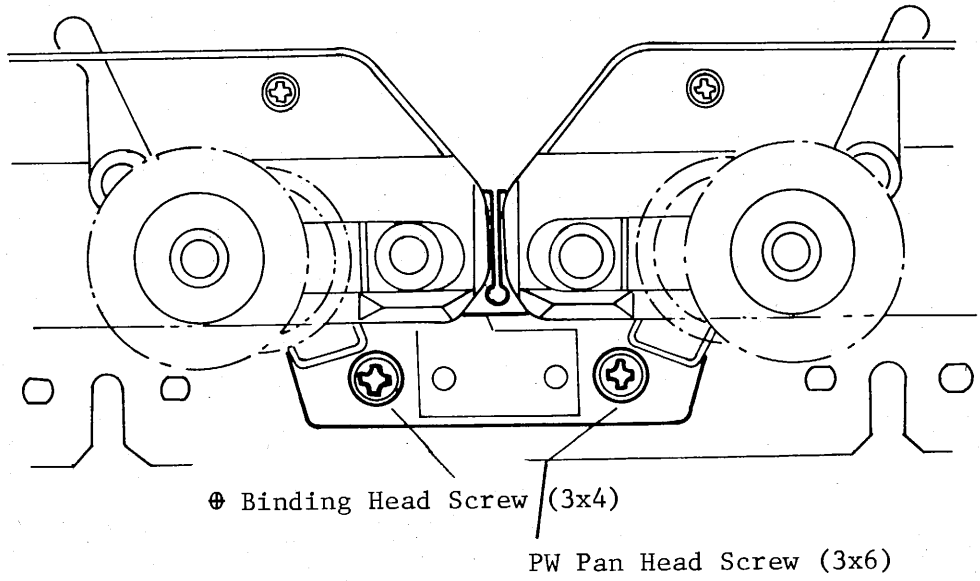


Fig. 106

Magnet:

Magnet C must be fixed with the white surface touching Carriage Plate.

Position Magnets A so that the poles will be reversed from those on corresponding Magnets B.

In case Magnets B and Magnets C are positioned in the manner so that poles N of Magnets B meet poles N of Magnets C, Tuck pattern knitting is apt to become Slip Pattern.

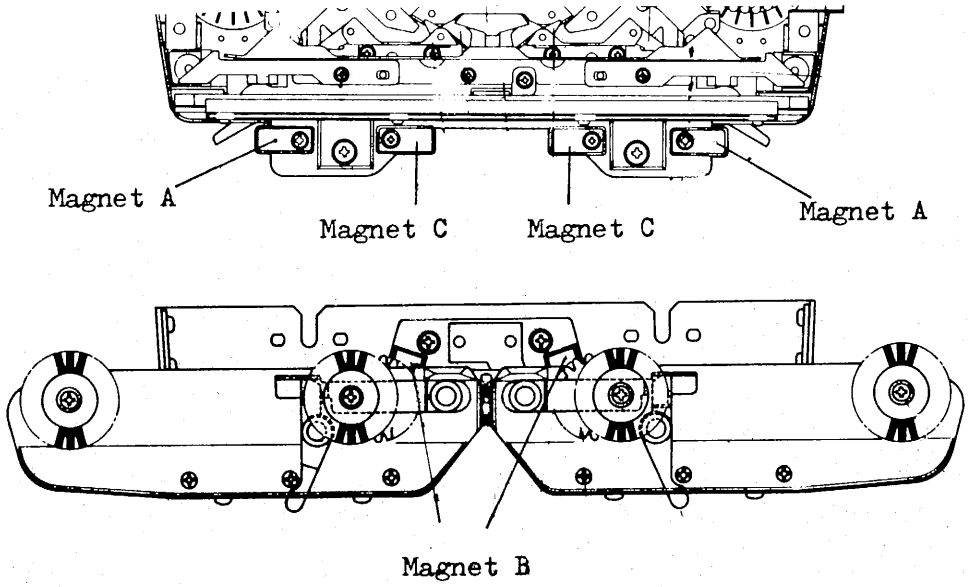


Fig. 107

XIII-e Adjustment of Auxiliary Arm (W.S. and W.P. Adjustment)

* The clearance between Weaving Brush and Fabric Presser should be -0.3 - 0 m/m.

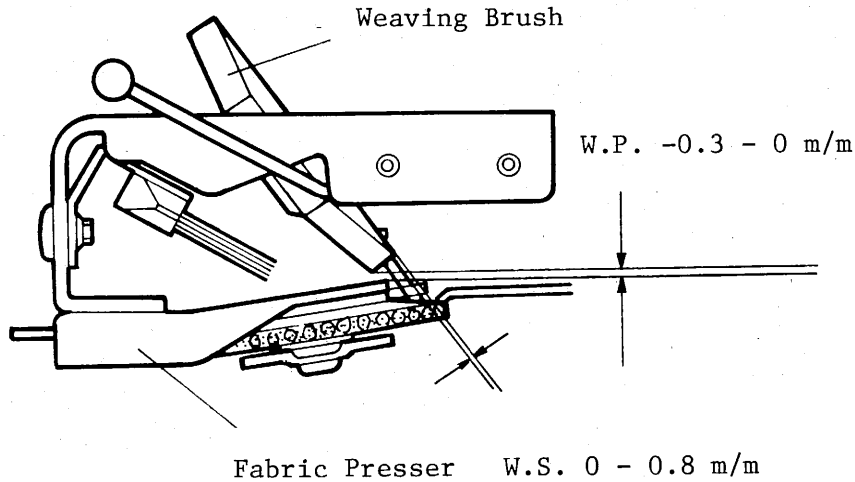
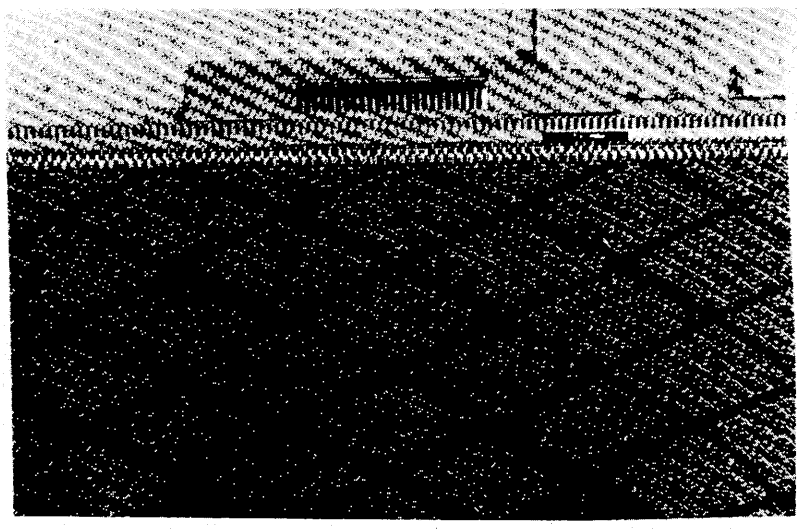


Fig. 108

(1) Picture below shows the fabric when adjustment of Weaving Brush is imperfect.



Picture 9

XIII-e-1 The principle of weaving.

As shown in Fig. 109 a weaving yarn is threaded by Weaving Brush through the underneath of the Needles which do not come out forward by a needle selecting operation (they do come out a little later).

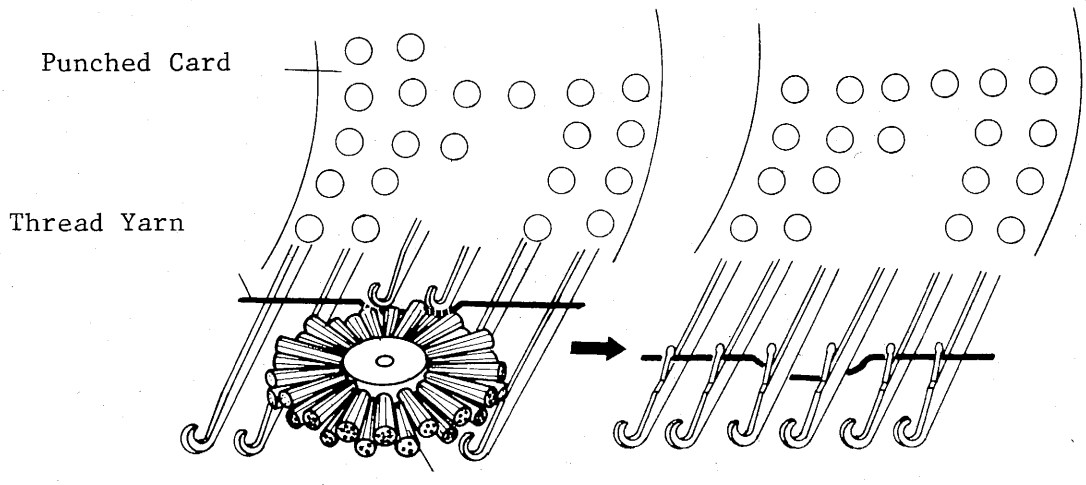


Fig. 109

XIII-e-2 Causes of Failure

Imperfect adjustment of Weaving Brush.

In case Weaving Brush is inadequately adjusted as shown in Fig. 110-1, it can not push a weaving yarn under the needles. So in this case, the knitted fabric looks like a stockinet knitting or an added yarn knitting.

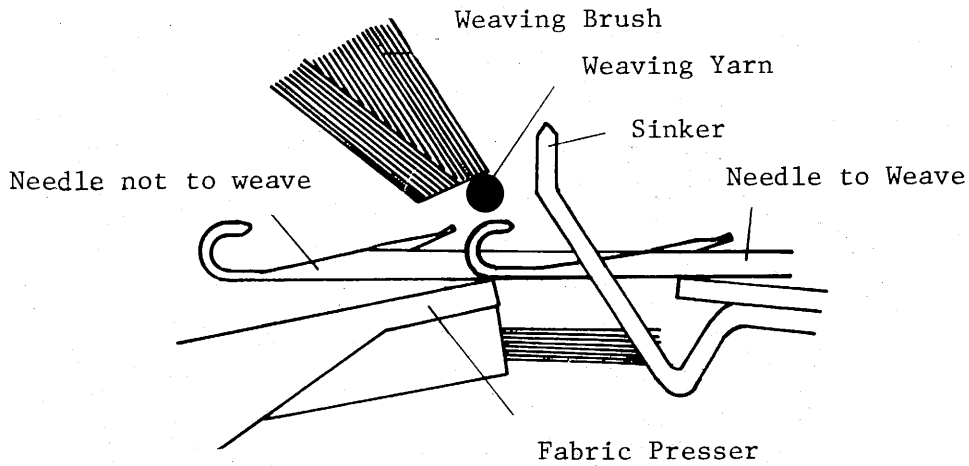


Fig. 110-1

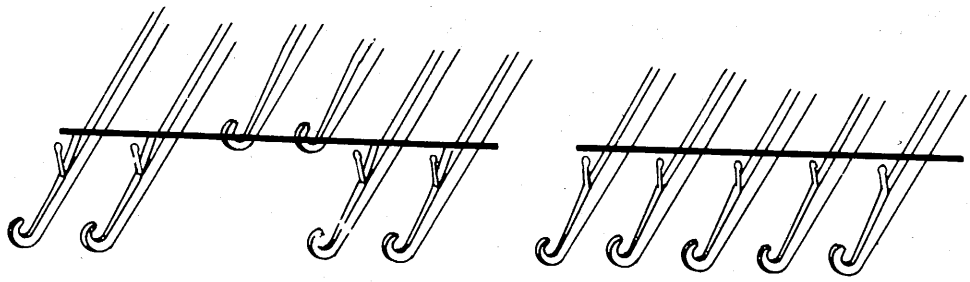


Fig. 110-2

XIII-e-3 Correcting Methods

Loosen a ⊕ binding head screw (3x8) securing Weaving Brush, and adjust the clearance between Fabric Presser and Weaving Brush to become -0.3 - 0 m/m while moving Weaving Brush up and down.

⊕ Binding Head Screw (3x8)

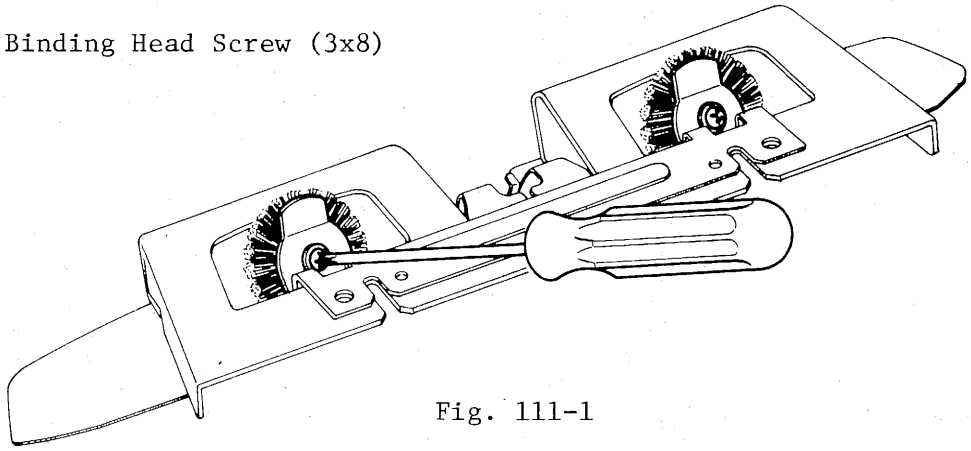


Fig. 111-1

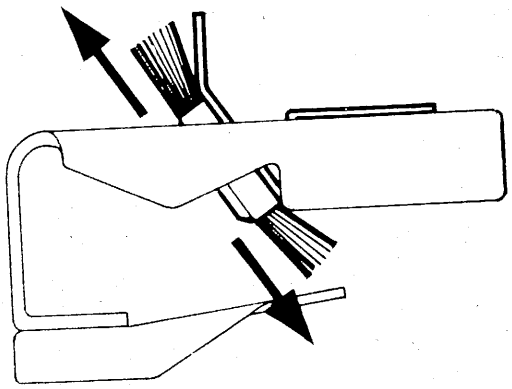


Fig. 111-2

XIV How to adjust when stitches come off hooks or drop.

Causes:

1. Insufficient Yarn Tension
2. The latches of needles do not open smoothly.
3. Speed of knitting
4. No using of accessory weights
5. P.N. and P.S. Adjustment
6. Flash on the cutting edge of Fabric Presser

Correcting Methods:

For cause 1.

(a) If the tension effected onto a yarn used is too weak, stitches come off hooks when Carriage returns owing to an imperfect take up of slack yarn. Accordingly, adjust Tension Spring with Auto-tension Dial so that it will stop within a range illustrated in Fig. 112 dependent upon the thickness of a yarn used.

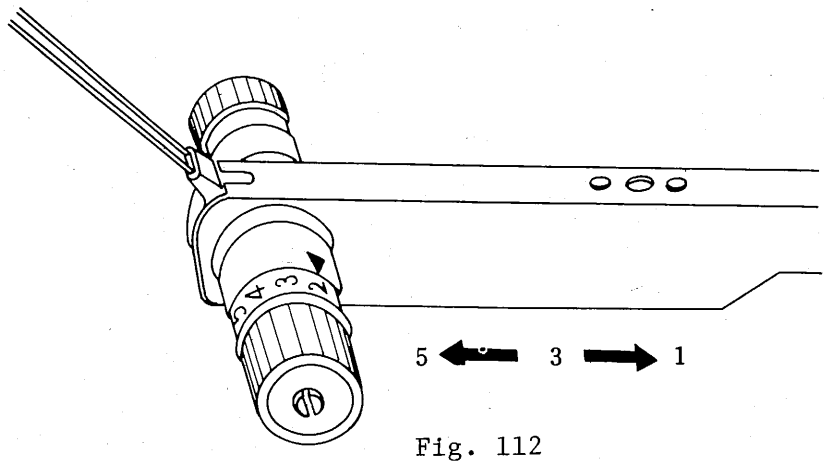


Fig. 112

(b) If a yarn is wrongly threaded through Tension, the yarn gets sagged and stitches come off hooks due to insufficient tension. In this connection, thread a yarn through Tension Spring correctly.

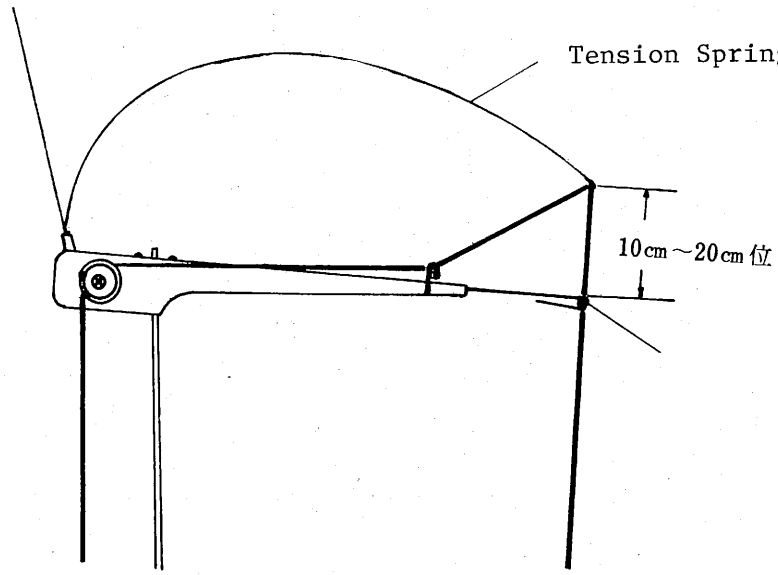


Fig. 113

For cause 2.

If the latch of needle is bent, it can not open or close and that causes the stitches to drop. Straighten the latch with plier or if irreparable, replace with new one. (See Instruction Book Page 78)

For cause 3.

If you move the Carriage extremely fast, the stitches become tight, and the stitches at both ends are apt to drop when you return the Carriage. Please move the Carriage in a reasonable speed evenly.

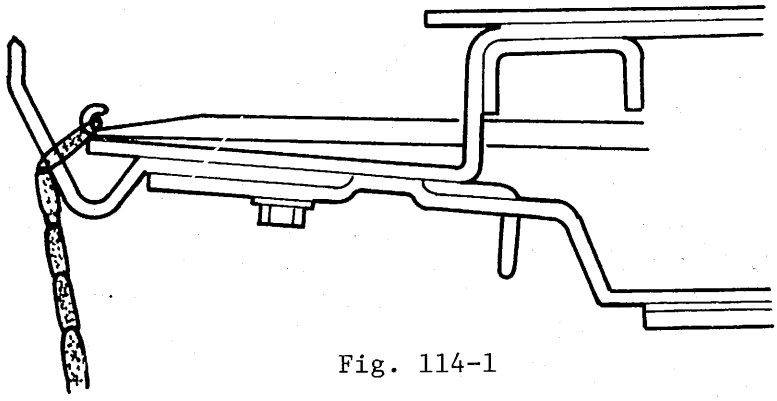


Fig. 114-1

A stitch by normal speed.

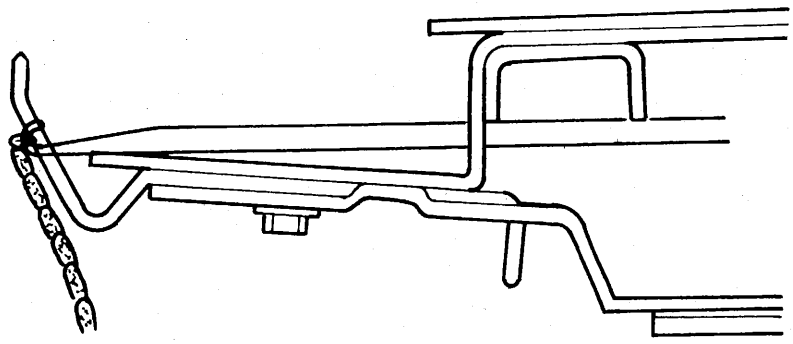


Fig. 114-2

A stitch by extremely fast speed.

For cause 4.

If the stitches at the both ends of garment are loose or easy to drop, hang the accessory weights on the garment at the both ends as in Fig. 115.

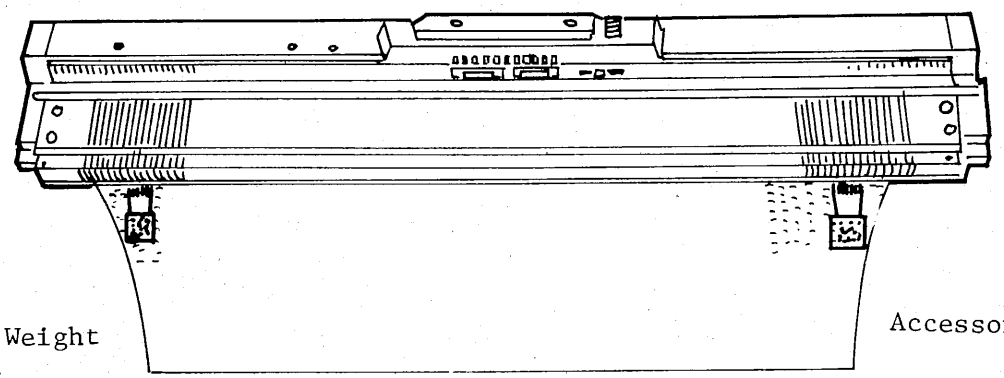


Fig. 115

For cause 5.

Please see page 68 & 71

For cause 6.

If there is a flash on the cutting edge of Fabric Presser, the yarn may be caught on the flash, and consequently the stitches may drop. Please grind it with oil stone or paper file.

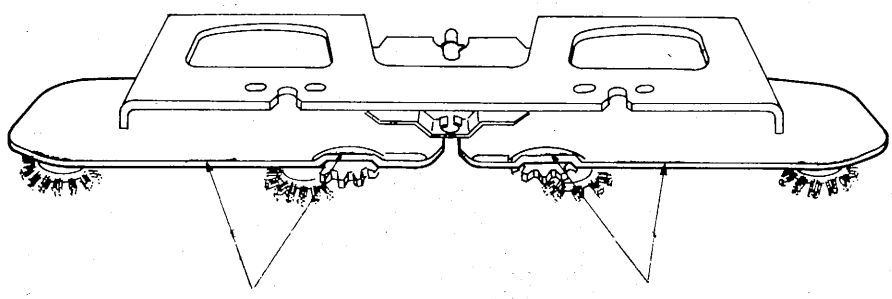


Fig. 116

XV HOW TO REMEDY WHEN CARRIAGE IS HEAVY TO OPERATE

* Causes

(1) Too much dust on the sliding surfaces, such as Carriage Pipe, Slider, Cams, etc.

(2) Lack of lubricant on sliding surfaces.

* Remedy

For the cause (1)

Wipe clean the sliding surfaces with oil damped cloth to apply oil on them.

For the cause (2).

Apply oil on Needle Butts and move the Carriage back and forth a few times.

Apply a few drops of oil on Rail and move Carriage back and forth a few times.

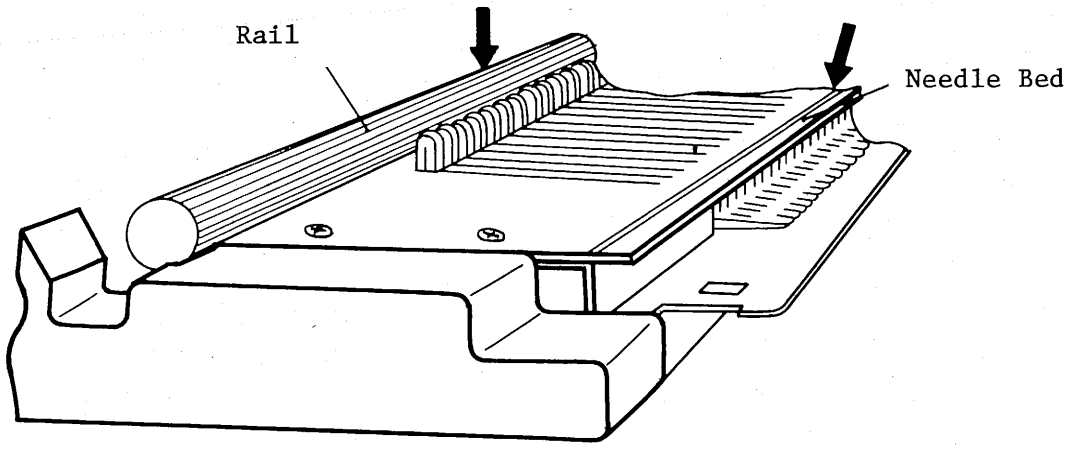


Fig. 117-1

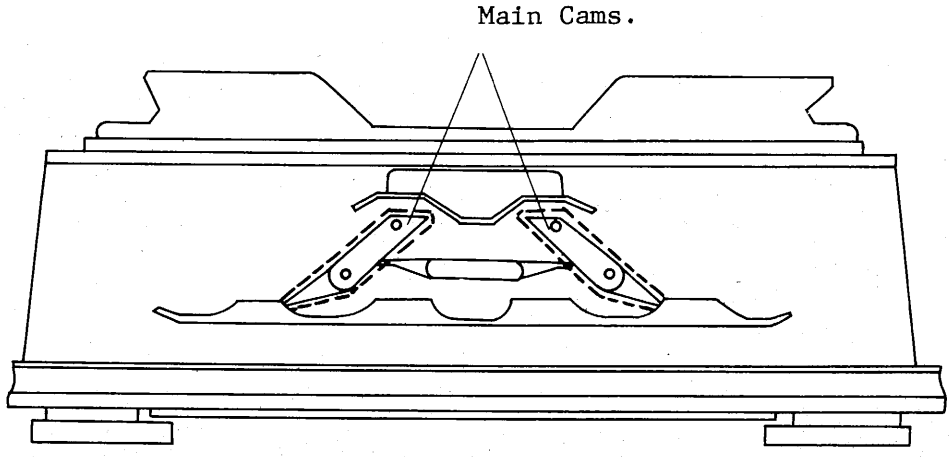


Fig. 117-2

XVI DIRECTIONS FOR SPECIAL TOOL KITS FOR SK-321

(A) RACK STANDARD GAUGE

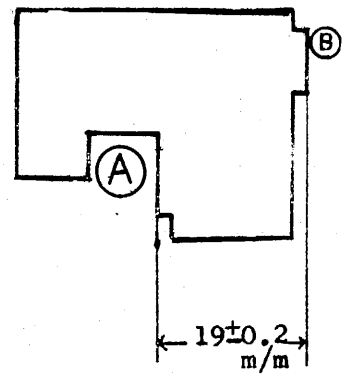


Fig. 118

Set Part A of the gauge on the Needle Bed Rail as Part B touches the Needle Bed Rack so as to check the distance between the Rack and the Rail. (See page 44)

(B) RACK ADJUSTING TOOL

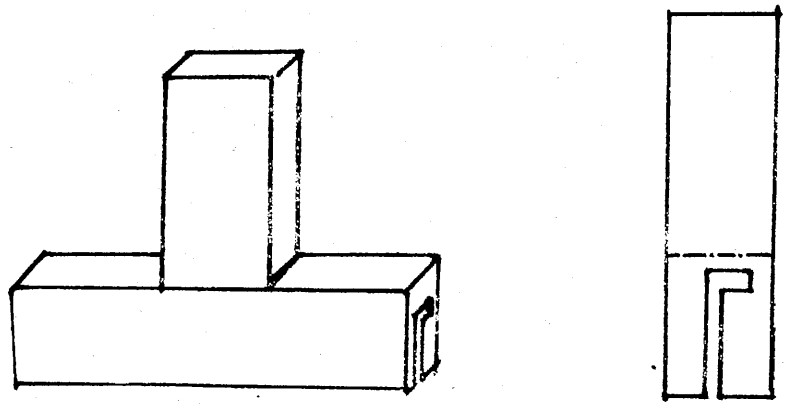


Fig. 119

This tool is used to correct the distance from Needle Bed Rack to Needle Bed Rail.

Fit this into Needle Bed Rack and push the handle forward or backward to correct the distance to the measurement (19±0.2m/m) of Rack Standard Gauge. (See page 45)

(C) COURSE STANDARD GAUGE

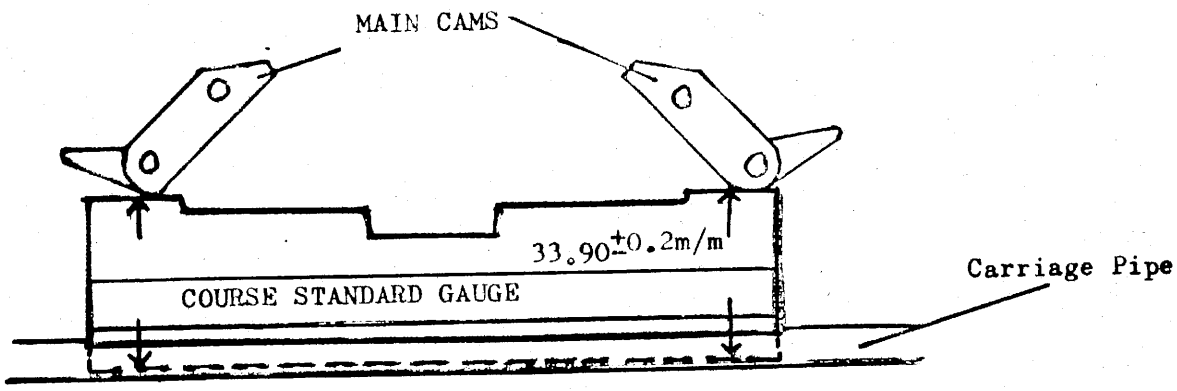


Fig. 120

This gauge is used to adjust the clearance between the inner surface of Carriage Pipe and the both Main Cams.

1) Turn Tension Dial (Stitch Dial) to 1, and set Cam Lever at Tuck.
2) Insert this gauge into Carriage Pipe.
3) Turn Tension Dial toward 5..
4) When Stitch Dial reads 5, no clearance should exists between the Main Cams and Course Standard Gauge

(See page 31)

(D) SUB DRUM GEAR

This gear is used to adjust the position of Drum Unit.

(See page 25)

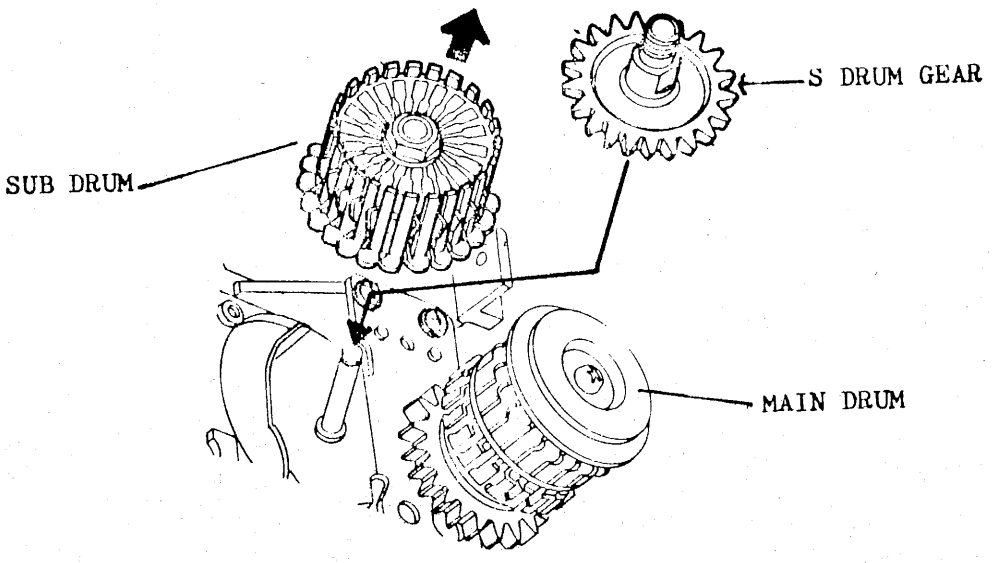


Fig. 121

XVII Failures and Diagnoses

Nature of Trouble	Place to be Inspected	Causes	Remedy
The left and right lengths of a knitted fabric are not equal	Check the dimension between Rail and Sinkers (Dimension L)	Dimensional difference at some points between Rail and Sinkers causes a knitted fabric to have different stitches, resulting in difference of the left length, from the right length, of the fabric.	Adjust the dimension between Rail and Sinker to be precisely equall at all points See page 46
	Check the speed at which you start and finish a stroke of Carriage	Difference in speed between when you start and when you finish your stroke causes a knitted fabric to have different stitches due to the difference in the tension of the yarn resulting in difference of the left length, from the right length, of the fabric.	Instruct an operator to operate the machine at as even a speed as possible both at the start and end of a stroke. See Instruction Manual page 14

Nature of Trouble	Places to be Inspected	Causes	Remedy
Stitches float	Check how arm is attached to Carriage	The position of Fabric pressers against Needle Bed gets out of order unless Arm is properly attached to Carriage, resulting in floatation of stitches and making knitting impossible.	Attach Arm properly to Carriage. See Instruction Manual page 3
	Check how the edge of Fabric Presser touches Needles.	If a clearance exists between the edge of a Fabric Presser and Needles, the yarn is prevented from coming off Latches because of insufficient pressing force on the fabric, causing stitches float.	Adjust Fabric Presser. (P.N. Clearance) See page 68
	Check the clearance between the edge of a Fabric Presser and Sinkers.	If a clearance between the edge of a Fabric Presser and Sinker is too wide, the stitch is prevented from coming over and behind the Latches because of insufficient pressing force on the fabric, causing stitches float.	Adjust Fabric Presser (P.S. clearance) See page 66
	Check the condition of Needles.	If Needles get their Hooks and Latches bent, the yarn can neither knock over Hooks nor can be pushed behind Latches, and Stitches float as a result.	Correct the bent Hooks and Latches. If irreparable, replace those Needles with new ones. See Instruction Manual page 78

Nature of Trouble	Places to be Inspected	Causes	Remedy
The stitches on the both edge of fabric drop	Auto-tension	If you continue knitting without noticing that Tension Spring (a spring to take up slack yarn) is jumping to its extremity and not functioning, the yarn gets sagged at the starting point of knitting and Needles can not pick up the yarn, making stitches come off Hooks. (this often takes place when you change yarn.)	Adjust the yarn tension by Auto Tension Dial See Instruction Manual page 7
	Check if yarn is correctly threaded through Auto-Tension	If yarn is wrongly threaded through Auto-Tension the yarn becomes sagged and stitches come off Hooks due to insufficient yarn tension	Instruct an operator a correct threading of yarn through Auto-Tension. See Instruction Manual page 6
Spacing random open holes in a knitted fabric (Dropped stitches)	Check how Needles get their latches opened and closed.	When the Latches of Needles do not open or close smoothly, stitches drop.	Correct the latches so that they open and close smoothly. If irremediable, replace the Needles with new ones. See Instruction Manual page 78
	Check the clearance between Fabric Presser and Needles (P.N. Clearance)	If there is a clearance between Fabric Presser and Needles, Needles become lower in position than the standard position, and Y.S. (Yarn Feeder and Sinker) clearance becomes wider. So the needles can not catch the yarn.	Adjust the P.N. Clearance. See page 68

Nature of Trouble	Places to be Inspected	Causes	Remedy
A Knitted fabric shows course stripes (Irregular traverse stitches)	Check if left and right Main Cams are located at an equal distance from the inner surface of Carriage Pipe. (Standard Level)	If the dimension between Carriage Pipe (Standard Level) and one Main Cam is different from that between Carriage Pipe and another Main Cam, there takes place course stripes.	Adjust Main Cams so that they may be correctly positioned. See page 31
	The speed at which Carriage is moved. (The speed at which knitting is done.)	Speed difference between starting and finishing a stroke, or between one stroke and another.	Instruct an operator to knit at as even speed as possible. (Even if a machine itself is in order, course stripes happen depending upon an operator or operating methods adopted.) See Instruction Manual page 14

Nature of Trouble		Places to be Inspected	Causes	Remedy
Knitted patterns do not come out as desired. (Poor Needle Selection)	Poor Needle Selection throughout the fabric.	Pattern Unit	If the perforated holes on a Punched Card are not brought into line with the scanning fingers of Touch Levers, the scanning fingers get caught by the holes, making Touch Levers unable to work in accordance with a Punched Card, and irregular appearance of pattern results.	Adjust Card Drum so that the perforated holes on a Punched Card may be brought into line with the scanning fingers of Touch Levers. See page 53
		Clearance between Touch Levers and Main Drum Pieces.	If there is too wide a clearance between Touch Levers and Main Drum Pieces, Touch Levers get prevented from pushing Main Drum Piece sufficiently and a poor memory results, accompanied by Poor Needle Selection.	Adjust the clearance between Touch Levers and Main Drum Pieces to be correct. See page 62
		Check the Clear Wire	If the length of Clear Wire is not correct, Sub Drum Piece Clear Cam can not clear the used memory on Sub Drum.	Adjust the length of Clear Wire. See page 26
		Check if Rachet Wheel is fed properly	If a clearance exists between Rachet Wheel and Feed Pawl, a Punched Card can not be fed smoothly nor correctly, causing Poor Needle Selection to happen.	Adjust Stop Lever Holder and Feed Lever. See page 57

Nature of Trouble	Places to be Inspected	Causes	Remedy
Poor Needle Selection appears at every 24 stitches.	Main and Sub Drum. Touch Levers	1. Breakage of Drum Piece 2. Inactiveness of Drum Piece 3. The loss of Drum Piece 4. The loss of steel ball 5. Rebound Spring is bent 6. Inactiveness of Touch Lever 7. Touch Lever Spring is weak.	Replace Drum Replace Drum Replace Drum Fill the Ball Replace the spring Check the Touch Lever Shaft. Replace the Spring.
Needle Butts collide with Carriage	Drum Unit	The mutual positions of Needle Bed Rack, Needle Bed grooves and Drum Unit are incorrect.	Adjust the position of Drum Unit. See page 23
	The clearance between Rail and Needle Bed Rack.	If the clearance between Rail and Needle Bed Rack is incorrect, the Needle Butts will collide with Separation Cam.	Adjust the Needle Bed Rack and Drum Unit. See page 44
Weaving can not be done.	Check if Weaving brush correctly positioned, and W.P. clearance.	In case Weaving brush is not correctly placed, or W.P. clearance is not correct, it becomes impossible to weave due to an insufficient pressure on a weaving yarn.	Adjust Weaving brush to be right in position, and adjust the W.P. clearance. See page 75

Nature of Trouble	Places to be Inspected	Causes	Remedy
Carriage is heavy in operation	Check if Rail of Needle Bed, Slider Carriage Pipe, Cams etc. are properly lubricated.	In case Rail of Needle Bed, Slider, Carriage Pipe, Cams etc are poorly lubricated, Carriage becomes rough and heavy in operation.	Clean off the solid surfaces of those parts and apply the machine oil contained in an accessory box. See Instruction Manual page 81
	Check the position of Fabric Presser.	If the edge of Fabric Presser is too high or comes in contact with Sinkers, Carriage gets heavy to operate because of an increased resistance upon a Fabric Presser.	Adjust the P.S. Clearance. See page 71
Latch and Hook of Needle get bent easily.	Yarn Feeder	In case Yarn Feeder is positioned too low, you will get the hook or latch of a Needle caught by Yarn Feeder when knitting at a high speed.	Adjust the Y.N. clearance. See page 73