

SINGER
491UTT

Service Manual

SINGER*

491UTT
Machine

THE SINGER COMPANY

To avoid improper handling and use of the motor, which may cause trouble or shorten its service life, read this manual carefully.

Please keep this manual for future references.

CAUTION: Static electricity will damage some electronic components in the control box. Refer service of circuit boards to qualified electronic service personnel.

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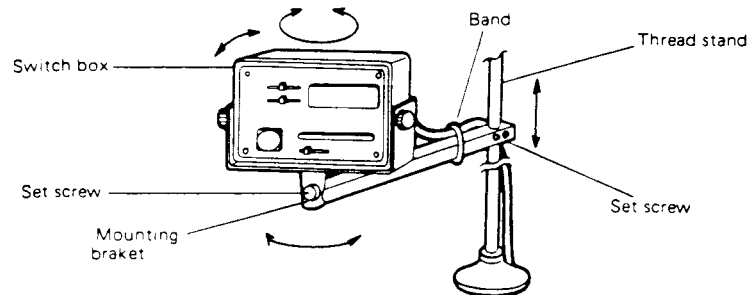
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3-3 Installation of optional switch box

Install the switch box on the thread stand by using the mounting bracket. As shown in fig. 6, adjust the position of the switch box where most convenient for the operations.

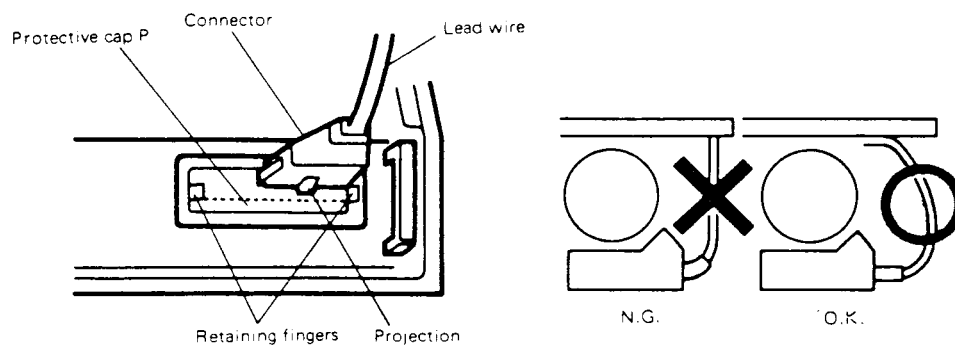
fig. 6



NOTE: Attach the connector of the selector panel to the control box using the following method. (fig. 7)

- (1) Cut the protective cap P along with a dotted line on the Control Box.
- (2) Push retaining fingers outward and insert the connector of the switch box.
Projection on connector must face downward.
- (3) Push retaining finger toward connector to lock securely.
- (4) Run the lead cable from connector in such manner that any strain on the connector is definitely avoided.

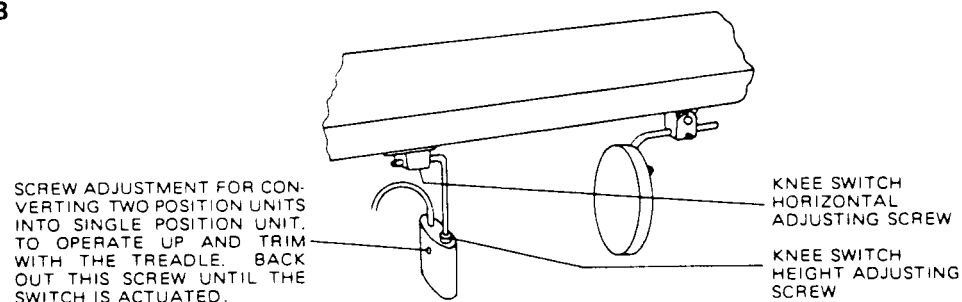
fig. 7

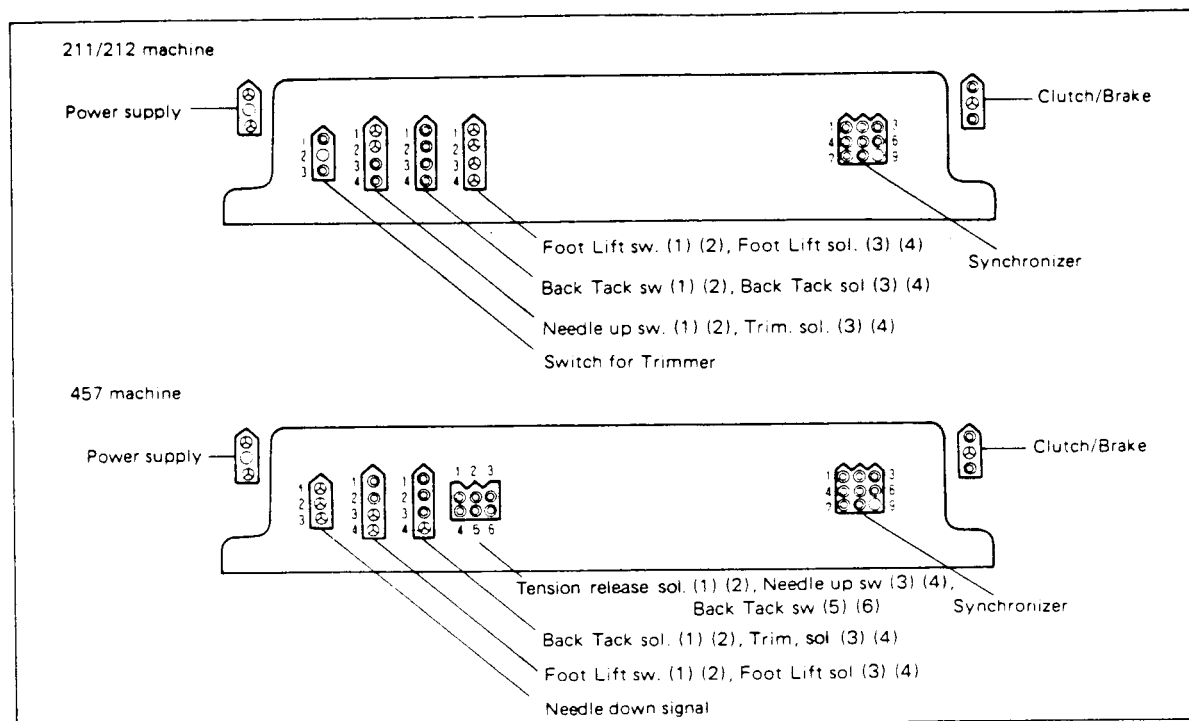


3-4 Installation of Knee Switch (211/212 machines)

The knee switch is placed so that the operator's right knee falls between it and the knee presser foot lift. Locate the switch and bracket as shown in figure 6 so that the operator can conveniently operate both presser foot lift and the separate knee switch without excessive movement of her knee. Secure switch bracket to underside of table with screws provided.

fig. 8





NOTE: As for the details of each respective connection, please see "BLOCK DIAGRAMS"

4-4 Synchronizer connections

Before starting operation, insert the synchronizer connector into the corresponding receptacle on the connector panel.

4-5 Connections of the lighting fixture

Two black wires are provided for 6 Volt 20 Watt lighting fixture in the end cover of the motor. Please connect properly when it will be needed.

IMPORTANT:

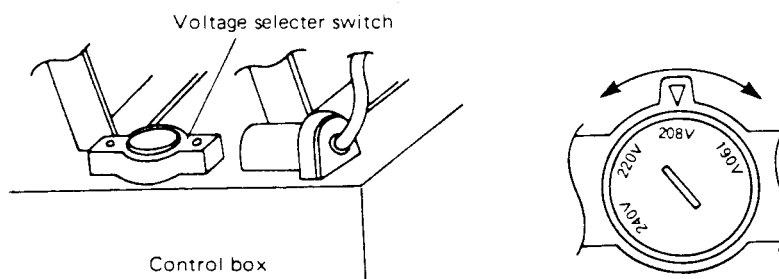
USE LAMP ASSEMBLY CERTIFIED FOR USE WITH SEWING MACHINES ONLY. LAMP CONNECTIONS HAVE FULL SUPPLY LINE VOLTAGE TO GROUND. MINIMUM CIRCUIT CAPACITY OF CONDUCTORS 15 AMPS. TO AVOID ELECTRIC SHOCK AND SHORT CIRCUITING, THESE LAMP WIRES MUST BE INDIVIDUALLY AND SECURELY INSULATED AFTER CONNECTING TO THE LAMP ASSEMBLY.

4-6 Changing the primary taps of the transformer used in 220V ~ 240V control box

The transformer which is located in the control box has the four taps (190V—208V—220V—240V). The factory sets the tap at rated nameplate voltage.

Before starting operation, check your power supply and if necessary, change the connection to the proper tap by turning the voltage selector installed on the control box.

fig. 11



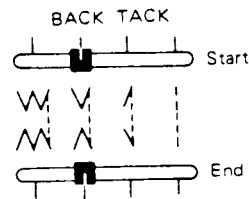
5-6 AUTOMATIC BACK TACKING (Function code of Control Box : 04, 14 and 24)

1) Back-tack patterns

These patterns can be selected by manipulating the back-tack switches. Fig. 16 below shows the respective switch positions for the back-tacks at the start and end of sewing.

- No back tacking
- Single back tacking
- Double back tacking
- Quadruple back tacking

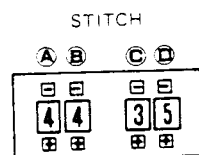
fig. 16



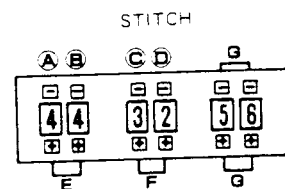
2) Pre-setting the stitches of back tacking

The number of stitches for each segment (A, B, C and D) of the back tacking can be adjusted from 0 to 9 by the stitch counter switches shown on Fig. 17. If it is desired to increase the number of stitches, push the lower button to the required number. When decreasing the number of stitches, push the upper button.

fig. 17



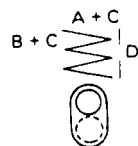
Function code: 14



Function code: 24

5-7 LINE TACKING

fig. 18



Function code: 14

(Function code of Control Box : 14)

1) Switch for line tacking operation

The line tacking can be selected as follows:

Push the switch to the upper position as indicated at left, when the line tacking is required.

2) Pre-setting the stitches of line tacking

The number of stitches of each segment in the forward sewing mode can be adjusted by the the stitch counters A and C from 1 to 18 stitches. (Simply add the numbers A and C)
The number of stitches of each segment for the reverse sewing mode can be adjusted by the stitch counters B and C same way as above.
The repeat times can be adjusted by stitch counter D from 1 to 9.

2) Details of pattern sewing

a) Pattern 1 (Normal sewing)

- I** By pressing the pedal down, the machine will start the sewing with start back tack (SBT) as the selection of SBT.
- II** During the free sewing, by releasing the pedal to the neutral, the machine stops at the first needle position and by heeling back the pedal to the intermediate position, Foot Lift (FT) will be operated.
- III** By heeling back the pedal fully, the machine performs the thread trimming (TRIM) with end back tacking (EBT) as the selection of EBT.

b) Pattern 2 (Basic stitch counting — one segment only)

- I** By pressing the pedal down, the machine will start the stitch count sewing (G) with SBT as the selection of SBT. As long as the pedal is kept to be pressed down, the machine will continue the stitch counting and complete the pattern sewing with TRIM and/or EBT.
- II** Except the EBT period, operator can stop the machine anytime by releasing the pedal to the neutral and can do TRIM without EBT regardless the EBT selection.

c) Pattern 3 (Combination of pattern 1 and 2)

- I** Same as Pattern 2 by the point ①.
- II** When the machine completed the pattern to the point ①, the machine will stop at the first needle position and FL goes up and stays up for 12 seconds or until treadle is returned to neutral and pressed down again for pivoting the materials. If longer FL is necessary, heel the pedal back to the intermediate position.
- III** Same as Pattern 1 after the point ①.
- IV** See "Note" in Pattern 6, 7, 8 for the fine adjustment of the length of "G".

d) Pattern 4 (Repeat of pattern 2)

- I** This pattern is the repeat of pattern 2. Operator can repeat as many as she/he wants.
- II** The differences are;
 - i) At the point of ①, to continue the pattern, the pedal has to be released to the neutral once and pressed down again.
 - ii) To finish the pattern with TRIM and/or EBT, the pedal has to be heeled back at the point ②.
 - iii) To operate FL at the point of ①, the pedal has to be heeled back to the intermediate position.
- III** See "Note" in pattern 6, 7, 8 for the fine adjustment of the length of "G".

NOTE: In Pattern 2, 3 and 4,

- 1) If the stitch counter G is set to "zero", the sewing will not be started.
- 2) If the pedal is heeled back fully before completing the G, TRIM is immediately performed without EBT.

fig. 22



fig. 23



fig. 24



fig. 25

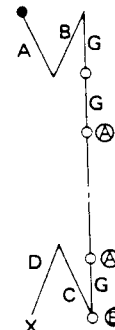
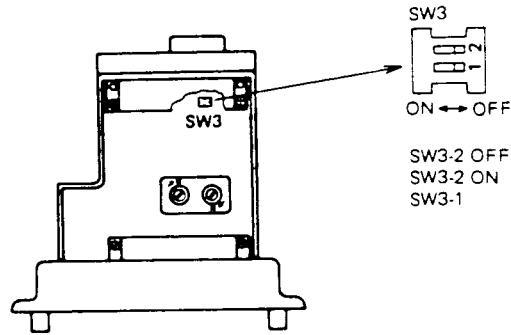


fig. 28



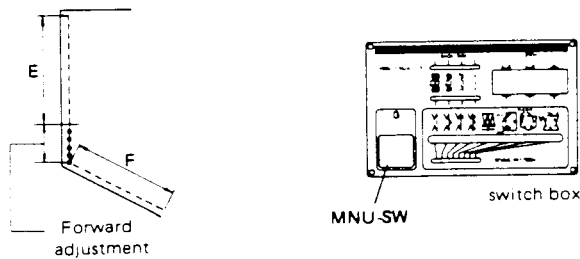
SW3-2 OFF : Option 1
SW3-2 ON : Option 2
SW3-1 : Not used

Option 1 : Automatic finish of pattern sewing with TRIM and/or END BACK TACK same as pattern 2.
Option 2 : Free sewing and TRIM and/or END BACK TACK by heeling the pedal same as pattern 3.

- 4) Fine adjustment of the length of each stitch counting seam
The length of each seam of stitch counting can be adjusted as follows;

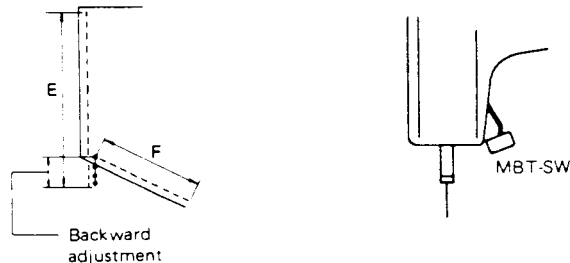
- a) Case 1: If the performed seam by the stitch counting is shorter than required, push the switch for manual needle up positioning (MNU-SW) momentarily which is located on the switch box. Then, the machine performs ONE stitch forward at the low speed. (Fig. 29)

fig. 29



- b) Case 2: If the performed seam is longer than required, use the switch for manual back tack (MBT-SW) to adjust the length, which is mounted on the sewing machine. In this case the machine performs ONE stitch backward at low speed. (Fig. 30)

fig. 30



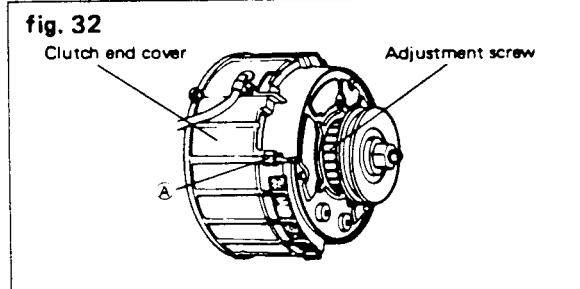
- NOTE:** 1) If the adjustment for more than ONE stitch is necessary, repeat above until the required length will be performed.
2) In this mode, both switches (MNU, MBT) function in different way from their own functions.

6 ADJUSTMENTS

CAUTION: NEVER MAKE ANY FOLLOWING ADJUSTMENTS WITH "POWER ON" AS IT CAN CAUSE SEVERE PHYSICAL INJURY TO HANDS, ARMS, ETC.

6-1. Adjustment of clutch air gap

- A) Turn the adjustment screw counterclockwise at least two turns, until the output shaft will not turn freely any longer.
- B) Turn the adjustment screw clockwise carefully until the shaft just begins to rotate by hand (At this point, the clutch air gap is zero). Continue to turn the adjustment screw 120° clockwise. (8 steps of ratchet).



6-2. Adjustment of needle stop positions

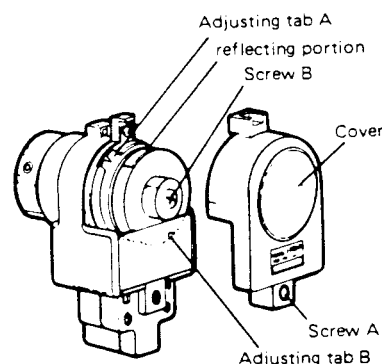
At factory this is pre-adjusted; however, if necessary, readjust the needle stop positions by turning the reflection plates of the synchronizer as described below.

NOTE: While readjusting the positions, trimmer and wiper solenoids should be disconnected. Do not touch the reflecting portions of the reflecting plates.

(457 machine)

- A) Turn the sewing machine manually into the "needle down" position.
(Make sure the direction of rotation is correct)
- B) Remove the cover from the synchronizer. (Remove the screw A)
- C) Loosen the screw B. (Do not remove the screw B)
- D) Turn the reflection plate A so that the adjusting tab of plate A will be located at uppermost position.
- E) Turn the sewing machine to the "needle up" position.
- F) Make the same adjustment of the reflection plate B for "needle up" position.
- G) Tighten the screw B.
- H) Replace the cover on the synchronizer.

fig. 33



To make fine adjustments follow the preceding instructions and . . .

- A) Operate the sewing machine with the foot treadle.
- B) Press the treadle forward and release.
- C) Make sure the sewing machine is in the "needle down" position.
- D) Correct for the required needle position by turning the adjusting tab A.
- E) Heel the treadle. (Needle stops in the up position.)
- F) Correct for the required position by turning the adjusting tab B.
- G) Finally tighten the screw B and install the synchronizer over.

CAUTION: DO NOT TOUCH THE SYNCHRONIZER REFLECTION PLATES OR OTHER ROTATING PARTS WHILE THE SEWING MACHINE IS OPERATING. REMEMBER THAT FINE ADJUSTMENT IS CHECKED WITH POWER ON.

6-3. Regulating the force required to operate the foot treadle

A) Downward force

Relocate the position of the hooked end A of the lever spring. The force is reduced as this end is moved closer to the lever fulcrum. Also when position of the treadle pitmanrod is moved from preferred position E to position F force needle is reduced.

B) Heeling-back force

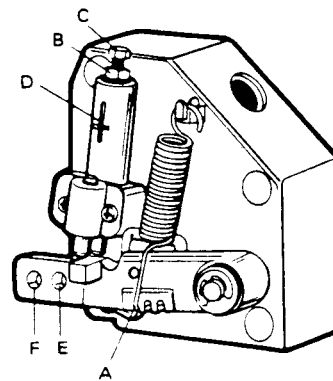
Adjust this force with screw C.

(NOTE: Nut B serves to lock screw C)

This amount of force is indicated at window D.

The position marked on window. D is the position to which the force was preadjusted at factory.

fig. 36



6-4. Adjustment of the maximum speed and back tacking speed

A) Maximum speed

The rotary control "MAX" to adjust the maximum speed is mounted behind the rubber cap located at the front of the control box as shown on Fig. 37. At the factory, it is adjusted to the highest speed (Synchronous speed), if necessary, remove the rubber cap and then carefully turn this rotary control counter-clock wise, using a small screw driver.

The operating speed is adjustable from the maximum synchronous speed to the lowest speed (ordinarily 200 RPM) in about 200 RPM steps. The lower speed is convenient for the training the beginner. However, the longer the use of the lowest speeds, the shorter the life of the clutch and brake linings.

B) Back-tacking speed

The rotary control "BT" to adjust the back tacking speed is mounted on the printed circuit board which is located in the modular shown in fig. 37. At the factory it is adjusted to 1,500 RPM for 591 machine, 1,000 RPM for 211/212 machine and 1,400 RPM for 457 machine. When speed adjustment is required for controlled back tacking, adjust following these instructions:

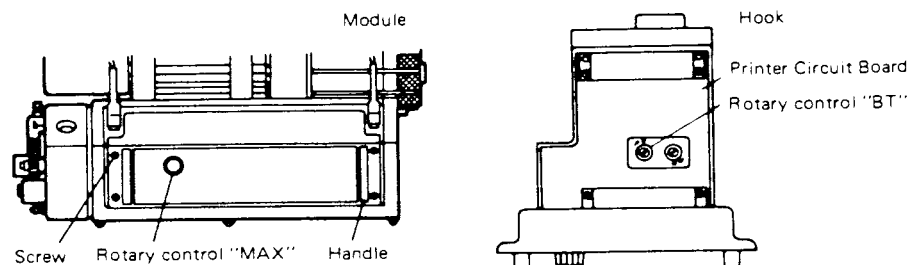
a) Remove the screws. (4 pcs)

b) Pull the handles of the module till the position at which the module can be hung by the hook.

c) Adjust to get required back tacking speed by turning the control "BT" with small screw driver.

The back tacking speed is adjustable from its lowest speed (ordinarily 200 RPM) to approximately 3200 RPM in about 200 RPM steps.

fig. 37



NOTE: a) All rotary controls are of the "click" type. When making adjustments, be certain that they click into position.

b) Do not touch the "POS" rotary control on the printed board. This adjusts the minimum speed and cutting speed: these are previously adjusted at the factory to suit the characteristics of specific modes of sewing machines.

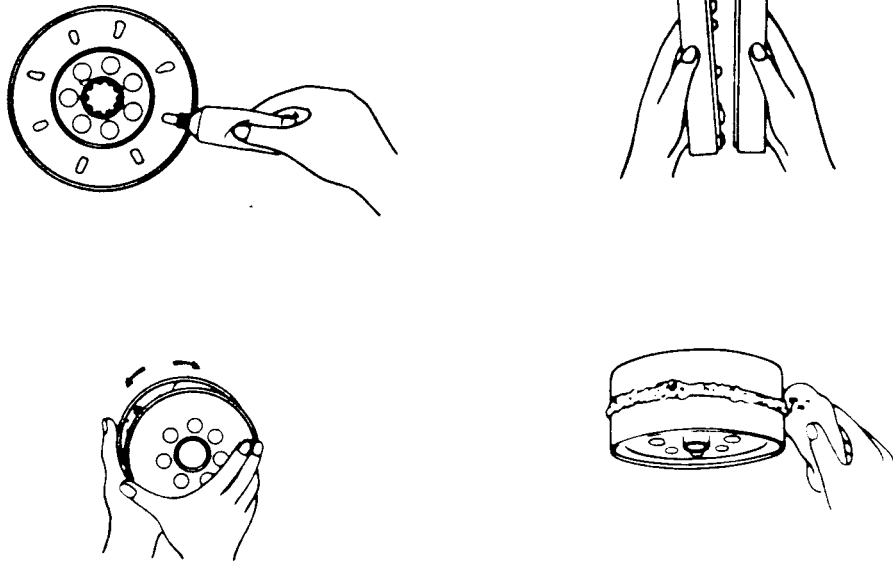
C) Application of coating to lining surfaces

- a) Squeeze an amount equal to about 2 match heads from the tube and apply to the lining surface of either the clutch or brake in 8 places.

NOTE: Be careful not to apply too much, because this may cause a malfunction of accurate stopping, also the motor might not operate even when power is turned on.

- b) Firmly press the uncoated lining surface against the coated surface.
c) Rotate the moving discs against each other.
d) Clean away any excess which squeezes out between the lining surfaces.

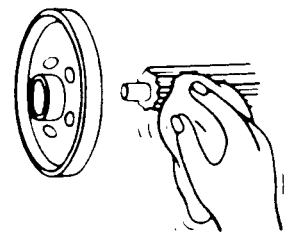
fig. 40



D) Application to clutch shaft

Clean away any waste or lint adhering to the splines of the clutch shaft, and apply the material evenly.

fig. 41



E) Motor assembly

Assemble the motor in the opposite order of disassembly.

F) Break-in operation

Perform a break-in operation soon after application of coating to the lining surfaces.

- a) Switch on the motor.
b) After the motor is operating normally, perform the break-in operation by operating the treadle at least 100 times.

NOTE: If too much material is applied to the lining surfaces the motor might not operate even when power is turned on. If this happens, remove excessive material from the friction disc surfaces.

8 HOW TO CHECK THE DRIVE UNIT

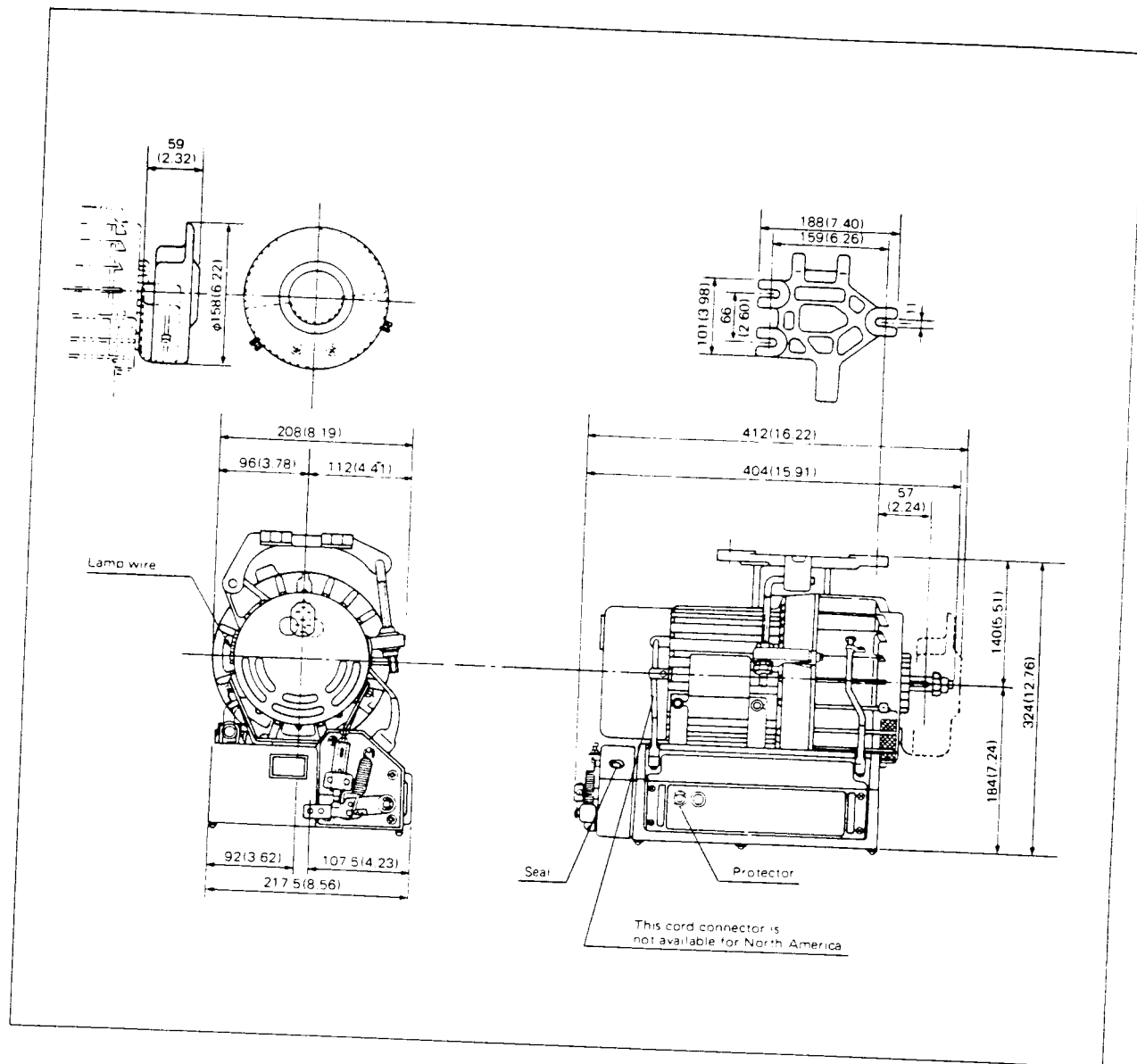
In case the trouble, proceed as follows:

- 1) Switch off the motor.
- 2) Pull out all connectors, then reinsert them.
- 3) Recheck to determine whether problems have been eliminated

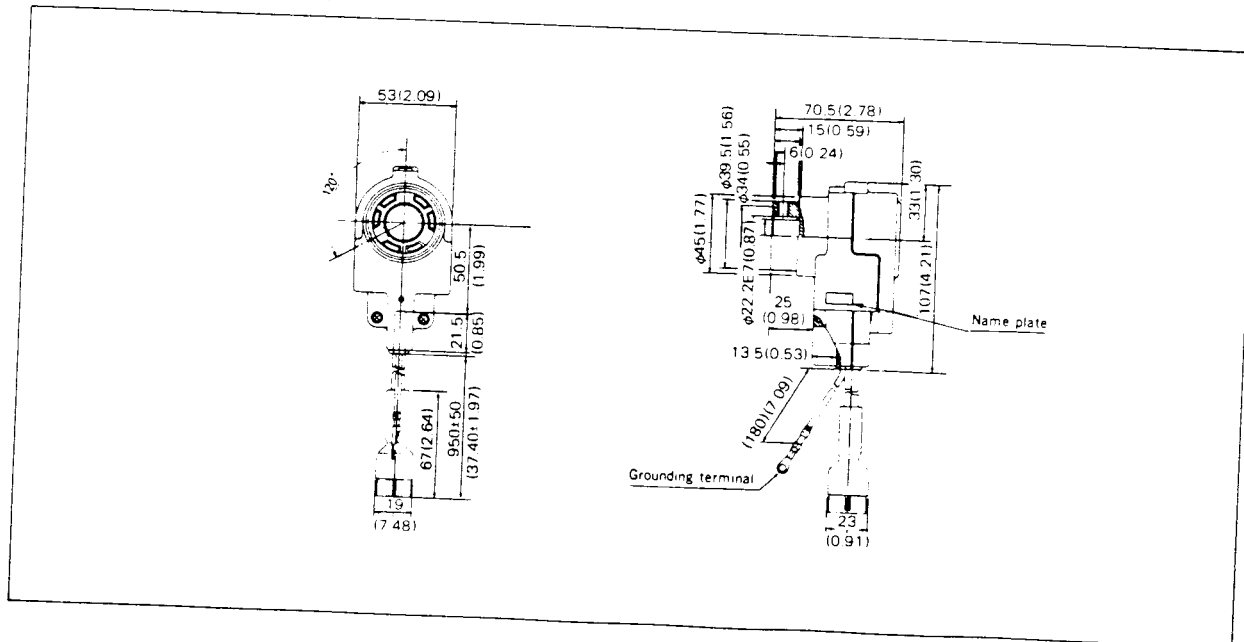
TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Motor does not start when turning main switch on.	Power supply cord (plug, protection switch) not properly connected.	Correct connection in accordance with Instruction.
	Power supply cord (plug, cord, protection switch) defective.	Replace defective part.
	Motor winding defective.	Replace motor.
Motor runs, but when activating sewing machine treadle, the machine does not start.	Plug for synchronizer, clutch, or clutch cord defective; connection in plug for clutch interrupted.	Replace defective part or repair connections respectively.
	Plug for synchronizer or clutch & brake not inserted.	Plug in.
	Power supply cord (plug, cord) for control box defective, or plug not inserted.	Replace defective part, or plug in.
	Fuse or protector in control box open.	Check fuse or protector in control box.
	Clutch & brake air gap too narrow, or after a long time of use, clutch lining worn down or defective.	Adjust air gap in accordance with Instructions. If necessary, replace clutch and brake discs.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
Motor decreases speed considerably or stops entirely.	Voltage too low.	Have power supply checked.
	Machine or devices (e.g. thread trimmer) binding or seized.	Repair machine or devices.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
Motor overheats.	Air passages within motor and clutch filled with lint or debris.	Clean air passages in motor and clutch.
	Machine or devices (e.g. thread trimmer) binding or seized.	Repair machine or devices.
	Brake air gap too narrow.	Adjust brake air gap in accordance with instructions.
	Clutch and/or brake coil defective.	Replace defective parts.
	Motor winding defective.	Replace motor.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
	Three phase motor operating only on two phases.	Check main power supply.
Once main switch turned on machine operates without treadle being actuated. Stop is only possible by turning switch off.	Machine treadle is jammed or actuates by own weight.	Replace or repair treadle. Check force of speed control spring.
	Clutch air gap too narrow.	Adjust clutch air gap in accordance with instructions.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.

9-1 MOTOR

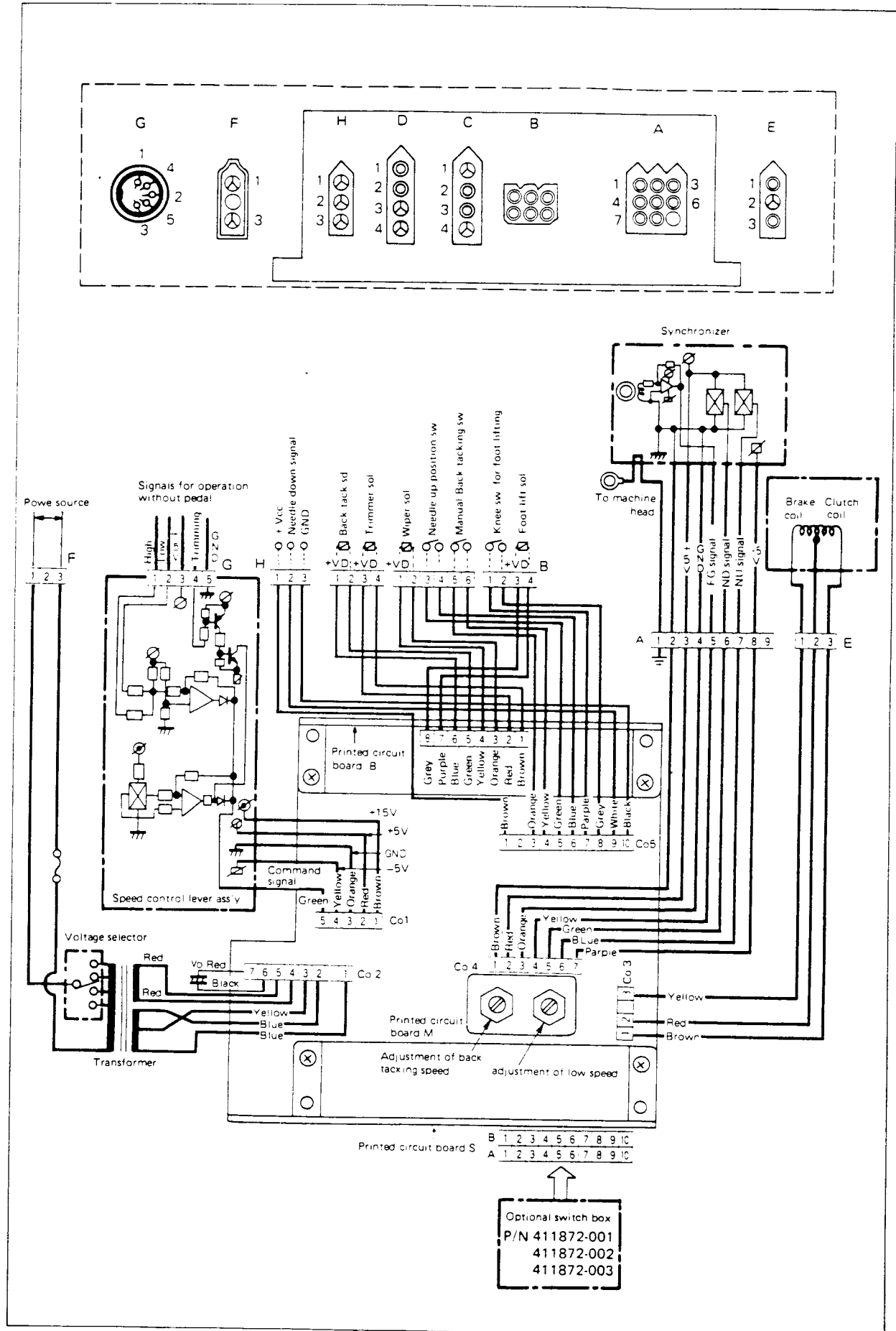


9-2 SYNCHRONIZER

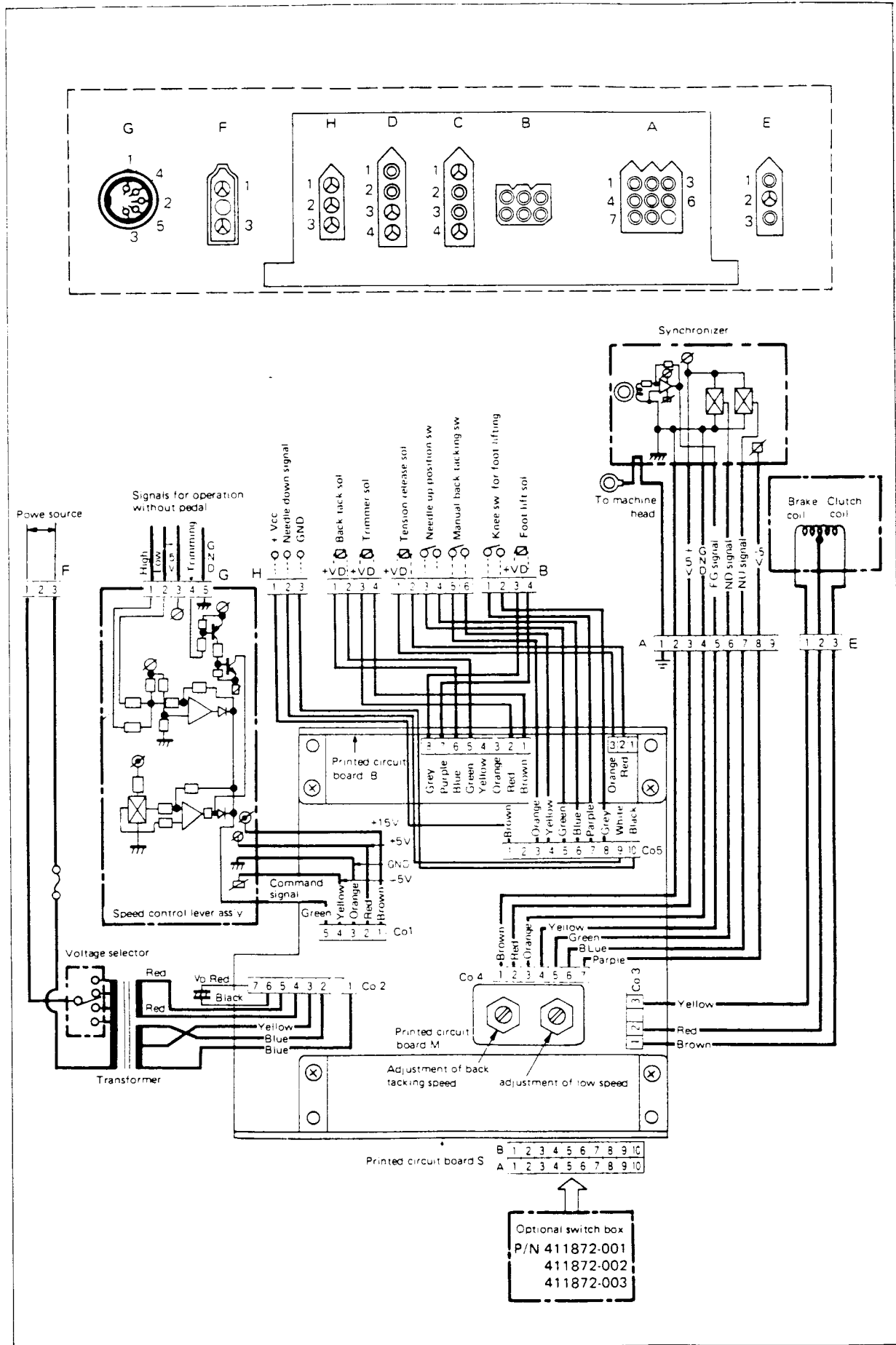


BLOCK DIAGRAMS

591 machine

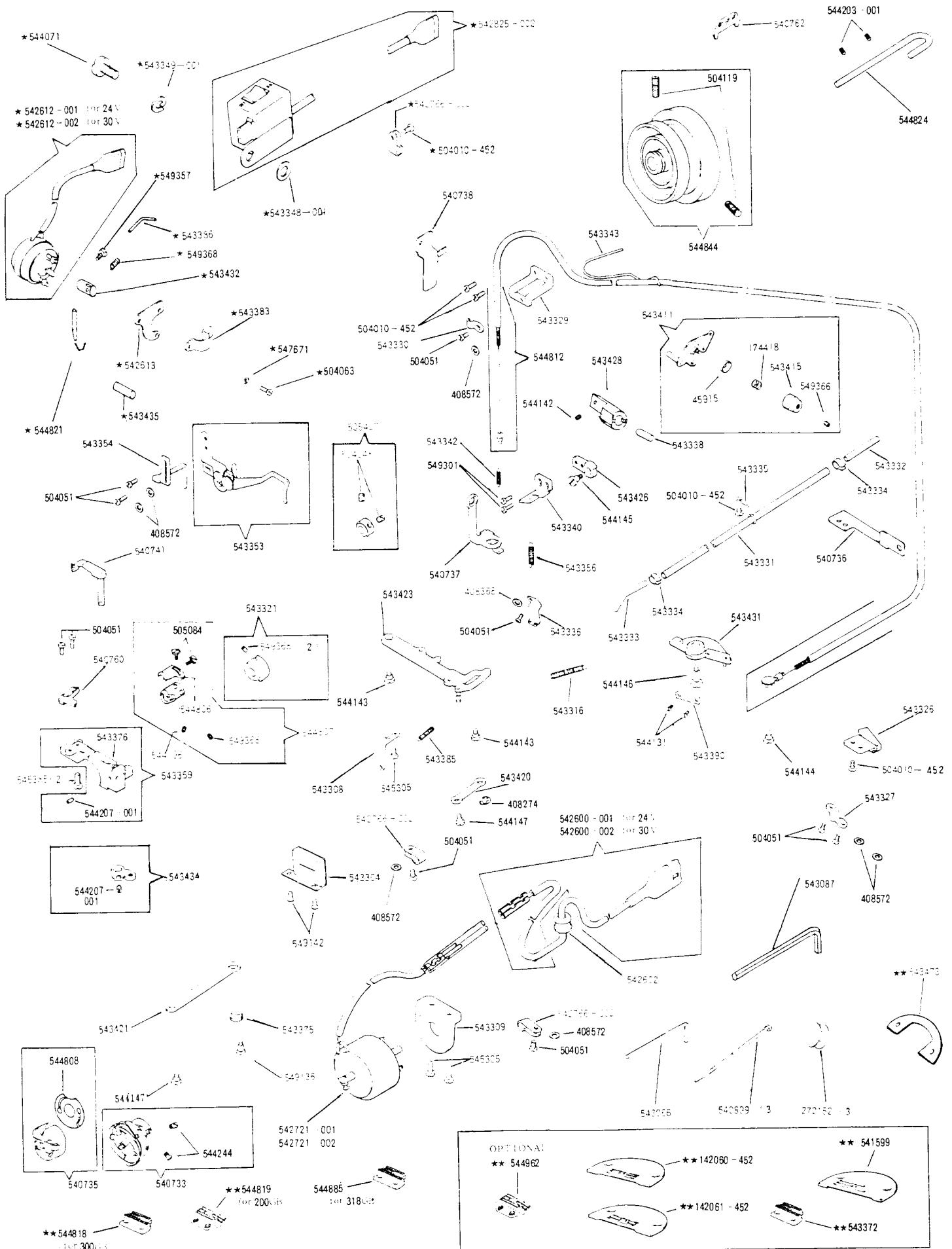


457 machine



PARTS FOR 491D200 210 300/310 318GB MACHINES WHICH DIFFER FROM 491D200 300 308GA MACHINES

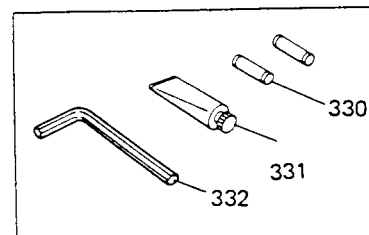
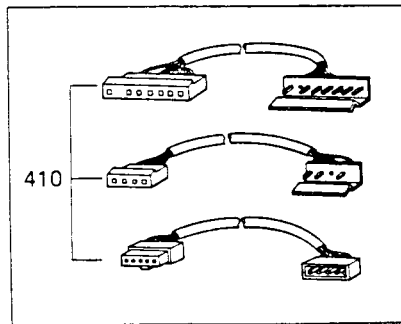
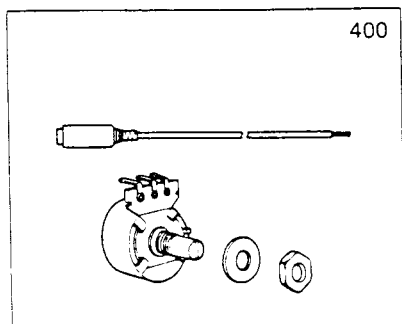
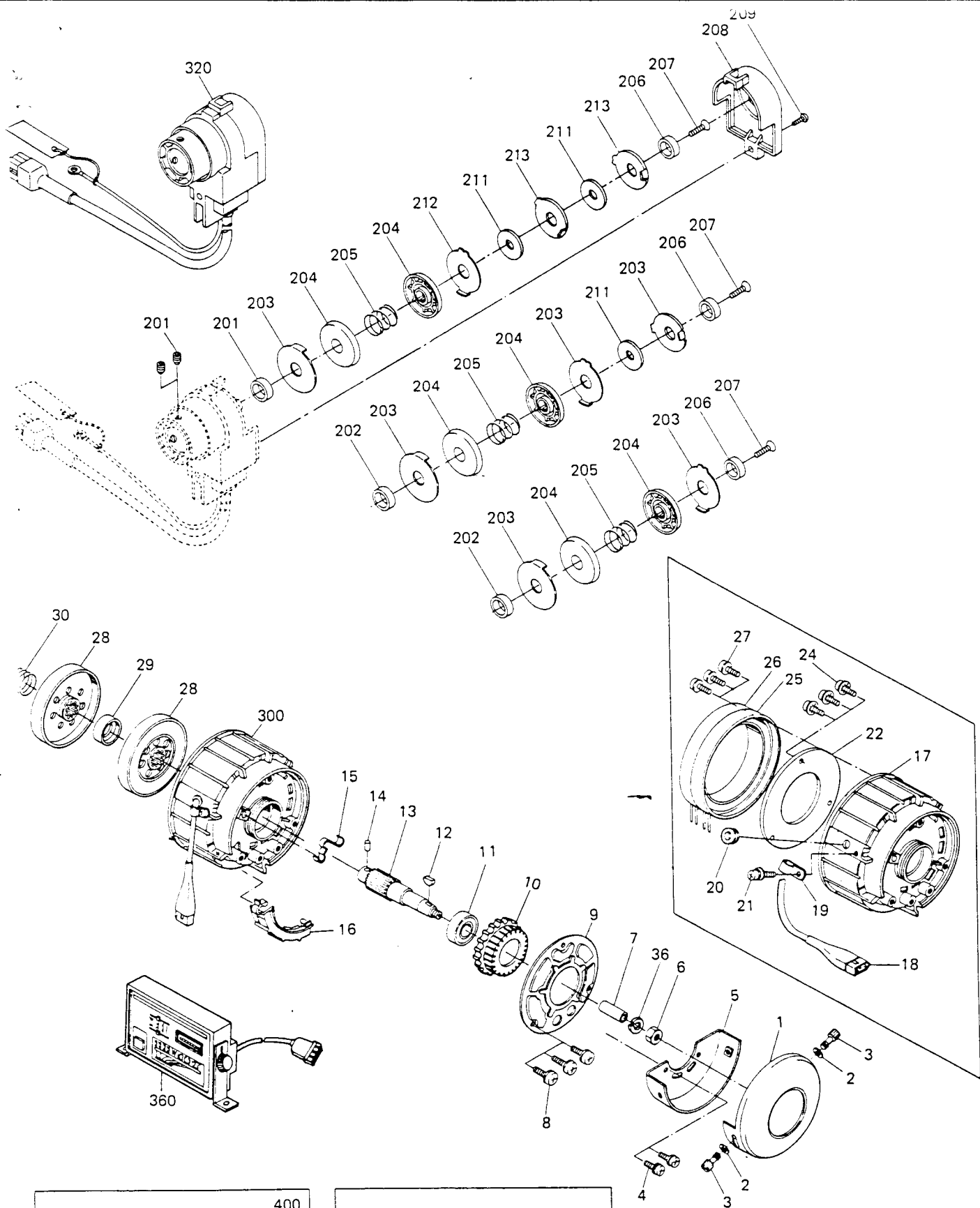
Form U 3017 1179
Part No 543080 002 Rev 3

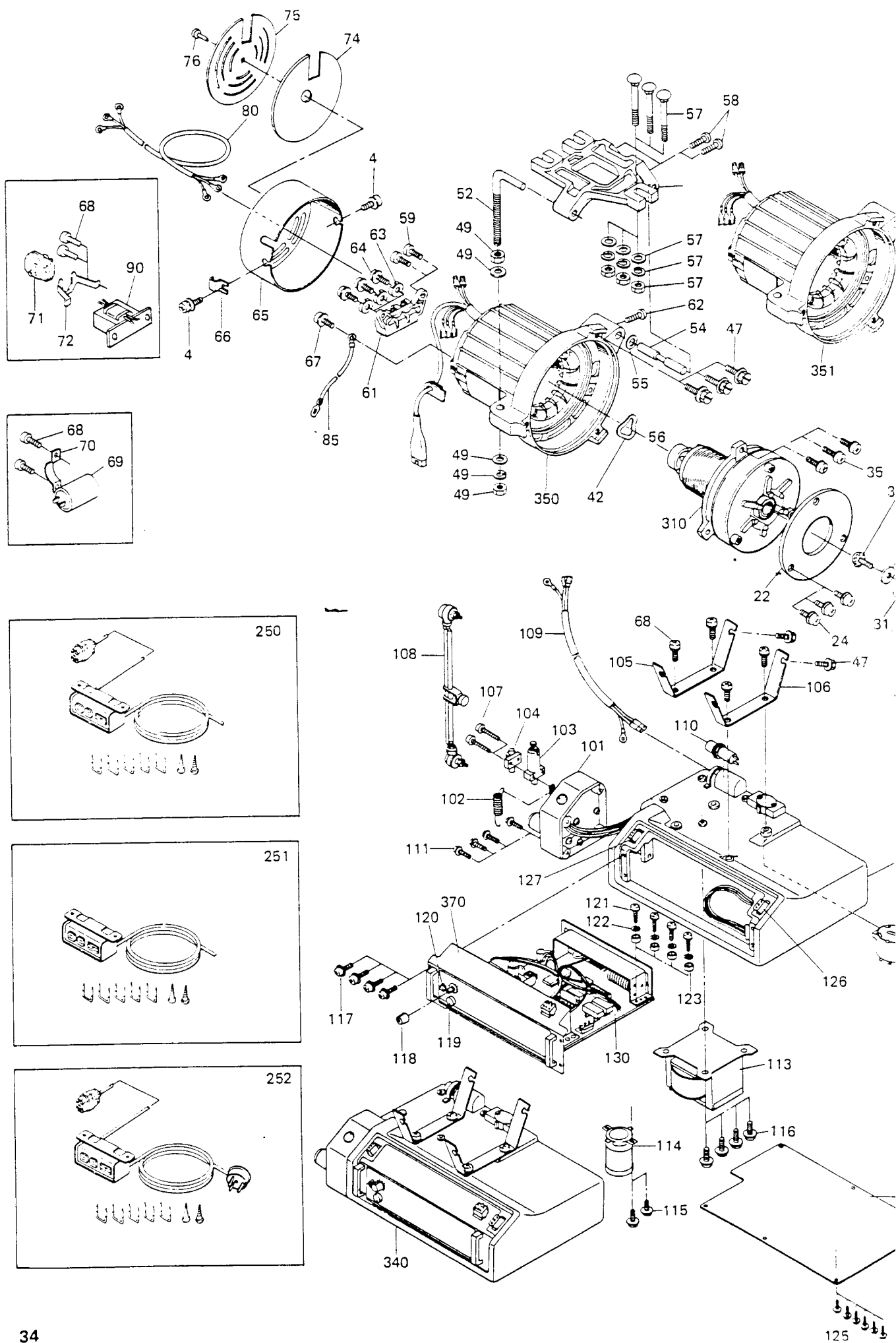


NUMERICAL LIST OF PARTS FOR 491200/210/300/310/318GA MACHINES
WHICH DIFFER FROM 491200/300/308GA MACHINES

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
45915	Pre-Tension Disc	543356	Tension Releasing Wire Connecting Plate Spring
47418	Pre-Tension Spring	543359	Thread Puller Bracket with 543376 and 54407-011
570152	Rotating Hook Bobbin	543375	Thread Puller Action Lever Link Eccentric Bushing
408574	Trimmer Solenoid Link Snap Ring	543376	Thread Puller Adjusting Pin
408586	Tension Releasing Wire Spring Retainer Washer	*543383	Wiper Solenoid Bracket Clamping Plate
408572	Black Thread Regulator Action Plate Set Screw Washer (2)	543385	Thread Puller Action Plate Spring
408571	Tension Releasing Wire Guide Tube Clamping Plate (Bed) Screw Washer (2)	*543386	Wiper Solenoid Cord Holder
408573	Tension Releasing Wire Guide Tube Clamping Plate (Arm) Screw Washer	543390	Tension Release Action Plate Cushion
408575	Trimmer Solenoid Cord Grip Screw Washer (2)	543411	Pre-Tension Bracket with 543415, 549366, 45915 and 174418
504010-450	Tension Releasing Wire Guide Tube Bracket (Arm) Screw (2)	543415	Pre-Tension Cap
504010-451	Tension Releasing Wire Guide Tube Bracket (Bed) Screw (2)	543416	Trimmer Solenoid Link
*504010-452	Wiper Solenoid Cord Clip Screw	543417	Thread Puller Action Lever Link
504046	Rotating Hook Shaft Collar (back) Set Screw	543418	Thread Puller Action Plate complete
504051	Tension Releasing Wire Spring Retainer Screw	543419	Tension Releasing Dam
504051	Stationary Knife Screw (2)	543420	Tension Releasing Dam Bracket
504051	Black Thread Regulator Action Plate Set Screw (2)	*543421	Tension Release Action Plate complete
504051	Tension Releasing Wire Guide Tube Clamping Plate (Bed) Screw (2)	543422	Wiper Holder
504051	Tension Releasing Wire Guide Tube Clamping Plate (Arm) Screw	543423	Thread Puller Action Lever with 54407-011
504051	Trimmer Solenoid Cord Clip Screw (2)	*543424	Wiper Cushion
*504051	Wiper Solenoid Bracket Clamping Screw	543425	Wiper Switch Box Screw
504051	Rotating Hook Shaft Collar (back) with Two 504051	543426	Tension Release Action Plate Cushion Screw (2)
540733	Rotating Hook and Rotating Hook Bobbin Case Holder complete with Two 541244	543427	Tension Release Action Cam Set Screw (2)
540735	Rotating Hook Bobbin Case complete with 544808	543428	Tension Releasing Dam Bracket Set Screw
540736	Tension Releasing Wire Guide Tube Holder (Bed)	543429	Thread Puller Action Cam Set Screw (2)
540737	Presser Bar Lifting Lever Link	543430	Thread Puller Action Plate Stopper Screw
540738	Arm Size Shield	543431	Thread Puller Action Plate Screw
540741	Thread Puller complete	543432	Tension Releasing Wire Sheave Screw
540742	Stationary Knife	543433	Tension Releasing Dam Screw
540743	Thread Guide	543434	Tension Release Action Plate Screw
544600-001	Trimmer Solenoid Cord, Connector complete (for 33V)	543435	Thread Puller Action Lever Link Screw
544600-001	Trimmer Solenoid Cord, Connector complete (for 33V)	543436	Trimmer Solenoid Link Screw
544600	Trimmer Solenoid Cord Bushing	543437	Thread Puller Action Cam Set Screw
*544610-001	Wiper Solenoid, Connector complete (16V D.C. 8.0A)	543438	Thread Puller Action Plate Adjusting Plate
*544610-001	Wiper Solenoid, Connector complete (33V D.C. 10.0A) for Electromagnetic Clutch Motor	543439	Thread Puller Action Cam Adjusting Plate with 543440, 544106 and 545084
*544610-001	Wiper Solenoid, Connector complete (33V D.C. 10.0A) for Electromagnetic Clutch Motor	543440	Anti Spill Spring
*544610	Wiper Solenoid Bracket	543441	Tension Releasing Wire, Guide Tube complete
544701-001	Trimmer Solenoid complete (16V D.C. 10.0A)	543442	Feed Dog, in place of 14481
544701-001	Trimmer Solenoid complete (33V D.C. 15.0A) for Electromagnetic Clutch Motor	543443	Feed Dog, in place of 149031
544766-001	Trimmer Solenoid Cord Grip (2)	*543444	Wiper
*544766-001	Wiper Solenoid Cord Grip	543445	Sensor Retainer
*544815-001	Wiper Solenoid Cord, Switch Box complete (for Electromagnetic Clutch Motor)	543446	Machine Pulley with 504119 (2)
544815	Bed Size Guard complete	543447	Feed Bar, in place of 543296
544815	Thread Puller Action Plate Spring Retainer	543448	Thread Puller Action Cam Adjusting Plate Screw (2)
544815	Trimmer Solenoid Bracket	543449	Thread Puller Action Plate Spring Retainer Screw
544815	Tension Release Action Plate Spring	543450	Trimmer Solenoid Bracket Screw (2)
544815	Tension Release Action Cam with Two 549366	543451	Thread Puller Action Cam Adjusting Plate Screw (2)
544815	Tension Releasing Wire Guide Tube Bracket (Bed)	*543452	Wiper Solenoid Cord
544815	Tension Releasing Wire Guide Tube Clamping Plate (Bed)	543453	Wiper Solenoid Cord
544815	Tension Releasing Wire Guide Tube Bracket (Arm)	543454	Wiper Solenoid Cord
544815	Tension Releasing Wire Guide Tube Clamping Plate (Arm)	543455	Wiper Solenoid Cord
544815	Oil Tube	543456	Wiper Solenoid Cord
544815	Oil Tube Guide Pipe (back)	543457	Wiper Solenoid Cord
544815	Oil Tube Guide Pipe (front)	543458	Wiper Solenoid Cord
544815	Oil Tube Clamp	543459	Wiper Solenoid Cord
544815	Oil Tube Holder	543460	Wiper Solenoid Cord
544815	Tension Releasing Wire Spring Retainer	543461	Wiper Solenoid Cord
544815	Tension Releasing Wire Spring	543462	Wiper Solenoid Cord
544815	Tension Releasing Wire Connecting Plate	543463	Wiper Solenoid Cord
544815	Tension Releasing Wire Guide Tube Holder (Arm)	543464	Wiper Solenoid Cord
*544815-001	Wiper Solenoid Box Washer	543465	Wiper Solenoid Cord
*544815-001	Wiper Solenoid Box Screw Washer	543466	Wiper Solenoid Cord
544815	Black Thread Regulator complete	543467	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543468	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543469	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543470	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543471	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543472	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543473	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543474	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543475	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543476	Wiper Solenoid Cord
544815	Black Thread Regulator Action Plate	543477	Wiper Solenoid Cord
544			

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Print Marked with ** is for the 1971-72 Machine





APPENDIX B

Frame ass'y

Remarks (2)	phase	pole	Output (HP)	Voltage (V)	Frequency (Hz)	Lamp voltage (V)	Connection
F-1	1	2	1/2	115	50/60	6	Connector
F-2	1	2	1/2	220	50	6	Connector
F-3	1	2	1/2	240	50/60	6	Connector
F-4	1	2	1/2	110/220	50/60	6	Terminal
F-5	1	2	3/4	115	60	6	Terminal
F-6	1	2	3/4	115	50/60	6	Connector
F-7	1	2	3/4	220	50/60	6	Connector
F-8	1	2	3/4	220	50	6	Terminal DIN
F-9	1	2	3/4	220	50	12	Terminal DIN
F-10	1	2	3/4	240	50/60	6	Connector
F-12	1	2	3/4	240	50	6	Terminal DIN
F-13	1	2	3/4	240	50	12	Terminal DIN
F-14	1	2	3/4	240	50	—	Connector
F-15	1	2	3/4	115	60	6	Terminal UL type
F-16	1	2	3/4	115	60	6	Terminal CSA type
F-19	1	2	3/4	240	50	6 (Lamp coil)	Connector
F-21	1	4	1/2	115	50/60	6	Connector
F-22	1	4	1/2	115	60	6	Terminal
F-23	1	4	1/2	220	50/60	6	Connector
F-24	1	4	1/2	220	50	6	Terminal DIN
F-25	1	4	1/2	220	50	12	Terminal DIN
F-26	1	4	1/2	240	50/60	6	Connector
F-27	1	4	1/2	240	50	6	Terminal DIN
F-28	1	4	1/2	240	50	12	Terminal DIN
F-30	1	4	1/2	240	50	—	Connector
F-31	1	4	1/2	110/220	50/60	6	Terminal
F-32	1	4	1/2	115	60	6	Terminal UL type
F-33	1	4	1/2	115	60	6	Terminal CSA type
F-35	1	4	1/2	240	50	6 (Lamp coil)	Connector
F-41	3	2	1/2	220/380	50/60	6	Terminal
F-42	3	2	1/2	380	50/60	6	Connector
F-43	3	2	1/2	415	50/60	6	Connector
F-44	3	2	3/4	220	50/60	6	Connector
F-45	3	2	3/4	220	60	6	Terminal
F-46	3	2	3/4	220/380	50	6	Terminal DIN
F-47	3	2	3/4	220/380	50	12	Terminal DIN
F-48	3	2	3/4	220/380	50/60	6	Terminal
F-50	3	2	3/4	415	50	—	Connector
F-51	3	2	3/4	415	50	6	Terminal DIN
F-52	3	2	3/4	415	50	12	Terminal DIN
F-53	3	2	3/4	220	60	6	Terminal UL type
F-54	3	2	3/4	220	60	6	Terminal CSA type
F-56	3	2	3/4	240	50	6 (Lamp coil)	Connector
F-61	3	4	1/2	220/380	50/60	6	Terminal
F-62	3	4	1/2	380	50/60	6	Connector
F-63	3	4	1/2	415	50/60	6	Connector
F-64	3	4	3/4	220	50/60	6	Connector
F-65	3	4	3/4	220	60	6	Terminal
F-66	3	4	3/4	220/380	50	6	Terminal DIN
F-67	3	4	3/4	220/380	50	12	Terminal DIN
F-68	3	4	3/4	220/380	50/60	6	Terminal
F-70	3	4	3/4	415	50	—	Connector
F-71	3	4	3/4	415	50	6	Terminal DIN
F-72	3	4	3/4	415	50	12	Terminal DIN
F-73	3	4	3/4	220	60	6	Terminal UL type
F-74	3	4	3/4	220	60	6	Terminal CSA type
F-75	3	4	3/4	240	50	6 (Lamp coil)	Connector

No. & Description	Parts No.	Remarks (1)	Remarks (2)
351S Frame ass'y			
351-15			F-15
351-16			F-16
351-32			F-32
351-33			F-33
351-53			F-52
351-54			F-53
351-73			F-73
351-74			F-74

360S Switch box			
360-1	411872-001	Function 04	
360-2	411872-002	" 14	
360-3	411872-003	" 24	

370S Cassette ass'y				* Specify the types by suffix.
370-1		Function 01	General purpose	General type
370-2		" 02	For 591 machine	
370-3		" 03	"	U: UL Approved
370-4		" 02	For 211/212 machine	C: CSA Approved
370-5		" 03	"	
370-6		" 02	For 457 machine	
370-7		" 03	"	

No. & Description	Parts No.	Remarks (1)	Remarks (2)
350S	Frame ass'y		* See appendix B
	350-1		F-1
	350-2		F-2
	350-3		F-3
	350-4		F-4
	350-5		F-5
	350-6		F-6
	350-7		F-7
	350-8		F-8
	350-9		F-9
	350-10		F-10
	350-12		F-12
	350-13		F-13
	350-14		F-14
	350-19		F-19
	350-21		F-21
	350-22		F-22
	350-23		F-23
	350-24		F-24
	350-25		F-25
	350-26		F-26
	350-27		F-27
	350-28		F-28
	350-30		F-30
	350-31		F-31
	350-35		F-35
	350-41		F-41
	350-42		F-42
	350-43		F-43
	350-44		F-44
	350-45		F-45
	350-46		F-46
	350-47		F-47
	350-48		F-48
	350-50		F-50
	350-51		F-51
	350-52		F-52
	350-56		F-56
	350-61		F-61
	350-62		F-62
	350-63		F-63
	350-64		F-64
	350-65		F-65
	350-66		F-66
	350-67		F-67
	350-68		F-68
	350-70		F-70
	350-71		F-71
	350-72		F-72
	350-76		F-76

No. & Description	Parts No.	Remarks (1)	Remarks (2)
300	Clutch-end cover ass'y		*See appendix B
	300-1		F-1~14, 19, 21~31, 35, 41~52, 56, 61~72, 76
	300-2		F-15, 16, 32, 33, 53, 54, 73, 74
310	Rotor and flywheel ass'y		
	310-1	490924	For single phase 2 poles ½ HP type
	310-2	365230	For single phase 2 poles ¾ HP type
	310-3		For single phase 4 poles ½ HP type
	310-4	365231	For three phase 2 poles ½ HP type
	310-5	490923	For three phase 2 poles ¾ HP type
	310-6		For three phase 4 poles ½ HP type
	310-7	365536	For three phase 4 poles ¾ HP type
320	Synchronizer		
	320-1	411871-001	For 591 machine
	320-2		For 211/212 machine
	320-3		For 457 machine and 591, 211/212 machine of function 01.
340S	Control box ass'y		*Specify the types by suffix
	340-1	NCB130102	General purpose 115V
	340-2	NCB120202	For 591 machine 115V
	340-3	NCB120302	" 115V
	340-5	NCB140202	For 211/212 machine 115V
	340-6	NCB140302	" 115V
	340-8	NCB150202	For 457 machine 115V
	340-9	NCB150302	" 115V
	340-11	NCB130107	General purpose 220V
	340-12	NCB120207	For 591 machine 220V
	340-13	NCB120307	" 220V
	340-15	NCB140207	For 211/212 machine 220V
	340-16	NCB140307	" 220V
	340-17	NCB150207	For 457 machine 220V
	340-18	NCB150307	" 220V
	340-20	NCB130108	General purpose 240V
	340-21	NCB120208	For 591 machine 240V
	340-22	NCB120308	" 240V
	340-24	NCB140208	For 211/212 machine 240V
	340-25	NCB140308	" 240V
	340-27	NCB150208	For 457 machine 240V
	340-28	NCB150308	" 240V

No. & Description	Parts No.	Remarks (1)	Remarks (2)	Remarks (2)
65-8				
65-8				F-4, 31
65-9				F-5, 8, 12, 22, 24, 27
65-10				F-45, 51, 65, 71
65-11				F-52, 72
65-12				F-54, 74
65-13				F-16, 33
65-14				F-2, 3, 23, 26
65-15				F-19, 35, 56, 76
65-16				F-46, 48, 66, 68
80 Wire cord ass'y				
80-1		For single phase type		
80-2		For three phase type	Cord color red, white, black, green	
80-3		For three phase type	Cord color brown, blue, black, green	
100 Control box				
100-1		For others		
100-2		For UL/CSA approved type		
101 Speed control lever ass'y				
101-1		For boxes of function code 01 and 02		
101-2		For boxes of function code 03, 04, 14 and 24		
113 Transformer				
113-1		For 115V type		
113-2		For 190~240V type		
113-3		For 190~240V type	(UL/CSA approved type)	
118 Control knob or cap				
118-1		Control knob		
118-2		Cap		
250 Push button switch				
250-1	365234	Single phase		
250-2	365235	Three phase		
251 Push button switch				
251-1		Single phase		
251-2	365236	Three phase		

No.	Parts No.	Note	Description
201	490910		Mounting screw
202			Rotor C
203			Reflection plate A-1
204			Spring holder
205			Spring
206			Holder ring
207	490916		Screw
208			Cover C
209			Screw
211			Spacer
212			Reflection plate A-1S
213			Reflection plate A-2
250		*See appendix A	Push button switch
251		*See appendix A	Push button switch
252	365237		Push button switch
300		*See appendix A	Clutch-end cover ass'y
310		*See appendix A	Rotor and flywheel ass'y

No.	Parts No.	Note	Description
320		*See appendix A	Synchronizer
330	490926		Fuse 250V 4A
331	490927		Special lining appli- cation lubricant
332	490928		Hexagonal wrench key
340S		*See appendix A	Control box ass'y
350S		*See appendix A	Frame ass'y
351S		*See appendix A	Frame ass'y
360S		*See appendix A	Switch box
370S		*See appendix A	Cassette as 'y
400		(option)	External control kit
410		(option)	Extention cord kit

APPENDIX A

No. & Description	Parts No.	Remarks (1)	Remarks (2)
20 Bushing			* See appendix B
20-1	490820		F-1~14, 19, 21~31, 36, 41~52, 56, 61~72, 76
20-2		Strain relief	F-15, 16, 32, 33, 53, 54, 73, 74
56 Belt tightener			
56-1			F-1~7, 10, 14, 15, 16, 19, 21~23, 26, 31~33, 36 41~45, 48, 50, 53, 54, 56, 61~65, 68, 70, 73, 74, 76
56-2			F-8, 9, 12, 13, 24, 25, 27, 28, 46, 47, 51, 52, 66, 67, 71, 72
61 Terminal block			
61-1	490855-002		F-5, 8, 9, 12, 13, 22, 24, 25, 27, 28
61-2			F-4, 31
61-3	365513		F-15, 16, 32, 33
61-4	490855-001		F-45, 51, 52, 65, 71, 72
61-5	365220		F-41, 46, 47, 48, 61, 66, 67, 68
61-6	365512		F-53, 54, 73, 74
65 End cover			
65-1			F-47, 67
65-2			F-1, 6, 7, 10, 14, 21, 30, 42, 43, 44, 50, 62, 63, 64, 70
65-3			F-15, 32
65-4			F-53, 73
65-5			F-9, 13, 25, 28
65-6			F-41, 61

1 PARTS LIST

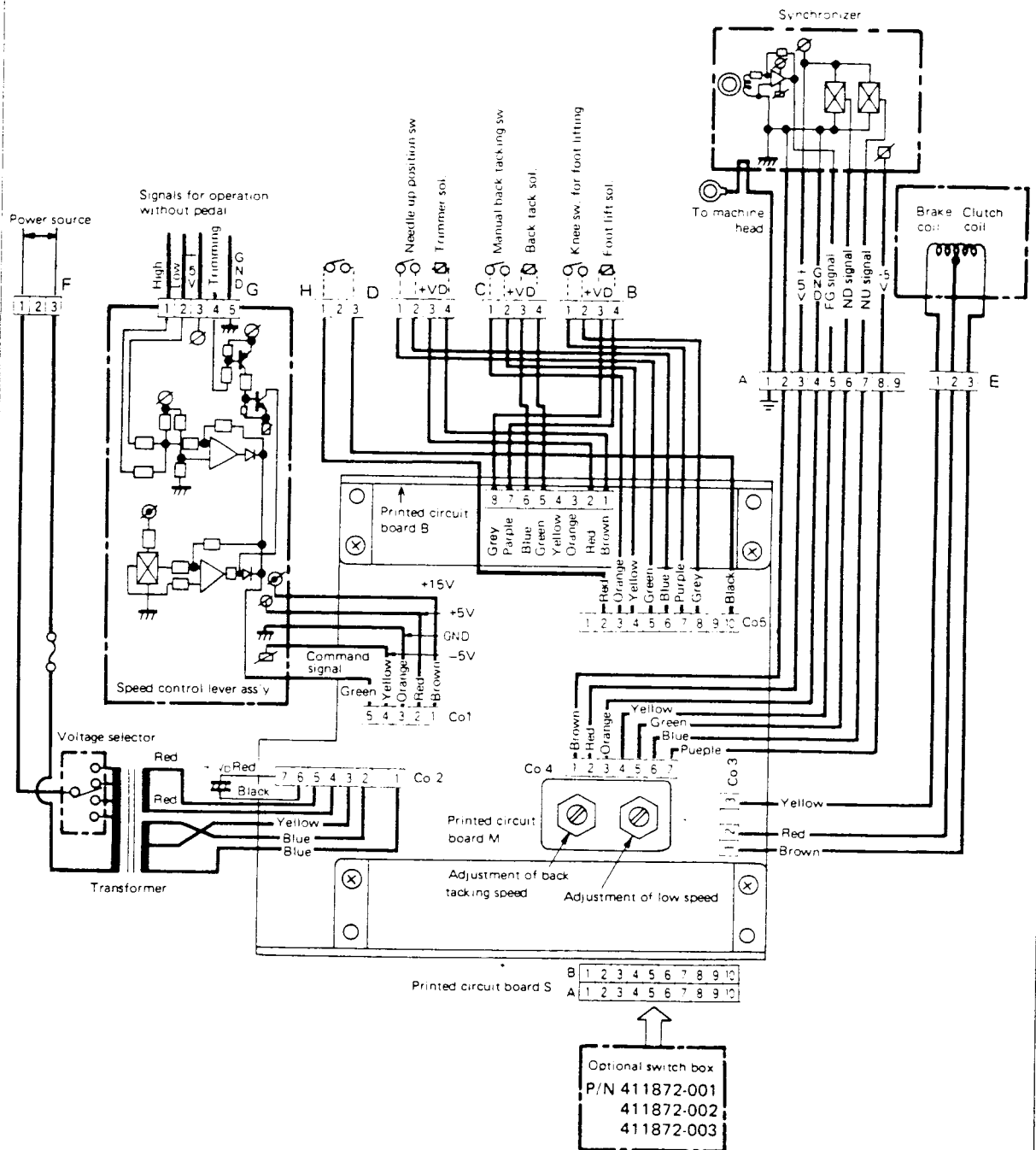
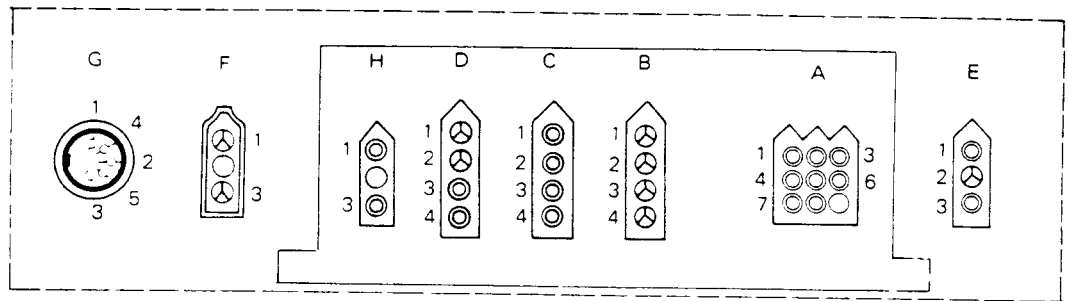
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PARTS LISTS

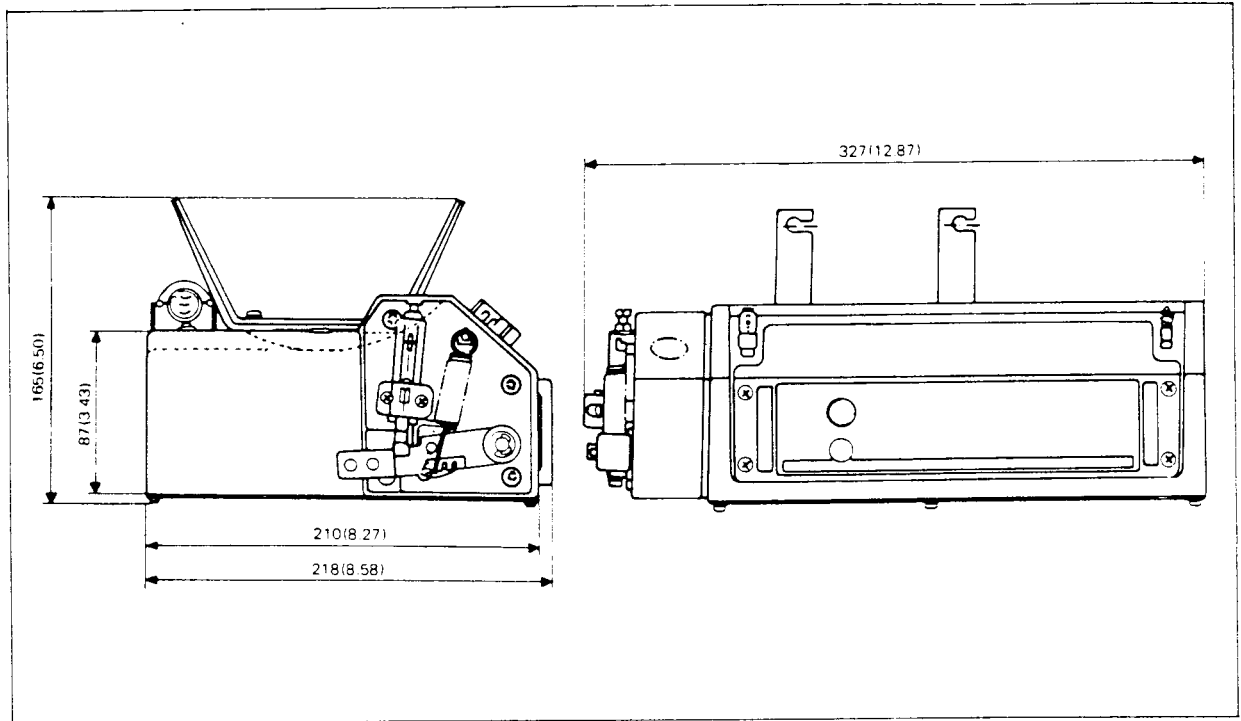
No.	Parts No.	Note	Description
1	490762		Pulley cover B
2	490805		Washer
3	490806		Screw
4	490708		Screw M5 x 10
5	490807		Pulley cover A
6	490670		Nut M10
7	490808		Tube
8	490809		Screw M4 x 8
9			Cover
10			Adjustment screw
11	490812		Ball bearing 6302
12	490672		Key
13	490813		Output shaft
14	490814		Key
15	490815		Spring
16	490816		Filter ass'y
17			Clutch end cover
18	490818		Connector ass'y
19	490819		Strain relief
20		*See appendix A	Bushing
21	490821		Screw M4 x 8
22	490822		Friction disc
24	490824		Screw
25	490825		Brake coil ass'y
26	490826		Clutch coil ass'y
27	490827		Screw
28	490828		Moving disc ass'y
29	490829		Nylon ring
30	490830		Spring
31	490831		Bearing housing
32	490832		Washer
34	490834		Screw
35	490691	Screw	
36			Spring washer
42	490692		Thrust wave washer
47	490844		Screw
49	490698		Nut & Washer
52	490846		
54	490848		Belt-tightener hinge pin
55	490849		Washer
56		*See appendix A	Belt tightener
57	490851		Mounting bolt kit
58			Screw
59	490856		Screw
61		*See appendix A	Terminal block
62			Screw

No.	Parts No.	Note	Description
63	490733		Terminal screw & washer
65		*See appendix A	End cover
66	490859		Strain relief
67	490860		Grounding screw
68	490706		Screw M5 x 10
69	490702		Capacitor
70	490705	*See appendix A	Mounting plate
71	365226		Connector
72	365227	*See appendix A	Mounting plate
80		*See appendix A	Wire cord ass'y
85	365229		Wire cord ass'y
100		*See appendix A	Control box
101		*See appendix A	Speed control lever ass'y
102			Spring
103			Spring ass'y
104			Spring ass'y
105			Mounting plate A
106			Mounting plate B
107			Screw
108			Pitmanrod
109			Wire cord
110			Fuse holder ass'y
111			Screw M5 x 12
112			Switch
113		*See appendix A	Transformer
114			Capacitor
115			Screw
116	490706		Screw
117			Screw
118		*See appendix A	Control knob or cap
119	490874		Cap
120			Breaker
124			Cover
125	490873		Screw
126			Connector ass'y
127			Connector

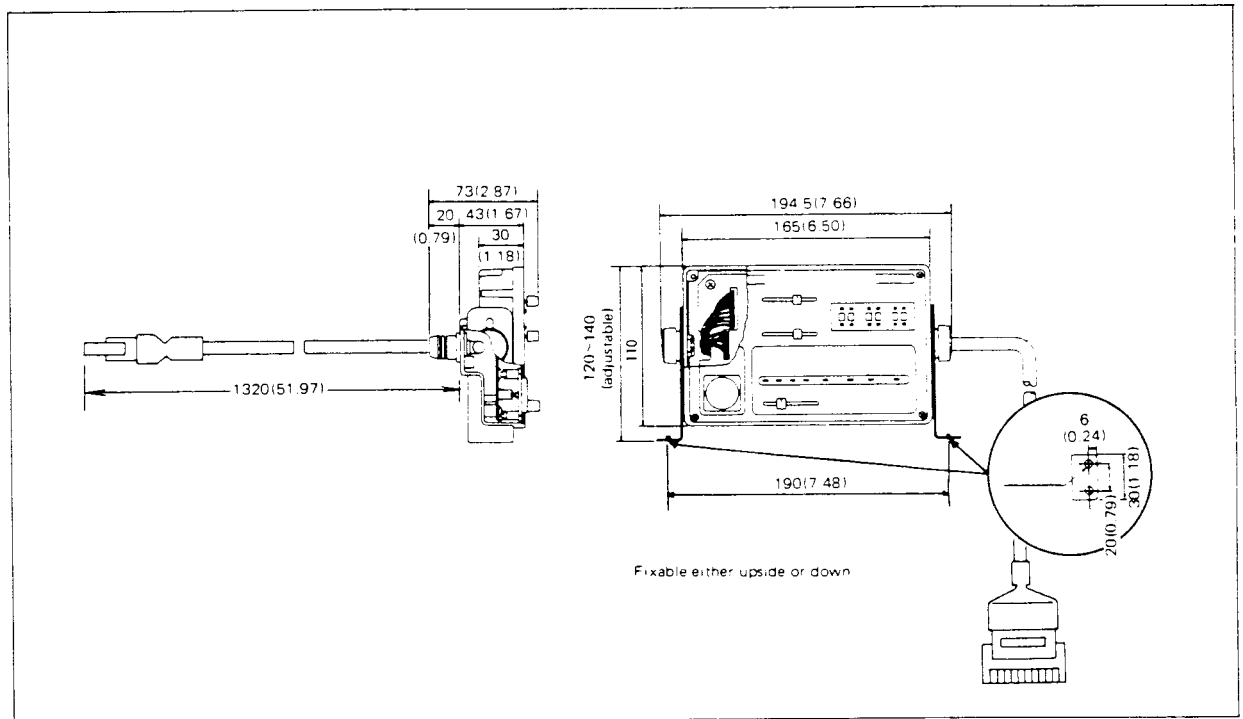
211/212 machine



9-3 CONTROL BOX



9-4 OPTIONAL SELECTOR PANEL

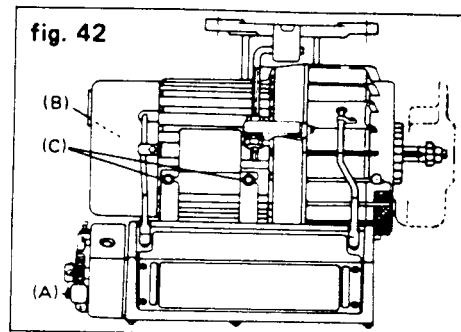


PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Machine runs at first actuation at full speed. Stop only possible by switching off.	Synchronizer defective.	Replace synchronizer.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
Irregular stopping or continuation of operation after stop signal given. Stop only possible by switching off.	Hub of synchronizer insecurely fixed on machine shaft.	Fix hub in accordance with instructions.
	Tension of V-belt not taut enough V-belt slips.	Correct tension in accordance with instructions.
	Machine treadle is jammed or actuates by own weight.	Repair or replace treadle.
	Synchronizer defective.	Replace synchronizer.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
Intermediate speed ranges are missing. (Machine runs only at positioning or maximum speed.)	Synchronizer defective.	Replace synchronizer.
	Control box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.
Motor has unusual noise and vibration.	Clutch air gap too wide.	Adjust clutch air gap.
	Clutch bearing defective.	Replace bearing.
	Clutch and/or brake lining, or friction disc worn down or defective.	Replace defective parts.
	Hub of synchronizer insecurely fixed on machine shaft.	Fix hub in accordance with instructions.
	Control box defective.	1) Replace modular. 2) Replace speed control lever assembly. 3) Replace control box.
	Tension of V-belt too taut or not taut enough.	Correct tension in accordance with instructions.
	Pulleys of motor and machine are not aligned.	Align.
No additional functions (e.g. trimming, wiping, foot lifting, etc.)	Additional device improperly connected, cord wrong or defective.	Correct corrections. If necessary, replace cord.
	Additional device defective (e.g. magnet or magnetic valve is jammed or burnt, knife jams, etc.)	Repair devices.
	Control Box defective.	1) Replace module. 2) Replace speed control lever assembly. 3) Replace control box.

7-4 REPLACEMENT

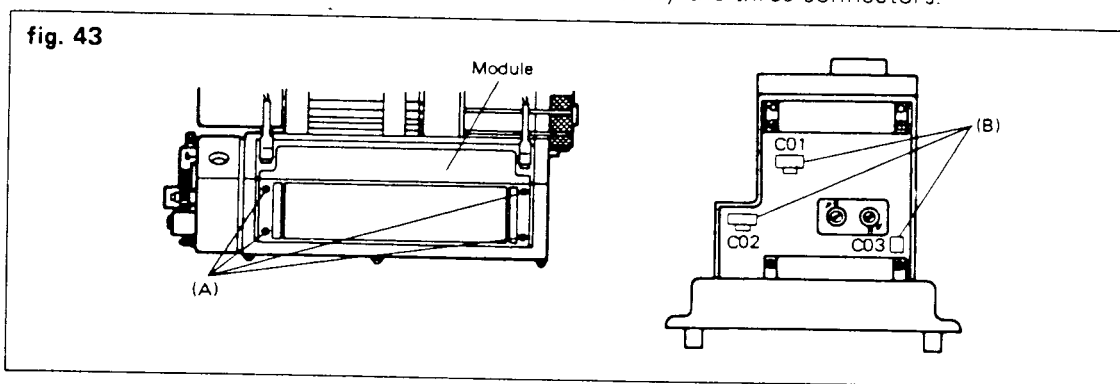
1) Control box

- (A) Switch off the motor, remove the pitman rod from the speed control lever.
- (B) Pull out all connectors. In case of the motor for North America, remove the power supply cord for control box connected to the terminal board located in the motor end cover.
- (C) Unscrew the four screws which hold the control box to the motor.
- (D) Remove the control box from the motor and replace it with the new control box.



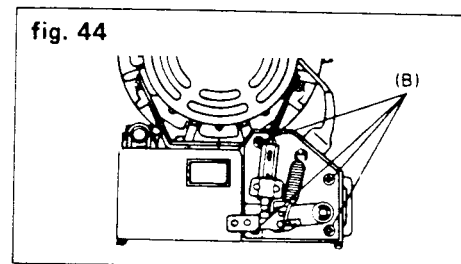
2) Module

- (A) Remove the four screws which hold the module to the control box.
- (B) Take out the module half and pull out the three connectors (co1, co2, co3) mounted on the printed circuit board as shown on fig. 43. Then remove the modular.
- (C) Replace it with a new module and reinsert securely the three connectors.



3) Speed control lever assembly

- (A) Take out the module half as mentioned above item 2), and disconnect the connector "co 1".
- (B) Unscrew the four screws which attach the speed control lever assembly to the control box and remove it from the control box.
- (C) Replace it with a new speed control lever assembly.
- (D) Reconnect "co 1".



4) Synchronizer

- (A) Remove the connector from the control box.
- (B) Unscrew two set screws and remove the synchronizer from the handwheel of the sewing machine.
- (C) Replace it with a new properly adjusted synchronizer.
- (D) If necessary, synchronizer should be readjusted as outlined in paragraph 6-2.

7 MAINTENANCE

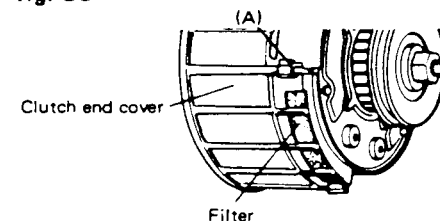
7-1. Cleaning up the filter

When the filter is clogged up with waste and lint the motor will heat up excessively. This may cause shorten the service life of the motor.

Cleaning up:

- A) Remove the filter by pulling the part A shown in fig. 38.
- B) Clean up the filter by blowing it out.
- C) Replace the filter. Do not leave filter off.

fig. 38



7-2. Adjustment of clutch air gap

See 6-1.

7-3. Use of special lining coating material.

For longer lining life it is important that the lining be always coated with a small quantity of special lining lubricant. Also apply the coating if noise would be heard during the clutch and brake cycles and the needle motion begins to be rough or unsteady.

NOTE: Don't use any coating material other than Type UM-1 (Part No. 490927)

This tube contains enough for 2 applications; the amount of coating should be applied accordingly.

HOW TO USE:

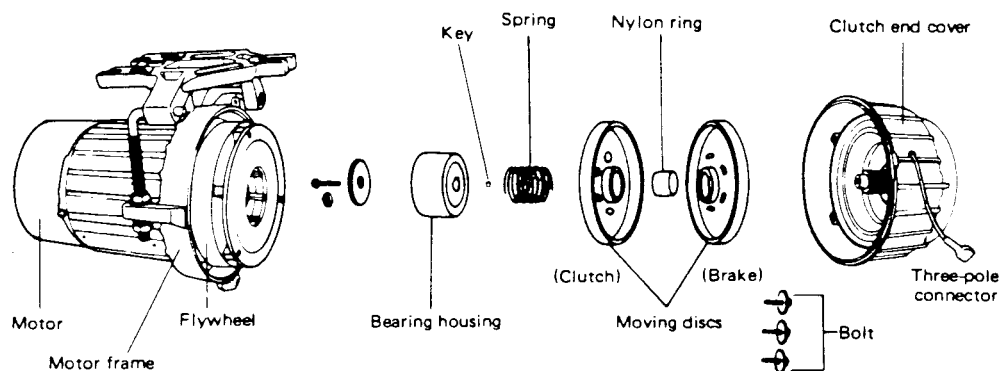
A) Motor disassembly (fig. 39)

- a) Switch off the motor and remove the pulley cover and V-belt.
- b) Pull out the three-pole connector from the control box.
- c) Remove the clutch and cover by unscrewing three bolts.
- d) Remove the bearing housing and the spring.
- e) Remove the clutch disc from the output shaft and remove the nylon ring together with the brake disc.

NOTE: Be careful not to drop the moving discs, or damage the moving discs or scratch or scar the lining surfaces.

Don't permit dust to adhere to the lining surfaces of the moving discs while they are disassembled.

fig. 39



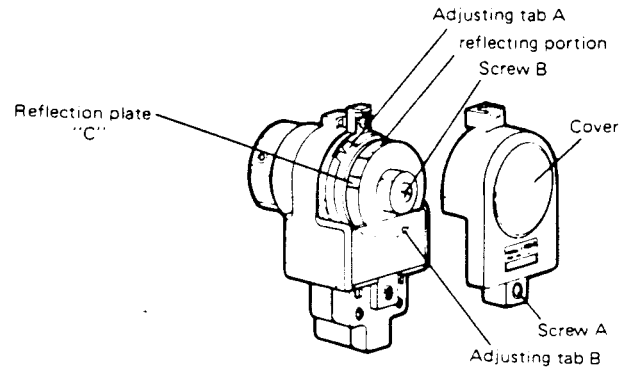
B) Cleaning of moving discs and motor interior

Clean away any waste, lint or other dirt adhering to the moving discs, clutch end cover, flywheel and each ventilation channel of the motor frame. Use a soft, dry cloth to clean away any waste etc. adhering to the lining surfaces.

(211/212 machine)

- A. In addition with above 457 machine adjustment, following adjustment is necessary;
- B. Rotate the handwheel so that the needle thread is at the 6 o'clock position around the bobbin case.
- C. Position the reflection plate C, which is the middle plate, so that the adjusting tab C will line up to uppermost position.

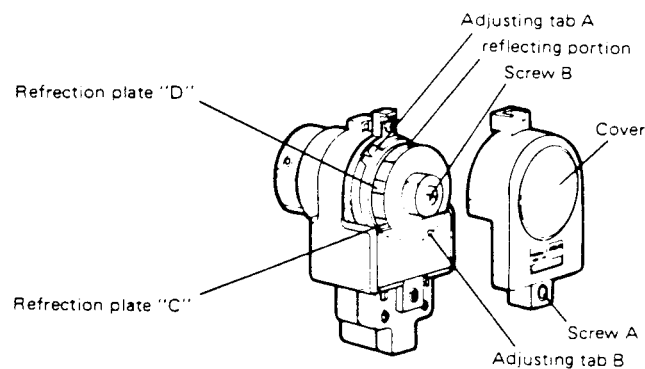
fig. 34



(591 machine)

- A. In addition with above 457 machine adjustment, following adjustments are necessary;
- B. Rotate the handwheel so that the machine is in the TRIM SOLENOID ON position.
- C. Adjust the reflection plate C, which is the second plate from inside, in the same manner as other adjustment.
- D. Rotate the handwheel so that the machine is in the TRIM SOLENOID OFF position.
- E. Adjust the reflection plate D, which is the third plate from inside, in the same manner as other adjustment.

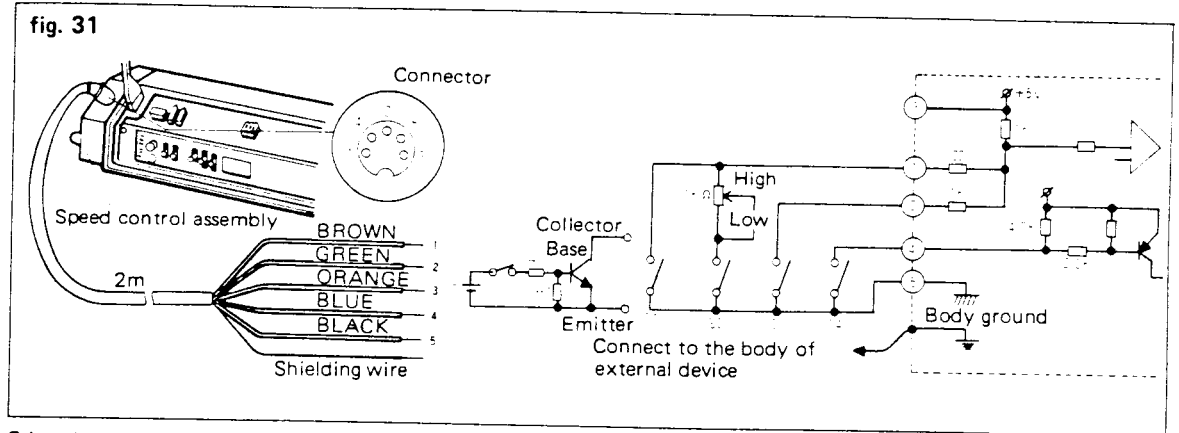
fig. 35



5-9 OPERATION WITHOUT THE PEDAL

When fully automated operation of the machine without use of the treadle is desired, such as for a handicapped person, use the optional connector shown below which is provided for this operation. The connector is located at the side of the control box in the speed control lever assembly and is sealed with an adhesive aluminum cap.

If this operation should be required, please tear off the cap with a screw driver or the like.



S1 : High speed operation. (Close 1 and 5)

S2 : Intermediate speed operation. (Insert the potentiometer between 1 and 5 together with switch S2)

S3 : Low speed operation. (Close 2 and 5)

S4 : Trimming (Close 4 and 5)

NOTE: a) Use a low load voltage or low load current contact relays (gold contact switch) for applying contact point switch.

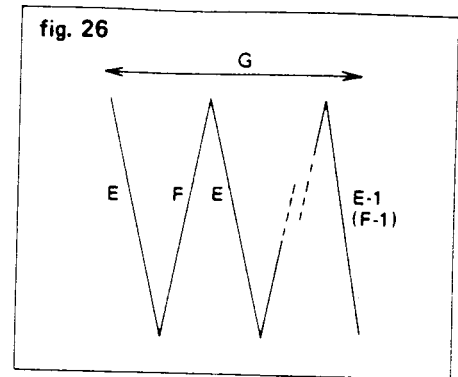
b) Use the non-contact switch installed for the following rating transistors for applying non-contact.

Rating of Transistors		
Collector to Base Breakdown Voltage	VCBO	more than 30V
Collector to Emitter Sustaining Voltage	VCEO	more than 30V
Collector Current	IC	more than 30mA
Collector Cutoff Current	ICBO	less than 1uA
Collector to Emitter Saturation Voltage	VCE (sat)	less than 0.4V

CAUTION: DO NOT SHORT 3 WITH ANY OTHERS, AS THIS MAY CAUSE DAMAGE TO THE CONTROL BOX.

e) Pattern 5 (Line Tacking)

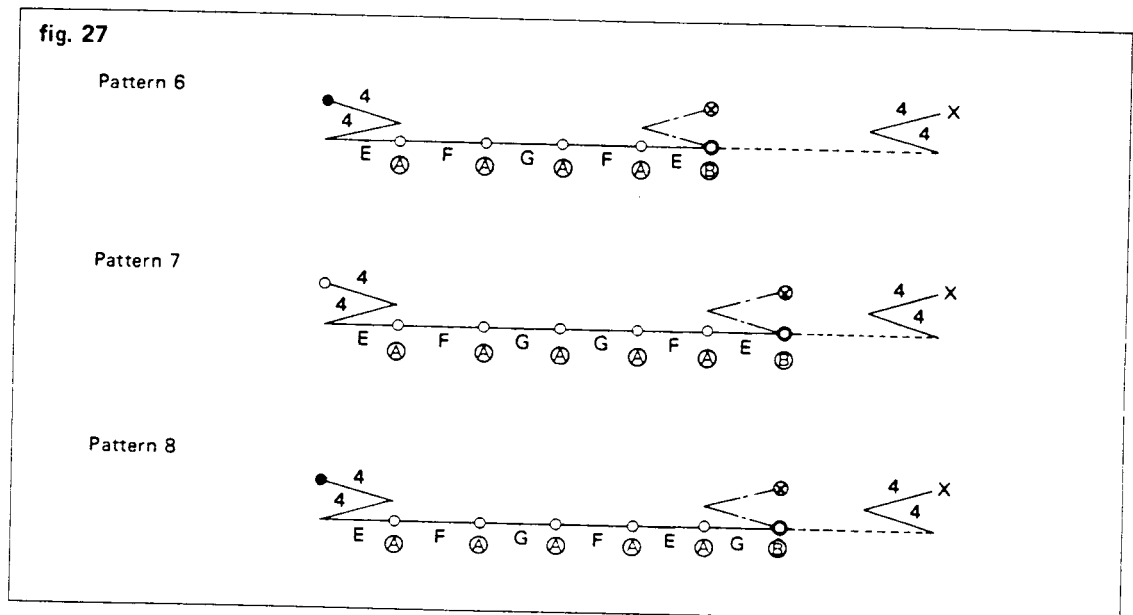
- I The machine will perform the Line Tacking (Repeat of E (forward) and F (backward)) until the pedal is released to the neutral or the machine completes the "G" times of repeats.
- II To prevent of stitching beyond pattern, TRIM is performed at ONE stitch shorter than programmed in the final segment.



NOTE: In Pattern 5,

- 1) The machine will not start sewing when one of the stitch counters E, F and G is set to "zero".
- 2) If the adjustment of the flow of seams is necessary, see item 5-7. (In item 5-7, the counter A and B correspond to the counter E and F.)

f) Pattern 6, 7 and 8 (Combination of stitch count E, F and G)



- I By pressing down the pedal, the machine will start the sewing with SBT as the selection of SBT.
- II By keeping the pedal down, the machine will perform the stitch counting same as pattern 4.
- III The differences are;
 - i) The number of the stitch of each seams is set by E, F or G.
 - ii) The combinations of E, F and G are different in pattern 6, 7 and 8.
 - iii) The period of each seam (point A), FL goes up and stays up for 12 seconds or until freadle is returned to neutral and pressed down again for pivoting the materials.
 - iv) The period of the last segment, two mode of sewing can be selected as options;

Option 1: Automatic finish of pattern sewing with TRIM and/or EBT same as pattern 2.

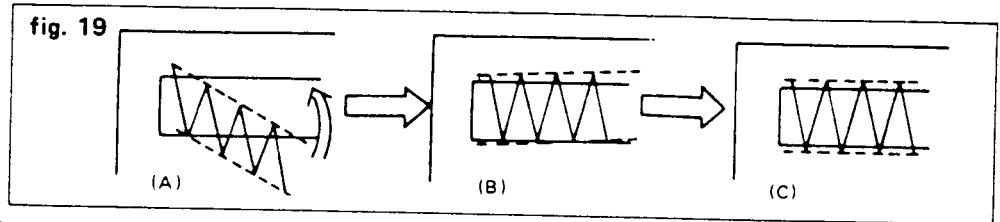
Option 2: Free sewing and TRIM and/or EBT by the pedal same as pattern 3.

NOTE: In Pattern 6, 7 and 8,

- 1) The number of stitches for each segments of SBT and EBT are all fixed into four stitches.
- 2) If either of E, F or G is set "zero", the machine will skip the corresponding seam.
- 3) Selection of options at the last seam can be done by the switch which is located in the control box.

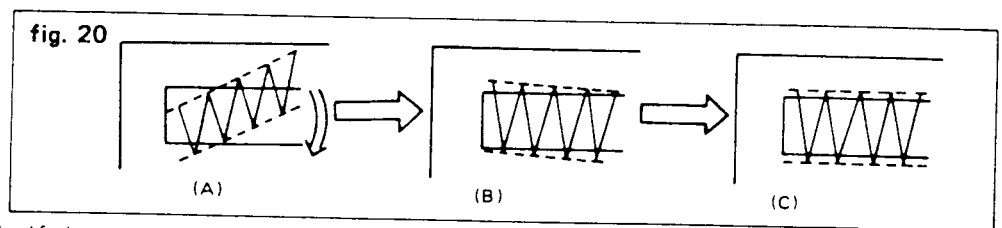
NOTE: If one of A and C, B and C or D is set to "zero", the sewing will not be started. If adjustments of line tacking is required, follow this procedure.

a) Case 1



- (A) If the correction as above is required.
 (B) Increase the stitch counter B till the flow of seam will be slightly reversed.
 (C) Then decrease B by one number.
 (D) If further adjustment is needed, turn the volume "BT ADJ" to clockwise using a screw driver, which is located at the front of the control box.

b) Case 2



- (A) If the correction as above is required.
 (B) Increase the stitch counter A till the flow of seam will be slightly reversed.
 (C) If further adjustment is needed, turn the volume "BT ADJ" to clockwise using a screw driver, which is located at the front of the control box.

CAUTION: DO NOT USE FORCE WHEN TURNING "BT ADJ".

5-8 PATTERN SEWING (Function code of Control Box : 24)

1) General

The following eight patterns are available;

1		Normal sewing	5		Line tacking
2		Single seam stitch counting	6		Combination pattern (E, F, G)
3		Combination 1 & 2	7		Combination pattern (E, F, G)
4		Repeat of 2	8		Combination pattern (E, F, G)

- start of sewing
- stop at the first needle position, even the pedal is pressed.
- ⊗ trimming even the pedal is pressed down.

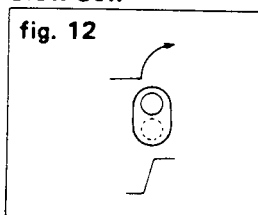
fig. 21

5 OPERATION

IMPORTANT: BEFORE THE OPERATION, MAKE SURE THE FOLLOWING DETAILS.

- Installation of the motor, the synchronizer and the belt.
- All connectors and motor wiring.

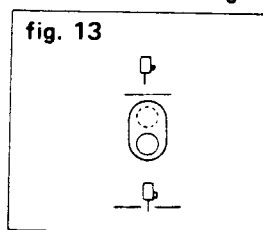
5-1 Slow Sew



When slow-sew is required at the beginning of the sewing operation, flick the switch to its upper position () as it indicated at left.

When slow-sew is selected, even when the treadle is fully depressed, the machine will increase the speed gradually during the first four stitches, then will run at Max. speed.

5-2 Needle Positioning



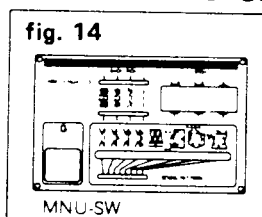
The needle positioning can be selected with the switch shown in fig. 13. When this switch is pushed down, the first positioning is "Needle-Down". When pushed up, it means "Needle-Up". The second positioning (after the thread trimming) is always "Needle-Up".

5-3 Needle-up positioning without the thread trimming.

(function code of Control Box : 02 and 03)

If needle up positioning without thread trimming is required as the second positioning, provide a normal open switch and wire this switch to the connector (see BLOCK DIAGRAMS), and activate it when this function is required.

(Function code of Control Box : 04, 14 and 24)



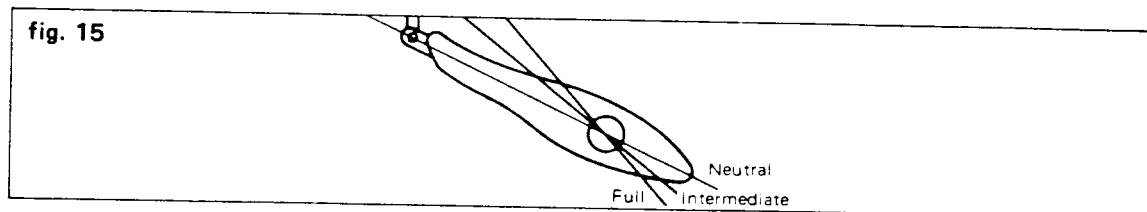
When this function is required, simply press the switch on the optional switch box.

(MNU-SW: Needle up switch)

5-4 PRESSER FOOT LIFTING

(Function code of Control Box : 03, 04, 14 and 24)

The presser foot lift is lifted by heeling treadle backward to an intermediate position while the needle is in the first position. When the treadle is fully heeled backward, the needle is positioned into the second position while thread trimming and wiping operations are performed, followed by lifting of the presser foot. The presser foot is kept lifted as long as the treadle is fully heeled backward.



5-5 MANUAL BACK TACKING (Function code of Control Box : 03, 04, 14 and 24)

If the Manual Back tack switch is pressed while the sewing machine is operating or stopped, the Back-tack solenoid is energized during that period.

Back-tack solenoid is not in effect in following cycles;

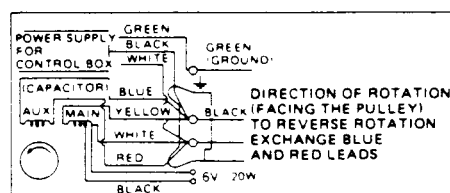
- during operation of Presser foot lift
- during back tacking operation at both start and end

NOTE: When the manual back-tack switch is pressed longer than 12 seconds while the sewing machine is stopped, the circuit protection disconnects the back-tack solenoid automatically.

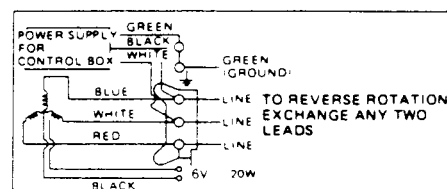
4 ELECTRICAL CONNECTIONS

4-1 Diagrams for power supply connections on terminal board

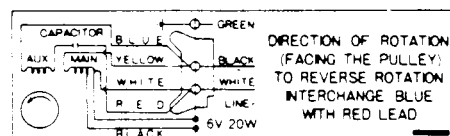
fig. 9



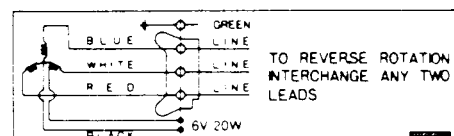
Single phase motor
for North America only



Three phase motor
for North America only

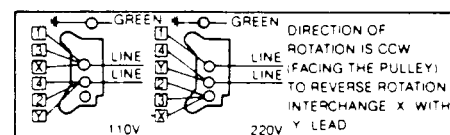


Single phase

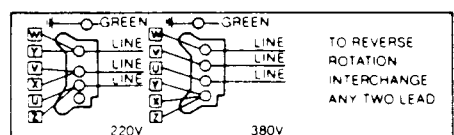


Three phase

For Single Voltage



Single phase



Three phase

For Dual Voltage

IMPORTANT:

BEFORE MAKING ANY CONNECTIONS TO THE POWER SUPPLY, CHECK THE NAMEPLATE RATING TO ENSURE CONFORMANCE TO THE LINE VOLTAGE. ALSO ASSURE LINE VOLTAGE TAPS CONFORM TO ACTUAL LINE VOLTAGE.

4-2 Changing for the direction of rotation

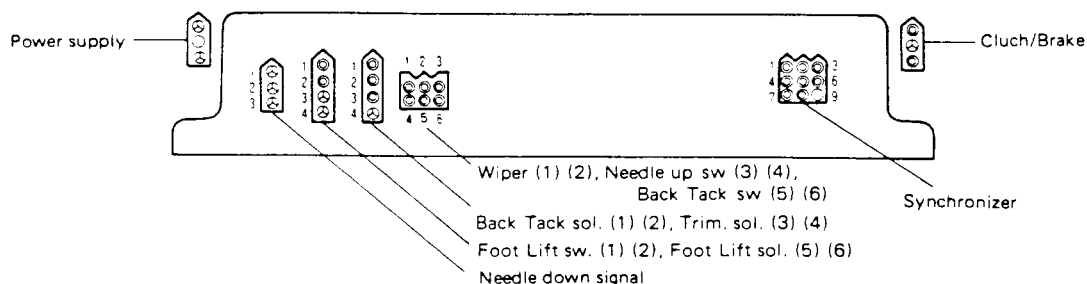
If the sewing machine runs in the reverse direction, be sure to turn off the motor and change the wiring as indicated on the connection diagram.

As for the connector type be sure to turn off the motor and reverse the connector up side down.

4-3 Wiring connections of the sewing machine solenoids.

The solenoid connector of the sewing machine should be connected to its corresponding connector on the connector panel as indicated on the following drawings.

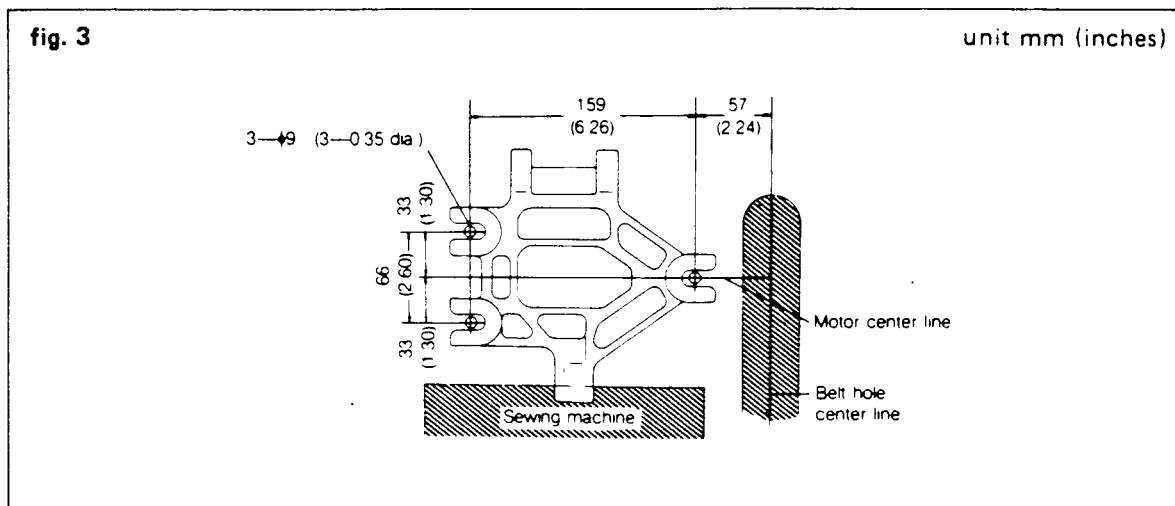
fig. 10 591 machine



3 INSTALLATION

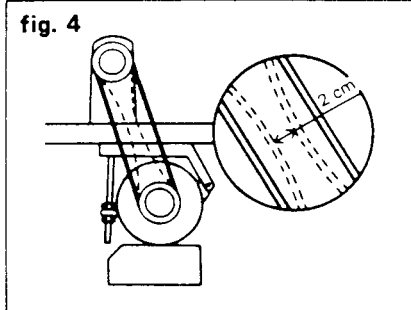
3-1 Installation of motor to sewing machine table

- 1) Drill three holes in the sewing machine table.



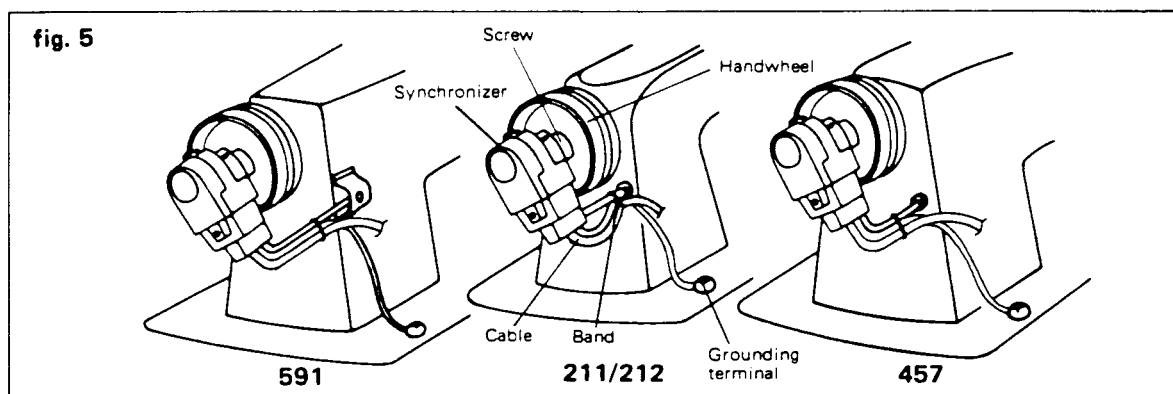
DIN standard belt-tightener (DIN 42 706) is also available on request.

- 2) Install the motor beneath the sewing machine table, observing the following precautions.
 - A. Don't drop or subject it to other severe shock.
 - B. The motor is mounted so that the drive pulleys of the motor and the sewing machine are properly aligned. Use low inertia pulley. (Aluminum preferred, not cast iron)
 - C. The V-belt connecting the motor to the sewing machine should be tightened properly as shown in fig. 4. It should be possible to pull a correctly tightened belt together between two fingers within approximately 2 cm (0.80 inches).
An excessively tight belt may not only shorten the life of bearings, but also affect the operation of the sewing machine.
Too loose a belt will affect accurate positioning.
 - D. After installing the motor, please make sure that the output shaft can be freely rotated by hand. If not, please adjust the clutch air gap, as instructed in item "MAINTENANCE."



3-2 Installation of synchronizer

Attach the synchronizer to the handwheel of the sewing machine.



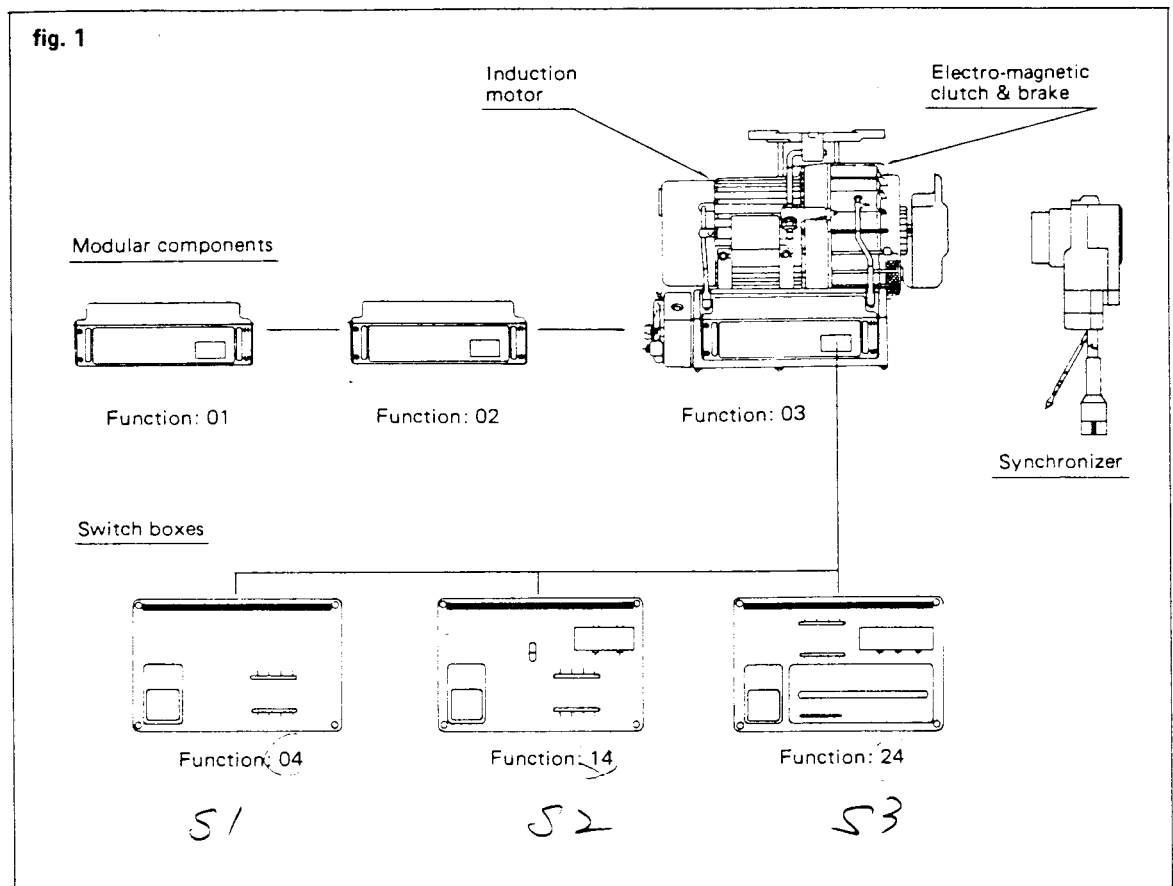
If adjustments of the synchronizer are necessary, please refer the chapter entitled: "ADJUSTMENTS".

NOTE: The cable extending from the synchronizer should be fixed to the retaining bolt with the band. The grounding terminal must be affixed on the sewing machine.

1 INTRODUCTION

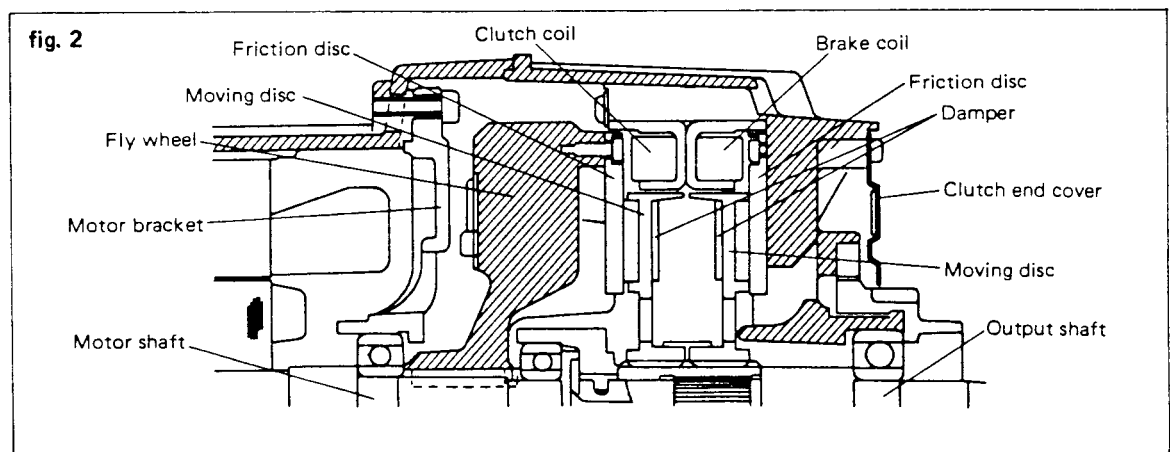
This needle positioner represents the latest concept in electronic needle positioning units. This device meets the requirements for various control functions and has the capacity to upgrade various functions through modular components and various optional switch boxes.

1-1 Component of the needle positioner



1-2 Principle of operation

The electro-magnetic clutch and brake consists of the clutch coil and brake coil assemblies, the output shaft, the clutch end cover, and two moving discs which slide on the output shaft (fig. 2). When the clutch coil is energized by operating the treadle, the moving disc is engaged with the friction disc affixed on the flywheel. And then the rotation is transferred to the output shaft. When the brake coil is energized, by removing the force on the treadle, the moving disc is engaged with the friction disc affixed on the clutch end cover. And it stops the rotating output shaft.



8. Adjustment of Push Button Spring Tension

To adjust the spring tension of the push button, loosen the back-tack switch action shaft collar set screw and move collar toward rear of machine to increase the spring tension and move collar toward front of machine to decrease the spring tension, then firmly tighten the set screw. (Fig. 35)

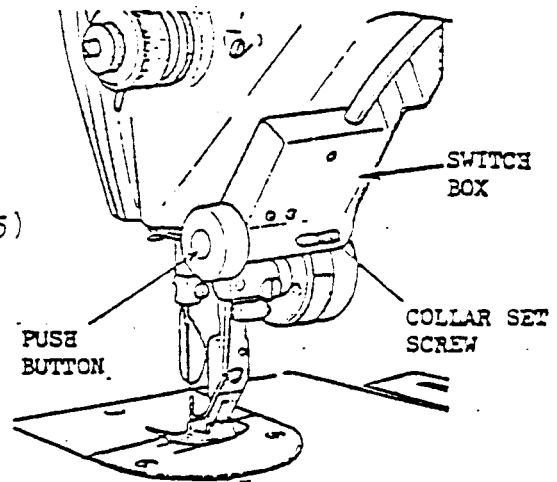


Fig. 35

9. Cords and Connections

Join the connectors to their mating terminals on the control box making sure they are correctly and fully inserted into the terminals. (Fig. 36)

Check that the sensor cord, back-tack switch cord and other wiring in the machine are not in contact with the belt, machine pulley and/or other moving parts.

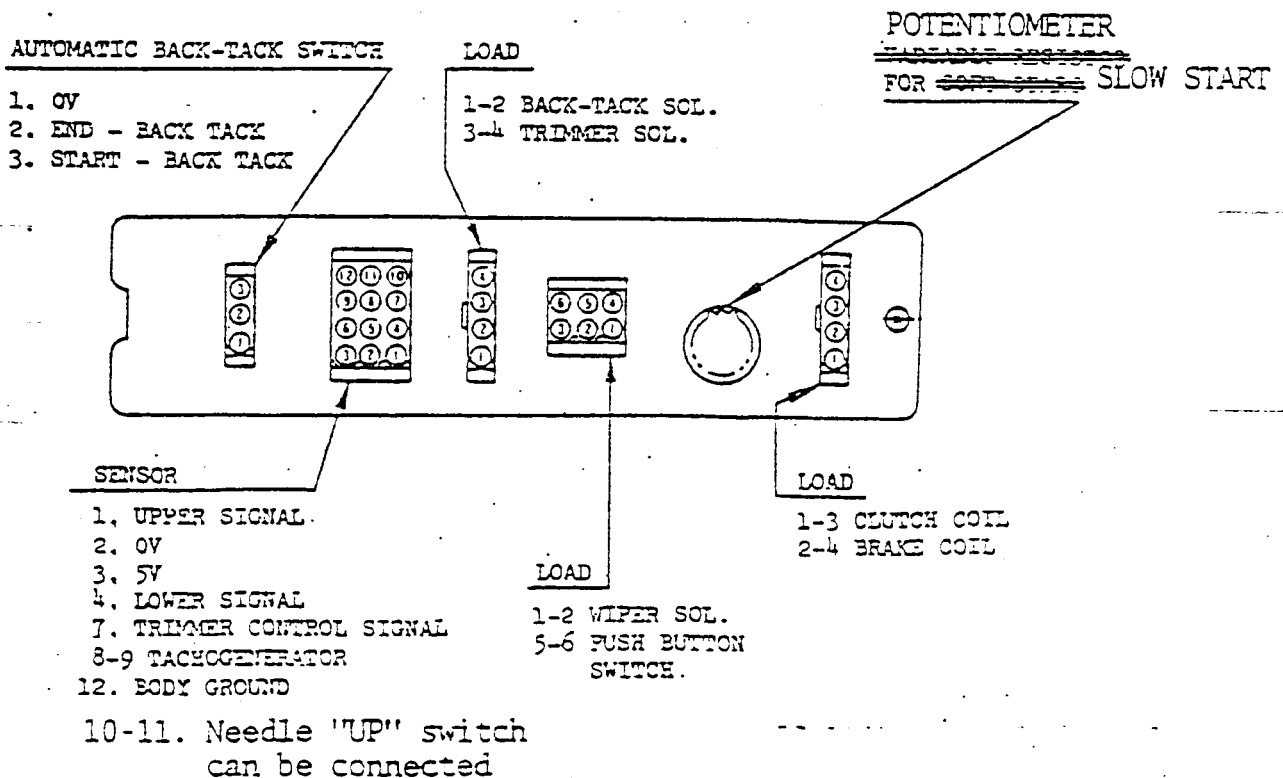


Fig. 36

While holding the back tack solenoid plunger in its rest position, turn feed rock shaft driving frame action lever until it contacts the feed rock shaft driving frame roller and firmly tighten the two driving frame action lever screws.

Check that the driving frame action lever is set laterally in relation with the feed rock shaft driving frame stopper lever as shown in Fig. 32.

Adjustment

Loosening the two screws holding the feed rock shaft driving frame action lever will permit moving the action lever sidewise and in rotational direction. Set action lever correctly in position and firmly tighten the two screws.

5. Feed Rock Shaft Driving Frame Spring Tension

The feed rock shaft driving frame spring tension should be set so that the force required to actuate the feed rock shaft driving frame when applied to point C would be approximately 1kg., feed regulator set at "6". (Fig. 33)

To adjust spring tension, bend the spring retainer portion of the oil pump screen frame as required.

6. Setting of Feed Rock Shaft Driving Frame Stopper Spring

Set feed regulating dial to "6" and depress feed reverse lever as far as it will go. While holding the feed reverse lever in this position, loosen the stopper spring regulating screw lock nut and adjust regulating screw so that its tip is in contact with the stopper spring and firmly tighten the lock nut.

7. Setting of Push Button Switch

To set the back-tack push button switch in desired position, loosen the two screws holding the push button switch box and move switch box as required, then firmly tighten the two screws. (Fig. 34)

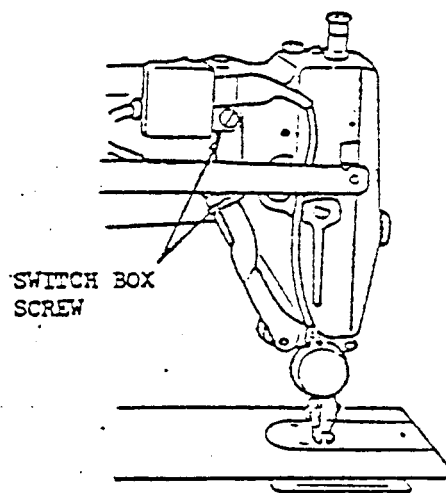


Fig. 34

2. Setting of Feed Rock Shaft Driving Frame (Fig. 32)

Setting

Set feed rock shaft driving frame so that there is a clearance of 1.5mm (.06") between its left end and the boss on the bed.

The feed rock shaft driving frame hinge pins, feed and feed lifting eccentric and feed reverse lever hinge stud crank must be correctly set in relation with the feed rock shaft driving frame so that it can rotate freely when operated manually.

Adjustment

Set feed regulating dial to "6" and loosen the set screws holding the feed and feed lifting eccentric. Loosen the set screws holding the left and right feed rock shaft driving frame hinge pins and slide hinge pins away from feed rock shaft driving frame leaving a clearance of approximately 1mm (.039") on each side of the driving frame. Move the driving frame to the left or right as required until it is positioned where it can function freely, then push the left and right hinge pins lightly against the driving frame just enough to prevent lateral play and temporarily tighten the set screws. Set feed and feed lifting eccentric so that it is in alignment with the feed rock shaft driving frame and firmly tighten the set screws. Then firmly tighten the feed rock shaft driving frame hinge pin set screws.

Using a screwdriver, zero out feed rock shaft driving frame as shown in Fig. 33. To make forward stitch length longer, turn feed rock shaft driving frame toward A. To make reverse stitch length longer, turn feed rock shaft driving frame toward B.

3. Setting of Feed Rock Shaft Driving Frame Action Shaft and Collar

Feed Rock Shaft Driving Frame Action Shaft

The Feed rock shaft driving frame action shaft supported by left and right feed rock shaft driving frame action shaft brackets must rotate freely without any binding. When torque is heavy, loosen the two screws holding the right bracket and adjust bracket so that the driving frame action shaft will rotate lightly, then firmly tighten the bracket screws.

Feed Rock Shaft Driving Frame Action Shaft Collar

Loosen the set screw holding the feed rock shaft driving frame action shaft collar and push the collar lightly against the left bracket just enough to prevent lateral play and also permit the driving frame action shaft to rotate freely. Then tighten the set screw.

4. Setting of Feed Rock Shaft Driving Frame Action Lever

Setting

Check feed rock shaft driving frame for correct zero position and set feed regulating dial to "6".

DESCRIPTION OF BACK TACKLING OPERATION

Back tacking with the back tack device is done by means of a built-in back-tack solenoid.

When an electronic command from the control box (for automatic back tacking) and/or the push button switch is relayed to the back-tack solenoid, the solenoid causes the feed rock shaft driving frame action lever fastened to the right end of driving frame action shaft to rotate and push the feed rock shaft driving frame upward and hold it in this position until back tacking is completed. While the above takes place, the feed reverse lever remains immovable due to the slot provided on the joint portion of the feed reverse lever hinge stud crank connecting link which is connected to the feed rock shaft driving frame.

The feed rock shaft driving frame stopper lever provided on the feed reverse lever hinge stud crank has been designed to control the reverse stitch length to same stitch length as set for forward stitch with the feed regulating dial on the feed reverse lever.

The automatic back tack switch connected to the control box permits automatic back tacking at start and at end of stitching independently. The number of stitches in reverse is controlled by the control box.

Back tacking can be done at any desired position during the sewing operation by depressing the push button switch provided adjacent to the needle bar. A back tack longer than can be obtained with the automatic back tack switch can be made when push button switch is used, however, in order to protect the back tack solenoid the current supply to the solenoid is automatically cut off after 5 seconds of continuous depression of the switch.

SETTING AND ADJUSTMENT OF BACK TACK DEVICE

1. Setting of Back Tack Solenoid (Fig. 32)

The back tack solenoid is correctly set in the machine before the machine leaves the factory. If, however, this setting has been disturbed and resetting becomes necessary, reset as instructed below.

Setting

Set the back tack solenoid so that there is a clearance of about 0.7mm (.03") between the flange of its plunger and the rotating hook shaft when plunger is pushed toward the shaft.

When assembling the back tack solenoid link to the solenoid, be sure the solenoid is correctly positioned laterally and correctly angled so that the link can operate smoothly and without any binding in the groove provided on the plunger.

Adjustment

Loosen the two screws holding the back tack solenoid bracket and adjust position of solenoid as required and re-tighten the screws.

PRINCIPAL PARTS (Continued)

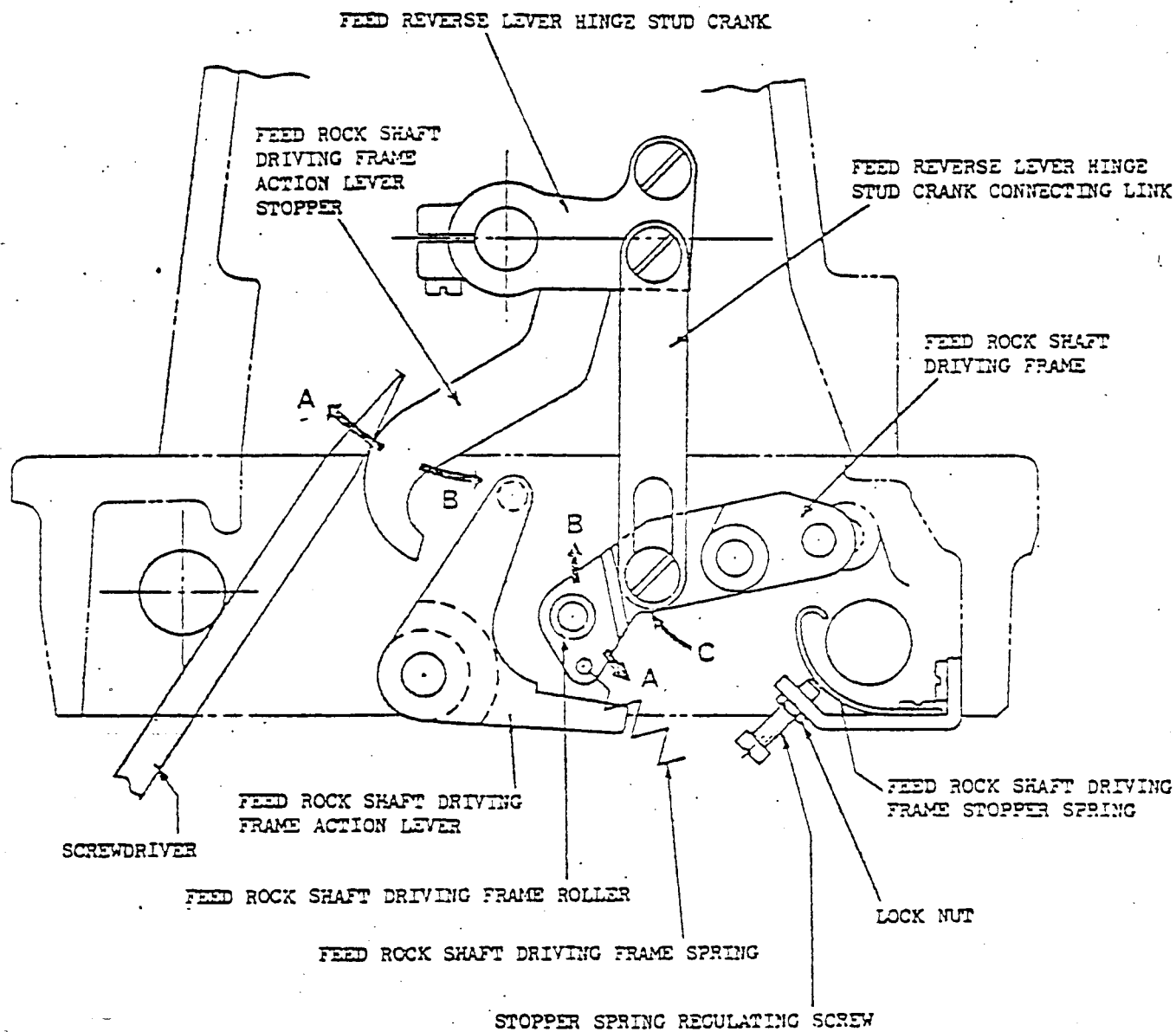


Fig. 33

PRINCIPAL PARTS

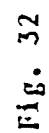


Fig. 32

Note: When using the pre-tension to adjust the length of needle thread end, every care must be taken not to cause ill effect to sewing performance.

To adjust the starting length of needle thread end with movable slack thread regulator, loosen the two set screws holding the slack thread regulator action plate and move action plate up or down as required, then firmly tighten the set screws. (Fig. 31)

(Move slack thread regulator action plate up to shorten and down to lengthen the needle thread end)

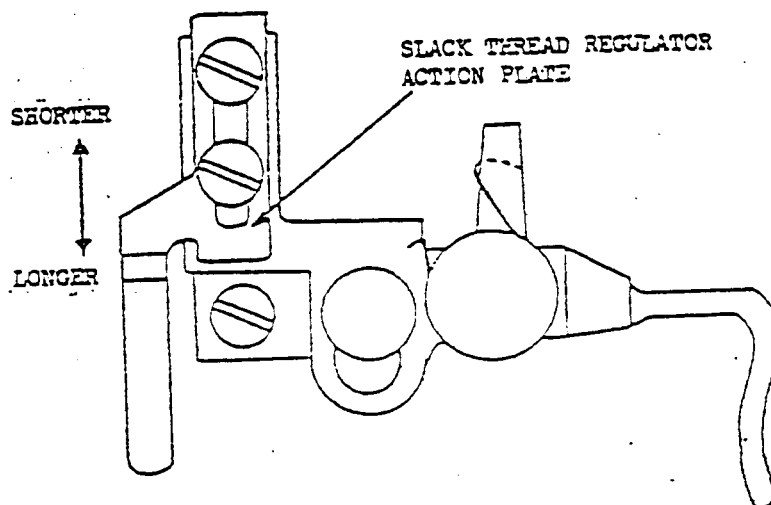


Fig. 31

Adjustment of Thread Wiper

The thread wiper does not require minute adjustment however care should be taken so that —

1. the wiper will not interfere with the right hand side of the presser foot when presser foot is raised.
2. there is at least 1.0mm (.039") clearance between wiper and point of needle when wiper is operated when needle is in upper stop position.

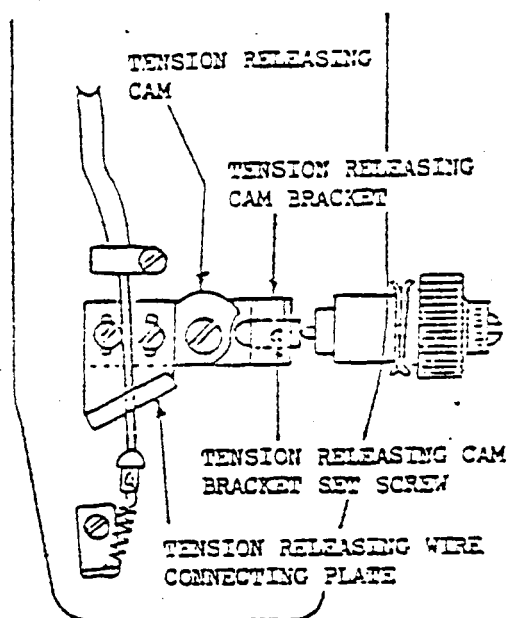


Fig. 28

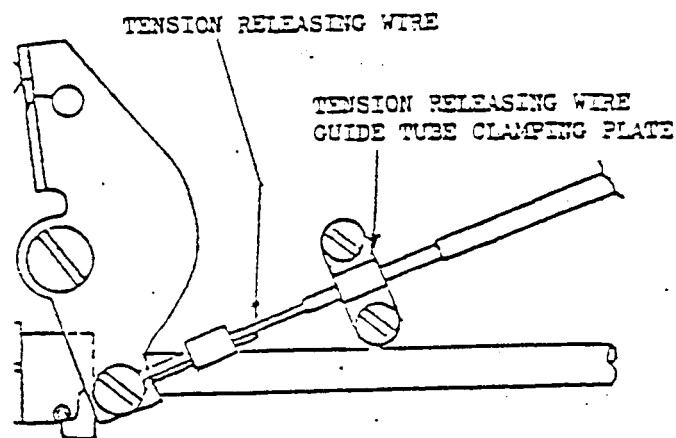


Fig. 29

Timing of Tension Release

To adjust the timing of releasing the tension when presser bar is raised by hand or by knee operation, loosen the two tension releasing wire connecting plate screws and move connecting plate up or down as required.

If timing is late, move connecting plate downward.

If timing is fast, move connecting plate upward.

Firmly tighten the two screws when correct timing has been achieved. (Fig. 28)

The tension discs should begin to separate, or release the needle thread tension, just before the thread puller begins to make its return stroke to trim the threads.

When adjusting this timing:

1. Check timing of tension release action cam. (Refer to Timing of Tension Release Action Cam adjustment procedure)
2. Loosen the two screws holding the tension releasing wire guide tube clamping plate and move guide tube to the left or right as required and firmly tighten the screws. (Fig. 29)

(To advance timing, move guide tube to the right and to retard the timing, move guide tube to the left.)

Adjusting the Length of Needle Thread End

To adjust the starting length of needle thread end with pre-tension, loosen the pre-tension cap screw and turn pre-tension cap clockwise to shorten the thread end, and turn pre-tension cap counterclockwise to lengthen the thread end. (Fig. 30)

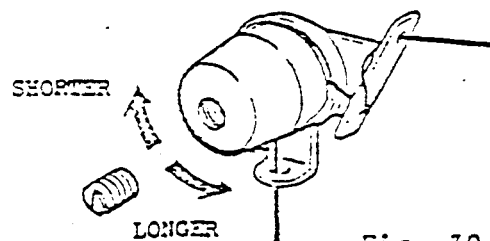


Fig. 30

Setting of Thread Puller Action Cam Adjusting Plate
(Timing (start of activation) of thread puller)

The thread puller action cam adjusting plate should be set so that its step portion will align with the follower on the thread puller action plate when distance from top of needle bar connecting stud to underside of arm at needle end, needle bar in ascent, is 69.5mm (2.736") in the case of 491D200GB machine and 72.5mm (2.854") in the case of 491D300GB machine. (See Figs. 26 and 27)

Depending on the type of thread used, setting of thread puller action cam adjusting plate require fine adjustment. When adjustment is necessary, loosen two set screws and turn thread puller action cam adjusting plate as required, and while holding the action cam adjusting plate pressed lightly against the tension release action cam, firmly tighten the two set screws.

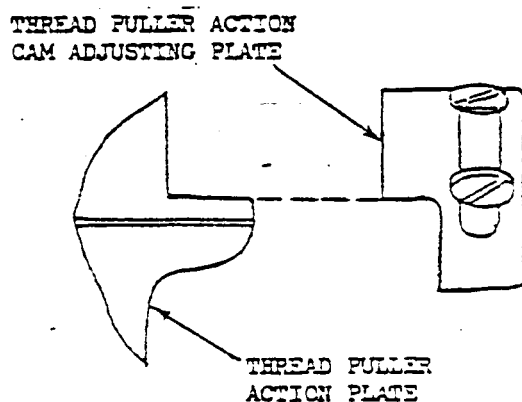


Fig. 26

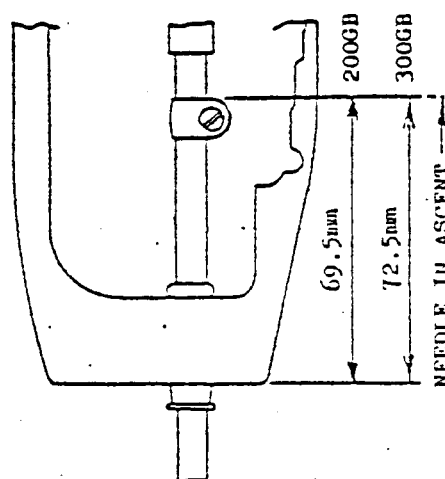


Fig. 27

Adjustment of Gap Between Tension Discs (Fig. 28)

The gap between the two tension discs should be 0.8 - 1.0mm (.032 - .039") while the tension is released. This gap will not increase even if the presser bar is pushed up as far as it will go.

Adjust gap as instructed below.

1. Check that the tension (complete) is correctly set in position.
2. Loosen the set screw holding the tension releasing cam bracket and move bracket to the left or right as required until desired gap has been achieved.
3. Hold bracket in this position and firmly tighten the set screw.

The timing mark on the thread puller action cam must align with the timing mark on the thread puller action plate when distance from top of needle bar connecting stud, needle bar on its downward stroke, to underside of arm at needle end is 66.6mm (2.622") in the case of 491D200GB machine and 69.2mm (2.724") in the case of 491D300GB machine. (See Figs. 23 and 24)

Adjust timing as instructed below.

1. Loosen the two set screws holding the thread puller action cam.
2. Turn machine pulley over toward front of machine until the needle bar go beyond its upper dead center and descends to the point shown in Fig. 24.
3. Turn thread puller action cam until its timing mark is aligned with the timing mark on the thread puller action plate and while holding the thread puller action cam pressed lightly against the tension release action cam, firmly tighten the two set screws.

Timing of Tension Release Action Cam

The tension release action cam must be set so that the tension release action plate pin is disengaged from the tension release action cam immediately after thread trimming is completed. (Fig. 25)

To make this adjustment, follow the instructions noted below.

1. Loosen two set screws and turn the tension release action cam as required.
2. When correct position has been located, firmly tighten the two set screws while holding the tension release action cam pressed lightly against the thread puller action cam.

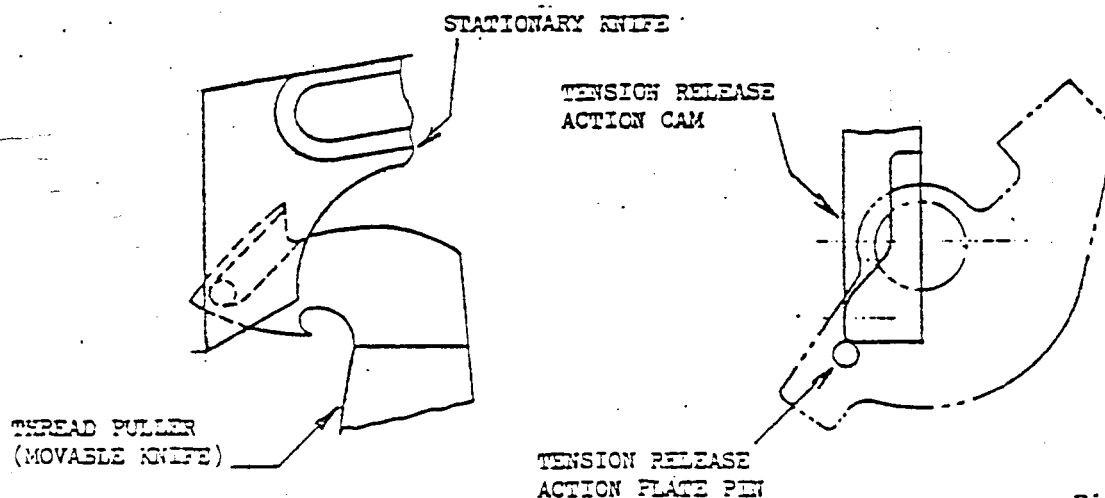


Fig. 25

Note: When replacing the feed dog with a new one, be sure to check the timing of tension release action cam and readjust if necessary.

To adjust the pressure, loosen set screws holding the eccentric stud and thread puller action lever and move pressure adjusting block as required by turning the eccentric stud. Tighten set screws.

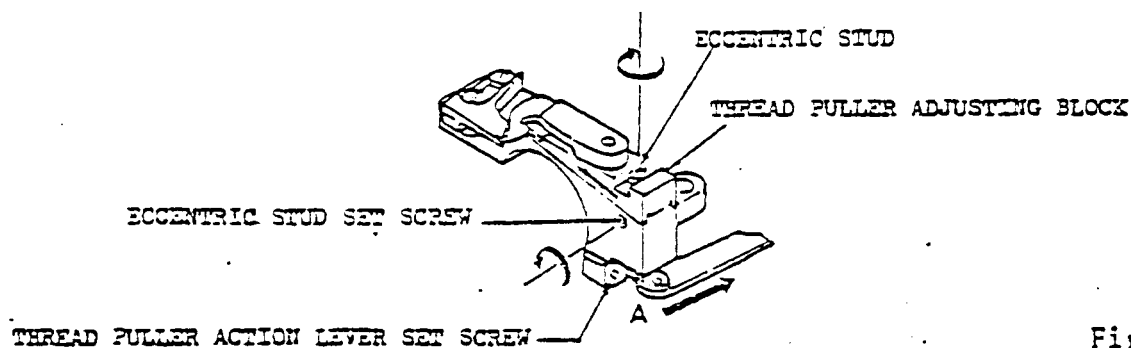


Fig. 22

Timing and Setting of Thread Puller Action Cam

The clearance between the highest point of thread puller action cam and follower portion of thread puller action plate should be 0.5mm (.020") (Fig. 23)

To make this adjustment, follow the adjustment procedure noted hereunder.

1. Loosen the two set screws holding the thread puller action cam and the two tension release action cam set screws.
2. Turn thread puller action cam until its highest point is located opposite the follower on thread puller action plate and slide thread puller action cam to the left or right as required to provide the 0.5mm (.020") clearance specified above, then temporarily tighten the set screws.
3. Push tension release action cam lightly against the right end of thread puller action cam and temporarily tighten the set screws.
4. Firmly tighten the set screws when thread puller action cam has been correctly timed as instructed in the following paragraph.

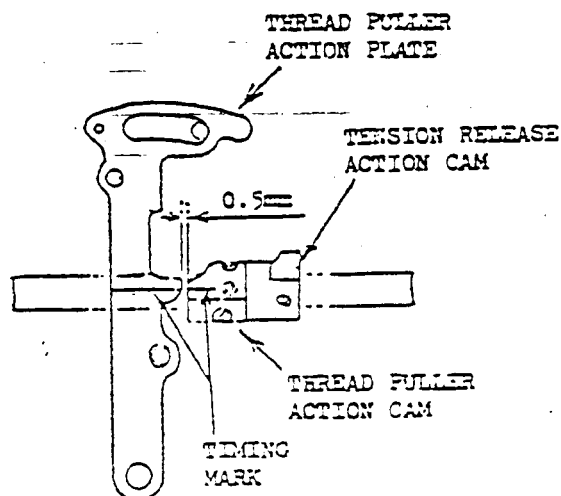


Fig. 23

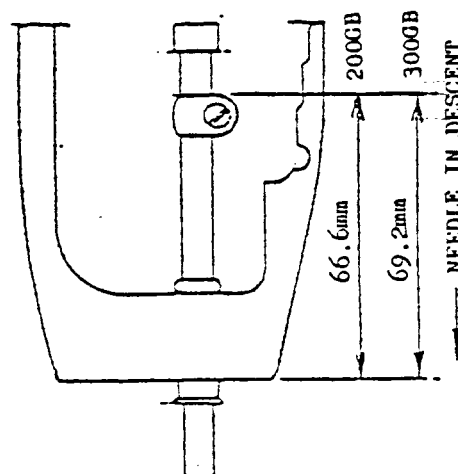


Fig. 24

To make this adjustment, loosen the set screw and turn eccentric bushing, as required, then tighten the set screw. (Fig. 20)

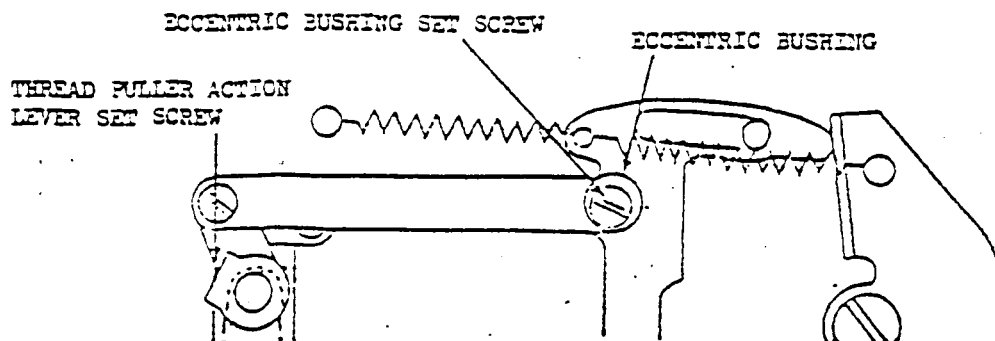


Fig. 20

The thread puller bracket should be set so that the tip of thread puller will pass by the center of the needle. (Fig. 21)

To adjust, loosen the two screws holding the thread puller bracket and move bracket as required, then firmly tighten the two screws.

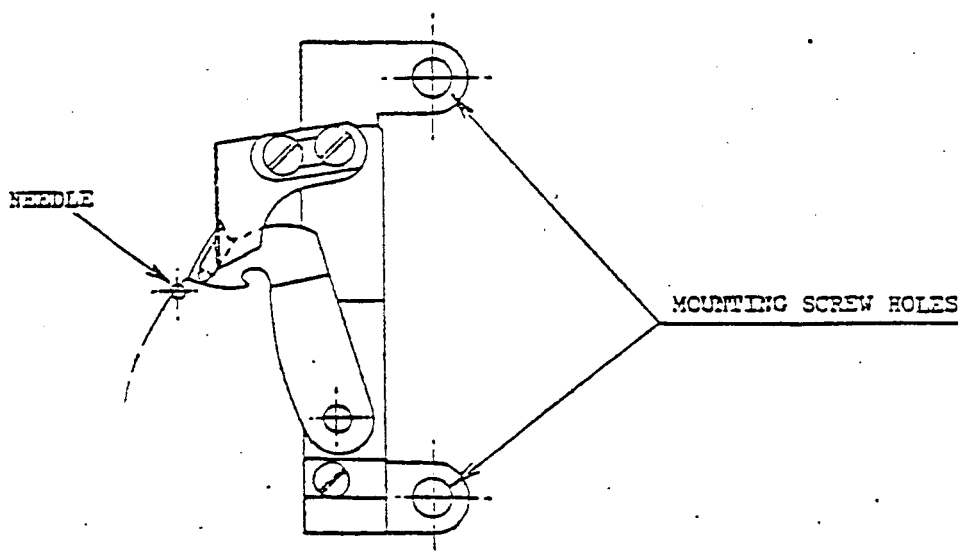


Fig. 21

Note: When replacing the feed dog with a new one, use only Singer part. Further, the feed dog should not be set lower than the standard height because it may cause the thread puller to interfere with the underside of the feed dog.

Adjustment of Pressure of Thread Puller Against Stationary Knife

The pressure of thread puller against stationary knife should be held as light as possible and never be greater than actually required. (The force required to actuate the thread puller when applied to point A, Fig. 22 should be approximately 1kg.)

Note: This timing must be adjusted as accurately as possible. If timing is too fast, the thread puller will not operate to trim the threads. If the timing is slow, it will cause the take-up lever to slow down on its upward stroke and stop anywhere before or beyond the correct upper stop position.

Setting of Trimmer Solenoid

The trimmer solenoid is correctly set on the machine before the machine leaves the factory. If, however, this setting has been disturbed and resetting becomes necessary, adjust as instructed below. (Fig. 17)

To adjust setting, loosen the two screws holding the trimmer solenoid bracket and move bracket as required to set:

Angle - Plunger on trimmer solenoid should be aligned with trimmer solenoid link.

Stroke - Clearance between flange of plunger and solenoid should be 4mm (.157")

Setting of Stationary Knife

The stationary knife should be set so that there is a clearance of 0.3mm (.012") between its cutting edge and the right side of the feed dog. (Fig. 18)

To adjust, loosen the two screws holding the stationary knife and move knife to the left or right as required, then firmly tighten the screws.

When replacing the feed dog, be sure this clearance is provided as instructed above.

Note: If the clearance mentioned above is too large, the length of thread end under the fabric will become longer.

Setting of Thread Puller

When the thread puller is in its rest position, its right edge should be parallel with the edge of bed as shown in Fig. 19.

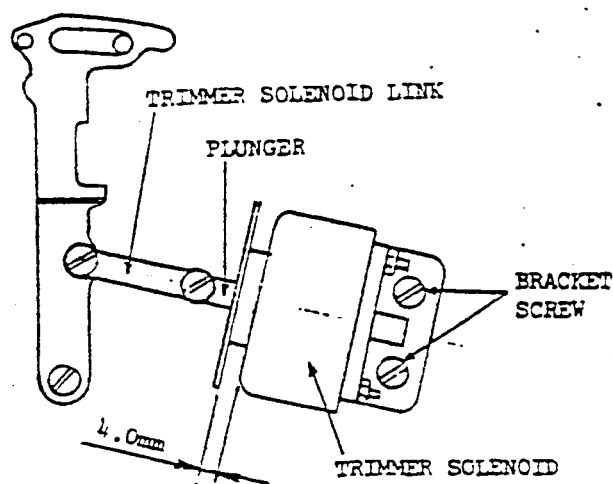


Fig. 17

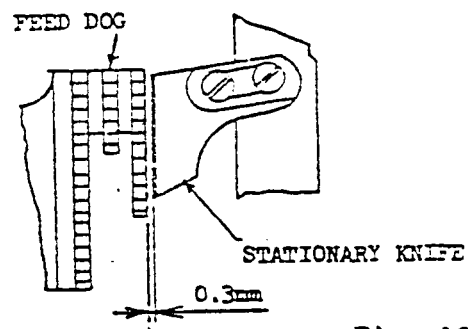


Fig. 18

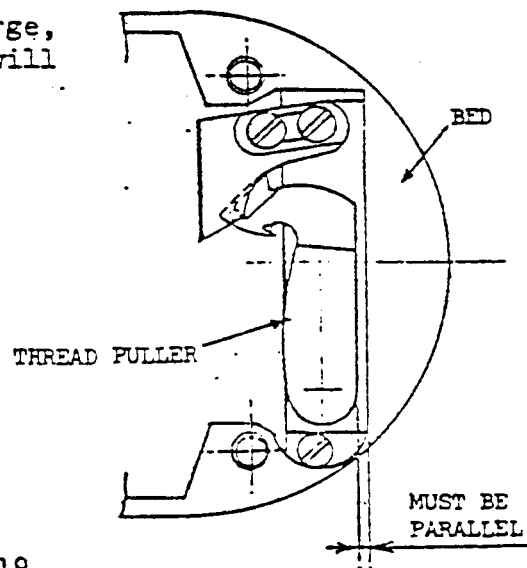


Fig. 19

3. Use sensor retainer supplied with the machine and be sure it is correctly secured in position.

Note: The sensor plate for upper needle position should not be reset in order to solve the problem of tension releasing mechanism not being released when needle stops in the second position. This adjustment should be made by resetting the sensor unit on the hub of machine pulley as instructed below.

- a. Loosen the two set screws holding the sensor unit and while holding the sensor with one hand, turn machine pulley slightly over toward the front of machine.
- b. Hold sensor in this position and temporarily tighten the first screw.
- c. Run machine and check whether the tension releasing mechanism is released when the needle stops in the upper position. Repeat above, if necessary.
- d. Firmly tighten both first and second set screws.

Timing - Actuation of Trimmer Solenoid

The trimmer solenoid is actuated when the take-up lever reaches a point 10mm (.394") before its lower dead center. The timing of this actuation is controlled by the sensor plate (for lower needle position) in the sensor unit. (Refer to item 3 under Description of Trimming Operation). If the sensor plate (for lower needle position) is correctly set, then the timing of actuating the trimmer solenoid should also be correct.

Timing - Completion of Actuation of Trimmer Solenoid

The current supply to the trimmer solenoid is cut off completing its actuation when the tension release action plate pin is in the range ℓ shown in Fig. 15. This timing is controlled by the sensor plate for trimmer solenoid and when adjustment is necessary, reset this sensor plate.

Turn machine pulley until the clearance between tension release action plate pin and tension release action cam is approximately 1mm (.039") (Fig. 15) and while holding the machine pulley in this position, set sensor plate for trimmer solenoid as shown in Fig. 16.

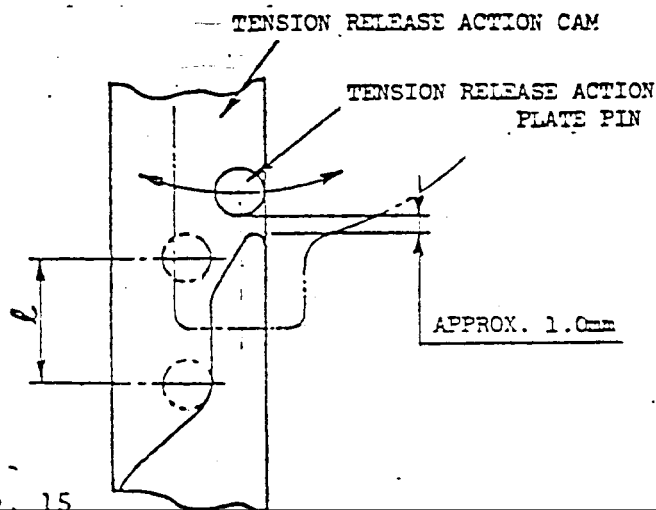


Fig. 15

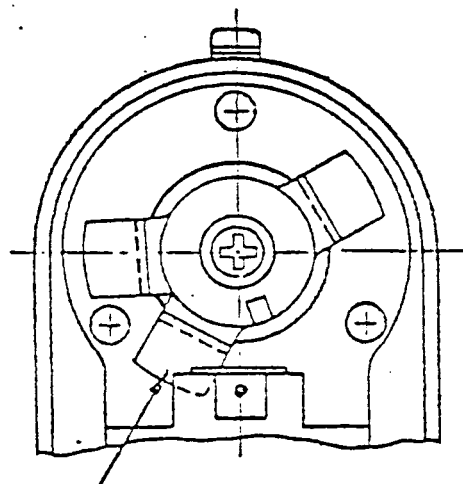


Fig. 16

SENSOR PLATE FOR TRIMMER SOLENOID

b. Upper Needle Position (2nd position)

The upper needle position of the 491D200GB machine is approximately 1mm (.039") before the take-up lever reaches its upper dead center and the upper needle position of the 491D300GB machine is when the take-up lever is at its upper dead center.

Adjust upper needle position as accurately as possible by running and stopping machine several times to check for correct position.

Adjustments

All sensors are correctly timed and set before leaving the factory. If, however, this timing or setting has been disturbed and retiming or resetting becomes necessary, adjust by correctly positioning the sensor plates.

1. The positions of the sensor plates (for upper and lower needle positions and for controlling the trimmer solenoid) in relation to the sensor set screw should be as shown in Figs. 12 and 13. To adjust the position of a sensor plate, loosen screw on right end of the sensor and turn sensor plate as required, then tighten the screw.

SENSOR PLATE (SECOND POSITION)

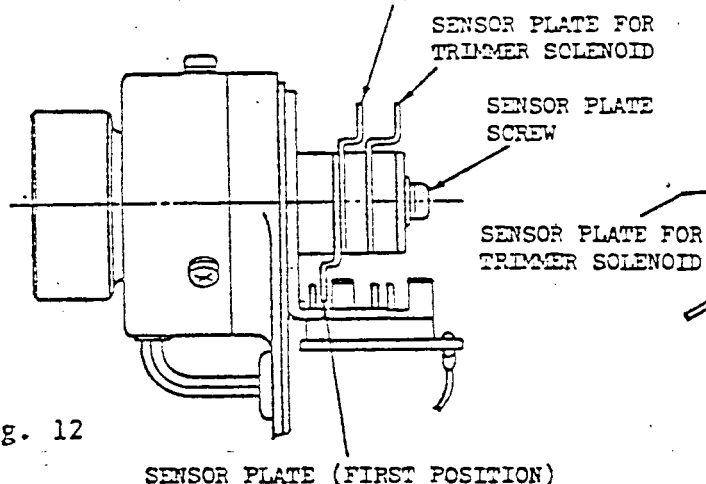


Fig. 12

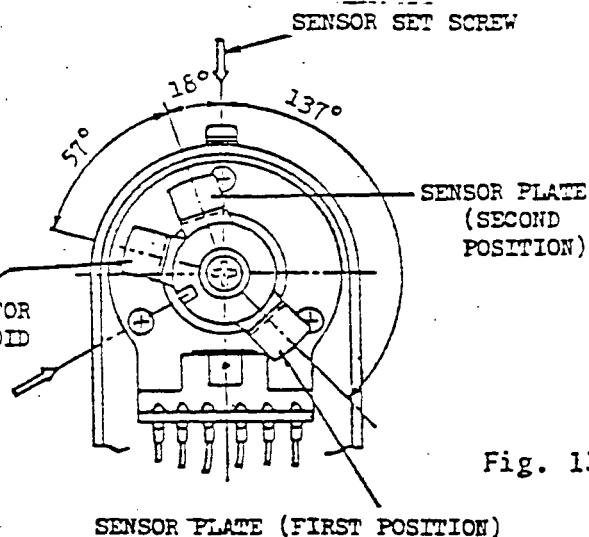


Fig. 13

2. Position sensor on hub of machine pulley so that its second set screw (set screw which appears immediately after the first set screw when sensor is rotated over toward the operator) is aligned with the second set screw of the machine pulley and firmly tighten the two set screws. (See Fig. 14)

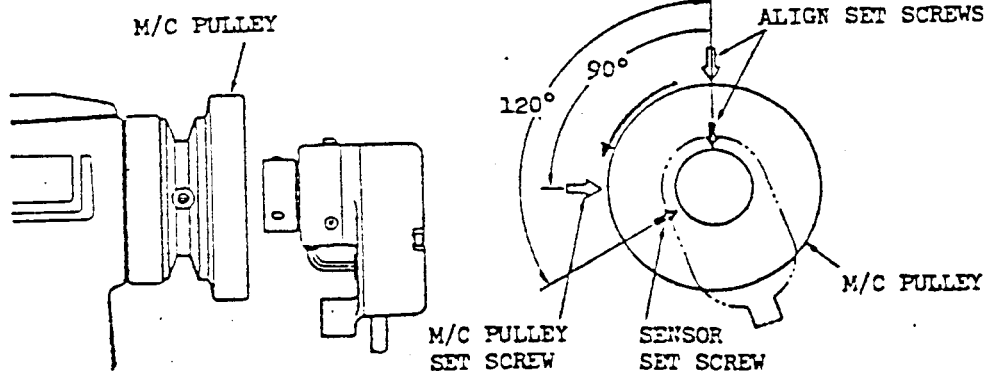


Fig. 14

10. The trimmer and tension releasing mechanisms return to their rest positions upon completion of the trimming operation and the machine stops in the upper needle position.

491D200GB - Approximately 1mm (.039") before take-up lever reaches its upper dead center.

491D300GB - Take-up lever at its upper dead center.

11. Upon completion of the trimming operation, the thread wiper makes a swivelling movement to place the needle thread in proper position for starting the next sewing operation.

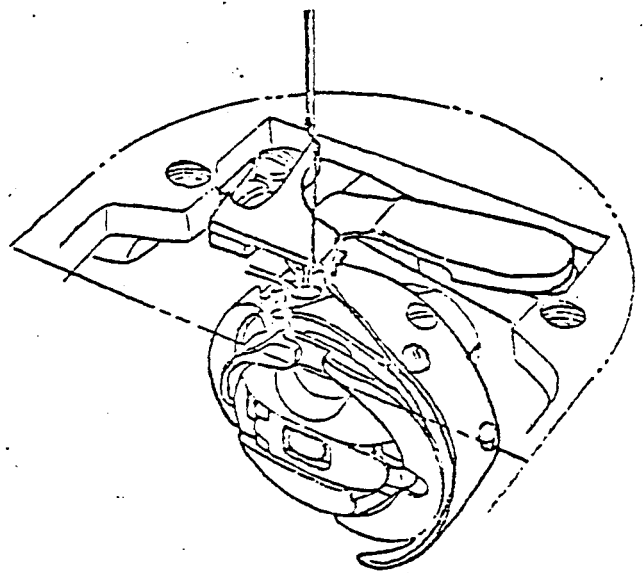


Fig. 11

TIMING AND SETTING

When checking the operation of the trimmer mechanism by manual actuation of the mechanisms.

- a. Be sure to turn machine pulley over toward front of machine.
- b. Push thread puller action plate toward cam when take-up lever is almost at its lower dead center.

NOTE: The thread puller may strike the needle and damage itself and the needle unless the thread puller action plate is pushed toward the cam as described above since the rotating hook shaft makes two revolutions against one cycle of the needle bar.

Be sure to check that the machine is correctly adjusted before making adjustments to the trimmer mechanism. (Refer to Service Manual for regular 491D machine)

Check and adjust the trimmer mechanism in the order instructed in this manual since it is interlocked with many other area.

Adjustment of Needle Stop Position

When checking and making adjustments of needle stop positions, be sure to disconnect the trimmer and wiper connectors from the control box.

Needle Stop Positions

- a. Lower Needle Position (1st position)

The lower needle position is approximately 3mm (.118") beyond the bottom dead center of the needle. This 1st position does not call for absolute accuracy and minor adjustments may be made if the threads cannot be properly trimmed due to skip stitching.

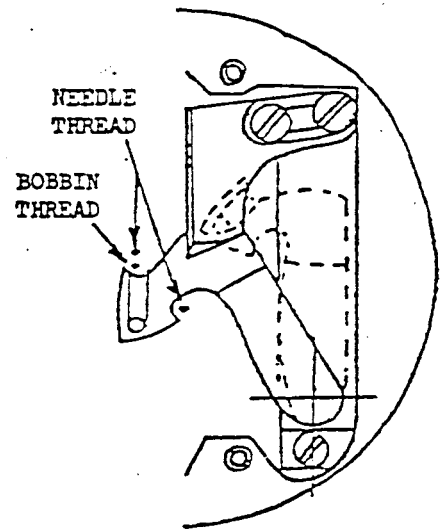


Fig. 8

5. As the needle thread is cast off the rotating hook, it catches on the hook portion of the thread puller. (Fig. 9)
6. The tension release action plate pin reaches the inclination on the tension release action cam and start releasing the tension discs immediately after the needle thread catches on the thread puller.

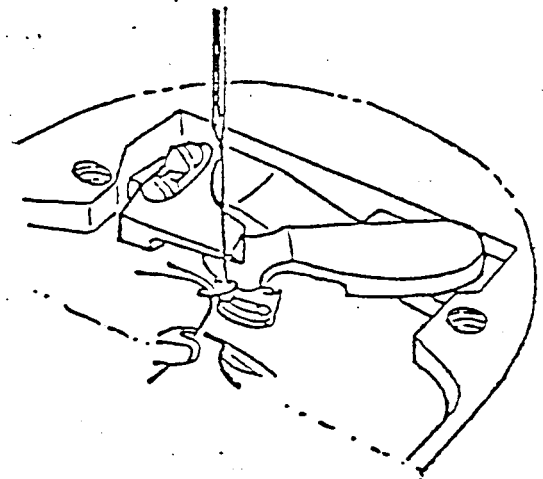


Fig. 9

7. While the above takes place, the cam follower on the thread puller action plate reaches the inclination on the thread puller action cam and the thread puller begins to pull the bobbin and needle threads toward the stationary knife.
8. The bobbin and needle threads are severed when the cutting edge of the thread puller closes in against the cutting edge of the stationary knife. (Figs. 10 and 11)

9. When the threads are trimmed, the spring biased tension release action plate moves back to its rest position disengaging its pin from the tension release action cam and thus complete its function of releasing and holding the needle thread tension released.

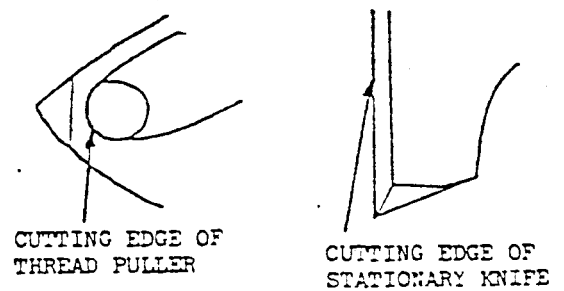


Fig. 10

3. The trimmer solenoid is energized when the sensor plate (for lower needle position) reaches a point shown in Fig. 6

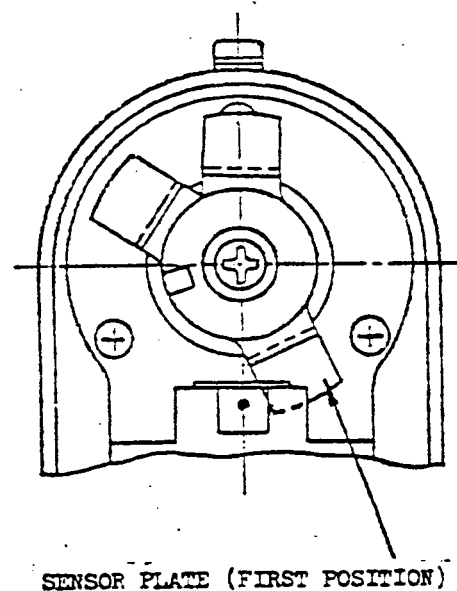


Fig. 6

4. When the cam follower on the thread puller action plate slips into the recessed portion of the thread puller action cam adjusting plate, the thread puller is activated to move through the loop (Fig. 7) to a point shown in solid line in Fig. 8, and the needle and bobbin threads are positioned as shown also in Fig. 8. Simultaneously, the thread puller action plate pushes the tension release action plate making its pin ride on the tension release action cam. Immediately when the pin rides on the tension release action cam, the electronic command relayed from the trimmer-solenoid control sensor cuts off the current supply to the trimmer solenoid. The above motion makes the tension releasing cam rotate until just before the tension discs are released.

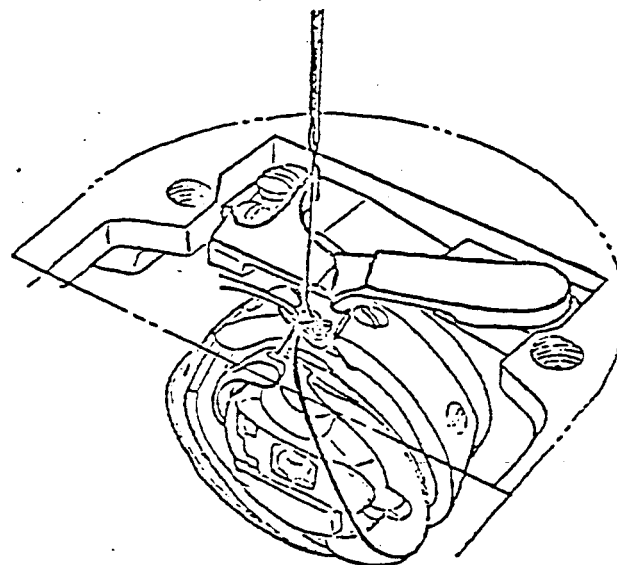


Fig. 7

c. Tension Release and Movable Slack Thread Regulator

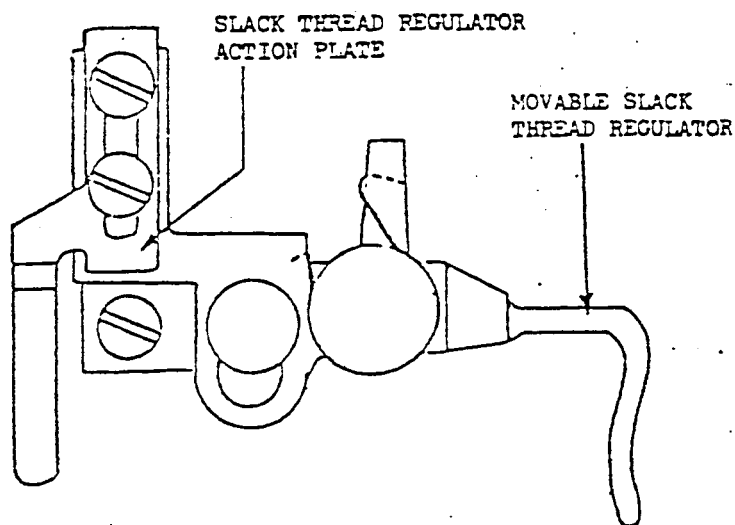


Fig. 3

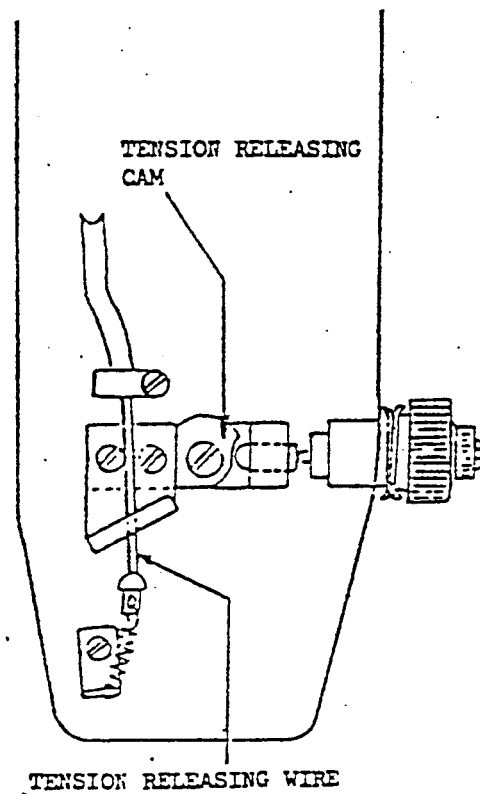


Fig. 4

DESCRIPTION OF THE TRIMMING OPERATION

1. When the foot treadle is returned to its neutral position upon completion of the sewing cycle, the machine stops approximately 3mm (.118") beyond the bottom dead center of the needle (hook point in the loop of needle thread). (Fig. 5)
2. Heeling the foot treadle will start the machine to run at low speed.

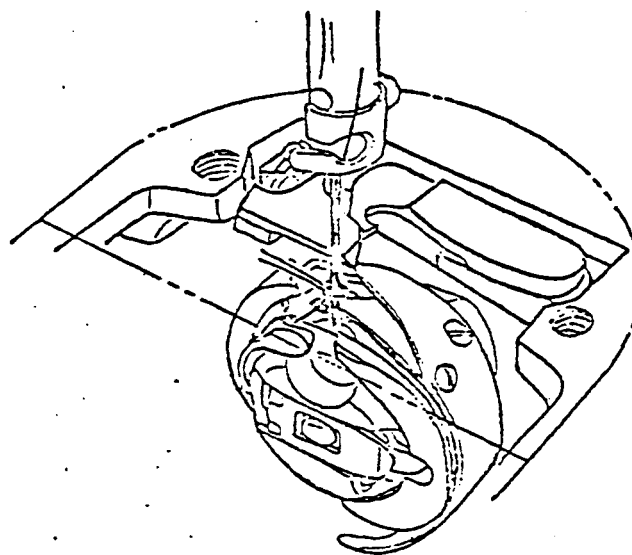


Fig. 5

UNDERBED THREAD TRIMMER

PRINCIPAL PARTS

a. Drive System of Thread Trimmer

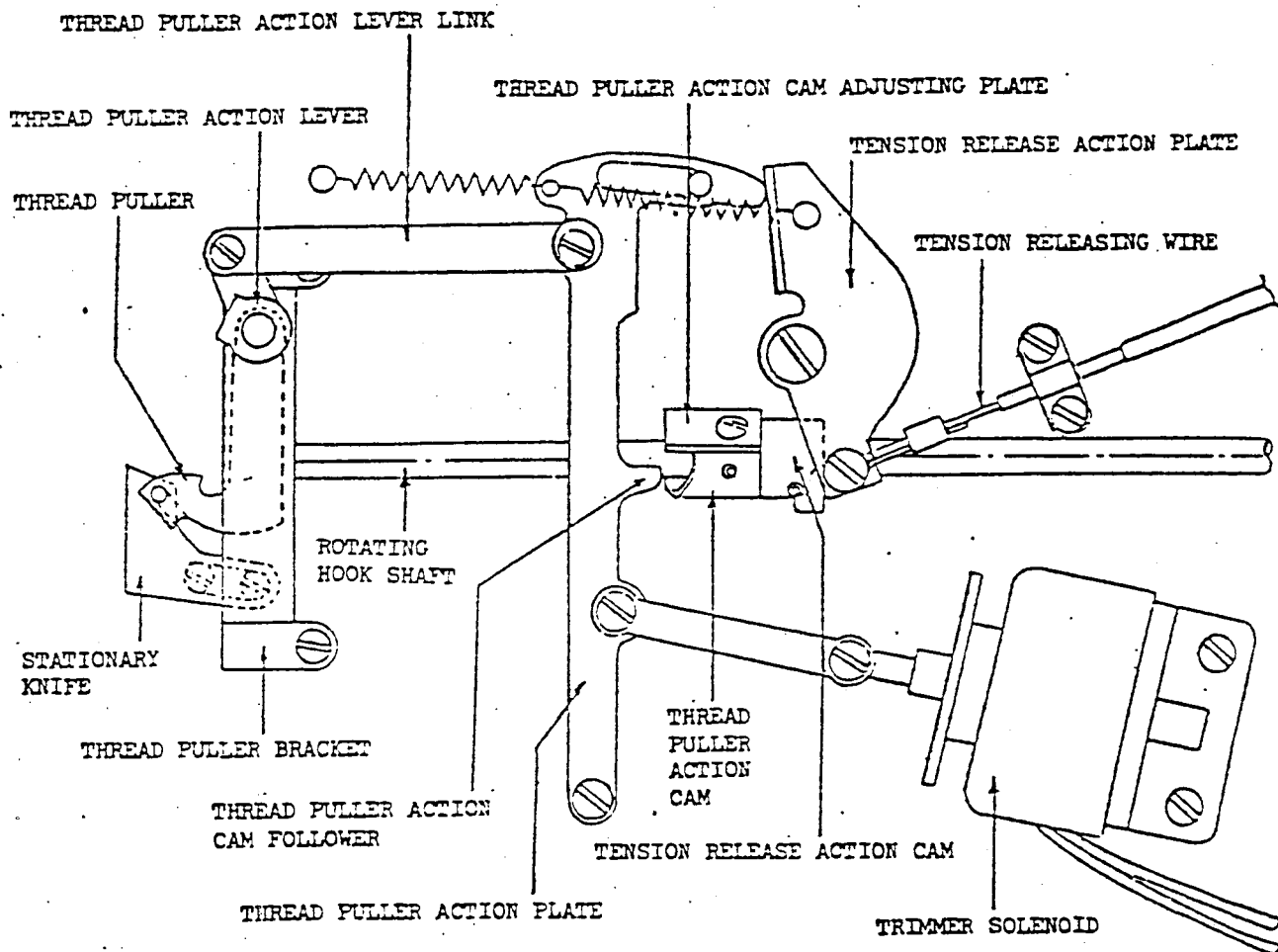


Fig. 1

b. Pulling and Trimming Unit

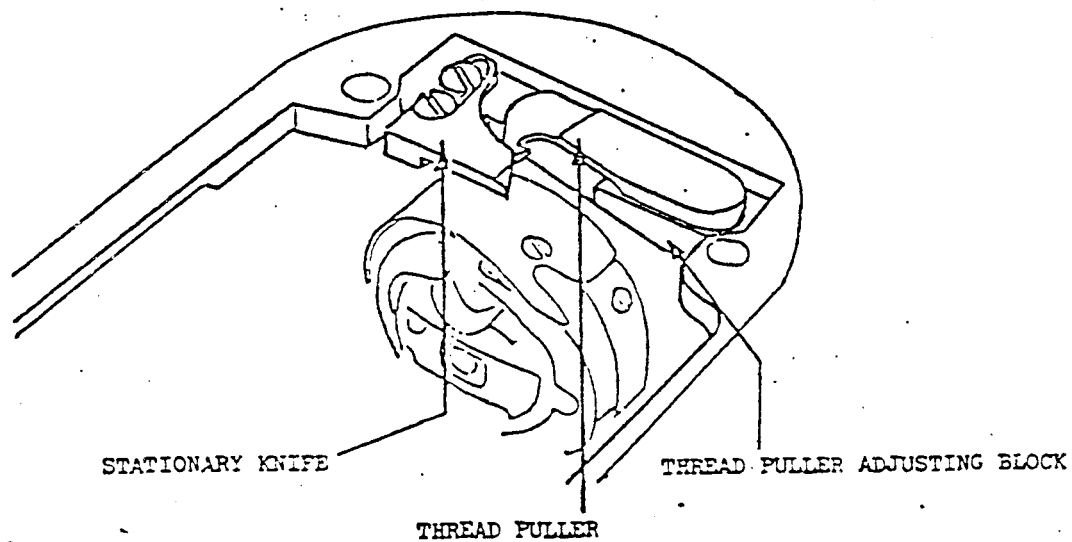


Fig. 2-

DESCRIPTION

An electro-mechanical underbed thread trimming unit, which is an integral part of the machine, is incorporated in the 491D200GB and 491D300GB machines.

The machine is driven by a needle positioner motor, and its sensor and control box relay the electronic commands to the built-in solenoids of the machine.

The needle and bobbin threads are trimmed below the throat plate after the sewing operation.

A thread wiper "Wipes" the needle thread to proper position for starting the next sewing operation.

In addition to the under bed thread trimming unit, a back tacking system is incorporated in the 491D200GG and 491D300GG machines. The automatic back tack switch and control box relay the electronic commands to the built-in solenoid for automatic back tacking at start and at end of stitching. The push button switch provided adjacent to the needle bar permits back tacking in the midst of the sewing operation.

This manual should be used in connection with the Service Manual for the regular 491D machine. It informs especially regarding the operation and maintenance of the underbed thread trimmer and back tacking device and their drive systems.

