

# SERVICE MANUAL SINGER\*

## ELECTRO-MECHANICAL SEQUENTIAL DEVICES USED WITH MACHINES OF CLASS 256



Four Buttonhole Sewing Units and One Operator

THE SINGER COMPANY

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TO ALL WHOM IT MAY CONCERN:

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## DESCRIPTION

**Electro-Mechanical Sequential Devices** are designed to automatically space buttonhole sewing in a garment.

The spacing governs the number of buttonholes which can be sewn in one cycling of the unit.

A complete unit consists of a steel cabinet which houses the mechanism required for the automatic movement of the garment. Top surface of cabinet forms a table which supports a sewing machine and a control panel.

### GENERAL FEATURES

Cam actuated mechanism controls operation of sewing machine.

Electrical switches control operation of entire device.

Control panel contains electrical equipment necessary to coordinate control circuits. Panel is equipped with thermal-overload protection.

A Series 38 Motor drives sewing machine. Indexing Unit is also driven by this motor through Speed-Reducer. Orders for motor must specify correct voltage, cycles and phase required.

### SPECIAL FEATURES

**ELECTRO-MECHANICAL SEQUENTIAL DEVICE 257000** is designed for use with Buttonhole Sewing Machine 71-201. Entire automatic buttonholing unit is known as Machine 256W1.

Machine 256W1 sequentially positions buttonholes parallel to edge of garment in accordance with a pre-determined spacing. Buttonholes can be aligned from 3/8 inch to 1 inch from edge of facing.

The machine positions and feeds the garment so that buttonholes are located vertically. From 3 to 7 buttonholes can be sewn in one cycle, depending upon the desired spacing within the machine's travel limit of 19 inches.

Spacing between buttonholes is adjustable from 2½ inches to 5¼ inches apart.

Feed wheels available for 100, 120, 150 and 180 stitches per buttonhole. Machine regularly supplied with feed wheel for 120 stitches per buttonhole.

With equal ease, machine handles resin-finished cottons, cotton and synthetic blends, 100% synthetics and silks.

A counter automatically stops machine before bobbin thread runs out. Red Indicator Light informs operator of reason for stoppage.

If needle thread breaks, buttonhole knife is automatically prevented from cutting buttonhole and operation is automatically stopped.

Knives available will cut buttonholes 3/8", 1/2", 5/8" and 3/4" long. Machine regularly fitted to cut buttonholes 5/8" long.

At completion of each buttonholing cycle, indexing clamp is automatically returned to open "start" position (ready to accept new work).

Convenient feeding and receiving racks simplify loading and unloading of work.

Operation of each unit requires little more than placing work under clamp, pressing starting button and removing work when cycle is completed.

The sewing head, Machine 71-201, has an oscillating shuttle and a maximum speed of 2000 R. P. M. Instructions for servicing Machine 71-201 are contained in Form 2174W.

In addition to the sequential device, the sewing head and other units already mentioned, Machine 256W1 includes an adjustable upper cloth plate, a thread unwinder and a light fixture.

**ELECTRO-MECHANICAL SEQUENTIAL DEVICE 257464** is designed for use with Buttonhole Sewing Machine 271K201. Entire automatic buttonholing unit is known as Machine 256-5.

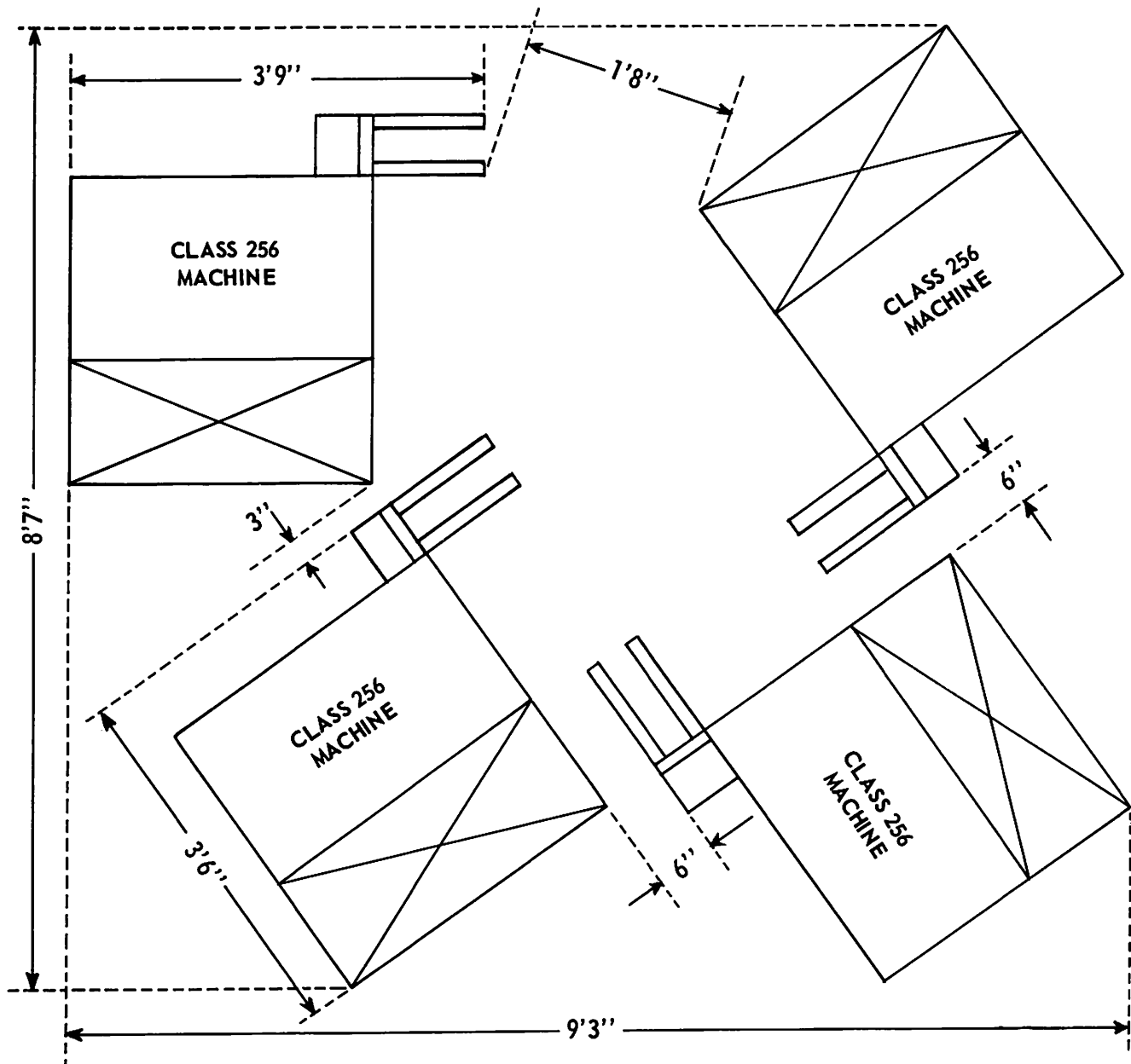
Machine 256-5 is essentially the same as Machine 256W1, except for sewing head in use.

The sewing head, Machine 271K201, has a lubricated rotary sewing hook and a two-speed drive. Its maximum speed is 3000 R. P. M. Instructions for servicing Machine 271K201 are contained in Forms 21303 and K6640, available upon request.

**A SUGGESTED BUTTONHOLE UNIT LAYOUT**  
1 Operator - 4 Machines

Stand-up Operation

Producing Buttonholes on 260 Dozen Dress or Sport Shirt Fronts per Day



AREA:  
80  
SQUARE  
FEET

## INSTALLATION

Machines of Class 256 are shipped completely assembled, ready for operation. When these units have been disassembled, the following instructions apply to their reassembly.

**MACHINE BASE AND BELT GUARD:** Position machine base and belt guard on base top plate with belt guard toward rear of indexing unit, as shown.

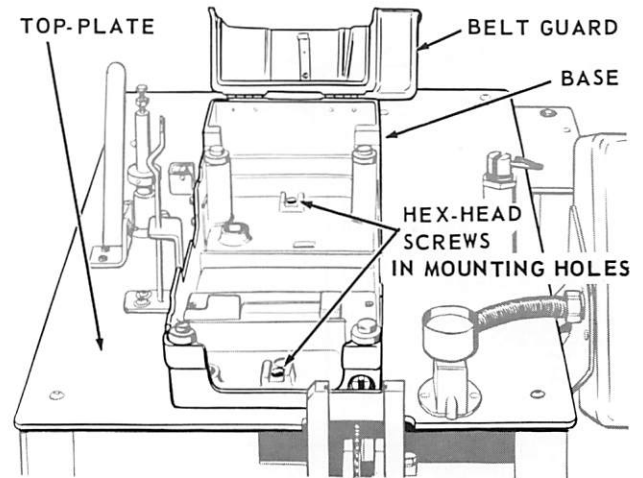


Fig. 1. Machine Base and Belt Guard

Align the two mounting holes in base with corresponding holes in base top plate. Insert two hex-head screws 350665 in mounting holes. Place one washer 67425 and nut 51749 on each screw (below top-plate) and tighten nuts.

**SEWING MACHINE HEAD:** Position sewing machine on machine base. Avoid damage to hook driving shaft oil-chain guard (beneath machine bed). Machine should rest on all four cushion caps at four corners of machine bed.

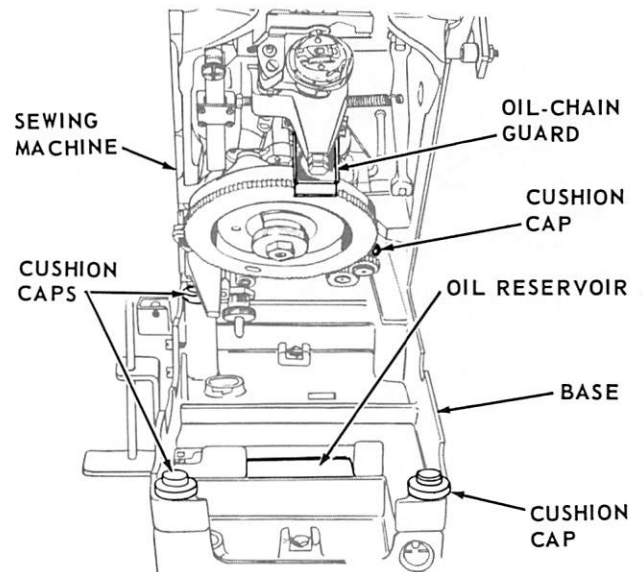


Fig. 2. Positioning the Sewing Machine Head

Remove machine hinge connection bracket, after removing two bracket screws.

Insert hinge-connection in rear hinge-connection hole in machine bed, with open side of connection UP.

Position connection bracket over hinge-connection. To prevent "rocking" of machine during machine starting and clamp lifting movements press bracket down firmly and fasten with two bracket screws, securely.

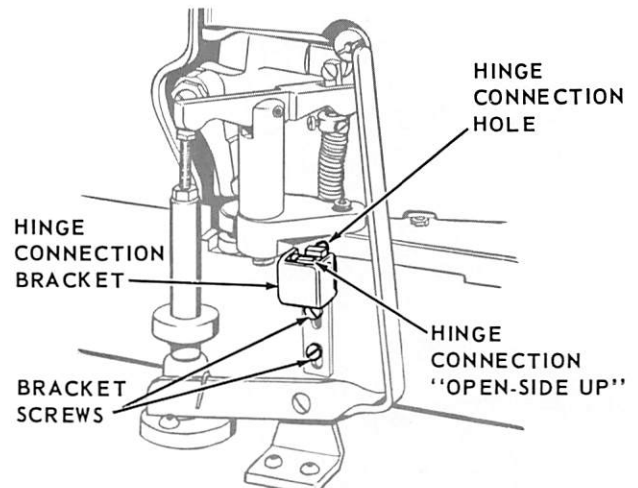


Fig. 3. Hinge Connection and Bracket



## INSTALLATION (Continued)

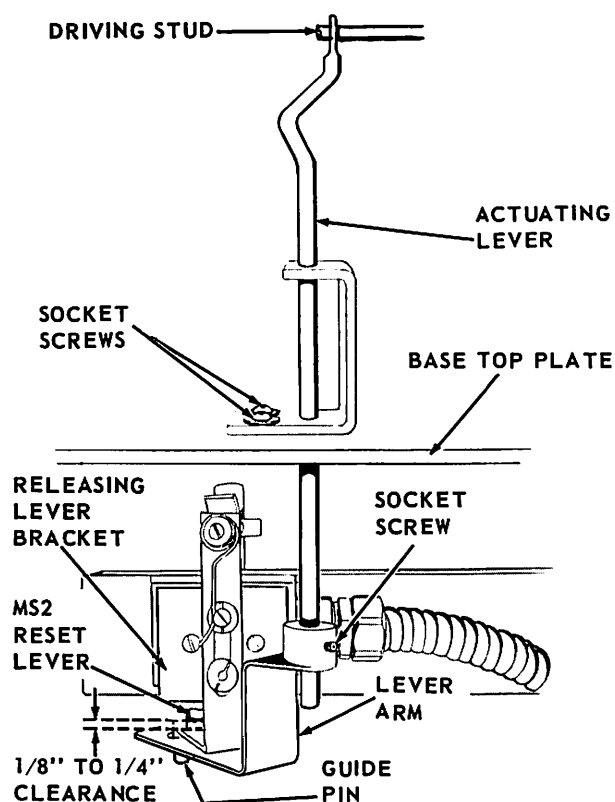


Fig. 4. Cycling Switch Actuating Lever

**CYCLING SWITCH ACTUATING LEVER:** Position cycling switch actuating lever on driving stud. Make certain guide pin on releasing lever bracket passes through guide hole in lever arm.

Check height of lever arm. Top surface of horizontal section of lever arm should be approximately 1/8 to 1/4 inch below microswitch reset lever, as shown. To adjust, loosen socket screw in cylindrical section of lever arm and raise or lower arm, as required. Then securely tighten socket screw.

**MANUAL START-LEVER:** Place manual start-lever mounting bracket on base top-plate, with upright section of bracket facing the machine, as shown below. Fasten bracket securely with two socket screws and washers, using tapped holes provided for this purpose in the top plate.

Assemble start-lever to bracket with hinge screw. Upright section of start lever must face operator (at front of unit). Start-lever should be mounted on left face of upright section of bracket. Place coil of lever spring around threaded portion of hinge screw and tail end of springhooked over rear section of start-lever as shown. Place washer and nut on hinge screw, tightening nut to apply just enough tension on spring to prevent start-lever from vibrating during operation of unit.

**STARTING LEVER PUSH-ROD:** Place push-rod bracket in position shown on base top-plate and, using tapped holes provided in plate, fasten bracket to top-plate with two socket screws.

Slip push-rod through manual start-lever collar and insert push-rod in push-rod bracket as shown. Position collar approximately 1/2 inch above top edge of start-lever. There should be clearance between collar and push-rod bracket when push-rod is at its lowest point. Tighten set screw in collar securely.

Assemble push-rod adjusting screw and nut to top end of push rod, as shown. Turn screw inward, approximately 15 threads; leaving nut loose above push-rod, for later adjustment.

Machine starting trip lever assembly should be assembled on machine, as shown. If it is not, place bracket mounting block, trip lever bracket and trip lever in position as shown and fasten block to machine bed with two socket screws. This block should be positioned as far away from machine as its screw slots will allow.

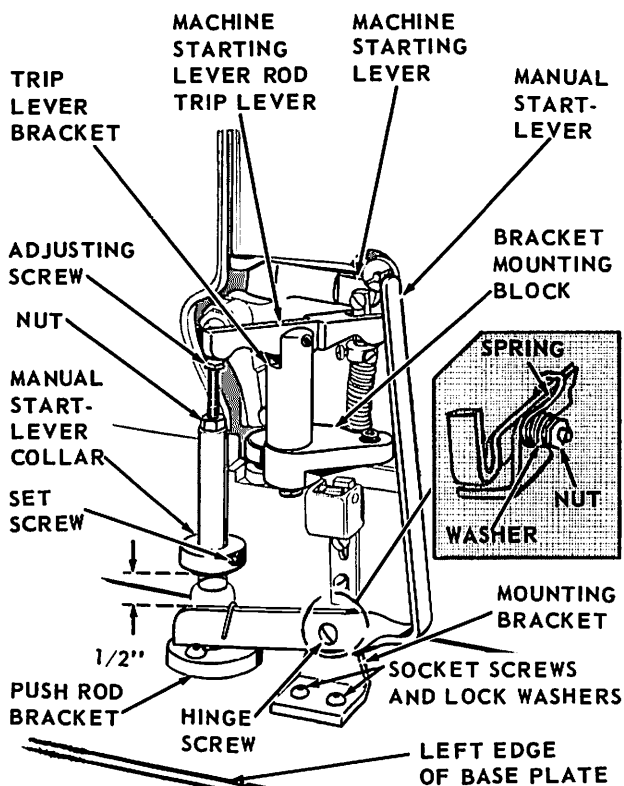


Fig. 5. Manual Start Lever and Starting Lever Push Rod

Adjust the push-rod adjusting screw so that it will cause the trip lever to engage the machine starting lever in the "RUN" position, providing an additional 1/32 inch overthrow when actuated by the indexing unit's machine starting lever. When correct adjustment is obtained tighten adjusting screw nut shown in Fig. 5, to retain this setting.

**CLAMP LIFTING CABLE:** Make certain that machine is in "stop" position. (See Service Manual for sewing machine.)

Connect lower thread cutting lever extension to lower-thread cutting lever. Observe that mounting hole in extension, shown in Fig. 7, is offset from centerline to give mechanic a choice of either a "HIGH" or "LOW" location of lifting cable connecting pin at outer end of lever. Mounting hole can be positioned above or below centerline by merely flipping extension over, as required. As it is usually correct to assemble extension so that outer end is in the "LOW" position, mounting hole should be positioned above the centerline.

Depress lever extension, inserting it into slot at top of clamp lifting safety device as shown in Fig. 6. Align pin in safety device with second hole from outer end of extension and insert connection pin.

Clamp lift should be set to obtain a 3/8 inch clearance under clamp check on machine. To adjust, loosen cable lock-nut and thread the lift cable into or out of plunger beneath the pressure cylinder. If sufficient lift cannot be obtained even when cable is threaded all the way into plunger, remove cable from plunger and out of clamp lifting lever below base top plate. Insert sufficient space washers above ball at bottom end of cable to obtain correct range of adjustment and replace cable up through clamp lifting lever and into plunger. When correct setting is obtained, securely tighten cable lock-nut.

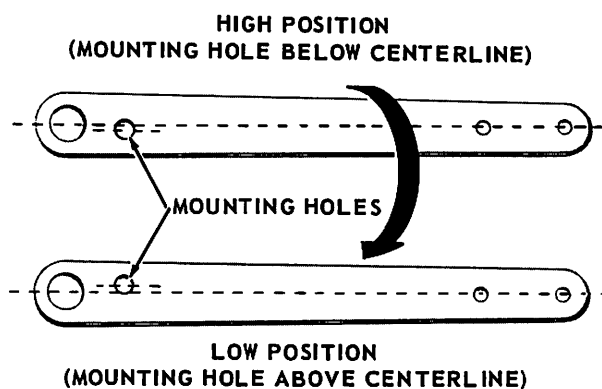


Fig. 6. Assembly of Lower Thread Cutting Lever Extension

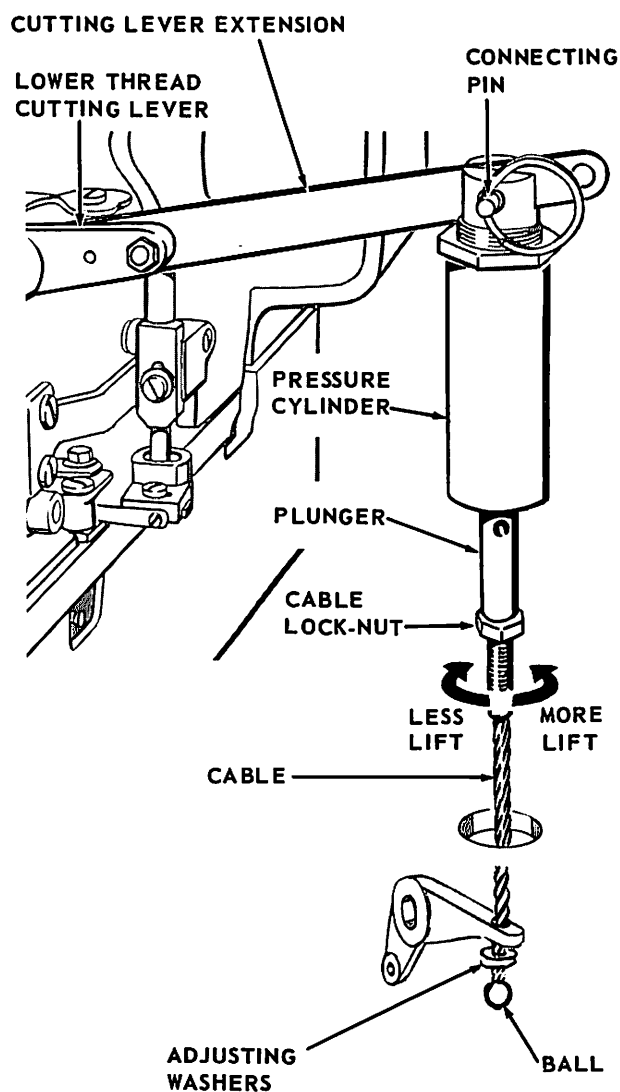


Fig. 7. Clamp Lifting Mechanism

## INSTALLATION (Continued)

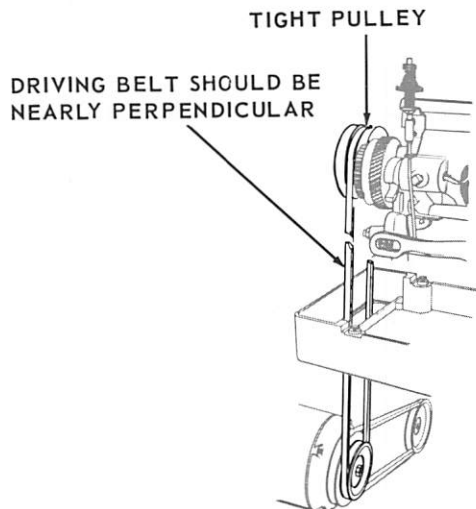


Fig. 8. Pulley Alignment

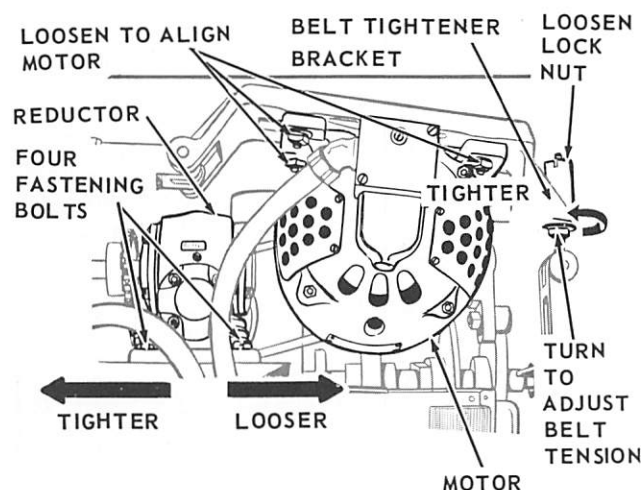


Fig. 9. Tightening the Belt

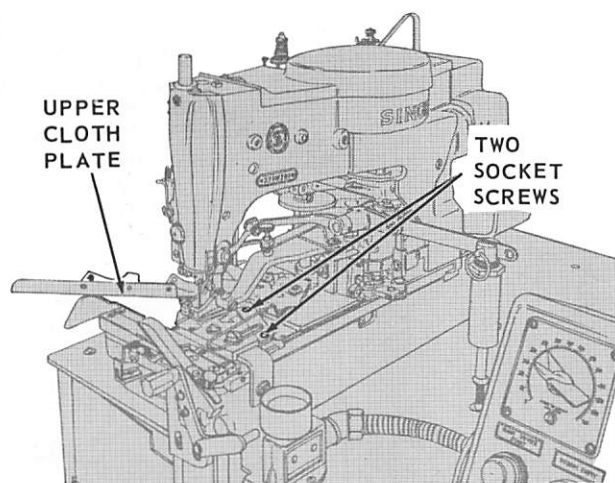


Fig. 10. Assembly Upper Cloth Plate

**MACHINE DRIVING BELT:** Motor is fastened to belt tightener bracket with four nuts and bolts. Loosen these four nuts and align driving pulley on motor with tight pulley on arm shaft of machine. Driving belt should be as close to perpendicular as possible when it is driving the tight pulley. Move motor toward right or left along underside of belt tightener bracket, as required, to obtain this setting. Then securely tighten the four motor bolt nuts.

The correct tension of the machine driving belt is obtained by raising or lowering one end of the belt tightener bracket, as required.

When first installed, a new belt is stiff and the tension should be adjusted so that there is enough slack to permit belt to curve slightly between motor and machine pulleys. After a few days service, tension should be increased to a point where one side of belt (but not both) can be pressed 1/2 inch out of a straight line between pulleys. Too tight an adjustment wastes power and causes unnecessary wear on a belt.

To adjust, loosen lock nut shown in illustration of belt tightener and adjusting nut below it to raise or lower belt tightener, as required. When correct tension on belt is obtained, securely tighten lock nut.

During adjustment of motor driving belt, it may be necessary to disturb setting of reductor at side of motor. Reductor may be moved toward left or right of its mounting by loosening four fastening bolts.

After adjustments have been accomplished on motor, move reductor toward right or left to obtain correct tension on its driving belt. Tension on this belt should be similar to that required on machine driving belt. Securely tighten four reductor fastening bolts.

**UPPER CLOTH PLATE (ADJUSTABLE):** Assemble cloth plate to sewing machine, by means of two socket screws shown.

**USE OF EXPLODED VIEWS IN PARTS CHART:** The correct assembly, disassembly or general relationship of other parts is shown in the parts chart for the complete electro-mechanical device at the rear of this manual.



## LUBRICATION

Shut off main-power-switch before attempting any lubrication.

**MOTOR:** Usually, no lubrication required. Follow instructions on tag attached to motor by manufacturer.

**REDUCTOR (SPEED REDUCER):** This unit is filled with oil when it is installed in electro-mechanical device. Follow instructions supplied by manufacturer (Boston Gear Works, Tag F688-B) and included in accessories. Every 1000 hours of operation, check oil requirements as indicated in instructions. When oil is below level on check-plug, add gear oil as needed. Use 600 gear oil.

**DO NOT APPLY OIL TO MAGNETIC CLUTCH:** Main shaft bearings are packed and do not need further lubrication.

**KEEP THE OTHER THREE CLUTCHES FILLED WITH OIL:** Once each month, remove oil plug from each of the two over-running clutches on the bottom shaft (the index clutch on the left end and the holding clutch on the right end of this shaft) and apply a few drops of sewing machine oil. Replace each oil plug. Hilliard clutch on middle shaft has a ball bearing plug. Merely press oil can spout against ball, push in and apply oil as needed.

**WEEKLY LUBRICATION:** Open left-front cover. Using a small paint brush, apply #30 to #40 oil sparingly on the following parts - - -

1. Cam shaft drive chain.
2. Cam shaft drive chain tightener sprocket.
3. Gripper chain (be sure to wipe off excess oil).
4. Front and rear sprocket bearings for gripper chain (depress gripper 6 inches manually to make front bearing accessible).
5. Gripper slide rails.

Lubricate the following parts lightly with regular sewing machine oil - - -

6. All cam follower bearings.
7. Indexing arm and shaft bearings.
8. Microswitch rollers and all other parts that come in moving contact with one another, except magnetic clutch. (See note above).

Ball bearing housings at both ends of each shaft, should be kept packed with Ball Bearing Lubricant.

**SEWING MACHINE:** Follow lubrication instructions supplied with each sewing machine.

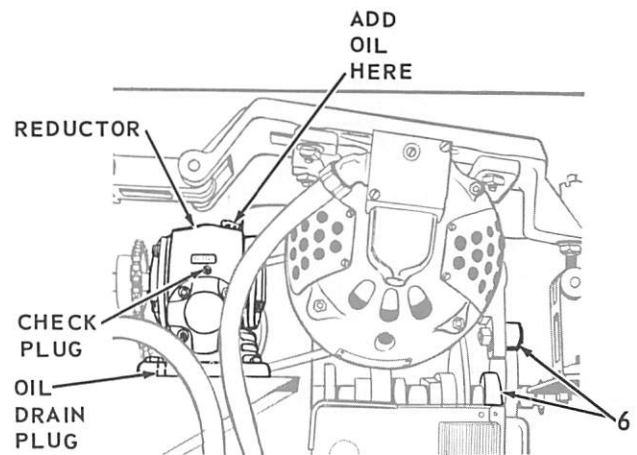


Fig. 11. Lubrication Points, Speed Reducer (Reductor)

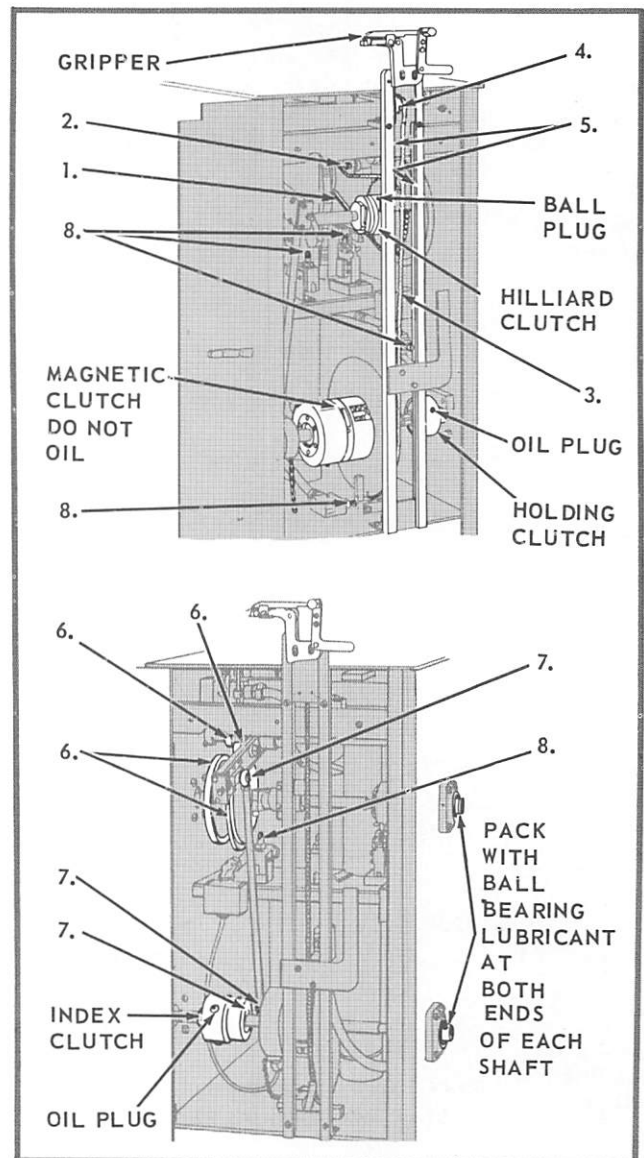


Fig. 12. Lubrication Points

## PREPARATION FOR SEWING BUTTONHOLES

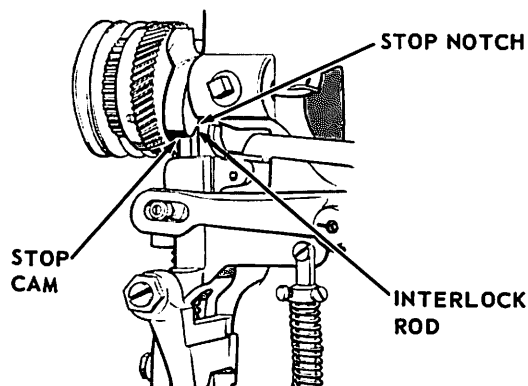


Fig. 13. Interlocking Rod in "Stop" Position Notch

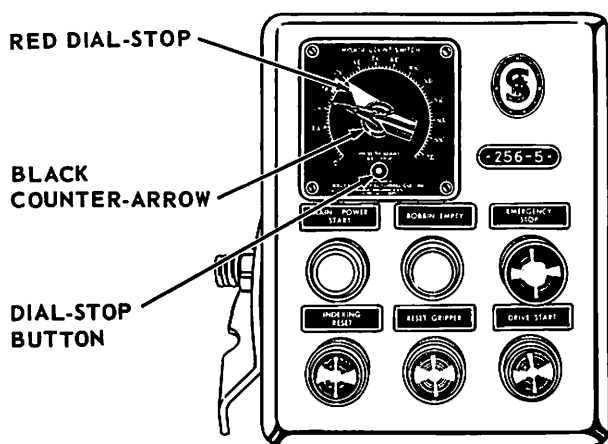


Fig. 14. Dial Stop Setting

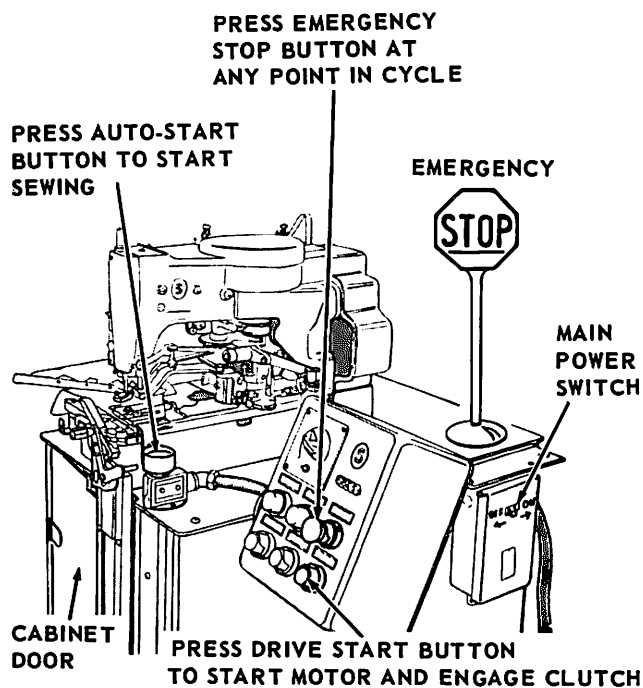


Fig. 15. Power Control Switches

**MACHINE AT REST:** To prevent sewing machine from starting, before you are ready (or while work clamp is raised), make certain that sewing machine is in "STOP" position (interlocking stop rod, at rear-left of machine, fully engaged in stop notch in cam) as shown.

Normally, a machine will have recently finished a complete cycle and should be ready to run again. If, however, the unit has required attention since last operated or has not been left in normal "stop" position, operator should summon the responsible mechanic to check unit for operation and reposition it for starting.

**LUBRICATION AND THREADING:** Prepare machine for sewing, as instructed in Operator's Guide and in Service Manual, furnished for your sewing machine. Make certain that a well selected needle is correctly inserted in needle bar and that machine is correctly lubricated and threaded. Use 40/6 cord cotton thread in needle and 80/3 cord cotton thread on bobbin.

**SPEED:** Sewing machine is designed to operate efficiently at recommended maximum speed. A new machine should be run at a speed 500 stitches per minute LESS than maximum, for the first 100 operating hours.

**DIAL - STOP SETTING:** Sewing machine is usually fitted to sew 120 stitches for each buttonhole. When so fitted, the average paper bobbin will complete approximately 240 buttonholes.

After determining the number of buttonholes a full bobbin in use will actually sew, press dial-stop button on control panel and set red dial-stop at this predetermined number. Release dial-stop button and set black counter-arrow directly over red dial-stop.

**POWER SWITCHES:** Main-power-switch is a toggle switch on switch box mounted at rear-top corner of right side of cabinet. When this switch is snapped toward rear, power is "ON" and main-power-start-light (green) is lit.

Drive-start button is at bottom right corner of control panel. When this button is pressed in, motor starts and magnetic clutch engages; ready for sewing.

In any case of emergency, IMMEDIATELY PRESS EMERGENCY STOP BUTTON, located just above drive-start button on control panel. Then turn off main power by snapping main-power toggle switch TOWARD FRONT of unit.



## BUTTONHOLE SEWING

**CABINET DOOR:** Be sure cabinet door is closed before starting to sew.

### TO TURN ON POWER:

1. Push main-power toggle switch toward rear.
2. Depress drive-start push-button.

### TO START SEWING:

1. Place garment under work clamp. Align facing edge of garment with guiding edge of cloth plate mounting block. Have bottom edge of garment just touching cloth stop, as shown.
2. Close gripper jaws by pushing gripper lever to the right, as shown.
3. Apply slight tension to garment, removing slack between work clamp and gripper.
4. Press AUTO-START button. Machine begins to sew.

**WHEN STITCHING OF BUTTONHOLE IS COMPLETED,** knife descends to cut buttonhole and the work clamp raises. Gripper is drawn downward in its slideway, feeding garment to the next button position and another buttonhole is started . . . automatically.

At completion of cycle (garment buttonholes finished), gripper jaws open and work clamp raises to release garment.

**RE-LOAD NEXT GARMENT,** same as described for previous cycle, and press AUTO-START to begin sewing again.

**WHEN PRE-SET NUMBER OF BUTTONHOLES HAVE BEEN SEWN,** counter-arrow reaches "0" on dial at top-left corner of control panel shown in Fig. 16. At this moment the **RED PILOT LIGHT** on panel lights up, indicating "BOBBIN EMPTY", and machine stops. **AUTO-START** button is now inoperative.

### TO RE-START MACHINE WHEN RED LIGHT IS ON: ---

1. Remove empty bobbin and replace with full bobbin.
2. Re-set black counter-arrow (see "DIAL-STOP SETTING", on page 10).
3. Make certain garment is in position for sewing and then —
4. Depress AUTO-START button.

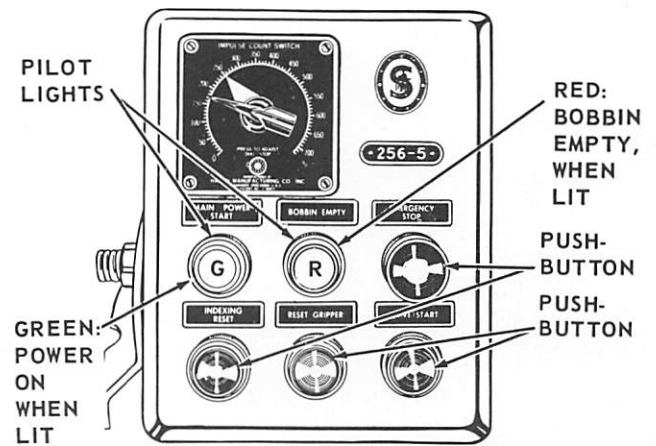


Fig. 16. Control Panel

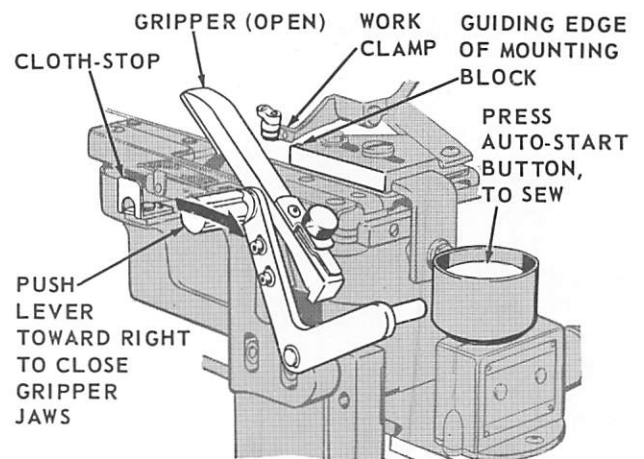


Fig. 17. Parts Involved in Preparation for Sewing

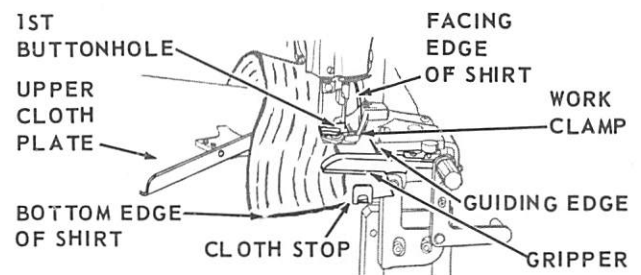


Fig. 18. Position of Shirt for First Buttonhole

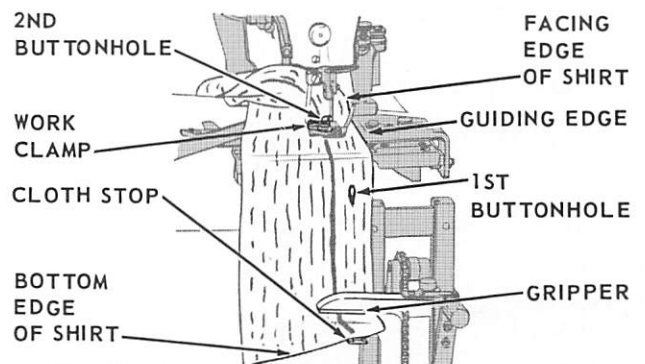


Fig. 19. Position of Shirt for Second Buttonhole

## SIMPLE ADJUSTMENTS

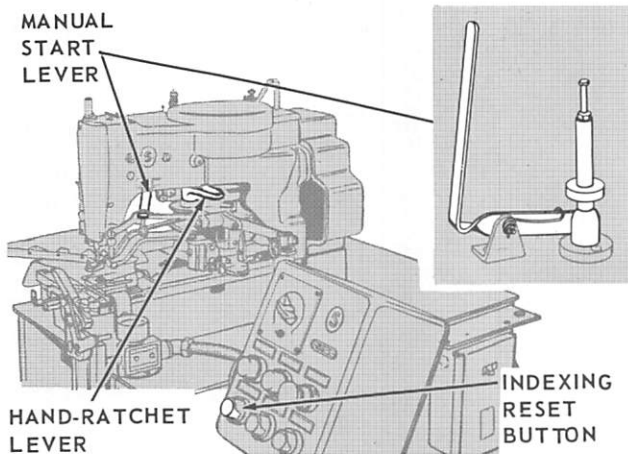


Fig. 20. Manual Controls Necessary for Sewing

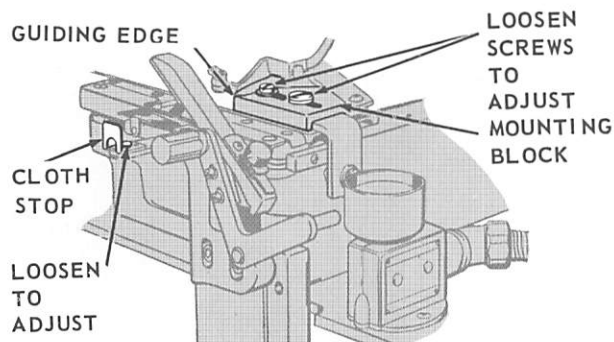


Fig. 21. Adjustments for Garment Edge

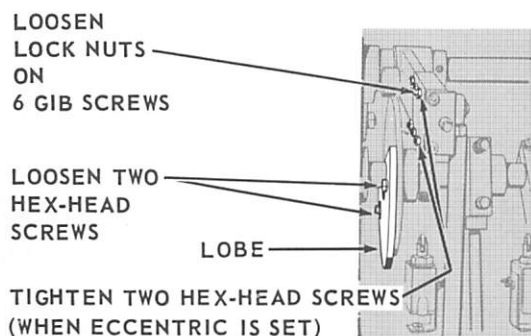


Fig. 22. Spacing Cam Adjustment

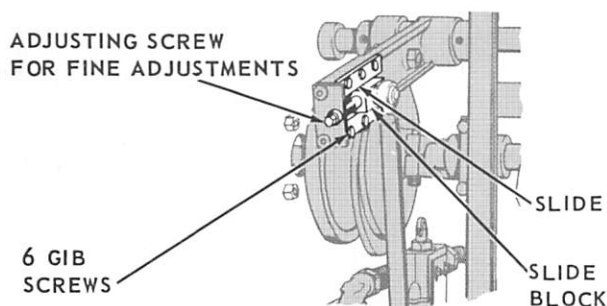


Fig. 23. Spacing Adjustment

**IF NEEDLE THREAD BREAKS** during sewing, machine automatically **STOPS** and knife does **NOT** descend. After machine is re-threaded, operator then has a choice of (1.) returning to point of break in sewing cycle and completing the unfinished buttonhole, or of (2.) continuing on to next buttonhole.

1. To complete unfinished buttonhole, operate hand ratchet lever on machine until work clamp moves garment to desired position. Pull manual starting lever on machine and machine will complete unfinished buttonhole, then automatically continue its regular cycle.
2. To continue on to next buttonhole, press indexing re-set button at bottom-left of control panel...machine will continue its regular cycle. The unfinished buttonhole can be repaired later.

**DISTANCE BETWEEN LEADING EDGE OF GARMENT AND FIRST BUTTONHOLE** can be adjusted after loosening screw that holds cloth stop. Move cloth stop in or out, as required and re-tighten its screw.

### TO ADJUST SPACE BETWEEN BUTTONHOLES:---

1. Open cabinet door.
2. Loosen lock nuts on 6 gib screws and loosen gib screws in slide, just enough to permit slide block to move when adjusting screw is turned.
3. Loosen two hex-head screws in face of index cam and set adjustable lobe to required eccentricity.

**ECCENTRICITY OF 1/16 INCH EQUALS APPROXIMATELY 3/8 INCH SPACE BETWEEN BUTTONHOLES. Thus, a 5/8 inch offset of lobe will produce about 3-3/4 inch space between buttonholes.**

4. After setting lobe eccentricity, tighten two of the six hex-head gib screws.
5. Test the spacing on sample piece of material. Make "fine" adjustment by loosening the two gib screws, just tightened in step 4, and turning large adjusting screw at front end of slide by means of "T" wrench supplied. Turn this screw clockwise for more space or counter-clockwise for less space between buttonholes. ONE COMPLETE TURN OF ADJUSTING SCREW EQUALS 1/64 INCH OF SPACE.
6. Tighten all 6 gib screws and lock them in place with their lock nuts.



#### TO ADJUST FOR THE NUMBER OF BUTTONHOLES:

1. THROW MAIN POWER SWITCH IN SWITCH BOX TO "OFF" POSITION.
2. Loosen two socket head screws in indexing stop switch bracket slide and allow slide to sink to lowest position in the slide rails..
3. Index the cloth gripper slide by hand to the position in the rails which properly locates the last desired buttonhole in the sequence.
4. Raise the stop switch bracket slide until the roller on the indexing microswitch is approximately 1-1/2" below the bottom edge of the cloth gripper slide.
5. Retighten the two screws.

#### TO ADJUST CAM SHAFT BRAKE:---

The cam shaft brake, located on the cam shaft between microswitches 1 and 5, may be adjusted by means of two spring loaded hex headed screws. Screws should be tightened until an even drag is applied to the rotating shaft and the shaft rotates something less than 10 degrees after the stop bar engages the Hilliard clutch. **Too little** braking action will be recognized by loud and severe chattering caused by the partially engaged clutch driving against the solenoid stop bar. **This condition should be corrected immediately** to prevent clutch damage. **Too much** braking action places an unnecessary burden on driving mechanisms.

#### TO ADJUST OR CHECK AIR GAP ON STEARN'S MAGNETIC CLUTCH:---

1. Rotate de-energized clutch until one adjusting screw lines up with the adjusting hole provided in the sprocket wheel.
2. Operate main power switch to on position and depress the drive start button. This will magnetize the clutch. (Subsequently de-energizing and energizing may be accomplished by depressing and releasing MS4 on the gripper track.)
3. When clutch is energized check air gap opposite adjusting screw using a brass or copper .032" gauge. Gauge should just slide into the gap easily. If gap is too tight or too loose, adjust screw as required by use of a screw driver inserted through hole in the sprocket wheel.
4. De-energize the clutch, (depress MS4) and rotate clutch until next screw is in line with adjusting hole. Proceed as above to adjust air gaps opposite the three adjusting screws.
5. Operate MS4 several times and observe action of clutch, which should operate with a snap when energized.

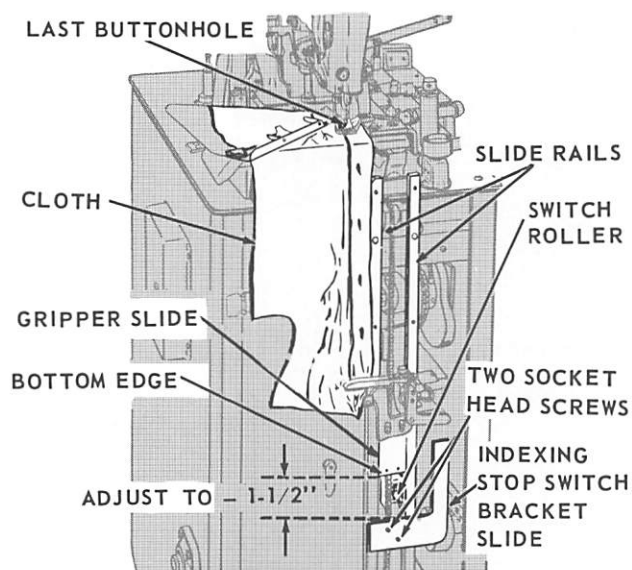


Fig. 24. Adjustment for Number of Buttonholes

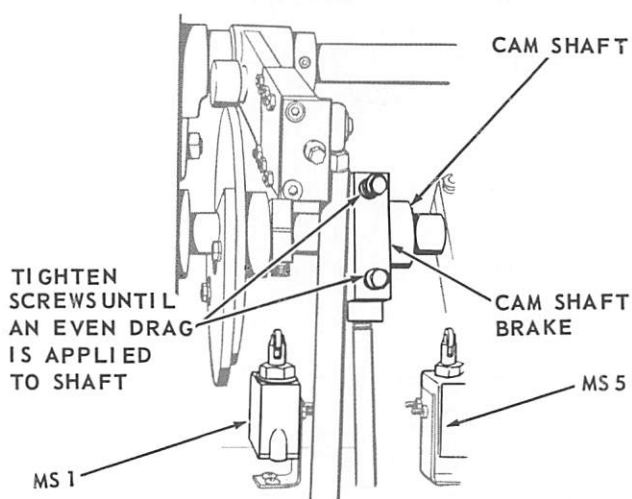


Fig. 25. Adjustment of Cam Shaft Brake

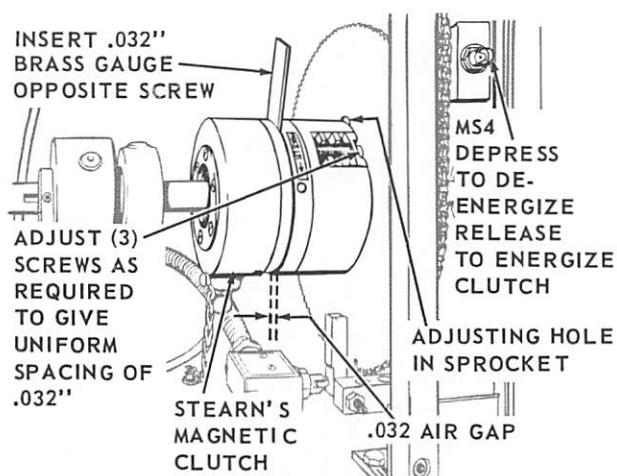


Fig. 26. Adjusting Air Gap in Stearn's Magnetic Clutch

## SEQUENCE OF OPERATIONS AND FUNCTIONS OF ASSOCIATED ELECTRICAL CIRCUITS

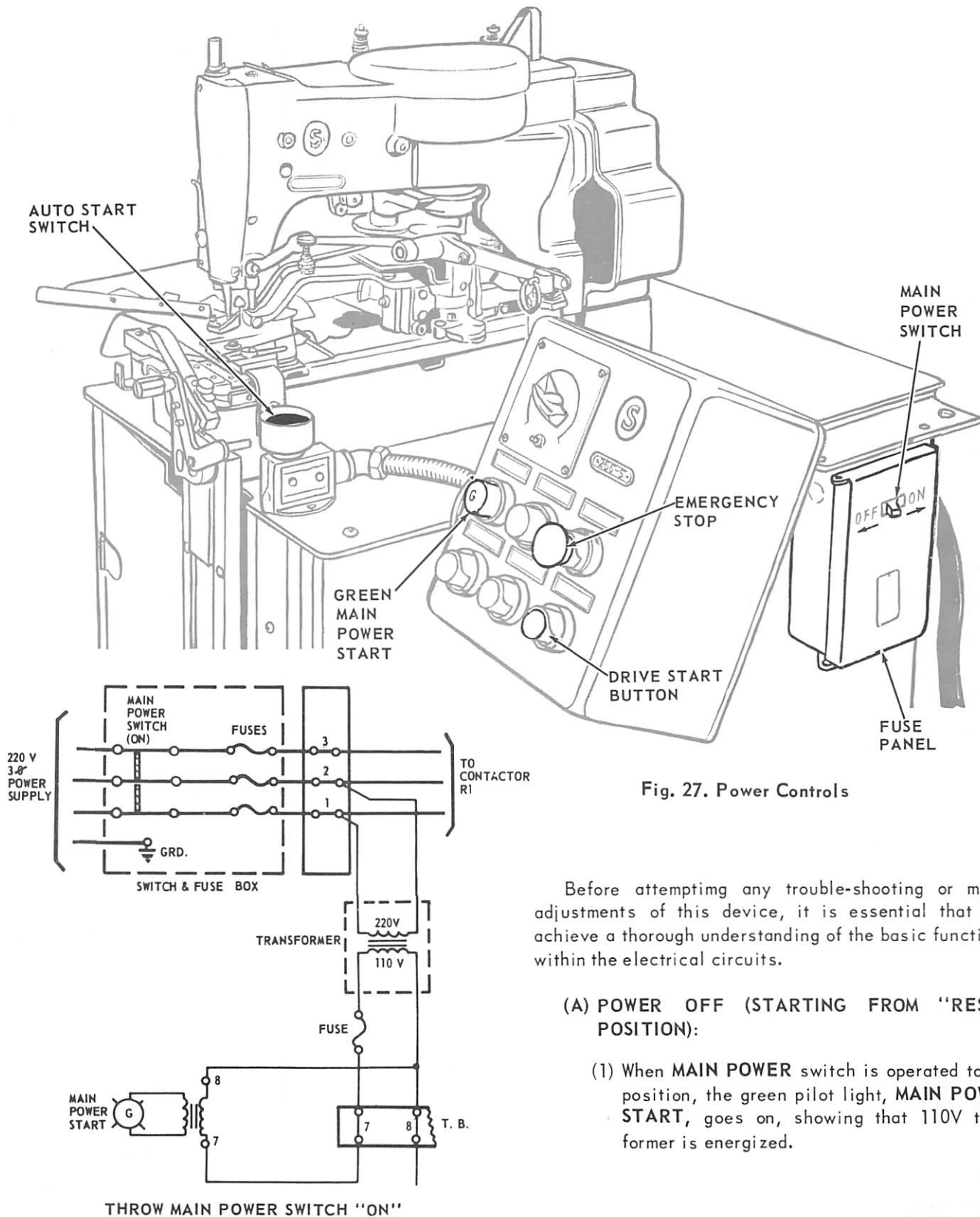


Fig. 27. Power Controls

Before attempting any trouble-shooting or major adjustments of this device, it is essential that one achieve a thorough understanding of the basic functions within the electrical circuits.

### (A) POWER OFF (STARTING FROM "REST" POSITION):

- (1) When **MAIN POWER** switch is operated to **ON** position, the green pilot light, **MAIN POWER START**, goes on, showing that 110V transformer is energized.



- (2) Depressing **DRIVE START** button sets up the following sequence: –
- (a) Contactor R1 operates starting motor through switches X, Y and Z and heat coils in the thermal overload unit. (See schematic diagram below).
  - (b) Contactor immediately locks up through switch P so that when the button is released, the power circuit is maintained.

The current through the contactor passes through switches adjacent to bimetallic elements in the thermal overload unit. Heavy drains on the three phase 220V circuit will momentarily distort these elements and open the 110V circuits. The circuit can then only be restored by operating reset bar on the magnetic motor starter R1. See schematics and glossary of symbols at back of manual.

- (c) The magnetic clutch is also energized through left hand contacts of Relay R4, due to rectified current at terminals 19 and 20.

**NOTE**—Depressing the **EMERGENCY STOP** button will open the contactor and cut off power to the motor.

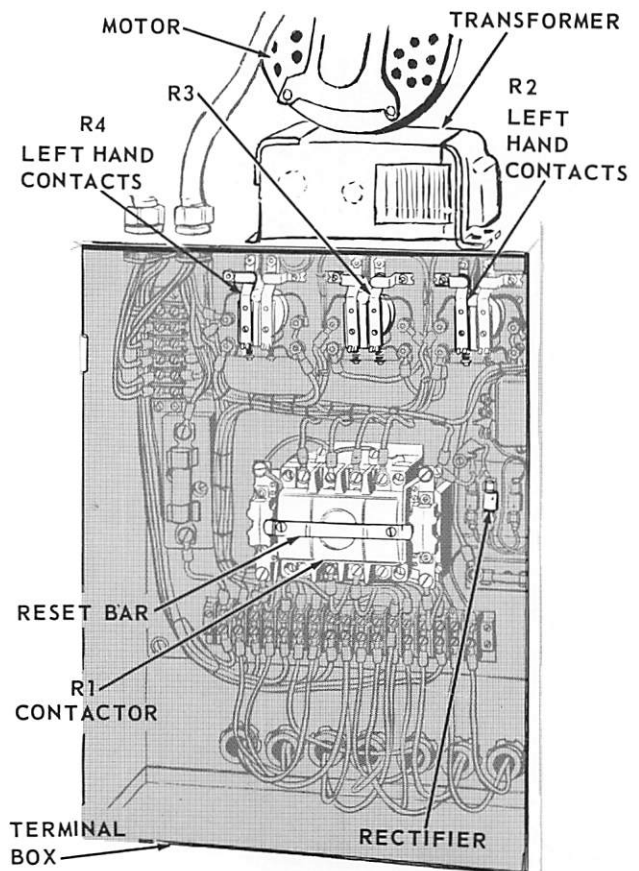
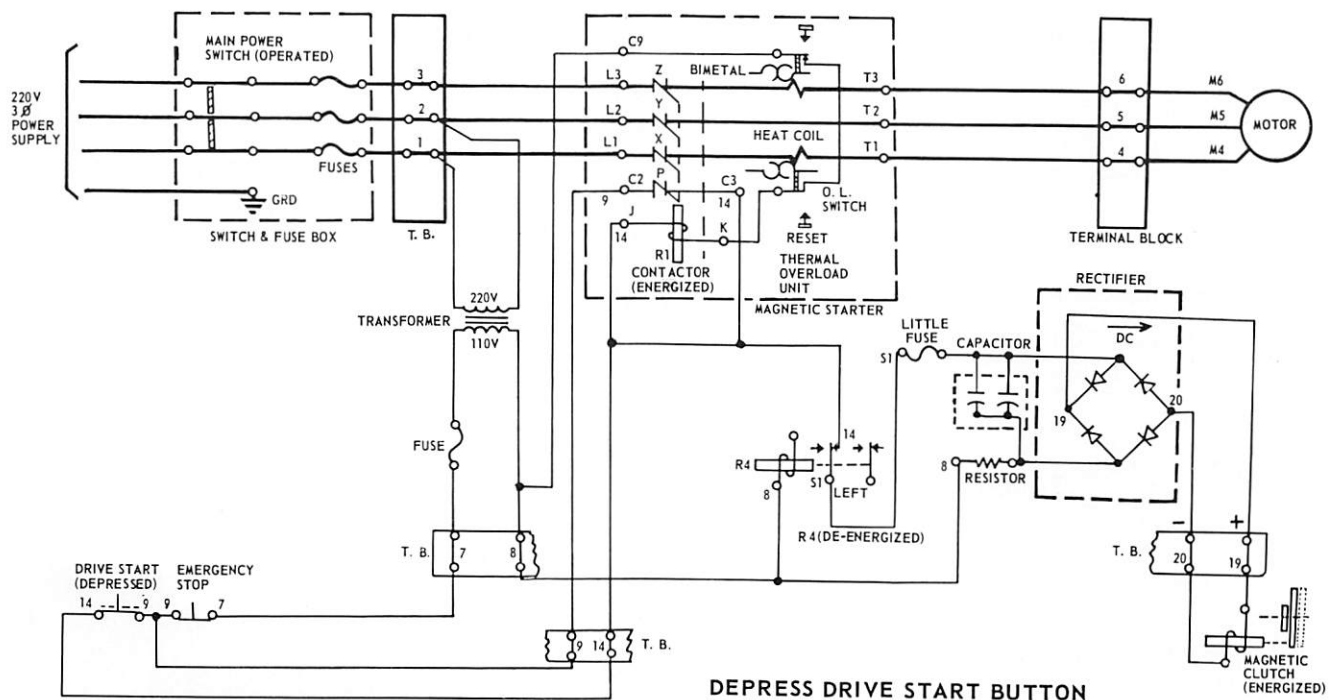


Fig. 28. Electrical Control Equipment



## SEQUENCE OF OPERATIONS AND FUNCTIONS (Continued)

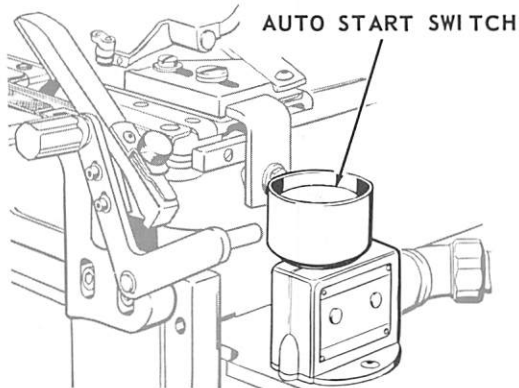


Fig. 29. Auto Start Switch

### (B) PREPARATION TO SEW – (REST POSITION)

Depress AUTO START switch.

- (1) Relay R 2 operates and locks up through left hand contacts of Relay R 4 (not energized). R 2 will remain locked up until R 4 is energized after sewing of last buttonhole and after final index.

The position of the indexing cam shaft is shown in Fig. 31 as the auto start switch is pressed. The work clamp is being held up by the lifting cam and lifting lever and Cam 1 is holding microswitch MS1 operated. The stop bar is holding the clutch in the rest position.

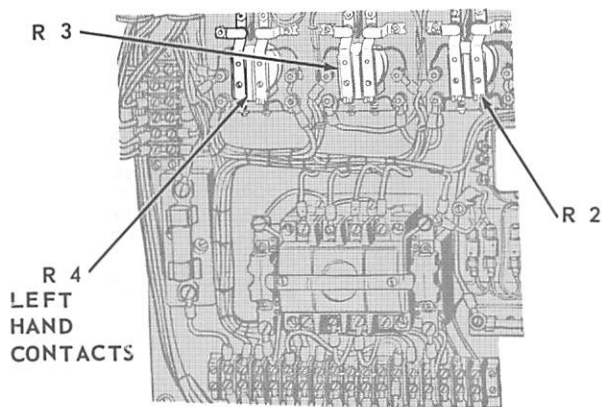
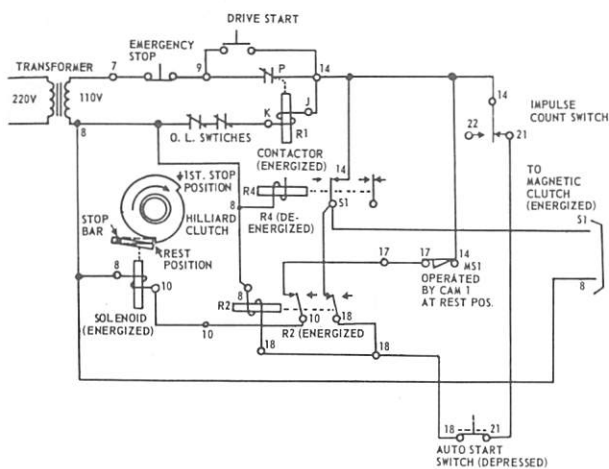


Fig. 30. Control Relays



DEPRESS AUTO START SWITCH

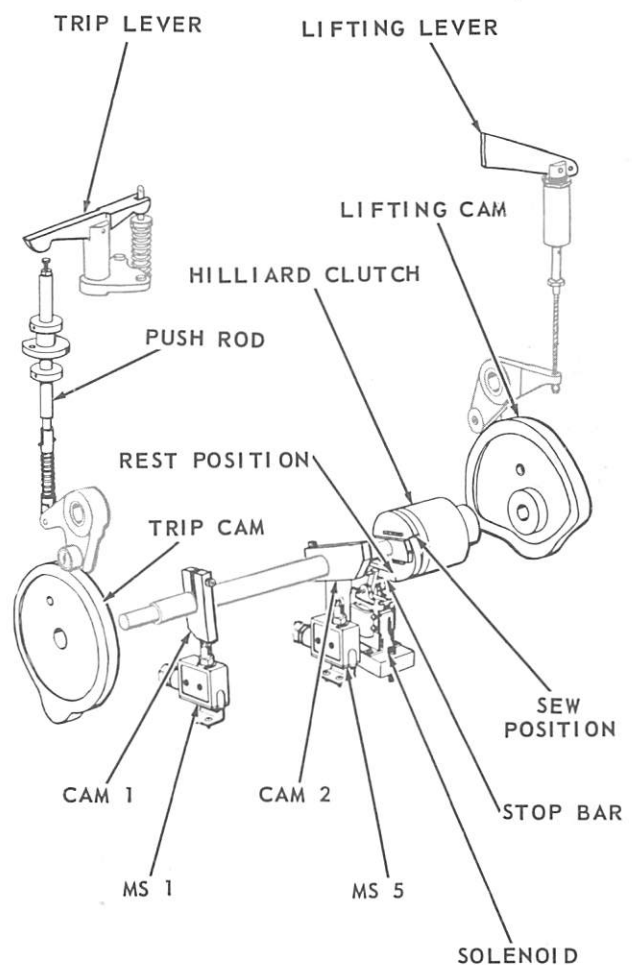
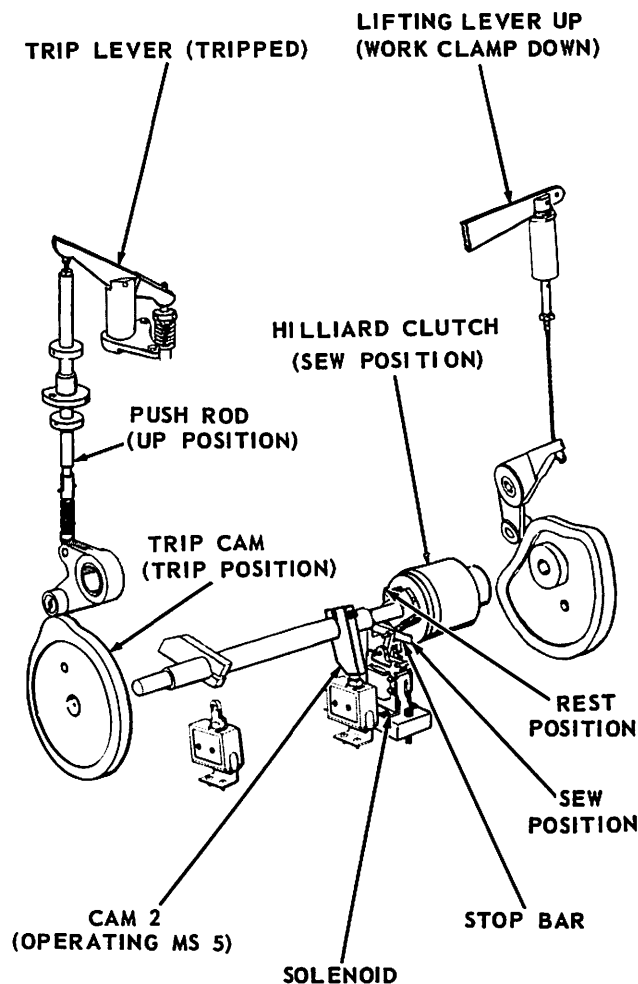


Fig. 31. Position of Indexing Cam Shaft and Associated Controls at Rest Position.



- (2) The solenoid is energized through micro-switch MS1 and left hand contacts of R2 Relay (now energized). As a result, stop bar is released from Hilliard Clutch on indexing cam shaft, allowing machine to start its cycle toward the 1st stop position (the sew position).

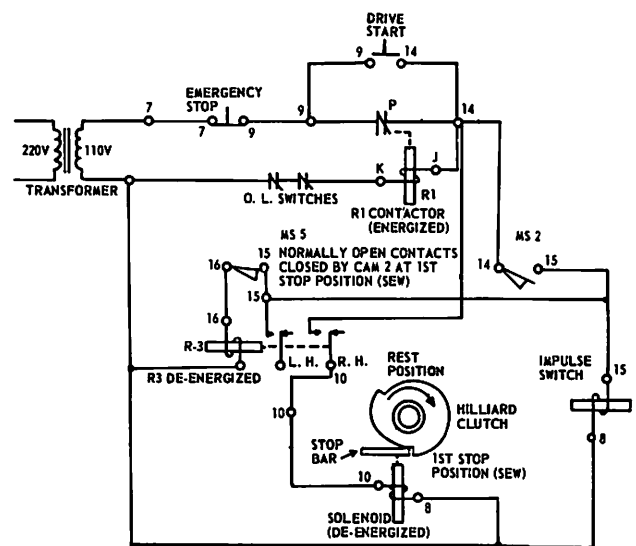
Fig. 32 shows the position of indexing cam shaft as clutch reaches the 1st stop position (sew position). The work clamp has been brought down on garment through action of lifting cam mechanism. Sewing begins due to tripping action of trip cam. push rod and trip lever.



- (3) MS1 opens as soon as cam 1 releases it. This de-energizes solenoid, releasing stop bar and freeing it to engage clutch and stop rotation at 1st stop position (sewing position).

### (C) SEW FIRST BUTTONHOLE, 1ST STOP POSITION, AND ADVANCE TO NEXT.

- (1) Microswitch MS5 is now operated by the second actuating cam on index cam shaft following along  $120^\circ$  behind first cam. This sets up a circuit condition through coil windings of R3 and impulse switch permitting them to be energized when microswitch MS2 is later tripped by knife mechanism, as buttonhole is cut.



CIRCUIT CONDITION AT SEW POSITION

Fig. 32. Position of Indexing Cam Shaft and Associated Controls as Machine is Tripped to Sew.

## SEQUENCE OF OPERATIONS AND FUNCTIONS (Continued)

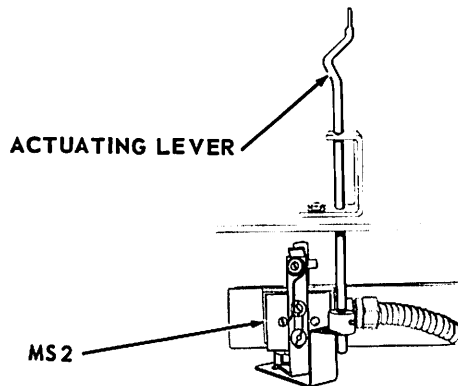


Fig. 33. Microswitch MS 2 and Actuating Lever

(2) Microswitch MS2 is now operated by cycling switch actuating lever during cutting operation. The impulse count switch coil, now energized, actuates a ratchet and pawl mechanism advancing external indicator one point toward zero. (When the indicator reaches zero, red **BOBBIN EMPTY** indicator is on and the auto start switch will no longer initiate the cycle. See later discussion.)

(3) Simultaneously R3 energizes solenoid through its right hand contacts. The Hilliard clutch is released; starting a complete rotation of the index cam shaft back to the first position (sew). During rotation the clamp lifts and garment is advanced to the next buttonhole location, by the action of buttonhole spacing cam and pitman and the buttonhole spacing clutch, which together rotate the gripper chain sprocket.

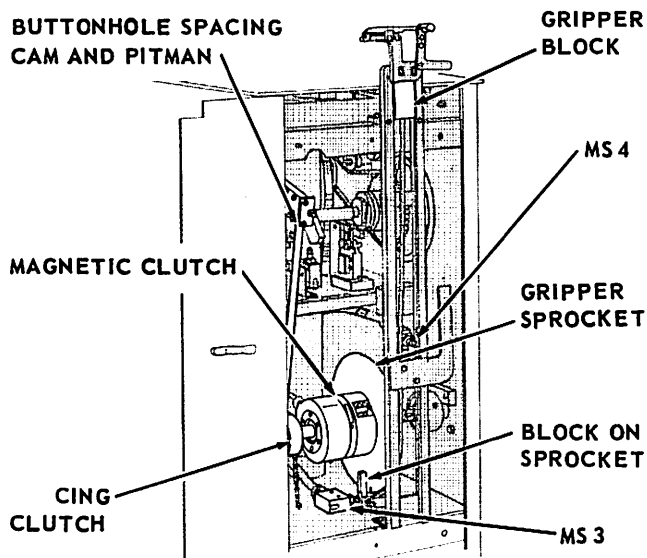
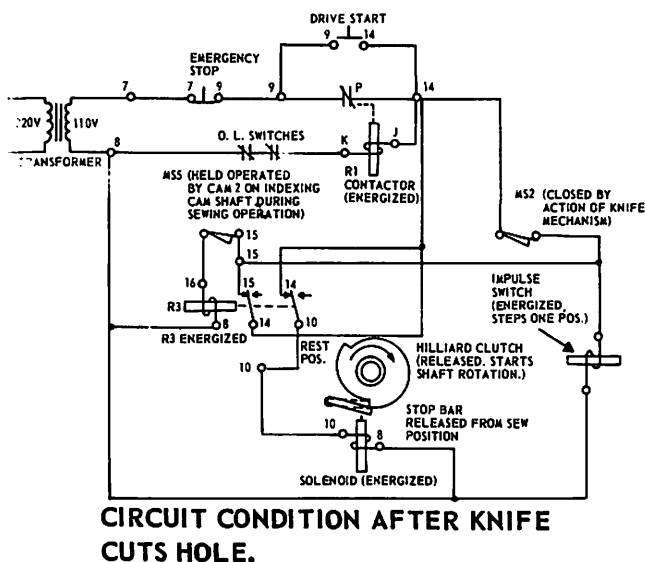


Fig. 34. Front View of Cabinet (open)



CIRCUIT CONDITION AFTER KNIFE CUTS HOLE.

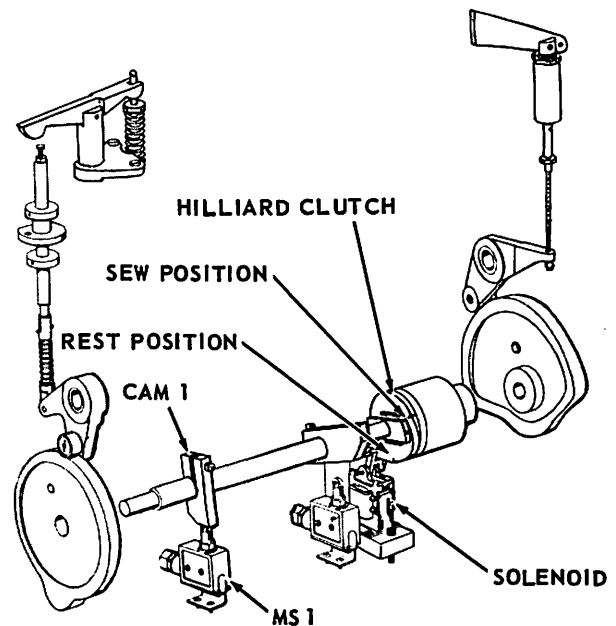


Fig. 35. Indexing Cam Shaft (Rest Position)

**NOTE:** Cam 1 must be accurately timed to operate MS1 and energize solenoid to cause the Hilliard clutch to pass through the REST POSITION. Otherwise the cycle would stop at the REST POSITION with the clamp up. This action repeats for each buttonhole.

- (1) When the last buttonhole in the sequence is completed the gripper carrier block starts to space but makes contact and closes micro-switch MS4. This energizes relay R4 which momentarily locks up through MS3 and right hand contacts of relay R4.

**NOTE:** MS3 is normally closed and is only open at final rest position.

As a result of the opening of the left hand contacts of relay R4, relay R2 and the magnetic clutch are de-energized.

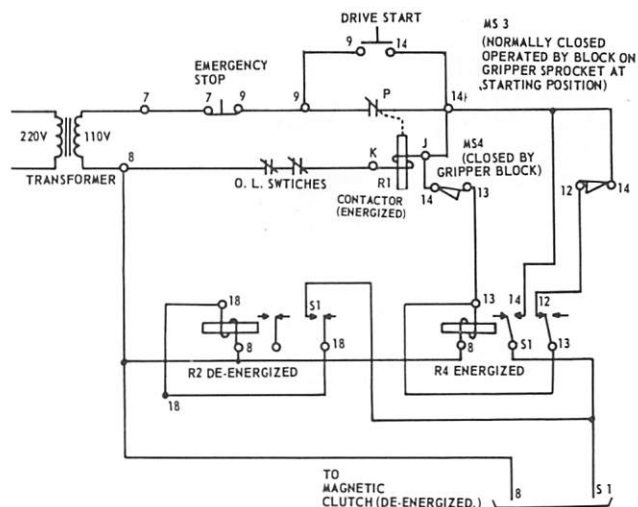
- (2) Return to **REST POSITION**.

De-energizing the magnetic clutch allows gripper block to return to start position due to action of gravity on counterweight. The gripper chain sprocket also returns to its start position. The block on sprocket now opens microswitch, MS3 and de-energizes R4. Current now flows through left hand contacts of R4, energizing magnetic clutch. Since R2 is open and solenoid is de-energized the indexing cam shaft is stopped at rest position due to engagement of the stop bar.

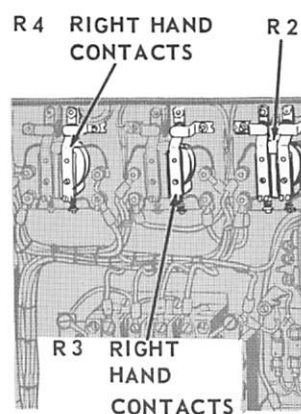
MS1 is depressed and held closed by cam 1 providing proper conditions for a new sequence.

After a pre-set number of buttonholes are sewn, the buttonhole counter coil returns black counter arrow to zero. The circuit through the auto start switch is broken and **RED EMPTY BOBBIN** panel light is on. The machine is now inoperative until operator replaces empty bobbin with a filled one and resets black counter arrow. This extinguishes red panel light and throws control back to auto start button.

As a further aid in understanding the electrical functions, a wiring diagram, complete schematic and glossary of electrical symbols is provided at the back of this manual.



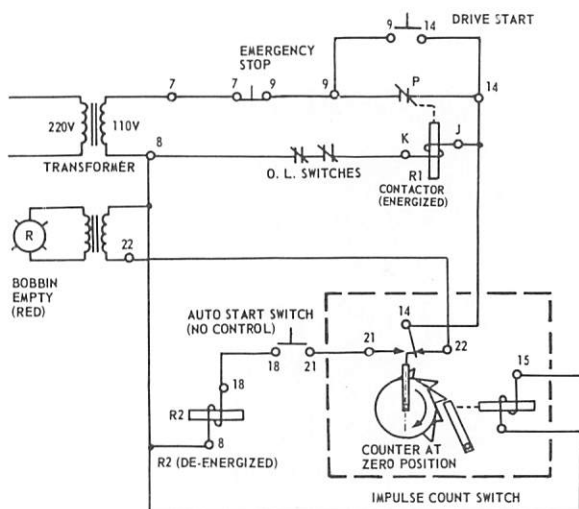
**CIRCUIT CONDITION AT FINAL INDEX**



**Fig. 36. Control Relays**



**Fig. 37. Control Panel  
(Counter at Zero)**



**CIRCUIT CONDITION, COUNTER AT ZERO**

## TROUBLE SHOOTING

GREEN PILOT LIGHT SHOULD BE LIT WHEN POWER SWITCH IS TURNED ON

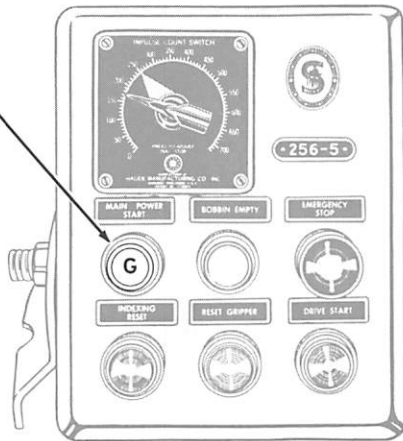


Fig. 38. Power Indicator Light

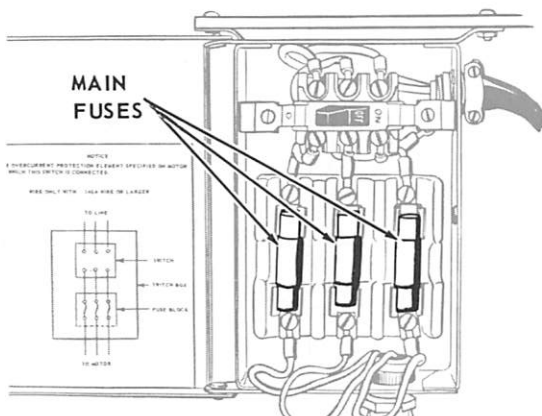


Fig. 39. Switch and Fuse Box

PRESSING RESET BAR RESTORES CIRCUIT

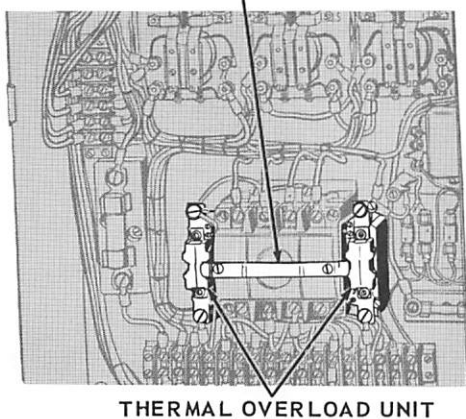


Fig. 40. Thermal Overload Unit and Reset Bar  
(Terminal Box Open)

### TROUBLE CONDITION:

#### NO APPARENT ELECTRICAL POWER.

Main power start indicator bulb does not light.

#### POSSIBLE CAUSES:

- (1) Main power start indicator bulb defective.
- (2) Main fuse or fuses blown from power line overload.
- (3) Thermal overload switch operated.
- (4) No power from main line.

#### CORRECTION:

- (1) Replace light bulb (GE 44).
- (2) Replace defective fuse (FRN-4) or fuses in fuse box.
- (3) Any trouble in the unit which places a severe load on the motor will develop a critical temperature rise in heater coils of R1, (thermal overload unit) thus causing the opening of protective switches in the thermal unit. The circuit may be restored in this case by pressing the reset bar on the thermal overload unit.
- (4) Check outlet with voltage indicator. In case proper voltage is available check power cord and plug for possible defects. If voltage is not available or of proper value at outlet, take appropriate action to have it restored.

### CAUTION:

The blowing of fuses or the opening of protective switches, should be viewed with suspicion.

Before circuits are restored all wiring should be checked for possible shorts, etc. and mechanical features should be examined in detail

### TROUBLE CONDITION:

#### INDEX UNIT WILL NOT MOVE.

Cycle incomplete. Buttonhole completed and cut. Work clamp raised. Finished buttonhole still beneath clamp.



## POSSIBLE CAUSES:

(1) Insecure or dirty left hand contact on R4. Left hand contact on relay R4, (R4 de-energized), channels current to the right hand contacts of R2 (energized) to provide a lock up of R2. If the left hand contacts of R4 are not positive vibration in unit may break circuit to R2, stopping the cycle.

(2) Magnetic clutch may be de-energized.

The same R4 contact supplies power to magnetic clutch which should be energized through out the sequence, except when R4 operates after last buttonhole.

## CORRECTION:

**NOTE:** To reposition garment for next buttonhole and finish cycle, move gripper chain sprocket by hand, pulling gripper down the exact distance desired between buttonholes. Release sprocket. Push auto-start button. Cycle should resume. If necessary repeat this manipulation for each successive buttonhole, until cycle is completed.

(1) Clean left hand contact of relay R4.

A fingernail sand board, used by manicurists, is a good tool for this purpose. If it is necessary to bend contact arm, do it very carefully and only enough to insure positive contact and release.

(2) Check circuits to magnetic clutch.

If the left hand contacts on R4 are positive and clean, check in turn, screw connection, little fuse, rectifier and coil of magnetic clutch. An ohmmeter or continuity checker may be used. If the coil of the clutch is open it must be replaced.

## TROUBLE CONDITION:

### WORK CLAMP DOES NOT RISE.

Buttonhole completed and cut.

## POSSIBLE CAUSES:

- (1) Cycling mechanism needs adjustment.
- (2) Associated electrical circuit defective.

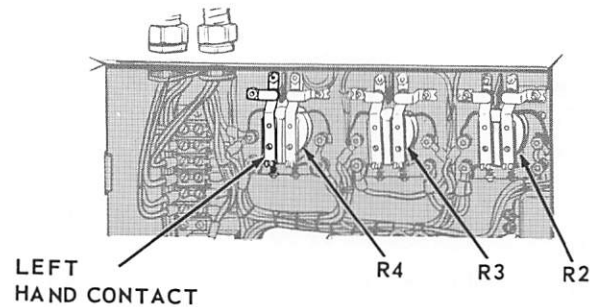


Fig. 41. Left Hand Contact of R4

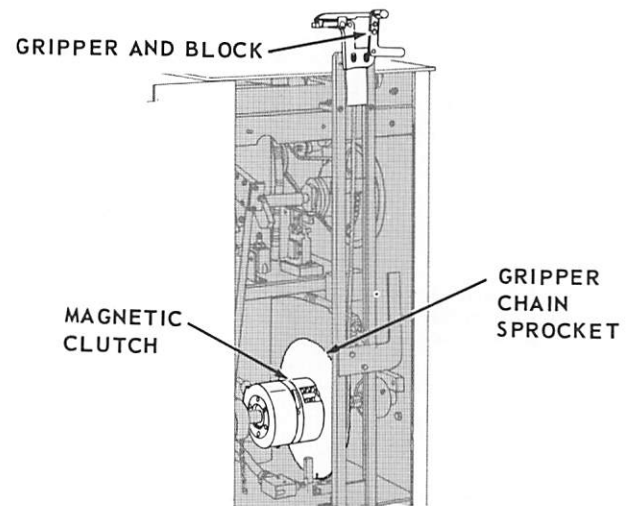
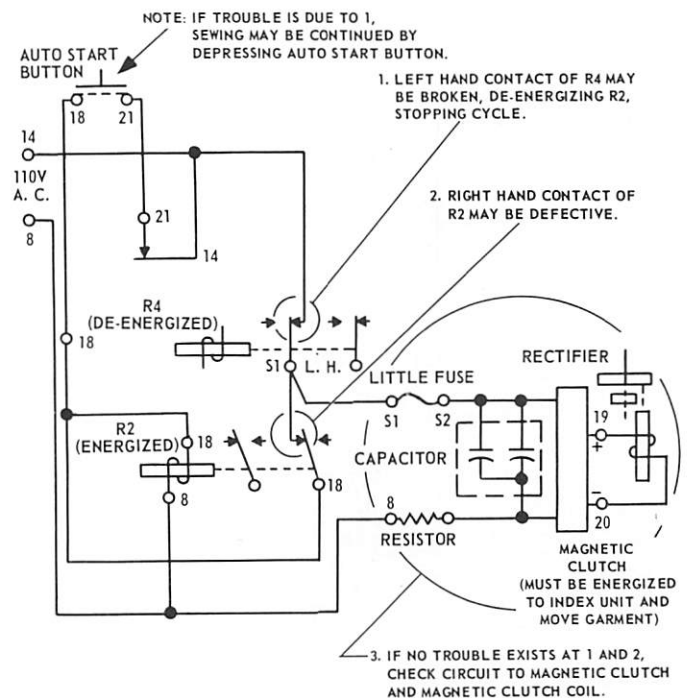


Fig. 42. Clutch Chain Sprocket and Gripper



TROUBLE: INDEX UNIT WILL NOT MOVE  
CYCLE INCOMPLETE, BUTTONHOLE COMPLETED  
AND CUT-WORK CLAMP RAISED.

## TROUBLE SHOOTING (Continued)

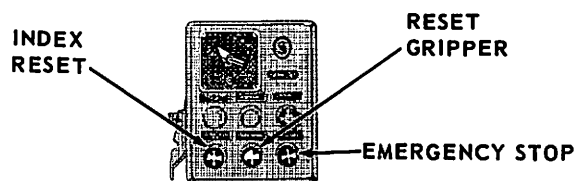
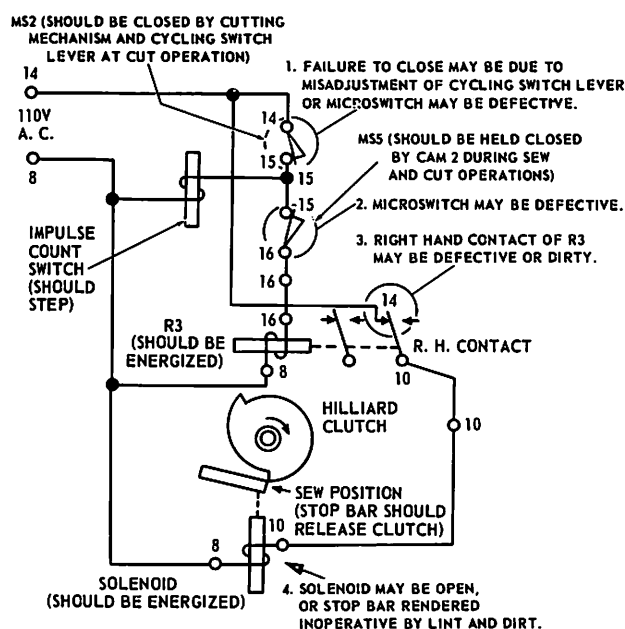


Fig. 43. Index Reset and Gripper Reset Buttons



TRUBLE: WORK CLAMP DOES NOT RISE  
BUTTONHOLE COMPLETED AND CUT

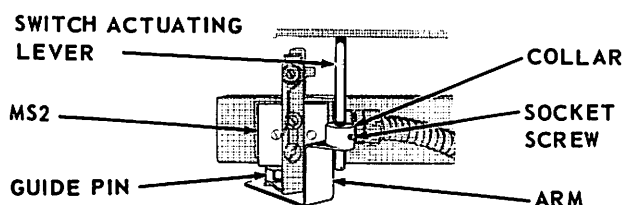


Fig. 44. MS2 and Actuating Lever

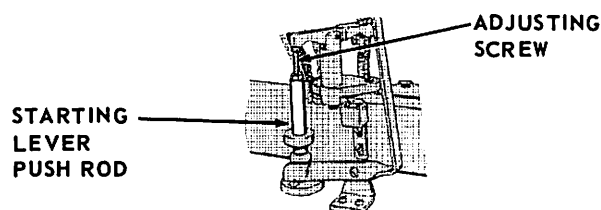


Fig. 45. Push Rod and Adjusting Screw

### CORRECTION:

**NOTE:** To continue sewing under this condition, push index reset button. Clamp will rise, index unit will move to next buttonhole position and buttonhole cycle will resume.

To raise clamp and not index to next buttonhole position, push both index reset and reset gripper buttons. Clamp will rise and gripper will return to start position.

### (1) Adjustment of cycling mechanism.

To inspect cycling mechanism, **PRESS EMERGENCY STOP BUTTON**, cutting power on index unit.

Check action of switch actuating lever and arm. When knife cuts, actuating lever should move up causing lever arm to contact button on microswitch MS2 and close the circuit. Guide pin should be in hole of arm. If arm needs adjustment, loosen socket screw in collar and move arm up or down as required. Arm should NOT be set TOO HIGH, as it may then be damaged or it may cause impulse-count switch to count double. Move arm 1/32 inch at a time until desired adjustment is obtained. Securely retighten socket screw.

If difficulty is encountered in making both impulse-count switch and microswitch MS2 work correctly, adjust screw in starting lever push rod. Turning this screw clockwise two to four turns may reduce side-rock of machine, (when tripped,) and eliminate faulty operation of levers and switches.

### (2) Check associated electrical circuit.

Check wiring to microswitches MS2 and MS5, to terminal blocks and to solenoid, for broken wires and loose terminal connectors. Check microswitch MS2 manually. Button on bottom of switch should click when pushed into "ON" position. Click should be felt if not heard, otherwise switch is defective.

If the above checks prove these parts are functioning correctly, check action of contact points on relay R3. Points should make firm contact. They should not be burned or uneven. Clean these contact points if necessary.

Next check microswitch MS5 (located near solenoid). If no other cause has been determined, remove this switch and test it with an ohmmeter. Push roller on switch all the way down. If no reading can be obtained, switch is defective and should be replaced.

Finally, check solenoid with an ohmmeter. No reading indicates an open circuit, a defective solenoid. Replace with solenoid in good condition. Recheck wiring connections for loose terminal screws.

## TROUBLE CONDITION:

### SEWING UNIT STOPS, WITH KNIFE IN MATERIAL.

Buttonholes completed.

## POSSIBLE CAUSES:

- (1) Knife condition unsatisfactory, (dull, rough, improperly ground).
- (2) Knife bar set for improper height.
- (3) Knife bar driving mechanism is binding.
- (4) Clamp check not holding material securely.
- (5) Improper functioning of stop motion on sewing unit.
- (6) (256W-1 Machine only) Lifting arm lock trip, improperly set.
- (7) (256W-1 Machine only) Belt shifter trip stud, improperly set.

## CORRECTIONS:

Push **EMERGENCY STOP** button.

In all cases above consult appropriate instruction in the service manual for the sewing machine involved.

Trouble items (6) and (7), above apply to the 256W1 machine only. For this type of machine use a large screw driver in the large screw at the pulley end of the arm shaft, turn the arm shaft into the "stop" position. Safety lock on right hand side of machine, (viewed from front), will be found engaged, preventing work clamp from rising. A sharp rap on this safety lock will release work clamp, permitting it to rise. Unit may then be ready to resume operation.

Adjust cam interlocking rod and interlock rod spring pressure as required to clear locking.

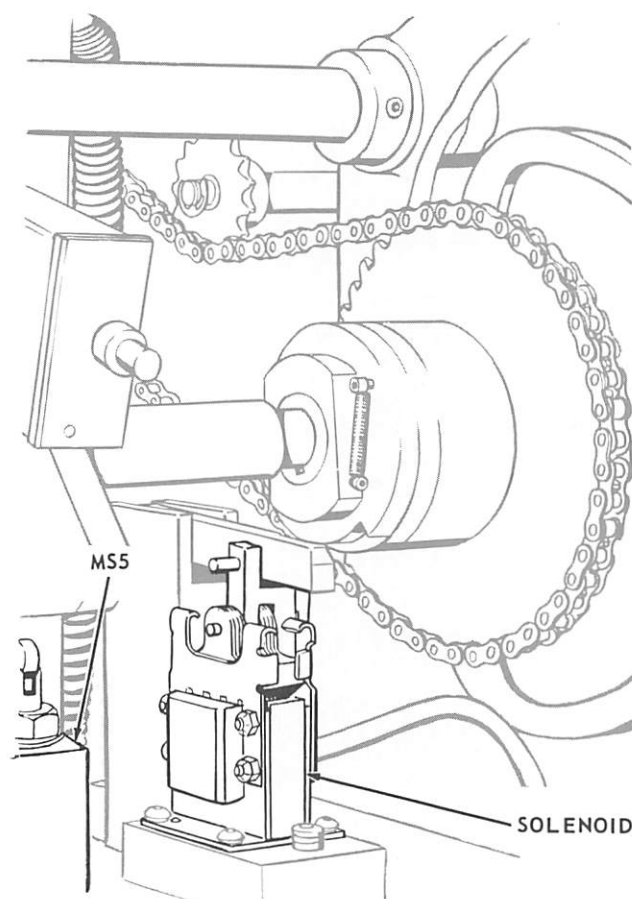


Fig. 46. MS5 and Solenoid

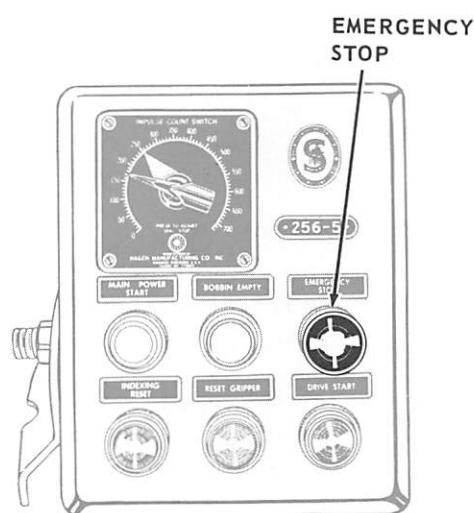


Fig. 47. Emergency Stop Button



## TROUBLE SHOOTING (Continued)

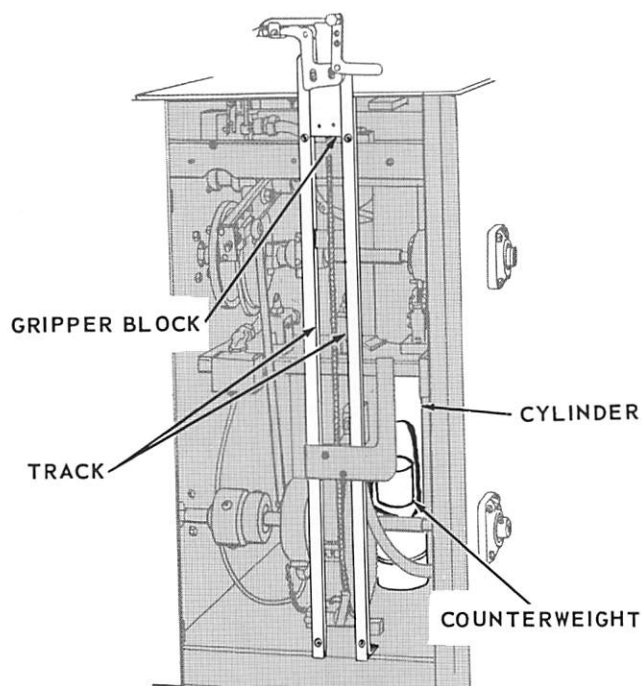


Fig. 48. Gripper Block, Track and Counterweight Cylinder

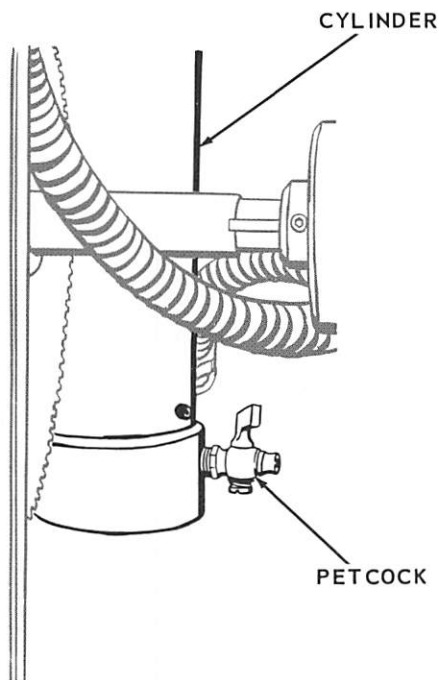


Fig. 49. Cylinder and Petcock

### TROUBLE CONDITION:

INDEX GRIPPER RETURNS TOO SLOWLY TO STOPPING POSITION.

### POSSIBLE CAUSES:

- (1) Lint and dirt inside cylinder, retarding motion of counterweight.
- (2) Sprockets and gripper track contaminated with lint, etc.
- (3) Petcock at bottom of cylinder, adjusted too far toward closed position.

### CORRECTION:

- (1) Clean cylinder and counterweight as required, and oil.
- (2) Clean sprockets and gripper track and oil as required.
- (3) After cleaning and oiling as covered above, move indexing unit manually, and slowly open petcock until a position is found such that the index gripper returns smoothly.

### TROUBLE CONDITION:

INDEX GRIPPER RETURNS TOO RAPIDLY.

### POSSIBLE CAUSES:

- (1) Oil seal between inside surface of cylinder and counterweight is broken.
- (2) Petcock in bottom of cylinder improperly adjusted. (open too wide)

### CORRECTION:

- (1) Re-oil cylinder to produce oil seal.
- (2) Adjust petcock opening toward closed position until satisfactory operation is obtained.

### TROUBLE CONDITION:

SPACING BETWEEN BUTTONHOLES INCONSISTENT OR WRONG.



#### POSSIBLE CAUSES:

- (1) Misadjustment of indexing cam slide adjusting screw.
- (2) Defective magnetic clutch.
- (3) Condition of gripper track (misaligned, needs cleaning).
- (4) Incorrect tension on springs in cloth plate.

#### CORRECTION:

- (1) Adjust cam slide screw to a satisfactory position while machine indexing device is in operation. Changes of 1/2 turn in screw setting, (in one direction) should be made at one time.
- (2) Some cleaning of the clutch may correct the difficulty. Lint and other foreign material may be removed, but **DO NOT DISASSEMBLE** for maintenance. Furthermore, **NEVER OIL** magnetic clutch.

If clutch remains sluggish after cleaning, when coil is energized, check air gap for uniform spacing of .032", using a suitable brass gauge. The clutch should act with a snap under normal operation. (See Page 13.)

If above conditioning fails to produce proper and consistent operation, remove and replace with a new clutch.

- (3) Clean track with stiff brush, align as required, lubricate as covered on page 9.
- (4) See instructions for setting up machine, page 8.

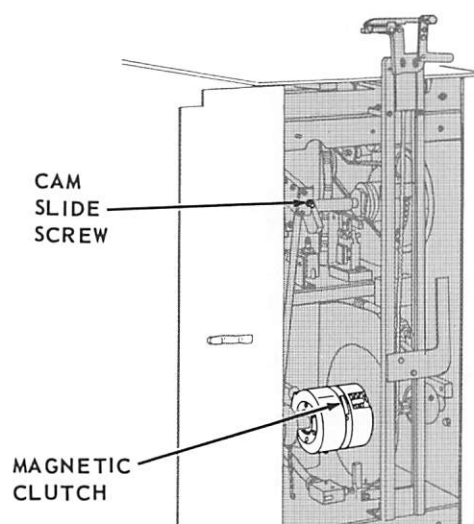


Fig. 50. Cam Screw and Clutch

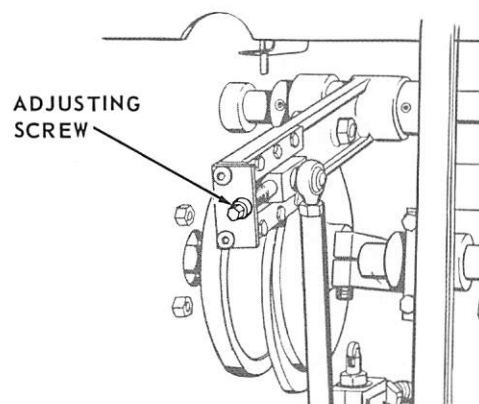


Fig. 51. Adjusting Screw

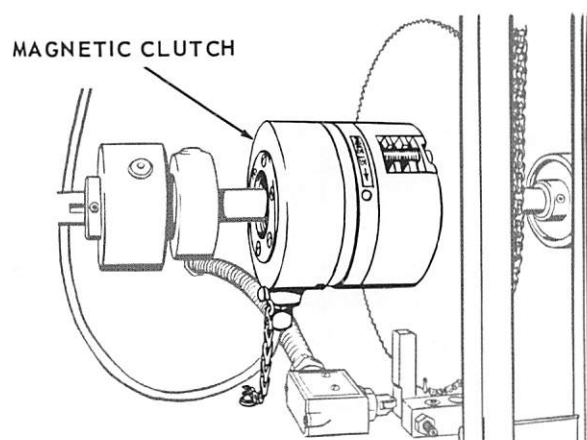


Fig. 52. Stearns Magnetic Clutch

## TROUBLE SHOOTING (Continued)

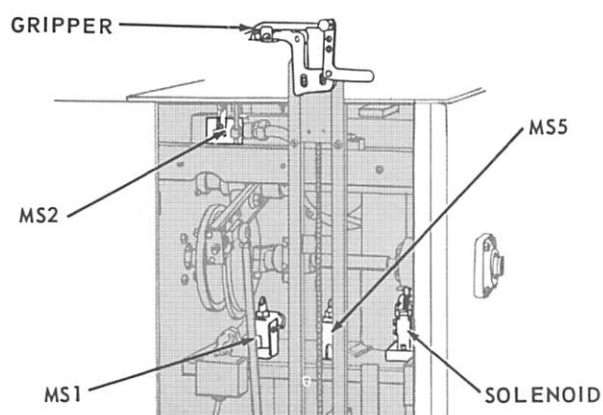


Fig. 53. Microswitches Solenoid and Gripper

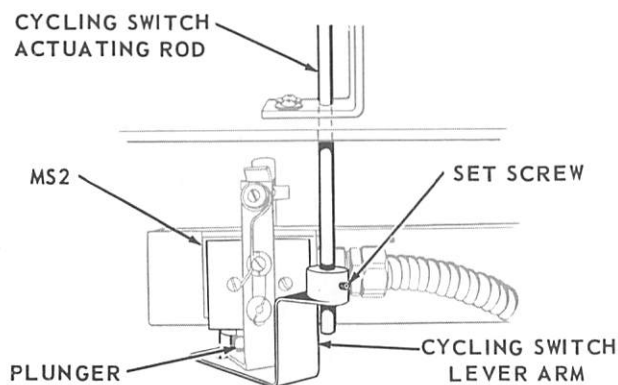


Fig. 54. MS2 and Actuating Lever

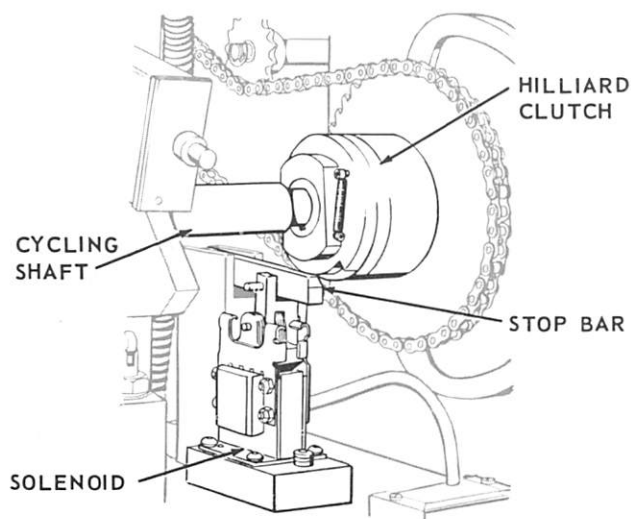


Fig. 55. Solenoid, Stop Bar and Clutch

### TRouble CONDITION:

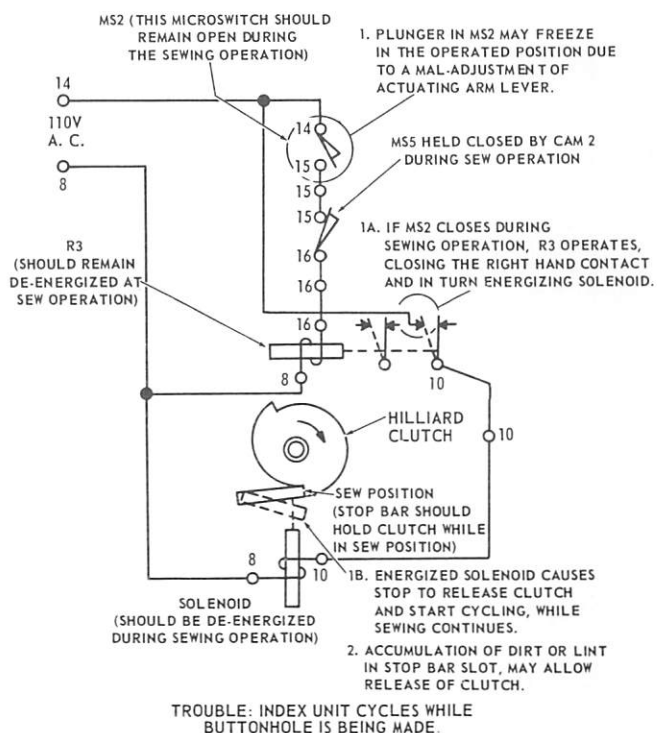
INDEX UNIT CYCLES WHILE BUTTONHOLE IS BEING MADE.

Gripper tends to move work while machine is sewing. Work may slip out of gripper and machine will continue to sew over same buttonhole.

### POSSIBLE CAUSES:

- (1) The cycling switch actuating lever arm may be bent or set too high causing the plunger in microswitch MS2 to stick in the up (closed) position.
- (2) An accumulation of dirt or lint may exist in the armature slot of the solenoid.

In any case the solenoid is energized when the positioning cam passes microswitch MS5 thus preventing the stop bar from engaging the clutch and stopping the shaft rotation.



### CORRECTION:

- (1) Check condition of activating arm lever for distortion or setting, adjust as required.
- (2) Clean slot of solenoid.

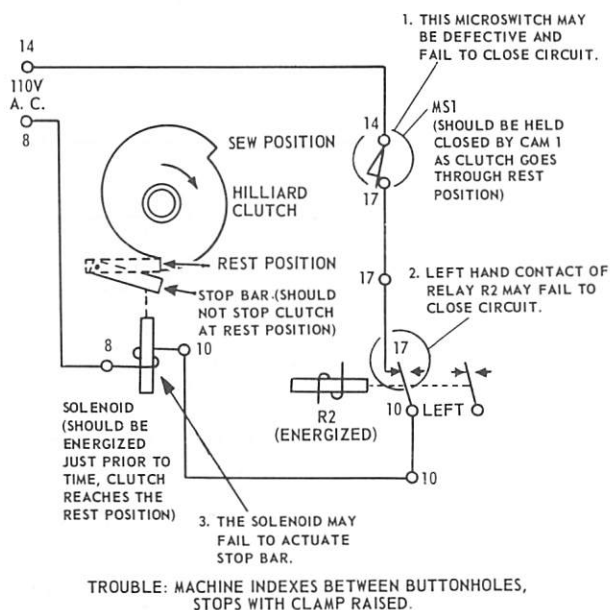
## TROUBLE CONDITION:

Machine indexes between buttonholes but stops with clamp raised.

## POSSIBLE CAUSES:

Circuit through MS1, left hand contacts of relay R2, and solenoid may be open, when MS1 is actuated by cam 1. Under these conditions the stop bar will engage the Hilliard clutch and stop the machine at rest position.

- (1) MS1 may be defective.
- (2) Left hand contacts of R2 may not be positive.
- (3) The solenoid may be defective.



## CORRECTION:

- (1) Check microswitch MS1 with ohmmeter. Push roller completely down. The circuit through switch should be continuous. If defective, replace switch.
- (2) Check through left hand contacts of R2 (energized) with ohmmeter. If circuit is not continuous or is insecure, clean contacts as previously described in this section.
- (3) Check the coil of the solenoid with ohmmeter and replace solenoid if coil is open. Check for accumulation of dirt and lint which might hinder action of solenoid. Clean as required.

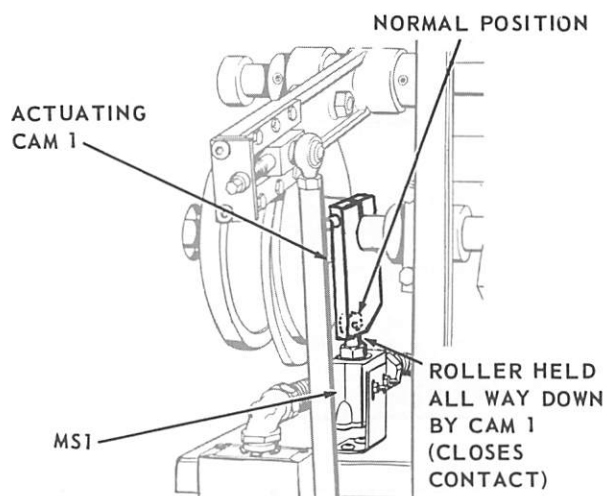


Fig. 56. MS1 and Actuating Cam at Rest Position

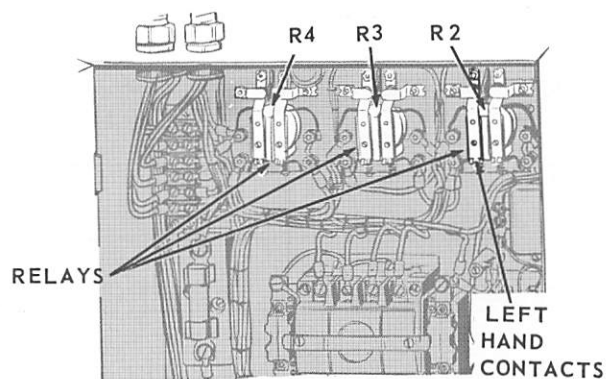


Fig. 57. Left Hand Contacts of Relay R 2

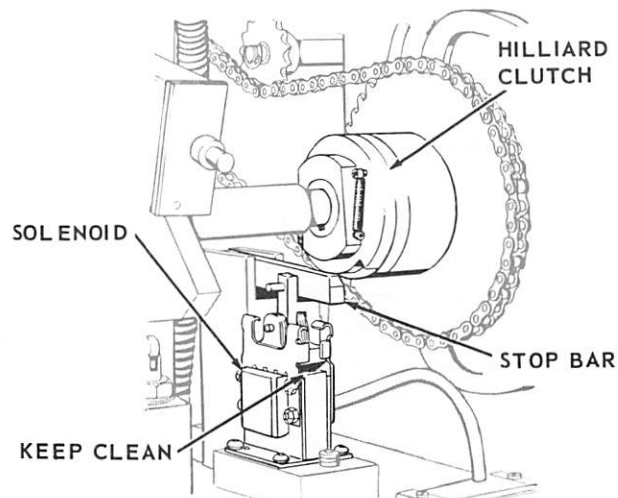
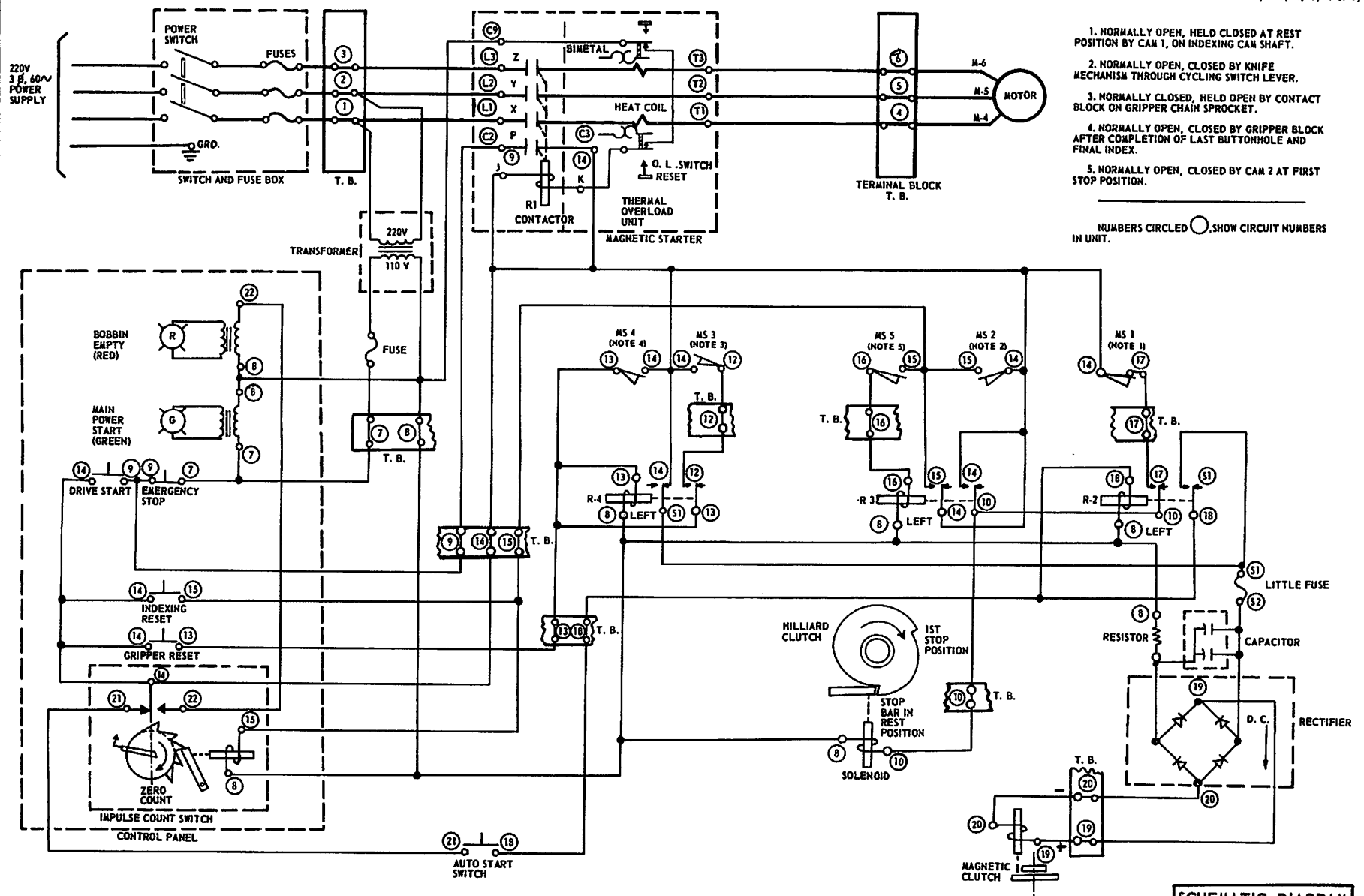


Fig. 58. Solenoid, Stop Bar and Clutch

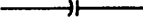

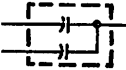
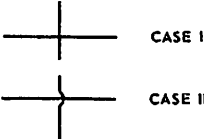
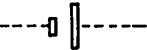

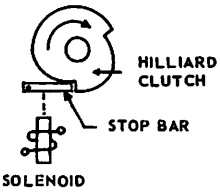
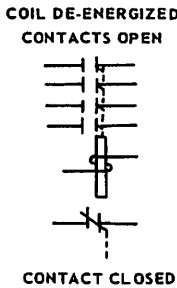
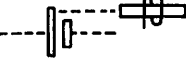





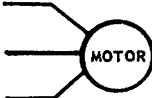


## NOTES AND MEMORANDA

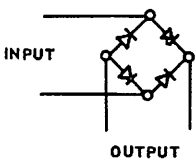
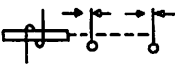
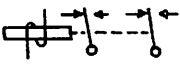





This image shows a page of lined paper, likely from a notebook or binder. The page is white with horizontal lines. There are three binder holes punched along the right edge. The page is titled "NOTES AND MEMORANDA" at the top center.

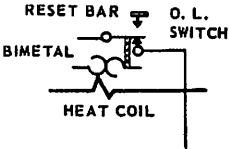
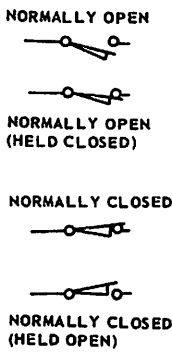
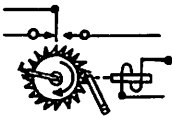
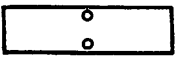
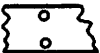
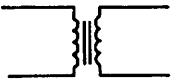


# GLOSSARY OF SCHEMATIC SYMBOLS

SYMBOL	FUNCTIONAL DESCRIPTION	SYMBOL	FUNCTIONAL DESCRIPTION
	<b>CAPACITOR (FIXED)</b> Two or more conducting materials separated by an insulating material (dielectric) – possessing the electrical property of capacitance.		<b>CONDUCTOR(JUNCTION)</b> A point where two or more conductors are joined together.
	<b>CAPACITOR (DUAL)</b> Two capacitors in same container.		<b>CONDUCTORS (CROSSING)</b> A point on schematic where wires are shown crossed but not in junction (Case I and Case II are equivalent.)
	<b>CLUTCH (GENERAL)</b> A means of mechanical coupling whereby a rotating shaft may be smoothly coupled to another mechanical system not yet in motion.		<b>CONDUCTOR (GROUND)</b> A point of zero potential. Condition usually represents the grounding medium to which machines are connected electrically by a low resistance circuit.
	<b>CLUTCH (HILLIARD CLUTCH AND ASSOCIATED SOLENOID)</b> Motion of clutch controlled through operation of a stop bar, actuated electromagnetically by a solenoid.		<b>CONTACTOR</b> An electromagnetic device for making and breaking power circuits. Normally-open contacts close when coil is energized and break when coil is de-energized.
	<b>CLUTCH (MAGNETIC)</b> A device for mechanical coupling between two rotating members controlled electromagnetically by means of an iron cored solenoid.		
	<b>COIL (IRON CORE)</b> Usually a coil of many turns of copper wire wound on an iron core. Has the electrical property of inductance.		<b>FUSE</b> A metallic conductor of low melting point used to protect electrical circuits from overloads.
	<b>COIL (RELAY)</b> Converts electrical energy into magnetic energy to attract a movable arm.		<b>LIGHT (PILOT)</b> Indicator light. Visually indicates presence of voltage in a circuit (color is indicated by letter in a circle; i. e. R, red.
	<b>CONDUCTOR</b> Usually a copper wire or a cable of copper wires having the property of conducting electric current.		<b>MOTOR (THREE PHASE)</b> Electro mechanical device for converting three phase electrical energy into mechanical power.



SYMBOL	FUNCTIONAL DESCRIPTION
	<p><b>RECTIFIER (FULL WAVE)</b></p> <p>A full wave rectifier composed of four solid state elements arranged in a bridge circuit. Input of alternating current (A. C.) pulses, provides an output of pulsating unidirectional current, (D. C.).</p>
	<p><b>RELAY (DE-ENERGIZED)</b></p> <p>An electromagnetic device used for switching electrical circuits. Armatures are actuated by magnetic pull, when coil is energized. (Equivalent to a double pole double throw switch).</p>
	<p><b>RELAY (ENERGIZED)</b></p> <p>Energized coil exerts a magnetic pulling force which causes the arm to move from one contact to another.</p>
	<p><b>RESISTOR (FIXED VALUE)</b></p> <p>A device for impeding the flow of electrical current. Electrical energy is changed into heat energy. Has electrical characteristic of resistance. Measured in ohms.</p>
	<p><b>SOLENOID</b></p> <p>An electromagnetic device used to actuate a movable magnetic bar, e. g. stop bar on Hillard Clutch.</p>
	<p><b>SWITCH (PUSH BUTTON) (NORMALLY OPEN)</b></p> <p>Pushing the button closes the electrical circuit. Button is usually spring loaded to return the switch to its original condition after a momentary contact.</p>
	<p><b>SWITCH (PUSH BUTTON) (NORMALLY CLOSED)</b></p> <p>Pushing the button opens the electrical contacts, momentarily.</p>
	<p><b>SWITCH (POWER) (TRIPLE POLE SINGLE THROW)</b></p> <p>Three separate conductors provided with a mechanical means for opening and closing three independent circuits.</p>

SYMBOL	FUNCTIONAL DESCRIPTION
	<p><b>SWITCH (THERMAL OVERLOAD)</b></p> <p>A device employing a heating element (coil) in series with an electric circuit. A bimetallic strip bends with excessive heat, developed in the coil due to current overloads. The bending opens a switch which protects the circuit.</p> <p>The switch contact may be restored by depressing a reset bar.</p>
	<p><b>SWITCH-LIMIT (MICRO)</b></p> <p>A device for opening and closing electrical circuits under the action of cams or levers. Provided with a plunger which is depressed mechanically to either open or close a switch.</p>
	<p><b>SWITCH (IMPULSE COUNTING OR TIMING)</b></p> <p>A device which may be set to operate a switch after the coil receives a predetermined number of electrical impulses.</p>
 	<p><b>TERMINAL BLOCK (T. B.)</b></p> <p>An insulating material having metallic terminal posts as wiring connections in electrical circuits.</p> <p>A section of terminal block.</p>
	<p><b>TRANSFORMER (POWER)</b></p> <p>An electromagnetic device used to couple electrical power circuits.</p> <p>Voltages may be "stepped up" or "down" by choosing the appropriate ratio of turns between primary and secondary windings.</p>

# WIRING DIAGRAM FOR 256-5 UNIT

