

**KS-20537, L1 MODUPRINTER AND AP-20 PRINTER  
DESCRIPTION, OPERATION, AND MAINTENANCE  
CABLE PRESSURE TELEMETRY SYSTEM**

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**1. GENERAL**

**1.01** ¶ This section describes the procedures to be followed for the operation and maintenance of the KS-20537, L1 moduprinter and the AP-20 printer used in the central control circuit of the Cable Pressure Telemetry System. It also contains a description of each printer.¶

**1.02** This section is reissued for the reasons listed below. Revision arrows have been used to highlight significant changes. The Equipment Test Lists are not affected.

- (a) To change the title of the section to include the new AP-20 printer
- (b) To change paragraph 1.01 to include the information in the revised title
- (c) To add paragraph 1.03 covering the manufacture discontinued status of the KS-20537, L1 moduprinter
- (d) To change the numbering of paragraphs 2.01 through 2.13 to 2.04 through 2.16 and add new paragraphs 2.01 through 2.03 describing the KS-20537, L1 moduprinter and its operation
- (e) To add Part 3, paragraphs 3.01 through 3.13 covering a description of the AP-20 printer, its operation and maintenance
- (f) To add Fig. 4 through 6 showing the AP-20 printer.

**1.03** ¶ The KS-20537-L1 moduprinter is manufacture discontinued and replaced by the AP-20 printer which is manufactured by Gulton Industries Inc.¶

**NOTICE**

Not for use or disclosure outside the  
Bell System except under written agreement

**2. ♦KS-20537, L1 MODUPRINTER****A. Description**

**2.01** The KS-20537, L1 moduprinter is a numerical printer which counts input electrical pulses, prints the total, and resets the count automatically upon receiving external electrical commands.

**2.02** The printer is housed in a metal case with provisions for mounting a connector on the rear of the case. A printer mechanism contains individual modules for each digit and for paper advance. The printer operates from a -24V dc power supply.

**B. Operation**

**2.03** The printer used in the central control unit is a Moduprint Data Printer manufactured by the Practical Automation Inc. of Shelton, Conn. It is based on a number of small "count modules," each of which has the capability of advancing its count by one each time an input pulse is received. The modules may be connected to accept information in parallel or serial. The pressure counter section of the printer accepts information in parallel. That is, each of the digits (hundreds, unit, etc) receives pulses separately and each automatically transfers "carriers" from one module to the next most significant one. The station counter and cable counter, on the other hand, are connected in a serial form so that the number of input pulses on a single lead is counted. Carry operations are automatic as in the parallel connection. All input signals to the printer, including the print input which causes the numbers stored in the modules to be printed, are made by grounding the appropriate terminal on the back of the printer. The input pulses directly drive the advance solenoids in the count modules drawing a current of 109 mA from the -24 volt supply. The maximum counting speed of a module is 40 counts per second, although it is only driven at 30 counts per second in this circuit. The reset and print pulses, in contrast to the count pulse, require a drain of about 35 mA and must be held for a minimum of 200 ms.

**C. Maintenance****Chamber Release Procedure♦**

**2.04** Using Fig. 1 as a guide, perform the following operations:

- (1) Extract the printer assembly from its enclosure until the back plate butts against the

♦printer extraction♦ stops. In this position, the printer can hang freely.

- (2) Grasping the paper bale assembly by the rear roller bar, swing it up until the assembly is latched in the up position on the side plate.

- (3) Swing the front plate and chamber assembly from under the lip of the locking bar in the predetermined arc.

- (4) Unlatch the paper bale assembly by depressing the spring loaded catch, allowing the paper bale assembly to drop back far enough to permit the front plate assembly to fit into the two notches in the paper bale assembly. Relock the paper bale assembly by swinging forward.

**2.05** The moduprinter is now exposed for ribbon or paper change, electrical checks, and manual adjustment of digits. When the required operations have been completed, proceed as follows:

- (1) Allow the paper bale assembly to drop back to its rest position.

- (2) Allow the front plate and chamber assembly to fall back down so it is parallel to the front edges of the side plates.

- (3) Raise the paper bale assembly and engage the lip of the front plate cutout under the lip of the locking bar.

- (4) Insert the printer assembly into its enclosure.

**2.06** If desired, the chamber release operations may be performed with the printer assembly totally removed from the enclosure. This is accomplished by pulling the printer assembly out to the stops at the top front of the enclosure, then swinging it up and out to clear the stops. To replace the printer assembly, this procedure is reversed.

**Paper Replacement**

**2.07** To replace the paper in the moduprinter, proceed as follows:

- (1) With paper bale assembly up, extract the paper shaft removing old core.

- (2) Reload with new roll. See Fig. 2.

- (3) Check that paper roll rotates freely on shaft.

- (4) Thread paper following path shown in Fig. 2.

This will be facilitated by folding the leading edge of the paper into an arrow and then creasing up 2 inches behind the tip.

- (5) With the paper extending through the cutout in the front plate and held taut, allow the paper bale assembly to drop into operating position.

- (6) Check that the front plate properly engages the locking bar.

- (7) Push the printer assembly back into the enclosure until the rubber rollers on the paper bale assembly are inside, exerting pressure to lock up the front plate solidly.

**Note:** The roller bar is adjustable. Ideally, it should project over the top of the side plate 1/16 inch when free of the enclosure.

- (8) With the printer assembly in this position, manually depress and release the solenoid approximately 12 times. This will cause it to print and advance the paper to ensure that loading was correct.

#### Paper Advance and Paper Skew

**2.08** Visually check that the paper advances with adequate separation between lines. (Adequate separation is defined as the amount of space needed for legibility of the printout.) If separation is inadequate, adjust the two eccentric bearings (screw adjustment bushings) that support the paper advance roller (see Fig. 2). Adjustment must be made with constant pressure on the paper bale assembly. Paper skew is checked and adjusted in the same manner.

**Note:** Bearings must be adjusted relative to one another, one on each side.

#### Ribbon Change

**2.09** To change a ribbon in the moduprinter, proceed as follows:

- (1) With module chamber in open or horizontal position as shown in Fig. 1 and 3, remove bobbin retaining knobs.
- (2) Swing abrasive drive wheel against the smaller diameter bobbin. In order for the

larger bobbin to clear the abrasive wheel, it may be necessary to manually decrease the windings on the smaller bobbin.

- (3) Swing detent away from larger bobbin and remove.

- (4) With larger bobbin removed, swing abrasive drive wheel to empty side.

- (5) Remove remaining bobbin in same manner.

- (6) Install new ribbon reversing the procedure of the preceding steps. Thread the ribbon as shown in Fig. 3.

- (7) Manually depress the ribbon actuator several times to take up slack and to ensure that new ribbon is not snagged.

- (8) With front plate back in operating position, place module chamber partly back in enclosure.

- (9) Depress solenoid several times observing that ribbon bobbins are advancing.

#### Electrical Checks

**2.10** **Caution:** *Due to the extremely fast response of the count modules, the driving circuitry must be selected with care. In particular, if switch contacts are used, especially snap switches, the bounce associated with the closures must be minimized to assure that the count module does not count a stray bounce as data.* The requirements for the count module are:

- Operating voltage: 24 through 26.4 Vdc
- Maximum speed: 40 Hz
- Print wheels ON time: minimum 12 ms, maximum 1 min
- Print wheels OFF time: minimum 12 ms.

**2.11** The requirements for the print solenoid are:

- Voltage: 24 Vdc
- Current: 1.0 A
- Duty cycle: 25%

- Inductance: approximately 20 mH
- Minimum ON time: 80 ms
- Minimum RELEASE time: 80 ms.

**Note:** The print solenoid is supplied with diode arc suppression to protect the input circuitry.

**2.12** When the basic control is installed and wired for separate print and reset, the print command must exist for a minimum of 80 ms and must not exceed 2 seconds. The printing will darken as the print command is lengthened due to the physical transfer of ink from the ribbon to the paper. For the highest possible line rate, the solenoid need not be fully relaxed before entering further data. Allow at least 10 ms for the platen to drop away from the contact with the printing wheels.

**2.13** When the basic control is installed and wired for print and reset interlock, the minimum input command should be 80 ms. The duration of complete cycle for reset which follows automatically from this closure will be for:

- 40-Hz count modules: 300 ms (see Note)
- 80-Hz count modules: 200 ms (see Note).

**Note:** Plus the duration of the print command. During this time, data or count input signals should be cut off.

**2.14** When a 115 Vac-24 Vdc power supply is not built in, proper functioning of this instrument depends on an adequate power supply with a line and load regulation consistent with the voltage tolerances given for the count modules. A maximum ripple of 100 mV is also essential, especially when the basic control is installed.

**2.15** When the basic control is set for automatic print and reset, power interruption will arm the differentiator, so when power is restored, automatic reset of stored data will result. The reset is not triggered when the two functions are separated.

**Manual Adjustment of Digits**

**2.16** *Warning: Do not attempt to move the wheels if modules are reversed; other-*

*wise, the count modules will be damaged.* Digits may be manually adjusted by moving the wheels normally in the direction of the front plate.

**3. AP-20 PRINTER**

**A. Description**

**3.01** The Gulton model AP-20 printer (Fig. 4) is a self-contained alphanumeric thermal printer. It uses a Gulton 20 column, 100 dot matrix thermal printhead capable of printing 20 columns of 5 x 7 characters. It is mounted on the same panel as the digital voltmeter. Its overall dimensions are 3-3/8 inches high, 6-7/8 inches, wide, and 12-7/8 inches deep.

**3.02** The AP-20 printer allows the use of the full upper case 64 character American standard code for information interchange (ASCII) subset via a straightforward, bit parallel, character serial interface controlled by a simple 2-line handshake with the data source. Data is accepted one character line at a time and stored in random access memory (RAM) until all seven dot rows for that character line have been printed.

**3.03** The paper is supplied on a roll, 2-1/4 inches wide by 150 feet long. Two types of paper are available; D20M for a black image, D20N for a blue image. The last printed line is immediately visible.

**3.04** The front panel contains a red light emitting diode (LED) which indicates that the power is on when it is lighted. Below the LED is the FEED switch. When operated, it advances the paper, except during the print cycle; the line is completed before the paper is advanced. Below the FEED switch is an indicator showing the relative amount of paper remaining on the roll.

**3.05** The power input to the printer may be either 115 or 220 Vac at 50 or 60 Hz.

**B. Operation**

**3.06** Printing is accomplished using a Gulton DM20100 dot matrix thermal printhead arranged in 20 groups (or columns) of 5 dots per group. The 100 diodes (1 per dot) are forward biased toward the 20 column strobes.

**3.07** The thermal print technique forms images of actual resistive printhead dot elements on

thermographic paper through heating of the resistive dot elements. When the temperature of a dot element exceeds the threshold temperature of the paper (90°C), a dye is released in the surface coating of the paper forming the image of that dot on the paper. Three variables (power density, thermal print pulse time, and paper sensitivity) determine the darkness of the image on the paper. After completion of five print intervals, a sixth interval advances the chart by a one dot line. A complete character line (35 possible dots in all 20 columns) is formed by repeating this sequence 7 times.

**3.08** After printing the last dot row of a character line and the paper roll has been indexed, an additional three step (three dot row increments) paper advance moves the paper into position for printing the first dot row of the next character line. This allows enough space between character lines to provide good legibility.

#### **C. Maintenance**

**3.09** The AP-20 printer requires minimum maintenance. No scheduled lubrication of the mechanism is necessary. The printhead should be cleaned occasionally. The print density is factory set for good legibility at a print power which ensures long printhead life and, under ordinary circumstances, will not need adjustment.

#### **Printhead Cleaning**

**3.10** Under normal operating conditions, the printhead will require cleaning after using 25

or more rolls of paper. Uneven print density is an indication that cleaning is required.

**3.11** Open the printer door and remove the roll of paper. Place the head pressure level in the release position (Fig. 5). Saturate a gauze pad with alcohol and place it between the printhead and drive roller as if loading paper. Operate the FEED switch until the gauze pad is fed through the roller and printhead. Repeat this procedure several times. Allow time for the alcohol to evaporate before replacing the roll of paper and close the printer door.

#### **Replacing Paper**

**3.12** To load the printer with a new roll of paper, pull open the printer door and release the pressure lever (Fig. 5). Remove the empty core from the mandrel and slip on a new roll of paper. Thread the paper between the printhead and drive roller while operating the FEED switch. Be sure the paper is centered in the front opening. Place the pressure lever in the locked position and close the printer door.

**3.13** If the print density is irregular and lighter than normal, the printhead should be realigned. Open the printer door and loosen the four set screws holding the printhead to the mounting hinge (Fig. 6). Reposition the printhead until the print density is legible and regular, and tighten the set screws. Close the printer door.♦

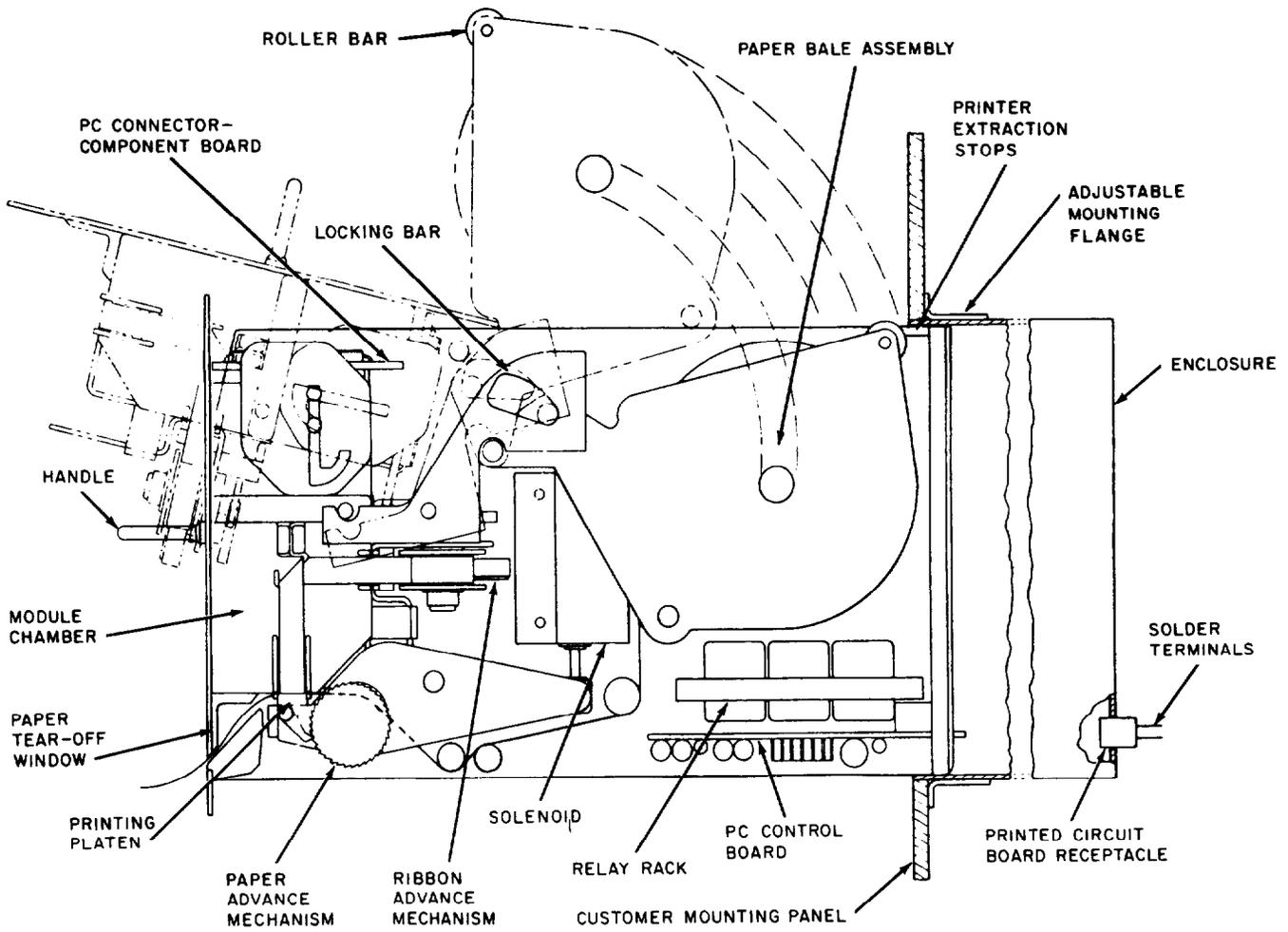
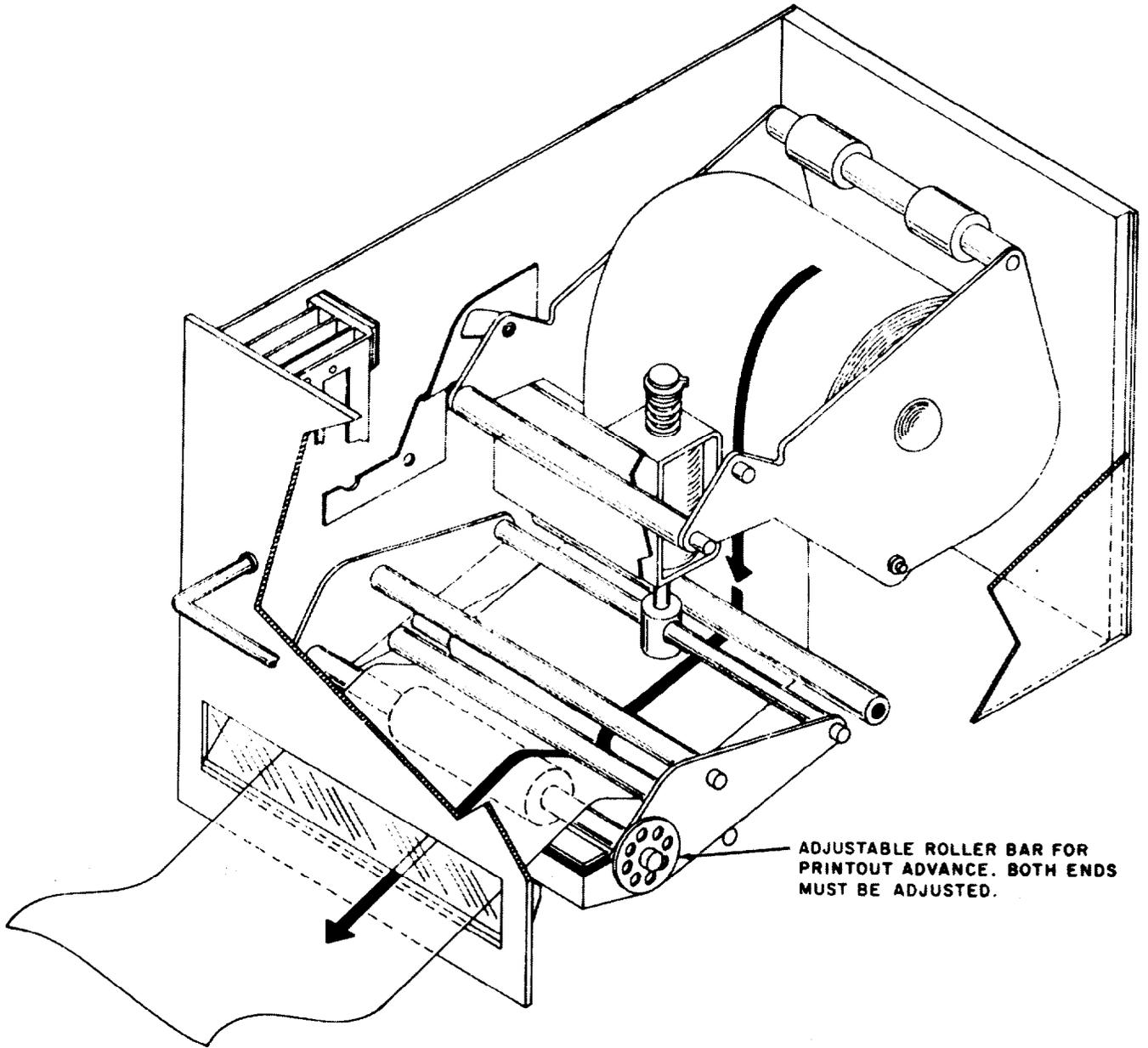


Fig. 1—Component Parts—KS-20537, L1 Moduprinter



**Fig. 2—Paper Path—KS-20537, L1 Moduprinter**

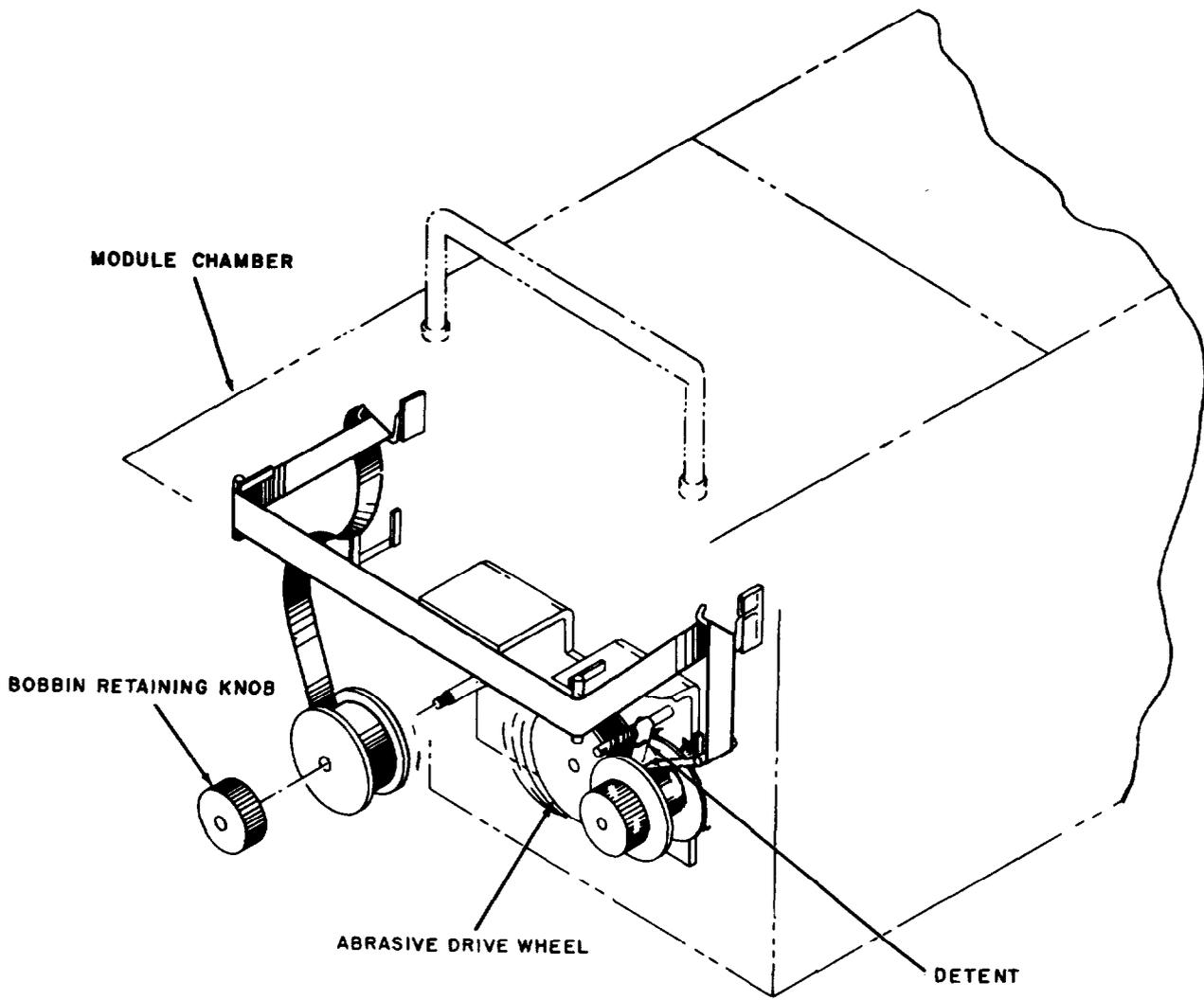


Fig. 3—Ribbon Path and Replacement—KS-20537, L1 Moduprinter

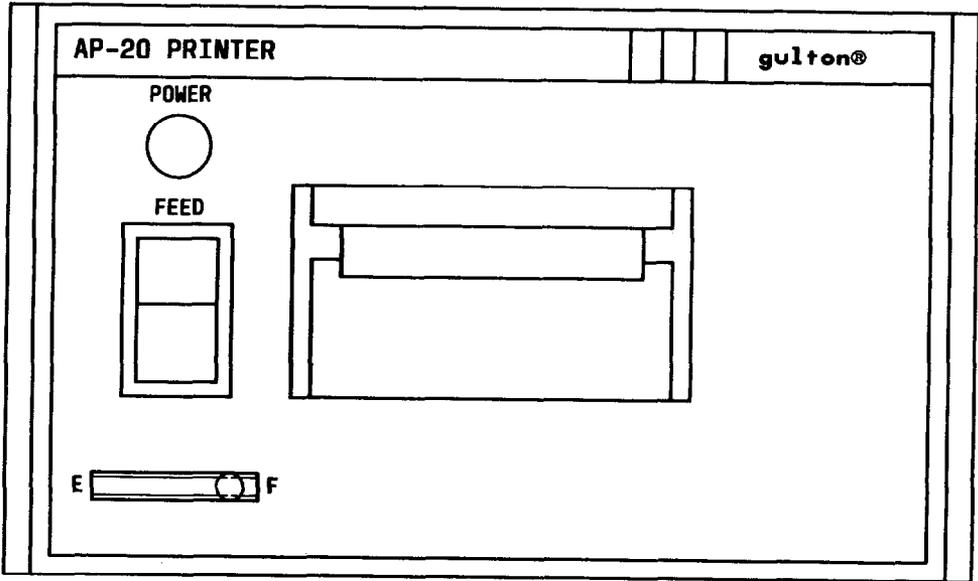


Fig. 4—Front Panel—AP-20 Printer

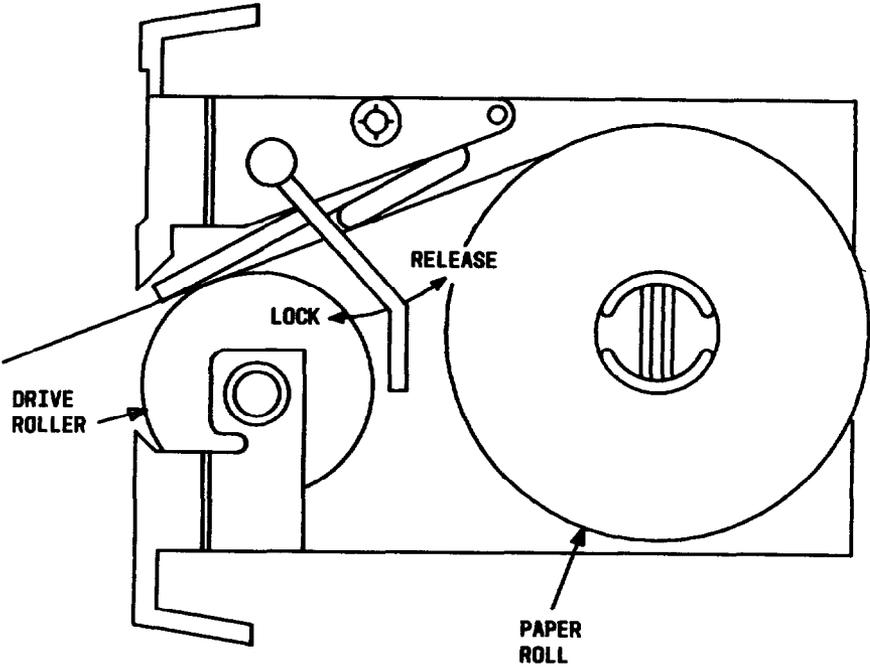


Fig. 5—Printer Mechanism—AP-20 Printer

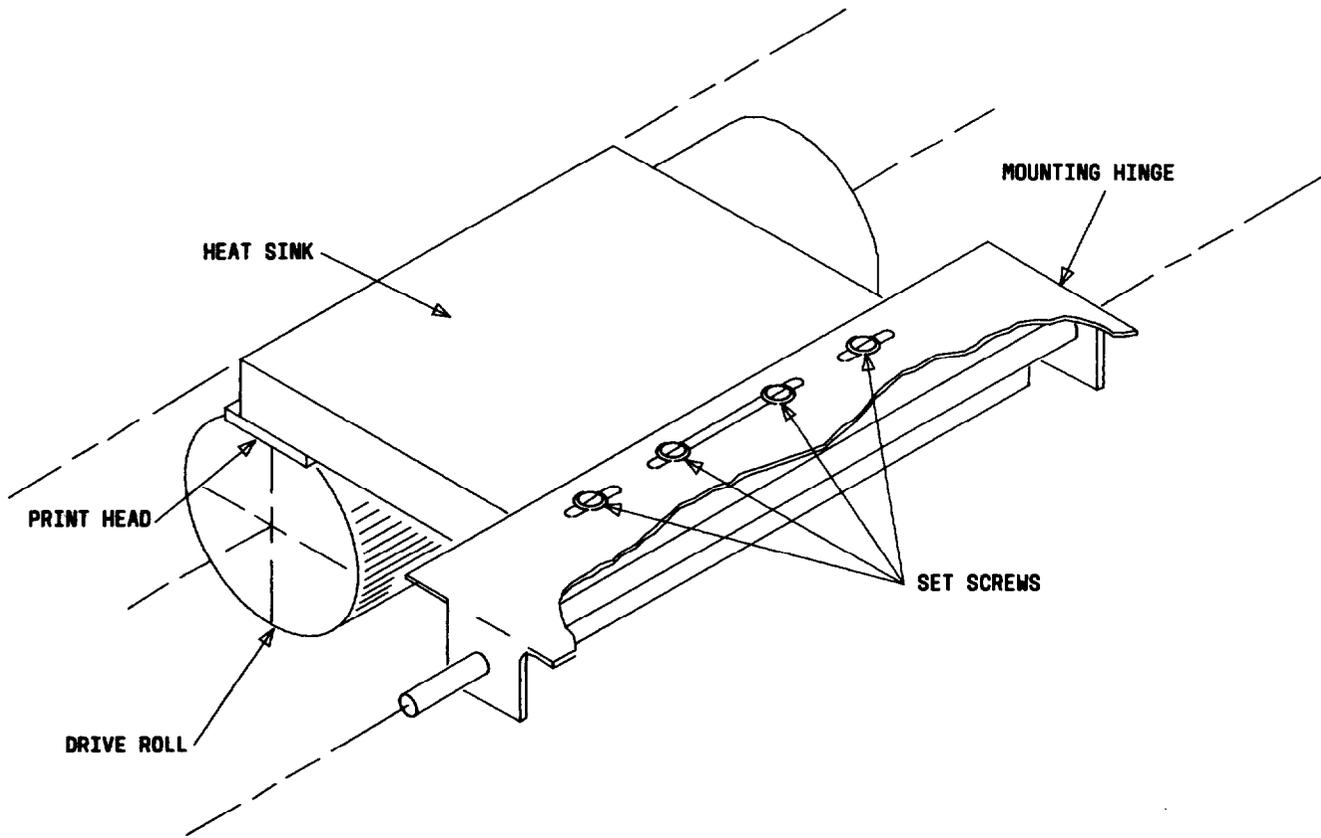


Fig. 6—Aligning the Printhead—AP-20 Printer