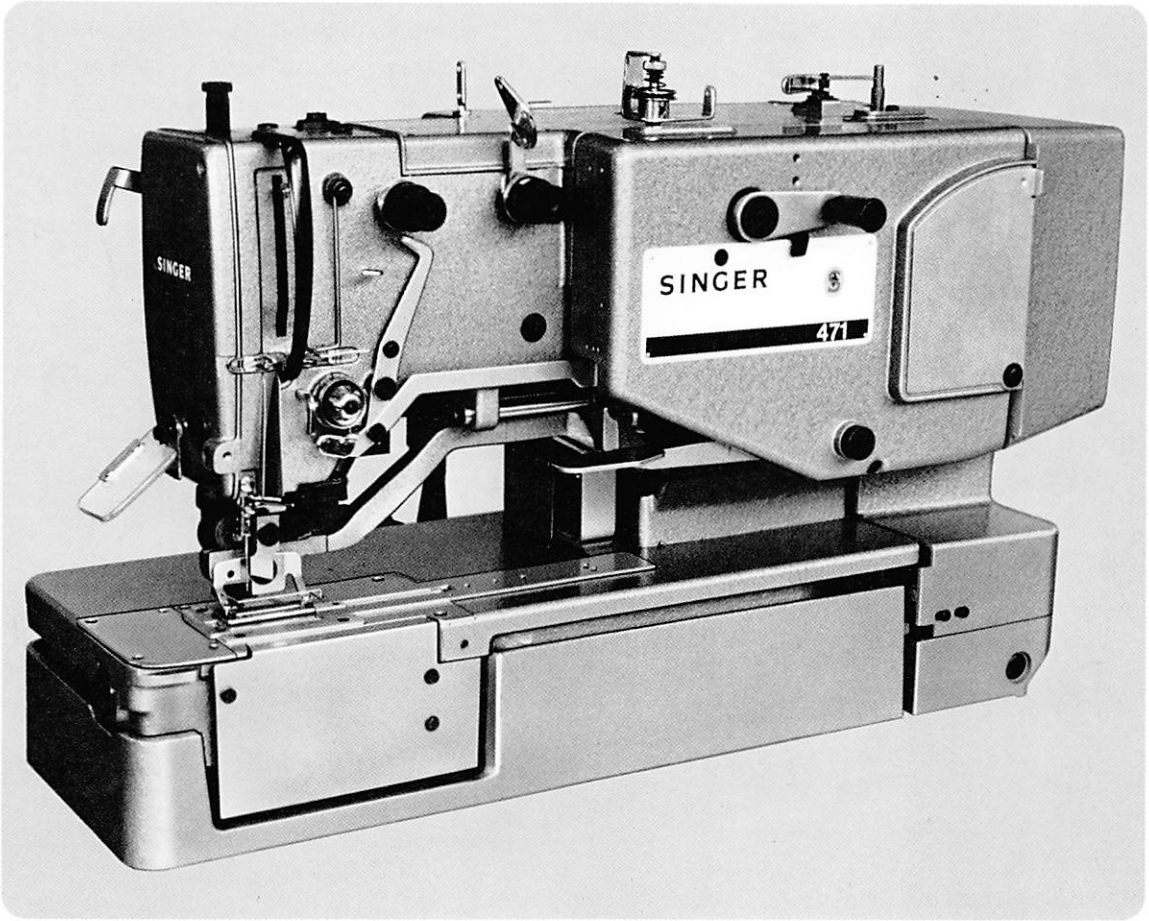
SERVICE MANUAL

FOR

SINGER MODEL 471U



THE SINGER COMPANY

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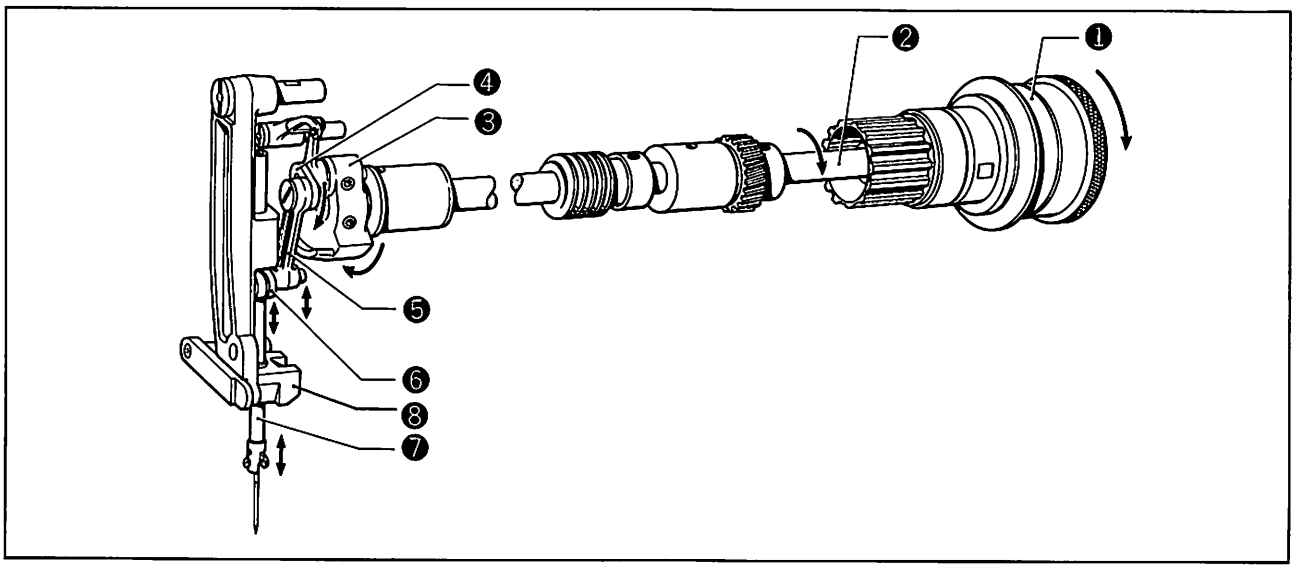
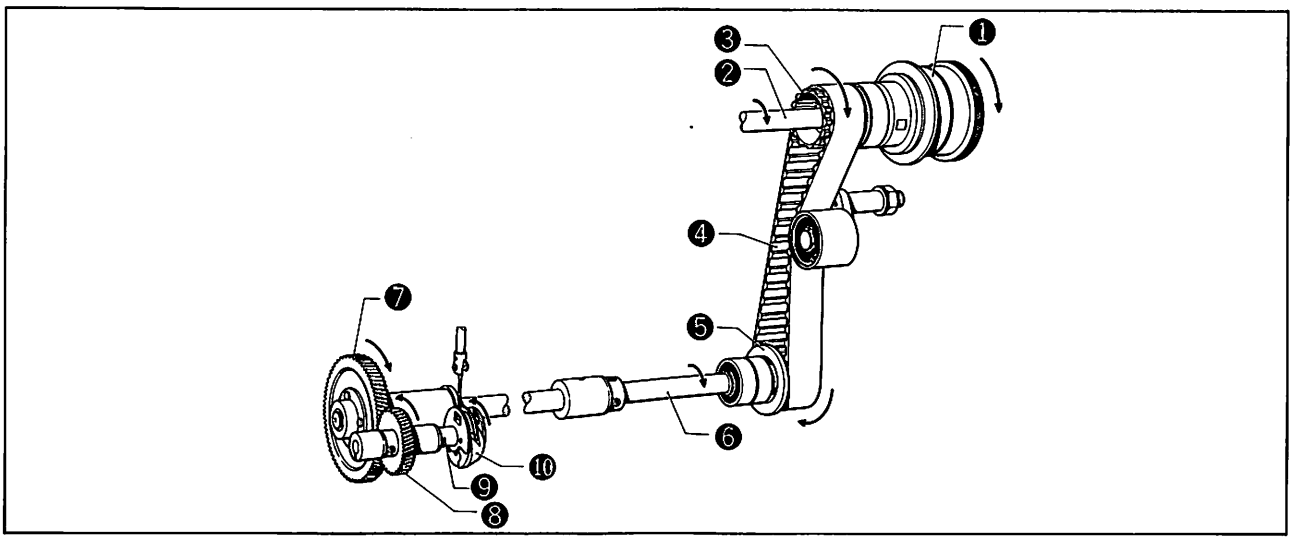
MECHANISMS

1 Needle bar mechanism



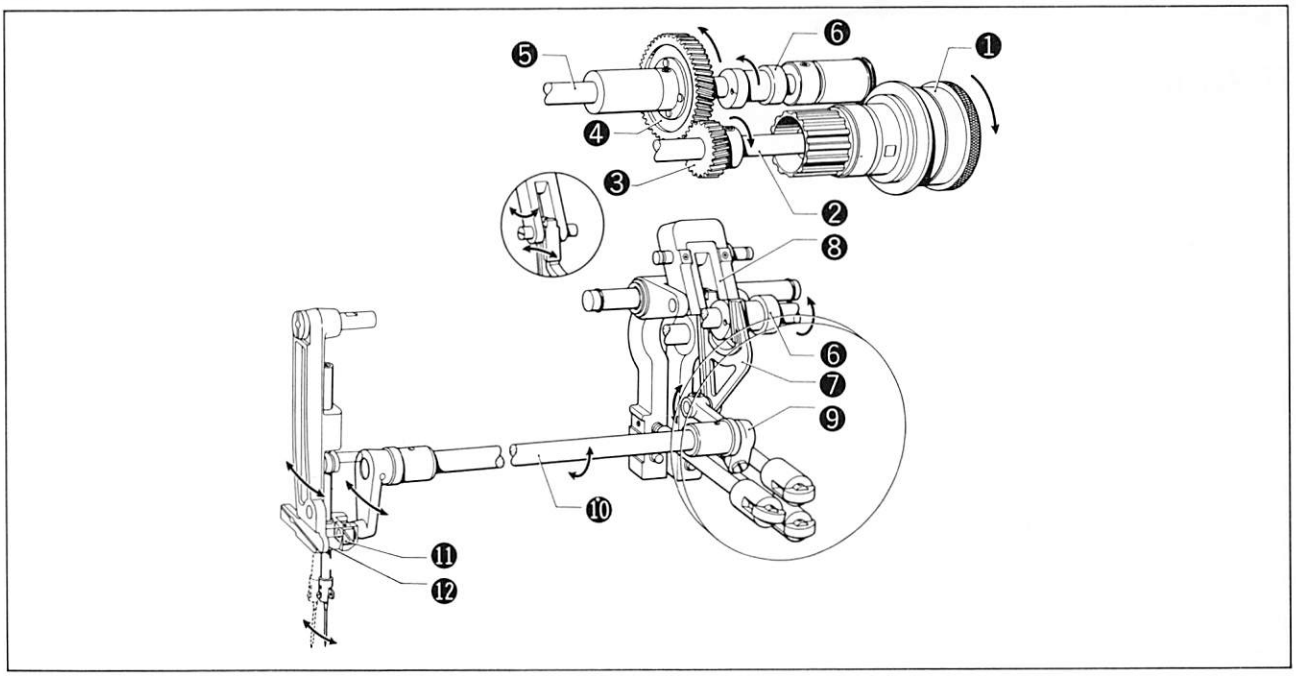
1. When the pulley ❶ rotates in the direction of the arrow, this movement is transmitted to the thread take-up crank ❸ fixed on the end of the upper shaft ❷.
2. The needle bar crank ❹ is fixed to the thread take-up crank ❸, and an up-down motion is transmitted to the needle bar clamp ❻ through the needle bar crank rod ❺.
3. The needle bar ❼ is fixed to the needle bar clamp ❻ and is guided by the vertical bushing on the needle bar support ❽ so that is moves smoothly up and down.

2 Rotary hook mechanism



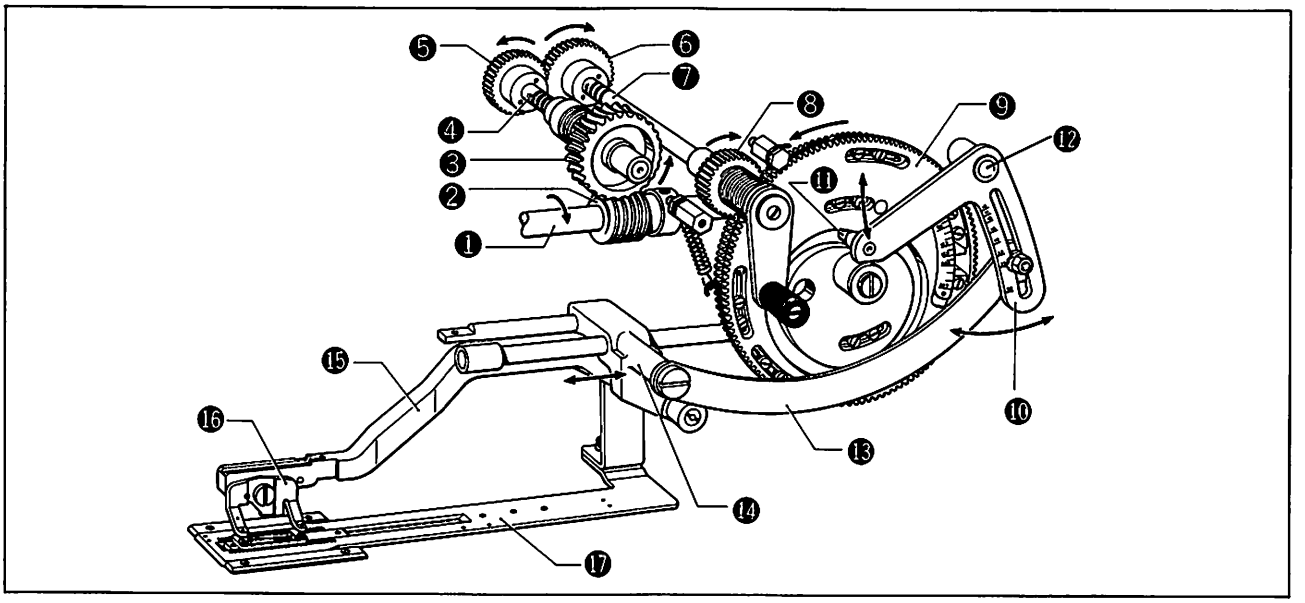
1. When the pulley ❶ rotates in the direction of the arrow, this movement is transmitted to the timing pulley U ❸ fixed on the upper shaft ❷.
2. The timing belt ❹ is wrapped around the timing pulley U ❸ and assures sure transmission of the rotating movement of the upper shaft to the timing pulley D ❺.
3. The timing pulley D ❺ is fixed to the lower shaft ❻ and transmits the rotating movement to the lower shaft gear ❼ fixed to the end of the lower shaft ❻.
4. The rotary hook shaft gear ❽ meshes with the lower shaft gear ❼, and the rotating movement is transmitted to the rotary hook shaft ❾.
5. The rotating hook assembly ❿ is fixed on the rotary hook shaft ❾ and rotates completely.

3 Needle zigzag mechanim



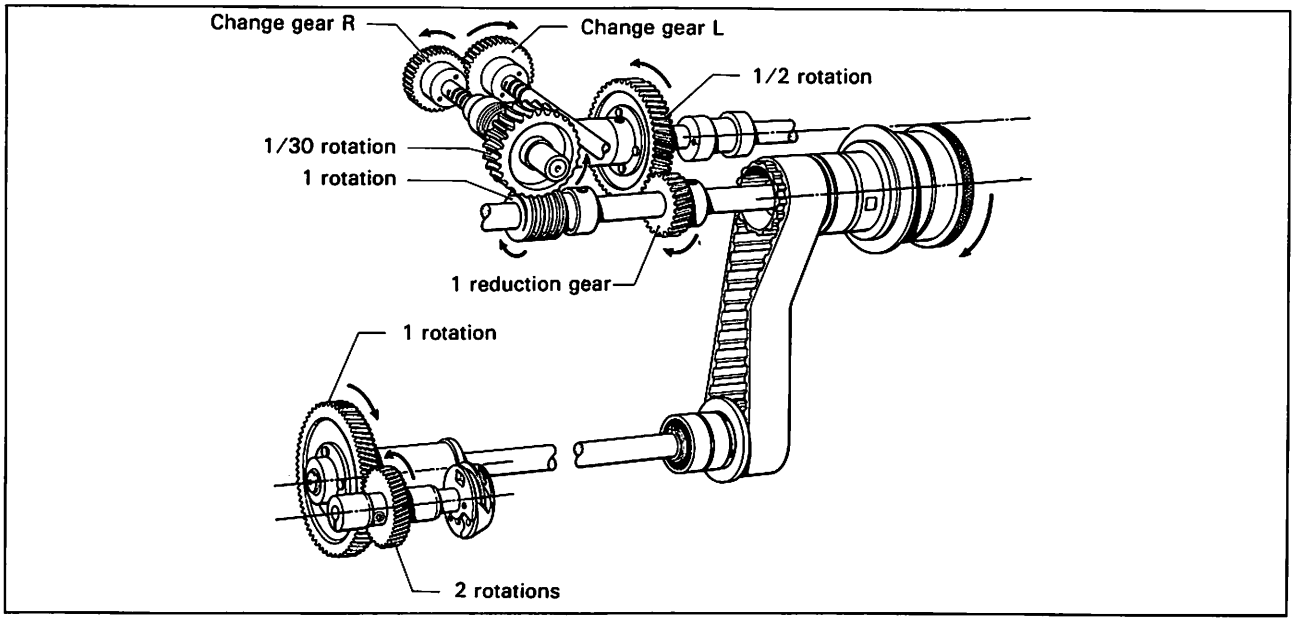
1. When the pulley ❶ rotates in the direction of the arrow, the rotating movement is transmitted to the reduction gear ❸ fixed on the upper shaft ❷.
2. The reduction gear ❸ meshes with the sub shaft gear ❹, reduces the rotation of the upper shaft ❷ by half, and transmits this motion to the sub shaft ❺.
3. The needle zigzag cam ❻ is fixed to the auxiliary shaft ❺, and the triangular portion of the needle zigzag cam fits in the needle zigzag forked link ❼.
4. The upper end of the needle zigzag forked link ❼ is fitted on the needle zigzag link ❽, and an oscillating movement is transmitted to the needle zigzag lever R ❾ linked with the lower end of the needle zigzag forked link ❼.
5. The needle zigzag lever F ❿ is fixed on the needle zigzag lever R ❾ and causes the needle bar frame slide block ⓫ fitted on the end of the needle zigzag lever F ❿ to oscillate.
6. The needle bar support slide block ⓫ fits in the groove of the needle bar support ⓬ and causes it to oscillate back and forth.

4 Feed mechanism



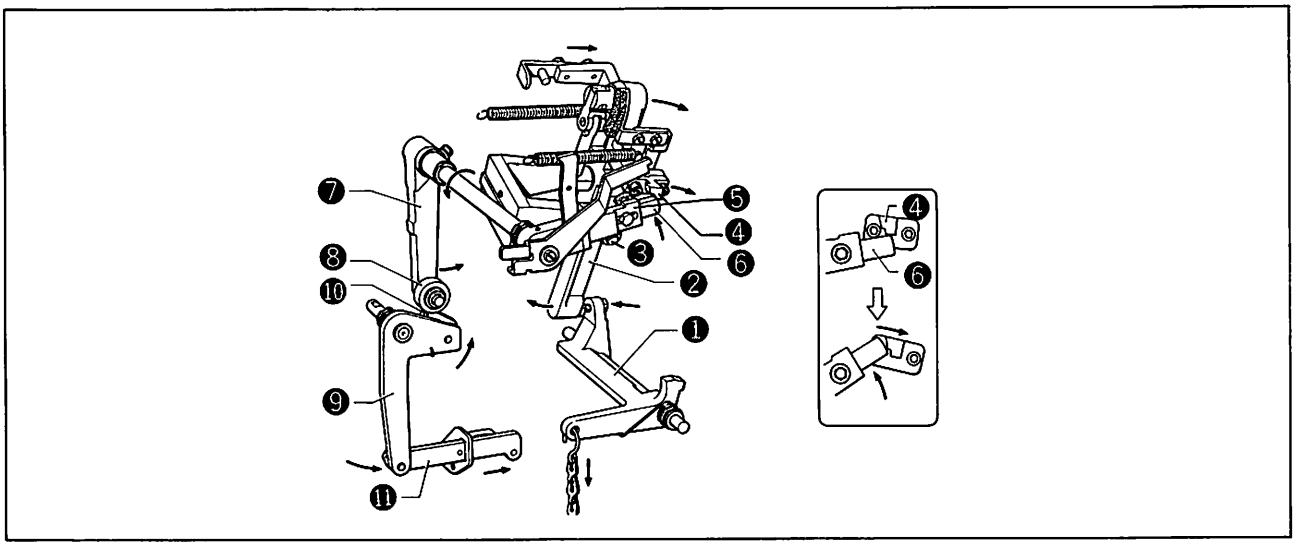
1. When the upper shaft ❶ rotates in the direction of the arrow, the worm ❷ fixed to the upper shaft ❶ also rotates.
2. The worm wheel ❸ meshes with the worm ❷, and the rotating movement is transmitted to the worm wheel shaft ❹.
3. The change gear R ❺ attached to the end of the worm wheel shaft ❹ meshes with the change gear ❻, which causes the change gear shaft ❼ to rotate.
4. The free wheel gear ❽ fixed on the change gear shaft ❼ meshes with the feed cam ❾ causing it to rotate.
5. The roller ⓫ attached to the end of the feed adjusting lever ❿ fits in the heart-shaped groove of the feed cam and causes the feed connecting rod ⓭ to move back and forth using the feed adjusting lever shaft ⓬ as a pivot point.
6. The end of the feed connecting rod ⓭ is linked to the feed drive shaft arm pivot point ⓮ and causes the length drive shaft feed arm ⓯, clamping foot ⓰, and length feed plate ⓱ connected to the feed drive shaft arm pivot point ⓮ to move back and forth.

Gear ratios



By changing the gear ratio (change gear combination) of the upper shaft rotation with respect to one rotation (one cycle) of the feed cam, the number of stitches can be varied between 58 and 347.

5 Clutch mechanism

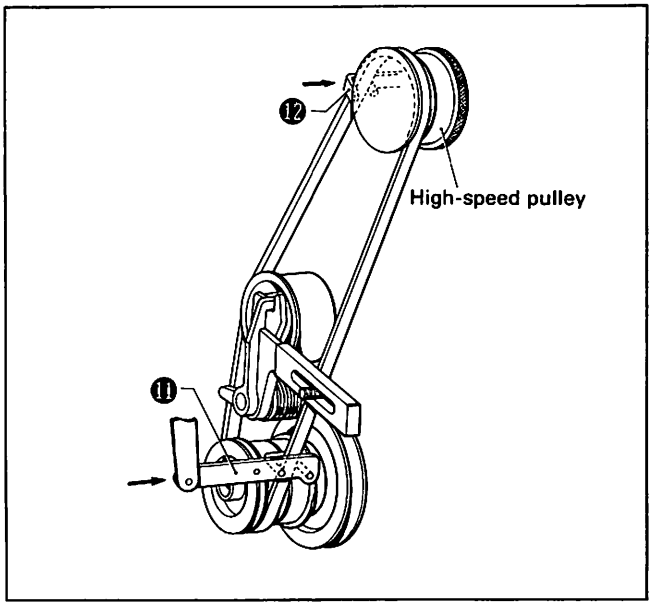


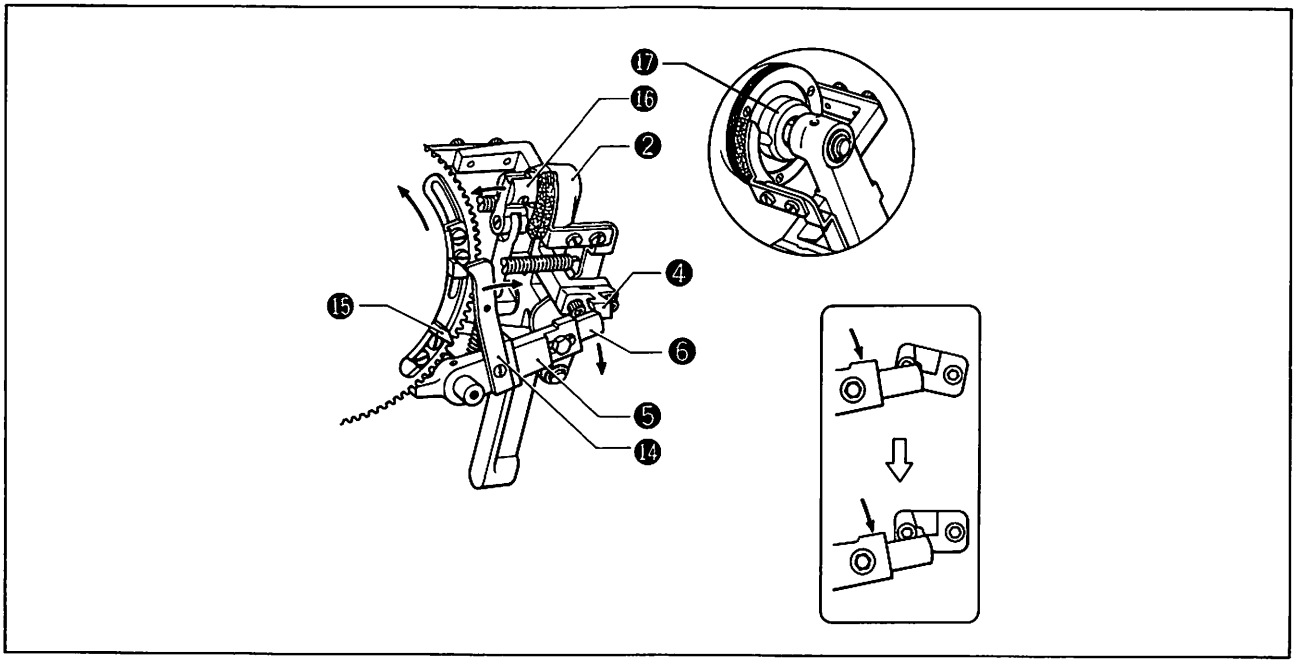
I Starting

1. When the starting lever ❶ is lowered in the direction of the arrow, it presses against the lower end of the clutch lever ❷, causing it to pivot on the clutch lever shaft ❸ and move in the direction of the arrow.
2. When the clutch lever ❷ moves in the direction of the arrow, the stop lever claw ❻ fixed on the stop lever ❺ rises to mesh with the clutch claw ❹ fixed on the clutch lever ❷.
3. The belt shifter drive lever ❼ is fixed on the end of the stop lever ❺, and the belt shifter roller ❽ attached to the lower end of this moves the top side of the belt shifter cam ❿ attached to the belt shifter lever ❾.
4. The belt shifter lower ⓫ linked to the belt shifter lever ❾ moves in the direction of the arrow to shift the flat belt to the low-speed pulley.

II Belt shifter

The belt shifter U ⓬ and the belt shifter lower ⓫ fixed to the clutch lever are linked to the movement of the clutch lever and shift the flat belt between the high-speed pulley and low-speed pulley so as to transmit a stable rotation to the machine.



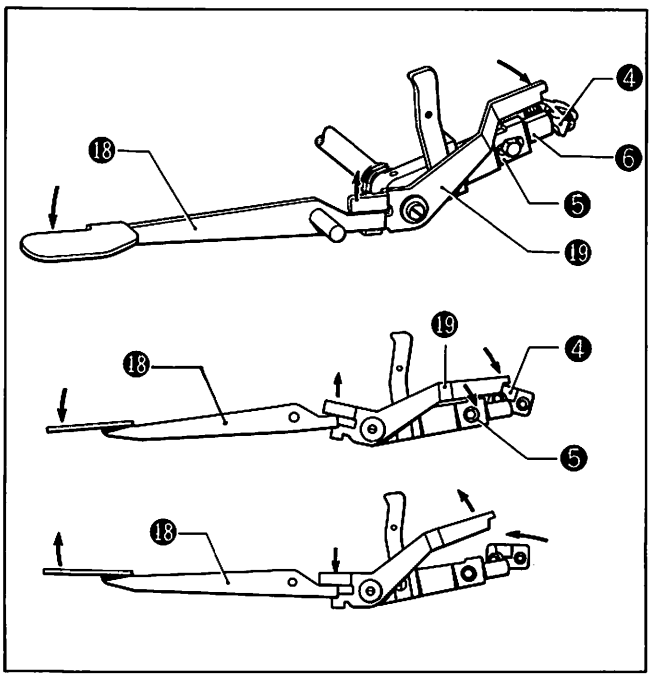


III Stopping

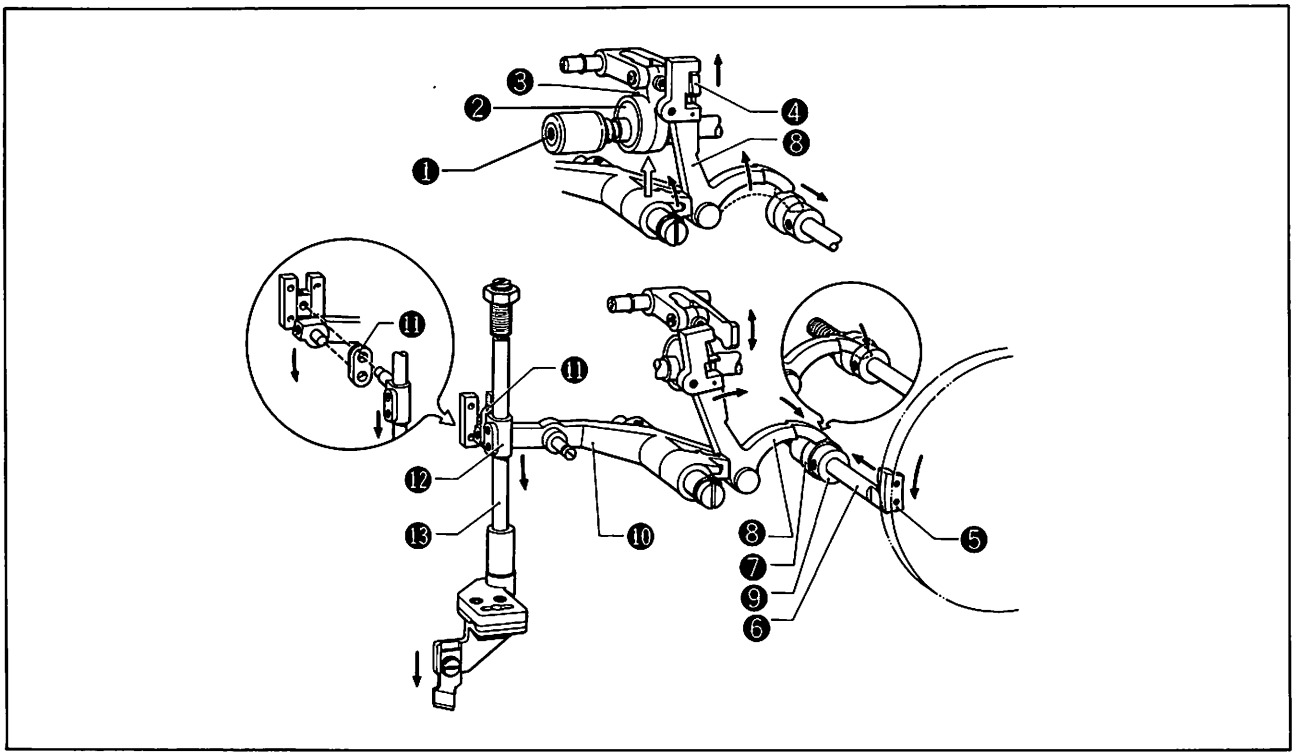
1. When the stop cam contact plate ⑭ fixed to the stop lever comes in contact with the stop cam segment B ⑬, the stop lever tongue ⑥ moves one step away from the clutch tongue ④.
2. When the stop cam contact plate ⑭ fixed to the stop lever ⑤ comes in contact with the stop cam segment A ⑮, the stop lever tongue ⑥ moves away from the clutch tongue ④, and the clutch lever return spring moves the clutch lever ② back in the direction of the arrow. The clutch stopper ⑯ enters the groove on the stop cam ⑰ and stops the machine.

IV Emergency stopping

1. When the emergency stop arm ⑱ is pushed down, the tongue of the emergency stop lever ⑲ meshes with the clutch tongue ⑤, and the machine goes to slow-speed operation.
2. When the emergency stop arm ⑱ is released, the tongue of the emergency stop lever ⑲ moves away from the clutch tongue ⑤, and the machine stops.

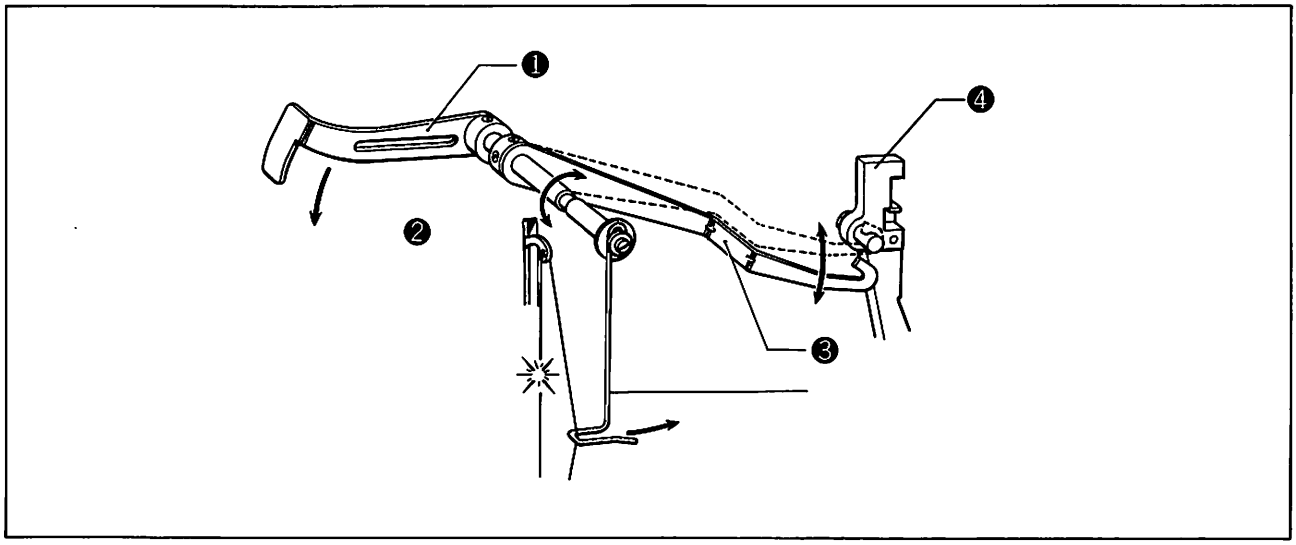


6 Cutter mechanism (I)



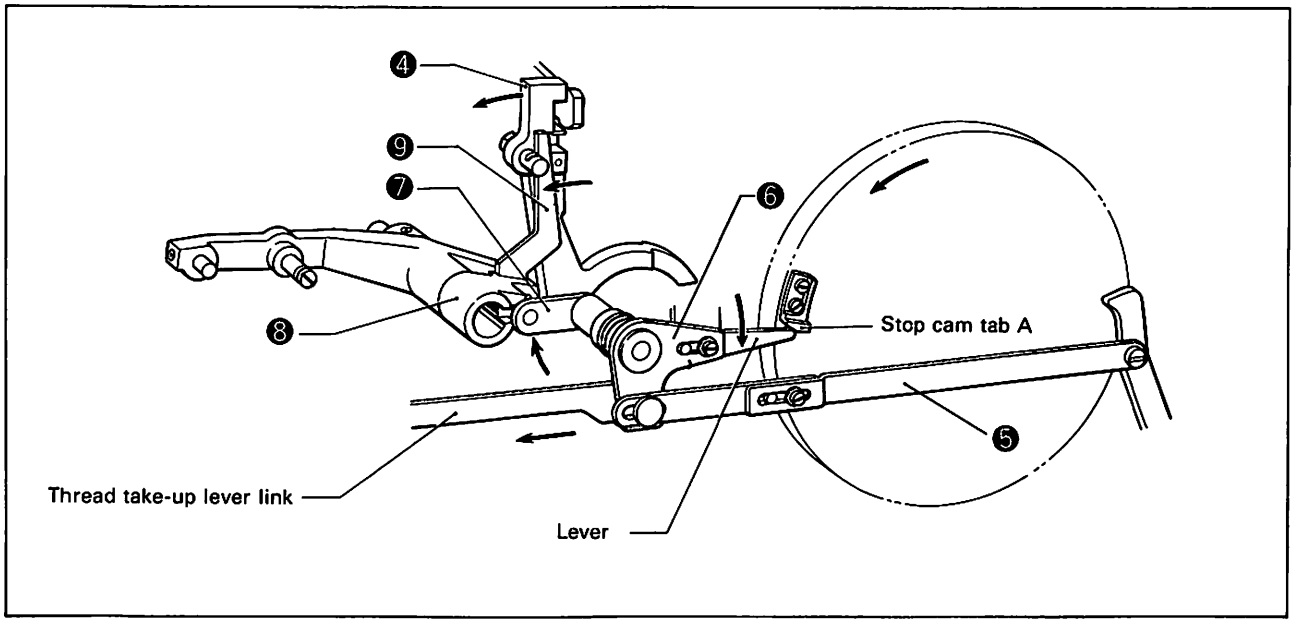
1. When the sub shaft ❶ moves in the direction of the arrow, the cutter eccentric rod ❸ fitted to the cutter eccentric wheel ❷ fixed on the sub shaft oscillates.
2. The cutter drive lever ❹ is linked to the end of the cutter eccentric rod ❸ and so oscillates in the same way.
3. When the cutter cam segment ❺ attached to the feed cam pushed against the cutter push bar ❻, the clutch ❽ riding on the clutch collar ❼ moves to the clutch set collar ❾.
4. When the cutter push bar ❻ moves away from the cutter cam segment ❺, the clutch ❽ falls in between the clutch collar ❼ and the clutch set collar ❾.
5. When this happens, the cutter drive lever ❹ enters the dent in the clutch ❽ and lifts it up.
6. The lower end of the clutch is linked to the cutter operation arm ❿ and causes the cutter operation link ⓫ linked to the end of the cutter operation arm ❿ to move up and down.
7. The cutter holder ⓬ is linked to the cutter operation link ⓫, and the cutter operation shaft ⓭ fixed to the cutter holder ⓬ is moved up and down.

7 Cutter mechanism (II)



I Cutter drop prevention mechanism during thread breakage

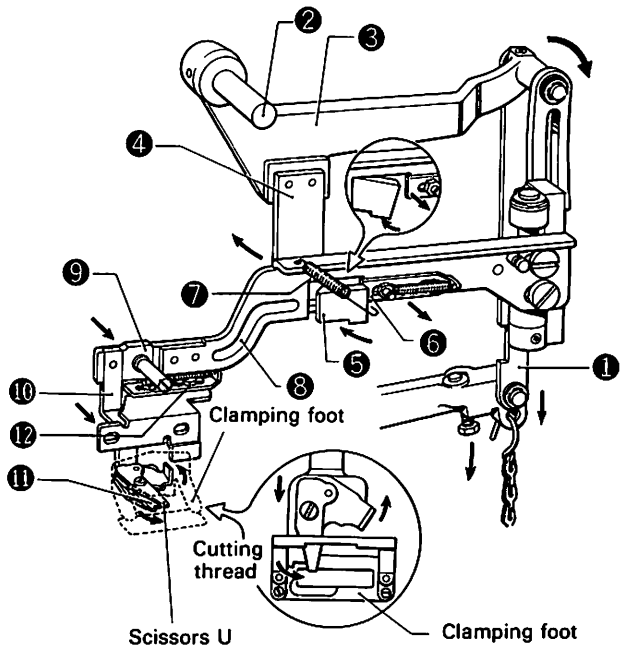
1. When the needle thread breaks, the thread breakage perceiving lever ❶ automatically comes down, and the end of the cutter clutch stopper ❸ fixed to the thread breakage perceiving lever shaft ❷ catches on the pin of the clutch ❹ and stops the cutter from falling.



II Cutter drop prevention mechanism during high-speed operation

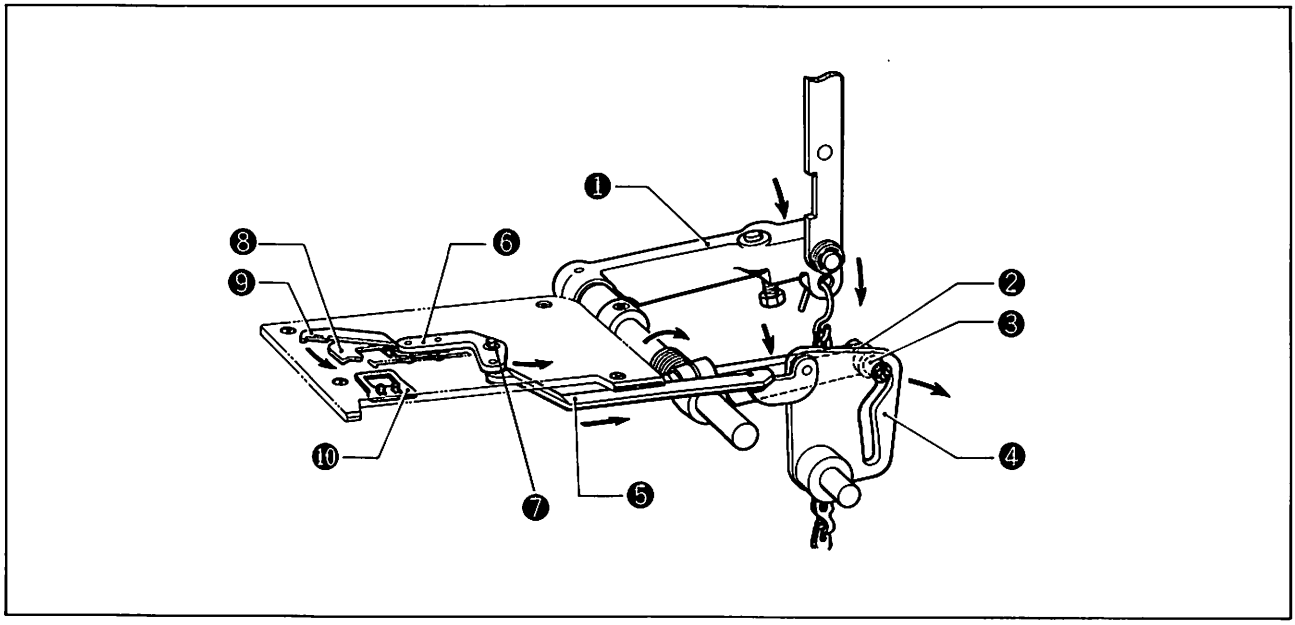
1. When the clutch lever rises, the cutter stop connection rod ❺ is pushed in the direction of the arrow, and the movement is transmitted to the cutter stop lever ❻ linked to its end.
2. The cutter stop lever shaft ❼ is fixed to the cutter stop lever ❻ and transmits the movement to the stop lever bracket ❽.
3. The clutch stop lever bracket ❾ fixed to the stop lever bracket ❽ is moved in the direction of the arrow. This holds the pin of the clutch ❹ and locks it securely in place, thus stopping the cutter from dropping.

8 Upper thread cutter mechanism



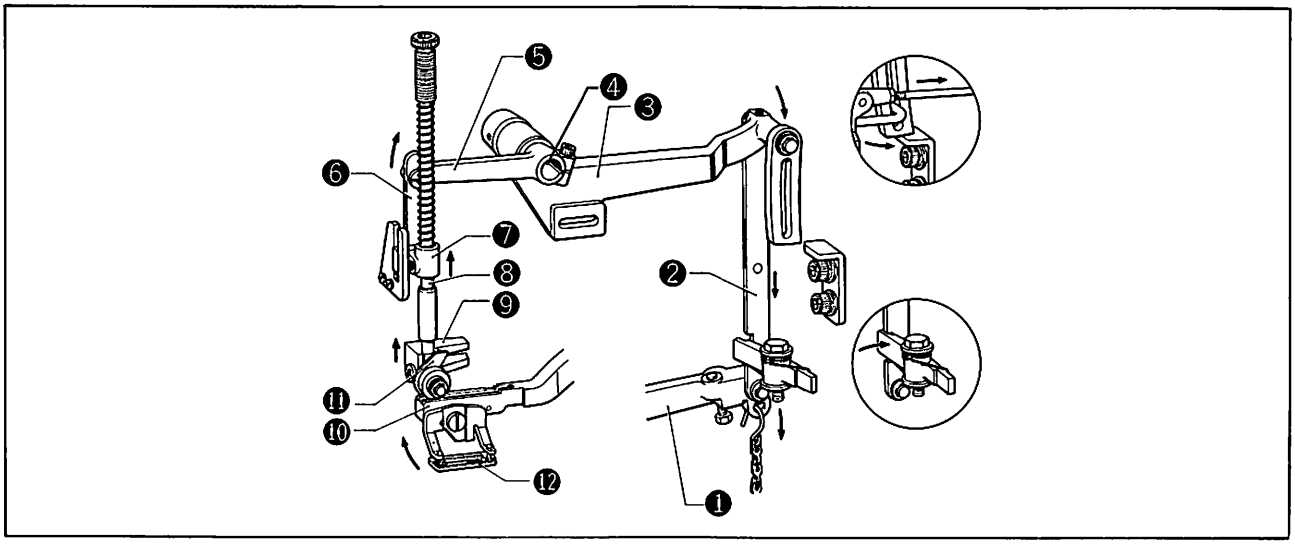
1. When the presser bar lifter connecting rod ❶ moves in the direction of the arrow, presser lifter ❸ drops down in the direction of the arrow pivoting on presser lifter lever shaft ❷.
2. The trimming clutch guide ❹ is fixed on the end of the presser lifter ❸, and the clutch cam ❺ is fixed on this and drops down in the same way.
3. When the clutch cam ❺ comes away from the trimming clutch plate ❻, the upper thread trimming lever ❽ is moved in the direction of the arrow by the scissors operating spring ❼.
4. The upper thread trimming lever B ❾ is fixed to the end of the upper thread trimming lever ❽, and the movement is transmitted to the scissors D ❿ fixed on the upper thread trimming B ❾.
5. The scissors M ⓫ attached to the scissors D ❿ come in contact with the clamping foot, and the scissors M ⓫ close to cut the needle thread.
6. The scissors guide ⓬ fixed on the length feed arm advances in the direction of the arrow when the machine is started, and the scissors M ⓫ open.

[9] Lower thread cutter mechanism



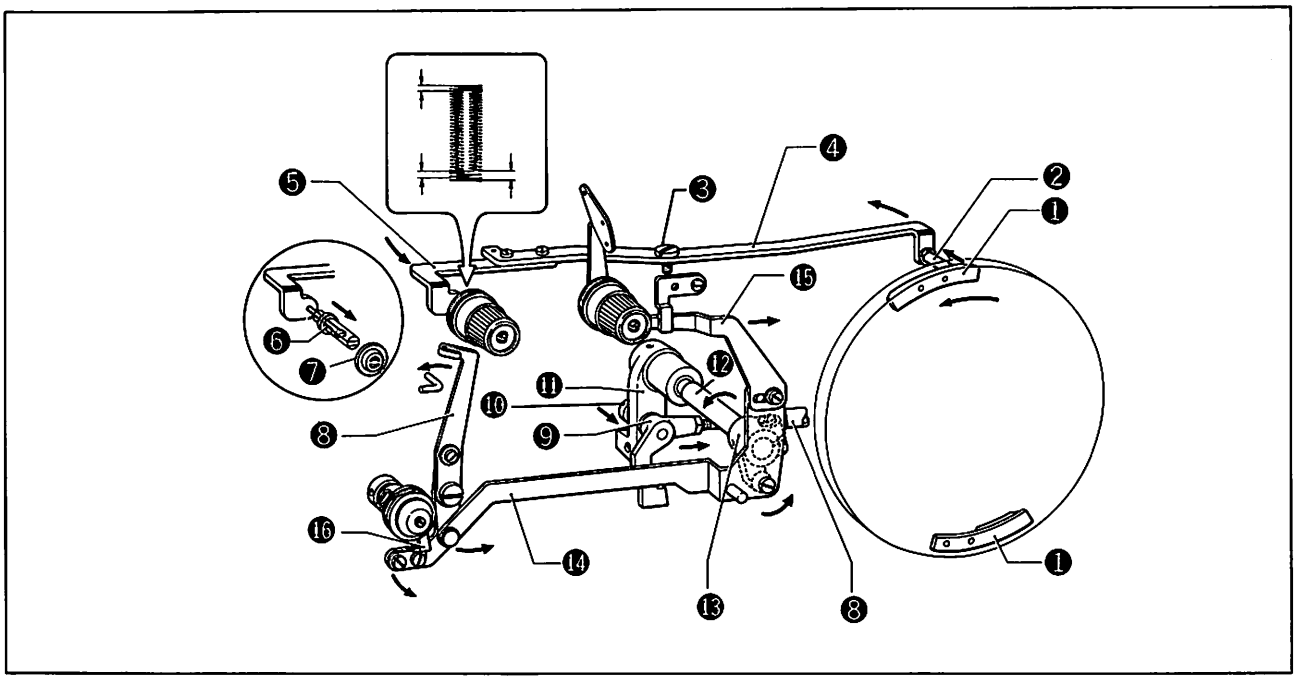
1. When the lower thread cutter lever ❶ moves in the direction of the arrow, the lower thread cam lever ❷ fixed on the lower thread cutter lever ❶ moves in the direction of the arrow.
2. The roller ❸ attached to the end of the lower thread cam lever ❷ fits in the cam groove on the lower thread cam ❹ and moves the lower thread cutter link ❺ back and forth.
3. The thread cutter driving lever ❻ is linked to the end of the lower thread cutter link ❺ and this transmits a circular movement to the thread cutter driving lever ❻ using the stud screw ❼ as pivot point.
4. The lower thread retainer ❽ and the lower movable knife ❾ are fixed on the thread cutter driving lever ❻, and the lower movable knife ❾ and lower fixed knife ❿ come together to cut the thread.

[10] Presser bar lifter mechanism



1. When the lower thread trimming lever ❶ moves in the direction of the arrow, the presser bar lifter connecting rod ❷ transmits the movement to the presser lifter ❸.
2. The presser lifter ❸ is fixed to the presser lifter shaft ❹ and moves the presser bar lifter ❺ fixed to the end of the presser lifter shaft ❹ up and down.
3. The presser bar lifter link ❻ is linked to the presser bar lifter ❺, and the bottom of this is linked to the presser bar clamp ❼ and moves it up and down.
4. The presser bar ❽ is fixed on the presser bar clamp ❼ and causes the presser foot roller unit ❾ connected to its bottom to move up and down.
5. The feed arm support ⓫ fixed to the length feed arm ❿ catches on the presser foot roller unit ❾ and moves the clamping foot ⓬ up and down.

11 Tension releasing mechanism

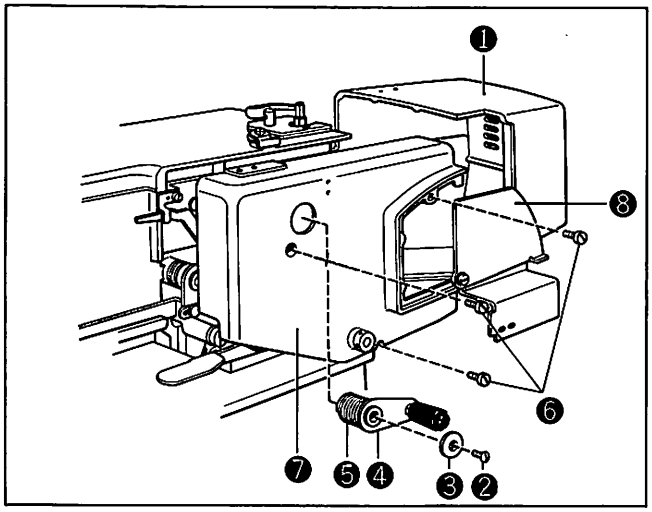


1. When the tension releasing cam segment F ❶ attached to the feed cam pushes against the tension releasing pin ❷, the tension releasing lever S ❺ fixed on the tension releasing lever ❹ pivots on the stud screw ❸ and pushes against the tension releasing pin ❻.
2. The tension releasing pin ❻ pushes against the tension releasing disc ❼ and releases the auxiliary tension Ⓑ.
3. When the clutch lever enters the stop cam, the tension releasing lever ❽ linked to the clutch lever moves in the direction of the arrow.
4. The end of the tension releasing rod ❽ is fixed to the tension releasing rod support ❾ and transmits the movement to the scissors push lever ⓫ through the stud screw ❿.
5. The thread take-up lever arm ⓭ is fixed on the end of the scissors push lever shaft ⓬, and the scissors push lever shaft causes the thread take-up lever link ⓮ fixed to the thread take-up lever arm ⓭ to operate.
6. A back-and-forth motion is transmitted to the main tension releasing plate ⓯ fixed on the top of the tension releasing lever link ⓮, and at the same time the main tension Ⓐ is released, the tension disc split tongue ⓰ attached to the end of thread take-up lever link ⓮ releases the tension disc Ⓒ.

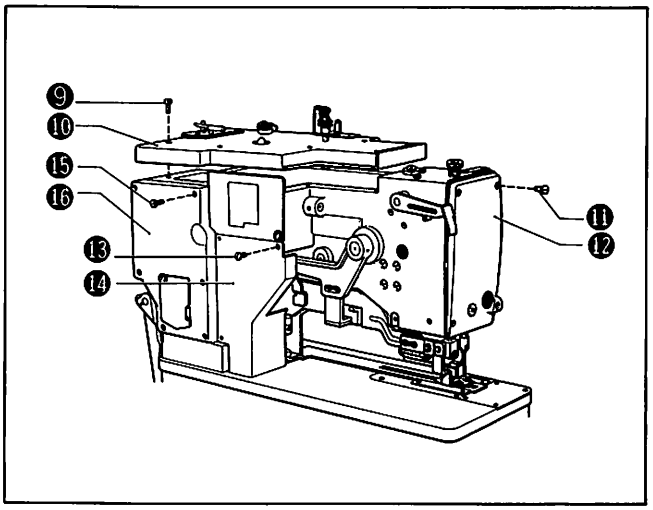
DISASSEMBLY PROCEDURES

1 Covers

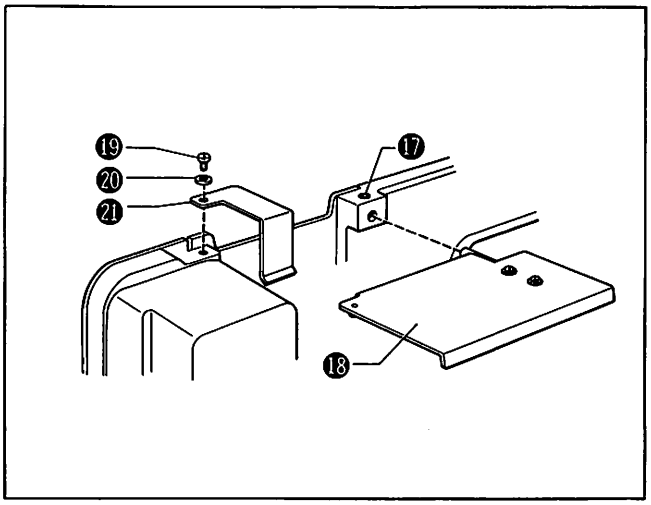
1. Remove the belt cover ❶.
2. Remove the screw ❷ and the bearing cover ❸, and remove the handle lever ❹ and the handle clutch spring ❺ together.
3. Remove the three screws ❻ and the cam cover ❼. When one of these three screws is removed it will allow the feed regulating cover ❽ to be removed. In this case, after removing the cam cover ❼, reattach the handle ❹ and the handle clutch spring ❺.



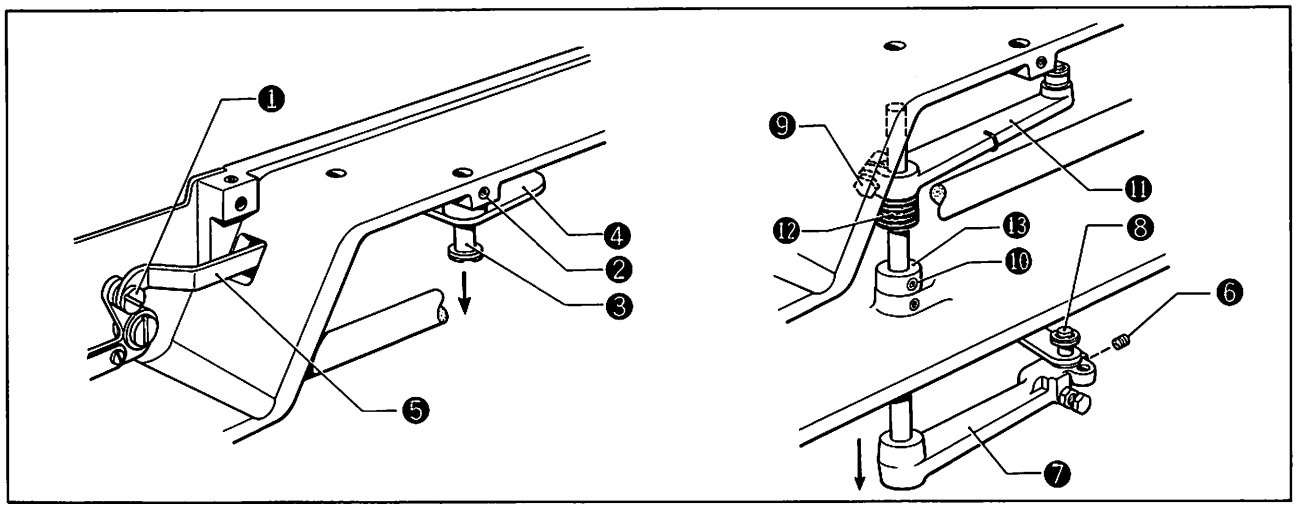
4. Remove the eight screws ❾ and the top cover ❿.
5. Remove the four screws ⓫ and the face plate ⓬.
6. Remove the three screws ⓭ and the back panel cover F ⓮.
7. Remove the six screws ⓯ and the back panel cover R ⓰.



8. Lay the machine down to the left.
9. Loosen the screw ⓱, and remove the rotary hook cover ⓲ as a set.
10. Remove the screw ⓳ and the washer ⓴, and then remove the inside rotary hook cover ㉑.



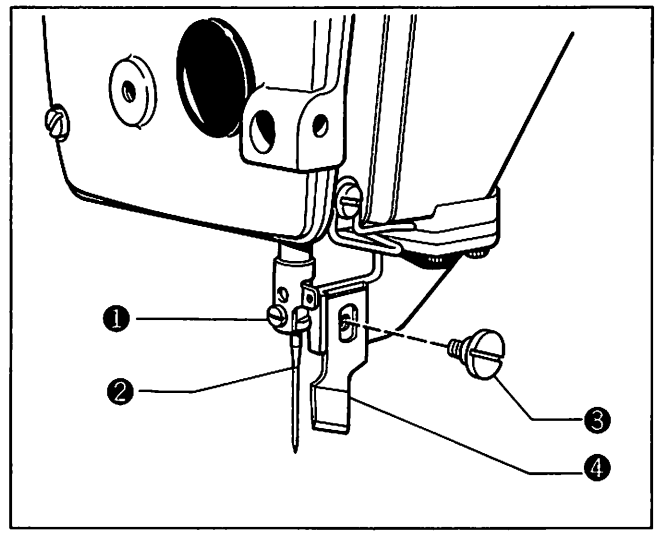
2 Lower thread cutter



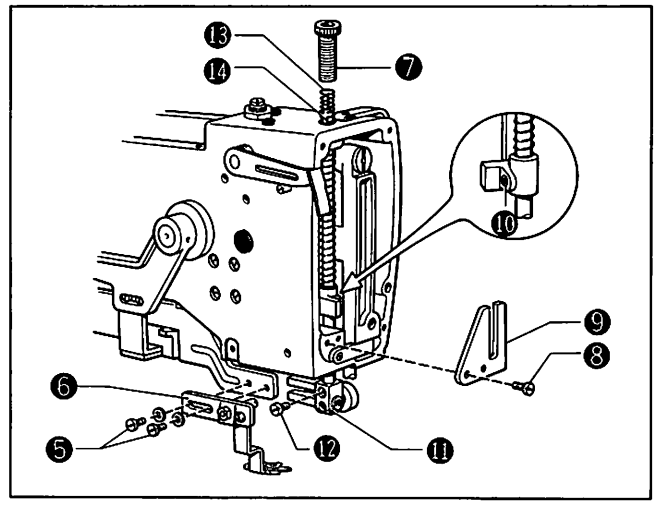
1. Remove the stud screw ❶.
2. Lower the machine below the bed.
3. Loosen the screw ❷ and pull out the cam shaft ❸, and then remove the lower thread cutter cam ❹ and the lower thread cutter link ❺ as a set.
4. Loosen the screw ❻, lower the lower thread cutter lever ❼, and pull out the lower thread cutter lever pin ❽.
5. Loosen the bolt ❾ and the set collar screw ❿, and while pulling out the lower thread cutter lever ❼, remove the lower thread cam lever ⓫, the lower thread cam lever spring ⓬, and the set collar ⓭.

3 Presser

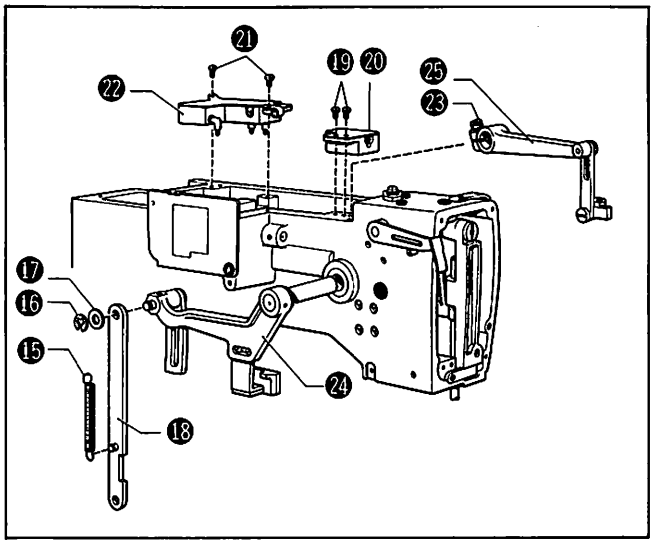
1. Remove the screw ❶ and the needle ❷.
2. Remove the screw ❸ and the cutter ❹.



3. Remove the two screws ❺ and the upper thread cutter lever B ❻.
4. Remove the presser adjusting screw ❼.
5. Remove the two screws ❽ and the presser guide plate ❾.
6. Loosen the screw ❿.
7. Loosen the screw ⓬ on the presser roller unit ⓫.
8. While pulling out the presser bar ⓭ and the presser spring ⓮ from the top of the arm, remove the presser roller unit ⓫.

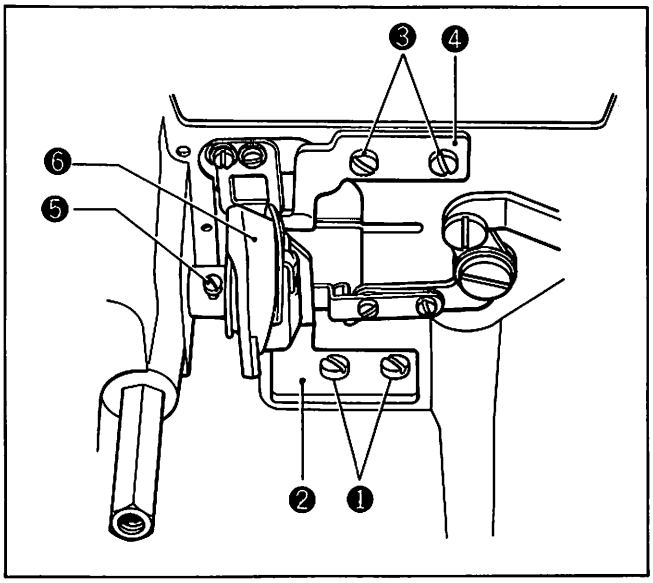


9. Remove the presser bar lifter connecting rod spring ⑮.
10. Remove the E stop ring ⑯ and the washer ⑰, and then remove the presser connecting rod ⑱.
11. Remove the two screws ⑲ and the wick base A ⑳.
12. Remove the two screws ㉑ and the wick base B ㉒.
13. Loosen the bolt ㉓, and while pulling out the lifting lever ㉔, remove the lifting lever arm ㉕.



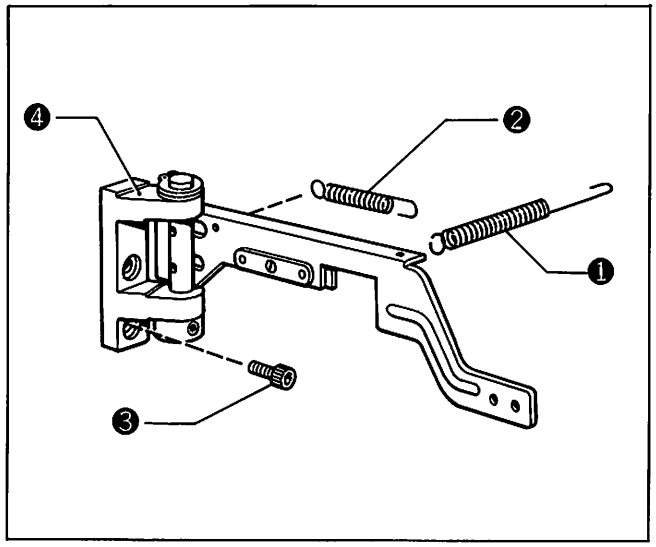
[4] Rotary hook

1. Lay the machine down on the left side.
2. Remove the two screws ❶ and the rotary hook position bracket A ❷.
3. Remove the two screws ❸ and the rotary hook position bracket B ❹.
4. Loosen the two screws ❺ and remove the rotary hook ❻.



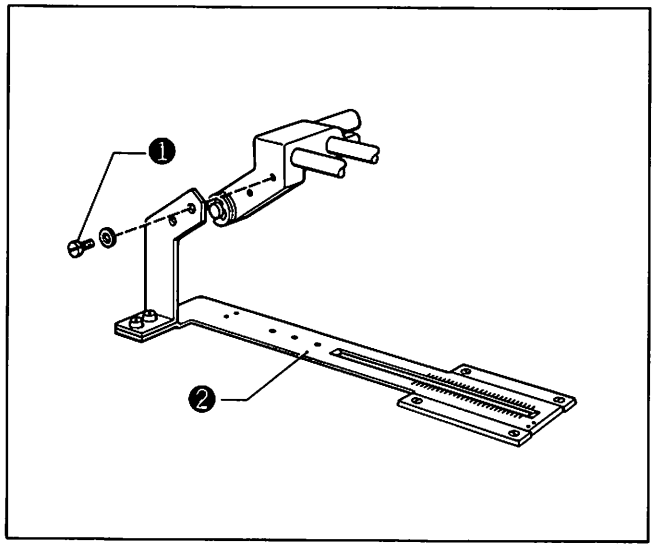
5 Upper thread cutter

1. Return the machine to its original position.
2. Remove the scissors operating spring ❶ and the scissors return spring ❷.
3. Remove the two bolts ❸ and the upper thread cutter lever ❹.



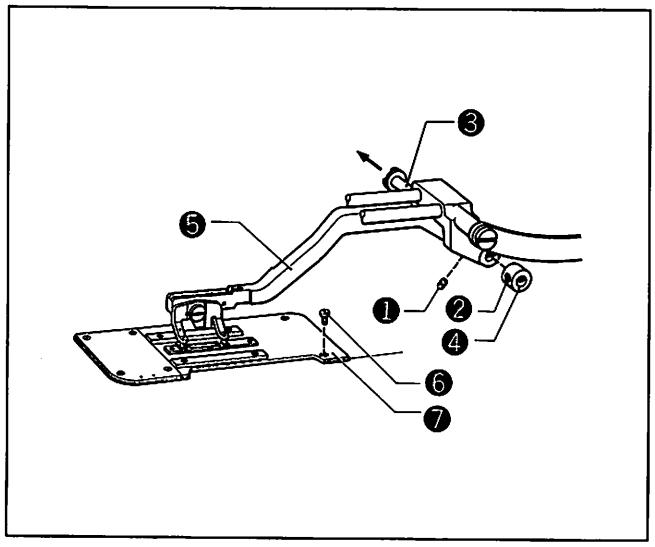
6 Length feed

1. Remove the two screws ❶, and slide the lower feed arm ❷ forward and remove it.



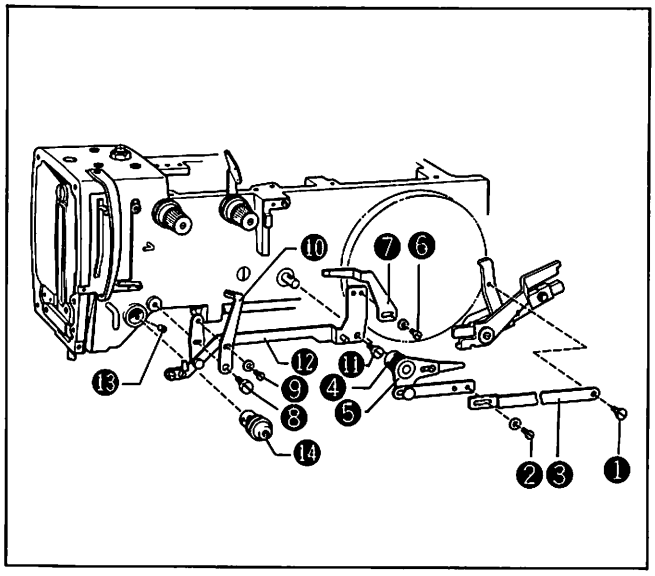
7 Clamping foot

1. Loosen the screw ❶.
2. Loosen the screw ❷, and while pulling out the length feed arm shaft ❸, remove the set collar ❹ and the length feed arm ❺.
3. Remove the four screws ❻ and the base needle plate ❼.



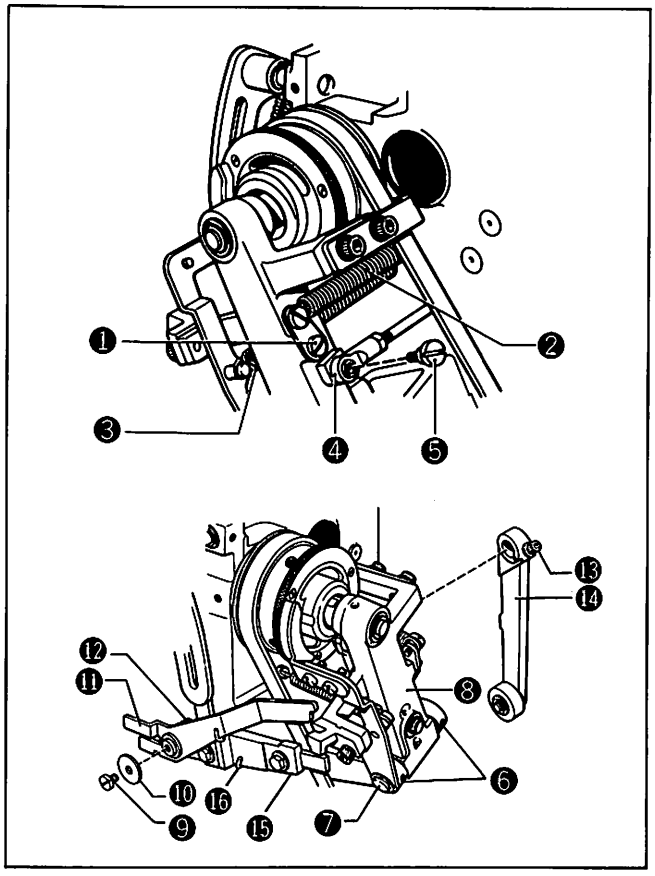
[8] Cutter safety device

1. Remove the stud screw ❶ and the screw ❷, and then remove cutter stop connecting rod ❸.
2. Loosen the two screws ❹, and remove the cutter stop lever assembly ❺.
3. Remove the screw ❻ and the main tension releasing plate ❼.
4. Remove the stud screw ❽ and the screw ❾, and then remove the tension releaser ❿.
5. Remove the stud screw ⓫ and the thread take-up lever ⓬.
6. Loosen the screw ⓭ and the thread tension ⓮.

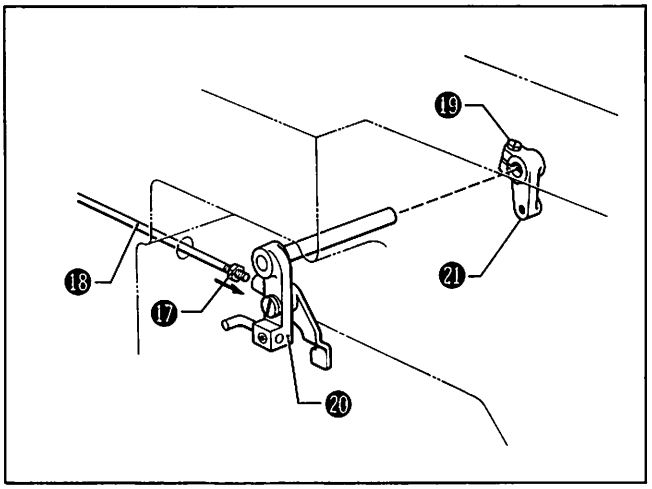


[9] Clutch and brake

1. Loosen the screw ❶, and remove the clutch spring ❷.
2. Remove the brake spring ❸.
3. Remove the stud screw ❺ on the ball joint ❹.
4. Loosen the two screws ❻, pull out the clutch lever shaft ❼, and remove the clutch lever assembly ❽.
5. Remove the screw ❾ and the washer ❿, and then remove the emergency stop lever ⓫ and the emergency stop lever spring ⓬.
6. Loosen the bolt ⓭, and remove the belt shift drive lever ⓮.
7. Remove the stop lever ⓯ and the stop lever spring ⓰ together.

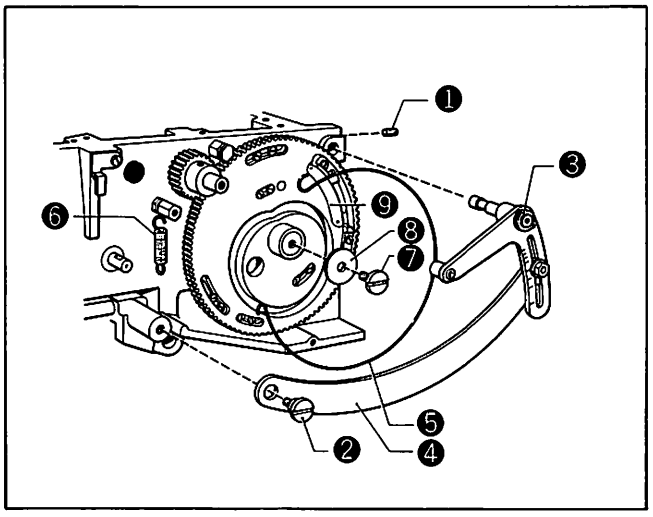


8. Loosen the nut ⑰, and turn the thread cutter connecting rod ⑱ and remove it.
9. Loosen the screw ⑲, and while pulling off the scissors push lever assembly ⑳, remove the thread take-up lever arm ㉑.



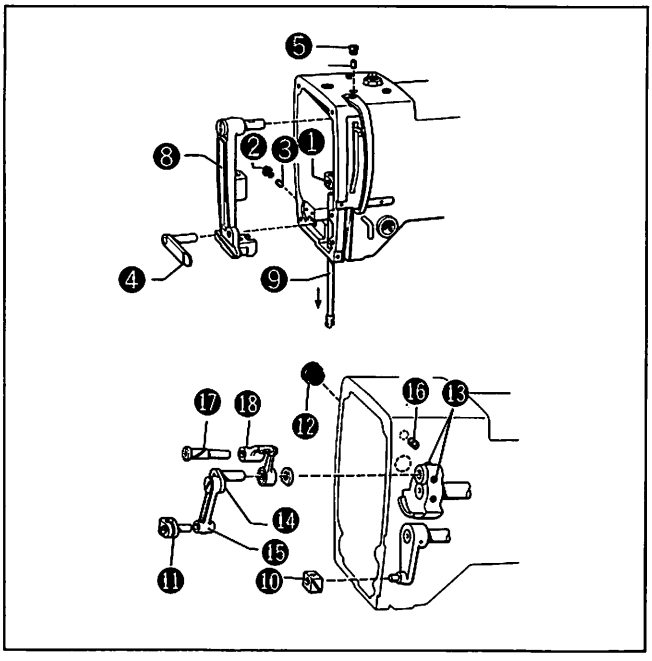
[10] Feed

1. Loosen the screw ❶.
2. Remove the stud screw ❷, and remove the feed reverse lever ❸ and the feed connecting rod ❹ together. Be careful not to drop the roller on the end of the feed reverse lever.
3. Remove the brake wire ❺ and the brake wire pull spring ❻ together.
4. Remove the screw ❼ (left-hand thread) and the washer ❽, and then remove the feed cam ❾.



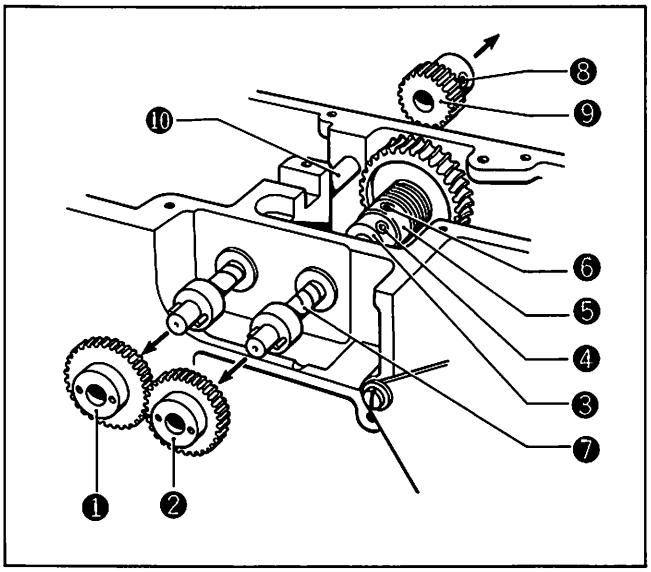
[11] Needle bar

1. Loosen the needle bar clamp screw ❶.
2. Remove the oil cap ❷, and then loosen the screw ❸ and remove the needle bar supporter guide ❹.
3. Remove the oil cap ❺, and then pull out the needle bar ❾ and remove the needle bar supporter ❽.
4. Slant the needle bar supporter ❽, and then pull out the needle bar ❾ and remove the needle bar supporter ❽.
5. Remove the slide block ❿ and the needle bar clmap ⓫.
6. Remove the oil cap ⓬, and then loosen the two screws ⓭ and remove the needle bar crank ⓮ with the needle crank rod ⓯ attached to it.
7. Loosen the screws ⓰, and remove the thread take-up lever stud ⓱ and the needle thread take-up ⓲.



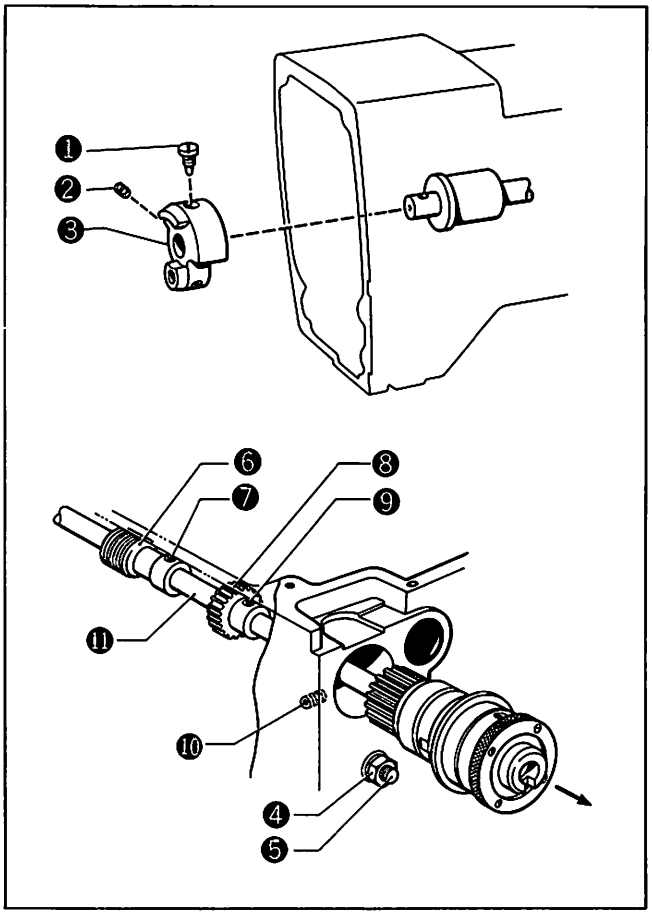
12 Cam relay

1. Remove the change gear L ❶ and the change gear R ❷.
2. Loosen the set collar ❸ screw ❹ and the collar ❺ screw ❻.
3. While pulling out the worm wheel shaft ❼, remove the set collar ❸ and the collar ❺.
4. Loosen the two screws ❽, remove the free wheel gear ❾, and pull out the change gear shaft ❿.



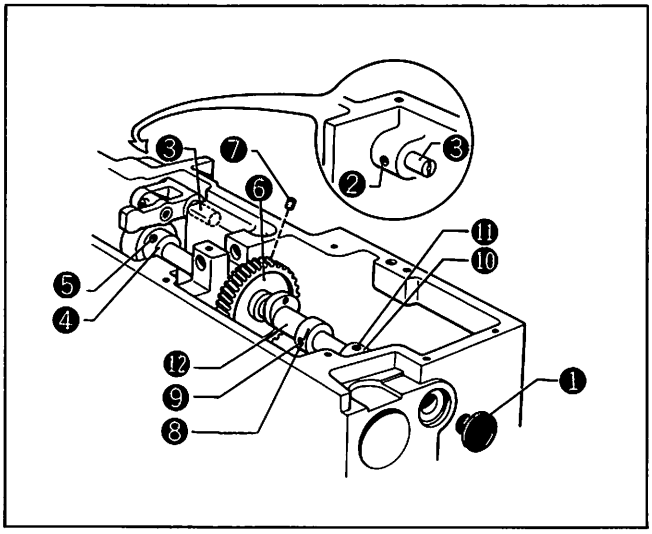
13 Upper shaft

1. Remove the screw ❶.
2. Loosen the screw ❷, and pull off the thread take-up crank ❸.
3. Loosen the nut ❹ (left-hand thread), turn the idler pulley arm ❺, and loosen the tension of the timing belt.
4. Loosen the two screws ❼ on the worm ❻.
5. Loosen the two screws ❾ on the reduction gear ❽.
6. Loosen the screws ❿, and while pulling out the upper shaft ⓫, remove the worm ❻ and the reduction gear ❽.



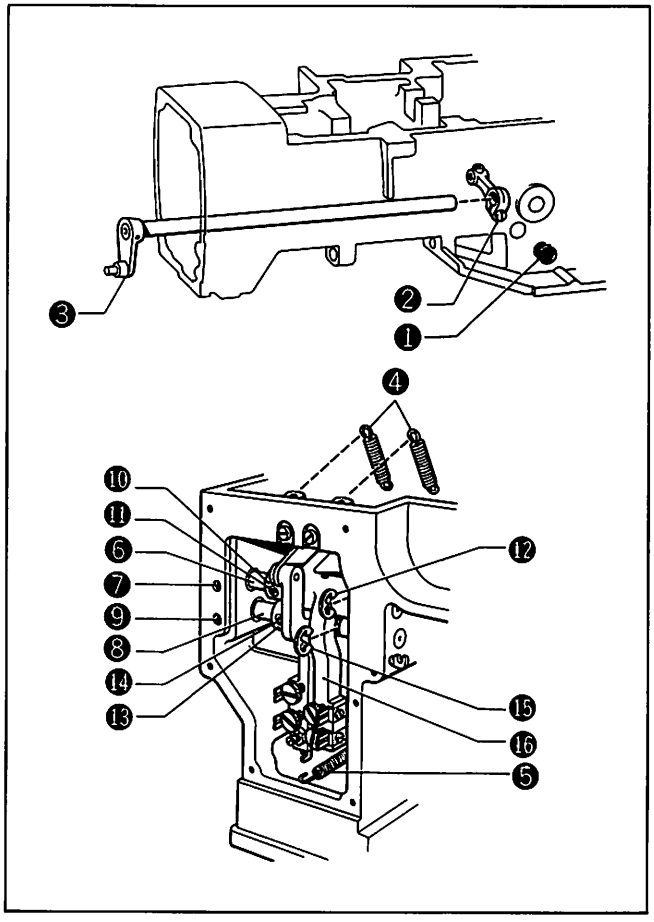
14 Auxiliary shaft

1. Remove the oil cap ❶.
2. Loosen the screw ❷, and remove the cutter driving lever shaft ❸.
3. Loosen the two screws ❺ on the cutter eccentric wheel ❹.
4. Loosen the two screws ❼ on the sub shaft gear ❻.
5. Loosen the two screws ❾ on the needle zigzag cam ❽.
6. Loosen the two screws ⓫ on the set collar ⓾.
7. While pulling out the sub shaft ⓬, remove the cutter eccentric wheel ❹ with the cutter driving lever ⓬ as a set, and then remove the auxiliary shaft gear ❻ and the needle zigzag cam ❽.



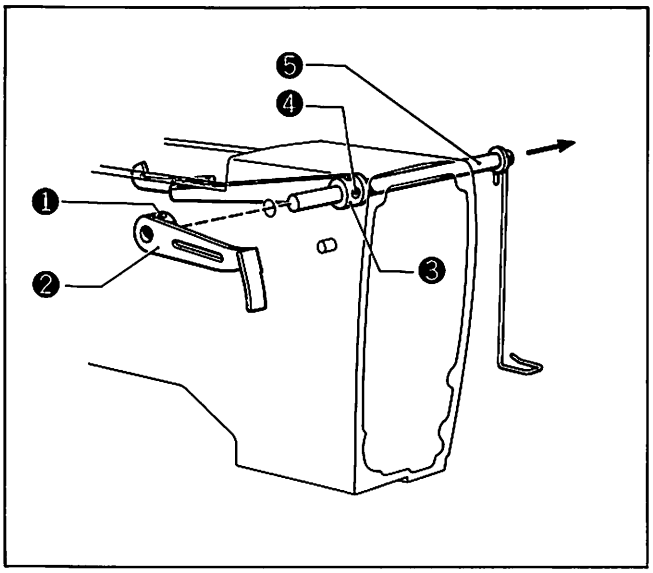
15 Needle zigzag

1. Remove the oil cap ❶, and the loosen the screw ❷ on the needle zigzag lever R and the pull out the needle zigzag F assembly ❸.
2. Remove the needle zigzag spring A ❹.
3. Remove the needle zigzag spring B ❺.
4. Loosen the screw ❼ on the reference arm shaft A ❻ and the screw ❾ on the reference arm shaft B ❽.
5. Loosen the screw ⓫ on the set collar ⓾, and then slightly pull out the reference arm shaft A ❻ toward the surface plate and remove the stop ring ⓬.
6. Loosen the screws ⓮ on the set collar ⓭, and then slightly pull out the reference arm shaft B ❽ and remove the stop ring ⓯.
7. Remove the reference arm shaft A ❻ and the reference arm sahft B ❽ while turning them toward the rear of the arm, and the remove the needle zigzag ⓰.



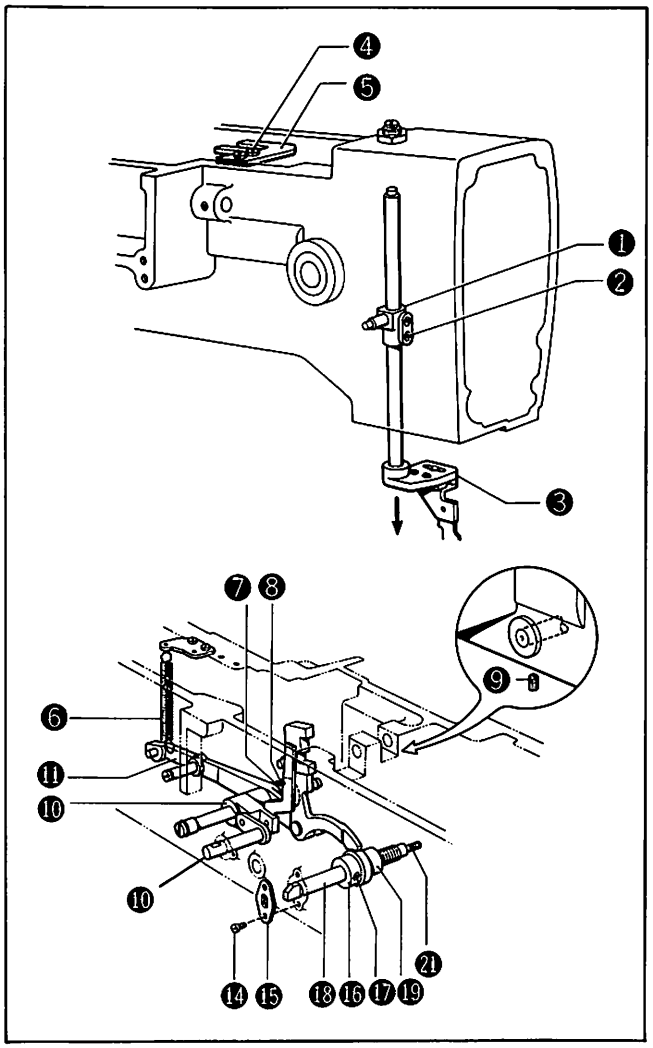
16 Needle breakage detection

1. Loosen the two screws ❶, and remove the thread breakage detection lever ❷.
2. Loosen the two screws ❹ on the cutter clutch stopper ❸ (loosen one of the screws from the top of the arm), and while pulling out the thread breakage detection lever shaft ❺, remove the cutter clutch stopper ❸.



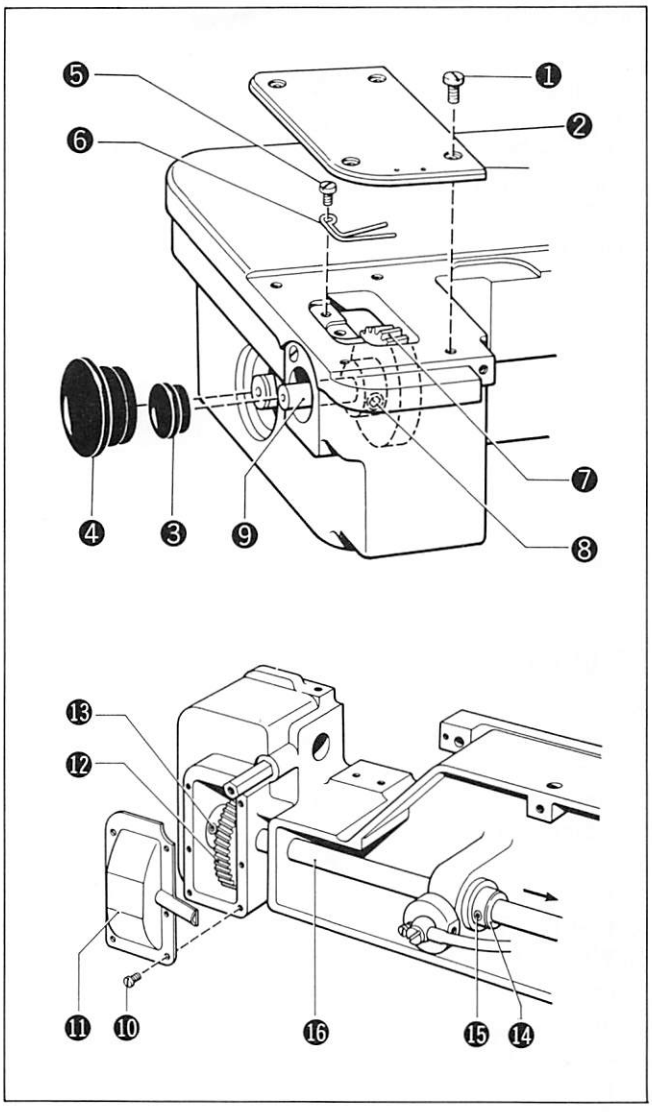
17 Cutter

1. Loosen the two screws ❷ on the cutter operation shaft holder ❶, and pull out the cutter operation shaft from the bottom.
2. Remove the two screws ❹, and remove the cutter clutch guide ❺.
3. Remove the cutter return spring ❻.
4. Loosen the two screws ❽ on the set collar ❼.
5. Loosen the screw ❾.
6. While pulling out the cutter operation arm shaft ❿, remove the cutter operation arm shaft assembly ⓫, the cutter stop lever plate mounting ⓬, and the cutter stop lever shaft ⓭.
7. Remove the two screws ⓮ and the cutter clutch shaft guide ⓯.
8. Loosen the two screws ⓱ on the cutter clutch set collar ⓰, and while pulling out the cutter presser bar ⓲, remove the cutter clutch collar ⓳, the cutter clutch set collar ⓰, the collar presser spring ⓴, and the cutter clutch presser bar ㉑.



[18] Lower shaft and rotary hook shaft

1. Remove the four screws ❶ and the material plate ❷.
2. Remove the rotary hook blind cover ❸ and lower shaft blind cover ❹.
4. Loosen the two screws ❽ on the rotating hook shaft gear ❼, and while pulling out the rotating hook shaft ❾, remove the rotary hook shaft gear ❼.
5. Lay the machine down to the left side.
6. Remove the six screws ❿ and the gear case cover ⓫.
7. Loosen the two screws ⓭ on the lower shaft gear ⓬ and the two screws ⓯ on the set collar ⓮.
8. With the timing gear connected pull the lower shaft ⓰ out from the back of the arm.
9. Remove the timing belt.

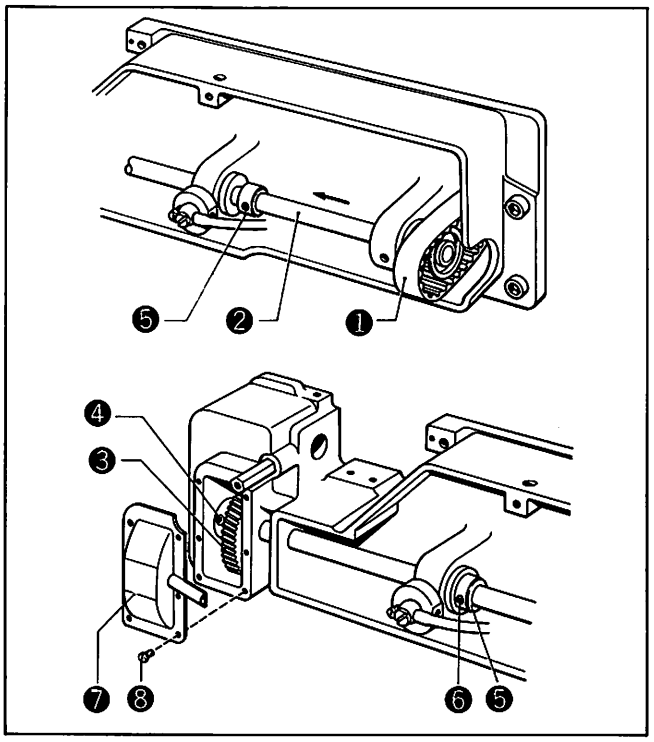


ASSEMBLY PROCEDURES

[1] Lower shaft

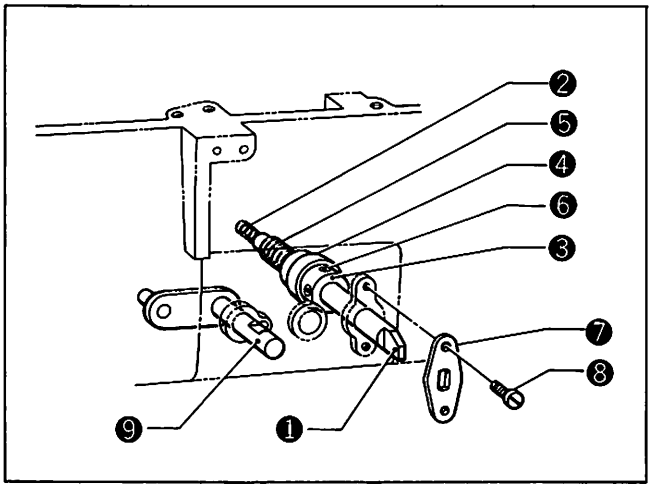
1. Insert the timing belt ❶ from the top of the arm.
2. Pass the lower shaft ❷ through the timing belt and insert it in the bushing.
3. Attach the lower shaft gear ❸ to the end of the lower shaft ❷, and make the end of the lower shaft ❷ even with the end of the lower shaft gear ❸. Of the two screws ❹ on the lower shaft gear, attach the one that is forward with respect to the direction of rotation so that it is against the screw stop.
4. Adjust the lower shaft ❷ with the set collar ❺ so that there is no play in the direction of the thrust. Of the two screws ❻, attach the one that is forward with respect to the direction of rotation so that it is against the screw stop.
5. Attach the gear case cover ❼ with the six screws ❽.

* Apply a sealant to the gear case cover to prevent the oil from leaking.

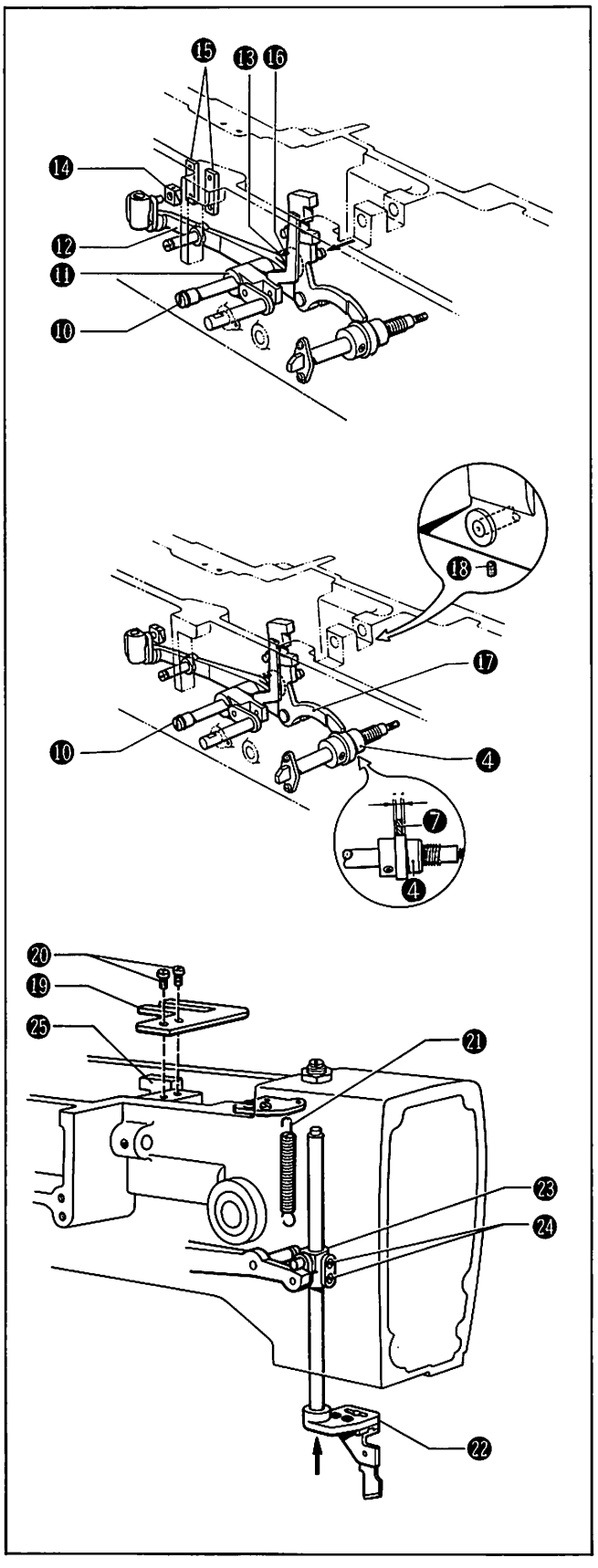


[2] Cutter

1. Insert the cutter clutch bar push spring ❷ in the end of cutter push bar ❶ and pass this through the side of the arm. Then attach the cutter clutch set collar ❸, the cutter clutch collar ❹, and the collar push spring ❺ in that order.
2. Place the side of the cutter clutch set collar ❸ against the stepped portion of the cutter push bar ❶, and of the two screws ❻ tighten one so that it is against the screw stop.
3. Turn the beveled portion of the cutter push bar ❶ up, and attach the cutter clutch shaft guide ❼ to the side of the arm with the two screws ❽.
4. Insert the cutter stop lever shaft ❾ into its hole from inside the arm.

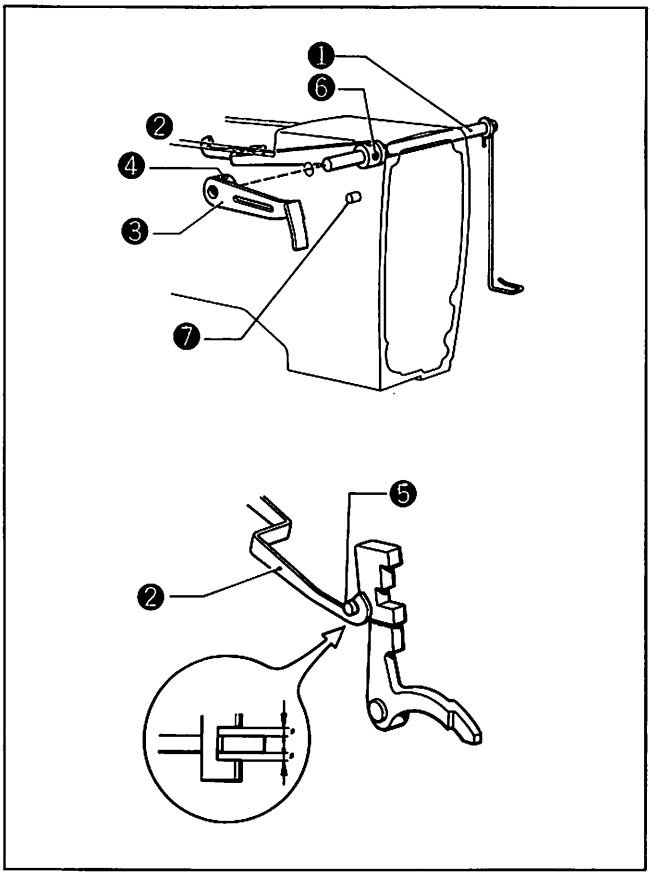


5. Pass the cutter operating arm shaft ⑩ through the side of the arm, and attach the cutter stop lever plate mounting ⑪, the cutter operating arm assembly ⑫, and the set collar ⑬ in that order. When doing this, place the cutter guide slide block ⑭ on the end of the cutter operating arm assembly ⑫ in the cutter bar guide ⑮.
6. Turn the set collar ⑬ in the direction of the arrow, and of the two screws ⑯ tighten one so that it is agianst the screw stop so that there is no play in the cutter operating arm shaft ⑩ in the direction of the thrust.
7. Adjust the cutter operating arm shaft ⑩ so that the C clutch ⑰ comes to a position in the center of the cutter clutch collar ④, and then tighten the screw ⑱.
8. Attach the cutter clutch guide ⑲ to the arm with the two screws ⑳. At this time, move the end of the cutter operating arm shaft assembly ⑫ and confirm that the C clutch ㉕ moves smoothly.
9 Connect the cutter return spring ㉑.
10. Insert the cutter operating shaft ㉒ from the bottom of the arm, and pass it through the cutter operating shaft holder ㉓ on the end of the cutter operating arm shaft assembly ⑫. Then tighten the two screws ㉔ so that they are against the screw stop.



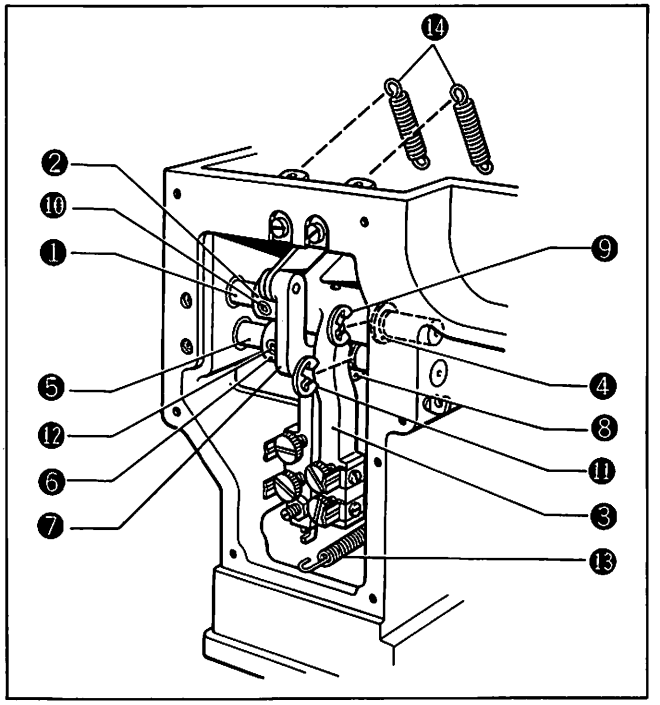
3 Thread breakage detection

1. Insert the thread breakage detection lever shaft ❶ through the side of the arm, and attach the cutter clutch stop ❷.
2. Fix the thread breakage detection lever ❸ on the end of the thread breakage detection lever shaft ❶, and tighten the two screws ❹ so that there is no play in the thread breakage detection shaft ❶ in the direction of the thrust.
3. When the thread breakage detection lever ❸ is against the stopper ❼, fix the position of the hook on the end of the cutter clutch stopper ❷ so that it is in the groove on the cutter stop pin ❺, and then tighten the two screws ❻ (tighten one from the top of the arm).

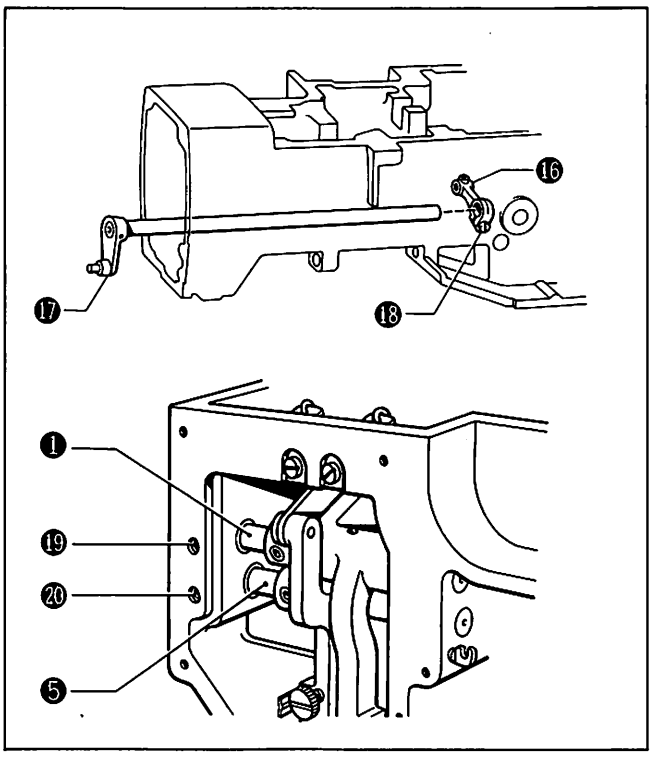


4 Needle zigzag

1. Insert the adjusting arm shaft B ❶ through the back of the arm, and pass it through the set collar ❷, the adjusting arm ❸, and the washer ❹ in that order.
2. Insert the adjusting arm shaft A ❺ through the back of the arm, and pass it through the set collar ❻, the needle zigzag regulator arm ❼, and the washer ❽ in that order.
3. Fix the snap ring ❾ on the adjusting arm shaft B ❶, and adjust the set collar ❷ so that there is no play in the adjusting position regulator arm ❸ in the direction of the thrust. Then tighten one of the two screws ❿ against the screw stop.
4. Fix the snap ring ⓫ on the adjusting arm shaft A ❺, and adjust the set collar ❻ so that there is no play in the reference position regulator arm ❼ in the direction of the thrust and then tighten one of the two screws ⓬ against the screw stop.
5. Connect the needle zigzag spring B ⓭ and the needle zigzag spring A ⓮.

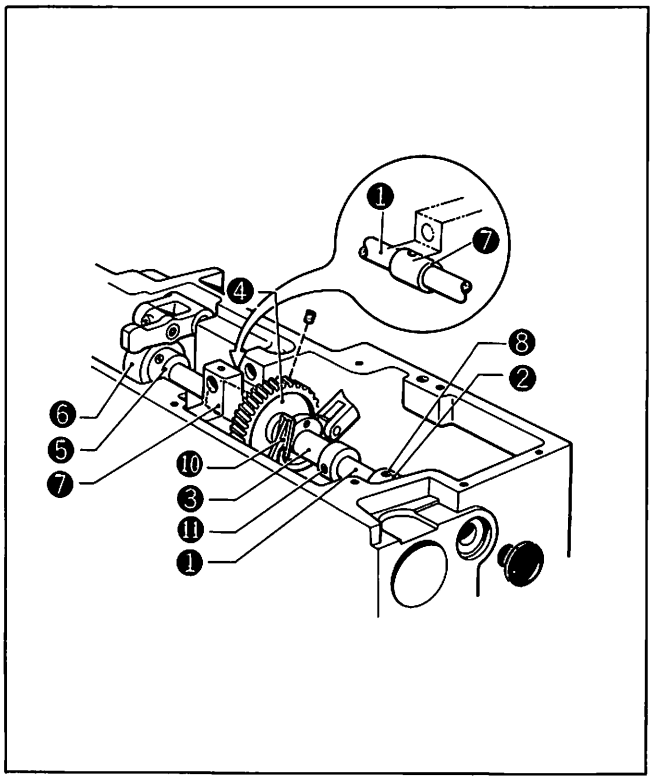


6. Confirm that the pin on the cutter stop lever shaft enters the groove on the cutter stop lever plate mounting.
7. Insert the needle zigzag lever F ⑰ from the face plate side, and attach the end to the needle zigzag lever R ⑯. By moving the adjusting arm shaft B ① and the adjusting arm shaft A ⑤, fix the position of needle zigzag lever R ⑯ so that there is no play in the needle zigzag lever F ⑰ in the direction of the thrust, and then tighten the screw ⑱.
8. Tighten the screw ⑲ on the reference arm shaft B ① and the screw ⑳ on the reference arm shaft A ⑤.

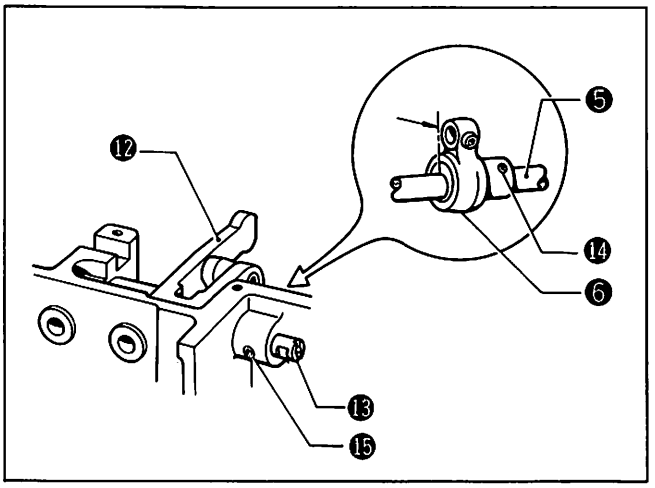


[5] Auxiliary shaft

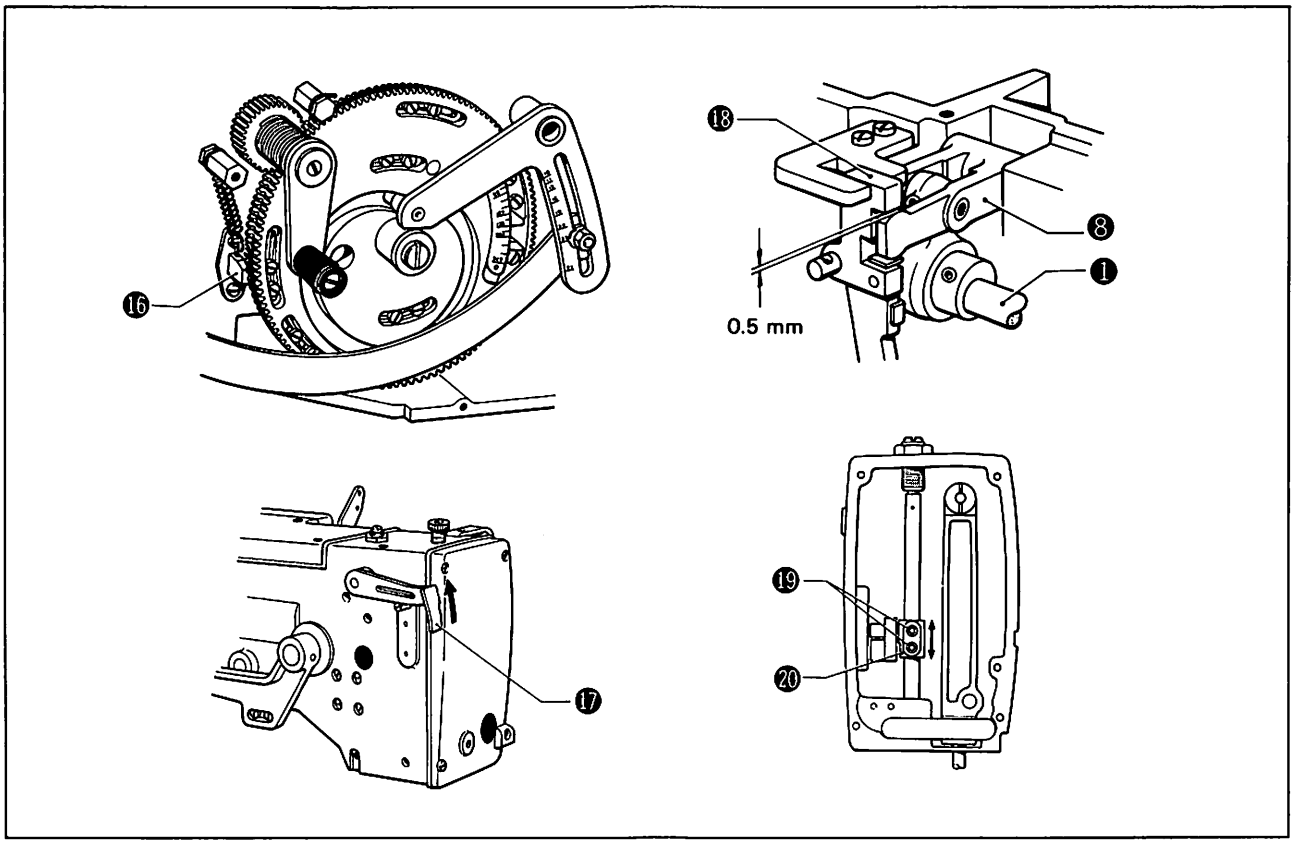
1. Insert the auxiliary shaft ① from the rear of the arm, and attach the set collar ②, the needle zigzag cam ③, the auxiliary shaft gear ④, and the cutter eccentric wheel ⑤ (in this case, attach with the cutter eccentric rod ⑥ as a set.)
2. Move the auxiliary shaft ① so that the oil hole on the auxiliary shaft bushing M ⑦ and the oil hole on the auxiliary shaft ① match up, and then set the collar ② against the arm, and of the two screws ⑧ tighten the one that is forward with respect to the direction of rotation so that it is against the screw stop.
3. Adjust the auxiliary shaft gear ④ so that there is no play in the auxiliary shaft ① in the direction of the thrust, and then of the two screws tighten the one that is forward with respect to the direction of rotation so that it is against the screw stop.
4. Adjust the needle zigzag cam ③ so that it comes to a position in the center of the needle zigzag forked link ⑩, and then of the two screws ⑪ temporarily tighten the one that is forward with respect to the direction of rotation so that it is against the screw stop.



5. Attach the cutter drive lever ⑫ to the arm by means of the cutter drive lever shaft ⑬.
6. Match up the ends of the cutter eccentric wheel rod ⑥ and the cutter eccentric wheel ⑤, and then of the two screws ⑭ tighten the one that is forward with respect to the direction of rotation so that it is against the screw stop.
7. Attach the cutter dirve lever shaft ⑬ using the screw ⑮ from the outside of the arm.

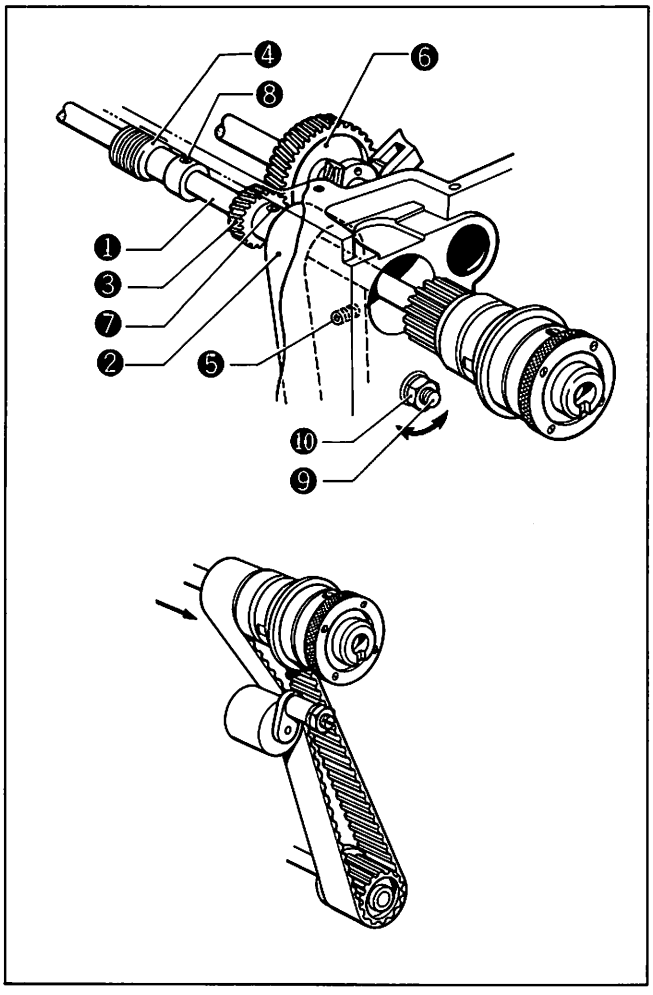


8. Push the cutter push bar ⑯ and raise the thread breakage detection lever ⑰. Turn the auxiliary shaft ❶ so that the C clutch ⑱ meshes with cutter dirve lever ❽, and when the cutter dirve lever ❽ is at the lowest position, loosen the two screws ⑲ and move the cutter operating holder ⑳ up and down to adjust the position of the C clutch ⑱ so that the space between the C clutch ⑱ and the cutter drive lever ❽ is 0.5 mm.



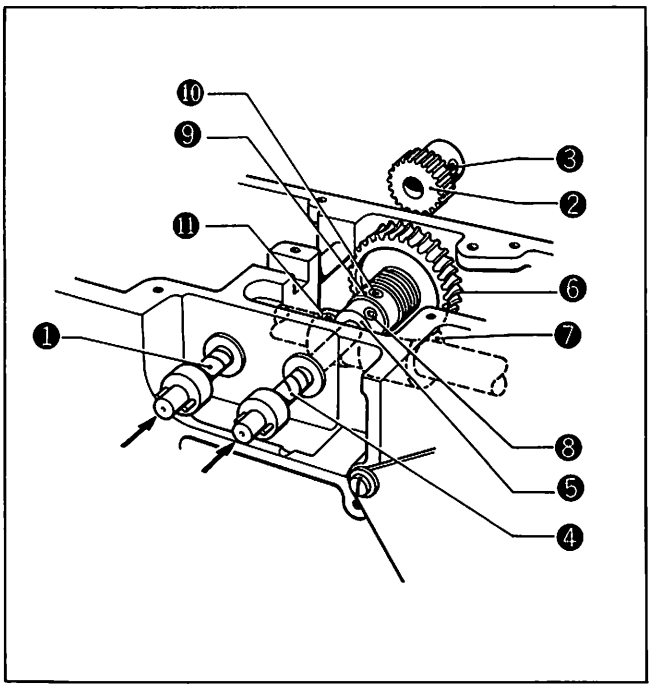
6 Upper shaft

1. Insert the upper shaft ❶ from the rear of the arm, and after passing it through the timing belt ❷, attach the reduction gear ❸ and worm ❹.
2. To put the timing belt ❷ on the timing pulley, push the timing belt ❷ from the side onto the pulley while turning the upper shaft ❶. Insert the screw stop on the bearing case so that it comes to the left when looking from the rear of the arm.
3. Tighten the bearing case screw ❺.
4. Mesh the reduction gear ❸ with the auxiliary shaft gear ❻, and of the two screws ❼ tighten the one that is forward with respect to the direction of rotation so that it is against the screw stop.
5. Of the two screws ❽ on the worm ❹ temporarily tighten the one that is forward with respect to the direction of rotation.
6. Increase the tension of the timing belt so that there is 10 kg/cm torque on the idler pulley arm shaft ❾. If the torque is too strong or too weak at this time, the noise will increase.



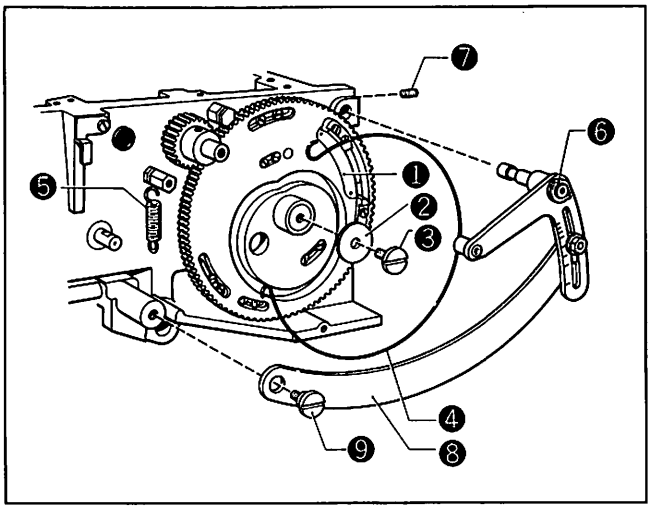
[7] Cam relay

1. Insert the change gear shaft ❶ from the side of the arm, and connect the free-wheel gear ❷ to the end. Of the two screws ❸ tighten the one that is forward with respect to the direction of rotation against the screw stop so that there is no play in the change gear shaft ❶ in the direction of the thrust.
2. Insert the worm wheel shaft ❹ from the side of the arm, and attach the set collar ❺ and the worm wheel ❼ to the end. Attach the worm wheel ❻ after meshing it with the worm ❼.
3. Of the two screws ❽ on the set collar ❺ tighten the one that is forward with respect to the direction of rotation against the screw stop so that there is no play in the worm wheel shaft ❹ in the direction of the thrust.
4. Set the worm wheel ❻ against the inside surface of the arm, and of the two screws ❿ on the one-way clutch collar ❾ tighten the one that is forward with respect to the direction of rotation against the screw stop.
5. Of the two screws ⓫ on the worm ❼ tighten the one that is forward with respect to the direction of rotation against the screw stop.
6. Turn the pulley and confirm whether the arm shaft turns smoothly or not.



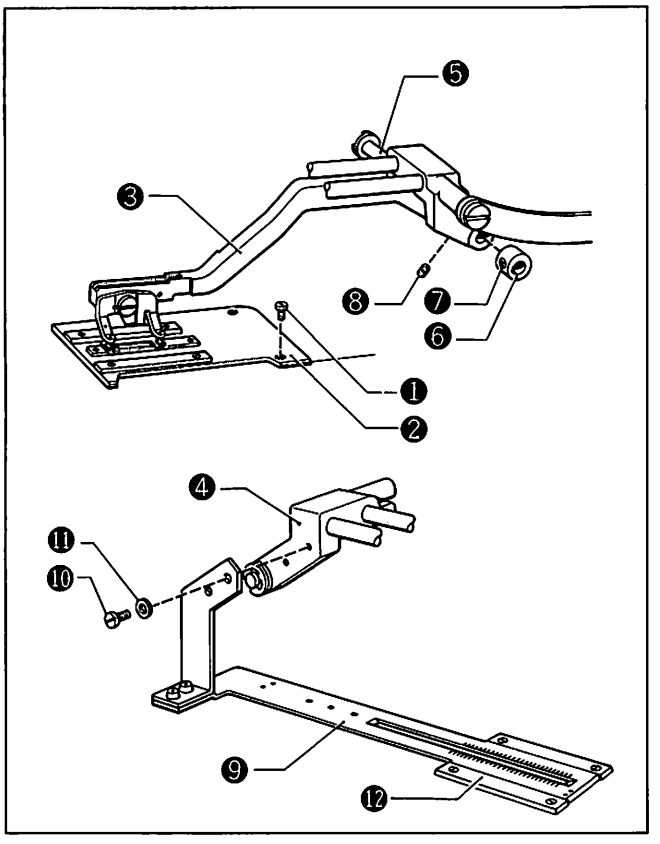
[8] Feed

1. Temporarily tighten the feed cam ❶ in place with the washer ❷ and the screw ❸ (left-hand thread).
2. Attach the brake wire ❹ and the brake wire spring ❺.
3. Insert the roller on the end of the feed reverse lever ❻ into the groove on the feed cam ❶, and insert the feed reverse lever shaft in the side of the arm, and then tighten the screw ❼.
4. Connect the feed connecting rod ❽ to the feed arm pivot point with the stud screw ❾.



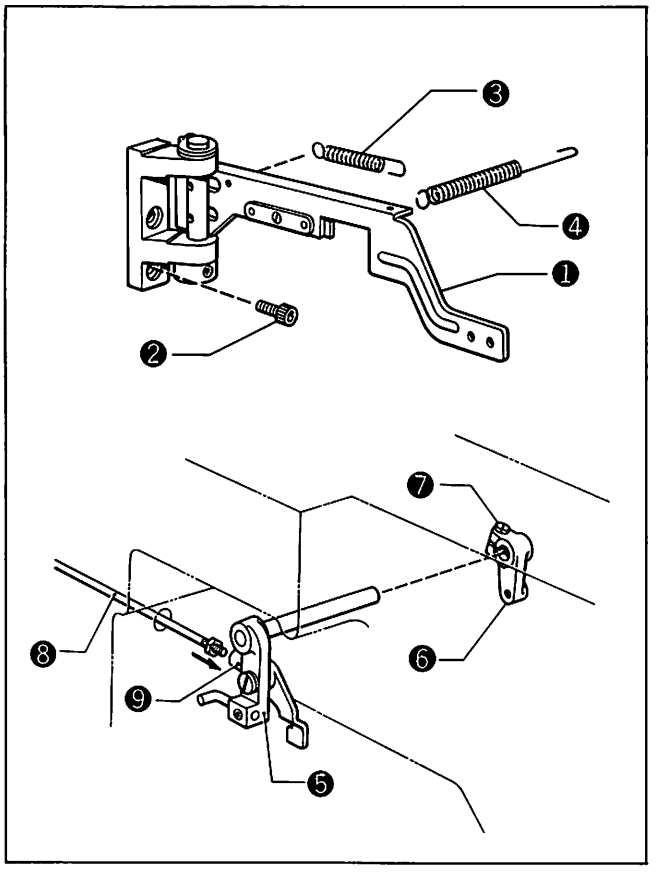
[9] Upper clamping foot

1. Temporarily tighten the base needle plate ❷ in place with the four screws ❶.
2. Insert the length feed drive shaft arm ❸ in the feed drive shaft arm pivot point ❹, and attach with the length feed drive shaft arm shaft ❺.
3. Adjust the set collar ❻ so that there is no play in the length feed drive shaft arm shaft ❺ in the direction of thrust, and tighten the screw ❼.
4. Temporarily tighten the length feed drive shaft arm ❸ with the screw ❽.
5. Insert the length feed plate ❾ in the length feed plate guide ⓬, and attach it to the feed drive shaft arm pivot point ❹ with the two screws ❿ and the washers ⓫.



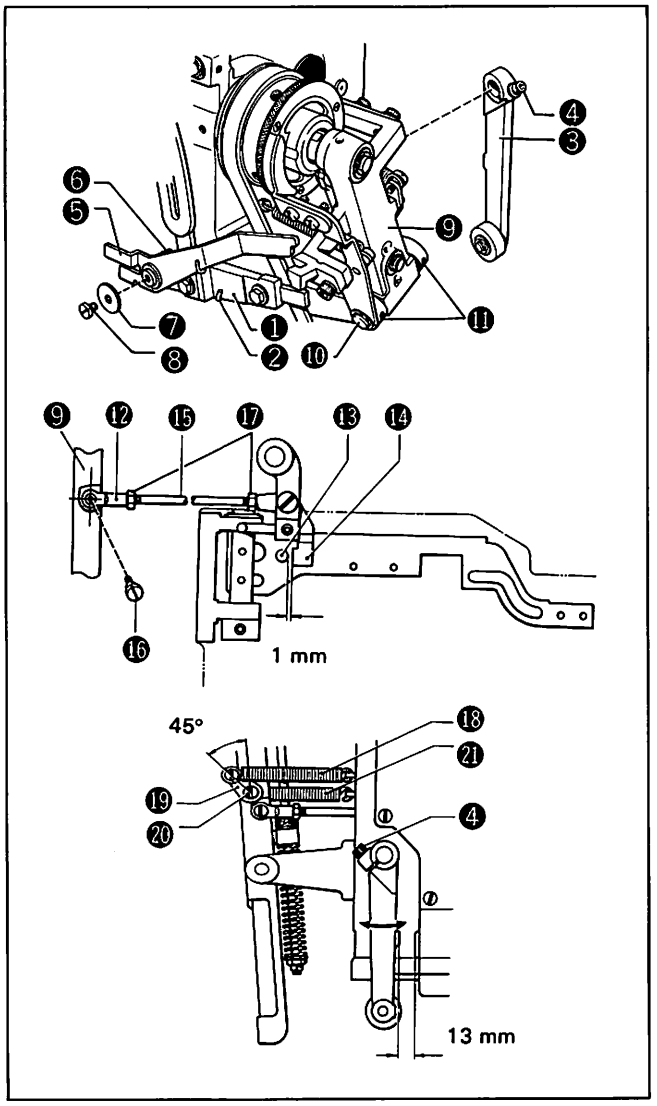
[10] Upper thread cutter

1. Attach the upper thread cutter lever ❶ with the two bolts ❷.
2. Attach the scissors return spring ❸ and the scissors operating spring ❹.
3. Insert the scissors push lever assembly ❺ from the side of the arm, and attach the thread take-up lever arm ❻ to the end. Adjust the scissors push lever assembly ❺ so that there is no play in the direction of the thrust, and temporarily tighten the screw ❼ on the thread take-up lever arm ❻.
4. Insert the upper thread cutter connecting rod ❽ from the rear of the arm and connect it to the upper thread cutter connecting rod suppoort ❾.



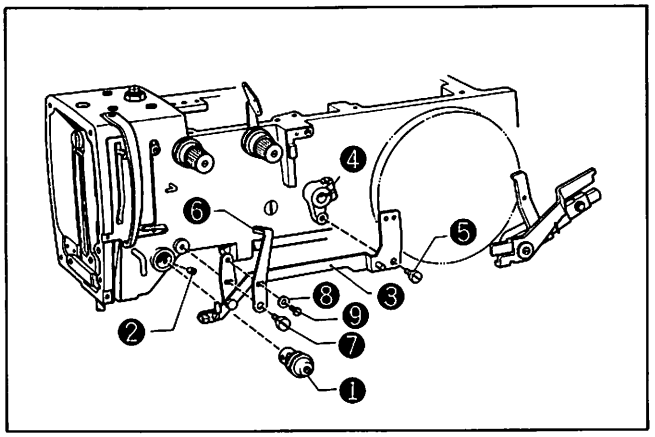
11 Clutch and brake

1. Fix the stop lever spring ❷ on the stop lever ❶ and insert this from the side of the arm. Attach the belt shift drive lever ❸ to the end and temporarily tighten the bolt ❹ so that there is no play in the direction of the thrust.
2. Fix the emergency stop lever spring ❻ on the emergency stop lever ❺, and attach this to the stop lever ❶ with the washer ❼ and screw ❽.
3. Attach the clutch lever assembly ❾ with the clutch lever shaft ❿ and tighten the two screws ⓫.
4. Insert the clutch stopper in the stopper cam groove (in the stop condition).
5. When the center of the hole of the ball joint ⓬ and the center of the attachment hole of the clutch lever ❾ are lined up, adjust the length of the upper thread cutter connecting rod ⓯ so that the space between the upper thread cutter lever pin ⓭ and upper thread cutter connecting rod support ⓮ is 1 mm, and then after tightening the stud screw ⓰, tighten the nut ⓱.
6. Attach the clutch spring ⓲, and adjust the spring adjustment plate ⓳ so that its angle is approximately 45°, and then tighten the screw ⓴.
7. Attach the brake spring ㉑.
8. Engage the clutch and start the machine. Adjust the space between the stopper on the clutch and the arm so that it is 13 mm, and then tighten the bolt ❹.

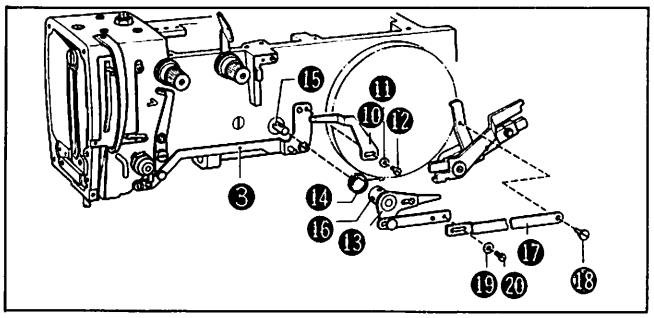


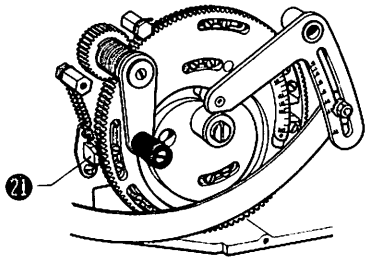
12 Cutter safety device

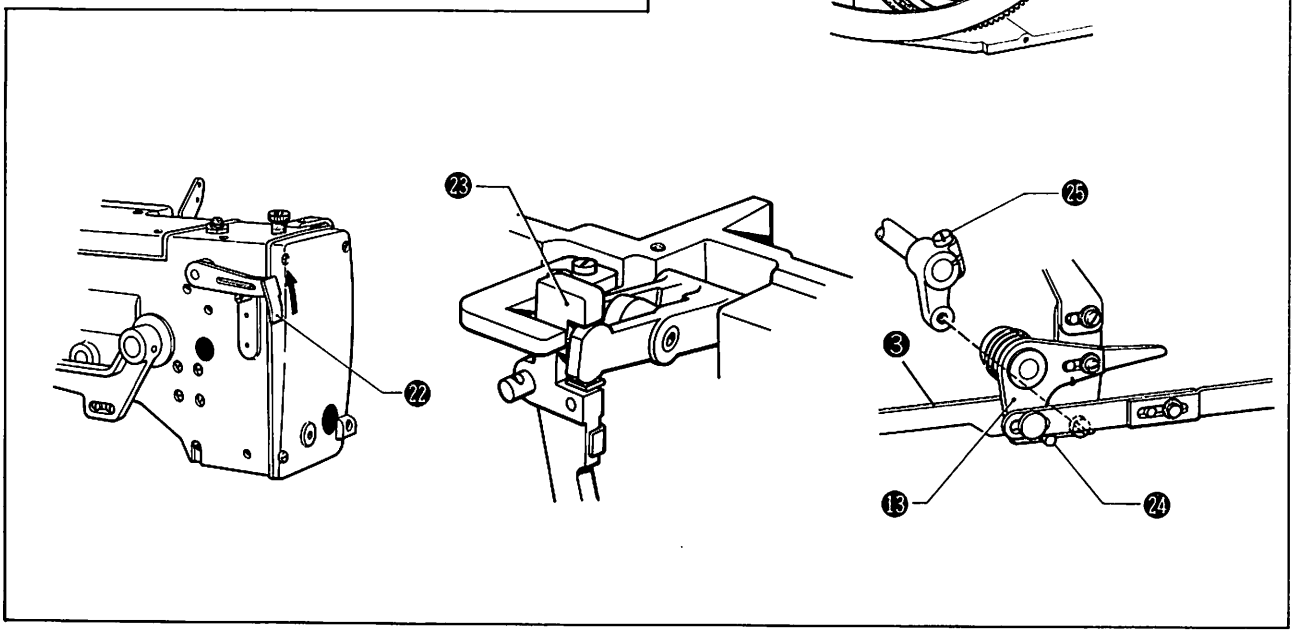
1. Attach the thread tension bracket ❶ to the arm, and tighten the screw ❷.
2. Attach the thread take-up lever ❸ to the thread take-up lever arm ❹ with the stud screw ❺.
3. Attach the tension releaser ❻ with the stud screw ❼ and the washer ❽ and screw ❾.



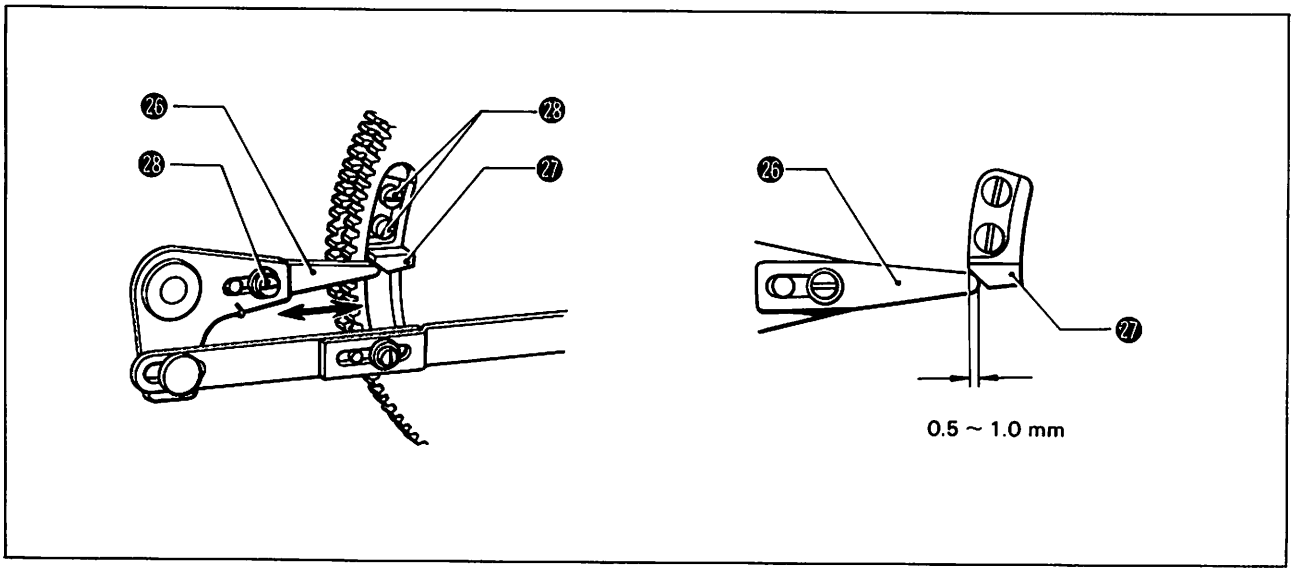
4. Attach the main tension releasing plate ⑩ to the thread take-up lever ③ with the washer ⑪ and screw ⑫.
5. Insert the cutter stop lever spring ⑭ in the cutter stop lever assembly ⑬, and attach this to the cutter stop lever shaft ⑮. Tighten the upper of the two screws ⑯ against the screw stop.
6. Attach the cutter stop connecting rod L ⑰ with the stud screw ⑱ and the washer ⑲ and screw ⑳. Only temporarily tighten the screw ⑳.
7. Engage the clutch and put the machine in the low speed condition. Push the cutter push bar ㉑ and raise the thread breakage detection lever ㉒. Turn the pulley until the C clutch ㉓ is in the upper most position.
8. Loosen the screw ㉕ and adjust the thread take-up lever ③ so that the thread take-up lever link pin ㉔ comes against the cutter stop lever assembly ⑬.



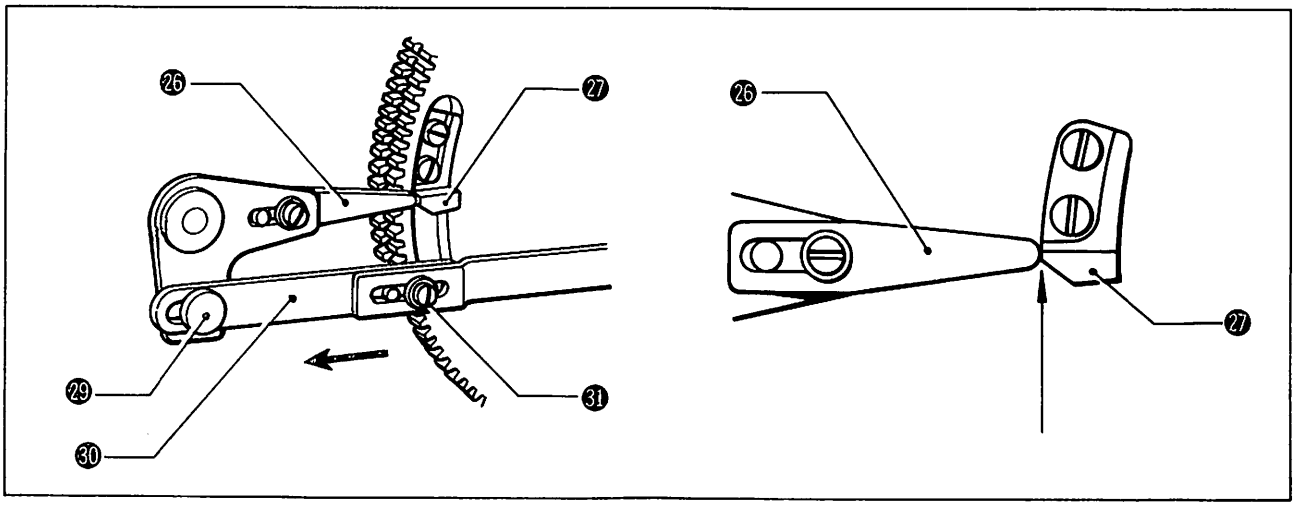




9. Insert the clutch stopper in the stopper cam groove (stopped condition), and then turn the handle and loosen the screw ㉘ and adjust the cutter release contact shoe ㉖ so that it overlaps the stop cam tab A ㉗ 0.5~1.0 mm.

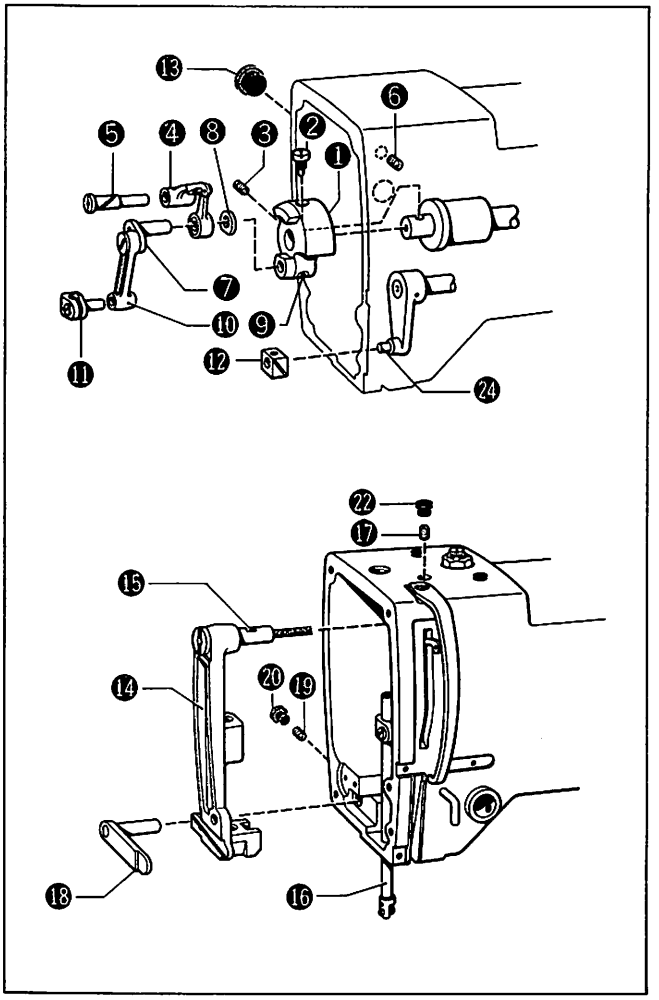


10. Slightly turn the handle so that the end of the cutter release contact shoe ㉖ and the end of the stop cam tab A ㉗ are lined up, and then engage the clutch and run the machine at high-speed. Loosen the screw ㉛ and adjust the cutter stop connecting rod S ㉚ so that the right side of its oblong hole is against the cutter stop connecting rod self-locking pin ㉙.

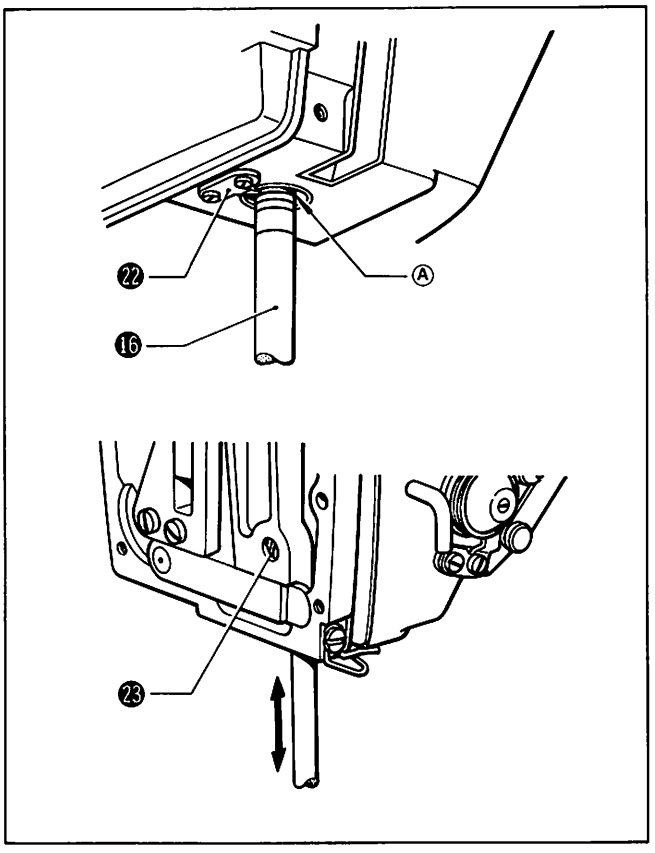


[13] Needle bar

1. Place the thread take-up crank ❶ on the arm shaft, and attach it in palce with the screw ❷ and the screw ❸.
2. Attach the needle thread take-up ❹ with the needle thread take-up lever link hinge pin ❺, and tighten the screw ❻.
3. Place the washer ❽ on the needle bar crank ❼, and insert the thread take-up crank ❶. Of the two screws ❾ tighten the one that is forward with respect to the direction of rotation against the needle stop.
4. Insert the needle bar clamp ⓫ in the needle bar crank rod ❿.
5. Insert the needle zigzag lever F ㉔ in the needle bar frame slide block ⓬.
6. Attach the rubber stopper ⓭.
7. Insert the needle bar frame support shaft ⓯ in the needle bar frame ⓮, and fix the bottom groove of the needle bar frame ⓮ on the needle bar frame slide block. When inserting the needle bar frame support shaft ⓯, first pass a string through the frame, and then attach the shaft.
8. After inserting the needle ⓰ from the bottom of the arm, tighten the screw ⓱ so that there is no play in the needle bar frame ⓮ in the direction of the thrust.
9. Insert the needle bar frame guide ⓲ in the arm, and tighten the screw ⓳ so that there is no play in the direction of the thrust.
10. Attach the rubber plugs ⓴, ㉒.

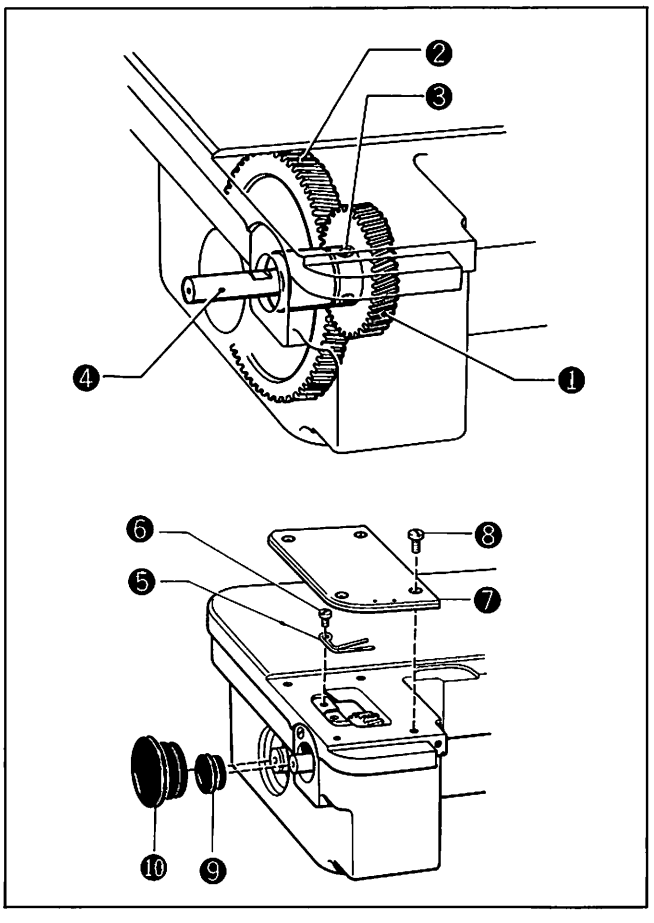


11. Turn the pulley so that the needle bar ⑯ is at the lowest possible position, and adjust the needle bar ⑯ up and down so that the second needle position Ⓐ from the bottom on the needle bar ⑯ is lined up with the needle bar index ㉒, and then tighten the needle bar clamp screw ㉓.



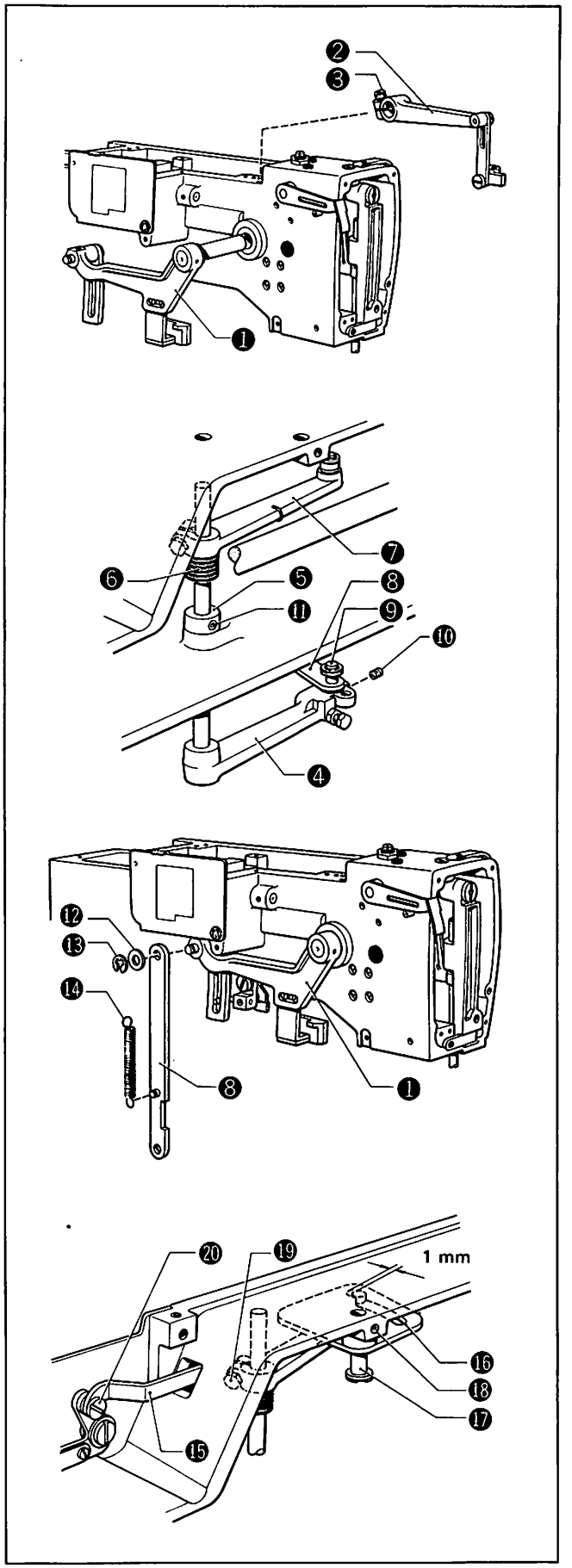
⑭ Rotary hook shaft

1. Insert the clutch stopper in the stop cam groove (stopped condition).
2. Place the rotary hook shaft gear ❶ in the bed and mesh it with the lower shaft gear ❷. Attach the rotary hook shaft gear so that of the two screws ❸ on the gear the one that is forward with respect to the direction of rotation is pointing straight up.
3. Point the screw stop of the rotary hook shaft ❹ straight up and insert it in the bed. Match up the end of the rotary hook shaft ❹ with the rotary hook shaft bushing, and tighten the screw ❸.
4. Attach the rotary hook shaft oil supply guide ❺ with the screw ❻.
5. Attach the material plate ❼ with the four screws ❽.
6. Attach the rubber stoppers ❾, ❿.

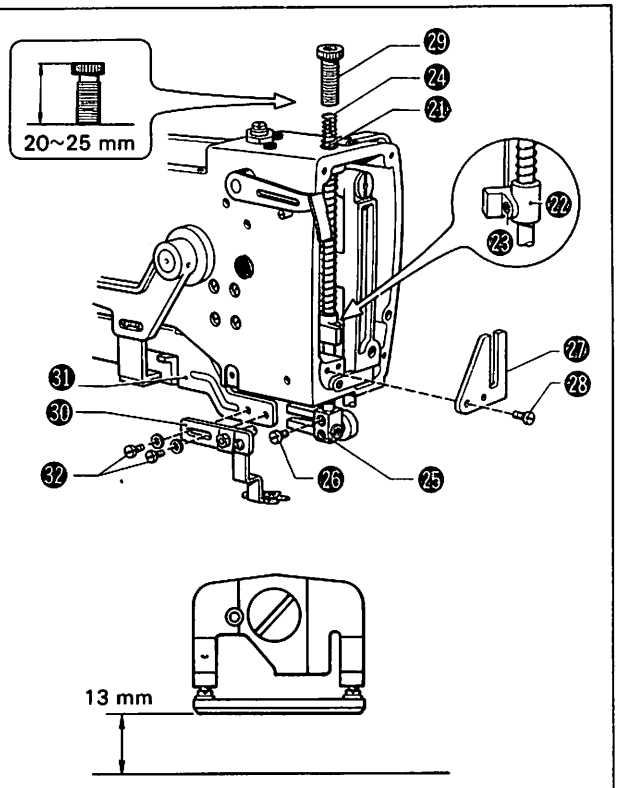


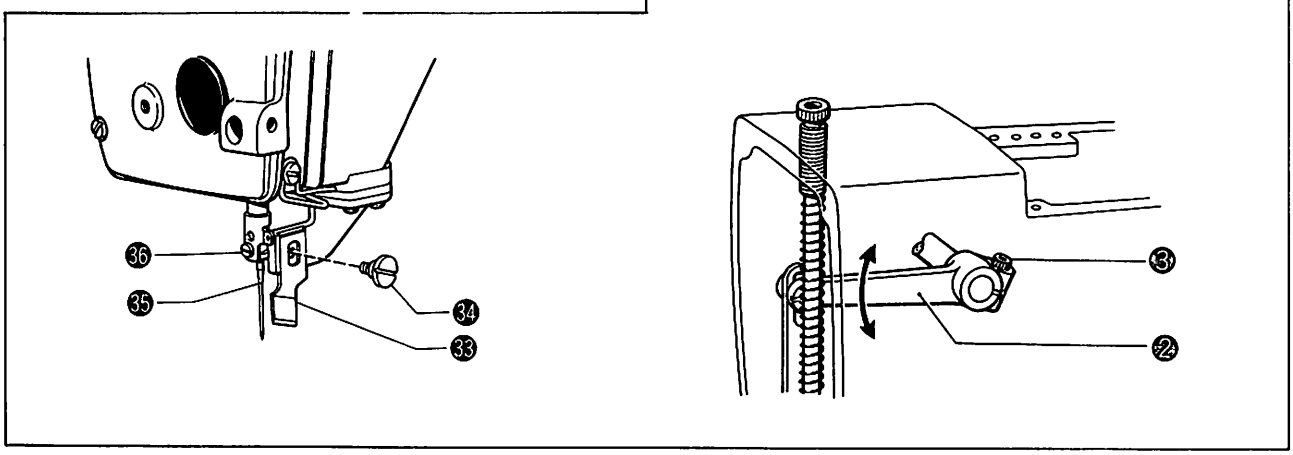
15 Upper clamping foot and lower thread cutter

1. Insert the knee lifter lifting lever ❶ from the back of the arm, and attach the knee lifter lifting lever arm ❷. Adjust the knee lifter lifting lever ❶ so that there is no play in the direction of the thrust and temporarily tighten the bolt ❸.
2. Insert the lower thread cutter lever ❹ from the side of the bed, and attach the set collar ❺, looper thread take-up lever spring ❻, and the looper thread take-up lever ❼ in that order.
3. Face the notched part of the presser foot connecting rod ❽ toward the surface plate and pass it through the hole in the bed. Attach the lower end to the lower thread cutter lever ❹ by means of the lower thread cutter lever pin ❾, and tighten the screw ❿.
4. Adjust the set collar ❺ so that there is no play in the lower thread cutter lever in the direction of the thrust, and tighten the screw ⓫.
5. Connect the upper end of the presser foot connecting rod ❽ to the knee lifter lifting lever ❶, and attach the washer ⓬ and the snap ring ⓭.
6. Connect the spring ⓮.
7. Pass the end of the lower thread cutter link ⓯ through the hole in the bed, and attach the lower thread cutter cam ⓰ by means of the cam shaft ⓱.
8. Tighten the screw ⓲ so that there is no play in the lower thread cutter cam ⓰ in the direction of the thrust.
9. Insert the roller on the end of the looper thread take-up lever ❼ in the groove of the lower thread cutter cam ⓰ and adjust so that the distance from the top of the groove on the lower thread cutter cam ⓰ to the roller is 1 mm, and then tighten the hexagonal bolt ⓳.
10. Connect the lower thread cutter link ⓯ to the knife operating lever with the stud screw ⓴.



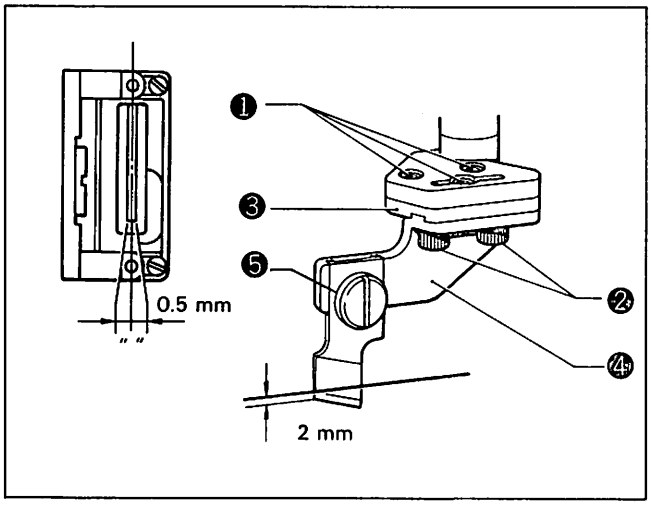
11. Insert the presser bar ㉑ from the top of the arm and pass it through the presser bar clamp ㉒. Attach the presser bar ㉑ so that the screw stop is facing toward the face plate, and tighten the screw ㉓.
12. Insert the presser foot spring ㉔ from the top of the arm.
13. Attach the presser foot roller unit ㉕ to the bottom end of presser bar ㉑ with the screw ㉖.
14. Attach the presser bar guide plate ㉗ to the arm with the two screws ㉘. Confirm that the presser bar move smoothly by operating the knee lifter lifting lever.
15. Attach the presser regulating thumb screw ㉙ and adjust it so that the distance from its upper surface to the upper surface of the arm is 20 ~ 25 mm.
16. Move the knee lifter lifting lever arm ② so that the distance from the top surface of the needle plate to the bottom surface of material clamp is 13 mm, and then tighten the bolt ③.
17. Temporarily tighten the upper thread cutter lever B ㉚ to the upper thread cutter lever ㉛ with the two screws ㉜.
18. Attach the cutter ㉝ with the screw ㉞.
19. Attach the needle ㉟ with the screw ㊱.





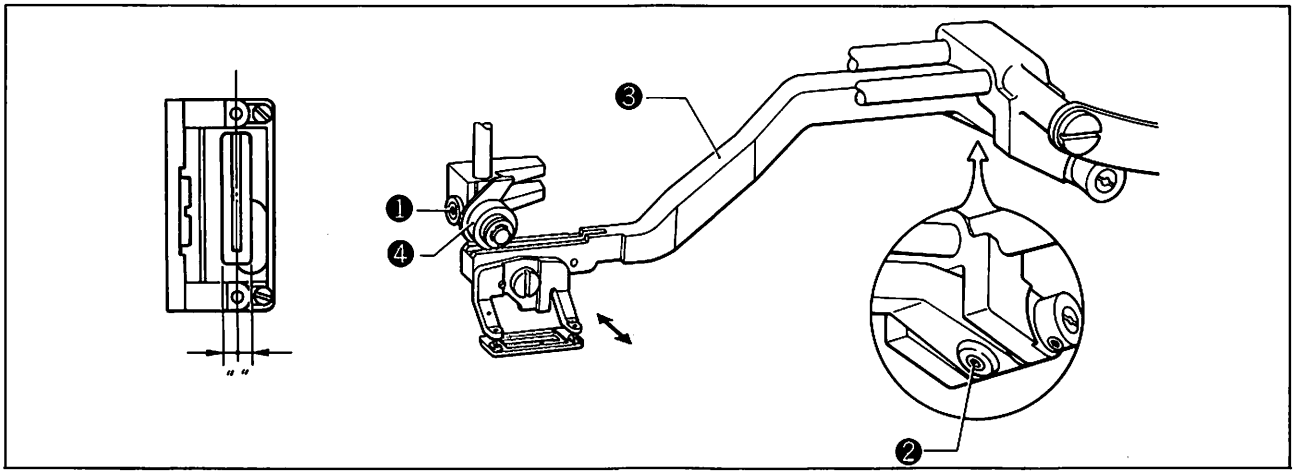
⑯ Base needle plate and cutter position control

1. Run the machine at low speed, loosen the bolts ❶, ❷, and adjust the cutter holder V ❸ and the cutter holder D ❹ so that when the thread breakage detector lever is raised and the pulley is turned to bring the cutter down, the cutter comes in the middle of the cutter groove from left to right and the distance from the cutter to the front edge of the groove is 0.5 mm.
2. Also, loosen the screw ❺ and adjust the vertical height of the cutter so that it enters the needle plate 2 mm from its top surface.



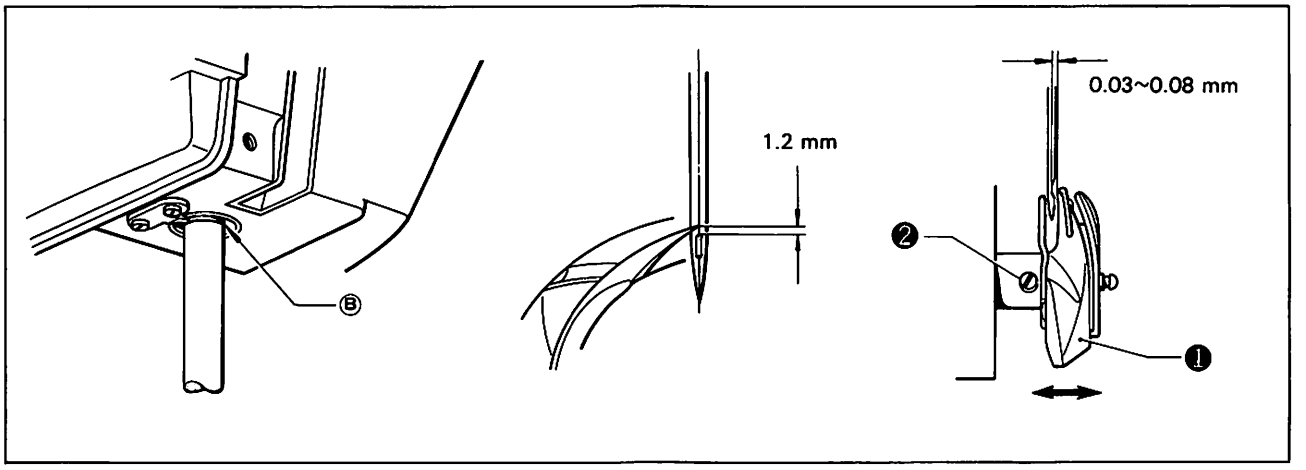
17 Upper clamping foot position control

Loosen the screws ❶, ❷ and adjust the length feed drive shaft arm ❸ and the upper clamping foot roller ❹ so that the cutter groove comes to the center of the upper clamp window. After adjustment, confirm that the upper clamp moves smoothly up and down by operating the presser bar lifter pedal.

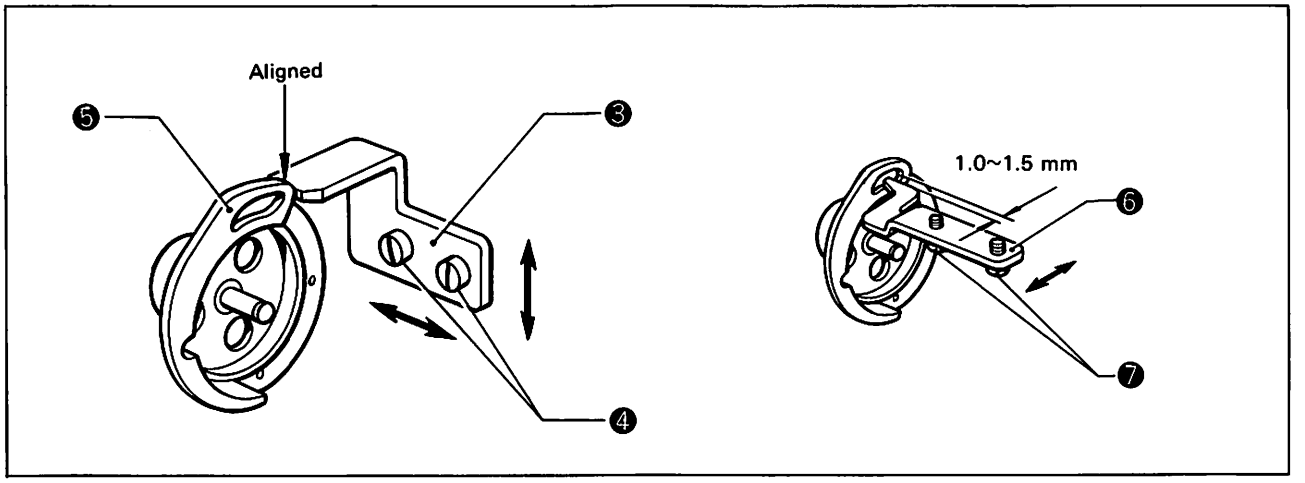


18 Rotaty hook

1. Temporarily fasten the rotary hook to the rotary hook shaft.
2. Adjust the rotary hook so that when the clutch is engaged and the pulley is turned to bring the needle bar up from the lowest point making the second needle position B form the bottom on the needle bar even with the index, the sharp end of the rotary hook is lined up with the center of the needle and the distance between the needle and the sharp end of rotary hook is 0.03 ~ 0.08 mm, and then tighten the two screws ❷.

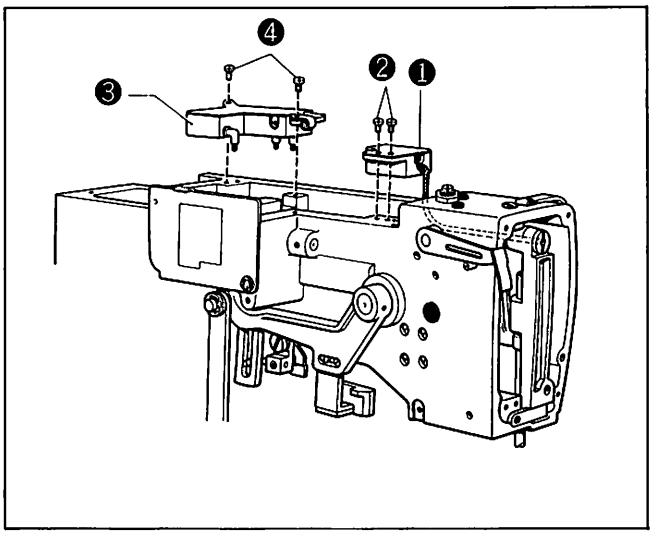


3. Attach the rotary hook position bracket A ❸ with the two screws ❹. Adjust the rotary hook position bracket A ❸ so that its end is even with the shuttle body ❺, and then tighten the two screws ❹.
4. Attach the rotary hook position bracket B ❻ with the two screws ❼, and adjust the distance between the shuttle body ❺ and the rotary hook position bracket B ❻ so that it is 1.0 ~ 1.5 mm, and the tighten the two screws ❼.



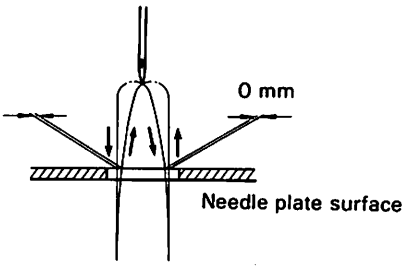
19 Lubrication

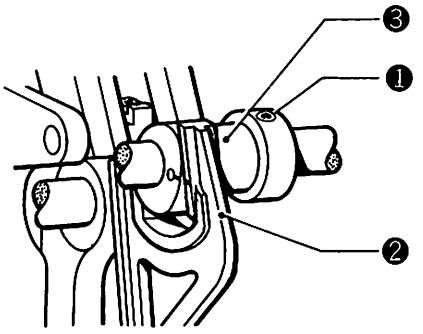
1. Attach the wick base A ❶ to the upper surface of the arm with the two screws ❷. When doing this insert a string from the needle bar bracket support shaft in the wick base A ❶.
2. Attach the wick base B ❸ to the upper surface of the arm with the two screws ❹.



20 Needle sidewise movement adjustment

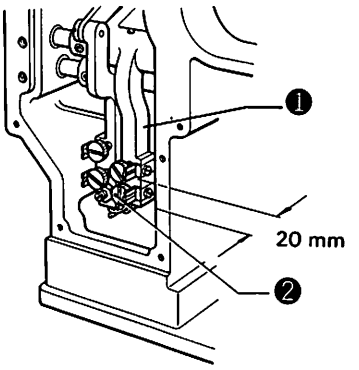
1. Engage the clutch, loosen the two screws ❶, and turn the pulley until the needle bar is at the lowest position. Match up the ticking of the needle zigzag link ❷ with the ticking of the needle zigzag cam ❸, and then tighten the two screws ❶.
2. Set the feed cam for inside bar tacking, and confirm that the left and right needle movement on the needle plate surface is 0 mm when the pulley is turned and the needle is oscillated all the way in the needle holle.



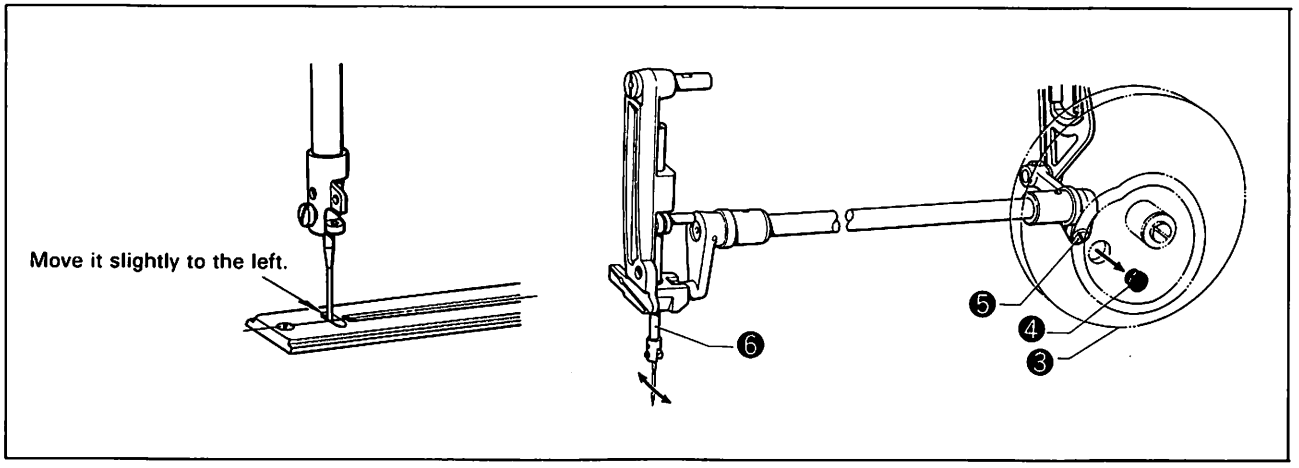


21 Needle zigzag reference position adjustment

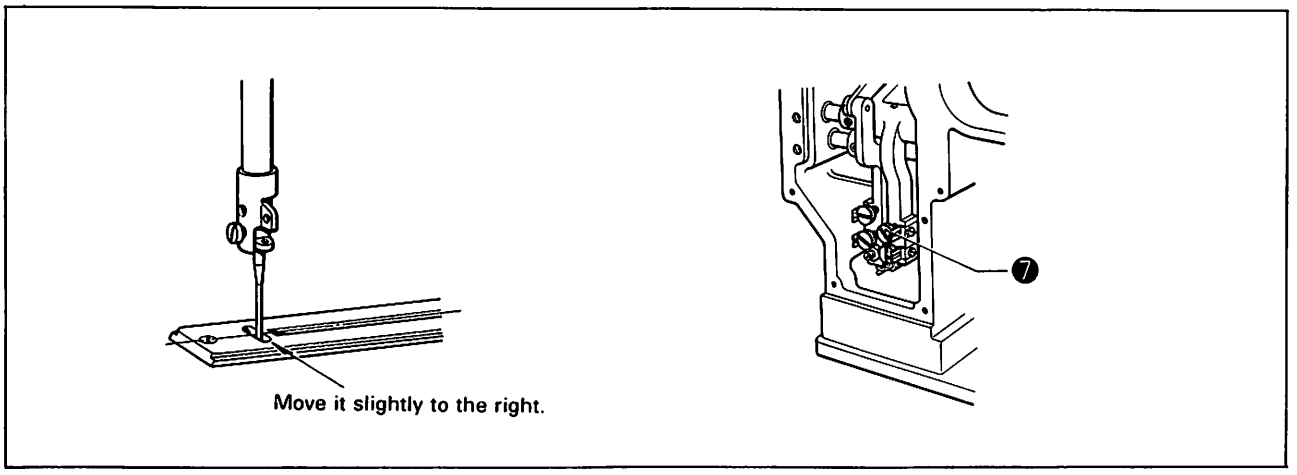
1. Turn the needle zigzag adjustment screw ❷ to adjust the distance from the end of the arm to the end of needle position regulating arm ❶ to 20 mm when the needle is at the lowest needle bar position on the needle position A side.



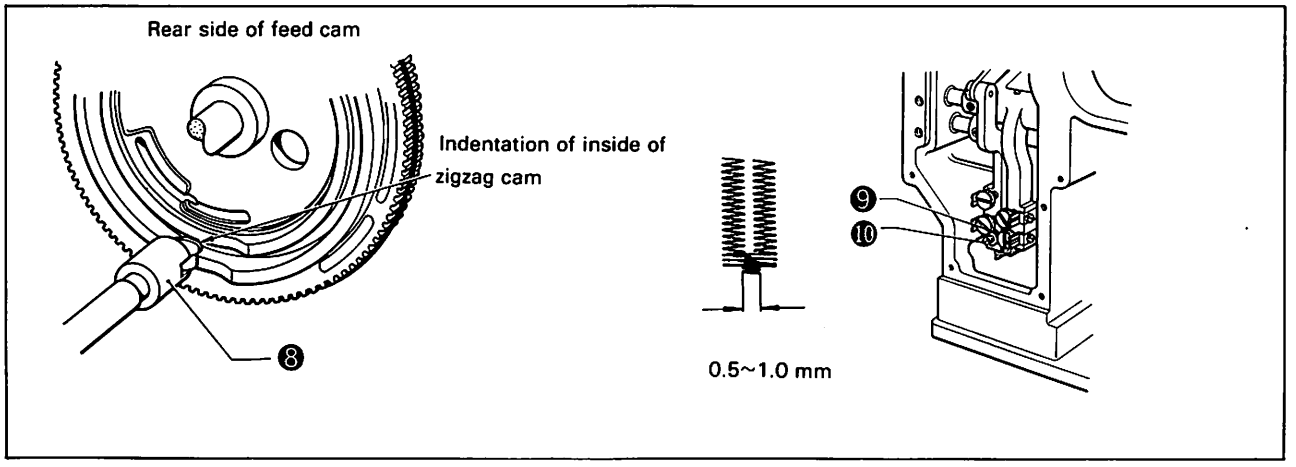
2. On the needle position A side turn the handle so that after the needle swings to the right side it comes slightly to the left of the center of the needle hole. Position the adjustment hole on the feed cam ❸ and the rubber plug ❹ so that they are lined up, remove the rubber plug ❹ and loosen the screw ❺, and then move the needle bar ❻ to the left and the right to adjust the needle position A.



3. On the needle position B side adjust the needle zigzag adjustment screw ❼ so that the needle comes slightly to the right of the center of the needle hole when the needle swings to the left.

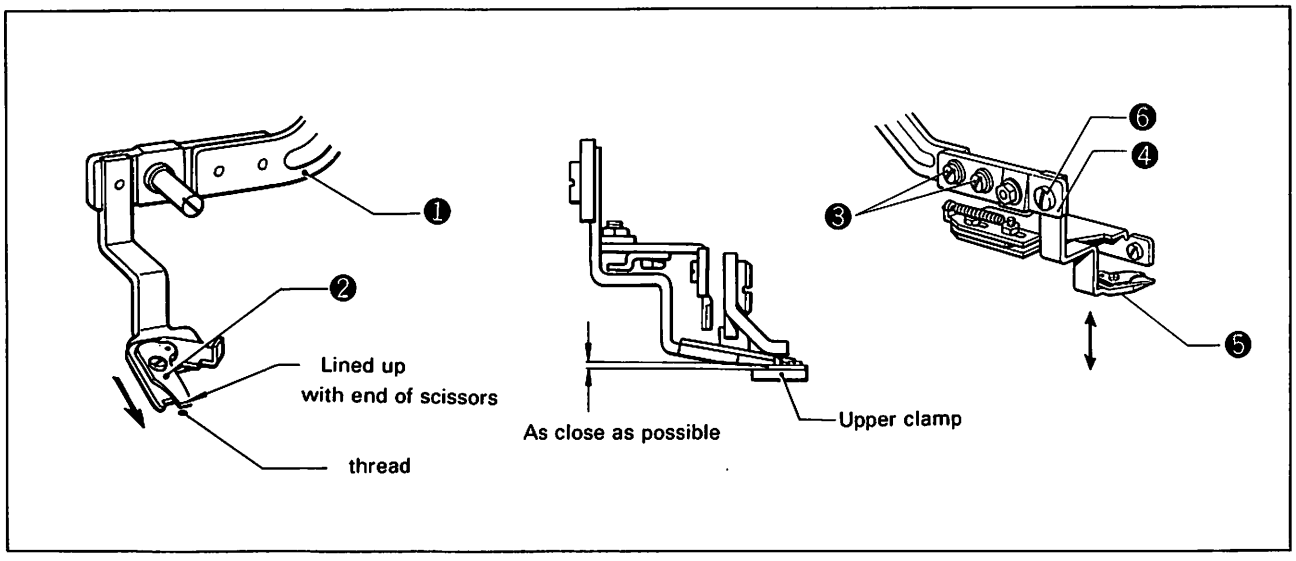


4. When the roller on the needle zigzag push bar ❽ falls in the indentation of the zigzag cam on the inside of the feed cam, loosen the nut ❾ and adjust the lock stitch adjustment screw ❿ so that the zigzag width is 0.5 ~ 1.0 mm. The more the lock stitch adjustment screw ❿ is turned to the right, the wider the lock stitch will become.



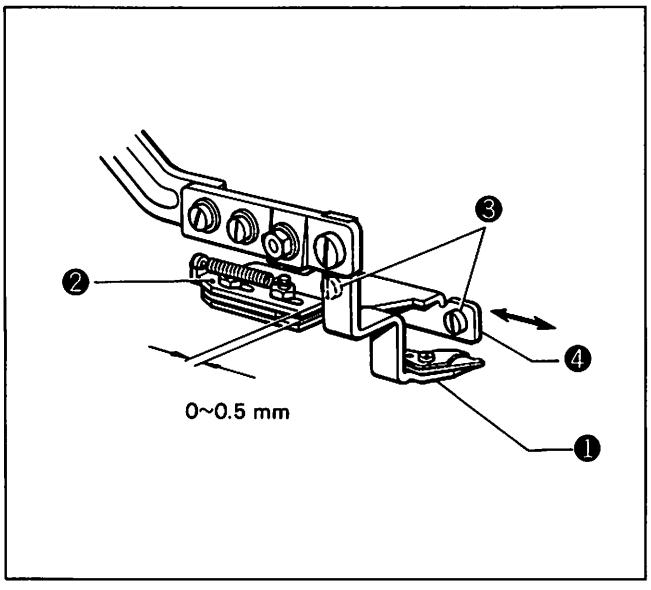
22 Scissors assembly position control

1. With the machine in the stopped position (before the thread is cut) and while supporting the upper thread cutter lever assembly ❶ wiht your hand, loosen the two screws ❸ and move the upper thread cutter lever B ❹ forward and backward until the end of the scissors U ❷ and the thread are lined up when the knee lifter lifting lever is operated and the upper thread cutter lever assembly ❶ is moved slowly toward the needle. Also, loosen the screw ❻ and move the scissors assembly ❺ up or down until the bottom of the scissors assembly is as close as possible to the material clamp.



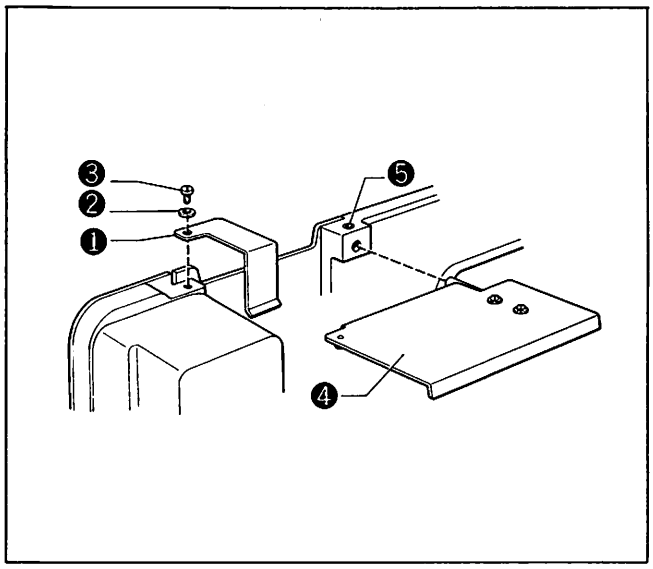
23 Scissors guide position control

With the machine in the stopped position (before the thread is cut), loosen the two screws ❸ and move the scissors guide ❹ back and forth until the distance between the end of the scissors assembly ❶ an the end of the sicssros safety plate ❷ is 0 ~ 0.5 mm.

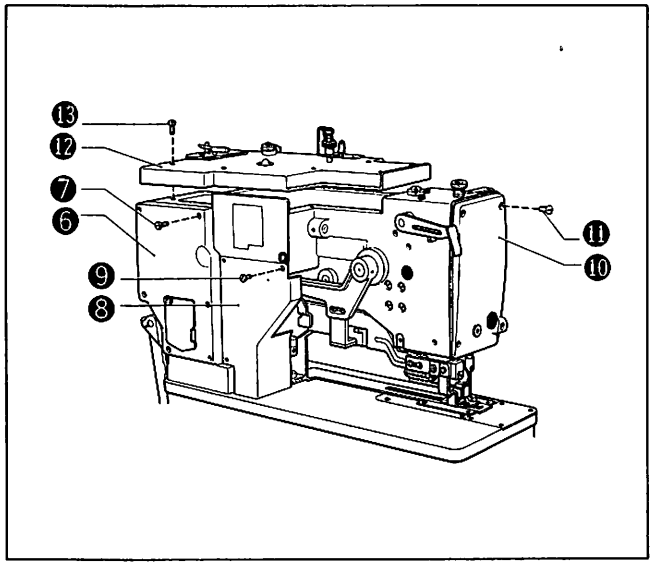


24 Covers

1. Attach the inside rotary hook cover ❶ with the washer ❷ and screw ❸.
2. Attach the rotary hook cover ❹ to the bed with the screw ❺.



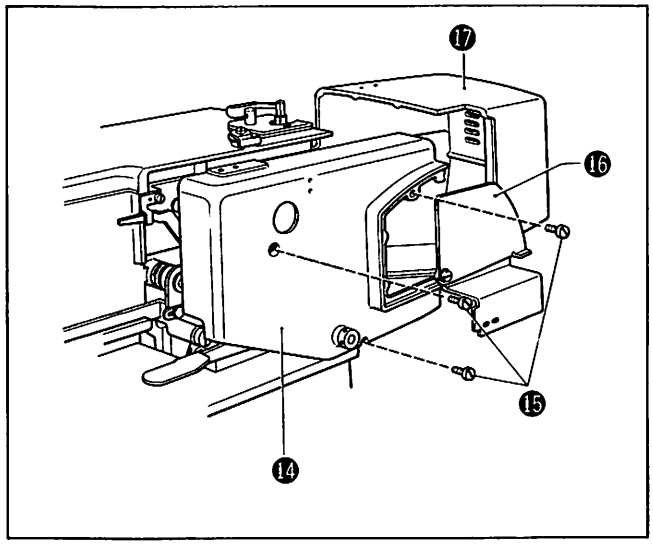
3. Attach the side cover R ❻ with the six screws ❼. Apply a sealant to prevent leakage of oil.
4. Attach the side cover F ❽ with the three screws ❾.
5. Attach the surface plate ❿ with the four screws ⓫.
6. Attach the top cover ⓬ with the eight screws ⓭.



7. Attach the cam cover ⓮ with the three screws ⓯. One of the three screws must be attached by opening the feed adjustment cover ⓰.

* If the handle is attached, remove the handle first.

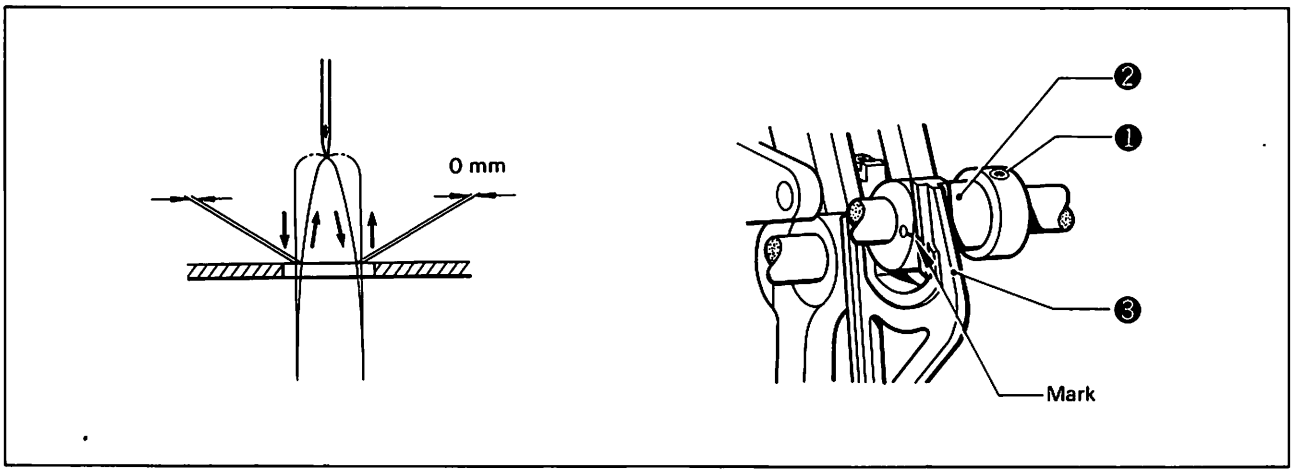
8. Attach the belt cover ⓱.



ADJUSTMENTS

1 Needle sidewise movement adjustment

If the needle sidewise movement is not properly adjusted, the needle will move even after it is inserted into the material, thus resulting in skipped stitches, and large, unsightly needle holes in the garment.

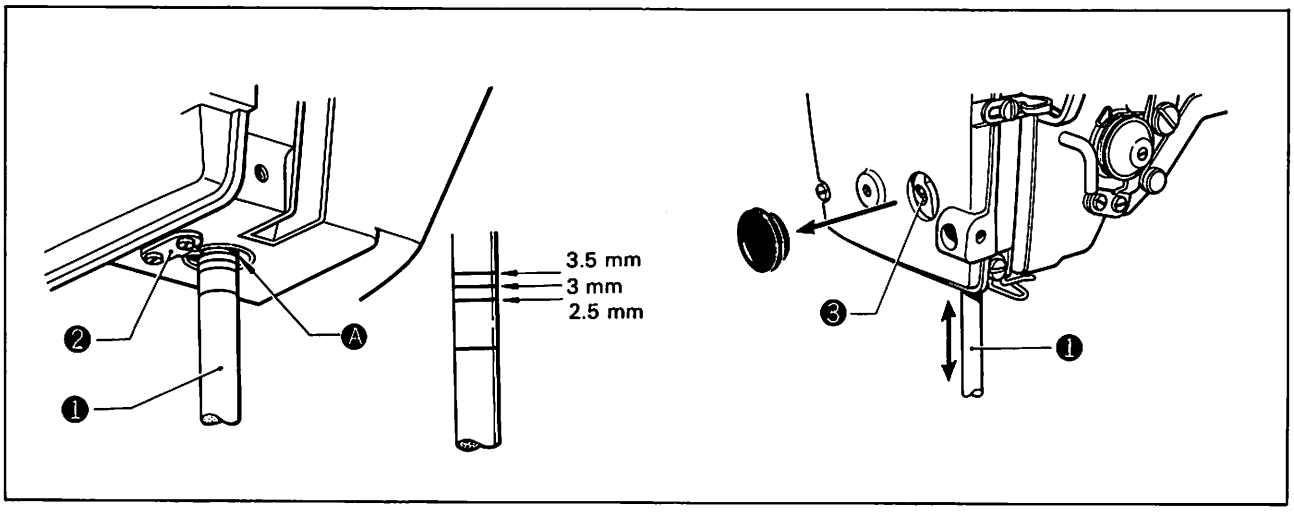


1. Remove the change gear and turn the handle to set the feed cam to the bar tack position.
2. When the machine is in normal condition to operate and the pulley is turned to zigzag the needle to the full width of the needle hole, adjust as necessary to make sure the needle shifts 0 mm right or left above the needle plate when the needle is both in the needle hole and when above the needle plate.
3. If adjustment is necessary, loosen the two set screws ❶, and turn the pulley to set the needle bar in the right shift down position. Match up the needle zigzag link ❷ take-in and the needle zigzag fork take-in, and then retighten the set screws ❶. Make sure the ends of the needle zigzag cam do not extend from the fork mouth.

2 Needle bar and rotary hook adjustment

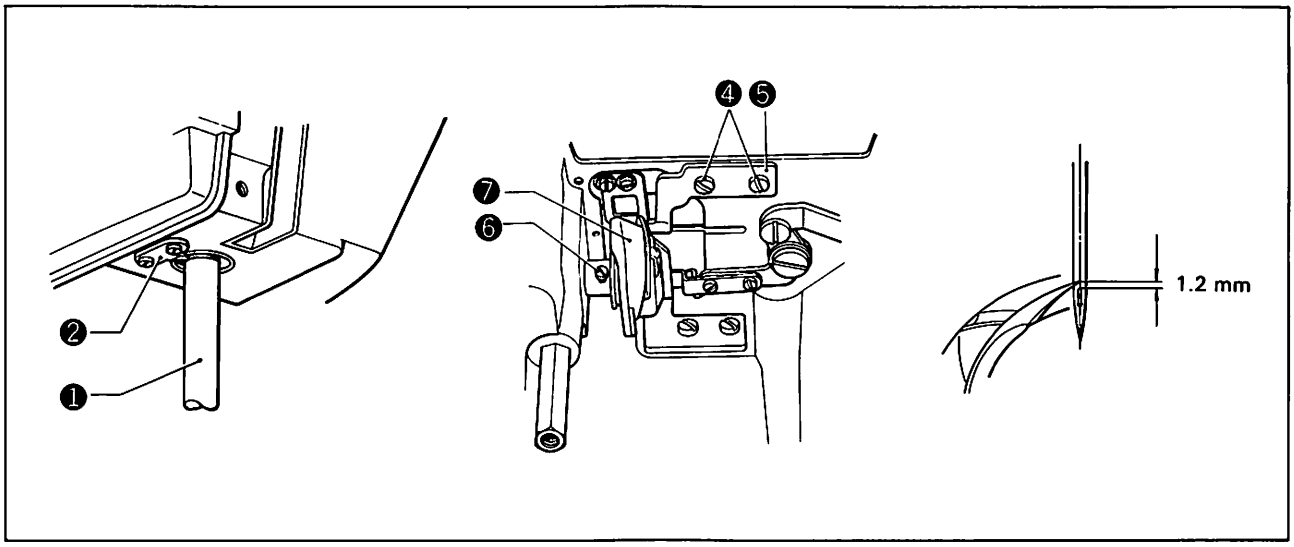
Improper needle bar and rotary hook adjustment would cause skipped stitches and caught threads.
To adjust needle bar height, needle bar lift stroke, and needle to rotary hook timing, the needle should be located in the center of the needle hole (in the middle of the cutter groove).

1. Needle bar height adjustment



Set the machine in normal condition to operate and turn the pulley to set the needle bar ❶ to the down position. Next loosen the set screw ❸ and vertically shift the needle bar ❶ to align the top reference line Ⓐ with the needle height index ❷.

2. Needle bar lift stroke adjustment

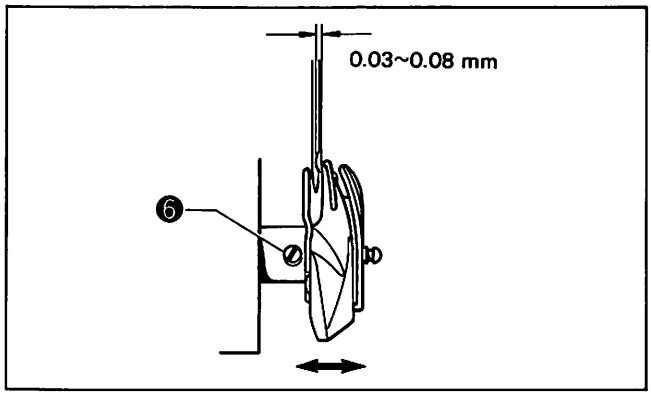


Turn the pulley and raise the needle bar ❶ above the needle down position. Remove the two set screws ❹, remove rotary hook position bracket B ❺, loosen the two set screws ❻, and turn the rotary hook ❼ to align the rotary hook point to needle center when the index ❷ is aligned with the second from top reference line.

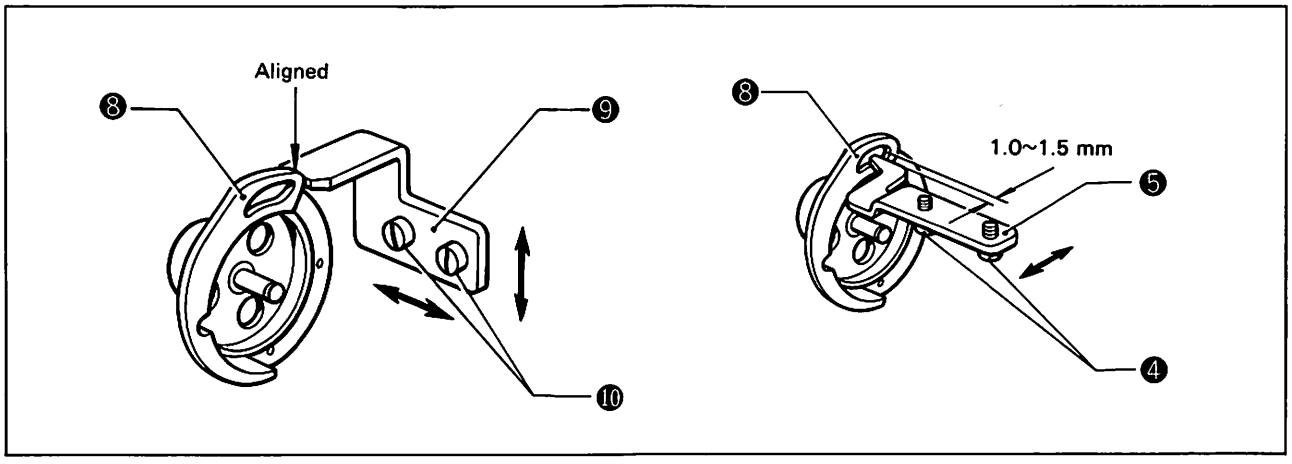
* Sewing is easiest and results best if the index is set to the bottom reference line when sewing outer garments and knitted fabrics, and if set to the second from bottom reference line for knits and jerseys.

3. Needle to rotary hook adjustment

1. Loosen the two set screws ❻ and move the rotary hook so that the rotary hook to needle gap is 0.03 ~ 0.08 mm when the pulley is turned and the rotary hook is aligned with the needle center.



4. Rotary hook position bracket adjustment



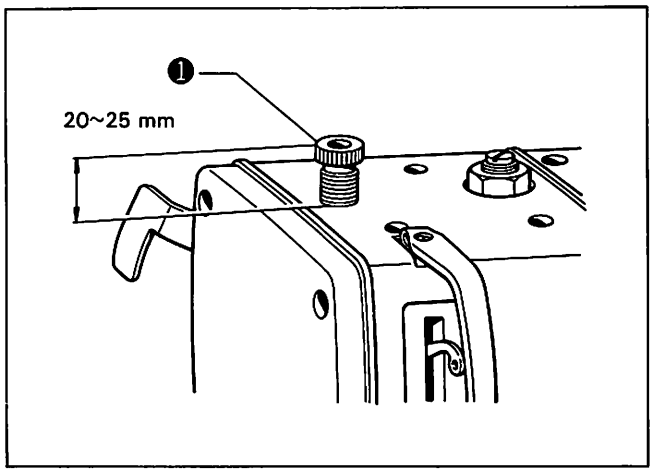
1. Loosen the two set screws ❿ and move the rotary hook position bracket to align the inner hook ❽ with the tip of the rotary hook position bracket ❾.
2. Loosen the two set screws ❹ and move the rotary hook position bracket B ❺, so that the inner hook ❽ to rotary hook position bracket B ❺ gap is 1.0 ~ 1.5 mm.

3 Upper clamping foot lifter adjustment

If these parts are not properly adjusted, the upper clamping foot may not be lifted and the material may slip resulting in unsightly buttonholes.

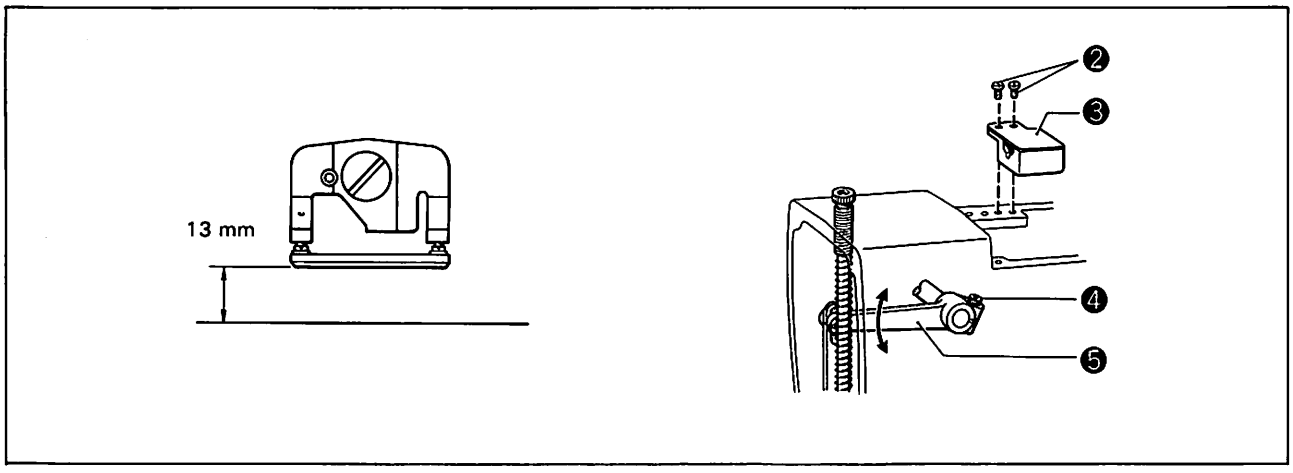
1. Upper clamping foot pressure adjustments

To adjust the upper clamping foot pressure, turn the pressure adjustment screw ❶ until the distance from the top of the arm to the pressure adjustment screw ❶ is within 20 ~ 25 mm.

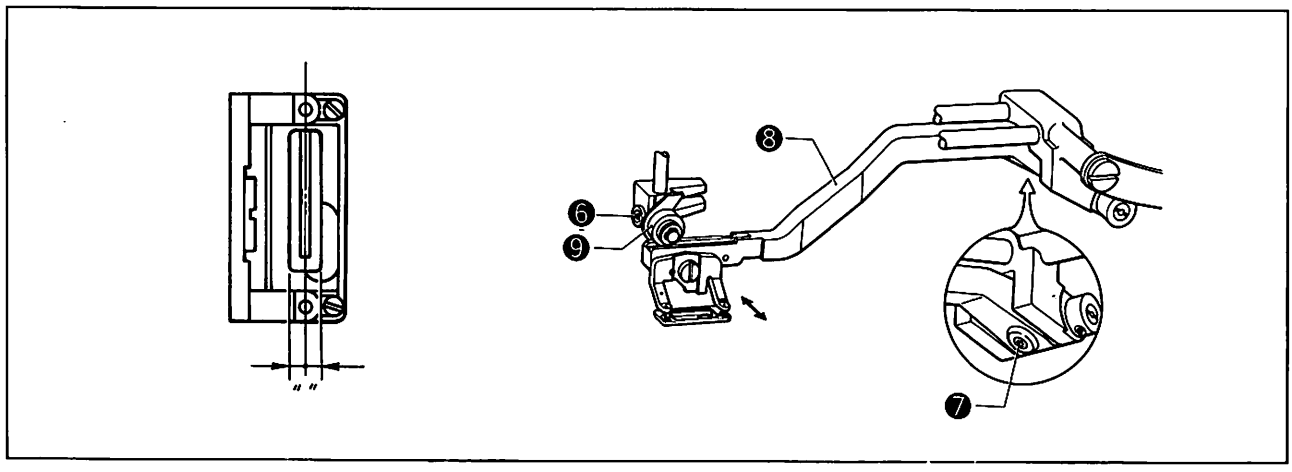


2. Upper clamping foot lift stroke

Remove the two set screws ❷ and remove wick base A ❸; next, loosen Allen bolt ❹ move the upper clamping foot lifter arm ❺ to adjust the distance from needle plate top to upper clamping foot bottom to 13 mm when the upper clamping foot lifter pedal is pressed.



3. Upper clamping foot position adjustment

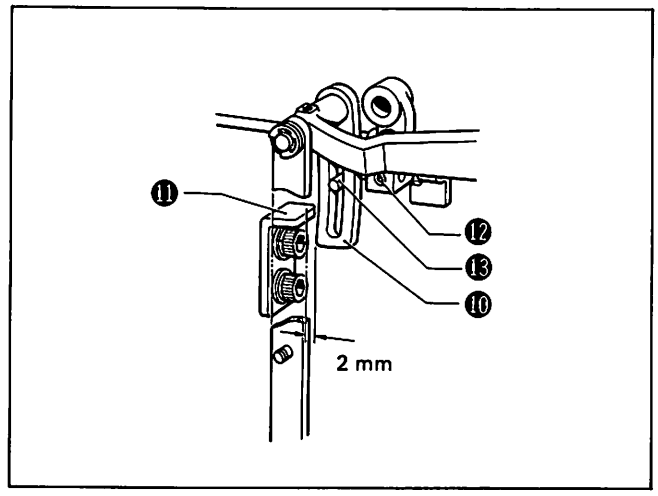


Loosen set screws ❻ and ❼, and move the length feed arm ❽ and upper clamping foot roller ❾ so that the cutter groove comes to the center of the upper clamping foot sight.

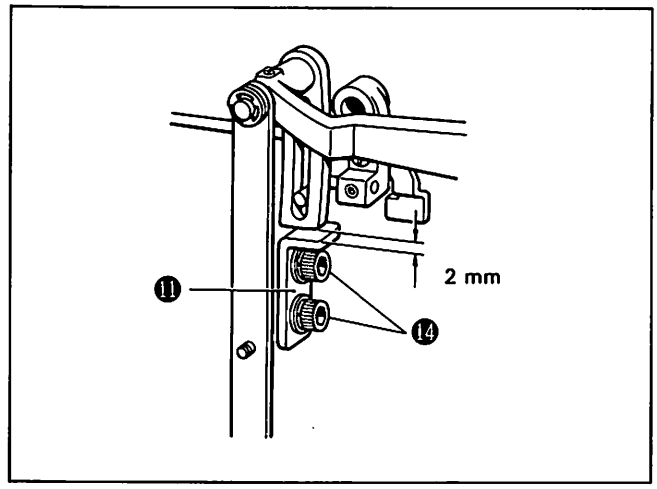
* After adjustment is completed, confirm that the upper clamping foot moves up and down smoothly when the upper clamping foot lifter pedal is operated. If movement is not smooth, readjust the length feed arm ❽.

4. Upper clamping foot lifter safety guide

1. Loosen set screw ⑫ and move the safety stop bearing ⑬ so that the upper clamping foot lifter safety stop ⑩ to safety stopper ⑪ is 2 mm when the upper clamping foot lifter pedal is pressed when the machine is stopped.



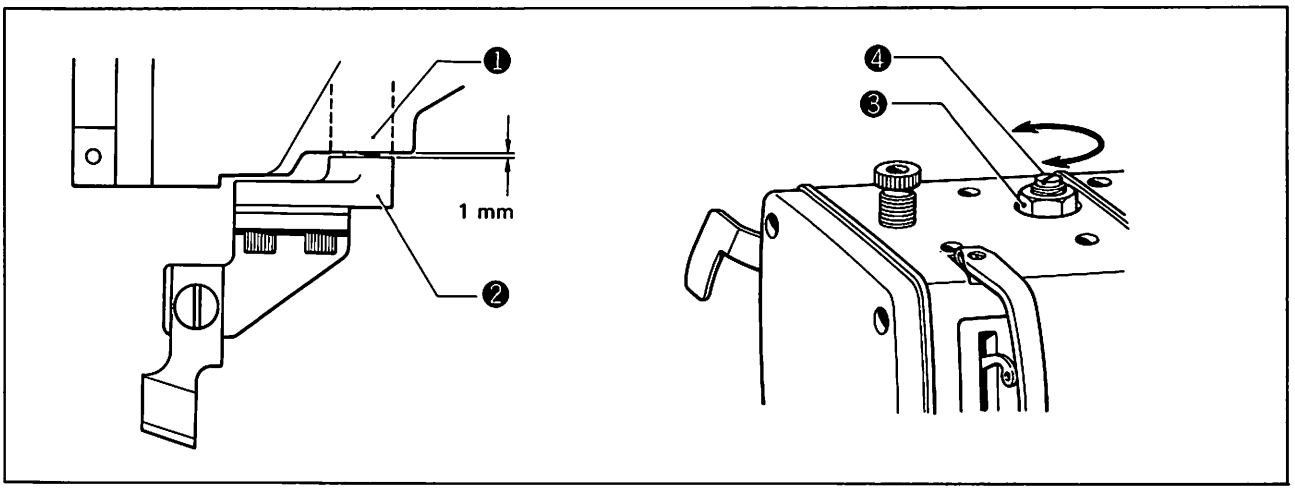
2. Loosen the Allen bolts ⑭ and shift the stopper ⑪ up or down so that the upper clamping foot lifter safety stop ⑩ to stopper ⑪ gap is 2 mm when the machine starts operating.



4 Cutter adjustment

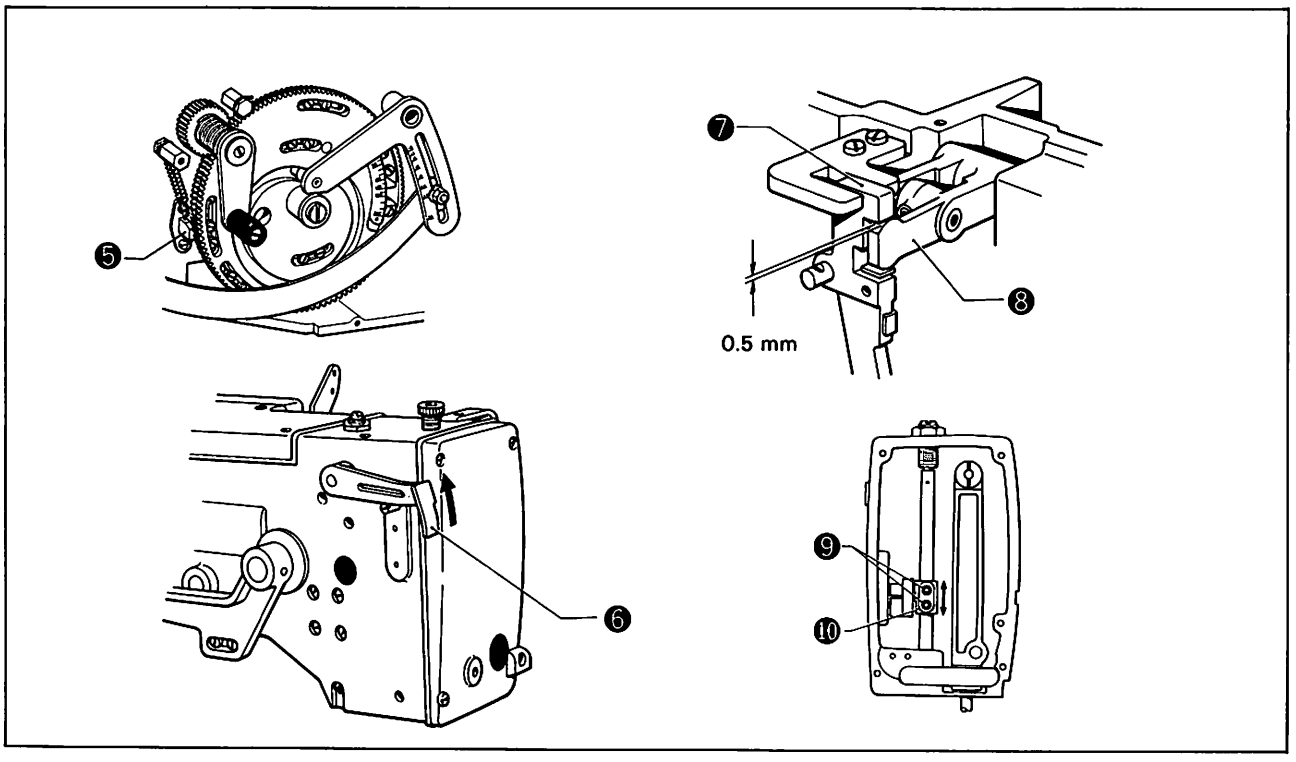
Improper cutter adjustment may cause the cutter to fall immediately after the start of special sewing operations, or may prevent it from falling even after the sewing operation is completed.

1. Cutter operating shaft adjustment



Loosen nut ❸ and turn the cutter adjustment screw ❹ until the cutter operating shaft bushing ❶ to cutter operating shaft ❷ gap is 1 mm when the machine is stopped.

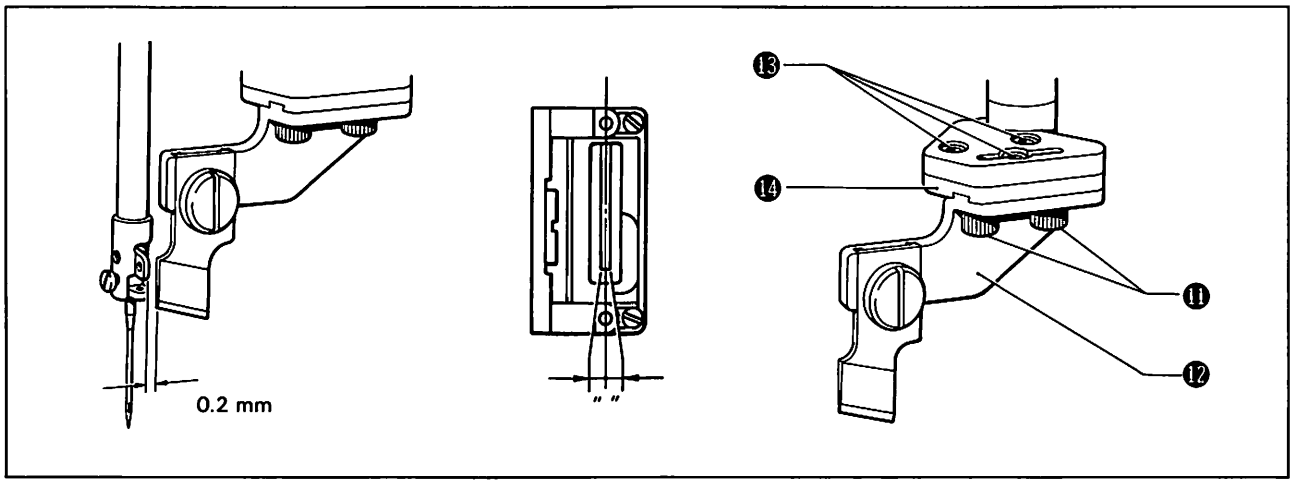
2. Cutter operating arm position adjustment



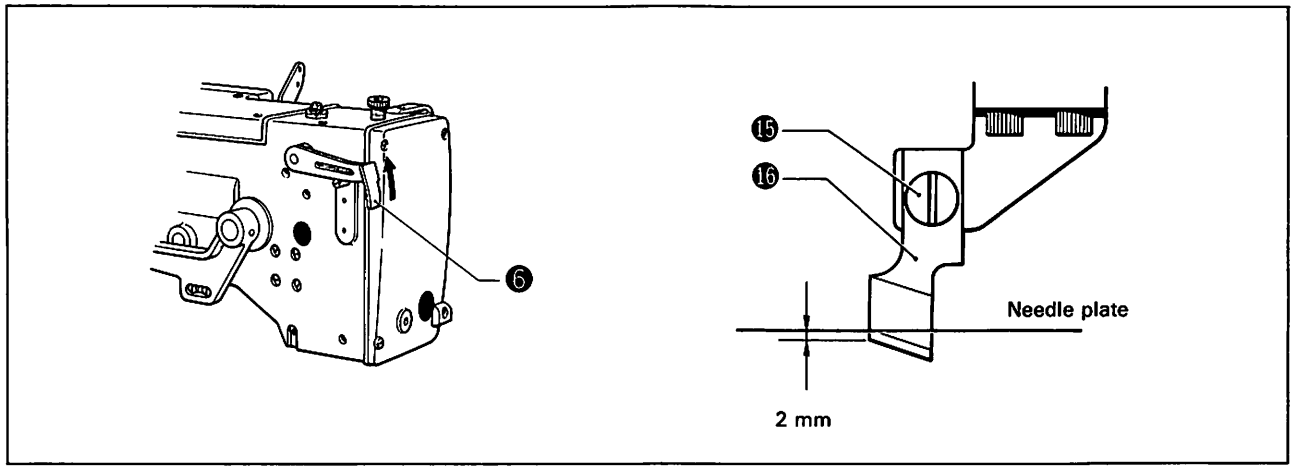
When the cutter push rod ❺ is pressed, the thread breakage detector lever ❻ is raised, and the pulley turned to align the cutter drive lever ❽ with the C clutch ❼, the C clutch ❼ to cutter drive lever ❽ gap should be 0.5 mm. Set the machine to slow speed; next, loosen the two set screws ❾ and shift the cutter operating holder ❿ up or down to adjust.

* To make the above adjustment, first remove the presser bar (refer to p.13, 3 Presser assembly disassembly).

3. Cutter installation adjustment



1. Loosen the two Allen bolts ⓫ and move cutter holder D ⓬ so that the cutter to needle bar gap is less than 0.2 mm when the pulley is turned and the needle bar is fully lowered with the machine running. Furthermore, loosen the three Allen bolts ⓭ and move cutter holder U ⓮ until the cutter is in the center of the cutter groove.

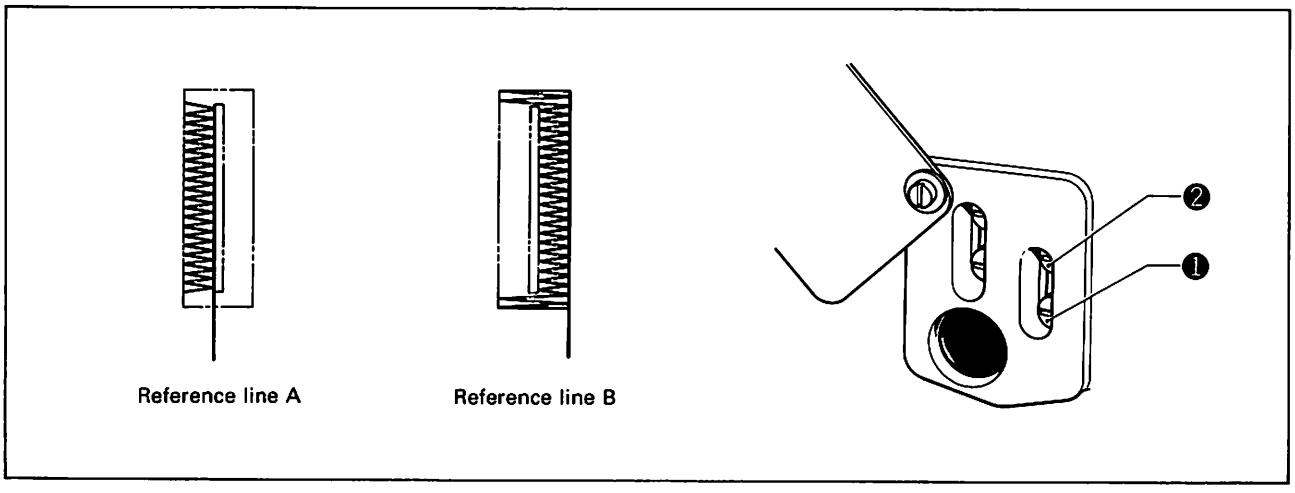


2. When the pulley is turned and the cutter is fully lowered while the machine is running and the thread breakage detection lever ⑥ is raised, the knife tip should be 2 mm above the needle plate. Loosen set screw ⓯ and move the cutter ⓰ vertically to adjust.

5 Buttonhole width and reference position adjustment

If these are not properly adjusted, seam threads amy break, and the needle may strike the needle plate when the needle zigzag width is very great.

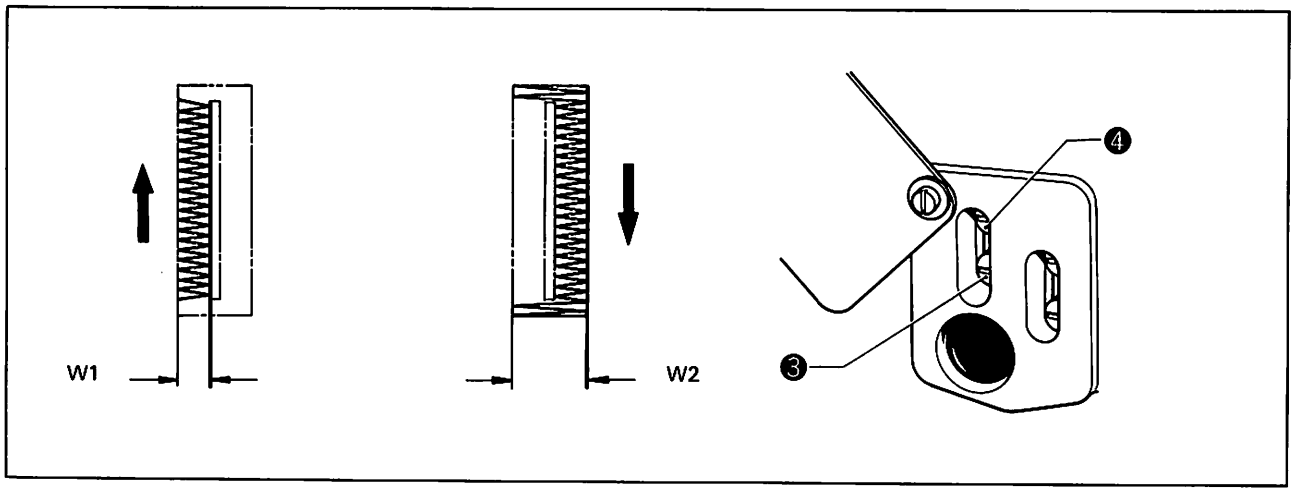
1. Buttonhole reference position adjustment



This machine uses the right side of the stitch as the reference line in both forward and return strokes. Be sure to set the needle at the right side when making these adjustments.

1. Turn the adjustment screw ❶ and adjust the position of reference line A so that seam threads are not broken when the cutter falls. Turn the adjustment screw to the right to move the reference line right.
2. Adjust reference line B as above by turning adjustment screw ❷. Note that contrary to A above, line B moves to

2. Buttonhole width adjustment



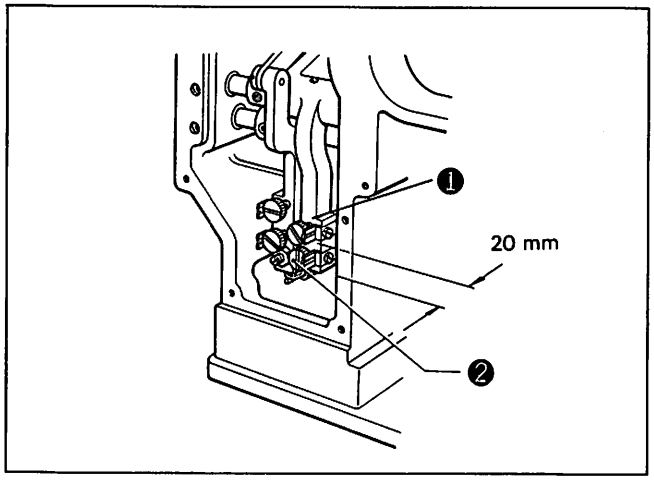
To adjust zigzag width W1, turn adjustment screw ❸; to adjust bar tacking width W2, turn screw ❹. Both zigzag width W1 and bar tacking width W2 will increase as the screws are turned right.

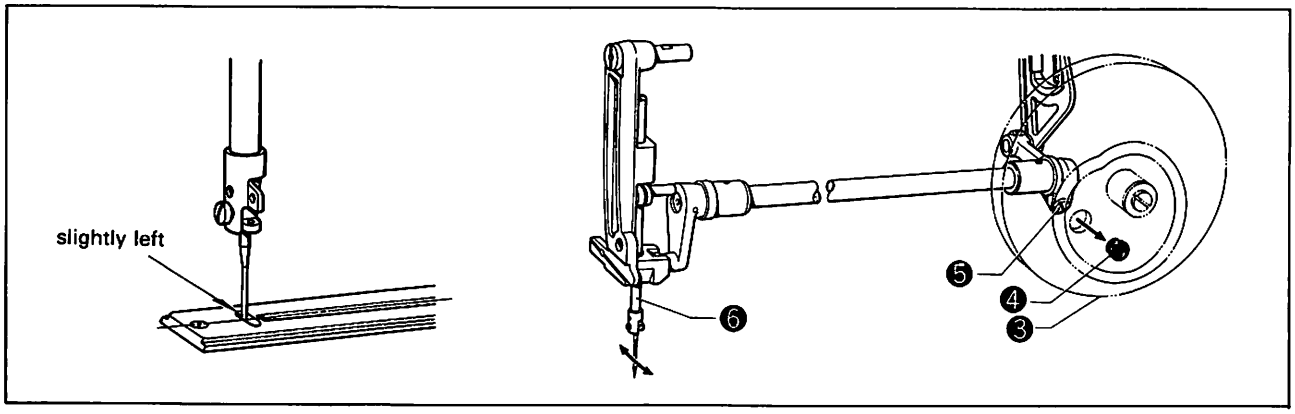
* The needle zigzag width adjustment range is greater than the width of the upper clamping foot. Whenever the bar tacking width is adjusted to greater than 4 mm, turn the pulley by hand and make sure that the needle does not strike the upper clamping foot on either the forward or return stroke.

◆ Needle zigzag reference line adjustment

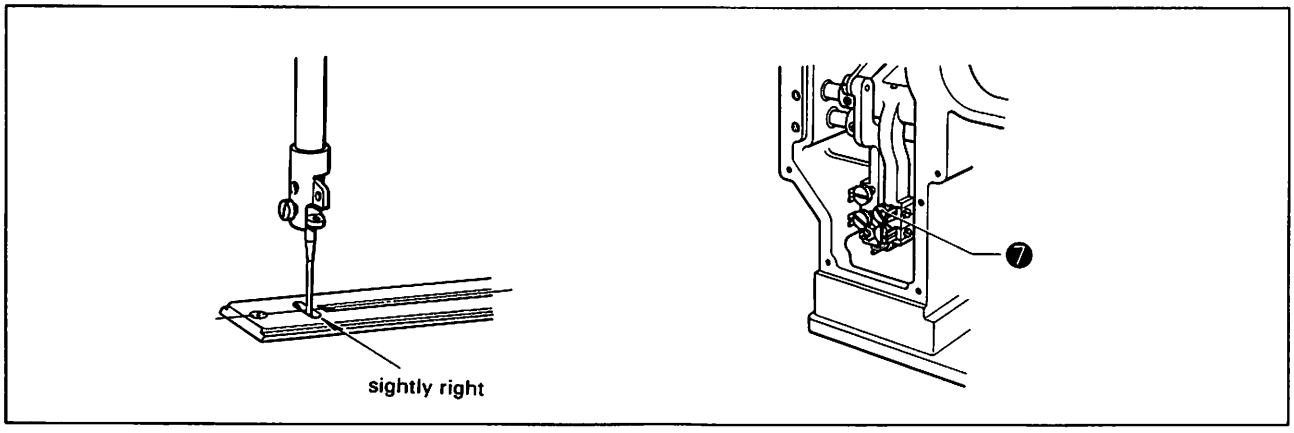
When the machine has been disassembled and needle zigzag parts have been replaced after being used for a long period of time, perform the following steps and then recheck the buttonhole reference line position and buttonhole width adjustments.

1. Turn the needle zigzag adjustment screw ❷ and set the distance from the end of the arm to the edge of the reference position adjustment arm ❶ to 20 m when the needle is set to the needle bar down position on the reference line A side.

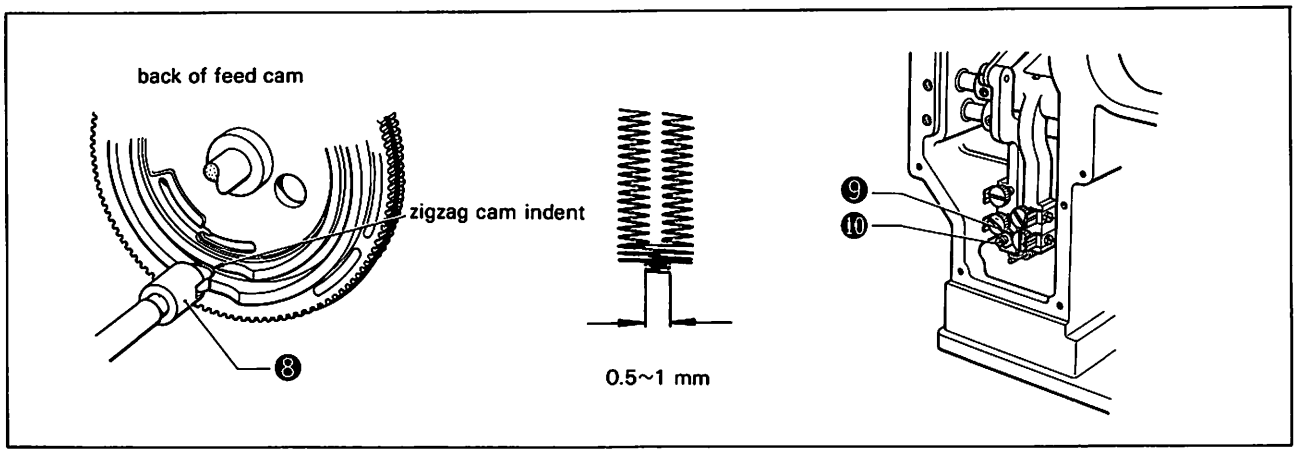




2. Turn the handle and align the feed cam ❸ adjustment hole with the rubber stop ❹ so that the needle will fall slightly left of the center of the needle hole when the needle is shifted right when sewing the left side of the zigzag (reference line A side). Next, remove the rubber stop ❹ and loosen the set screw ❺; move the needle bar ❻ right or left to adjust reference line A position.



3. Turn needle zigzag adjustment screw ❼ and adjust reference line B so that the needle will come slightly right of center in the needle hole when sewing the right side of the zigzag (reference line B).



4. Loosen nut ❾, and turn the tacking width adjustment screw ❿ so that the zigzag width is 0.5 ~ 1.0 mm when the roller on the zigzag drive rod ❽ drops into the indent in the zigzag sewing cam inside the feed cam. The further right the adjustment screw is turned, the wider the tacking width becomes.

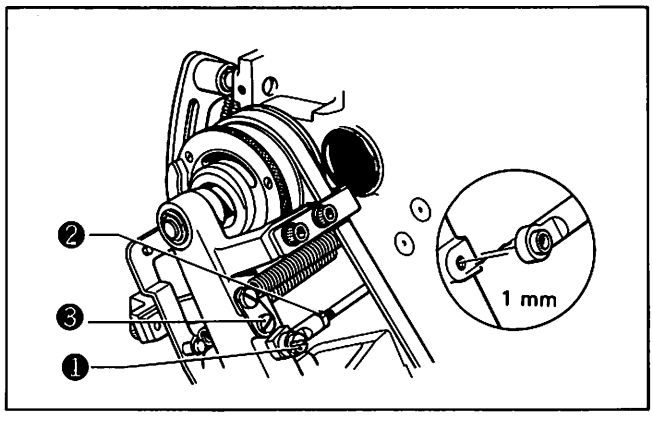
6 Upper thread cutter adjustment

If this assembly is not properly adjusted, the upper thread may not be cut, or the thread end may not be sewn all the way into the material.

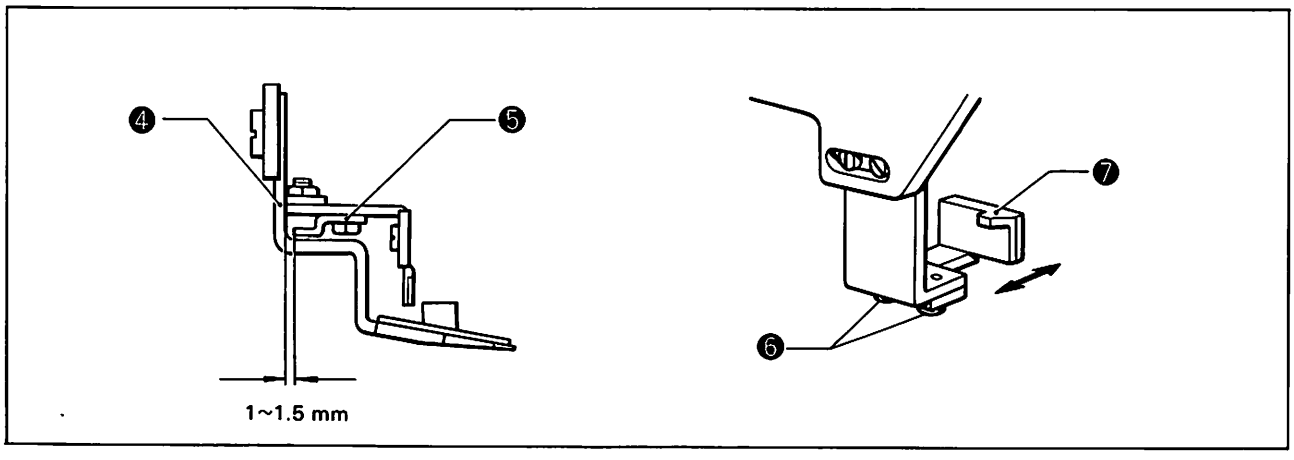
1. Upper thread cutter link length adjustment

Stop the machine and remove the screw ❶; loosen nut ❷ and turn the ball joint until the center of the ball joint is approx. 1 mm shorter than the center of the clutch lever installation hole.

* After this adjustment is completed, be sure to readjust the upper clamping foot lifter safety guide (p. 43), and make the adjustment in steps 2 ~ 4 below.



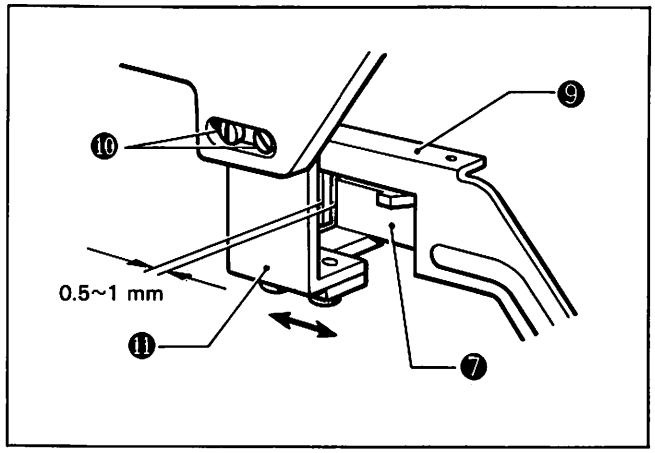
2. Thread cutter retractor cam position adjustment



1. With the machine stopped (before working the presser foot lifter pedal), loosen the two Allen bolts ❻, and shift the thread cutter retractor cam ❼ left or right so that the cutter assembly ❹ to cutter safety plate D ❺ gap is 1.0 ~ 1.5 mm.

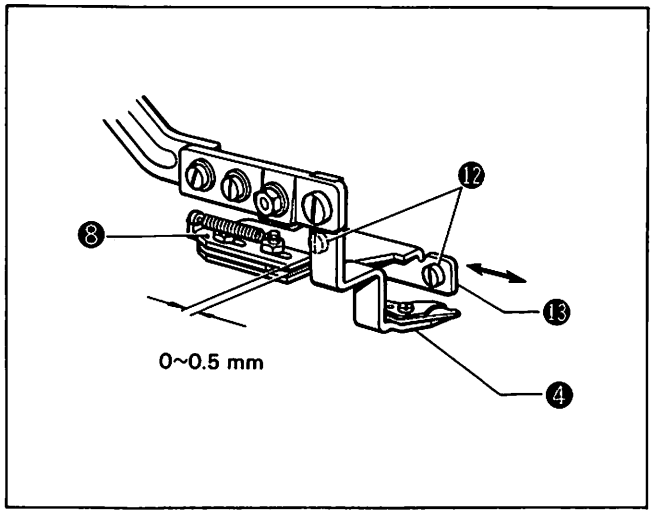
* When the end of the cutter safety plate ❽ and the end of cutter D arm are aligned, the gap between the cutter assembly ❹ and cutter safety plate D ❺ will be approx. 1.0 ~ 1.5 mm. Use this as a rough guide to simplify the above gap adjustment.

2. With the machine stopped (after working the upper clamping foot lifter pedal), loosen the two set screws ⑩, and move the cutter retractor guide ⑪ forward or back so that the gap between the end of the upper thread cutter lever ⑨ and cutter retractor cam ⑦ is 0.5 ~ 1.0 mm.

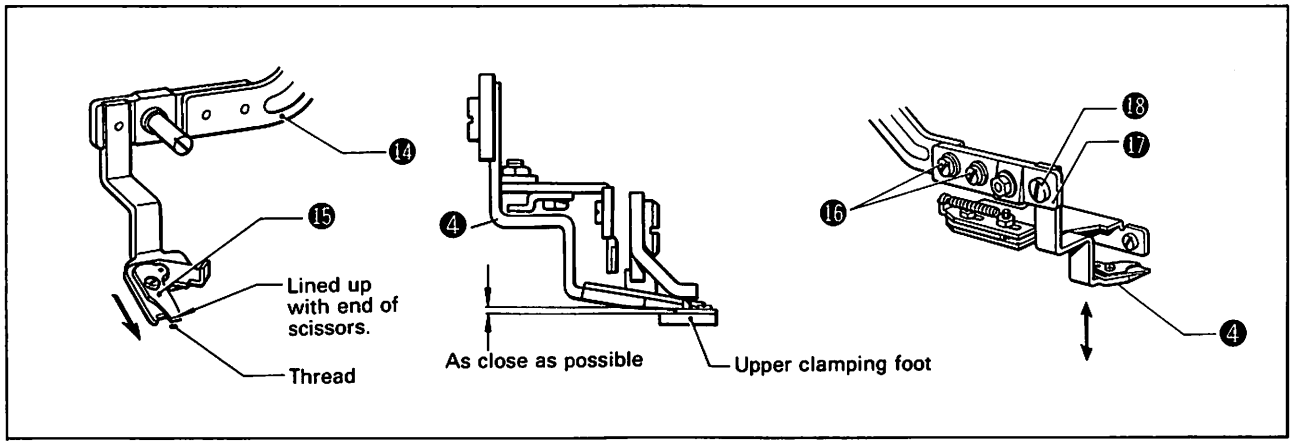


3. Thread cutter guide position adjustment

With the machine stopped (before working the upper clamping foot lifter pedal), loosen the two set screws ⑫ and move the cutter guide ⑬ forward or back so that the gap between the end of the cutter assembly ④ and the end of the cutter safety plate ⑧ is 0 ~ 0.5 mm.



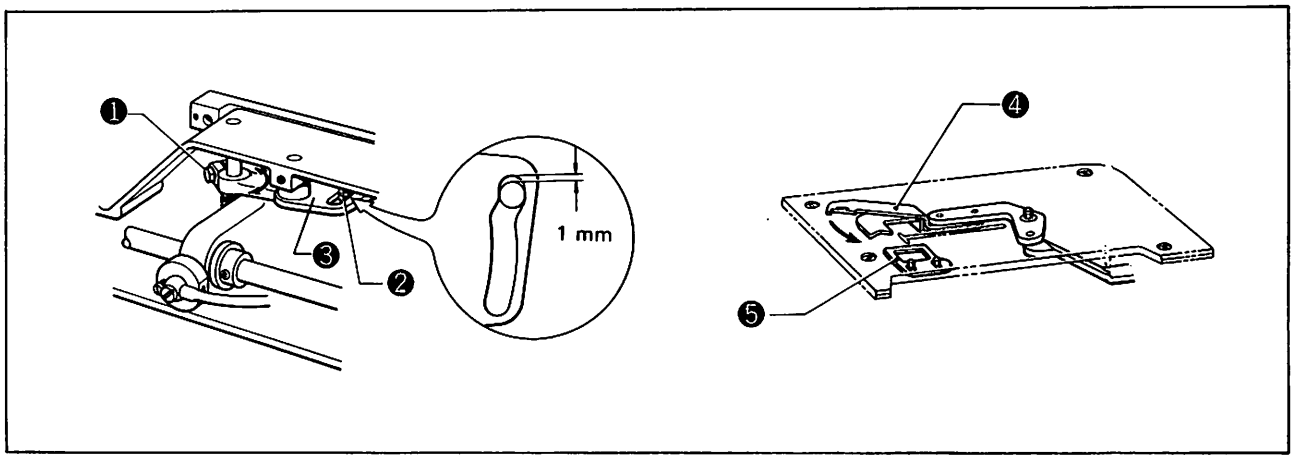
4. Thread cutter assembly position adjustment



1. With the machine stopped (before working the upper clamping foot lifter pedal) support the upper thread cutter lever ⑭ by hand; next, loosen the two set screws ⑯ and shift upper thread cutter lever B ⑰ forward or back so that the tip of cutter U ⑮ is aligned with the thread when the presser foot lifter pedal is depressed and the upper thread cutter lever ⑭ is slowly moved in the direction of the needle.
2. Next, with the machine stopped (after working the presser foot lifter pedal) loosen set screw ⑱ and move the cutter arm vertically so that the bottom of the cutter arm ④ is as close to the upper clamping foot as possible.

7 Lower thread cutter adjustment

If this assembly is not properly adjusted, the bobbin thread cutter to upper thread cutter timing will be off, the bobbin thread may not be cut, and the bobbin thread length may become inadvertently long.



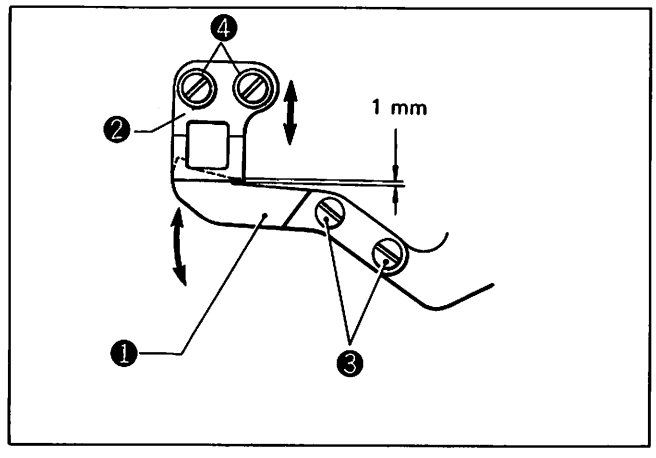
With the machine stopped, loosen the bolt ❶, and adjust the gap between the bobbin thread cam lever roller ❷ and top of the groove in the bobbin thread cutter cam ❸ to 1.0 mm. After adjusting, depress the upper clamping foot lifter pedal and check that the lower movable knife ❹ meets the lower fixed knife ❺ and cuts the thread cleanly before the upper clamping foot raises 2.0 mm above the top of the needle plate.

8 Movable knife and fixed knife adjustment

If these knives are not properly aligned, the bobbin thread may not be cut, or the remaining bobbin thread may be too short and cause the next stitch to be skipped.

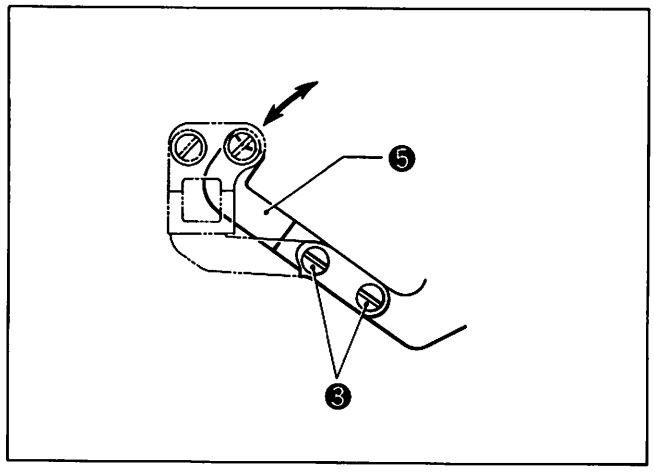
1. Movable knife and fixed knife adjustment
   Loosen the four set screws ❸ and ❹ and move the movable knife ❶ and/or the fixed knife ❷ to adjust the movable knife ❶ to fixed knife ❷ cutting width to 1.0 mm. Operate the bobbin thread cutter lever by hand to cross the movable knife over the fixed knife for this adjustment.

* Doing this adjustment, please check thread retainer writer blow again.



2. Thread retainer position adjustment
   Loosen the two set screws ❸ and move the thread retainer ❺ so that approximately 30 mm of thread trails from the bobbin case after bobbin thread cutting. Work the bobbin thread cutter lever by hand for this adjustment.

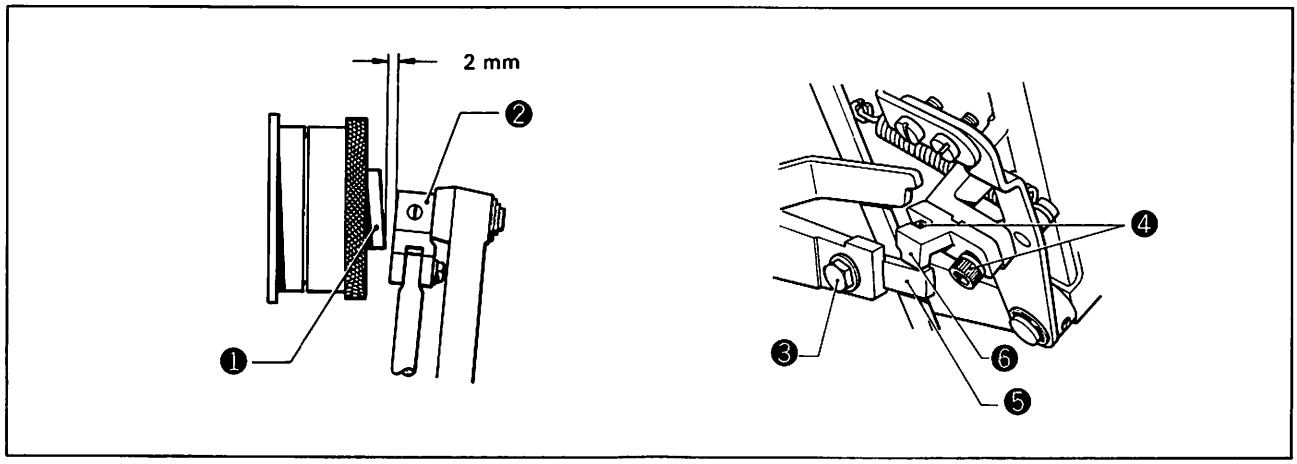
* If the thread retainer is adjusted, be sure to readjust the movable knife and fixed knife as described above.



9 Clutch and brake adjustment

Improper clutch and brake adjustment may prevent the machine from starting, and may increase the shock absorbed by the machine when it is stopped. In all cases, improper adjustment will adversely effect the machine's durability and service life.

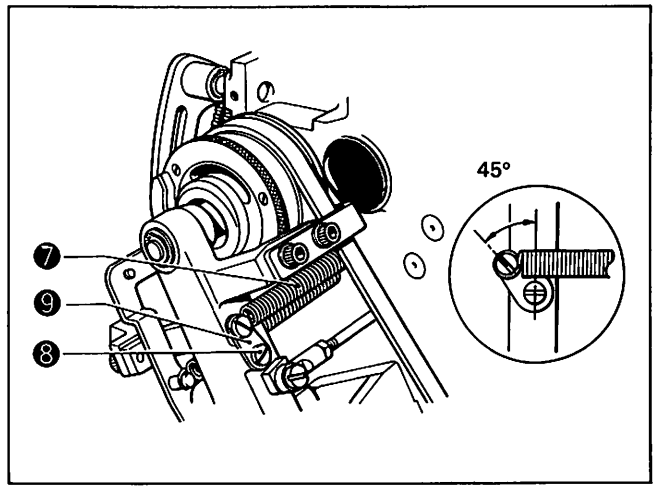
1. Clutch stopper and stop cam adjustment



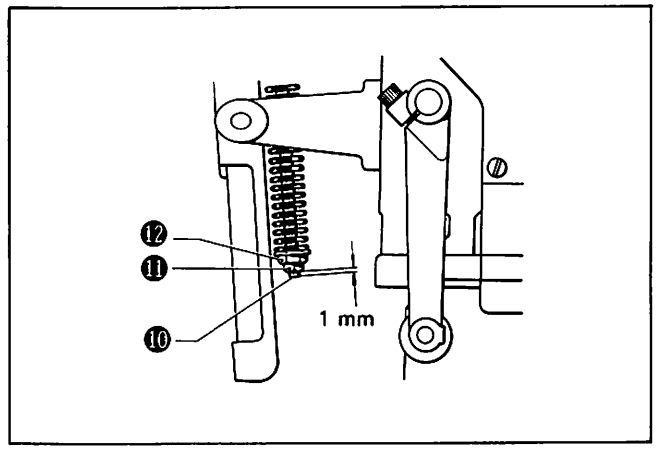
Loosen the bolt ❸ and two Allen bolts ❹, and move the stop lever claw ❺ and clutch claw ❻ to adjust the stop cam ❶ to clutch stopper ❷ gap to 2.0 mm when the machine is operating at slow speed.

* Place a gauge in between the stop cam ❶ and clutch stopper ❷ to simplify adjustments.

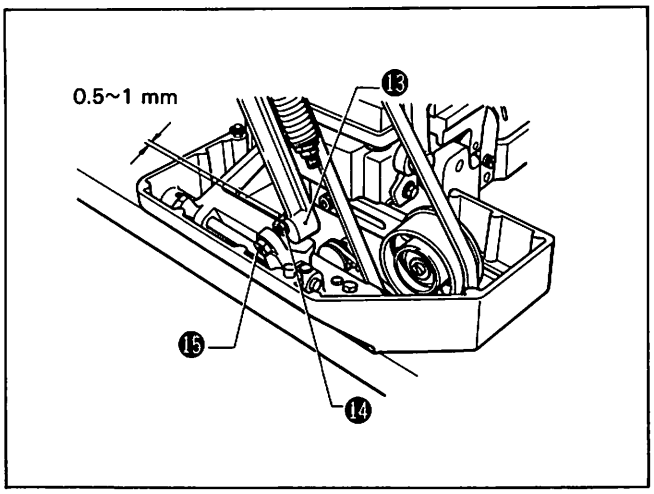
2. Clutch return spring adjustment
Loosen set screw ❽ and adjust the angle of the spring adjustment plate ❾ so that the clutch return spring ❼ will be as weak as possible and so that the clutch stopper will fit into the stopper cam. Standard angle is 45°.



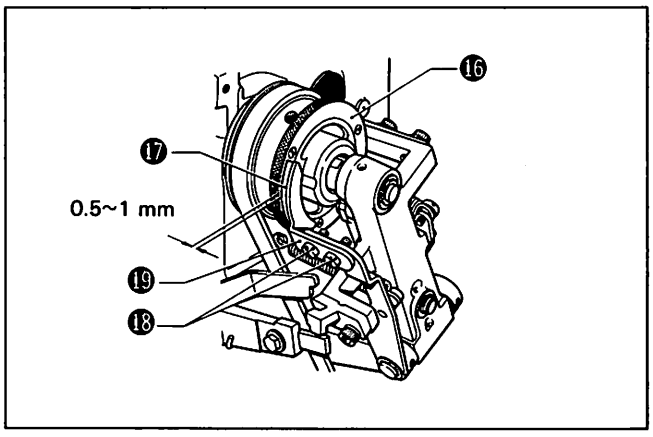
3. Stopper spring adjustment
Loosen nut ⓬ and turn nut ⓫ to adjust the gap between the bottom end of the stopper spring shaft ⓾ and nut ⓫ to 1.0 mm.



4. Clutch engagement lever adjustment
Loosen nut ⑮ and turn bolt ⑭ to adjust the clutch lever ⑬ to bolt ⑭ gap to 0.5 ~ 1.0 mm when the machine is stopped.



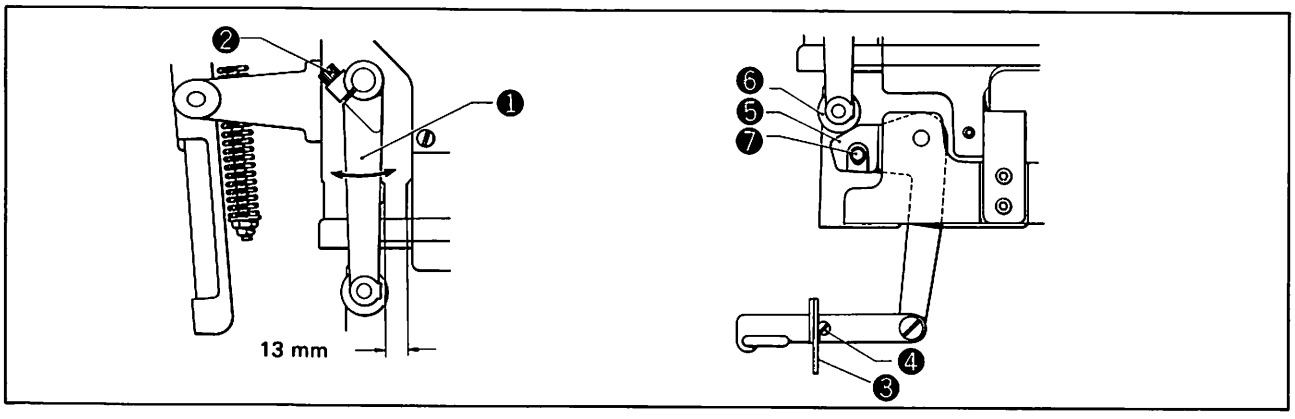
5. Brake adjustment
Loosen the two set screws ⑱ and move the brake assembly ⑲ adjusting the stop cam lid ⑯ to brake shoe ⑰ gap to 0.5 ~ 1.0 mm when the machine is running slowly.



[10] Belt shifter adjustment

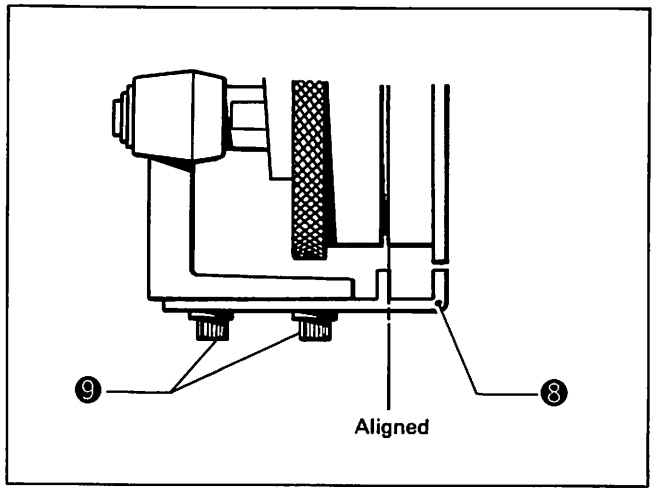
If the belt shifters are not properly adjusted, the belts may not shift properly in either high or low speed, the machine may suddenly stop without having been slowed down, and machine speed may not increase properly.

1. Belt shifter D position adjustment



1. Loosen Allen bolt ② and move the belt shifter drive lever ① to adjust the belt shifter drive lever ① stopper to arm gap to 13 mm when the machine is running.
2. Loosen the bolt ⑦ and vertically shift the belt shifter cam ⑤ so that it touches the roller ⑦ lightly when the stopper ④ meets the belt shifter guide ③.

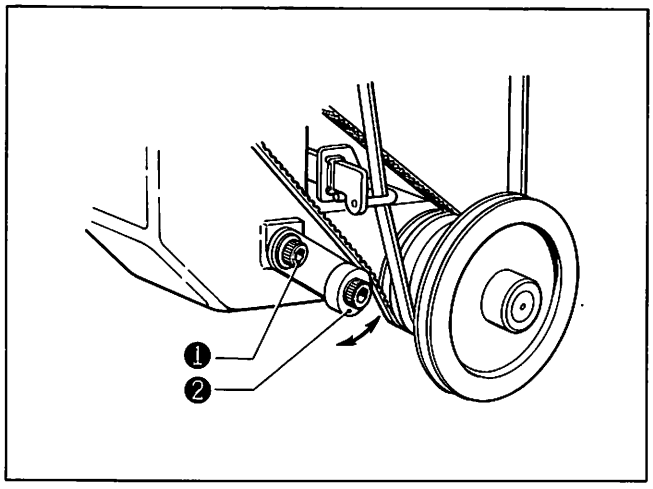
2. Belt shifter U position adjustment
Loosen the two set screws ❾ and move belt shifter U ❽ to align the inside of the belt shifter U ❽ pin with the inside of the idler pulley when the machine is stopped.



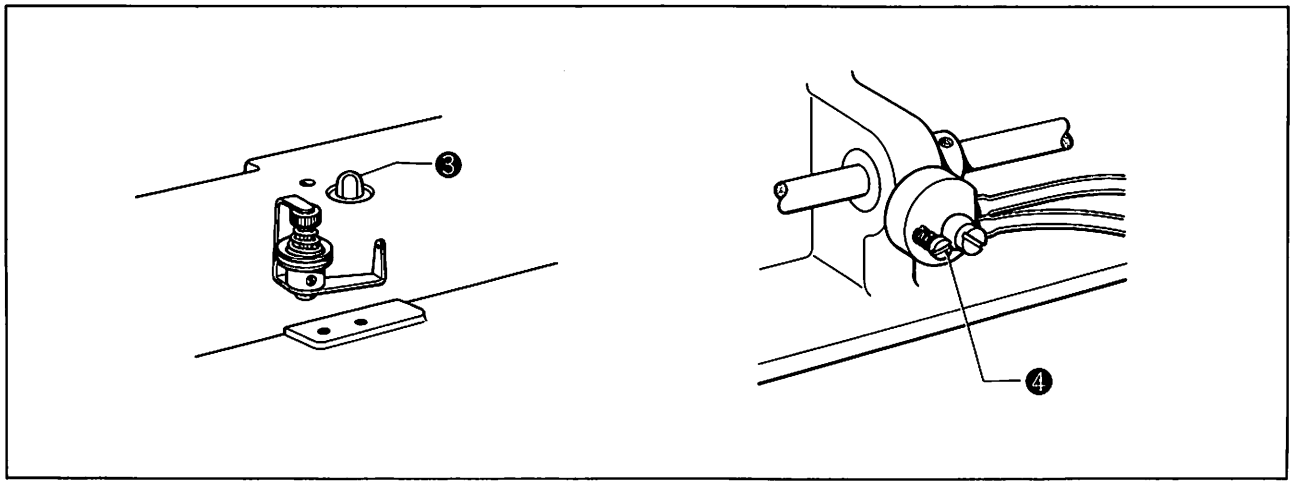
[11] Lubrication adjustment

Improper adjustment of the lubrication system may cause the machine to burn and may cause oil to leak.

1. Pump belt adjustment
Loose the Allen bolt ❶ and adjust the P tension pulley ❷ so that there is approx. 5 ~ 10 mm of slack in the belt when you press it in the center with your finger.



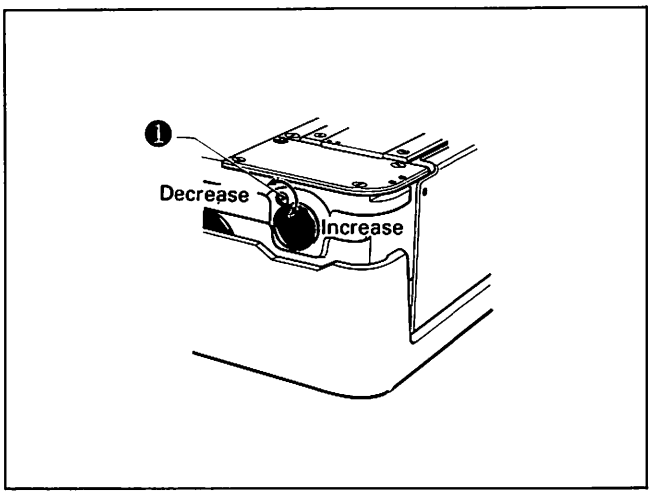
2. Lubrication level adjustment



Turn the adjustment screw ❹ to adjust the oil level so that it just wipes the oil cap ❸ when the machine is running. Turn the adjustment screw to the right to increase oil flow.

* Oil level will decrease slightly when the machine is idling.

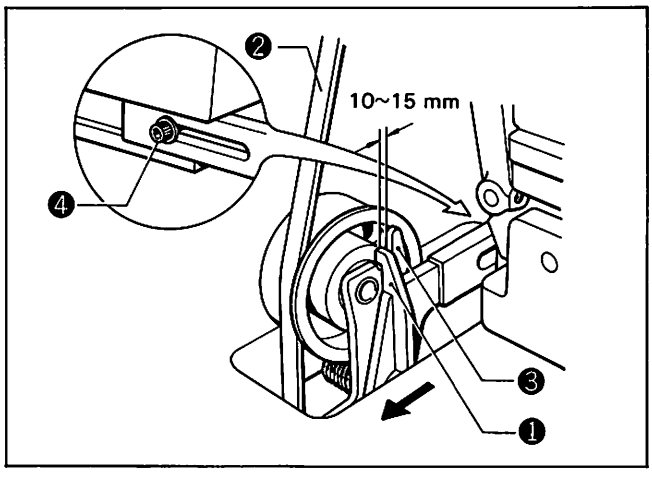
3. Rotary hook lubrication adjustment
To adjust the lubrication of the rotary hook, turn the adjustment screw ❶ to appropriately increase or decrease the oil flow. Turning the screw to the right increases the oil supply, to the left decreases the oil supply.



12 Tension pulley adjustment

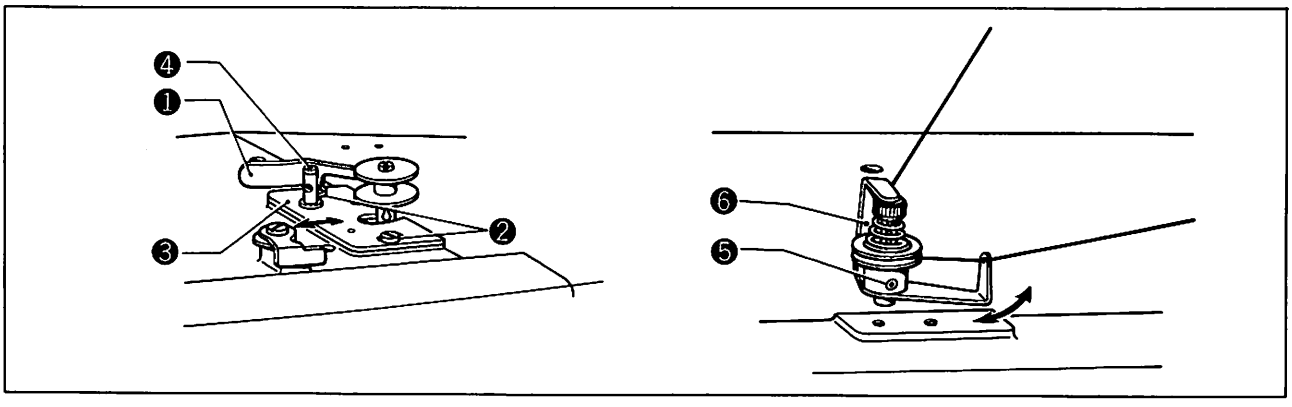
If the tension pulley is not properly adjusted, the machine may stop running. Furthermore, if the tension is greater than is necessary, excessive load will be applied to the machine thus adversely affecting the machine's durability.

With the machine in the stop position, loosen bolt ❹, and adjust the tension pulley arm position ❸ so that the tension pulley bracket ❶ to tension pulley arm ❸ gap is 10 ~ 15 mm when the tension pulley bracket ❶ is turned in the arrow direction and tension is applied to the flat belt ❷.



13 Bobbin winder adjustment

If the bobbin winder is not properly adjusted, the bobbin thread may not wind onto the bobbin, or it may wind unevenly on to one side of the bobbin.

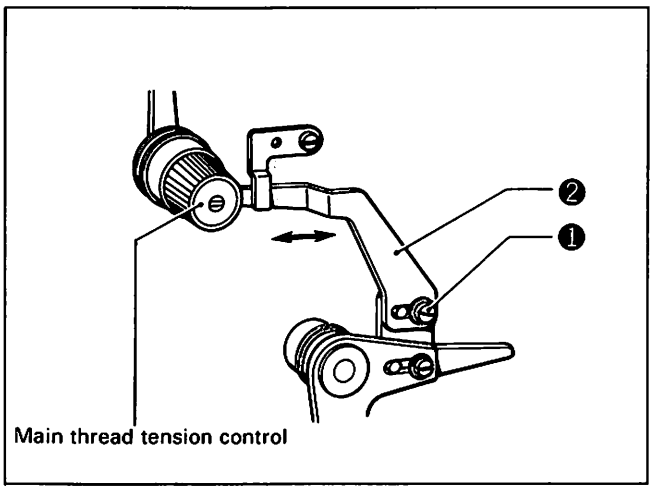


1. When the bobbin will not wind in idling condition of the machine even though the bobbin winder stop latch ❶ is pressed, stop the machine and remove the two set screws ❷; next, adjust the bobbin winder base ❸ position forward or back.
2. If too much thread is wound onto the bobbin, loosen set screw ❹, and move the bobbin winder stop latch ❶ in or out to adjut the amount of thread appropriately.
3. If the thread is wound onto the bobbin unevenly, loosen set screw ❺, and vertically adjust the position of the bobbin winder guide ❻.

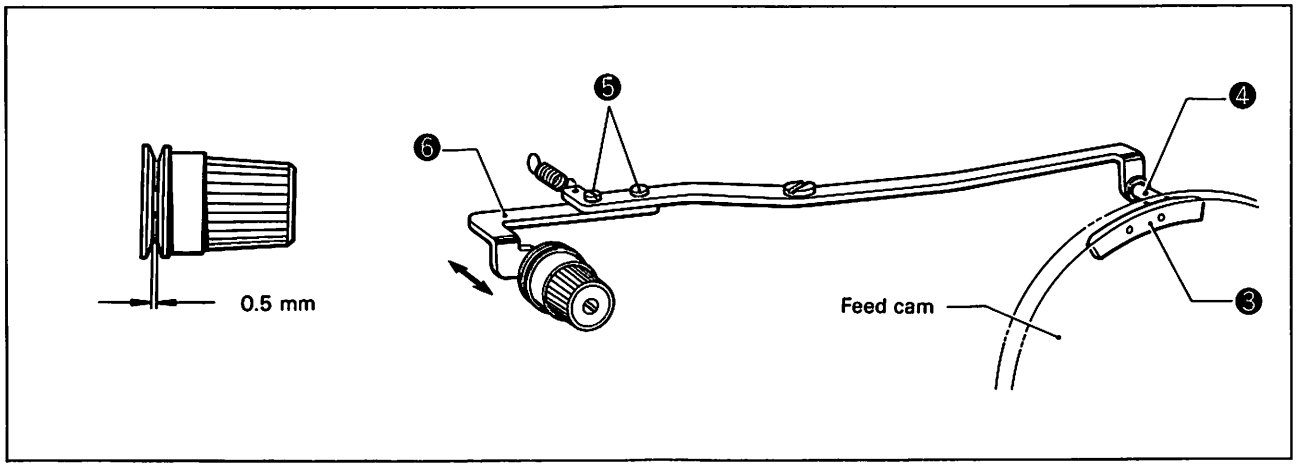
14 Main tension and auxiliary tension adjustment

Improper tension release lever adjustment may result in thread breakage and erratic stitch patterns with unsightly seams in the final garment.

1. Main tension adjustment
   Loosen set screw ❶, and then adjust the position of the main tension release lever ❷ so that the main tension disc floats when the machine is stopped.

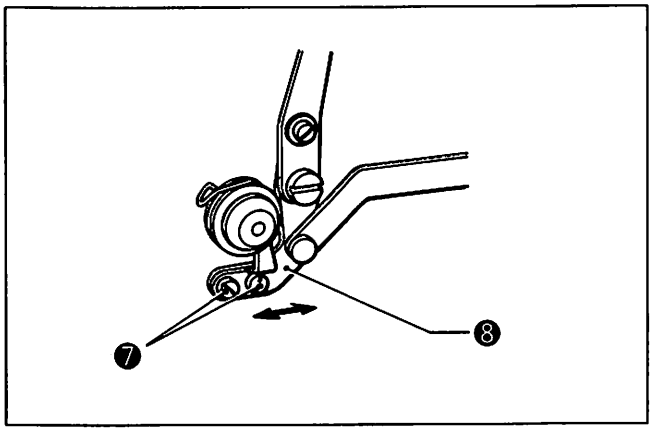


2. Auxiliary tension adjustment



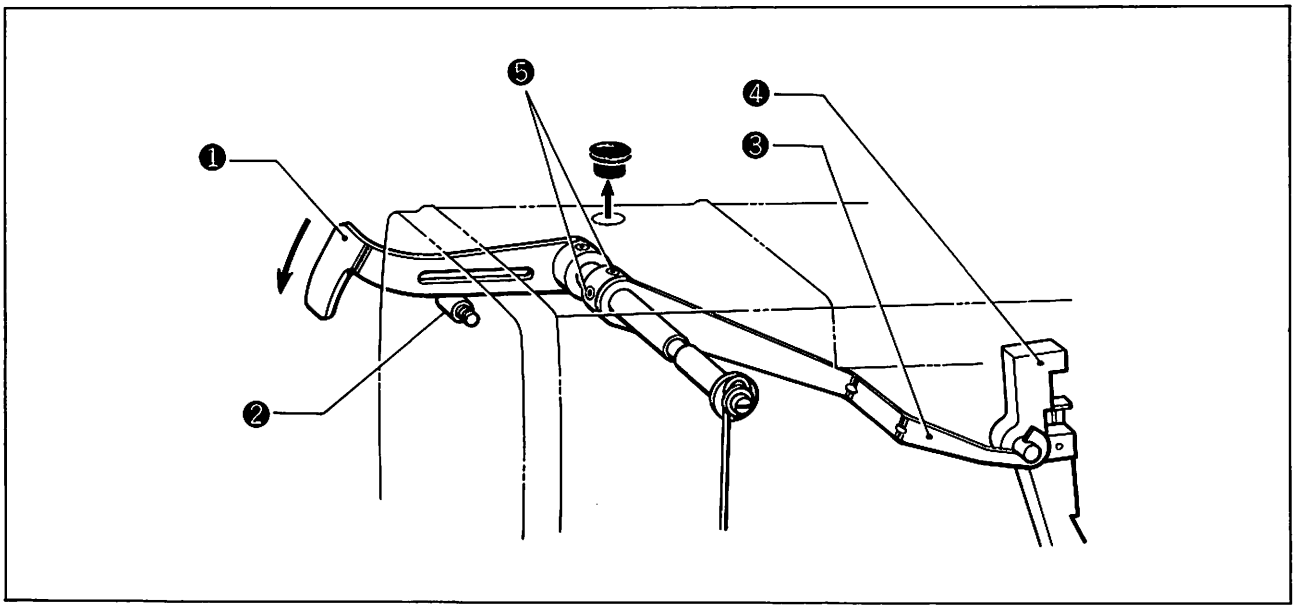
Loosen the two set screws ❺ and move the thread tension release lifting lever ❻ so that the tension disc opens out approx. 0.5 mm when either the machine is stopped or the release lever drive pin ❹ rides onto the release lever cam ❸.

3. Thread tension bracket adjustment
   Loosen the two set screws ❼, and adjust the tension disc driver ❽ position so that the tension disc opens when the machine is stopped.

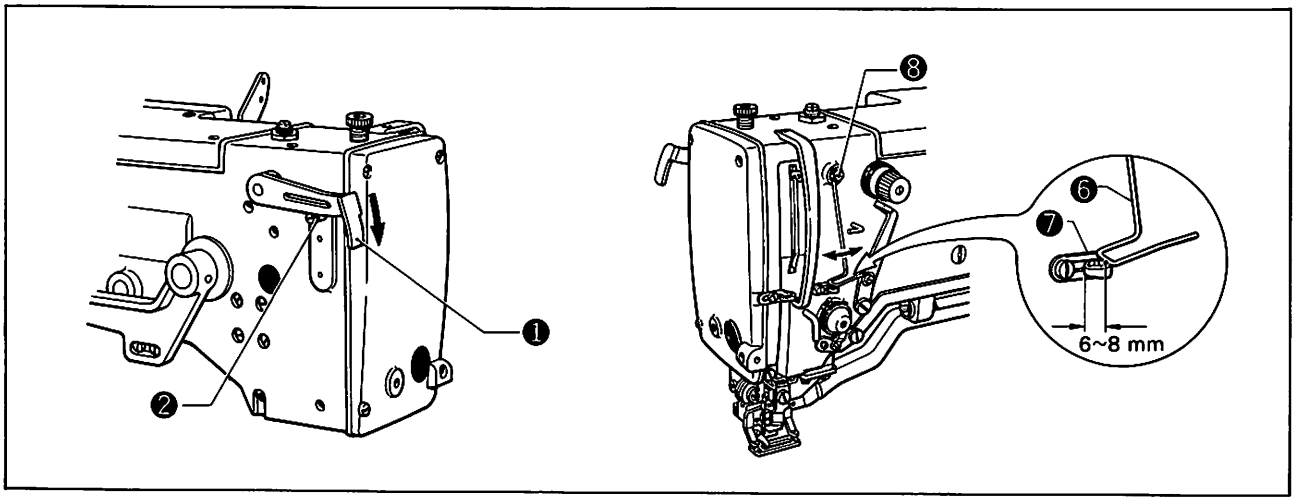


15 Thread breakage detection assembly adjustment

If this assembly is not properly adjusted, the thread cutter will operate even though the thread has broken during sewing.



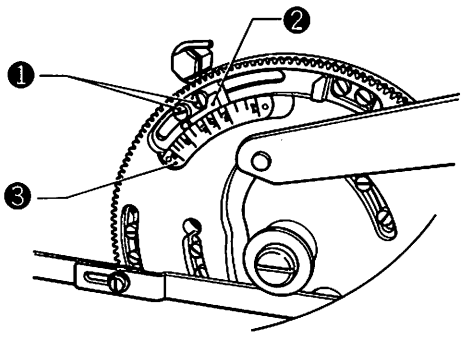
1. When the machine is stopped, loosen the two set screws ❺ and move the cutter clutch stopper ❸ right or left so that the cutter clutch stopper ❸ drops into the cutter stop pin groove ❹ when the thread breakage detector lever ❶ meets the stopper ❷.

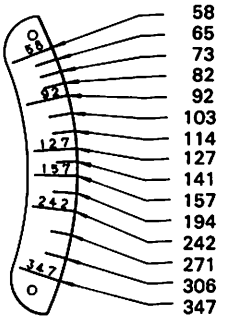


2. When the machine is stopped, loosen set screw ❽ and move the thread breakage detector thread guide ❻ so that the thread breakage detector thread guide ❻ to arm thread guide ❼ gap is 6 ~ 8 mm when the thread breakage detector lever ❶ meets the stopper ❷.

16 Adjustment for changing the stitch number

If this is not properly adjusted, the machine will be severely jolted when it stops and overall durability will be adversely affected.

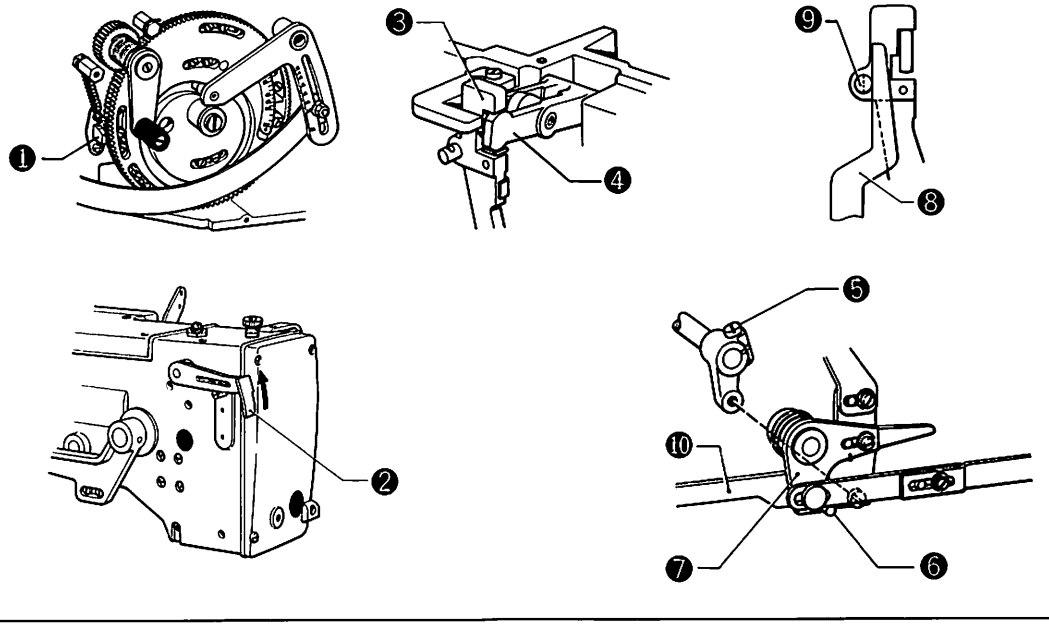




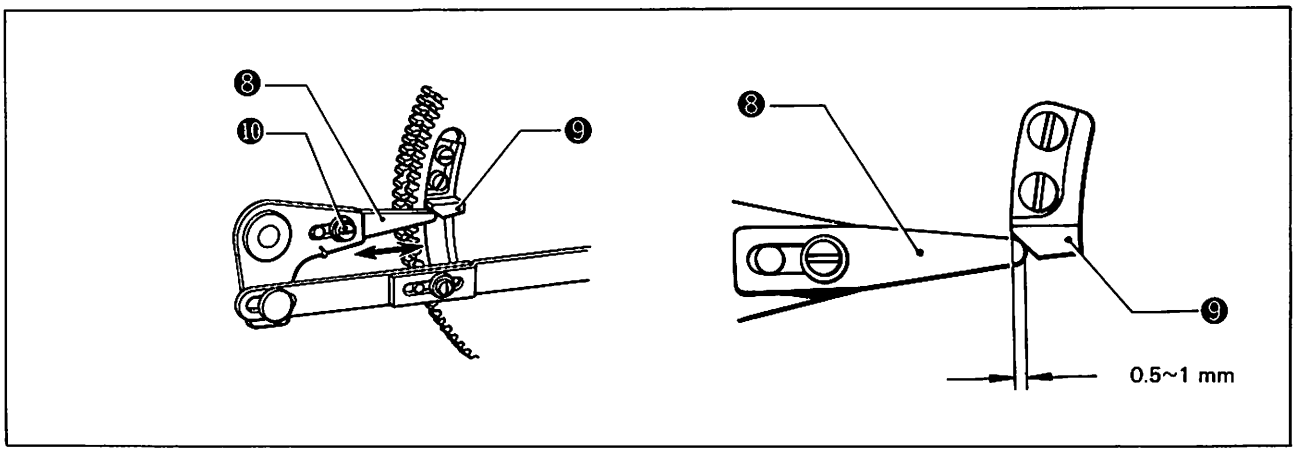
1. With the machine stopped, turn the handle until the two set screws ❶ are in an easy-to-loosen position.
2. Loosen the two set screws ❶, and align the index of stop cam B ❷ with the stitch number on the deceleration scale ❸. Retighten the set screws.

17 Cutter safety device adjustment

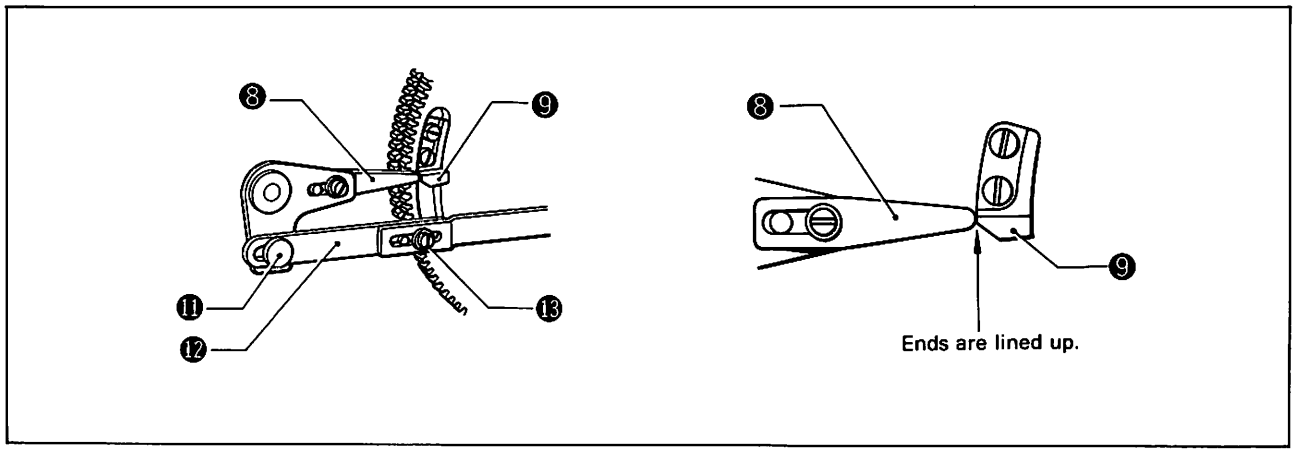
If this device is not properly adjusted, the cutter may fall at the start of sewing, and may not fall at the end of sewing.



1. Press the cutter push rod ❶ and raise the thread breakage detector lever ❷ in condition of deceleration, then to raise it fully, turn the pulley and have the C clutch ❸ meet the thread take-up lever link pin ❹.
2. Loosen the screw ❺, and adjust the position of the thread take-up lever link ❿ so that the stop lever plate ❽ can touch the pin ❾ when the pin ❻ meets the cutter stop lever ❼.



3. Turn the handle with the machine in the stopped position, loosen the screw ⑩, and move the cutter release contact shoe ⑧ in or out so that it overlaps on the stop cam segment A ⑨ 0.5 ~ 1.0 mm.



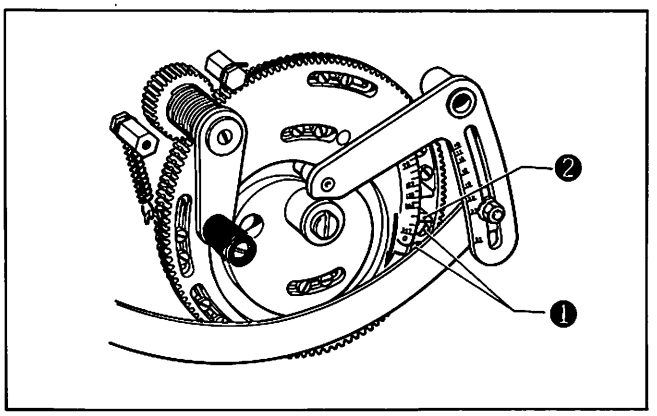
4. Turn the handle until the end of the cutter release contact shoe ⑧ and the end of the stop cam segment A ⑨ are lined up, and then engage the clutch and run the machine at high speed.
5. Loosen the screw ⑬ and adjust the cutter stop connecting rod S ⑫ so that the lock pin ⑪ on the cutter stop connecting rod contacts the right side of the oblong hole in the cutter stop connecting rod S ⑫.

[18] Adjustment of feed cam segment

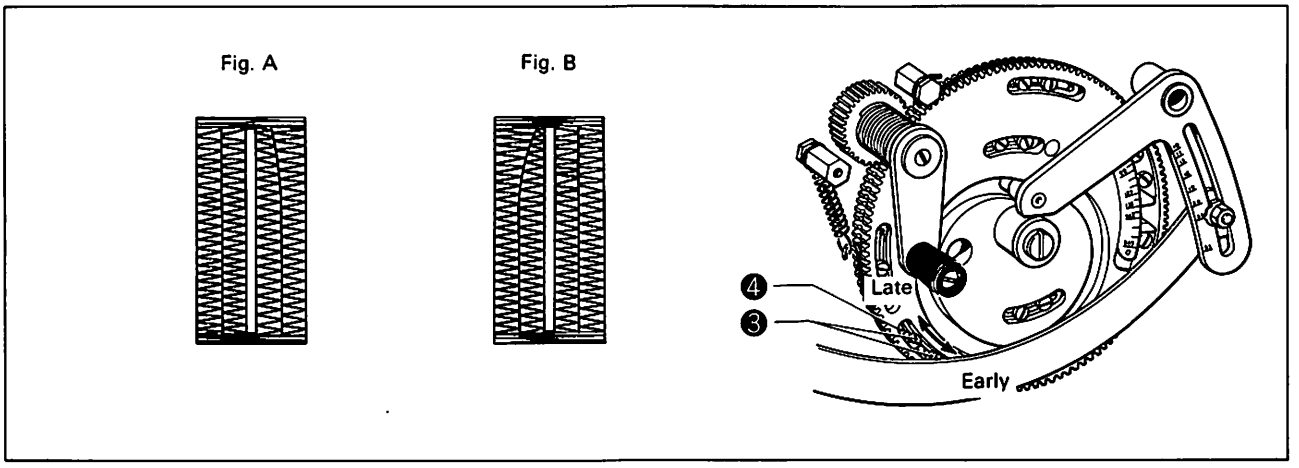
When these adjustments are not complete, the timing for the bar tacking periods and the tenison releasing will be adversely affected, resulting in thread breakage or uneven stitches.

1. Position adjustment of stop cam segment

1. Turn the handle with the machine in the stopped position until the two screws ❶ are in a position where they can be easily removed.
2. Loosen the two screws ❶, and then tighten them again after moving the stop cam segment A ❷ to its lowest position.

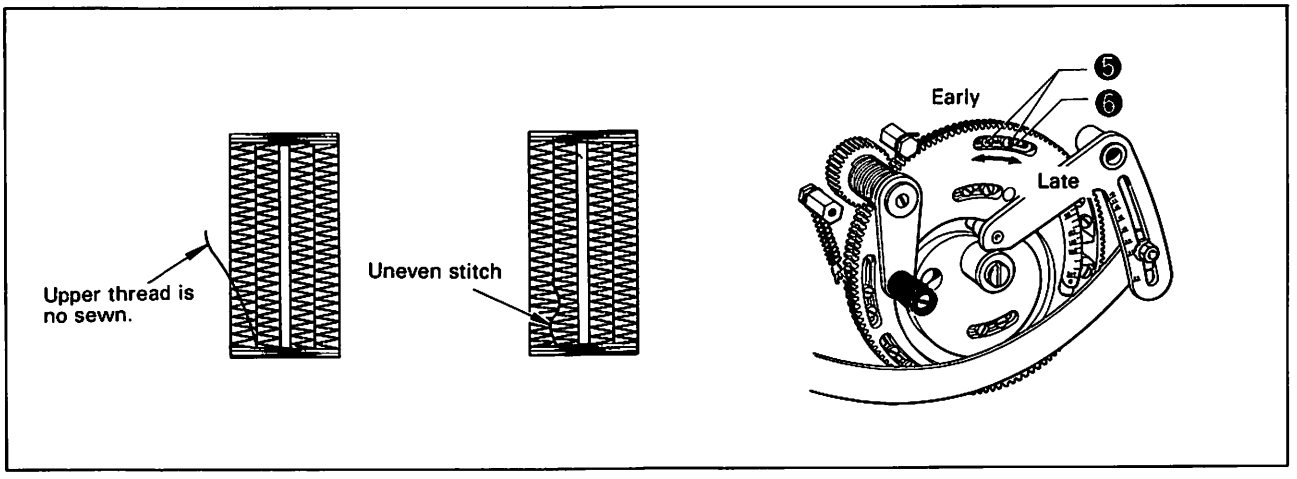


2. Position adjustment of tension releasing cam segment B



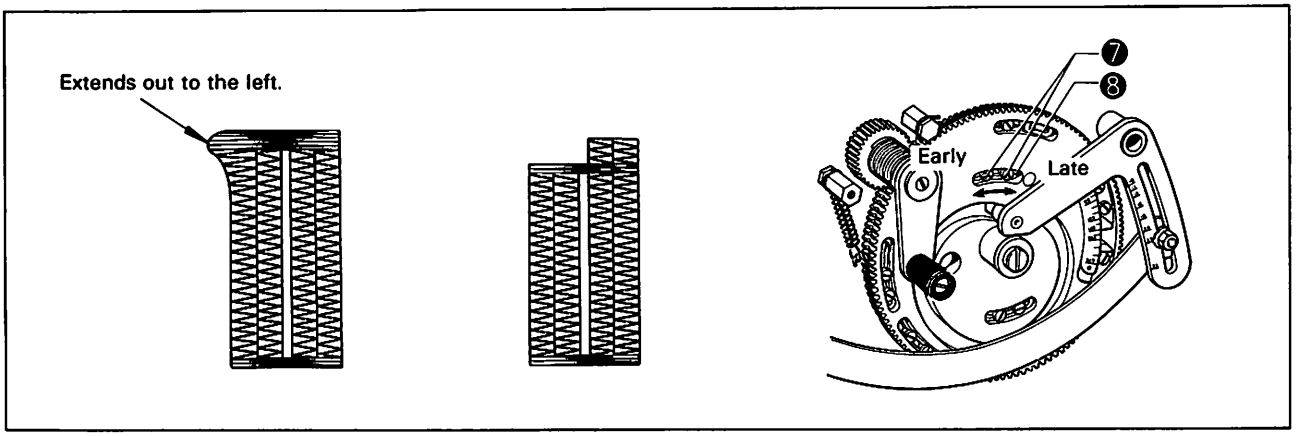
Loosen the two screws ❸ and adjust the position of the tension releasing cam segment B ❹ so that the auxiliary tension disc stops the slack one to three stitches before the end of bar tacking in the inner bar tacking. When the slack period for the auxiliary tension disc is too early, the seam will tend to the left as in Fig. A, and when the slack period is too late, the seam will tend to the right as in Fig. B.

3. Position adjustment of tension releasing cam segment F



Loosen the two screws ❺ and adjust the tension releasing cam segment F ❻ so that the period for the tension releasing at the beginning of sewing ends after two to three stitches. When the slack period of the auxiliary tension disc is early, the end of the thread will slip out of the scissors, and when it is late, the puarl will be adversely affected.

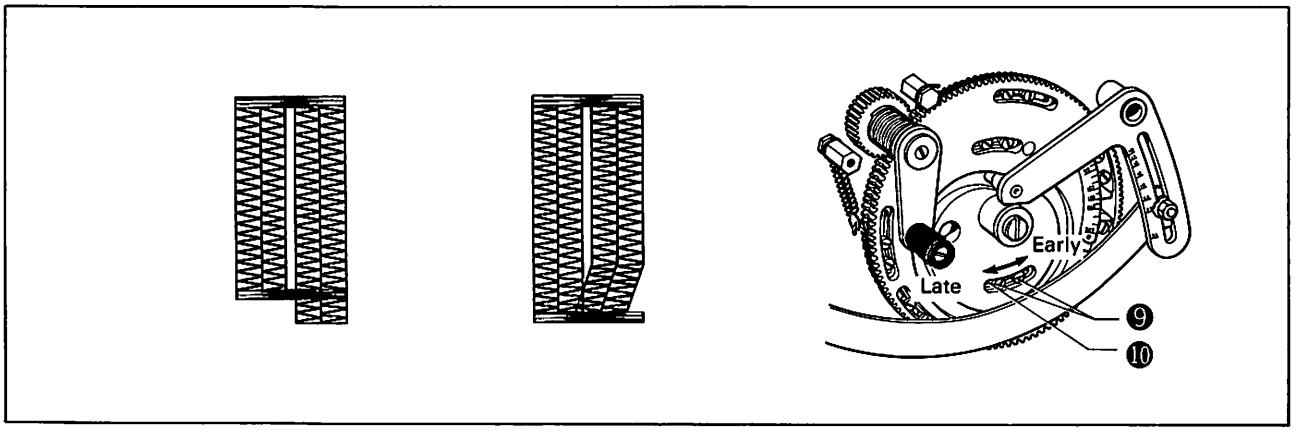
4. Position adjustment of the bar tacking cam segment B



The number of bar tacking stitches is fixed with respect to the total number of stitches. To adjust the inner bar tacking, loosen the two screws ❼, and then move the bar tacking cam segment B ❽ while performing trial sewing. When the bar tacking is too early, the bar tacking will extend out to the left side, and when it is too late, the end of the zigzag stitch will not be covered by the bar tacking.

* When this adjustment is made, readjust the positions of the thread releasing cam segments B and F.

5. Position adjustment of the bar tacking cam segment F



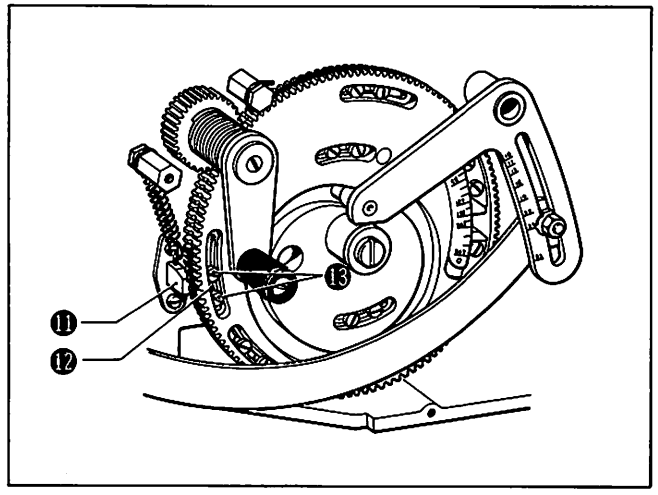
The number of bar tacking stitches is fixed with respect to the total number of stitches. To adjust the forward bar backing, loosen the two screws ❾, and then move the move the bar tacking cam tab F ❿ while performing trial sewing. When the bar tacking is too early, the end of the zigzag stitch will not be covered by the bar tacking, and when it is too late, there will be an open interval which will appear like stitches have been skipped.

* When this adjustment is made, readjust the positions of the tension releasing cam segments B and F.

6. Position adjustment of the cutter cam segment

Loosen the two screws ⓭ and adjust the position of the cutter cam segment ⓬ so that the cutter starts operating when the cutter push bar ⓫ is away from the cutter cam segment ⓬.

* Be sure to make this adjustment when the stitch number has been changed.



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