

TECHNICAL MANUAL

**HIGH - SPEED
TAPE PERFORATOR
RECORDING SYSTEM**

Model GP-2-300P

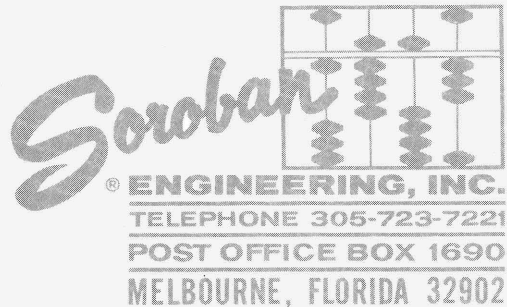


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SECTION I

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION.

1-2. GENERAL. The Model GP-2-300P Tape Perforating System is designed for use in the fields of data processing, office automation, numeric control, high speed communications, data logging and ground support test equipment. This manual is written to cover an eight level system but applies to the five, six and seven level systems as well. The difference in the systems being the data recording levels appropriate to the perforator supplied and the deletion of the circuitry for the levels omitted. The GP-2-300P System is designed to operate as a recording subsystem of a data generating system.

1-3. MODEL GP-2-300P HIGH SPEED TAPE PERFORATING SYSTEM (Figure 1-1). The GP-2-300P System consists of a Model GP-2-300 High Speed Perforator, a Model GP-2-300 Panel to support the perforator and a Model P Tape Panel.

1-4. GP-2-300 HIGH SPEED PERFORATOR.

1-5. GENERAL. The GP-2-300 Perforator, the heart of the system, is ruggedly designed for extremely reliable operation under environmental extremes. The perforator is capable of recording digital data of five to eight level codes, in standard perforator tape including mylar and

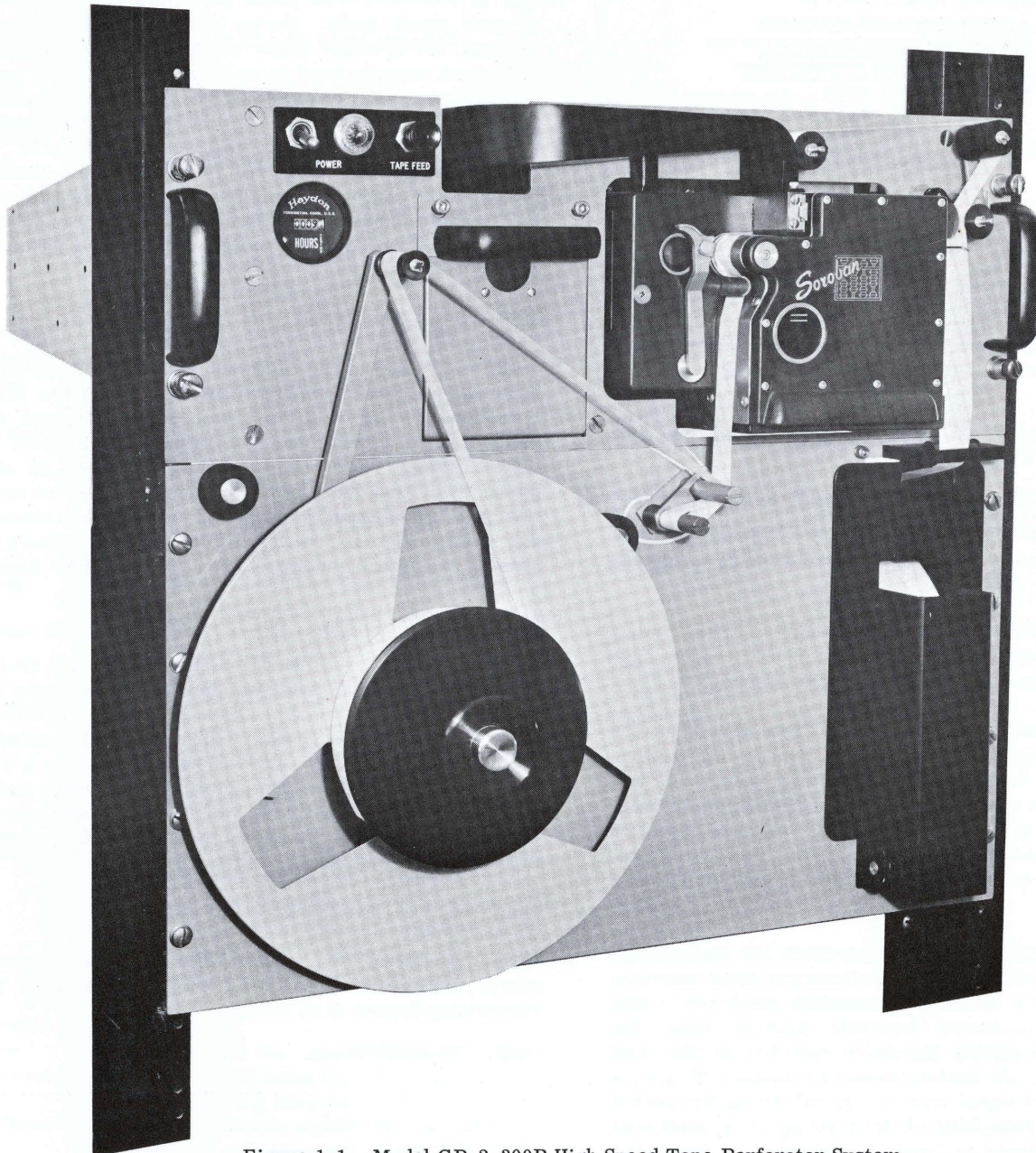


Figure 1-1. Model GP-2-300P High Speed Tape Perforator System

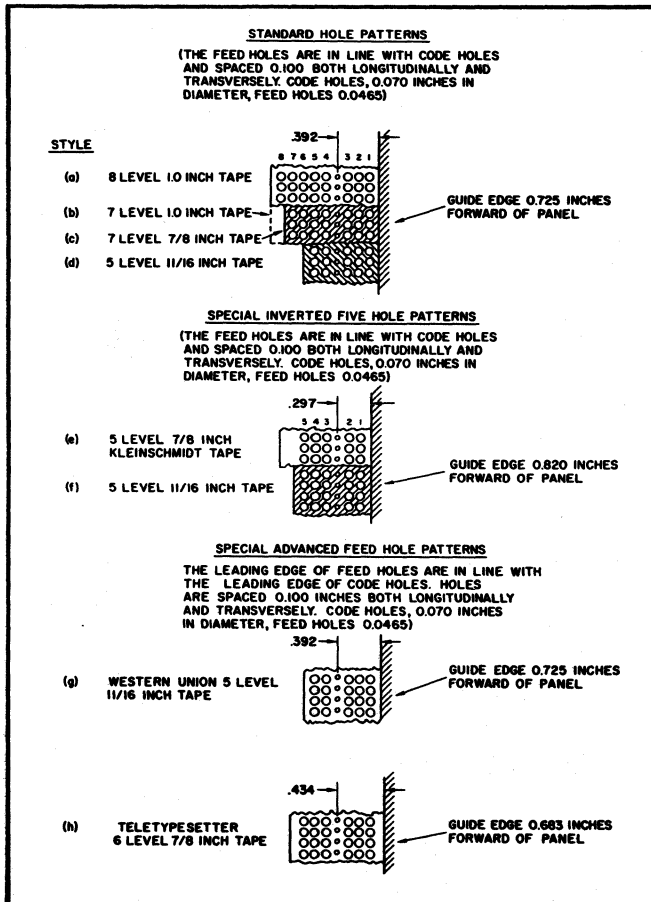


Figure 1-2. Available Hole Patterns

mylar combinations, at recording rates up to 300 code characters per second.

1-6. HOLE PATTERNS. The GP-3-200 Perforator is normally supplied to punch one of the standard hole patterns illustrated in Figure 1-2. One of the special hole patterns is provided when specified.

1-7. TAPE WIDTH. The GP-2-300P System, when shipped, is equipped and adjusted for the proper tape width to correspond with the hole pattern specified.

1-8. PERFORATOR CYCLING. When the GP-2-300 Perforator is operating, a pair of reciprocating motions for cycling the tape feed and punching operations are derived from two constant diameter triangular (three lobe) cams. Yoke type cam followers maintain constant mechanical contact with the cams. The relative phasing of the cams is established by a toothed drive belt between the camshafts.

1-9. TAPE FEED CYCLE. In the GP-2-300 Perforator's tape feed system there are two stationary or dwell intervals which last for 1/6 of the feed camshaft revolution. The two separate stationary intervals provide time for coupling and decoupling the drive sprocket to the feed driving member. To initiate forward transport of tape, a feed magnet drive signal must be applied during the period while the feed cam-follower is pivoting in a clockwise direction (referenced to front of perforator). When the feed cam-follower becomes stationary the feed magnet

armature inserts the feed pawl into the feed sprocket drum. The cam-follower then pivots in the counter-clockwise direction, rotating the sprocket drum and in turn feeding one code space of tape. When the cam-follower again becomes stationary, an armature reset cam withdraws the feed pawl. If further tape feed is not desired a feed mark magnet drive signal is removed and a feed space magnet drive signal applied until further tape feed is required. During the time the feed space magnet is energized, tape feed is inhibited. When continuous tape feed is desired the feed mark magnet is energized throughout the full 360° of the feed cycle. During continuous feed the insertion and removal of the pawl is controlled by the armature reset cam.

1-10. PERFORATING CYCLE. One complete rotation of the punch pin camshaft sequences the punch bail through two punch cycles, therefore the punch pin camshaft rotates at one-half the rpm of the tape feed camshaft. The punch bail is stationary with punch pins retracted for one-third of each punch cycle. During the punch bail's stationary interval, the sprocket mark magnet and the appropriate code mark magnets must be energized to positively engage selected punch pins by extending interposers. The selected punch pins are driven upward by the punch bail through the tape. The resulting hole pattern records one code character. The punch pins are retracted by the downward motion of the punch bail, which again becomes stationary. During this period, the code space magnets must be energized to withdraw the interposers, ending the perforating cycle.

1-11. GP-2-300 PANEL.

1-12. GENERAL. The GP-2-300 Panel, size 7 x 19 inches, contains a center of gravity shock mount with two plug-in connectors for the GP-2 Perforator, a 1/3 HP punch drive motor, a chad chute and collection box, elapsed time meter, sponge rubber tape tension decoupler, an off-on power switch and indicator, a momentary tape feed switch, and an out-of-tape sensing device. Prewired connectors for timing signals, power input, control signals and sensing circuit are accessible from the rear of the panel.

1-13. MODEL P TAPE PANEL.

1-14. GENERAL. The Model P Tape Panel, size 10-1/2 x 19 inches, contains a 1000-foot capacity tape supply well, no tape, tight and low tape sensing devices, a 1000-foot NAB (National Association of Broadcasters) hubbed or single flange Amerline reel for tape pickup, a 1/40 HP induction motor with clutch and brake assembly and its associated control circuitry. A prewired connector for control signals, input power and sensor switches circuitry is accessible from the rear of the panel.

1-15. SYSTEM POWER REQUIREMENTS.

1-16. GENERAL. The power required, from an external source, for operation of the GP-2-300P High Speed Tape Perforating System is as follows:

- (a) GP-2-300 Panel.
- 115 volts \pm 10%,
 - 60 cycle \pm 3 cycles,
 - single phase a-c,
 - 10 amp max. ,
 - 50 volts \pm 5% d-c.

- (b) Model P Tape Panel.
 - 115 volts \pm 10%,
 - 60 cycle \pm 3 cycles,
 - single phase a-c,
 - 0.9 amp max.

1-17. QUICK REFERENCE DATA.

1-18. GENERAL. The quick reference data is contained in the specifications.

1-19. MECHANICAL SPECIFICATIONS.

1-20. GP-2-300 HIGH SPEED TAPE PERFORATOR.

- Height: 5 inches
- Width: 6-1/2 inches
- Depth: 6-1/2 inches
- Mounting: Center of gravity shock mounted.
- Weight: Perforator only, 9 pounds.
- Character Speed: Up to 300 characters per second.
- Code Characteristics: Models available for perforating 5, 6, 7 or 8 level patterns; inverted 5 level patterns and advanced feed hole patterns (see Figure 1-2).
- Perforator Starting Torque: 60 inch ounces maximum.
- Feed Error: Maximum accumulated error of ± 0.005 inch in 6 inches of perforated tape, corresponding to 60 recorded code characters.
- Hole Pattern Spacing: Exceeds requirements of EIA Standards.
- Thermal Rise: 40°C with continuous operation at 300 characters per second.
- Environment: The perforator design is such that severe environmental requirements can be met. Particular emphasis has been placed on adherence to MIL-E-16400 and MIL-I-26600.
- Lubrication: Oil splash bath lubrication for punch pins, cams and balls. Pressure lubrication of the complete feed mechanism. Oil change is recommended after each 500 hours of operation. Crankcase capacity is 6-1/2 fluid ounces.
- Perforator Cooling Requirements: Forced air cooling, 100 cfm over fins on bottom of perforator housing.
- Chad Removal: Chad is gravity fed through a chute to the chad collection box on the GP-2-300 Panel.

Tape Restrictions: The GP-2-300 High Speed Tape Perforator will perforate any paper or relatively flexible plastic tape of thickness between 0.0025 and 0.005 inches, including mylar and mylar combinations.

Drive Pulley (300 characters per second rate): 18 tooth 0.234 pitch, on punch camshaft.

Timing Pulleys: 32 tooth 0.234 pitch, on punch camshaft, 16 tooth 0.234 pitch on tape feed camshaft.

Timing Belt: 46 tooth 0.234 pitch, rubber chain belt.

Servicing Schedule: Factory servicing of the GP-2-300 High Speed Tape Perforator is recommended after 2500 rolls of dry tape, 6000 rolls of oiled tape or 1000 hours of operation, whichever occurs first. This is based on 1000-foot rolls.

1-21. MODEL GP-2-300 PANEL.

- Height: 7 inches
- Width: 19 inches
- Depth: 20 inches behind the panel.
- Mounting: Relay rack, slide hardware equipped.
- Weight: 53 pounds with drive motor and perforator in place.
- Chad Box: 4-1/2 inches high, 3-1/2 inches wide and 5-1/2 inches deep (approximately).
- Handles: Panel is equipped with front mounted handles to facilitate handling.
- Drive Motor: Induction motor, 1/3 HP, 3350 rpm, 115 volt, 60 cycle a-c, single phase.

Pulley, Drive Motor (300 character per second rate): 45 tooth 0.234 pitch.

Belt, Drive: 58 tooth 0.234 pitch, rubber chain belt.

1-22. MODEL P TAPE PANEL.

- Height: 10-1/2 inches.
- Width: 19 inches.
- Depth: 15 inches
- Weight: 22 pounds
- Tape Well: Front loading recessed well, tape capacity 1000-foot roll.
- Tape Pickup: 10-1/2 inches diameter NAB hubbed or single flange Amerline reel, tape capacity 1000 feet.

Snubber: Mechanical snubber to decouple pickup tension from GP-2 Perforator sprocket.

Drive Motor: Induction motor 1/40 HP, 1140 rpm, 7-1/2 inch ounces torque full load.

Drive Belt: 77 tooth 0.234 pitch, rubber chain belt.

Mounting: Relay rack, eight EIA standard notches.

- (a) GP-2, 37 pin, for code mark and space drive signals, tape feed mark and space drive signals and no-tape sensor switch contacts.
- (b) Six pin, for a-c power input and tape feed switch contacts.
- (c) Two pin on synchronization pickup, with mating plug and shielded lead.

1-23. ELECTRICAL SPECIFICATIONS.

1-24. GP-2-300 HIGH SPEED TAPE PERFORATOR

Code Interposer Magnets, Mark and Space: Three watts maximum continuous dissipation, 10 to 14 mh, six ohms, 480 ma min. Design center with normal 60% duty cycle circuitry 620 ma.

Feed Magnet, Mark: Six watts maximum continuous dissipation, 75 to 90 mh, 17 ohms, 440 ma min. Design center 550 ma.

Feed Magnet, Space: 1.6 watts maximum continuous dissipation, 6 to 10 mh, 5.2 ohms, 330 ma min. Design center 380 ma.

Magnet Insulation: 300 volt d-c test. Transients must be suppressed to less than 100 volts peak.

Synchronization Signals: GP-2, 10 volts peak-to-peak, 1/4 millisecond duration from 1000 ohm source spaced 0.030 inch to 0.045 inch from synchronization disc.

GP-2A, 6 volts peak-to-peak, 1/4 millisecond duration from 1000 ohm source, factory adjusted.

Two connectors (with mating plugs) when panel is equipped for a Model GP-2A Perforator (synchronization pickup sealed in perforator and signals are fed through 37 pin connector):

- (a) GP-2A, 37 pin, for code mark and space drive signals, tape feed mark and space drive signals, synchronization signals and no-tape sensor switch contacts.
- (b) Six pin, for a-c power input and tape feed switch contacts.

1-26. MODEL P TAPE PANEL.

Power Requirements: 115 volts \pm 10%, 60 cycles \pm 3 cycles single phase a-c.

Tape Pickup Motor: 1/40 HP 1140 rpm 115 volt, 60 cycles, single phase a-c induction motor, 0.9 amp max. starting current, 0.5 amp running current.

Clutch and Brake Assembly: 90 volts d-c, 0.55 amps, supplied from rectifiers built into the internal control circuitry. The SLACK OR BROKEN TAPE (pickup) arm has a cam actuated microswitch to engage and disengage the drive clutch.

Sensors: LOW TAPE (supply) sensing arm actuated SPDT microswitch.

TIGHT TAPE (supply) sensing arm actuated SPDT microswitch.

NO TAPE (pickup) slack arm actuated SPDT microswitch. The usage of these sensor microswitches is described in Section IV of this manual.

Connector (with mating plug): 12 pin connector for 115 volt 60 cycle a-c power input and sensor switches circuitry.

1-25. GP-2-300 PANEL.

Power Requirements: 115 volts \pm 10%, 60 cycle \pm 3 cycles a-c, single phase.

Controls: ON-OFF a-c power switch. TAPE FEED press-to-feed switch. The usage of this switch is described in Section IV of this manual.

Indicators: ON-OFF a-c power indicator lamp. Elapsed time meter, hours of operation.

Drive Motor: Induction motor 1/3 HP, 3350 rpm, 115 volt, 60 cycle single phase a-c, 10 amps max. starting current, 3.5 amps nominal running current.

Sensors: NO-TAPE, mechanically operated SPDT microswitch to detect a no-tape or broken tape preceding the GP-2 Perforator. The usage of this sensor is described in Section IV of this manual.

Connectors: Three connectors (with mating plugs) when panel is equipped for a Model GP-2 Perforator (synchronization pickup external to perforator):

1-27. ASSOCIATED EQUIPMENT.

1-28. GENERAL. The associated equipment which must be provided consists of:

- (a) Interconnecting Cables.
- (b) Electronic Circuits for Conditioning Drive Signals to The Perforator.
- (c) DC Power Supply.
- (d) AC Power Supply.

SECTION II INSTALLATION

2-1. UNPACKING AND HANDLING.

2-2. GENERAL. The Model GP-2-300P High Speed Tape Perforator System is shipped in four separate containers. The contents of the separate containers are as follows:

- (a) One Model GP-2 High Speed Tape Perforator in a shock resistant steel drum.
- (b) One 7 x 19 inches Model GP-2-300 Panel Assembly in a shock resistant corrugated box.
- (c) One 10-1/2 x 19 inches Model P Tape Panel Assembly in a shock resistant corrugated box.
- (d) The following lot of spare and sundry items in a corrugated box:

- 1 ea. spare timing belt for the GP-2 High Speed Tape Perforator
- 2 ea. drive belts for the GP-2 High Speed Tape Perforator
- 1 ea. pressure type oiler
- 1 pound can #0 Lubriplate oil
- 1 set Instruction Manuals.

2-3. UNPACKING THE PANELS. No special procedures, only reasonable care, need be followed to unpack the two panels.

NOTE

Do not unlock the slack tape arm from the tape tension snubber.

2-4. UNPACKING THE GP-2 HIGH SPEED TAPE PERFORATOR. Although ruggedly built, the GP-2 Perforator is a precision instrument and should not be subjected to rough handling.

NOTE

The GP-2 Perforator must always be handled in an upright position to avoid oil leakage. The shipping container should be kept in the upright position.

The GP-2 Perforator is designed to operate in an oil bath and has its own oil circulating pumping system. An oil breather is provided to compensate for temperature changes. It is possible that oil may seep out through the breather during shipment. This seepage does not indicate a damaged or improperly assembled perforator. After unpacking the GP-2 Perforator, carefully examine the unit and if oil seepage has occurred it should be removed by the following procedure:

- (a) Wipe the surface of the guide plate (4, Figure 2-1) and the depressor plate (6) with a clean lint-free cloth SLIGHTLY dampened with Inhibisol or Magnus #5 solvent and then wipe the surfaces with a dry lint-free cloth.

CAUTION

Extreme care should be exercised to avoid removal of lubrication on the rear pulley bearings. Such lubricant removal or dilution can result in immediate bearing failure.

- (b) Place a piece of paper recording tape between the punch and die assemblies (2, Figure 2-1) and move tape back and forth to remove oil from the punch surface. The front cover of the GP-2 High Speed Tape Perforator has a circular window (5) with two lines inscribed for oil level indication. With the perforator in an upright level position, check that oil level is between these two lines. If level is below the bottom line, oil must be added as outlined in Section VI of this manual.

2-5. INSTALLATION REQUIREMENTS.

2-6. GENERAL. The general requirement for installation of the system is a proper site selection which will afford sufficient space for operation, service and the associated equipment required (see Paragraph 1-27), but not supplied.

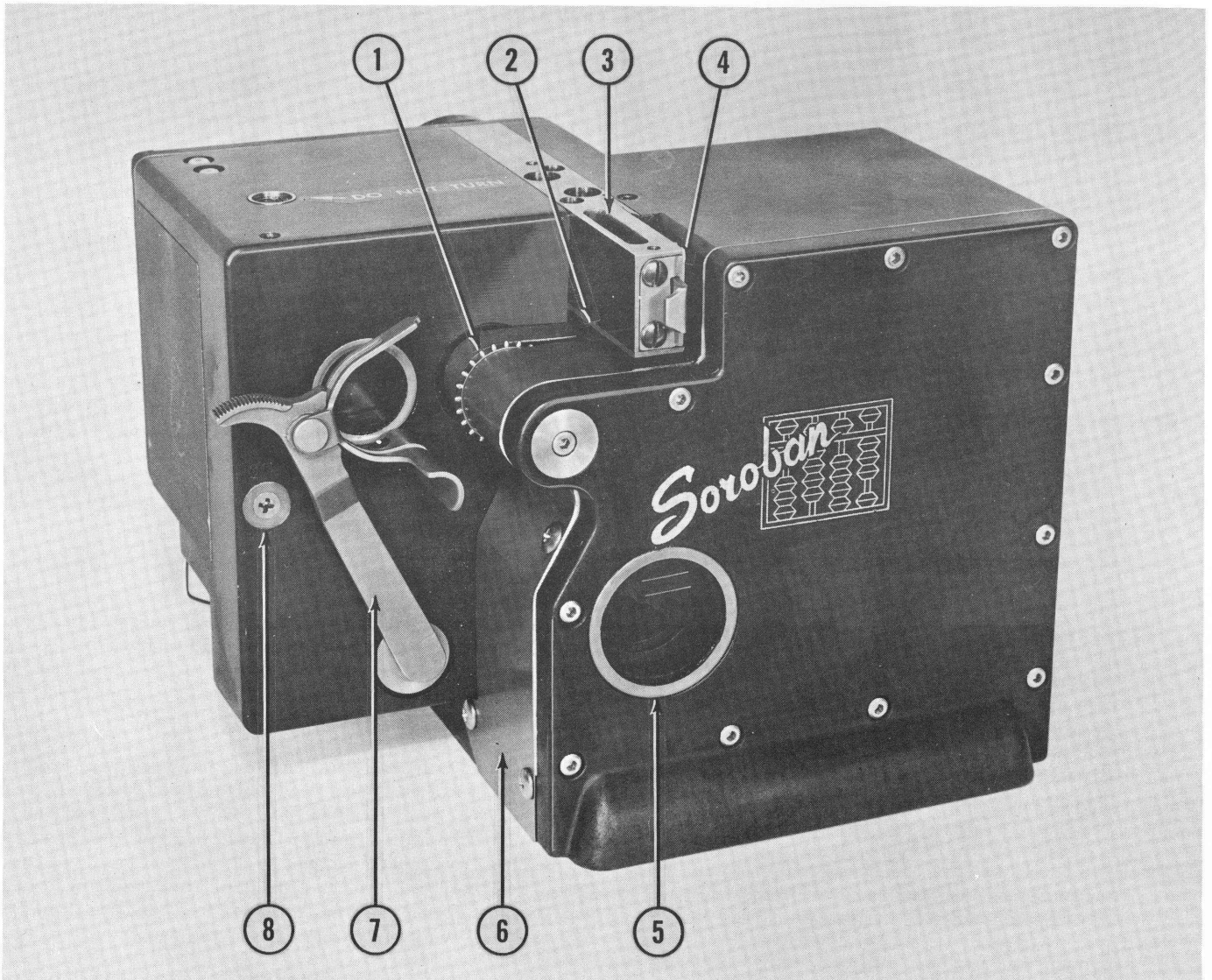
2-7. SITE SELECTION. The selection of a site for the GP-2-300P High Speed Tape Perforating System may be dictated by limitations of space in the immediate area of the data generating system. However, the system should be physically located as near to the data generating source as possible. Short input connecting cables are preferred. The site should provide sufficient free air circulation to meet the cooling requirements of the system.

2-8. SPACE REQUIREMENTS. The entire system requires 17-1/2 inches vertical space in a standard 19-inch relay rack with a depth clearance of at least 20 inches. When installed, the GP-2 Perforator extends 2-1/2 inches from the front surface of the GP-2-300 Panel.

2-9. CONTROL CIRCUIT REQUIREMENTS. The warranty of the GP-2-300 Perforator requires initial over-voltage series dropping resistor circuitry in the 50 volt d-c magnet control circuits. The diodes, resistors and transistors of the schematic circuit, Figure 2-2, are not supplied as part of the GP-2-300P System. The left half of the schematic (Figure 2-2) is the code and sprocket mark and space magnet control circuits. The diodes, resistor and transistor circuitry must be supplied for each data level circuit and for the sprocket control circuit. The right hand half of the schematic is the tape feed mark and space magnet circuitry. The diode, resistor and transistor circuitry must be supplied for the tape feed control circuit.

NOTE

Overvoltage series dropping resistors and necessary heat sinks mounted on a seven inch panel may be obtained, on separate order, from Soroban Engineering, Inc., P.O. Box 1717, Melbourne, Florida.



- | | |
|------------------------|-------------------------|
| 1. SPROCKET, TAPE FEED | 5. OIL LEVEL WINDOW |
| 2. DIE PLATE | 6. TAPE DEPRESSOR PLATE |
| 3. CHAD EXHAUST | 7. TAPE DEPRESSOR |
| 4. TAPE GUIDE PLATE | 8. OIL FILLER PLUG |

Figure 2-1. GP-2 Perforator

2-10. SYNCHRONIZATION REQUIREMENTS. The data generating system must be capable of accepting the timing signal generated in the reluctance pickup unit. Where a Model GP-2 Perforator is employed, the reluctance pickup is mounted, external to the perforator, in a circular plate attached to the motor mount casting. The timing signal output appears at the two pin connector on the rear of the pickup. The pickup is supplied with mating plug and shielded lead. Where a Model GP-2A Perforator is employed, the reluctance pickup is mounted inside the perforator housing and the timing signal output is wired to pins 32 and 33 of the 37 pin connector J4 of Figure 2-3. The shield on the timing signal conductors is connected to pin 34.

2-11. TAPE TROUBLE WARNING CIRCUITS. The GP-2-300P System is equipped with microswitch sensors to detect tape trouble and provide four separate warning-

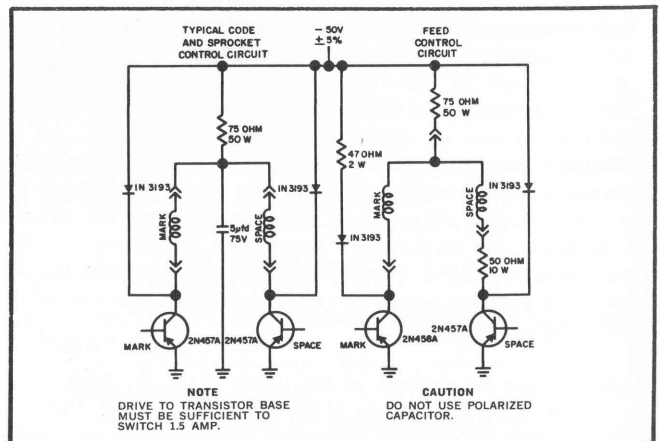


Figure 2-2. Typical Circuits for Code, Sprocket and Feed Magnet Control

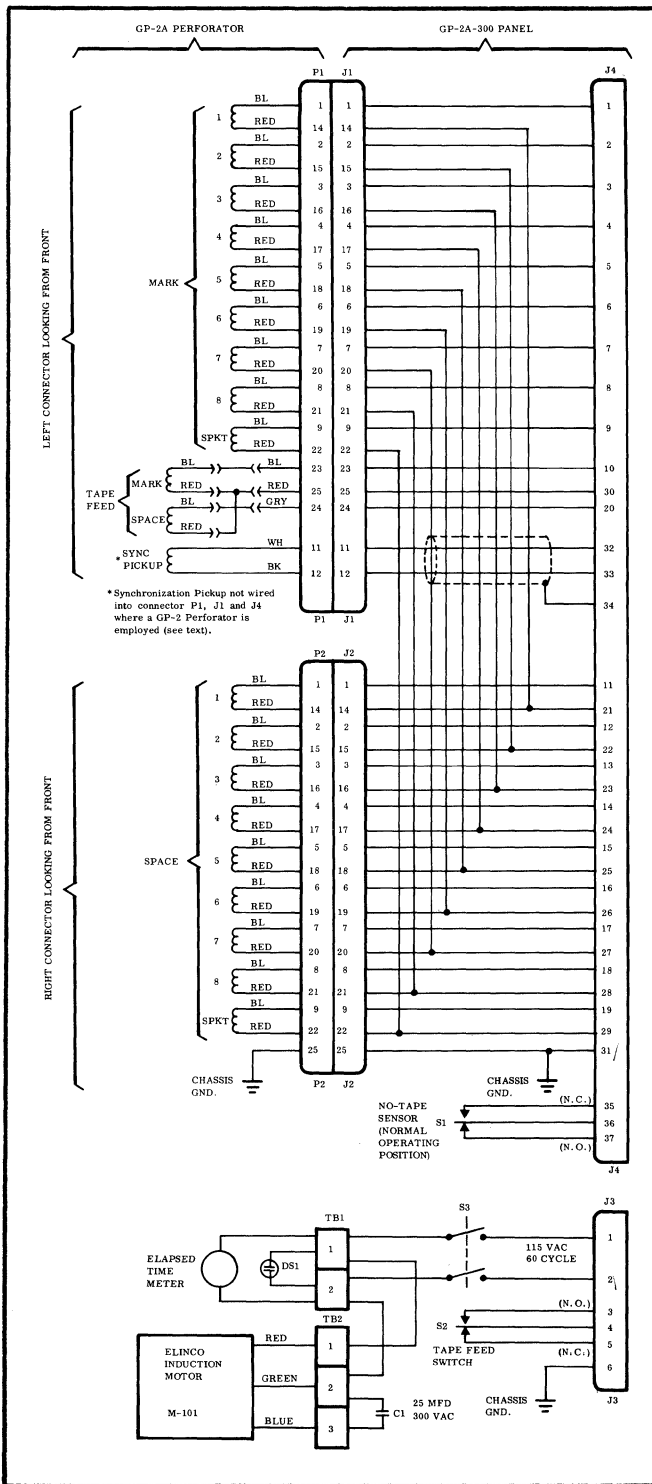


Figure 2-3. GP-2A Perforator, GP-2A-300 Panel, Wiring Diagram

switch circuits (see Figures 2-3 and 2-4). In designing control circuits for integrating the GP-2-300P System with a data generating system, consideration should be given to making use of these switch circuits for warning signals. Under normal operation (when no tape trouble exists) these switches are in the positions illustrated.

2-12. INSTALLATION OF THE GP-2-300P HIGH SPEED TAPE PERFORATOR SYSTEM.

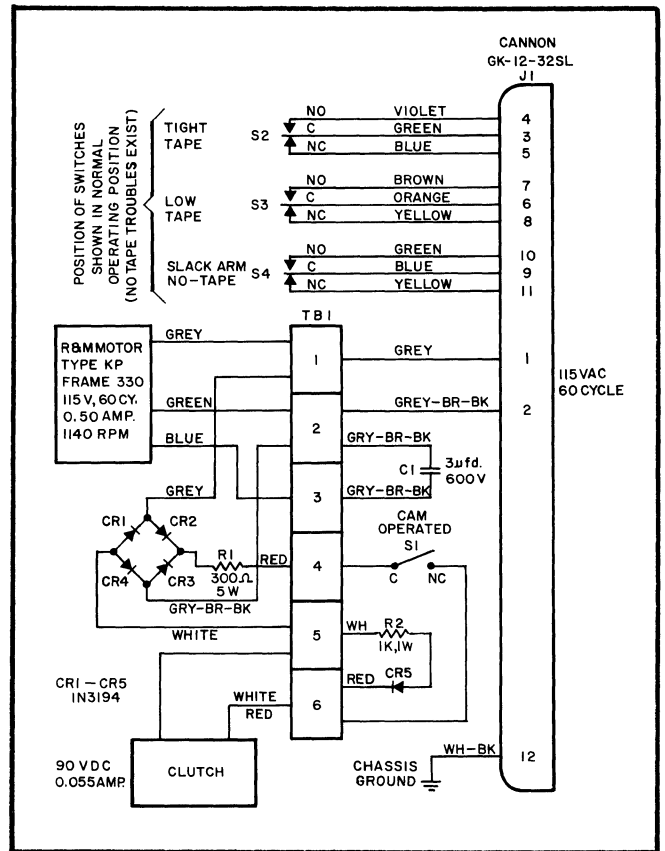


Figure 2-4. Model P Tape Panel, Wiring Diagram

2-13. GENERAL. The GP-2-300 Panel and the Model P Tape Panel are completely wired with their internal circuitry terminating at connectors. The mating plugs are supplied with each connector.

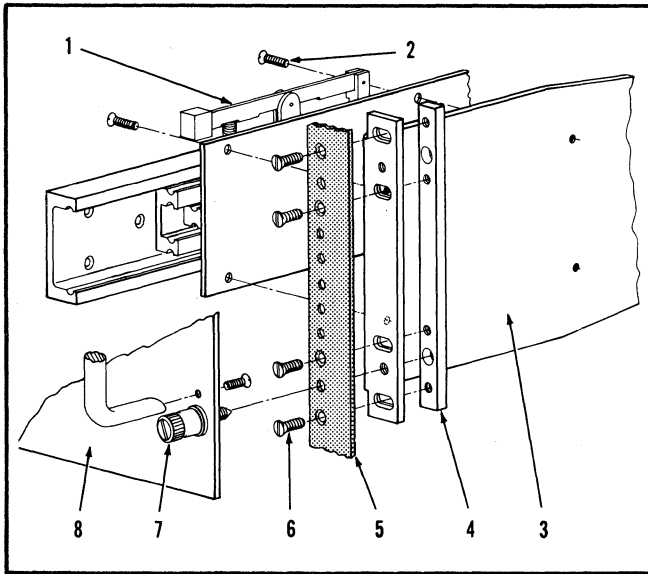
2-14. INSTALLATION OF THE GP-2-300 PANEL (Figure 2-5). Install the two side plates (3) to the relay rack as follows:

- (a) Remove the side plates (3) from the slide mounting guide rails by removing the eight mounting screws (2) in each plate.
- (b) Locate the eight mounting holes (four on each side) required in the relay rack (5) and countersink these holes for 10-32 flat head screws (6). Heads must be flush.
- (c) Mount the side panels (3) on the rear of the relay rack front member by placing nut strap (4) in back of side panel flange and place the 10-32 flat head screws (6) through the relay rack and side panels into the nut straps (4). Tighten all screws.

NOTE

Two men are required for the next step.

- (d) With the guide rails fully extended, place the guide rail mounting screw holes in line with side plate holes (2) and replace the mounting screws in both side plates. Tighten all screws.



1. SLIDE POSITION LOCK
2. MOUNTING SCREWS, SLIDE HARDWARE
3. SIDE PLATE, SLIDE HARDWARE
4. NUT STRAP
5. RELAY RACK (REFERENCE)
6. FLAT HEAD MOUNTING SCREWS, SIDE PLATE
7. CAPTIVE RETAINING SCREW, GP-2-300 PANEL
8. GP-2-300 PANEL (REFERENCE)

Figure 2-5. Slide Hardware Mounting, GP-2-300 Panel

- (e) Depress and hold the spring loaded slide position locks (1) and slide panel assembly into the closed position in rack.
- (f) Loosely tighten the four knurled captive retaining screws (7) to hold panel assembly in place.

2-15. INSTALLATION OF THE MODEL P TAPE PANEL. Place the Model P Tape Panel in the relay rack directly below the GP-2-300 Panel and fasten in place with four screws on each side.

CAUTION

Do not unlock the slack tape arm at this time as it will interfere with sliding GP-2-300 Panel outward for perforator drive belt installation.

2-16. ELECTRICAL CONNECTIONS.

2-17. GENERAL. The electrical connections required during installation of the GP-2-300P System are divided according to the individual panels.

2-18. GP-2-300 PANEL (Figures 2-2 and 2-3).

- (a) Provide the code magnet and sprocket control circuits in the left hand portion of Figure 2-2 for each data level and one for the sprocket control circuit. For example, an eight level system requires nine of these circuits.

- (b) Provide the tape feed magnet control circuit in the right hand portion of Figure 2-2. Only one of this circuit is required.
- (c) Provide a cable to interconnect the 37 pin connector (J4) with the control circuitry of the data generating system. This cable must contain the following circuit conductors:

Data Levels (mark and space)	3 conductors for each level
Sprocket Control (mark and space)	3 conductors
Tape Feed Control (mark and space)	3 conductors
Chassis Ground	1 conductor
No-Tape Sensor Switch	3 conductors
Synchronization Pickup (GP-2A)	1 shielded pair

NOTE

Where a Model GP-2 Perforator is employed, the synchronization pickup is equipped with a two pin connector, mating plug and shielded conductor.

- (d) Remove the mating plug from connector J4 and connect the cable conductors, step (c) to the pins indicated in Figure 2-3.
- (e) Provide a cable to interconnect the six pin connector (J3) with the control circuitry of the data generating system. This cable must contain the following conductors:

AC Power 115V 60 cps 10 amp capacity	2 conductors
Tape Feed Switch	3 conductors
Chassis Ground	1 conductor

- (f) Remove the mating plug from connector J3 and connect the cable conductors, step (e), to the pins indicated in Figure 2-3.

CAUTION

Magnet drive power must not be applied to the magnets when the drive motor is not operating. This will overheat the magnets and cause premature oil sludging.

- (g) Place all input power switches in OFF position.
- (h) Mate the plugs to the connectors, J3 and J4, properly seating the retaining collars.

2-19. MODEL P TAPE PANEL (Figure 2-4). The Model P Tape Panel must be interconnected to the input power control panel of the data generating system to control the

115 volt 60 cycle a-c supply for the 1/40 HP tape pickup motor circuitry.

- (a) Provide a cable containing one pair of conductors capable of carrying 1.5 amps starting current for the motor circuitry, one conductor for system ground and nine conductors for the sensor switch circuits. The usage of the sensor switch circuits is explained in Section IV.
- (b) Remove the 12 pin mating plug from connector J1 (Figure 2-4).
- (c) Connect the conductors of the cable, provided in step (a), to the pins of the plug in accordance with Figure 2-4.
- (d) Place the 115 volt 60 cycle input power control in OFF position.
- (e) Mate the plug to connector J1 and properly seat the retaining collar.

2-20. INSTALLATION OF THE GP-2 HIGH SPEED TAPE PERFORATOR. Install the GP-2 Perforator in the GP-2-300 Panel by the following procedure:

- (a) Loosen the four captive retaining screws (7, Figure 2-5) of the GP-2-300 Panel and slide panel approximately halfway out until it locks in this position.

NOTE

Keep GP-2 Perforator in an upright position to prevent oil leakage through the breather system.

- (b) Remove the GP-2 Perforator from its shipping container and remove the (socket type) flat head mounting screws protruding from the bottom of the perforator. Place the perforator on the shock mount with the toothed pulleys entering the panel opening. Slide the perforator into the panel, leaving sufficient space to place the drive belt on the pulley.

- (c) Reach in back of the perforator and place the drive belt on the pulley of the perforator.
- (d) Carefully mate the connectors on the rear of the perforator with the connectors on the shock mount. Fully seat the perforator and insert the (socket type) flat head screws up through the shock mount into the bottom of the perforator and tighten the screws.

CAUTION

The rear cover of the punch unit has an arrow which indicates the proper direction for rotation of the punch drive shaft. Do not under any circumstances run the GP-2 Perforator in the opposite direction. A few seconds operation in the wrong direction will cause severe damage to the punch unit.

- (e) Reach in back of the perforator and place the toothed belt on the drive motor pulley by turning pulley CLOCKWISE until belt is properly seated. This momentary slow hand turning in the wrong direction will not result in damage.

2-21. RELUCTANCE PICKUP POLARITY. When the GP-2-300P System is interconnected with a data generating system, care must be exercised to insure that the pickup leads are connected with the proper polarity. If the polarity is reversed, the code magnets will be energized during the interval when they should not be driven. The perforator may operate under reversed polarity conditions but the recording accuracy will be seriously degraded. Proper wiring of the timing signal polarity is indicated when the code magnet excitation interval exceeds the no-drive interval. If necessary, reverse the reluctance pickup output leads. Refer to Figure 4-3 for the relation of the timing signal polarity with respect to the perforator mechanical motions.

2-22. RFI SUPPRESSION. When RFI suppression becomes necessary, additional ground straps and external shielding should enable the system to meet most of these requirements. Consult Soroban Engineering regarding RFI shielding requirements.

SECTION III OPERATORS SECTION

3-1. PREOPERATION INFORMATION.

3-2. GENERAL. The GP-2-300P High Speed Tape Perforator System is designed to record digital data at speeds up to 300 code characters per second in 5, 6, 7 or 8 level hole patterns. This manual is written to cover an eight level system but applies to the five, six and seven level systems. The difference in the systems consists of the data recording levels appropriate to the perforator supplied and the deletion of the circuitry for the levels omitted. This section contains the preoperation checks to be performed in preparation for use of the system.

NOTE

Before attempting to operate the system the operator should thoroughly understand the information contained in this section and be familiar with the theory contained in Section IV.

3-3. FUNCTIONAL OPERATION. The GP-2-300P High Speed Perforator System is designed to operate as a recording subsystem of a digital data generating system. Power input, timing signals, code input and control signals of the GP-2-300P System are interconnected to a data generating system, hence master control of the perforator system is a function of the data generating system. Figure 3-1 is a block diagram of a typical system integration. The controls and power indicator lamp shown at the top of Figure 3-2 are provided as standard. During system integration with the data generating system these controls may have been moved to a centralized master control and display panel. Refer to the principles of operation (Section IV) for more detailed information on functional operation.

3-4. PREPARATION FOR USE.

3-5. GENERAL. Before operating the GP-3-200P High Speed Tape Perforating System, preparatory steps must be taken to insure proper operation and prevent interruption to data recording.

NOTE

Make sure the power ON-OFF switch (2, Figure 3-2) is in the OFF position.

3-6. OIL LEVEL CHECK. The oil level window (14, Figure 3-2) is inscribed with two horizontal lines. The proper oil level, when perforator is not operating (drive motor power off), is between these two lines. If oil level is low, add oil as outlined in (d) and (e) of paragraph 6-6.

3-7. LOADING TAPE. Load and thread tape according to the following procedure (see Figures 3-2, 3-3 and 3-4):

- (a) Move the slack tape arm (22, Figure 3-2) to the right and lock at the tape tension snubber.
- (b) Draw the tape well housing (18) forward and down (see position of well, 6, Figure 3-3).
- (c) Grasp the spring loaded knob (1) with the left hand and pull straight out. This knob is attached to the left half of the tape hub (2).
- (d) Hold roll of tape in the right hand with tape feeding from top of roll toward the panel.
- (e) Place core of tape roll on right hand hub in tape well. Release left hand spring loaded knob, seating hub in core of tape roll.
- (f) Thread tape under and in back of the roller (4) on the tight tape sensor arm.

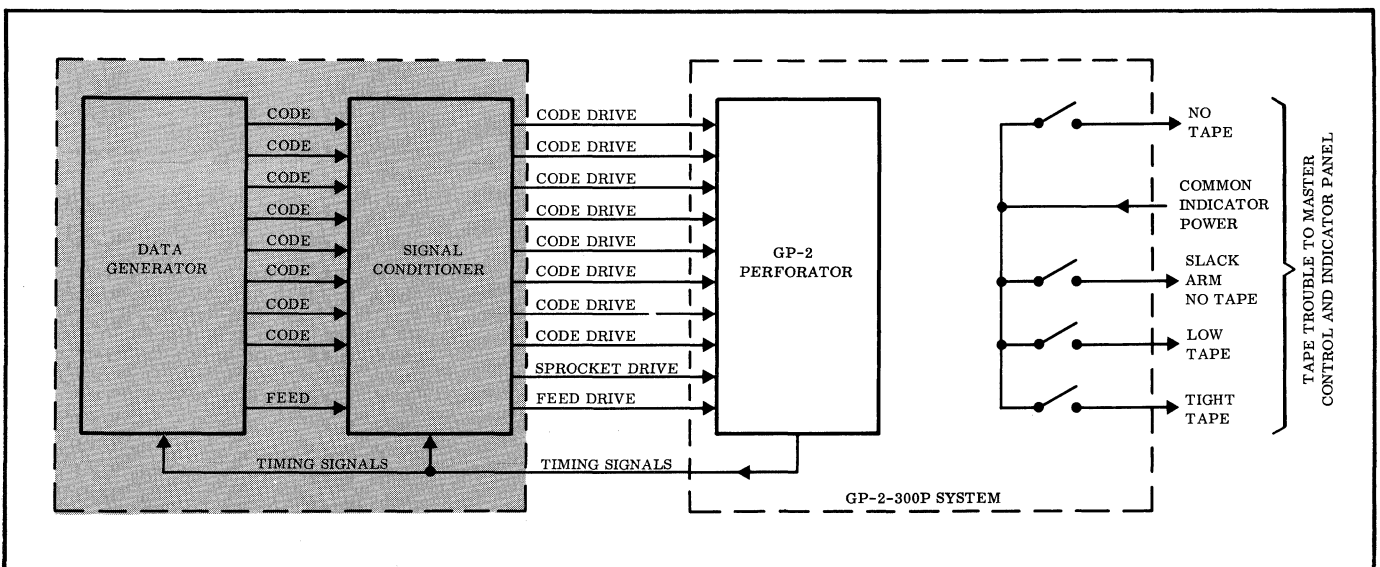
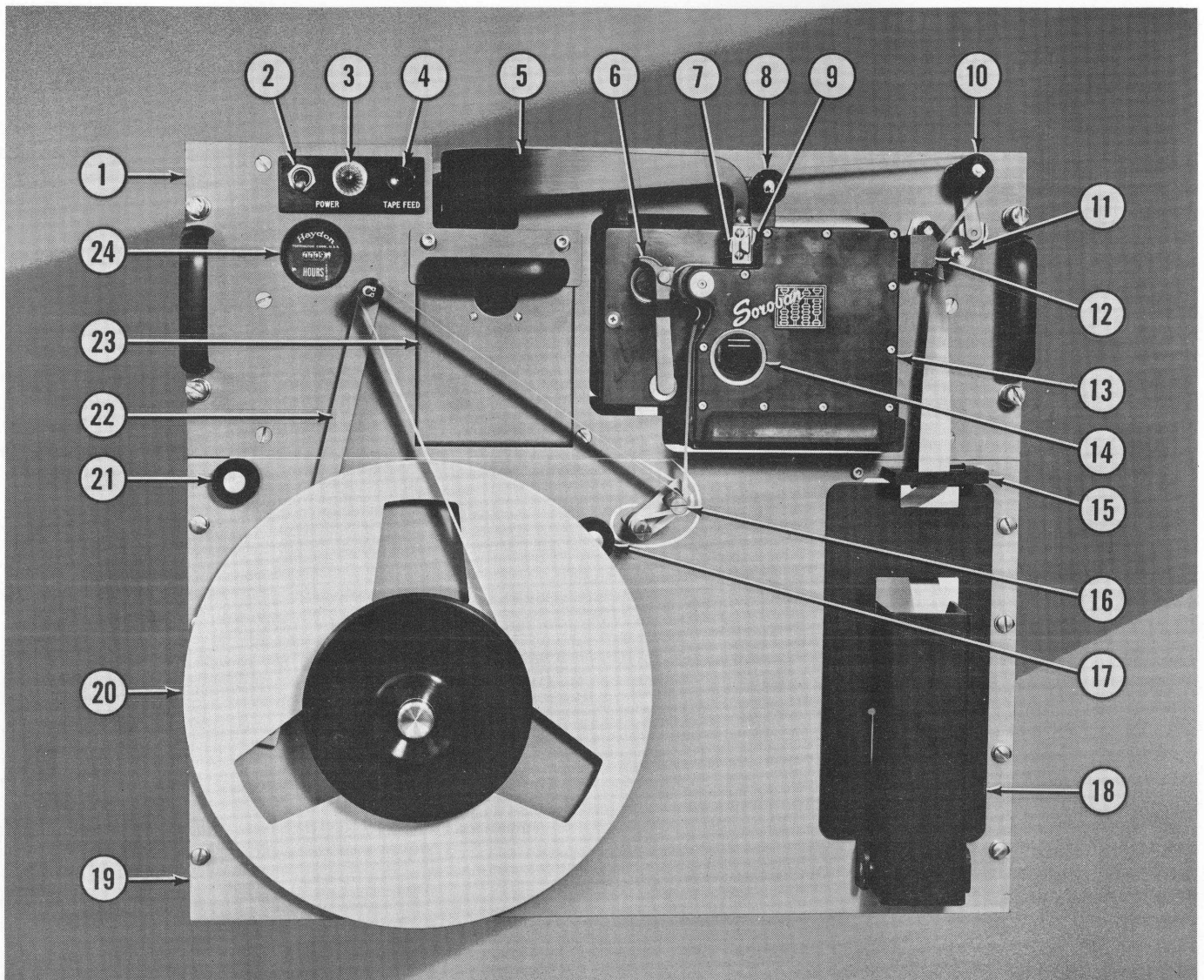


Figure 3-1. Simplified Block Diagram Showing Typical Code Inputs



- | | |
|----------------------------|--------------------------|
| 1. GP-2-300 PANEL | 13. GP-2 PERFORATOR |
| 2. POWER ON-OFF SWITCH | 14. OIL LEVEL WINDOW |
| 3. POWER INDICATOR LAMP | 15. TAPE GUIDE SUPPORT |
| 4. TAPE FEED SWITCH | 16. TAPE TENSION SNUBBER |
| 5. CHAD CHUTE | 17. RIGHT HAND BUMPER |
| 6. TAPE DEPRESSOR ARM | 18. TAPE SUPPLY WELL |
| 7. DIE BLOCK | 19. MODEL P TAPE PANEL |
| 8. SPONGE RUBBER ROLLER | 20. TAPE PICKUP REEL |
| 9. TAPE GUIDE | 21. LEFT HAND BUMPER |
| 10. TAPE TENSION DECOUPLER | 22. SLACK TAPE ARM |
| 11. NO TAPE SENSING ROLLER | 23. CHAD BOX |
| 12. ROLLER STOP | 24. ELAPSED TIME METER |

Figure 3-2. GP-2-300P High Speed Tape Perforator System

- (g) Bring tape forward and feed vertically through the guide support (5) in front of the roller and pull through approximately three feet of tape.
- (h) Twist tape 90 degrees counterclockwise and feed vertically through the wire tape guide and between the no-tape sensor roller (11, Figure 3-2) and the roller stop (12).
- (i) Pass the tape to the right under and up over the sponge rubber decoupler (10).
- (j) Pass the tape over and down the left side of the sponge rubber roller (8).
- (k) Pass the tape down the right side and under the die block (7).

3-14. TAPE LINT REMOVAL. Tape lint, a normal byproduct during operation, could produce a jammed tape if allowed to accumulate. As a precautionary measure the die block should be inspected and cleaned of foreign matter following each 1000 feet of tape perforated. A special die block scraper tool (2, Figure 3-5) is located on the back of the chad box. Figure 3-6 illustrates the use of the die block scraper tool.

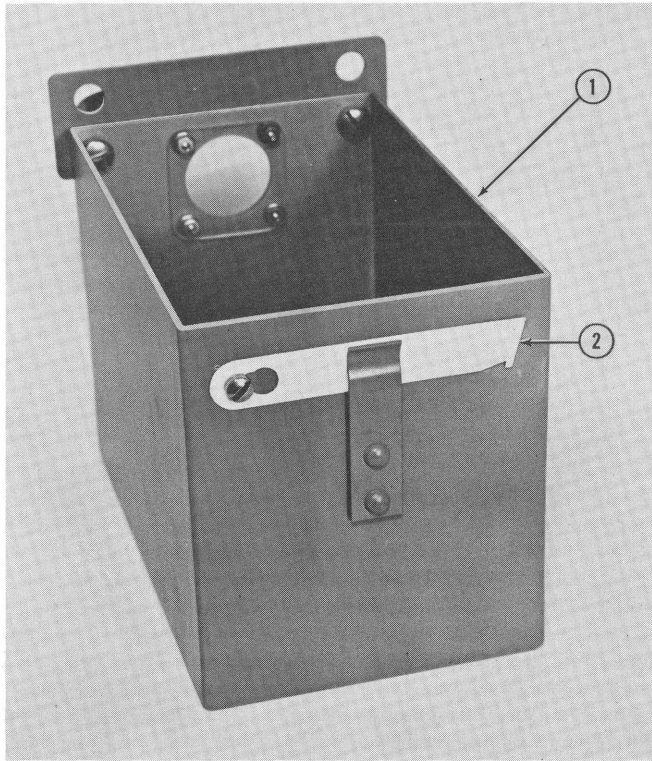


Figure 3-5. Die Block Scraper Tool Location

CAUTION

Drive motor power must be OFF when using scraper tool.

3-15. OIL LEVEL CHECK. Check the oil level in the GP-2 Perforator periodically (see Paragraph 3-6).

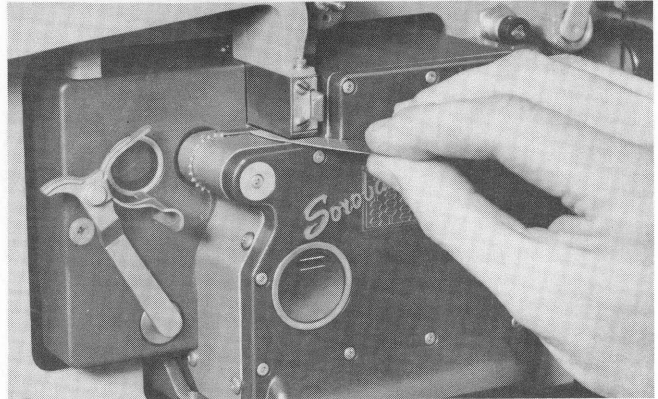


Figure 3-6. Using The Die Block Scraper Tool

SECTION IV

PRINCIPLES OF OPERATION

4-1. GP-2-300P SYSTEM.

4-2. GENERAL. The GP-2-300P High Speed Tape Perforating System consists of a GP-2 High Speed Tape Perforator; a Model GP-2-300 Panel with drive motor, input connectors to receive the power and code character drive signals; and a Model P Tape Panel with tape supply well, tape pickup reel, drive motor and control circuitry. A simplified block diagram, Figure 3-1, shows the GP-2-300P System integrated with a data generating system. In this diagram, all control signals presented to the GP-2-300P System are supplied from the signal conditioner portion of the data generating system with the GP-2-300P System supplying the synchronization timing signals to the data generating system. In the following discussion, the GP-2 High Speed Tape Perforator will be referred to as the GP-2, the Model GP-2-300 Panel will be referred to as the perforator panel and the Model P Tape Panel will be referred to as the tape panel, to simplify reference to these units. The GP-2-300P System produces a five, six, seven or eight level perforated tape, which provides a permanent record of the data. This manual is written to cover an eight level system but applies to the five, six and seven level systems as well.

4-3. GP-2-300 PANEL.

4-4. GENERAL. The perforator panel contains the drive motor, shock mount and plug-in connectors for the GP-2, a no tape sensor, chad chute and collection box, ON-OFF power switch and indicator, manual tape feed switch, elapsed time meter and input connectors for code character drive signals and input power. Where a Model GP-2 is employed a reluctance pickup is mounted on a circular plate attached to the motor mount casting. Where a Model GP-2A is employed the reluctance pickup is housed within the GP-2A.

4-5. DRIVE MOTOR. When the drive motor is initially energized, approximately two seconds are required for the motor to attain proper speed for perforating 300 code characters per second. The drive motor is connected to terminals 1, 2 and 3 of TB2 (Figure 2-3).

4-6. NO TAPE SENSOR. The no tape sensor switch (S1, Figure 2-3) is a mechanically operated SPDT microswitch to sense an exhausted tape supply or broken tape between the tape supply and the GP-2. The contacts of this switch are wired to pins 35, 36 and 37 of connector J4. Pins 35 and 36 are the normally closed contacts. During normal operation, the presence of tape between the sense arm roller and roller stop holds the contacts connected to pins 35 and 36 open and closes the contacts connected to pins 36 and 37.

4-7. POWER ON-OFF SWITCH AND INDICATOR. The power ON-OFF switch (S3, Figure 2-3) controls the 115 volts 60 cycle a-c to the drive motor for the GP-2. This DPST switch is connected between pins 1 and 2 of connector J3 and terminals 1 and 2 of TB1 respectively. The indicator lamp DS1 is connected to terminals 1 and 2 of TB1. When the switch is in the ON position the indicator is lighted and power is applied to the drive motor and elapsed time meter.

4-8. ELAPSED TIME METER. The elapsed time meter (24, Figure 3-2) is wired to terminals 1 and 2 of TB1. When the power switch is in the ON position (perforator drive motor energized) the elapsed time meter operates, recording and indicating total hours of operation. This aids in scheduling perforator oil changes and other maintenance.

4-9. TAPE FEED SWITCH. The perforator panel contains a TAPE FEED switch to manually advance tape through the perforator. The contacts of this momentary (pushbutton) switch are wired to pins 3, 4 and 5 of connector J3 for cabling to the master control panel of an integrated system. When connected into a system, this switch provides the operator a convenient means to advance tape through the perforator during tape loading operations. Pins 3 and 4 are the normally open contacts.

4-10. MODEL P TAPE PANEL.

4-11. GENERAL. The tape panel, located beneath the perforator panel, contains a 1000-foot capacity recessed tape well on the right hand side, a twin post stationary tension snubber, a standard 1000-foot capacity NAB or single flange Amerline pickup reel and a slack tape arm (which contains the clutch brake drive assembly).

4-12. TAPE SUPPLY WELL (Refer to Figures 6-7 and 6-8). The tape well is equipped with a drag brake and drum to maintain proper tape tension, a microswitch for detecting tight tape, and a microswitch for signaling a low tape supply. Contacts of these microswitches are wired to the connector J1 (Figure 2-4) for cabling to the master control panel of an integrated system.

4-13. TIGHT TAPE SENSOR. The tight tape sense SPDT microswitch contacts are wired to pins 3, 4 and 5 of the connector J1. Pins 3 and 5 are the normally closed contacts. During normal operation, the contacts connected to pins 3 and 4 are open and the contacts connected to pins 3 and 5 are closed. When a tight tape condition exists, the tape tension moves the arm forward, opening the contacts connected to pins 3 and 5, and closing the contacts connected to pins 3 and 4.

4-14. LOW TAPE SUPPLY SENSOR. The low tape supply sense SPDT microswitch contacts are wired to pins 6, 7 and 8 of the connector J1. Pins 6 and 8 are the normally closed contacts. When adequate tape supply is available, the contacts connected to pins 6 and 7 are open and the contacts connected to pins 6 and 8 are closed. When a low tape condition exists, the small diameter of the tape roll allows the sense arm to actuate the microswitch, opening the contacts connected to pins 6 and 8, and closing the contacts connected to pins 6 and 7.

4-15. TAPE TENSION SNUBBER. The twin post stationary snubber is a friction device which eliminates the tape pickup tension from the tape advance sprocket of the GP-2.

4-16. TAPE PICKUP REEL. The 1000-foot capacity tape pickup reel may be either a double flange NAB hubbed reel or a single flange Amerline reel. The NAB reel (20,

Figure 3-2) is 10.5 inches in diameter and has two metal flanges permanently attached to a metal hub. The hub contains slots for friction retention of the start end of the tape. The NAB reel accommodates only one width of tape and is available for the three standard tape widths used. The Amerline reel is a 10.5 inch diameter molded plastic single flange and hub reel equipped with an overlapping metal band for friction retention of the start end of tape. The loose fitting metal band with the spooled tape is removed from the plastic hub, slightly compressed, removed from the spooled tape and replaced on the hub. The Amerline reel is a universal type reel and accommodates any of the three standard width tapes.

4-17. SLACK TAPE ARM. The slack tape arm located on the left of the panel is attached to a spring loaded shaft passing through the panel. In back of the panel, the shaft is equipped with a pie section cam having a special peripheral contour to actuate the microswitch for control of the drive clutch assembly of the tape pickup reel (see Figure 6-9). One of the radial edges of the cam actuates the slack or no-tape sense microswitch. Both microswitches are SPDT switches.

4-18. CLUTCH AND BRAKE. The clutch control microswitch (S1, Figure 2-4) is wired into the assembly and utilizes the normally closed contacts. When the slack arm is against the left hand bumper (21, Figure 3-2) (slack or no-tape position), the switch contacts are opened, releasing the clutch and applying the brake. When the slack arm is against the right hand bumper (17, Figure 3-2) (tight tape position), the contacts are again opened, releasing the clutch and applying the brake. During normal operation, as the tape is picked up by the reel, the tension applied to the arm moves the arm toward the right. At a point controlled by the cam, the switch contacts are opened and the clutch is released. The tape continuing to feed from the GP-2 reduces the tension on the arm allowing the arm to move toward the left until it reaches another point controlled by the cam, at which time the switch contacts close and engage the clutch. In this manner the arm oscillates back and forth through a predetermined arc and maintains a smooth tape pickup.

4-19. SLACK TAPE SENSOR. The slack or no tape microswitch is wired to pins 9, 10 and 11 of connector J1 (Figure 2-4) for cabling to the master control panel of an integrated system. Pins 9 and 11 are the normally closed contacts. When the slack arm is against the left hand bumper, the radial edge of the cam actuates the microswitch to close the contacts connected to pins 9 and 10 and open the contacts connected to pins 9 and 11.

4-20. GP-2 HIGH SPEED TAPE PERFORATOR.

4-21. GENERAL. The GP-2 High Speed Tape Perforator (Figure 4-1) is used for varied applications such as high speed communications, analog-to-digital recorders, code converters, computer output and data logging for both commercial and military use. The GP-2 perforating rate is 300 code characters per second. The operating speed, extreme reliability of punching, plus long life, identifies the GP-2 as an outstanding achievement in the tape recording equipment field.

4-22. CYCLING OPERATION. In the GP-2, a pair of reciprocating motions for cycling the tape feed and perfo-

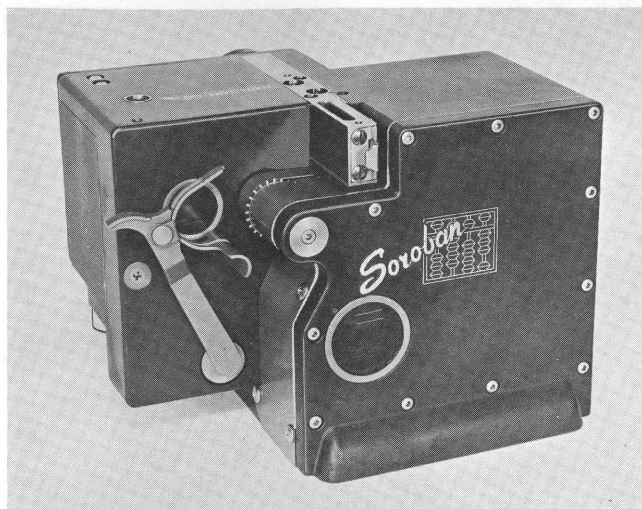


Figure 4-1. GP-2 High Speed Tape Perforator

rating operations are derived from a constant rotational power source. Each reciprocating drive is selectively coupled to its load at a pre-established drive shaft position. Thus both reciprocating motions are designed to be stationary while their respective feed and perforating loads are coupled and decoupled. (See Figures 4-2 and 4-3.) The basic cycling motions are derived from two constant diameter triangular (three lobe) cams operated in an oil splash bath. The relative phasing of the cams is established by a toothed drive belt between the camshafts. The tape feed camshaft rotates at twice the rpm of the perforating camshaft.

4-23. CAMS AND FOLLOWERS. The three lobe cam systems permit generation of reciprocating motions free of resonance effects so common to spring-loaded cam-follower systems. Thus, positive following is maintained throughout the complete operating cycle. The cams are precision ground so that the measured diameter at any angular position deviates by no more than 0.0002 inch from the specified diameter. This configuration permits parallel sides of enclosing "U" shaped cam-followers to maintain contact with opposing sides of the cams during cam rotation. When the camshafts are driven at a constant speed, the cam-followers become stationary at the extremes of their cyclic strokes. The two stationary intervals last for one-sixth of a camshaft revolution.

4-24. TAPE FEED SYSTEM.

4-25. GENERAL. In the perforator tape-feed system, two separate stationary intervals provide time for positively coupling and decoupling the drive sprocket to the feed driving member. The resultant mechanism permits tape to be both power accelerated from rest as feed commences and smoothly driven to rest following feed. Since impacts are eliminated, sprocket hole deterioration and mechanical wear are reduced to a minimum. The geometry of the Model GP-2 Perforator's tape feed system produces alternate clockwise and counter-clockwise drives of the tape feed cam-follower. (See Figures 4-2 and 4-3). The feed cam is supported within a cam-bearing housing on a preloaded ball bearing pair. The cam-follower, control magnets and cam-bearing housing with enclosed cam are designed to pivot about the feed sprocket shaft.

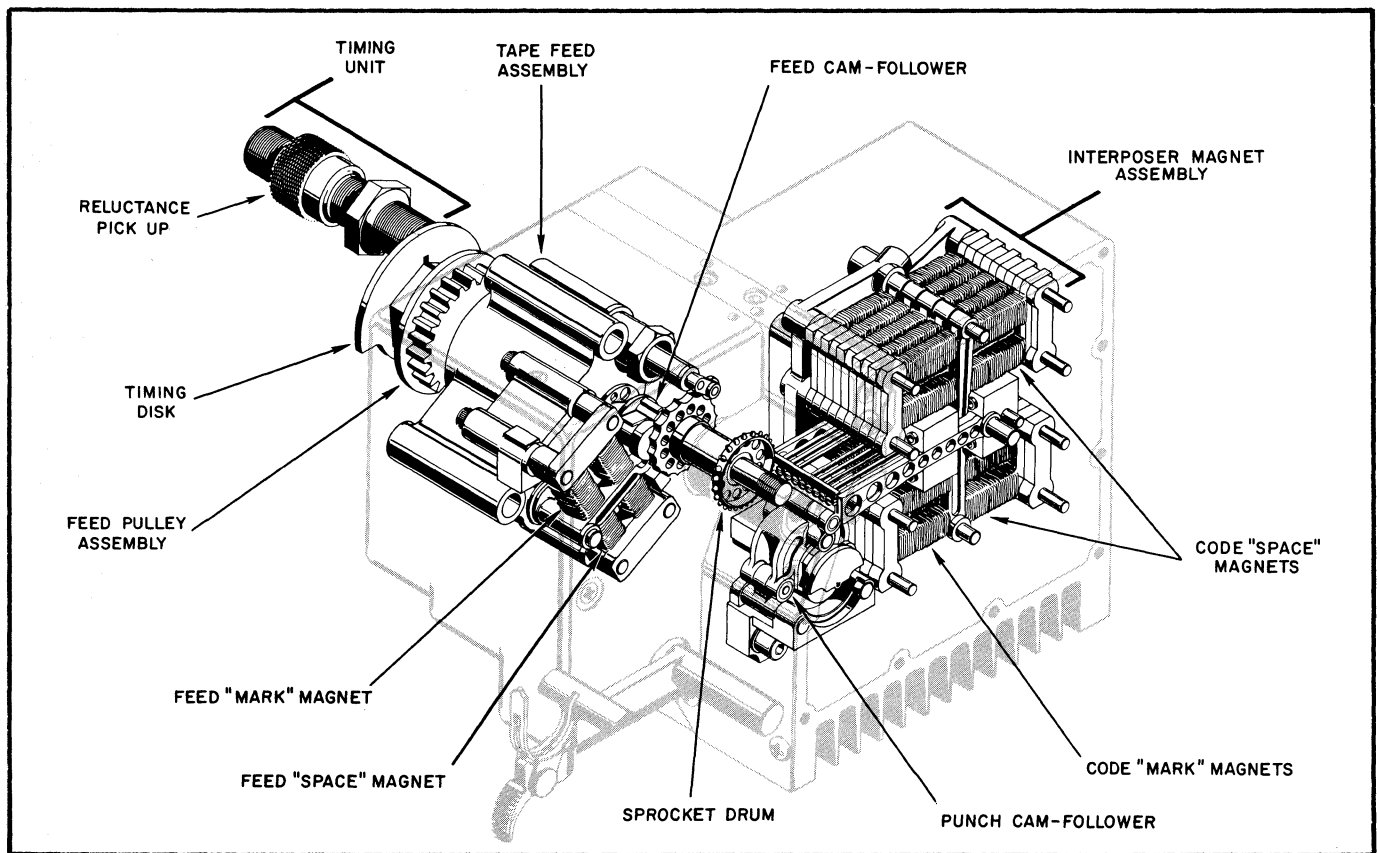


Figure 4-2. Model GP-2 Perforator, Interior Assembly View

4-26. FEED CYCLE. As indicated in Figure 4-3F, 135 degrees of the tape feed cycle are available for counterclockwise drive of the tape feed cam-follower and 105 degrees of the feed cycle for clockwise drive of the cam-follower. The feed cam-follower is stationary at both extremes of its pivotal stroke for 60 degrees of the tape feed cycle.

4-27. TAPE ADVANCE. Tape advance is controlled by the tape feed mark magnet visible in Figure 4-2, and timed by an armature reset cam. To initiate forward transport of tape, drive signal energy is applied to the tape feed mark magnet during the period the feed cam follower is pivoting in a clockwise direction. During this interval full mark magnet pull may be established since the armature reset cam prevents engagement of the feed pawl with the rectangular ratchet teeth of the feed sprocket drum. During the interval when the feed cam follower is stationary at its maximum clockwise position, the retreating armature reset cam permits smooth insertion of the pawl, through the slitted boss of the cam follower, into the ratchet teeth of the sprocket drum by the magnet armature. The magnet pull on the armature maintains positive locking of the pawl in the drum. The feed cam follower then rotates in a counterclockwise direction, turning the sprocket which advances the tape. At the completion of feed, of one character space, when the cam follower is stationary at its maximum counterclockwise position, the armature reset cam smoothly removes the pawl from the sprocket drum ratchet teeth. If further feed is to be inhibited, the feed mark magnet drive is removed and simultaneously the feed space magnet is energized, restraining the armature, holding the pawl out and inhibiting tape feed. A spring-

loaded detent roller maintains the feed sprocket indexed following tape advance. To prevent resonance effects the detent roller's torsion spring has been designed to resonate at frequencies no lower than 2000 cycles per second. It should be noted that the torsion spring is the only spring in the GP-2 and does not contribute any active force to position the sprocket during dynamic operation of the perforator.

4-28. MECHANICAL WEAR. The basic feed geometry eliminates sliding motions between engaged driving parts since both the pawl and driving follower are pivoted about the driven sprocket shaft. The configuration effectively eliminates wear.

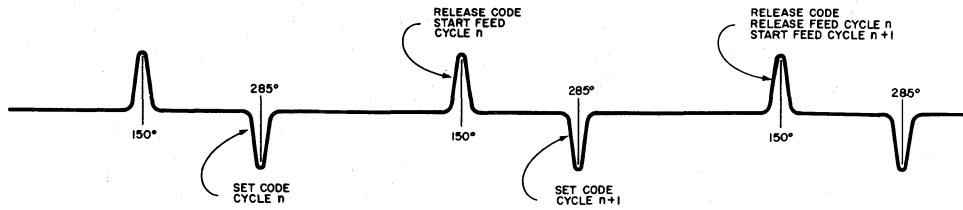
4-29. LUBRICATION. All working parts of the perforator are contained within the oil splash bath enclosure. In addition, all bearing surfaces in the feed drive system are pressure lubricated by an internal oil pump.

4-30. TAPE PERFORATING SYSTEM.

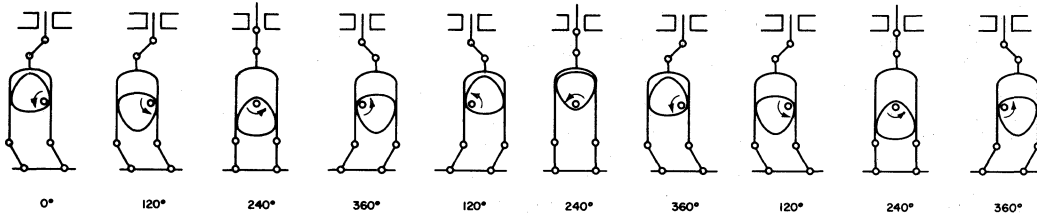
4-31. GENERAL. The tape perforating motion derived from a three lobe cam and "U" shaped cam-follower is translated by a toggle system to a punch bail with punch pin interposers. The translation results in two punch cycles per punch camshaft revolution.

4-32. CAM-FOLLOWER TOGGLE OPERATION. As the punch drive camshaft rotates, the cam-follower is moved back and forth from one side to the other. Since the cam-follower drives a punch bail-link anchor-link toggle, each movement of the cam-follower to one side is translated by

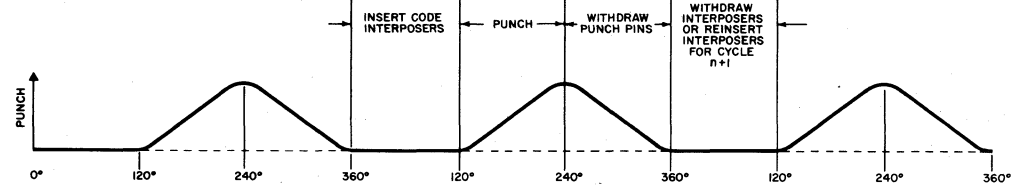
A
TIMING SIGNALS FROM PICK-UP (SHIELD GROUND)



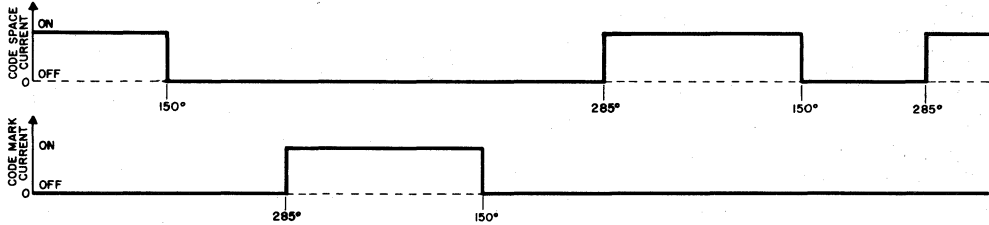
B
PUNCH CAM AND FOLLOWER MOTION



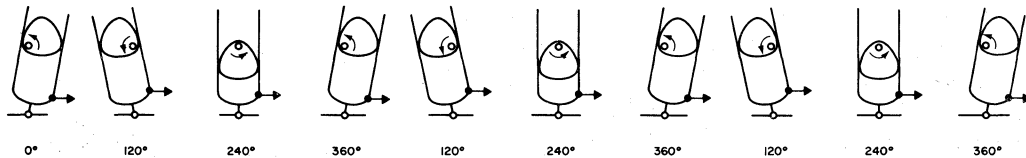
C
PUNCH BAIL AND SELECTED PUNCH PIN MOTION



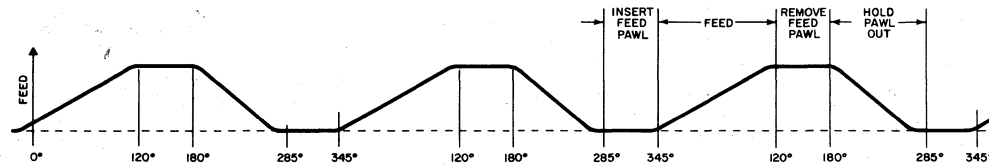
D
CODE MAGNET EXCITATIONS AS ARE REQUIRED TO PUNCH ONE HOLE IN CHANNEL 'X' DURING RECORDING CYCLE n



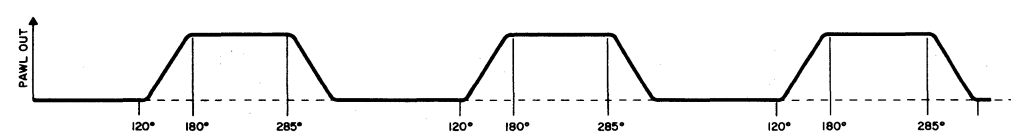
E
FEED CAM AND FOLLOWER MOTIONS



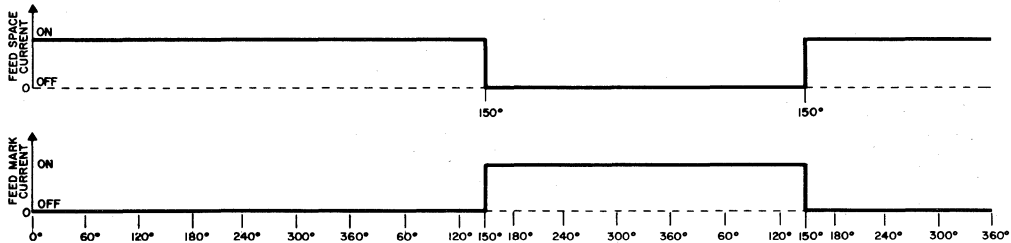
F
FEED CAM FOLLOWER PIVOTAL MOTION



G
FEED ARMATURE RESET CAM



H
FEED MAGNET EXCITATIONS AS ARE REQUIRED TO PRODUCE A SINGLE CHARACTER OF TAPE ADVANCE FOR RECORDING CYCLE n



ELECTRICAL OR CYCLE DEGREES = ANGULAR DISPLACEMENT OF FEED CAM SHAFT

Figure 4-3. Cam Actions and Mechanical Motions In Relation To Punch Timing

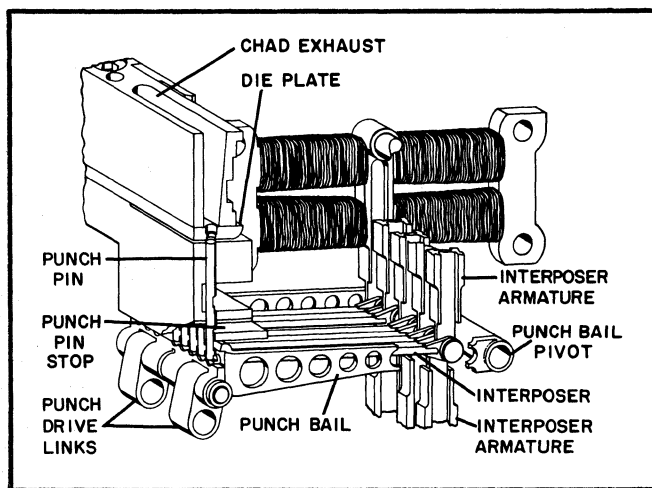


Figure 4-4. Punch, Die, Punch-Bail and Interposers

the anchor-link toggle into a punch bail drive. When the cam-follower is moved to the other side another punch bail drive is generated (see Figures 4-2 and 4-3B). Therefore, two punch cycles are generated for one revolution of the perforating camshaft. The degrees shown on Figure 4-3B are degrees of a punch cycle.

4-33. PUNCH BAIL AND INTERPOSERS. The punch bail contains a punch pin interposer for each data code level plus one for the sprocket hole. The punch bail is stationary for one-third of each punch cycle. (See Figures 4-3C and 4-4.) During the period when the punch bail is stationary, the selected code mark magnets must be energized to insert interposers between the bail and punch pins. During the upward drive period, the bail drives the selected punch pins through the tape and into the die block. On the bail return stroke, drive must be removed from the mark magnets and the code space magnets must be energized to withdraw the interposers. The bail continues downward and positive withdrawal of the punch pins is accomplished by the engagement of the bail's edge with the flat notch ground in the punch pins. The punch pin stroke is approximately 0.032 inch, of which 0.013 is for penetration of the punch pins into the die plate and 0.010 is for withdrawal into the guide block for stripping.

4-34. PERFORATING CYCLE. The perforating cycle degrees correspond to the tape feed cycle degrees since the punch camshaft produces two punch cycles per revolution and rotates at half the rpm of the tape feed camshaft. (See Figures 4-3C and 4-3F.)

4-35. CODE AND SPROCKET MAGNETS. Modified horseshoe or "U" shaped electromagnets are employed for positive operation of the punch pin interposers. Two such magnets are used for each code level and the sprocket hole punch pin interposers, one magnet for mark and one for space. The armature flux reaches its maximum 0.6 millisecond after application of excitation signals and as a result, first motion of the armature takes place approximately 0.4 to 0.6 millisecond after application of the sequencing drive signals. Similarly, armature flux decay follows removal of the applied coil drive signal by 0.4 to 1.0 millisecond or more if coil transients are suppressed excessively.

4-36. CODE MAGNET EXCITATION. The recommended excitation interval for the code mark magnets extends from 0.7 millisecond before the punch bail becomes stationary following a punching cycle to 0.3 millisecond after the next punch drive stroke has been initiated (see Figure 4-3). Thus, the approximate duty cycle for sequencing signals need only be 62%. The desired excitation interval for the code mark and space magnets is derived from the timing signals supplied the data generating equipment by the reluctance pickup of the GP-2 Perforator.

4-37. PHASING OF SYNCHRONIZING SIGNALS. The GP-2's electrical drive signals are applied in synchronism with the output signals of a timing reluctance pickup (Figure 4-3A). The reluctance pickup derives its output from a notched disc mounted on the rear of the feed camshaft (Figures 4-2 and 4-5). When the disc rotates to the point where iron bridges the pickup's gap, a magnetic circuit is established and an output pulse produced. Removal of the iron produces a pulse of opposite polarity. Proper disc phasing with respect to the punch and feed shafts is illustrated in Figure 4-5. For a perforator operating at 300 code characters per second, typical tape feed and punch control signals have been plotted in Figure 4-3, with respect to the timing signal output of the reluctance pickup. The timing signal output is plotted in Figure 4-3A, the punch control signal in Figure 4-3D and the tape feed signal in Figure 4-3H. Where a Model GP-2 is employed, the reluctance pickup is externally mounted on a circular plate attached to the drive motor mount casting. The gap between the pickup and synchronizing disc should be between 0.030 and 0.045 inch. Where a Model GP-2A is employed, the reluctance pickup is housed within the GP-2A with the gap adjusted at the factory. The synchronizing disc on the GP-2A is a one-piece magnetic disc.

4-38. ELECTRICAL DRIVE REQUIREMENTS. At 300 code characters per second, the complete recording of one character including tape advance must be accomplished in approximately 3.3 milliseconds. To achieve adequate response times, the time constant of the GP-2 control magnets must be reduced through appropriate design of external drive circuits as illustrated in Figure 2-2. The initial overvoltageing of the magnet coils through use of series dropping resistors and peaking capacitors is a definite necessity. The GP-2 should not be operated from drive sources of lower potential than 50 volts. The warranties only apply to GP-2's operated from circuits illustrated in Figure 2-2. When the operation cycle involves punch and then feed, the sequence of control signals illustrated in Figures 4-3D and 4-3H would apply for a single character recording. Such operation permits servicing personnel to observe the last recorded character during system checkout. Care should be exercised to remove drive from the control magnets when the drive motor is turned off and cooling is removed. It is recommended that current be applied to all space magnets when the drive motor is initially turned on and operating on a standby basis. After the drive motor is turned off, while the motor is coasting to a stop, drive should be held on the space magnets for the required five seconds or so, and removed thereafter. If drive power is left on the magnets, when the motor is not operating, the magnets will overheat and premature oil sludging will result, possibly impairing perforator performance.

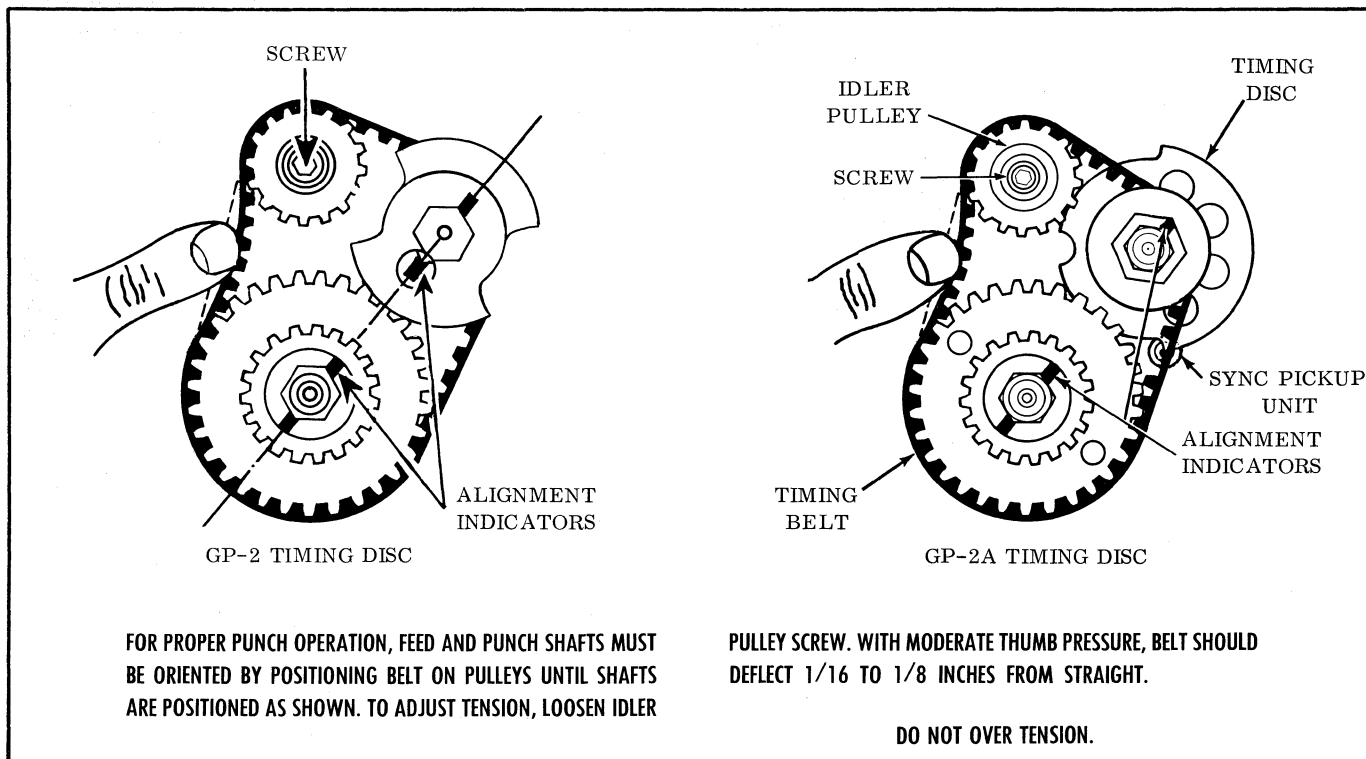


Figure 4-5. Punch and Feed Drive Shafts and Timing Disc Alignment

4-39. FEED FOLLOWED BY PUNCHING. If feed followed by punching accords system simplicity, such operation can be achieved by advancing the waveforms of Figure 4-3H by 360 degrees. In this instance, the last recorded character will be positioned immediately above the punch pins in the punch and die assembly.

4-40. PREFERRED TAPE CHARACTERISTICS. For optimum equipment life, use of heavily oiled rolled paper tape is recommended. Recording in tape of 25 to 30 percent oil content will produce a greatly improved punch and die life expectancy over that obtainable from a punch operated with dry paper tape. Although the GP-2 is designed to punch plastic or paper tape up to 0.005 inch in thickness, paper or plastic tapes thinner than 0.0025 inch should not be employed. The design provides for exertion of a 10-pound force for each perforated hole.

CAUTION

Although the force is adequate to punch steel or other metallic tapes, punching of materials as hard as Rockwell 35C will result in serious damage to the punch.

4-41. PUNCHING PHOTO TAPES. Since lubricant is routed to the punch pins, a punch pin which repetitively enters a previously punched hole will gradually wick oil to the sides of that hole and create an oil spot. In the GP-2 Perforator all punch pins are electromagnet controlled, including the tape advance sprocket hole punch pin. To eliminate oil spots, associated control circuits must be designed to direct one sprocket punch signal for each character recorded. The sprocket hole punch magnet must not be held energized continuously or oil wicking will result in oil spots.

SECTION V

TROUBLE SHOOTING

5-1. GP-2-300P HIGH SPEED TAPE PERFORATING SYSTEM.

5-2. GENERAL. Trouble shooting the Model GP-2-300P High Speed Tape Perforator System is comparatively simple and requires a minimum of test equipment.

5-3. TEST EQUIPMENT. The following pieces of electronic test equipment are adequate to trouble shoot the GP-2-300P System:

VOM	Simpson 260 or equivalent.
Oscilloscope	Tektronix 530 or 540 series with CA plug-in unit or equivalent.

5-4. TROUBLE SHOOTING PROCEDURES. After becoming thoroughly familiar with the information in the preceding sections of this manual, follow the procedures outlined in Table 5-1. Functional difficulties within the GP-2 Perforator require the faulty perforator be returned to the factory for servicing.



Any attempt to open the GP-2 Perforator in the field will void its warranty.

Table 5-1. Functional Trouble Shooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Perforator drive motor fails to run when energized. (GP-2-300 Panel)	(a) 115V a-c power not reaching motor.	(a) Refer to Figure 2-3. Check terminals 1 and 2 of TB1 with VOM for 115V a-c. If power is not available check power source and switch S3. If power is available see cause (b).
	(b) Open or shorted motor capacitor C1.	(b) Place switch S3 in OFF position. Short capacitor C1 (Figure 2-3) to remove any residual charge. Replace capacitor C1 per paragraph 6-11. If motor still fails to run see cause (c).
	(c) GP-2 Perforator jammed.	(c) Remove GP-2 Perforator from shock mount and energize motor. If motor fails to run see cause (d). If motor runs properly, return GP-2 to factory for service and repair.
	(d) Faulty motor.	(d) Place switch S3 in OFF position. Change motor per paragraph 6-12.
Perforator drive motor sluggish starting.	(a) Open or shorted motor capacitor C1.	(a) Place switch S3 in OFF position. Short capacitor C1 (Figure 2-3) to remove residual charge. Replace capacitor C1 per paragraph 6-11. If motor is still sluggish starting see cause (b).
	(b) GP-2 Perforator jammed or oil sludged.	(b) Remove GP-2 Perforator from shock mount and energize motor. If motor is still sluggish starting see cause (c). If motor starts properly, return GP-2 to factory for service and repair.

Table 5-1. Functional Trouble Shooting Chart (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
<p>Perforator drive motor fails to come up to operating speed.</p>	<p>(c) Faulty motor.</p> <p>See causes (a), (b), and (c) of "Perforator drive motor sluggish starting."</p>	<p>(c) Place switch S3 in OFF position and replace motor per paragraph 6-12.</p> <p>See Remedy (a), (b), and (c) of "Perforator drive motor sluggish starting."</p>
<p>GP-2 Perforator fails to punch when code signals are supplied to system.</p>	<p>(a) Code drive signals not reaching perforator.</p>	<p>(a) Refer to Figures 2-2 and 4-3D. Refer to data generating equipment manual covering drive circuits. Use oscilloscope and check for code drive signal output. Check initial overvoltage series dropping resistors and transistors for faulty components. Check all code levels. Replace faulty components as required. If all levels check properly, see cause (b).</p>
<p>GP-2 Perforator fails to punch when code signals are supplied to system (continued)</p>	<p>(b) Faulty magnet coil in GP-2 Perforator.</p> <p>(c) Timing signals out of synchronism.</p>	<p>(b) Remove GP-2 from shock mount and check resistance of magnet coils at connectors on rear of GP-2 (see P1, Figure 2-3). If magnet coil or coils check open, return GP-2 to factory for service and repair. If coils check properly, see cause (c).</p> <p>(c) Turn power off and remove GP-2 Perforator per paragraph 6-4. Check rear of GP-2 Perforator for correct feed and punch shaft alignment per Figure 4-5. Reinstall GP-2 Perforator per paragraph 2-20. Refer to the data generating equipment manual covering synchronization signal input terminals (signals supplied from pins 32 and 33 of J4, Figure 2-3). Adjust oscilloscope for two milliseconds per centimeter sweep and connect oscilloscope to the timing signal input terminals of data generating equipment. Refer to Figure 4-3A. Timing pulses should be symmetrical as follows: GP-2, 10 volts peak-to-peak; GP-2A, 6 volts peak-to-peak, or greater. The time interval between the 150° and 285° pulses should be between 1.2 and 1.35 milliseconds. If time interval is greater than 1.35 milliseconds, see trouble identified as "Perforator drive motor does not come up to speed." If the Model GP-2 timing pulses are less than 10 volts peak-to-peak, check the gap between the synchronizing disc and reluctance pickup per paragraph 6-8. If adjustment does not</p>

Table 5-1. Functional Trouble Shooting Chart (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
	(d) Faulty wiring on GP-2-300 Panel.	<p>provide proper pulse peaks, replace the reluctance pickup. If the Model GP-2A timing pulses are less than 6 volts peak-to-peak, return the perforator to the factory for service and repair.</p> <p>(d) With GP-2 Perforator removed from panel, check wiring from pins of J4 to pins of small connectors mounted on the perforator shock mount. Replace faulty wiring as necessary (see Figure 2-3).</p>
GP-2 Perforator fails to punch sprocket hole.	Sprocket drive signal not reaching perforator.	Follow the same procedures for the sprocket drive signals as outlined for the code drive signals, except check the sprocket drive circuits.
GP-2 Perforator fails to feed tape.	Tape feed signal not reaching perforator.	Follow the same procedures for the tape feed drive signals as outlined for the code drive signals except check the tape feed drive circuits.
GP-2 Perforator fails to operate at proper speed.	Faulty motor or perforator not operating properly.	Follow the same procedures outlined for drive motor sluggish starting.
NO-TAPE switch fails to open when tape supply is exhausted.	(a) Switch S1, Figure 2-3, out of adjustment.	(a) Adjust switch per paragraph 6-10.
	(b) Faulty switch S1, Figure 2-3.	(b) Replace switch S1, Figure 2-3, per paragraph 6-10.
Tape pickup reel (Model P Tape Panel) fails to spool tape when GP-2 is operating.	(a) Broken drive belt.	(a) Replace drive belt (see specifications). If motor is not running see cause (b) (c) and (d).
	(b) 115V a-c not reaching drive motor.	(b) Check 115V a-c source and control switch. Check terminals 1 and 2 of TB1 with VOM for 115V a-c, (Figure 2-4).
	(c) Open or shorted motor capacitor C1 (Figure 2-4).	(c) Replace capacitor C1 (3 mfd, 600V).
	(d) Faulty motor.	(d) If 115V a-c is present at terminals 1 and 2 of TB1, capacitor C1 has been replaced and motor does not operate, replace motor per paragraph 6-20.
	(e) Faulty rectifier circuit for tape pickup clutch.	(e) Check terminals 4 and 5 of TB1, Figure 2-4, for 150V d-c (switch S1 open). If 150V d-c is not present, check rectifiers CR1, CR2, CR3, CR4 and resistor R1 for faulty component and replace as required.

Table 5-1. Functional Trouble Shooting Chart (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
<p>Tape pickup reel (Model P Tape Panel) fails to spool tape when GP-2 is operating. (continued)</p>	<p>(f) Faulty clutch switch.</p> <p>(g) Faulty clutch power series resistor R1.</p> <p>(h) Faulty clutch assembly.</p>	<p>(f) Place switch (2, Figure 3-2) in the OFF position (GP-2 Perforator not operating). With tape properly threaded to pickup reel and 115V a-c applied to Model P Tape Panel (terminals 1 and 2 of TB1, Figure 2-4) manually rotate pickup reel clockwise until SLACK ARM (22, Figure 3-2) is approximately three inches to the right of the bumper (21). With VOM check terminals 5 and 6 of TB1 (Figure 2-4) for 90V d-c. If 90V d-c is not reaching terminals 5 and 6, check resistor R2, diode CR5 and switch S1 for faulty components. Replace faulty components as required. See paragraph 6-18.</p> <p>(g) With VOM check the series resistor R1 (mounted on screw 26, Figure 6-10) for continuity. This is a 300 ohm 5 watt resistor. Replace if required.</p> <p>(h) If 90V d-c is available at terminals 5 and 6 of TB1 and R2 and CR5 are not faulty, replace the clutch assembly per paragraph 6-21.</p>
<p>Tape pickup reel fails to stop and breaks tape.</p>	<p>Clutch-brake mechanism not operating properly (in 8, Figure 6-10)</p>	<p>(a) Check the adjustment of cam (8, Figure 6-9) per paragraph 6-18. If cam is properly adjusted proceed with step (b).</p> <p>(b) Set a VOM to read 90 volts d-c and connect the positive (+) lead to terminal 6 of TB1 (Figure 2-4) and the negative (-) lead to terminal 5. When the slack arm (5, Figure 6-9) is against the left bumper, panel front view, the voltmeter should read zero volts.</p> <p>(c) Move the slack arm approximately one-half inch to the right of the bumper. The voltmeter should read approximately 90 volts d-c.</p> <p>(d) Continue to move the slack arm to the right, as the switch roller (11) passes position "C" on cam (8) the voltmeter should read zero volts.</p> <p>(e) If voltmeter indicates 90 volts at all times, the switch (9) should be replaced per paragraph 6-18 steps (i) (j) and (k).</p>

Table 5-1. Functional Trouble Shooting Chart (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
<p>TIGHT TAPE switch fails to open when tight tape condition exists.</p> <p>LOW TAPE switch fails to open when tape supply reaches pre-determined low level.</p> <p>Slack arm NO TAPE switch fails to open when slack arm (22, Figure 3-2) is against left bumper (21).</p> <p>Slack arm operating range not proper.</p>	<p>Faulty switch or switch out of adjustment (S2, Figure 2-4).</p> <p>Faulty switch or switch out of adjustment (S3, Figure 2-4).</p> <p>Faulty switch or switch out of adjustment (S4, Figure 2-4).</p> <p>Improper adjustment of slack arm cam.</p>	<p>(f) Recheck the switch per steps (b) (c) and (d) above.</p> <p>(g) With slack arm (5, Figure 6-9) against left bumper, if takeup reel continues to rotate, remove the clutch-brake assembly per paragraph 6-22 and return it to the factory for service and repair.</p> <p>With VOM check pins 3 and 5 of J1 for opening and closing of S2. See paragraph 6-17 for the procedure. Replace switch if faulty.</p> <p>With VOM check pins 6 and 8 of J1 for opening and closing of S3. See paragraph 6-16 for procedure. Replace switch if faulty.</p> <p>With VOM check pins 9 and 11 of J1 for opening and closing of S4. See paragraph 6-18 for the procedure. Replace switch if faulty.</p> <p>Adjust cam per paragraph 6-18.</p>

SECTION VI

SERVICE AND REPAIR

6-1. SERVICE AND ADJUSTMENT.

6-2. GENERAL. The following paragraphs contain information necessary to service, adjust and repair the GP-2-300P High Speed Tape Perforator System at field level. When internal mechanical or electrical failures are isolated to the GP-2 Perforator, the perforator must be returned to the factory for servicing. The complexity of the mechanism and critical adjustments prohibit field maintenance.

NOTE

Care should be exercised to remove drive from the control magnets when the drive motor is turned off and cooling is removed. It is recommended that space - magnet current be applied to all magnets when the drive motor is turned on. After the drive motor is turned off, while the motor is coasting to a stop, drive should be held on the space magnets for the required five seconds or so, and removed thereafter. If drive power is left on the magnets, when the motor is not operating, the magnets will overheat and premature oil sludging will result.

6-3. GP-2 PERFORATOR AND GP-2-300 PANEL.

6-4. REMOVING THE PERFORATOR. To remove the perforator unit proceed as follows:

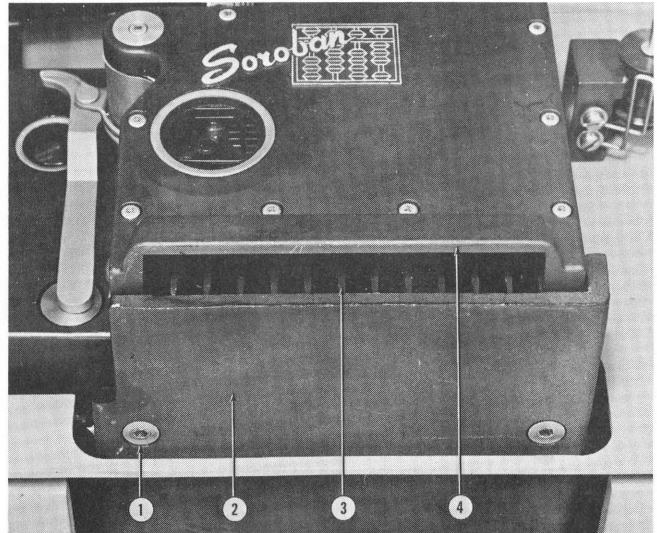
- (a) Place the 115V a-c power control switch (2, Figure 3-2) in the OFF position and disconnect the mating plug from J3 (Figure 2-3).
- (b) Remove the two screws (1, Figure 6-1).
- (c) Rock the perforator (4) gently to the right and left and draw forward. (The rocking motion will free the drive belt coupling the perforator to the drive motor and the plug-in connectors on the rear of the perforator.)

NOTE

If belt hangs up, it may be necessary to slide panel forward and reach behind punch and slide belt off pulley.

6-5. CHAD CHUTE REMOVAL. The chad chute (9, Figure 6-2) is attached to the perforator with three socket head screws. To remove the chad chute, remove the three screws (6, 7 and 8) and remove the chute. Replace in reverse order.

6-6. CHANGING THE PERFORATOR OIL. After removing the perforator from the GP-2-300 Panel, per Paragraph 6-4, proceed as follows for changing oil:



1. SCREW, MOUNTING
2. SHOCK MOUNTING
3. COOLING FINNS (GP-2)
4. GP-2 PERFORATOR

Figure 6-1. GP-2 Perforator On Shock Mount

- (a) Provide a suitable receptacle (a pan or basin of approximately one-quart capacity) in which to drain the oil.
- (b) Using a ^{9/16} 5/8 inch socket wrench, remove the oil drain plug (1, Figure 6-3) from the bottom of the perforator and thoroughly drain the oil (tilt the perforator from side to side to insure complete drainage).
- (c) Clean the magnetic tip of the oil drain plug and replace (make sure the "O" ring is on the plug).

NOTE

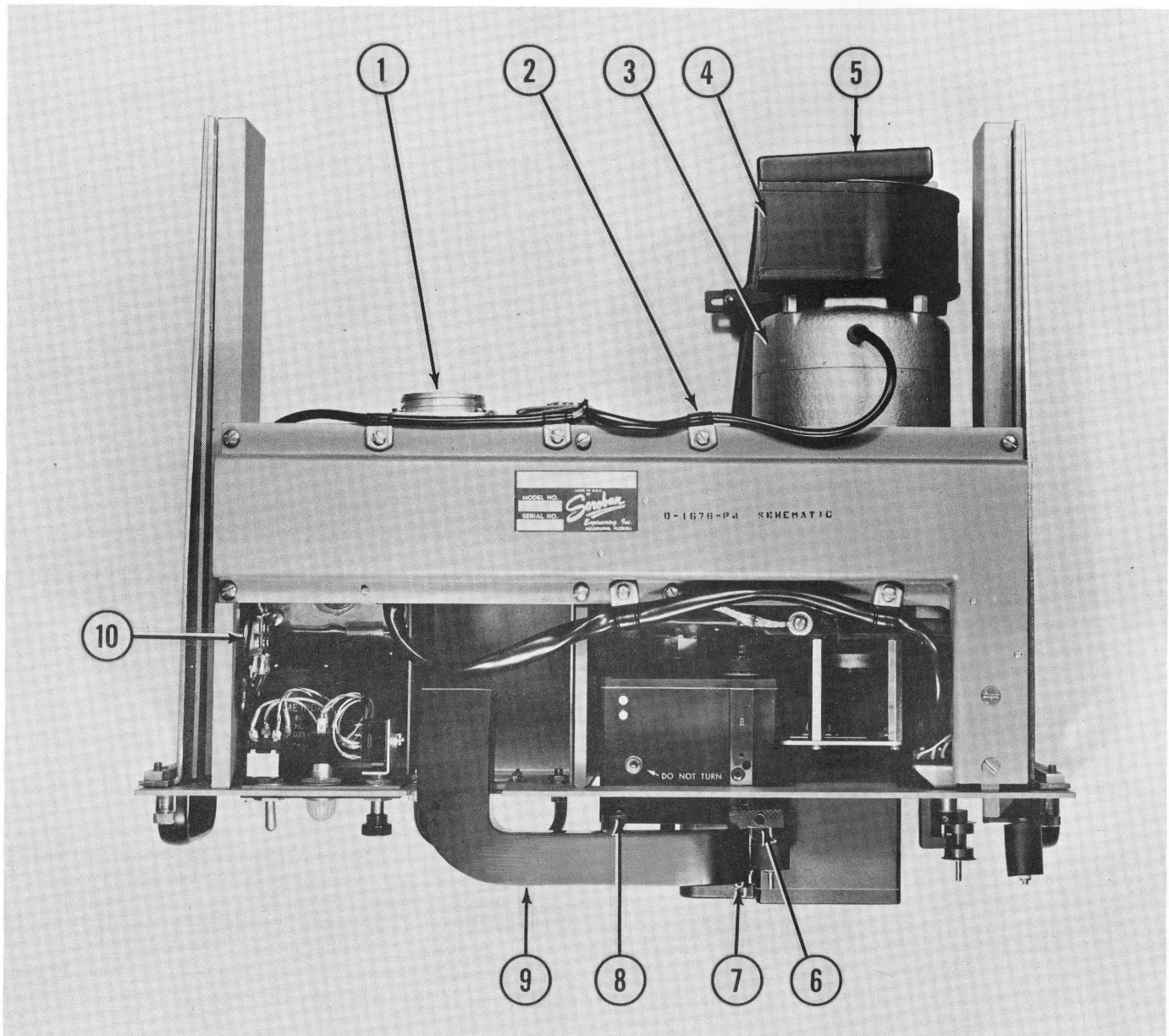
Never attempt to fill the perforator through the oil drain hole.

- (d) With the perforator in the upright position, remove the Phillips head screw from the oil filler plug (1, Figure 6-4).

CAUTION

Use only Lubriplate #0 oil* in the GP-2 Perforator.

*Lubriplate #0 oil can be obtained from Fiske Bros. Refining Co., 129 Lockwood St., Newark, N.J., or Soroban Engineering, Inc., Melbourne, Florida.



- | | |
|-----------------------|---|
| 1. CONNECTOR, 37 PIN | 6. SCREW, 4-40 X 5/16", CHAD CHUTE MOUNTING |
| 2. CLAMP, MOTOR CABLE | 7. SCREW, 4-40 X 3/16", CHAD CHUTE MOUNTING |
| 3. DRIVE MOTOR | 8. SCREW, 4-40 X 1/4", CHAD CHUTE MOUNTING |
| 4. BLOWER HOUSING | 9. CHAD CHUTE |
| 5. AIR DUCT | 10. TERMINAL BOARD TB1 |

Figure 6-2. GP-2-300 Panel, Top View

(e) Insert the spout of the pressure type oiler can into the nylon filler plug (see Figure 6-4) and slowly inject Lubriplate #0 oil until the oil level is between the two scribed lines on the oil level window. Note the absorbent material held in the left hand to catch oil drippings. Replace the Phillips head screw.

6-7. REPLACING THE PERFORATOR TIMING BELT (see Figure 4-5). Remove the GP-2 Perforator by following the instructions of Paragraph 6-4.

(a) The idler pulley has an adjustable center; by loosening the screw in the center of the pulley

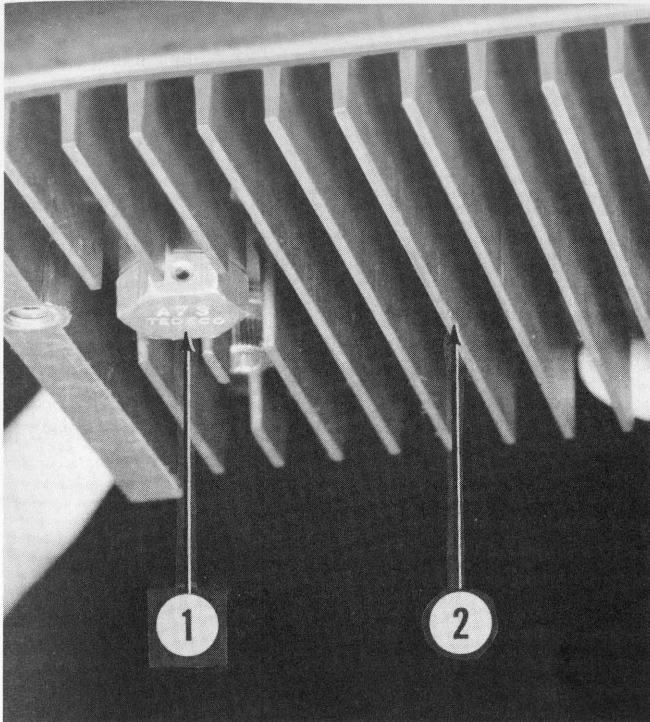
the new belt can be installed and adjusted for the proper tension.

NOTE

Follow the instructions of Figure 4-5 closely.

(b) Replace the GP-2 Perforator on the shock mount and perform steps (c), (d), and (e) of Paragraph 2-20.

6-8. RELUCTANCE PICKUP GAP ADJUSTMENT GP-2. The reluctance pickup for the Model GP-2 Perforator is



1. OIL DRAIN PLUG
2. COOLING FINES

Figure 6-3. GP-2 Perforator, Bottom View

threaded into a circular plate external to the perforator. The pickup has a locknut on the pickup side of the circular plate to maintain the gap adjustment. The gap between the pole of the pickup and the synchronization disc should be 0.030 to 0.045 inch. When necessary to adjust the gap, proceed as follows:

- (a) Place the 115 volt 60 cycle a-c power switch in the OFF position.
- (b) Disconnect the plugs from connectors J3 and J4, (Figure 2-3) for safety.
- (c) Loosen the locknut on the pickup at the circular mounting plate.
- (d) Using a feeler gauge between the pole of the pickup and the synchronization disc, screw the pickup into the circular plate to reduce the gap and out of the plate to increase the gap, adjust pickup for a gap of 0.030 to 0.045 inch.
- (e) Tighten locknut on pickup to maintain gap adjustment.

CAUTION

Do not disturb the position of the synchronization timing disc on the perforator feed shaft. The timing disc is properly aligned at the factory in relation to the internal cycling of the perforator. If the timing disc becomes damaged, the perforator must be returned to the factory for repair.

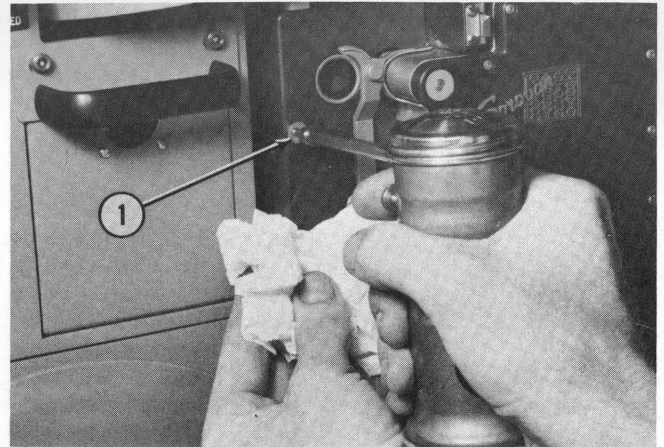


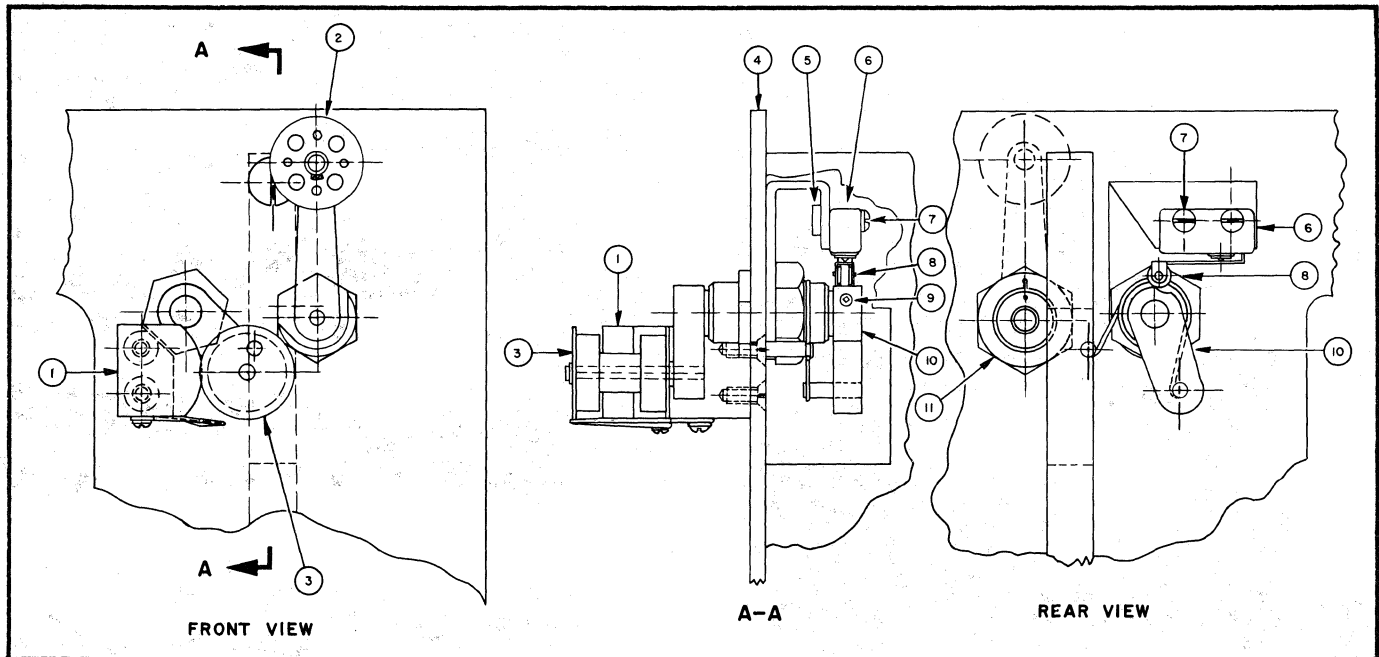
Figure 6-4. Adding Oil To The Perforator

6-9. RELUCTANCE PICKUP GAP ADJUSTMENT GP-2A. The reluctance pickup gap on the Model GP-2A Perforator can only be adjusted at the factory as the pickup is mounted internally. When the timing signal output is less than 6 volts peak-to-peak, return the perforator to the factory for repair.

6-10. ADJUSTING OR REPLACING THE NO TAPE SENSOR (Figure 6-5). To adjust the NO-TAPE sensor assembly, or other circuits located on the GP-2-300 Panel, it is necessary to extend the panel and chassis. Before extending the panel make sure the slack tape arm (22, Figure 3-2) is moved to the right and locked near the tape tension snubber (16). Release the four captive retainer screws of the GP-2-300 Panel and draw panel forward until panel locks in the extended position. Then proceed as follows:

- (a) Place the 115V a-c power switch (2) in the OFF position and disconnect the mating plugs from J3 and J4, Figure 2-3.
- (b) Connect an ohmmeter (VOM) across pins 35 and 36 of connector J4. With no tape between roller (3, Figure 6-5) and stop (1), the ohmmeter should indicate a closed circuit (low resistance).
- (c) Place a piece of tape between roller (3) and stop (1). The ohmmeter should indicate an open circuit (infinite resistance).
- (d) Note position of roller, remove piece of tape and check switch transfer from closed circuit to open circuit. The transfer should occur approximately midway between the roller positions of steps (b) and (c).
- (e) If transfer does not occur as indicated in step (d), loosen setscrew (9) in cam (10) and adjust cam until proper transfer is obtained. Tighten setscrew and recheck.
- (f) Connect the mating plugs of J3 and J4 (Figure 2-3).

6-11. REPLACING THE MOTOR CAPACITOR (Figure 6-6). To replace the motor capacitor C1 (8) proceed as follows:



- | | | |
|-----------------------------|---------------------------|---------------------------|
| 1. ROLLER STOP | 5. NUT STRAP | 8. SWITCH ACTUATOR ROLLER |
| 2. TENSION DECOUPLER ROLLER | 6. OUT OF TAPE SWITCH | 9. SETSCREW |
| 3. OUT-OF-TAPE ROLLER | 7. SWITCH MOUNTING SCREWS | 10. CAM ASSEMBLY |
| 4. 7" PANEL (REFERENCE) | | 11. JAM NUT |

Figure 6-5. NO TAPE Switch Assembly

- | | |
|--|--|
| <p>(a) Place the 115V a-c power switch in the OFF position and disconnect the mating plug from connector J3 (Figure 2-3) for safety.</p> <p>(b) Carefully unsolder the leads from the terminals of capacitor C1 (8, Figure 6-6).</p> <p>(c) Remove the two mounting clamps and lift out capacitor.</p> <p>(d) Obtain new capacitor and replace in reverse order.</p> <p>6-12. REPLACING THE PERFORATOR DRIVE MOTOR.
To remove the perforator drive motor, proceed as follows:</p> <p>(a) Remove the GP-2 Perforator as outlined in Paragraph 6-4.</p> <p>(b) Disconnect the motor electrical connections from terminals 1, 2 and 3 of terminal board TB2 (6, Figure 6-6).</p> <p>(c) Remove the two screws (10) and the two screws (12) and lift air duct (13) straight out from motor mount.</p> <p>(d) Remove the two screws in the sponge rubber gasket plate on rear of centrifugal fan (blower) and remove plate.</p> <p>(e) Loosen the two socket head setscrews in the hub of the fan wheel and remove the wheel.</p> | <p>(f) Remove the four screws through the motor side of the fan housing (1) and remove the housing.</p> <p>(g) Remove the toothed belt from the motor pulley.</p> <p>(h) Remove the cable clamp screw (3) and remove the clamp.</p> <p>(i) Remove the plastic cable-tie above the terminal board (6) TB2.</p> <p>(j) Remove the four screws (2) and lift out motor (4).</p> <p>(k) Remove the four screws from the air duct support bracket and remove the bracket.</p> <p>(l) Remove the drive pulley from the motor shaft.</p> |
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NOTE

Care must be exercised so the three parts of the motor casing are not misaligned during the next operation.

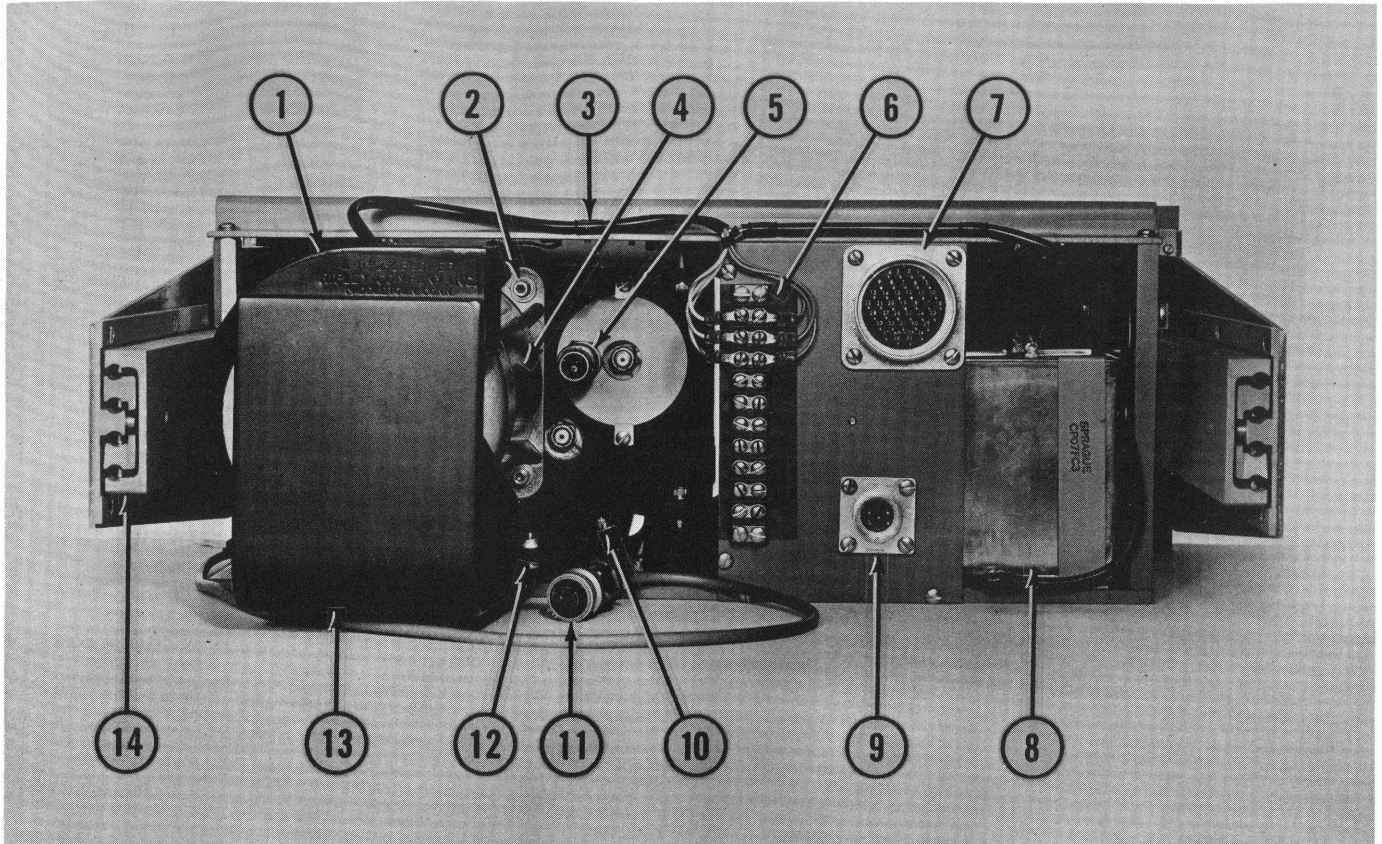
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|--|
| <p>(m) Obtain new motor and replace the end bell retaining nuts with the hexagon spacers from the motor removed and tighten spacers.</p> <p>(n) Reassemble by reversing steps (a) through (l).</p> |
|--|

NOTE

Connect the motor electrical leads to terminal board (6) TB2, placing the RED tracer lead to terminal 1, the GREEN tracer lead to terminal 2 and the BLUE tracer lead to terminal 3.

NOTE

To loosen the setscrews of step (e), carefully place appropriate straight wrench (for socket head setscrews) between the fan blades and into the screw heads.



- | | |
|---------------------------|--|
| 1. BLOWER HOUSING | 8. MOTOR CAPACITOR C1 |
| 2. SCREW, MOTOR MOUNTING | 9. CONNECTOR, SIX PIN |
| 3. CABLE CLAMP | 10. SCREW, AIR DUCT MOUNTING (TWO) |
| 4. DRIVE MOTOR | 11. MATING PLUG, RELUCTANCE PICKUP |
| 5. RELUCTANCE PICKUP GP-2 | 12. NUT AND SCREW, AIR DUCT MOUNTING (TWO) |
| 6. TERMINAL BOARD TB2 | 13. AIR DUCT |
| 7. CONNECTOR, 37 PIN | 14. SLIDE HARDWARE |

Figure 6-6. GP-2-300 Panel, Rear View

6-13. ELAPSED TIME METER. To replace the elapsed time meter (24, Figure 3-2) proceed as follows:

- (a) Place the 115 volt 60 cycle a-c power switch in the OFF position and remove the plug from connector J3 (9, Figure 6-6).
- (b) Disconnect the elapsed time meter leads from terminals 1 and 2 of terminal board TB1 (10, Figure 6-2).
- (c) Remove the chad box (23, Figure 3-2) from the panel.
- (d) Remove the front mounting nut of the power on-off switch (2) and lift switch out of panel.
- (e) Remove the four mounting nuts of the elapsed time meter (24) and remove the meter.
- (f) Replace in reverse order.

6-14. MODEL P TAPE PANEL.

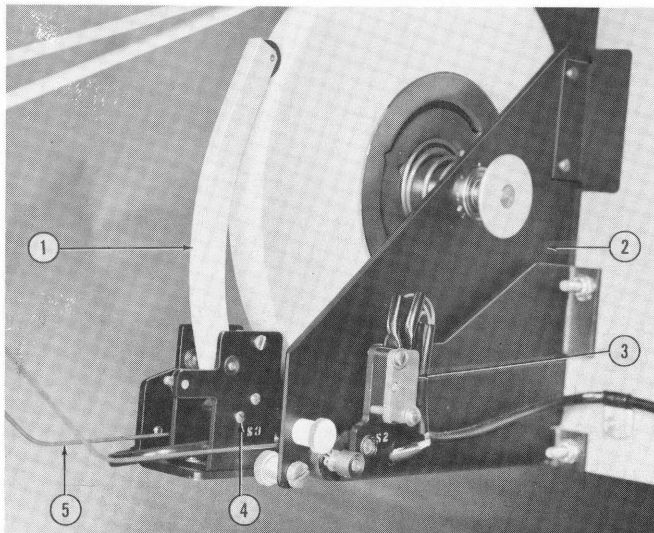
6-15. GENERAL. To service or repair circuits or components located on the tape panel (19, Figure 3-2), the

panel must be removed from the relay rack. To remove the tape panel from the rack, proceed as follows:

- (a) Disconnect the 115 volt 60 cycle power supply at the control panel.
- (b) Disconnect the mating plug from connector J1 (Figure 2-4).
- (c) Remove the eight screws retaining the panel in the rack and remove the panel.

6-16. ADJUSTING OR REPLACING THE LOW TAPE SENSOR (see Figures 6-7 and 6-8). The two screws used to retain the switch are inserted through slotted mounting holes. By loosening the screws the switch can be positioned to actuate when the tape supply reaches a selected level. To adjust or replace the switch proceed as follows:

- (a) Remove the Model P Tape Panel per paragraph 6-15.
- (b) Loosen screws (4, Figure 6-7).
- (c) Move the low tape sensing arm (1) to the level at which a low tape warning signal is desired, move



1. LOW TAPE SENSOR ARM
2. HUB SUPPORT BRACKET
3. TIGHT TAPE SWITCH
4. LOW TAPE SWITCH RETAINING SCREWS
5. TIGHT TAPE SENSOR ARM

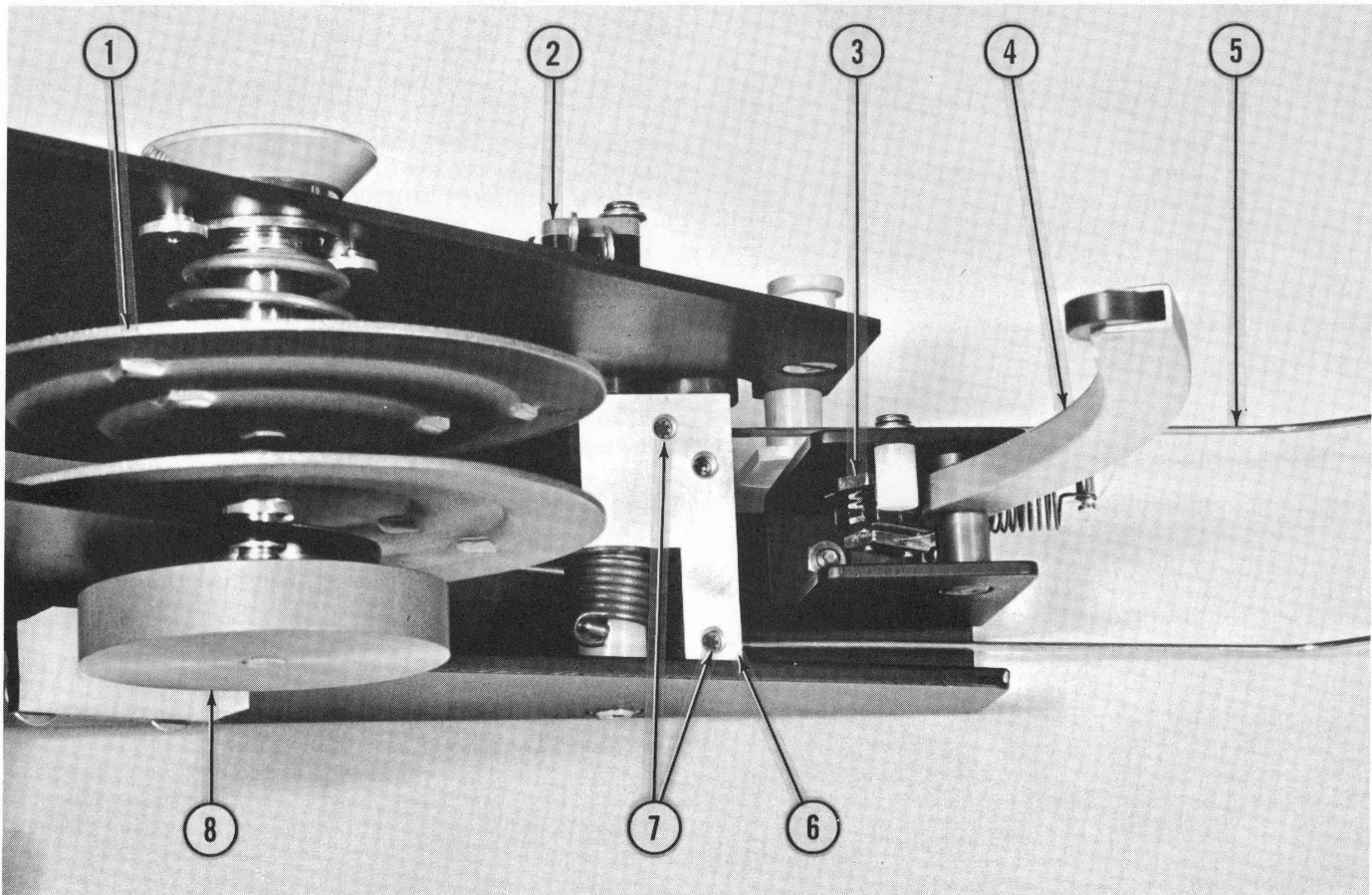
Figure 6-7. Tape Supply Well, Rear View

switch (3, Figure 6-8) until plunger is depressed and tighten the screws (4, Figure 6-7).

- (d) To replace the switch, unsolder the electrical leads, remove the screws (4) and remove the switch (3, Figure 6-8).
- (e) Replace in reverse order.
- (f) Adjust switch per steps (b) and (c) above.

6-17. ADJUSTING OR REPLACING THE TIGHT TAPE SENSOR ARM OR SWITCH (see Figures 6-7 and 6-8). The tight tape sensing arm and switch are located in the rear of the tape supply well. The switch is not adjustable.

- (a) Remove the Model P Tape Panel per paragraph 6-15.
- (b) To replace the switch (3, Figure 6-7) unsolder the electrical leads and remove the mounting screws.
- (c) Mount the new switch and solder the electrical connections to the proper terminals.
- (d) If it becomes necessary to replace the tight tape sensor arm (5, Figure 6-8) loosen the two setscrews (7), and remove arm.



1. SPRING LOADED TAPE HUB
2. TIGHT TAPE SENSING SWITCH
3. LOW TAPE SENSING SWITCH
4. LOW TAPE SENSING ARM
5. TIGHT TAPE SENSING ARM
6. PIVOT BLOCK, TIGHT TAPE SENSING ARM
7. SETSCREWS, TIGHT TAPE SENSING ARM RETAINING
8. DRAG BRAKE, TAPE SUPPLY HUB

Figure 6-8. Tape Supply Well, Top View

- (e) When replacing the arm, the leg (5) nearest the sensing switch (2) must be cut approximately one-quarter inch longer than the opposite leg.
- (f) Place legs in pivot shaft block (6) and tighten the setscrews (7).

NOTE

When the tight tape sensing arm is drawn forward, it must clear the perforator mount and motor support located on the GP-2-300 Panel immediately above the tape supply well. If the arm fails to clear this support, increase the bend in the wire legs until the forward movement allows the arm to pass freely under this support.

6-18. ADJUSTING OR REPLACING THE SLACK ARM-NO TAPE SENSING OR CLUTCH OPERATING SWITCHES (Figure 6-9). To check for proper adjustment of the SLACK ARM-NO TAPE switch (7) and the cam operated clutch switch (9) proceed as follows:

- (a) Remove the Model P Tape Panel per paragraph 6-15.
- (b) Disconnect the solid RED and the WHITE-RED tracer leads (see Figure 2-4) from terminal 6 of TBI (1, Figure 6-10).
- (c) Gently move the slack tape arm (5, Figure 6-9) against the left hand bumper on the front panel.
- (d) With the arm in this position, switch (7) should have its plunger depressed by the edge of the cam (8), and an ohmmeter across pins 9 and 10 of J1 should show continuity. The clutch switch (9) should also have its plunger depressed, the clutch switch roller (11) should be in position "A" on the cam (8) and an ohmmeter across terminals 4 and 6 of TBI (1, Figure 6-10) should indicate an open circuit.
- (e) Move the slack tape arm (5, Figure 6-9) approximately one-half inch to the right of the bumper; the clutch switch roller (11) should be in position "B" on the cam (8) and the plunger of both switch (7) and switch (9) should be released. With the arm (5) in this position an ohmmeter across pins 9 and 10 of J1 should indicate an open circuit and an ohmmeter across terminals 4 and 6 of TBI should show continuity.

NOTE

When performing step (e) above, check to see that the plunger of switch (7) is released just prior to the release of the plunger of switch (9). This indicates proper adjustment of these switches with relation to each other.

- (f) Continue to move the slack tape arm to the right, rotating cam (8) clockwise. As the roller (11) passes position "C" the plunger of switch (9) is depressed and is held depressed at position "D", opening the circuit between terminals 4 and 6 of TBI. Under normal system operation, as tape is

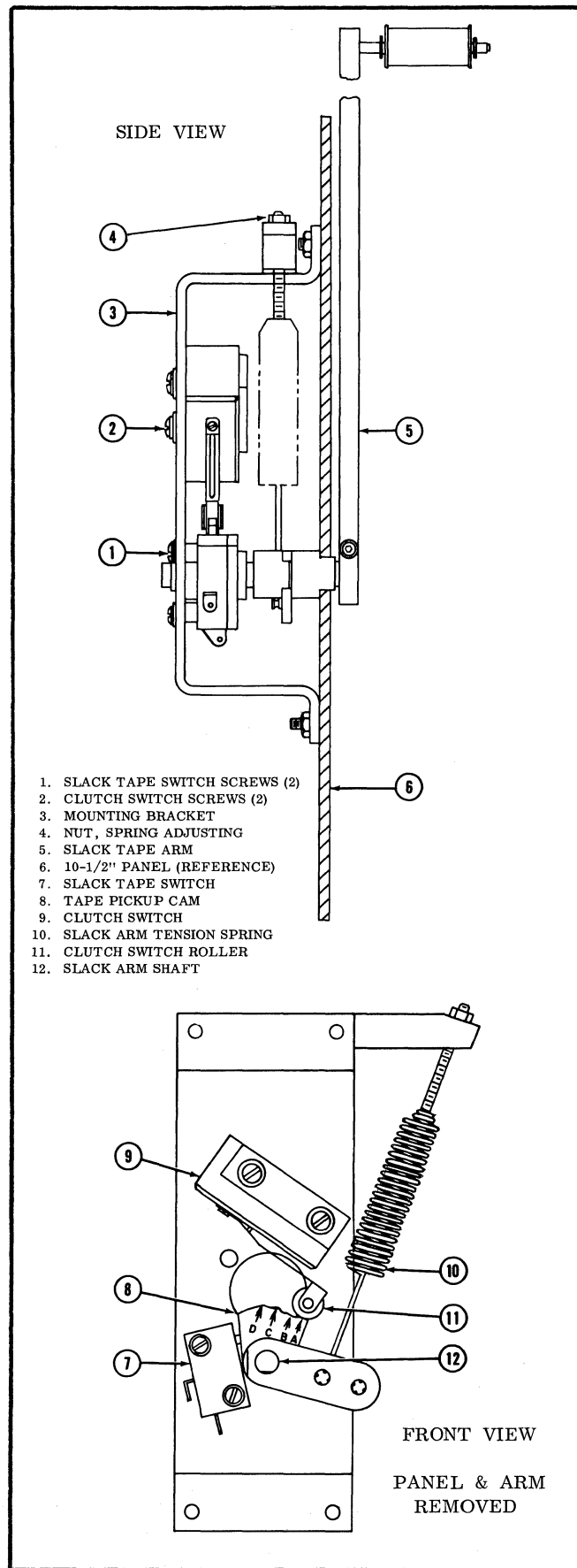
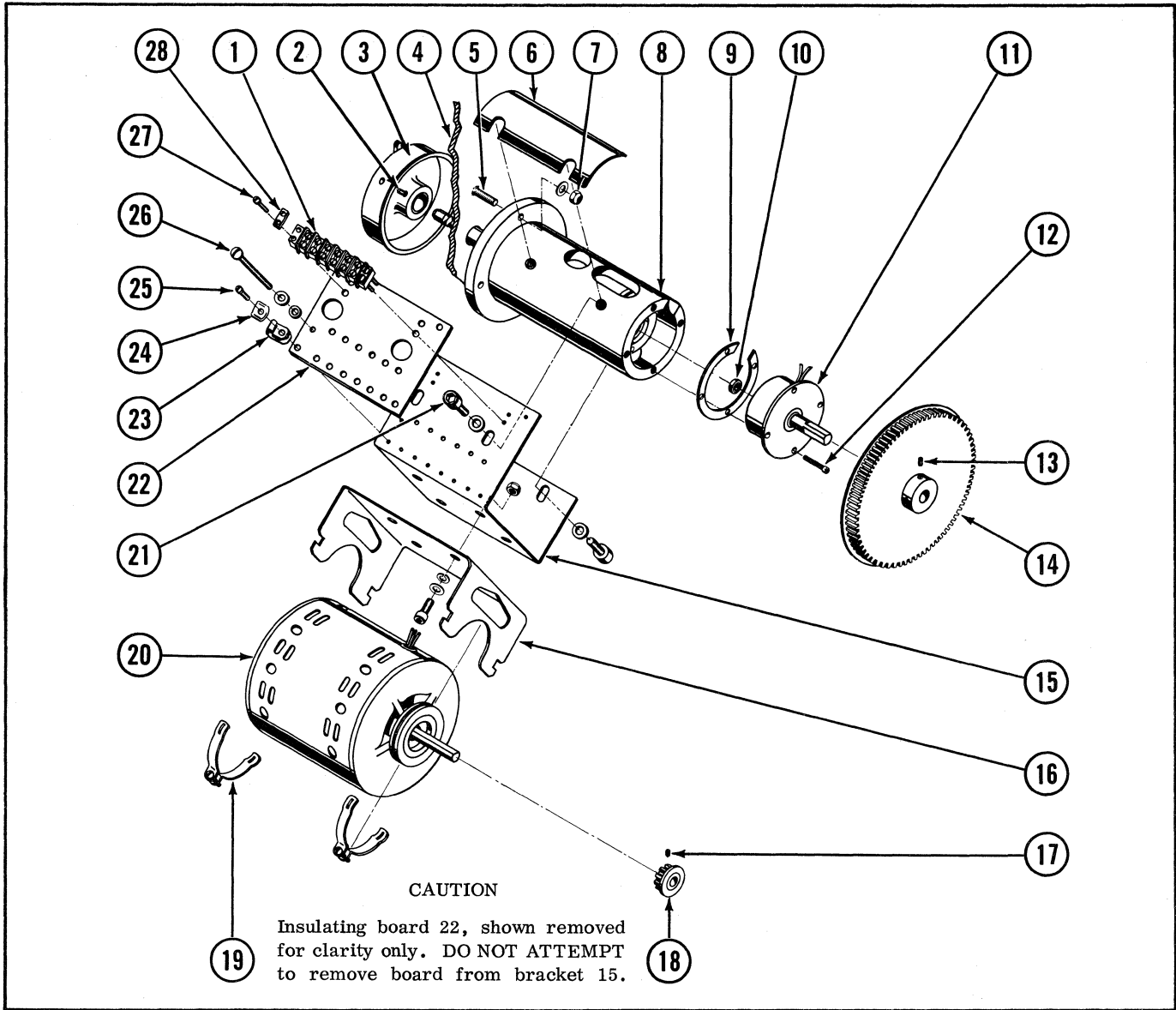


Figure 6-9. Slack Arm Sensing Assembly



- | | |
|---|--|
| <ul style="list-style-type: none"> 1. BARRIER TERMINAL STRIP TB1 2. SETSCREW, REEL HUB 3. REEL HUB, FOR NAB REEL 4. PANEL (REFERENCE) 5. STUD (FOUR), CLUTCH HOUSING MOUNTING 6. COVER, CLUTCH HOUSING 7. NUT, SELF LOCKING 8. CLUTCH-BRAKE HOUSING 9. CLUTCH SPACER 10. BALL BEARING, CLUTCH SHAFT, INNER END 11. CLUTCH, ELECTROMAGNETIC 12. SCREW (FOUR), CLUTCH MOUNTING 13. SETSCREW, CLUTCH PULLEY 14. PULLEY, CLUTCH DRIVE | <ul style="list-style-type: none"> 15. MOTOR MOUNTING BRACKET 16. MOTOR BASE 17. SETSCREW, MOTOR PULLEY 18. PULLEY, MOTOR DRIVE 19. CLAMP (TWO), MOTOR RETAINING 20. MOTOR 21. SCREWS, MOTOR BRACKET MOUNTING 22. INSULATING BOARD 23. CABLE CLAMP 24. "D" WASHER 25. SCREW (FOUR), CABLE CLAMP & INSULATING BOARD 26. SCREW, RESISTOR MOUNTING 27. SCREW, BARRIER STRIP MOUNTING 28. STRADDLE PLATE, BARRIER STRIP MOUNTING |
|---|--|

Figure 6-10. Tape Pickup Drive Assembly, Exploded View

fed from the GP-2 Perforator, the slack arm moves the cam back and forth with the clutch switch roller (11) riding between positions "B" and "C", opening and closing switch (9) which disengages and engages the clutch to facilitate tape spooling. The slack arm operational travel should be the central portion of the arc between bumpers. If necessary, loosen setscrew and adjust cam for proper operational travel.

- (g) If the conditions of steps (c) through (f) are met, the SLACK TAPE and CLUTCH switches are properly adjusted. For fine adjustment, loosen screws (1) and (2) and adjust the position of the switches by means of the clearance in the slotted mounting holes.
- (h) Reconnect the solid RED and WHITE-RED tracer leads to terminal 6 of TB1.
- (i) To replace either of the switches, unsolder the electrical leads and remove appropriate mounting screws (1) or (2).
- (j) Replace in reverse order.
- (k) When either switch has been replaced, perform steps (c) through (f) to assure proper adjustment.

6-19. ADJUSTING THE TENSION OF THE SLACK TAPE ARM (Figure 6-9). The tension of the slack tape arm (5) should be 18 to 20 ounces. Adjust as follows:

- (a) Hook a spring gauge at the slack arm roller and pull to the right with the spring gauge. The arm should begin to move with 18 ounces pull.
- (b) To adjust the tension either loosen or tighten the spring (10) by adjusting the nut (4) of the spring retaining screw.

6-20. REPLACING THE TAPE PICKUP DRIVE MOTOR (Figure 6-10). To remove the motor, proceed as follows:

- (a) Place the 115V a-c supply switch at the control panel in the OFF position and remove the mating plug from connector J1.
- (b) Disconnect the electrical leads of the motor at terminals 1, 2 and 3 of barrier terminal strip TB1 (1).
- (c) Remove the drive belt from pulleys (14 and 18).
- (d) Loosen the screws in the motor retaining clamps (19) at each end of the motor and remove clamps.
- (e) Lift out motor (20).
- (f) Replace in reverse order.
- (g) Adjust the belt tension by loosening the four motor mounting bracket retaining screws (21), two through top of bracket and two through bottom of bracket under the clutch assembly. (Screw holes are slotted.)

- (h) Slide the motor mounting bracket as required to obtain 3/16 to 1/4 inch belt deflection under moderate thumb pressure and tighten all four screws.



Be sure the dust cover (6) is properly seated on the housing (8) before tightening the screws (21).

- (i) Connect the mating plug to J1.

6-21. REPLACING THE CLUTCH ASSEMBLY (Figure 6-10). To replace the electromagnetic clutch assembly, proceed as follows:

- (a) Place the 115V a-c supply switch at the control panel in the OFF position and remove the mating plug from connector J1.
- (b) Disconnect the electrical leads (white with red tracer) at terminals 5 and 6 of barrier terminal strip TB1 (1).
- (c) Remove the drive belt from pulley (14), loosen the two setscrews (13) holding the pulley and remove the pulley.
- (d) Remove the four screws (12) in the rear of the clutch assembly (11) and remove the assembly.

NOTE

The clutch spacer (9) and clutch shaft inner end ball bearing (10) will come out with the clutch assembly.

- (e) Obtain new clutch assembly and place spacer (9) on assembly.
- (f) Place ball bearing (10) on inner end of clutch shaft.
- (g) Place clutch assembly (11) into brake and clutch housing (8) with leads upward and carefully seat ball bearing in end of shaft within housing.
- (h) Cut leads to proper length, strip and attach crimp-on terminals for number six screws.
- (i) Connect leads to terminals 5 and 6 of barrier terminal strip (1).
- (j) Replace pulley (14) on shaft and tighten setscrews.
- (k) Replace drive belt on pulleys (14 and 18).

NOTE

The brake assembly in housing (8) is a long life design with close tolerances and should not require replacement. Oil and foreign matter on the brake assembly surfaces will result in poor operation. The brake mechanism should not be disassembled in the field and the dust cover (6) must always be in place.

- (l) Connect the mating plug to J1.

6-22. REPLACING THE CLUTCH-BRAKE HOUSING ASSEMBLY. The brake assembly in the clutch-brake housing (8, Figure 6-10) is a long life design and should not normally need replacement. If the tape pickup reel fails to stop when the slack tape arm (22, Figure 3-2) is against the rubber bumper (21), the brake is not operating properly. The clutch-brake housing assembly and clutch must be removed and returned to the factory for service and repair. To remove the assembly, proceed as follows:

- (a) Place the 115 volt a-c input power control in the OFF position.
- (b) Disconnect the 115 a-c input leads from terminals 1 and 2 of TB1 (Figure 2-4), the clutch leads from

terminals 5 and 6 and the cam actuated switch S1 from terminals 4 and 6.

- (c) Remove the drive belt from the pulleys (14 and 18, Figure 6-10).
- (d) Remove the pulley (14) from the clutch (11) shaft.
- (e) Remove the four screws (21) and lift out the motor and mounting assembly.
- (f) Loosen the setscrew (2, Figure 6-10) and remove the tape hub (3).
- (g) Remove the four mounting nuts from the studs (5) and lift out clutch-brake assembly as a unit.
- (h) Replace in reverse order.