

BULLETIN 242B

# TELETYPE

PRINTING TELEGRAPH SYSTEMS

BULLETIN 242B

GENERAL DESCRIPTION  
AND  
THEORY OF OPERATION  
MODEL 28 TRANSMITTER DISTRIBUTOR  
LBXD1, LBXB1, LBXC1

  
CORPORATION  
SUBSIDIARY OF  
*Western Electric Company*  
CHICAGO, U. S. A.

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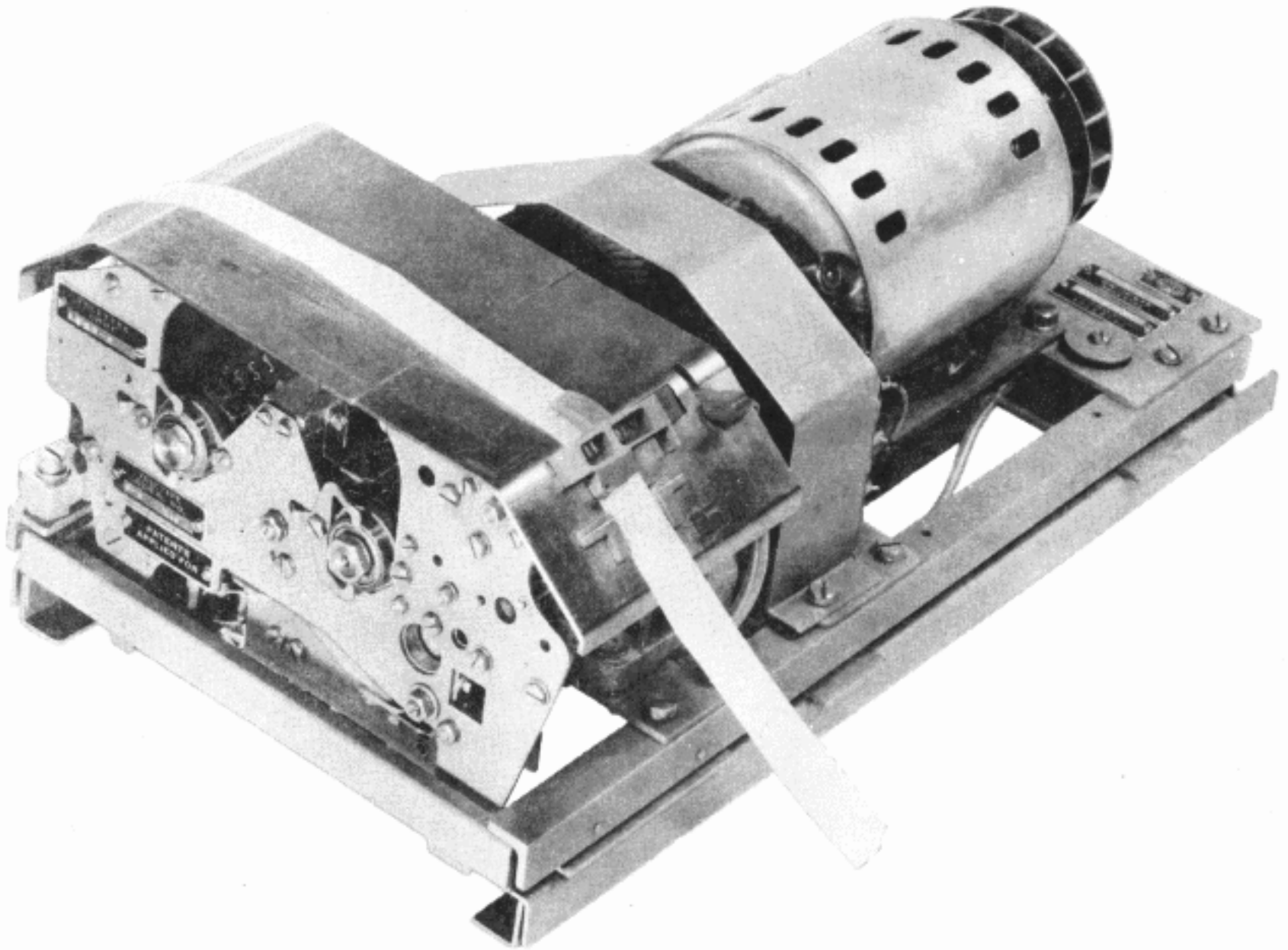
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## LIST OF EFFECTIVE PAGES

APRIL, 1957

PAGE NUMBER	CHANGE IN EFFECT
Title Page	Original
Effective Page	Original
B	Original
C	Original
1-1 to 1-2	Original
2-1 to 2-3	Original
3-0 to 3-14	Original

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MODEL 28 TRANSMITTER DISTRIBUTOR - LBXD1, LBX81

ORIGINAL

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## SECTION 1

## GENERAL DESCRIPTION

## 1. GENERAL

a. **Function** — The Model 28 two-shaft transmitter distributor is a tape reader and distributor providing a means of sensing code combinations, perforated in a tape - or received from an external multi-wire input, and converting them into electrical code pulses for distribution over a signal circuit. It also provides a means of sensing the code combinations perforated in a tape for conversion to a multi-wire output.

b. **Physical Description (Figure 1-1)** — The set consists of a two-shaft transmitter distributor, base, motor unit, and cover. Approximate overall dimensions are six and one-half inches in height, nine inches in width, and sixteen inches in depth.

c. **Features (Figures 1-2, 1-3, 1-4)** — The set incorporates provisions for the following operational features:

- (1) Storing the last character sensed for subsequent transmission
- (2) Sensing and distributor mechanisms capable of being actuated independantly of one another from either a local or remote source
- (3) Wiring of transmitter distributor and base terminating at two 24-point connectors on the base to facilitate external controls and the distribution of multi-wire inputs
- (4) Accomodation of fully perforated or chadless tape - straight or advanced feed, round or square hole
- (5) Operating speeds up to 100 words per minute with gear change only
- (6) Auxiliary contacts "A" and "B" operated from the sensing cam sleeve for controlling external circuits.
- (7) Auxiliary contact "C" operated from the distributor cam sleeve for controlling the sensing cam
- (8) Facilities for gang-mounting
- (9) An oil reservoir for extending lubrication intervals
- (10) An index mark located seven characters ahead

of the sensing pins for aligning message start position

(11) Spring-biased tape lid which raises when a red plastic tape lid release plunger is depressed

(12) Green plastic start-stop lever with a free-wheeling position to facilitate insertion or removal of tape

(13) Five level tape handling facilities with provisions for modification to accomodate six seven, or eight level tapes

(14) Tape-out pin, either four characters in advance of, or, in line with the tape sensing pins

(15) Provision for addition of a tight or tangled tape stop device

(16) Provision for addition of a contact operated from the tape lid.

## 2. COMPONENTS

a. **Transmitter Distributor Base (Figure 1-2)** — The base is a channel iron and sheet metal structure consisting of a mounting base which rests on a sub-base. External connections are made to two 24-point female connectors on the sub-base and associated male connectors on the mounting base. Connections to the transmitter distributor are made through three 14-point connectors and associated cabling. The mounting base supports the transmitter distributor, motor unit, intermediate gear train, and gear guard. Four vibration mounts serve to reduce the amount of noise and vibration conducted through the base. A motor on-off toggle switch is mounted on the left side of the base to the rear of the transmitter distributor.

b. **Motor** — The 3600 RPM (two pole), single phase, capacitor start, synchronous motor is located at the rear of the base. A combination hand wheel and fan is mounted on one end of the motor shaft. A motor starting relay and capacitor, together with a thermal cutout switch are mounted in a compartment on the underside of the motor. The thermal cutout switch (manual reset) is arranged to de-energize the motor if an overload should continue long enough to overheat the motor windings. A resilient mount on each end bell hub isolates the motor from its supporting cra-

dle, to reduce the vibration transmitted to the base.

c. Transmitter Distributor (Figure 1-3, 1-4) — The transmitter distributor incorporates the necessary mechanical and electrical features for translating code combinations in a perforated tape, or from an external multi-wire source, into electrical code pulses. Essentially, it consists of a main casting and front, rear, and center plates on which are mounted the following mechanisms:

- Distributor Cam
- Sensing Cam
- Clutch Trip Magnets
- Distributor Contacts
- Storing Switch
- Auxiliary Contacts
- Tape Sensing
- Tape Feeding
- Tape-Out
- Tape Guide Plate

Wiring terminates at three 14-point connectors for connection to the base.

d. Covers — The covers are of sheet metal construction and are finished internally and externally in baked enamel. The panel snaps into position around the front of the transmitter distributor. The top cover rests in position over the motor and intermediate gear train.

### 3. ELECTRICAL CHARACTERISTICS AND REQUIREMENTS

a. Signalling Code (Figure 1-5) — The signalling code most generally transmitted is the five-unit, start-stop neutral code consisting of current and no-current intervals, or pulses. A marking pulse is a measured interval of time during which current flow is permitted through the closure of a contact. A spacing pulse is a measured interval of time during which the flow of current is interrupted through the opening of a contact. The transmission pattern for a complete character consists of a start pulse (always spacing), five code pulses — any one of which may be either marking or spacing, and a stop pulse (always marking). The start and the stop pulses are to keep the receiving telegraph apparatus in synchronism with the transmitter.

b. Motor Power Requirements — Power requirements for the synchronous motor are as follows —

- (1) Input voltage: 115 volts a-c  $\pm$  10 percent
- (2) Phase: Single phase
- (3) Frequency: 60 cycles  $\pm$  0.75 percent
- (4) Input current:
  - Starting; 9.0 amps.
  - Running; 1.85 amps.
- (5) Power factor: 0.30
- (6) Wattage: 65 watts.

c. Control Circuit Requirements — The clutch trip magnets will operate from 110-120 volts, d-c, or 45-55 volts, d-c. Input current to each clutch trip magnet is approximately 0.100 amperes.

## SECTION 2

## THEORY OF OPERATION

## 1. GENERAL

The ensuing description pertains to the sequence of operation of the transmitter distributor under assumed conditions of operation. These conditions are as follows:

- a. Current applied to the distributor and sensing clutch trip magnet circuits and the motor power circuit at the base connector terminals
- b. Motor toggle switch in its "on" position
- c. Tape inserted in the transmitter, tape lid closed, and the start-stop lever in its right or run position
- d. Distributor clutch trip magnet and start-stop and tape-out switches connected in series
- e. Sensing clutch trip magnet and auxiliary "C" contact connected in series
- f. Storing switch contacts and distributor contacts connected in series with the signal line.

## NOTE

In the illustrative drawings, fixed pivot points are indicated as solid black circles or ellipses.

## 2. SUMMARY (Figure 2-1)

As the distributor clutch trip magnet is energized, the clutch will trip and the cam will start rotating.

The auxiliary "C" contact will close to energize the sensing clutch trip magnet and the distributor contacts will operate to distribute a pattern of code pulses over the signal line (corresponding to the combination resposing in the storing switch from the previously sensed character).

The sensing clutch and cam sleeve will start their rotation to advance the tape, sense the tape, store the sensed character in the storing switch, and operate auxiliary contacts "A" and "B".

In continuous transmission, the distributor cam will have started its next cycle while the actions controlled by the sensing cam sleeve are taking place. These motions will continue until the distributor clutch

trip magnet circuit is interrupted (as by the exhaustion of tape or by moving the start-stop lever to the stop position) whereupon, the distributor clutch will disengage and the transmitter will idle.

## 3. GEARING

The distributor shaft assembly mounts two gears; the rear gear meshes with the intermediate gear train on the base and is driven from the motor. The clutch drum gear, through an idler gear, drives the sensing clutch drum gear to rotate the sensing and the distributor shafts at the same speed.

## 4. TRANSMITTER DISTRIBUTOR

## a. Distributor Shaft

(1) Clutch Trip (Figure 2-2) — As the distributor clutch trip magnet is energized, its armature and armature extension bail are attracted to the magnet core, thus releasing the latching extension of the lower trip lever. The lower trip lever and the upper trip lever pivot on their shaft and the upper trip lever releases the clutch shoe lever from the stop lug on the clutch cam disk.

(2) Clutch Engagement (Figure 2-3) — Clutch engagement is accomplished by releasing the lower end of the clutch shoe lever, B. The upper end of the clutch shoe lever pivots about its ear, C, (which bears against the upper end of the secondary shoe) and moves its ear, D, and the upper end of the primary shoe toward the left until the shoe makes contact with the drum at point E. As the drum turns counter-clockwise, it drives the primary shoe downward so that it again makes contact with the drum, this time at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point C. The lower end of the secondary shoe then bears against the drum at point H. The revolving drum acts to drive this shoe upward so that it again makes contact with the drum at point I. Since the forces involved are multiplied at each of the preceding steps, the final force developed at point I is very great. This force is applied to the lug J on the clutch cam disk to cause it to turn in step with the drum. The cam disk on the clutch is connected to the cam sleeve and engagement of the clutch starts the distributor cam sleeve rotating.



(3) Clutch Reset (Figure 2-2) — As the distributor cam sleeve starts its rotation, the reset extension of the lower trip lever rides to the peak of its cam to place the upper trip lever in the path of the clutch shoe lever.

Should the magnet remain energized, the armature will remain attracted to the magnet core and the armature extension bail will be prevented from latching the lower trip lever. Then, as the cam continues to rotate, the reset extension of the lower trip lever will ride to the low part of its cam and permit the upper trip lever to pivot out of the path of the clutch shoe lever. The cam will continue to rotate thus, until the trip magnet is no longer energized.

When the clutch trip magnet circuit is interrupted, the armature and armature extension bail will be released. Then, as the reset extension of the lower trip lever rides to the high part of its cam, the latching extension will be latched by the armature extension bail to hold the upper trip lever in the path of the clutch shoe lever. As the clutch shoe lever strikes the upper trip lever, the inertia of the clutch will cause it to rotate a slight additional amount and permit the clutch latch lever to fall into the notch in the cam disk. In this position, the clutch shoe lever is held in proximity to the stop lug on the clutch cam disk.

(4) Clutch Disengagement (Figure 2-4) — Disengagement is accomplished by bringing together lug A on the clutch cam disk and the lower end of the clutch shoe lever B. The upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum to stop rotation of the clutch and cam sleeve.

#### (5) Cam Sleeve (Figure 2-5)

(a) Auxiliary "C" Contact — Shortly after the distributor cam sleeve starts to rotate, an auxiliary "C" cam follower lever will ride into its cam indent. In so doing, it will release its rocker to permit the auxiliary "C" contact to close and complete the sensing clutch trip magnet circuit.

(b) Distributor Contacts — The contacts of the storing switch assembly will have been arranged in conformance with the code combination of the last character sensed by the sensing mechanism. Then, as the distributor cam sleeve continues its rotation, the cam follower levers will be actuated by their cams to open and close the distributor contacts for measured intervals of time. Operation of the distributor contacts (in series with the storing switch contacts) will

generate a signal pattern corresponding to the code combination of the previously sensed character.

#### b. Sensing Shaft

(1) Clutch Operation (Figure 2-2, 2-3, 2-4) — As the sensing clutch trip magnet is energized, the sensing clutch will rotate in a manner similar to that of the distributor clutch (as described in paragraphs 4. a. (1) to 4. a. (4) preceding) causing the sensing cam sleeve to rotate.

(2) Tape Feeding (Figure 2-6) — As the sensing cam sleeve rotates, a roller on the rear feed lever rides to the high part of its cam moving the lower extension of the front feed lever downward. The feed levers actuate a feed pawl assembly which then engages a tooth on the feed wheel to rotate the feed wheel one space. As the feed wheel rotates, the detent lever roller will rest in the hollow between two teeth and hold the feed wheel in position. With the continued rotation of the sensing cam sleeve, the feed lever roller rides to the low part of its cam and the feed pawl rises to move past the next tooth where it is in position for the next cycle.

(3) Tape Sensing (Figure 2-7) — At the start of the sensing cam sleeve rotation, the sensing pins are in their downward position, withdrawn from the tape, and the storing switch contacts are arranged in accordance with the code combination of the previous sensed character.

(a) Pusher Bail (Figure 2-8) — As the pusher bail roller rides to the peak of its cam, the pusher bail moves the pusher levers to the right, thus stripping any previously selected pusher levers from the shoulders of their sensing pins. Then, as the pusher bail roller rides to the indent of its cam, the pusher bail is withdrawn from the pusher levers to permit the levers to rest against their sensing pins.

(b) Sensing Bail (Figure 2-9) — The sensing bail rollers move into the indent of their cams and the right end of the sensing bail rises to permit the sensing pins to rise and sense the code perforations in the tape. If the code level sensed by a pin is not perforated, travel of the pin is blocked by the tape and the pusher lever remains to the right of its sensing pin. If the code level is perforated, the pin is free to rise through the perforation sufficiently to permit the top of the pusher lever to drop under the shoulder of the sensing pin. Further rotation of the sensing cam sleeve will move the sensing bail rollers to the peak of their cams and start the right end of the sensing bail, the sensing pins and the selected pusher levers moving downward.

(c) Latch Bail (Figure 2-10) — As the latch

bail roller rides to the peak of its cam, the lower end of the latch bail will be moved to the left to actuate the latch levers. The lower end of the latch levers are moved to the right to release any previously latched slides and the slides will start to rise under the tension of their springs. If its pusher lever has not been selected, the slide is free to rise to its unoperated position. If its pusher lever has been selected, and moved downward by the sensing bail, the pusher lever will hold the slide down. Then, as the latch bail roller rides to the indent of its cam, the lower end of the latch bail will move to the right, permitting the latch levers to latch the slides in their operated position.

(d) Storing Switch (Figure 2-11) — In its unoperated or upward position, the slide holds the contact lever upward and the contact open. In its downward position, the slide permits the contact lever to move downward and close the contact. Thus, the code combination of the sensed character is stored in an arrangement of the storing switch contacts, and, on the next cycle of the distributor cam sleeve, will be transmitted sequentially over the signal circuit.

(4) Auxiliary Contacts (Figure 2-12) — With the rotation of the sensing cam sleeve, auxiliary levers "A" and "B" follow their cams to actuate pusher levers, slides, and the contact levers of the storing switch assembly. These contacts are operated for each cycle of the sensing cam sleeve as follows:

(a) Auxiliary contact "B" closes at approximately 66 degrees

(b) Auxiliary contact "A" opens at approximately 92 degrees

(c) Auxiliary contact "B" opens at approximately 236 degrees

(d) Auxiliary contact "A" closes at approximately 312 degrees.

### c. Controls

#### (1) Start-Stop Lever

(a) Run (Figure 2-13) — When the start-stop

lever is moved to the right or "run" position, the start-stop lever bail is released, and, in pivoting, releases the start-stop switch bail. The start-stop switch bail releases the start-stop switch plunger to complete the distributor clutch trip magnet circuit and energize the magnet.

(b) Stop (Figure 2-13) — When the start-stop lever is moved to the center or "stop" position, the lever cams the start-stop lever bail which transfers its motion to the start-stop switch latch bail which, in turn, operates the start-stop switch bail to actuate the start-stop switch plunger. Actuation of the switch opens the distributor clutch trip magnet circuit to de-energize the magnet and stop the rotation of the distributor cam sleeve.

(c) Free-Wheeling (Figure 2-14) — When the start-stop lever is moved to the left or the "free-wheeling" position, the lever cams the bail an additional distance and an extension of the bail disengages the feed pawl and detent lever from the feed wheel to permit the wheel to rotate freely. In addition, the start-stop lever bail extension operates an extension of the tape-out pin depressor bail to depress the tape-out pin and permit the free passage of tape under the tape lid.

(2) Tape-Out (Figure 2-14) — The normally closed contacts of the tape-out switch are in series with the distributor clutch trip magnet. With tape in the transmitter, the tape-out pin is held depressed and away from the switch plunger to energize the distributor clutch trip magnet and permit operation. As the end of the tape passes over the tape-out pin, the pin rises to actuate the switch plunger and interrupt the magnet circuit, thereby stopping transmission.

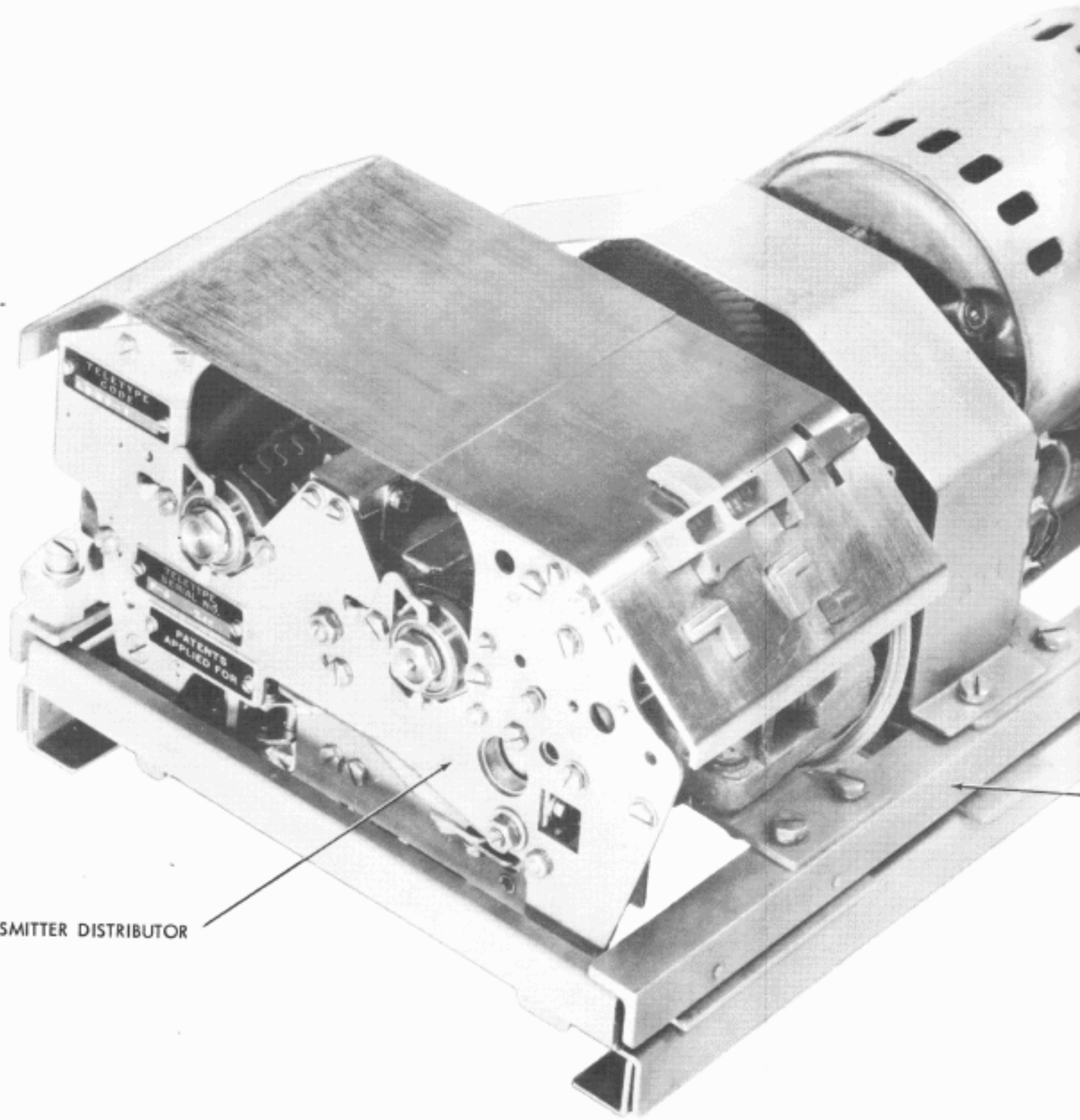
(3) Tape Lid (Figure 2-15) — When the red plastic tape lid release plunger is depressed, it operates the plunger bail. The latching extension of the plunger bail releases the tape lid latching post permitting the post spring to move the post downward and the tape lid upward. Manually depressing the tape lid causes the latching post to move upward, past the latching extension of the plunger bail. The latching extension of the bail then moves under the post to hold the post up and the tape lid closed.

SECTION 3

FIGURES

FOR

SECTIONS 1 AND 2



TRANSMITTER DISTRIBUTOR

FIGURE 1-1

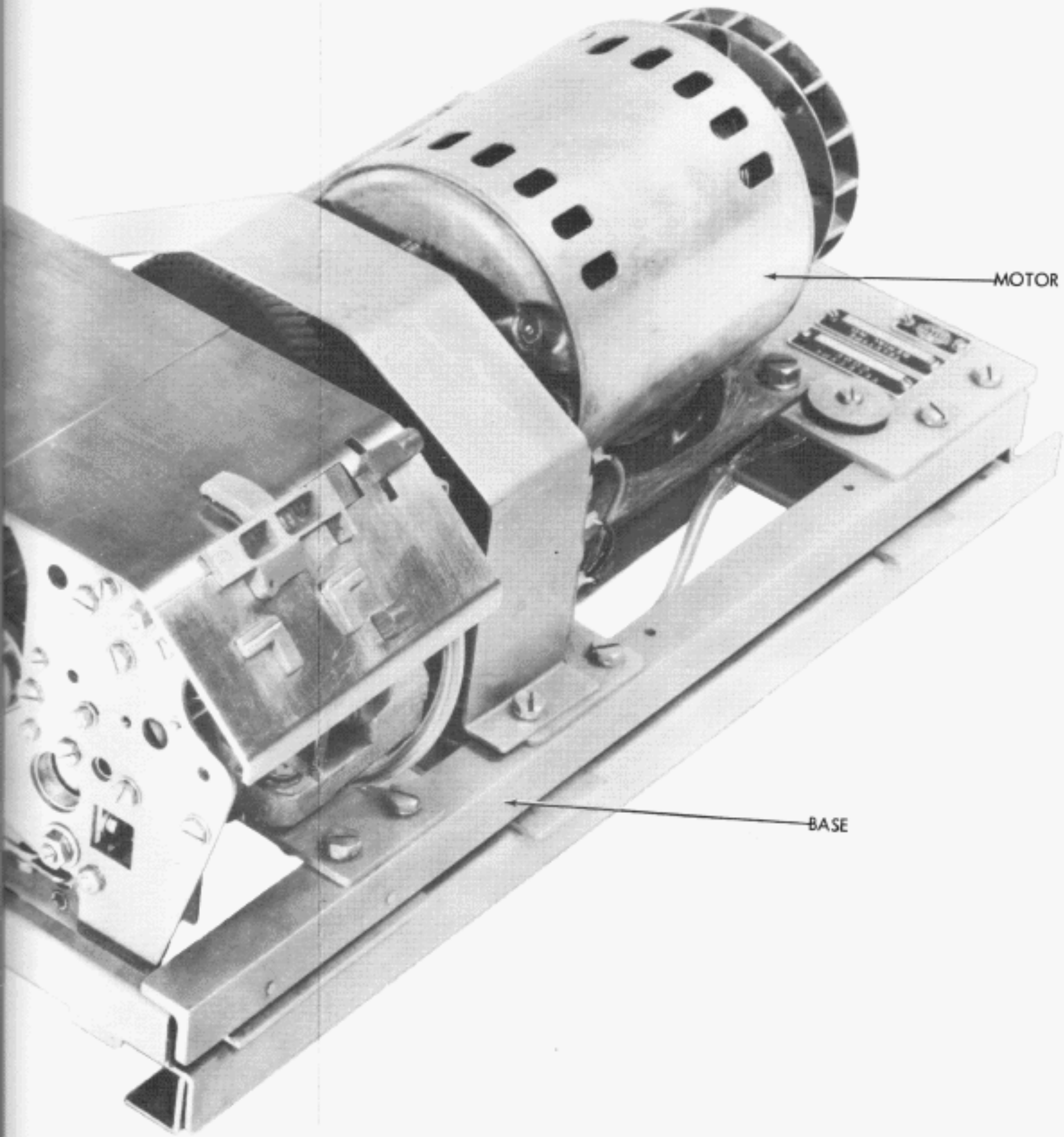


FIGURE 1-1

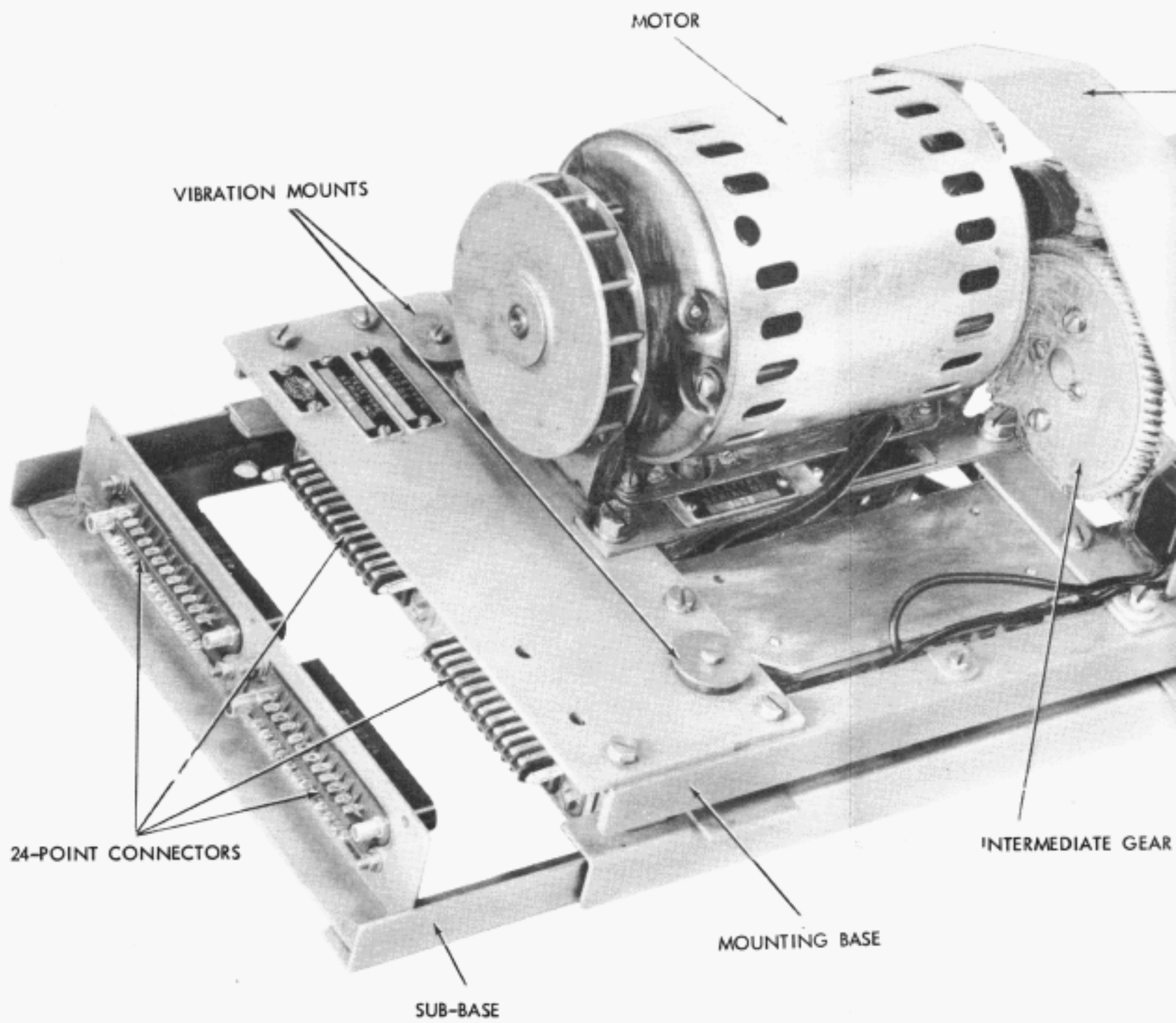


FIGURE 1-2

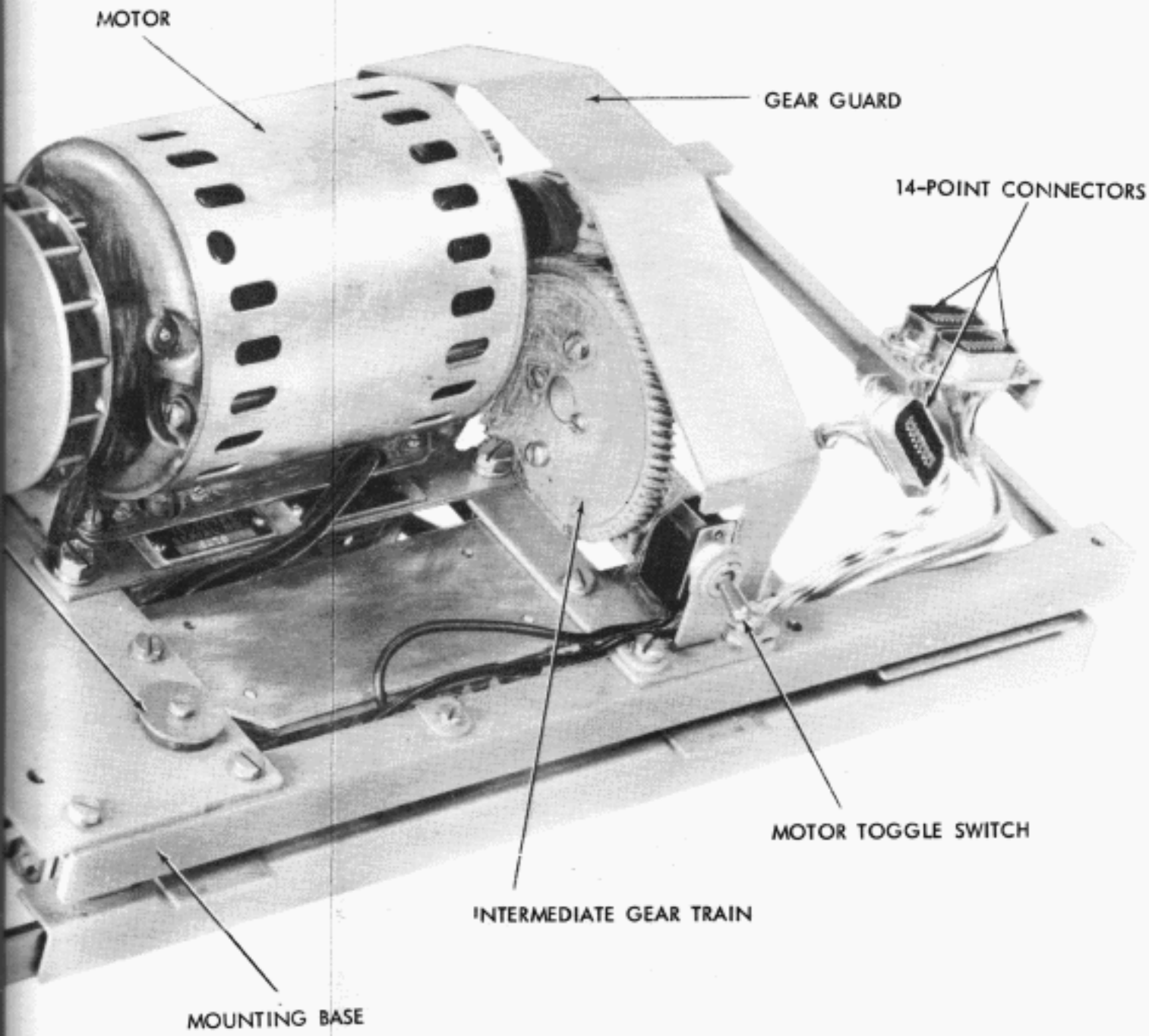


FIGURE 1-2

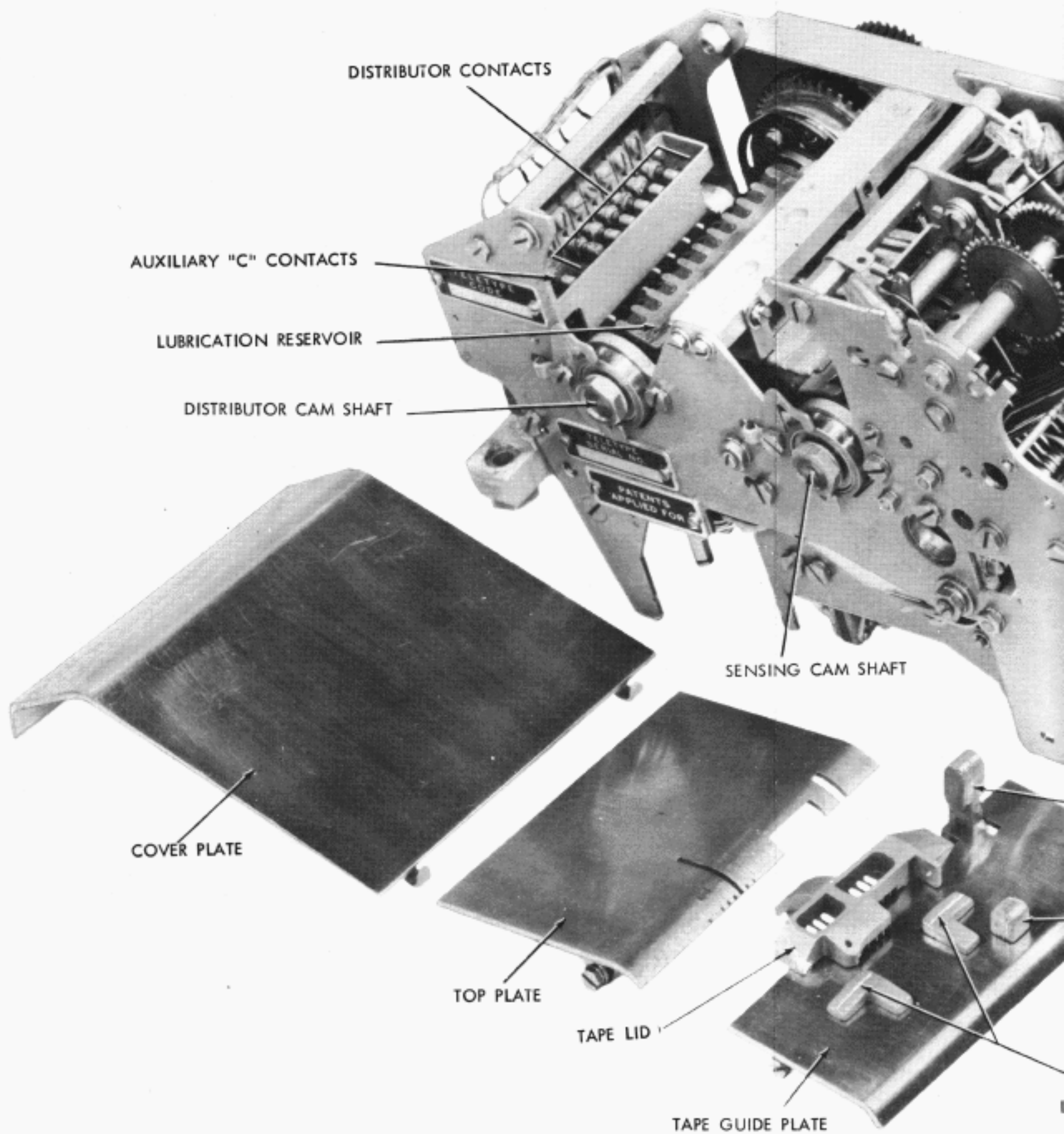


FIGURE 1-3



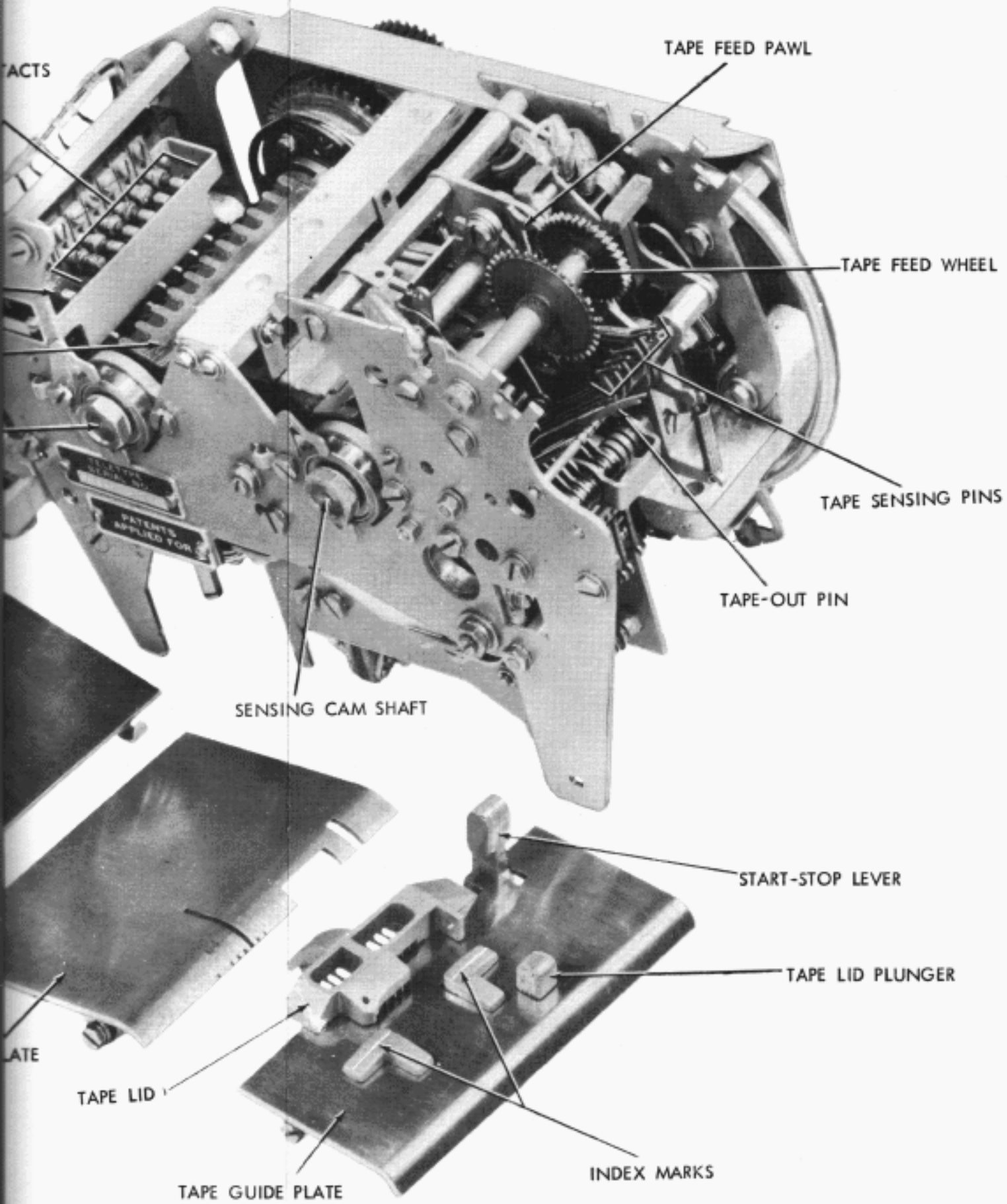


FIGURE 1-3

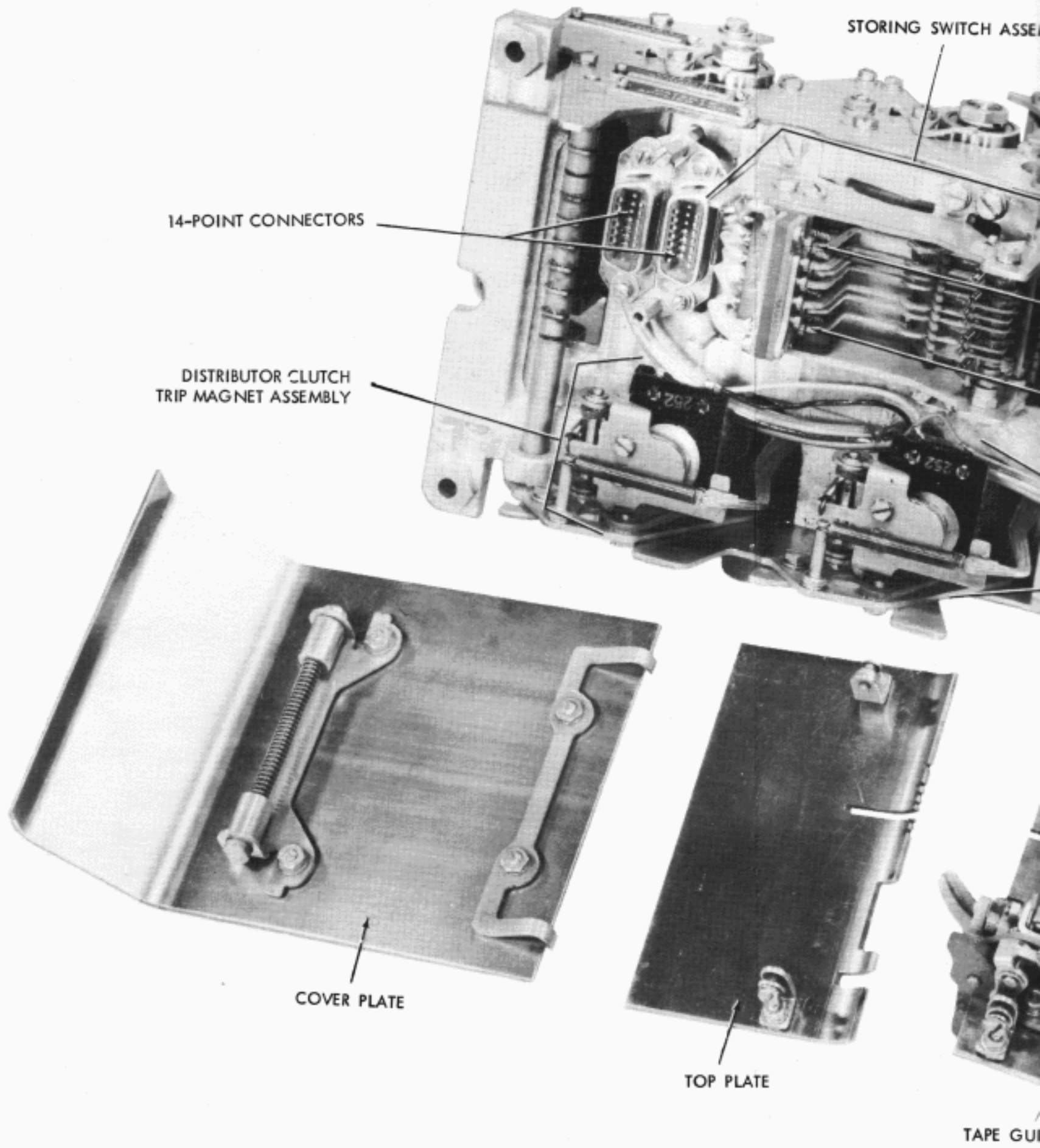


FIGURE 1-4

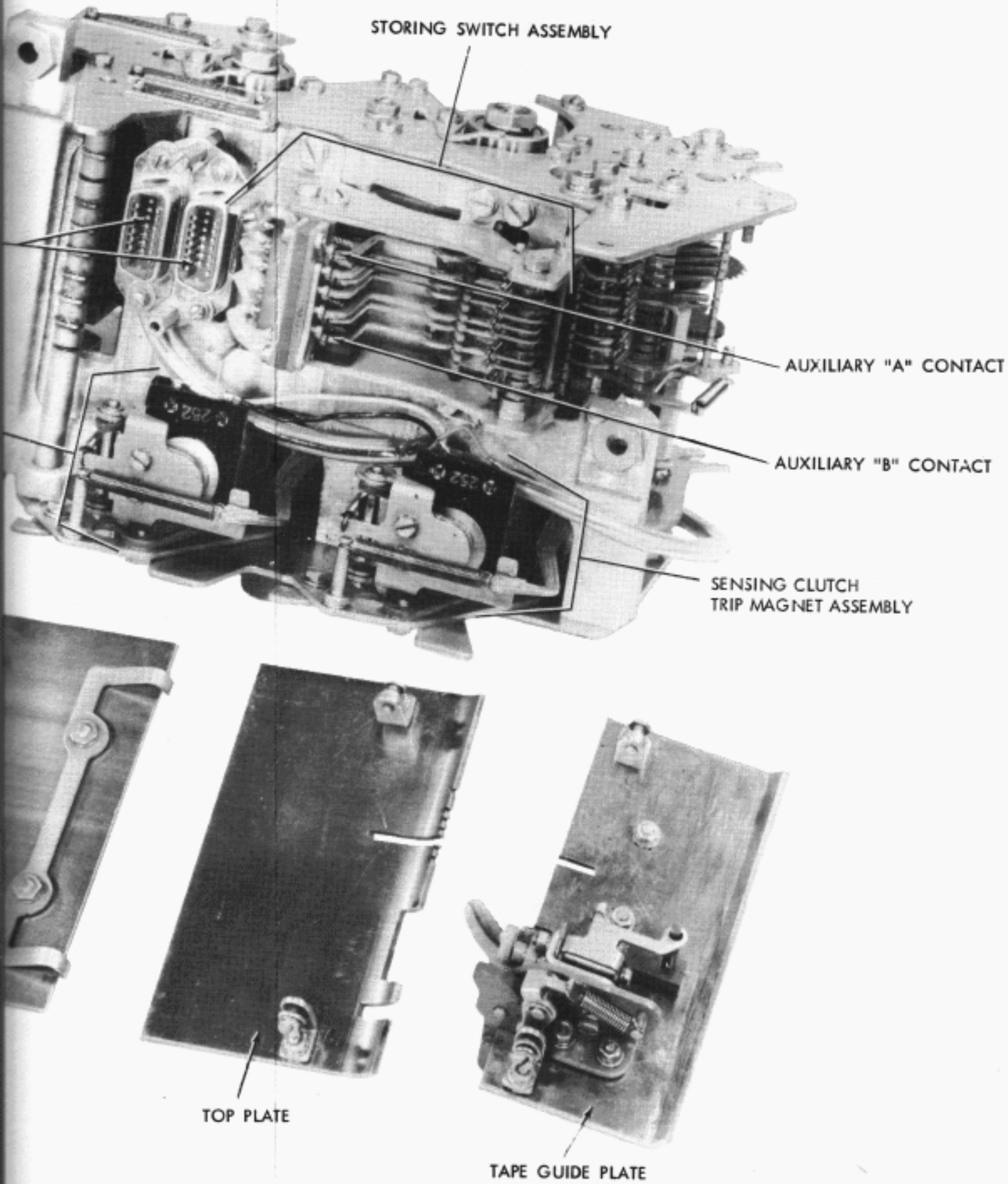


FIGURE 1-4

FIGURES	-	?	:	\$	3		&	#	8	Bell	(	)	.	,	9	0	1	4	'	5	7	,	
LETTERS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	
NUMBERS INDICATE MARKING CODE PULSES	1	1		1	1	1				1	1						1		1		1		
	2		2				2		2	2	2	2				2	2	2				2	2
			3			3		3	3		3		3	3		3	3		3			3	3
		4	4	4		4	4			4	4		4	4	4			4					4
		5						5	5				5	5	5	5	5				5		5

FIGURE 1-5 CODE CHART

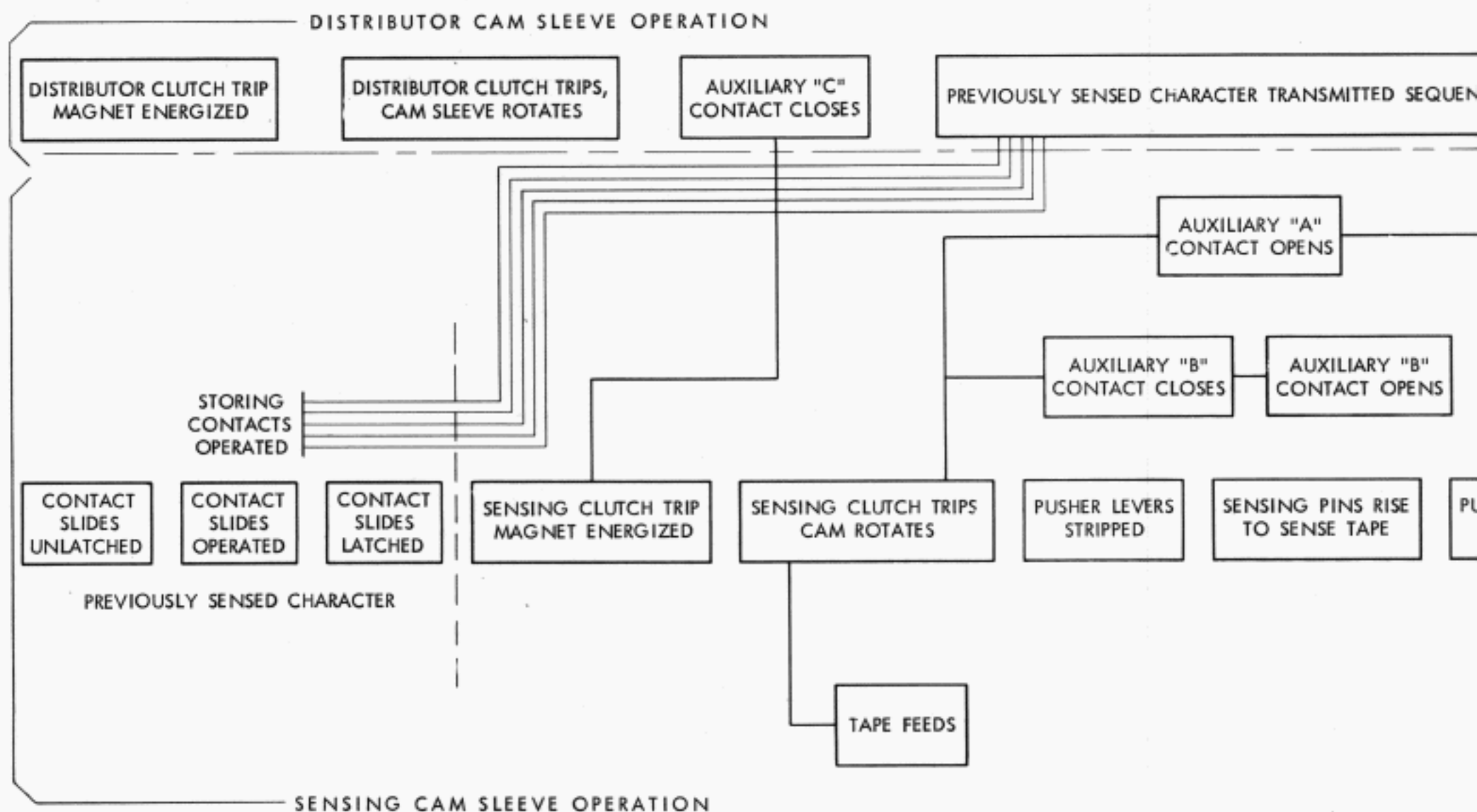


FIGURE 2-1  
FUNCTIONAL BLOCK DIAGRAM  
MODEL 28 TWO-SHAFT  
TRANSMITTER DISTRIBUTOR

&	#	8	Bell	(	)	.	,	9	0	1	4	'	5	7	;	2	/	6	"	Blank	Letters	Figures	C.R.	L.F.	Space
G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z						
			1	1						1		1		1		1	1	1	1		1	1			
2		2	2	2	2				2	2	2			2	2	2					2	2		2	
	3	3		3		3	3		3	3		3		3	3		3	3			3				3
4			4	4		4	4	4			4				4		4				4	4	4		
5	5				5	5		5	5	5			5		5	5	5	5	5		5	5			

FIGURE 1-5 CODE CHART

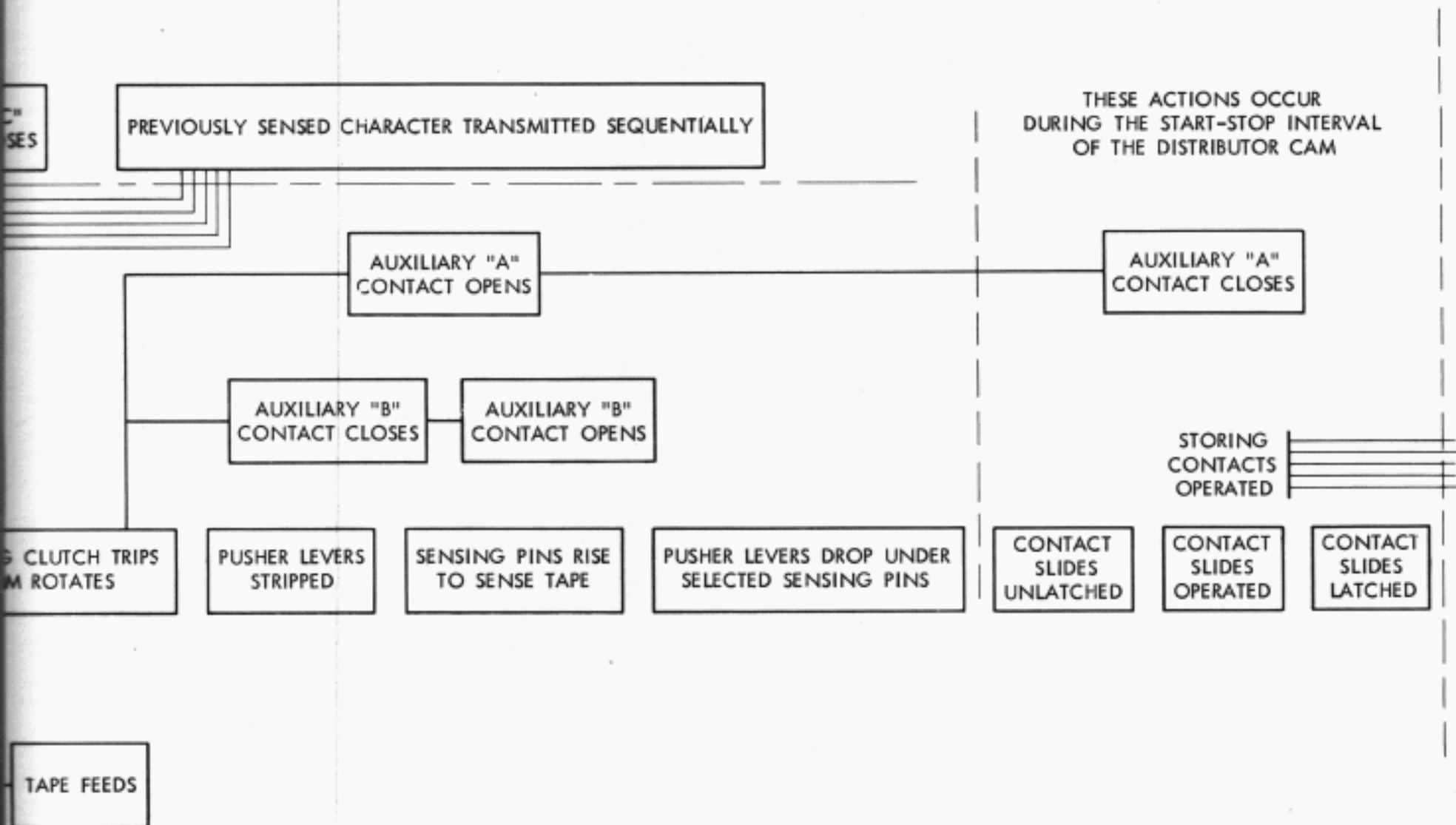


FIGURE 2-1  
FUNCTIONAL BLOCK DIAGRAM  
MODEL 28 TWO-SHAFT  
TRANSMITTER DISTRIBUTOR

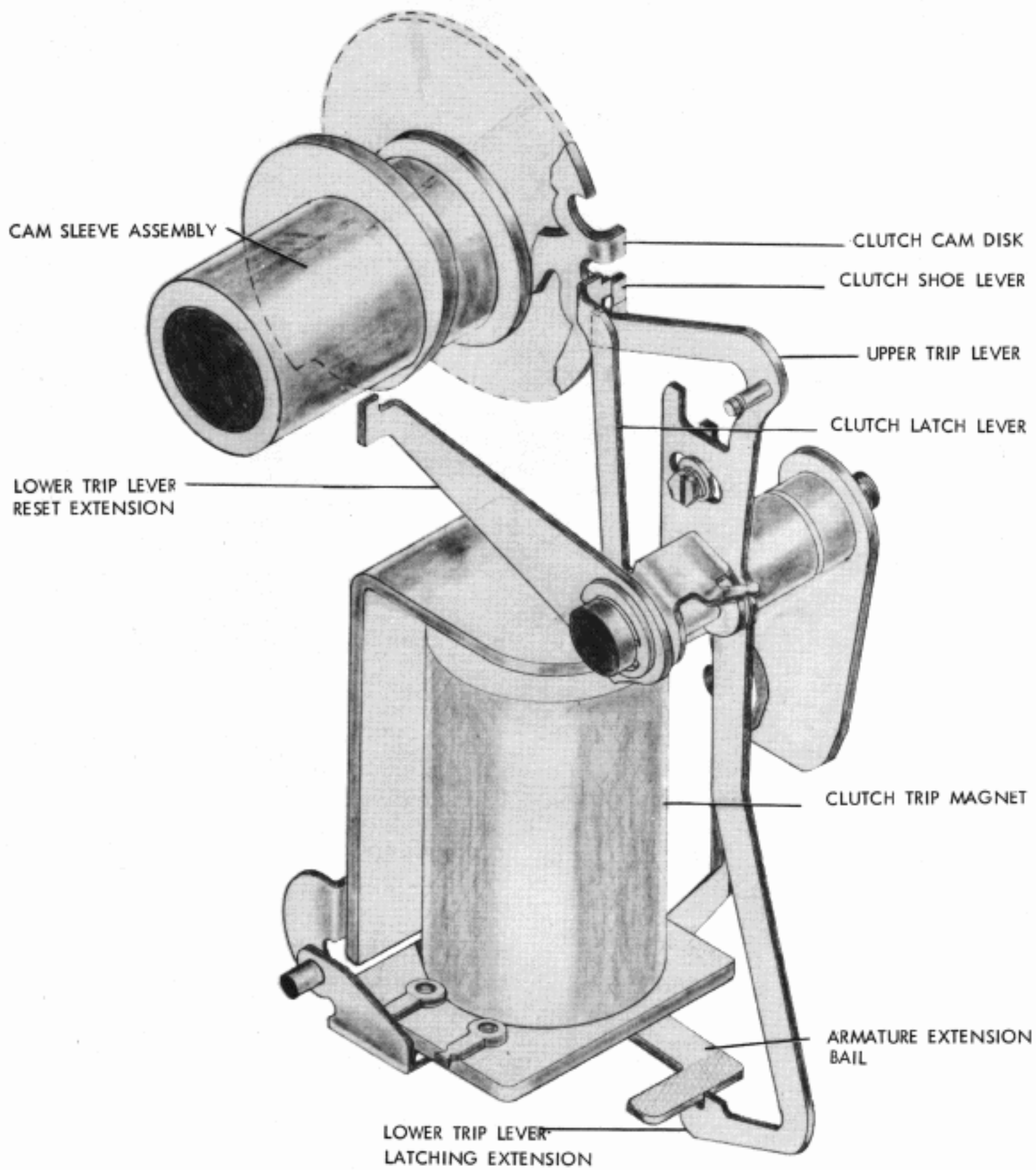


FIGURE 2-2 CLUTCH TRIP

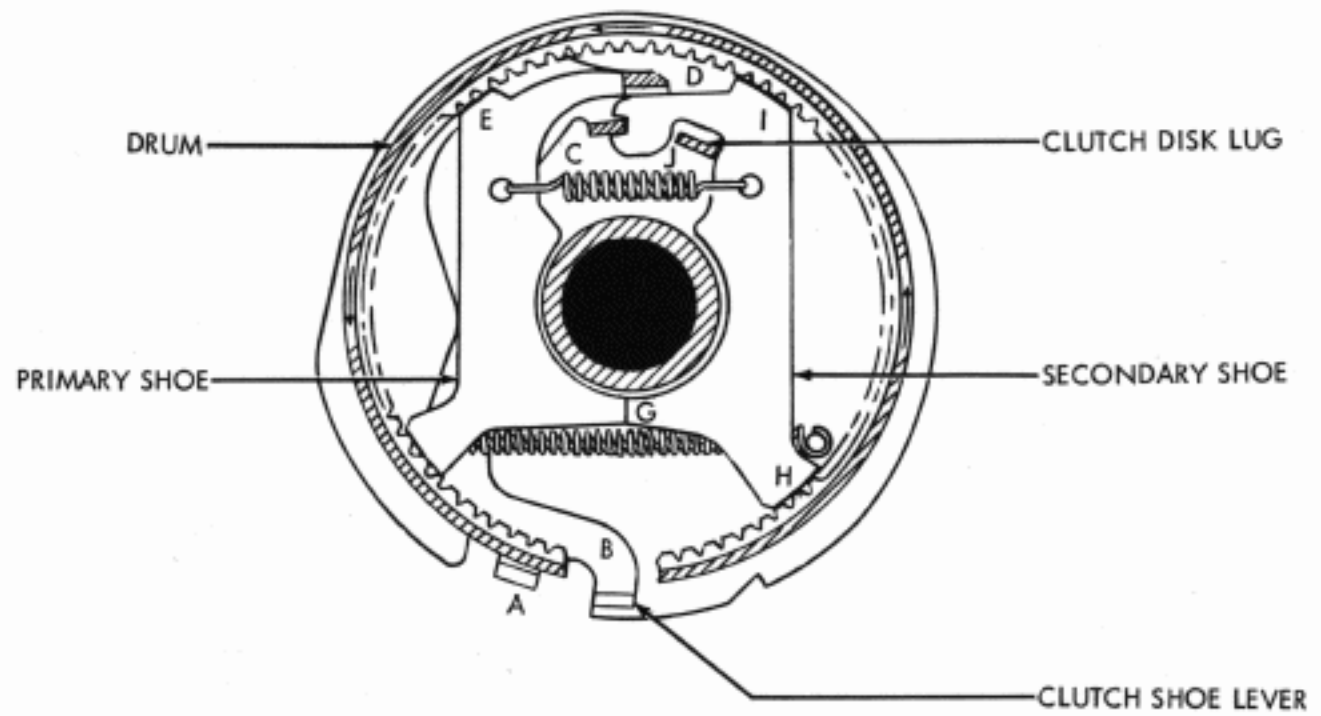


FIGURE 2-3 CLUTCH ENGAGED

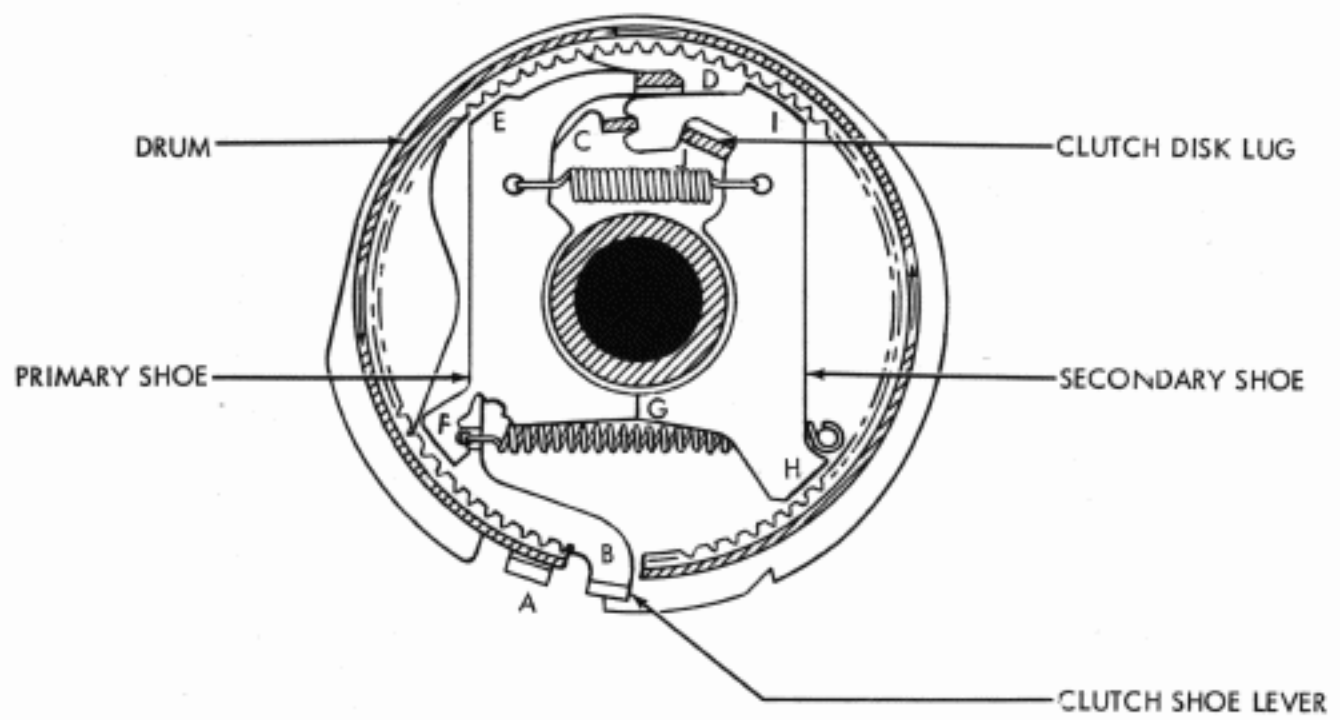


FIGURE 2-4 CLUTCH DISENGAGED

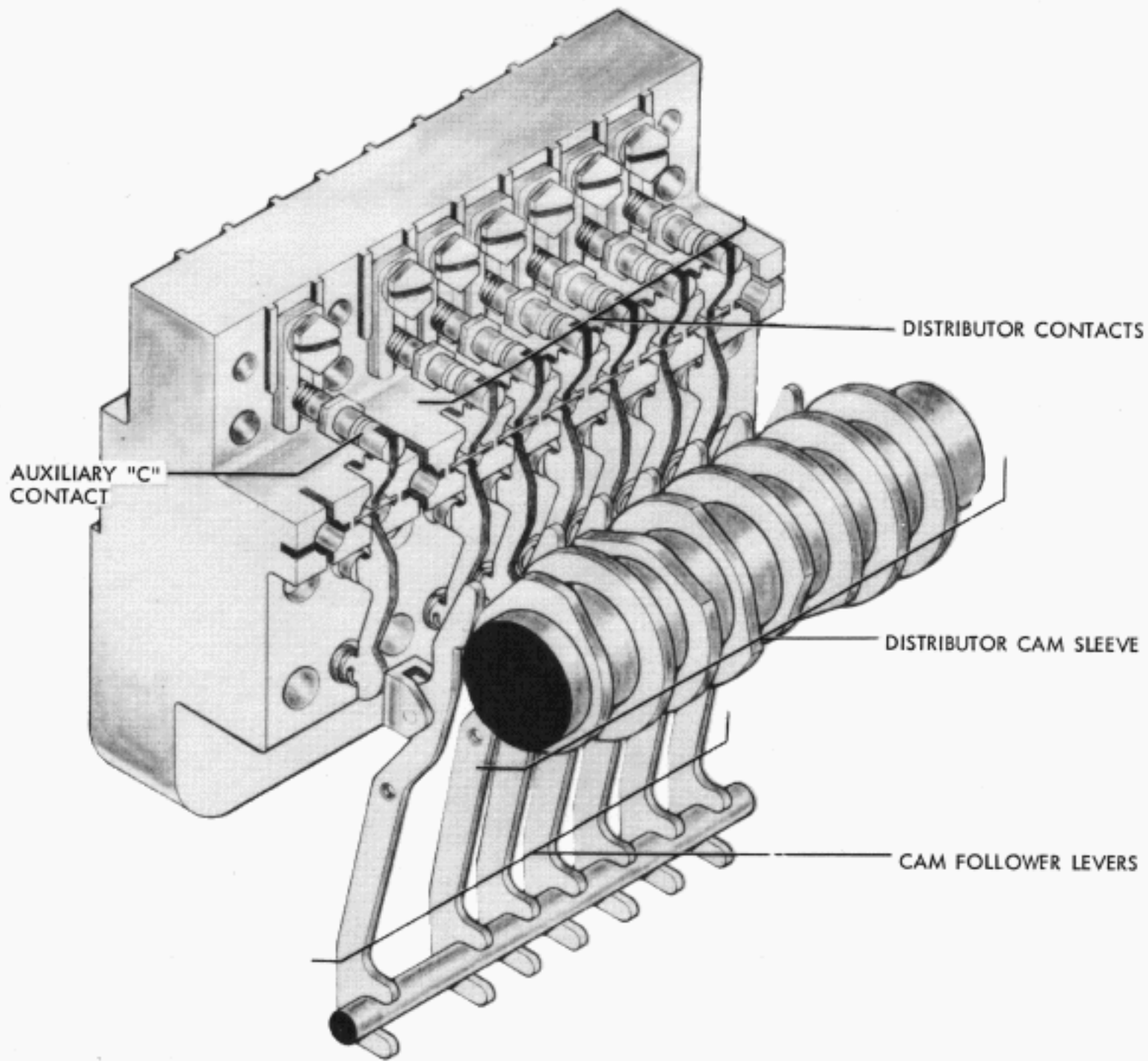


FIGURE 2-5 DISTRIBUTOR CAM SLEEVE



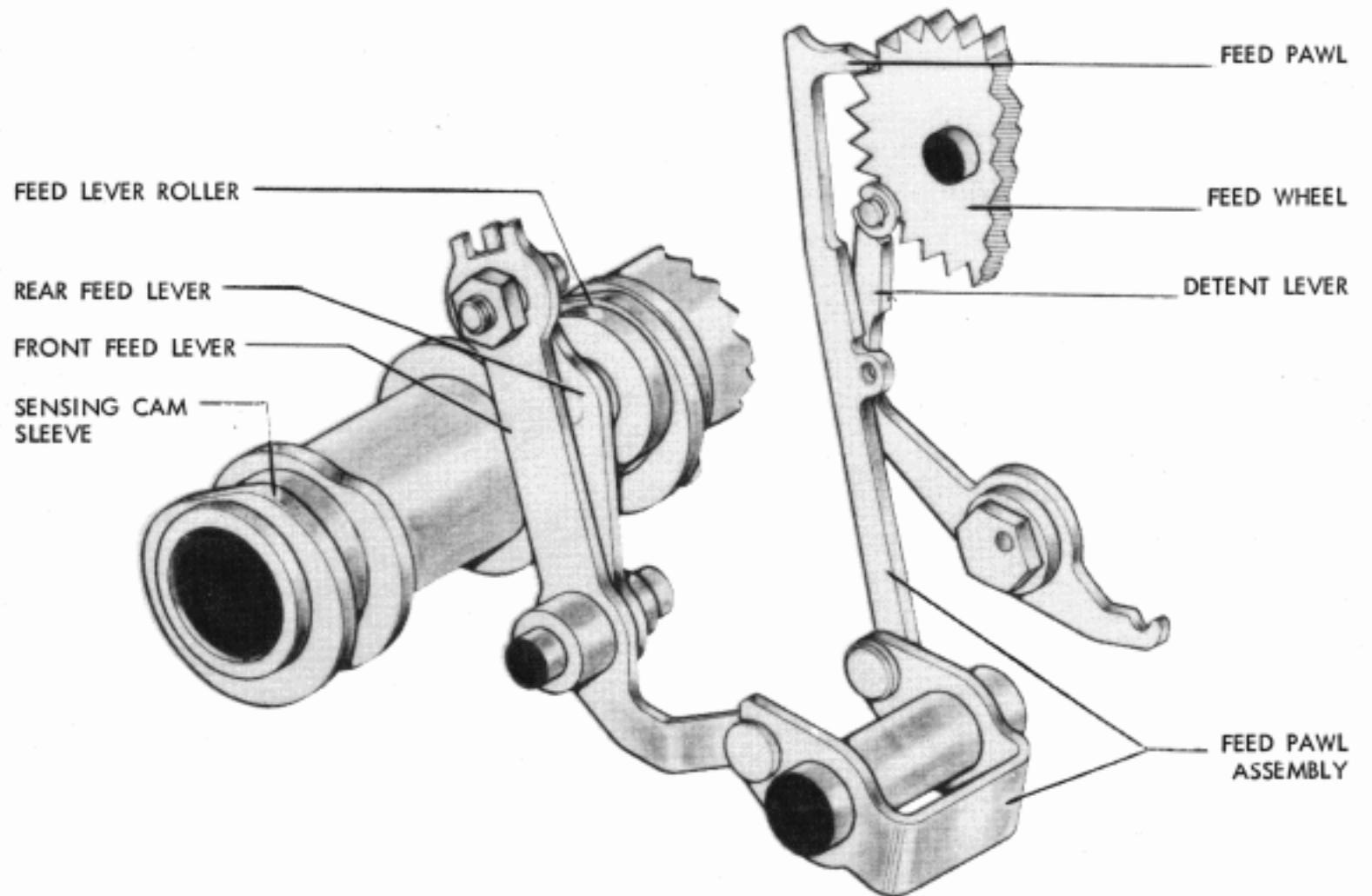


FIGURE 2-6 TAPE FEEDING

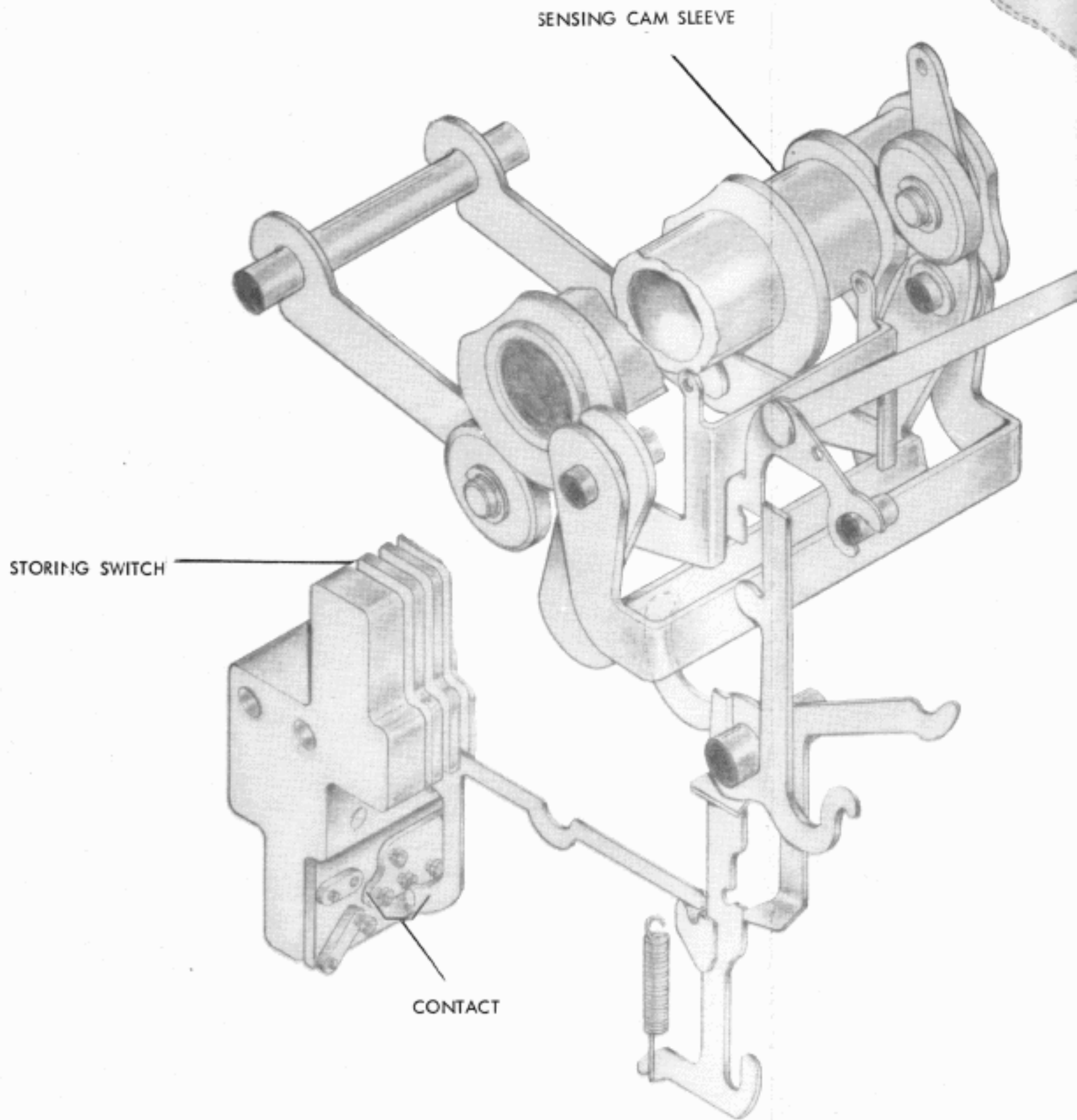


FIGURE 2-7 TAPE SENSING

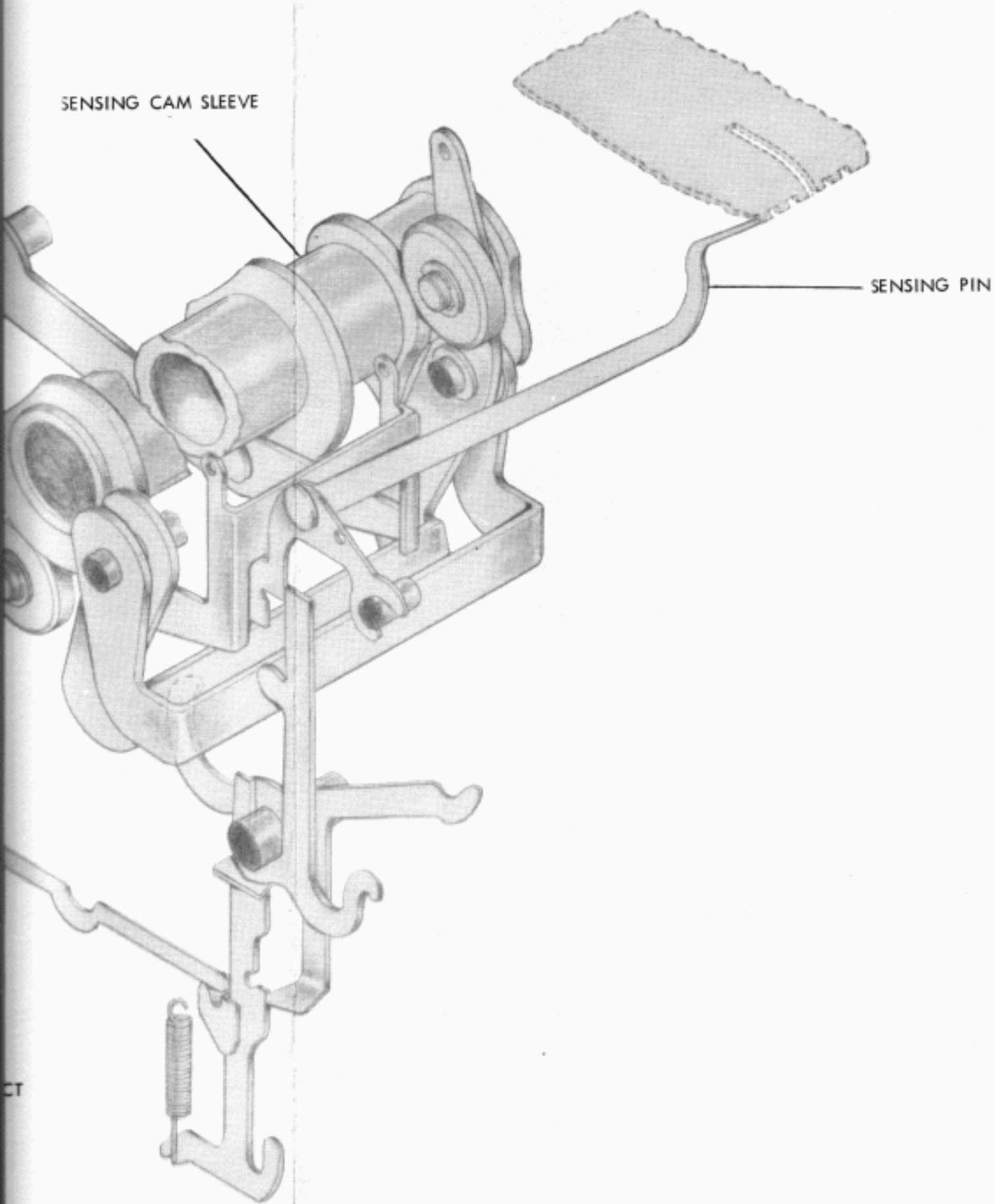


FIGURE 2-7 TAPE SENSING

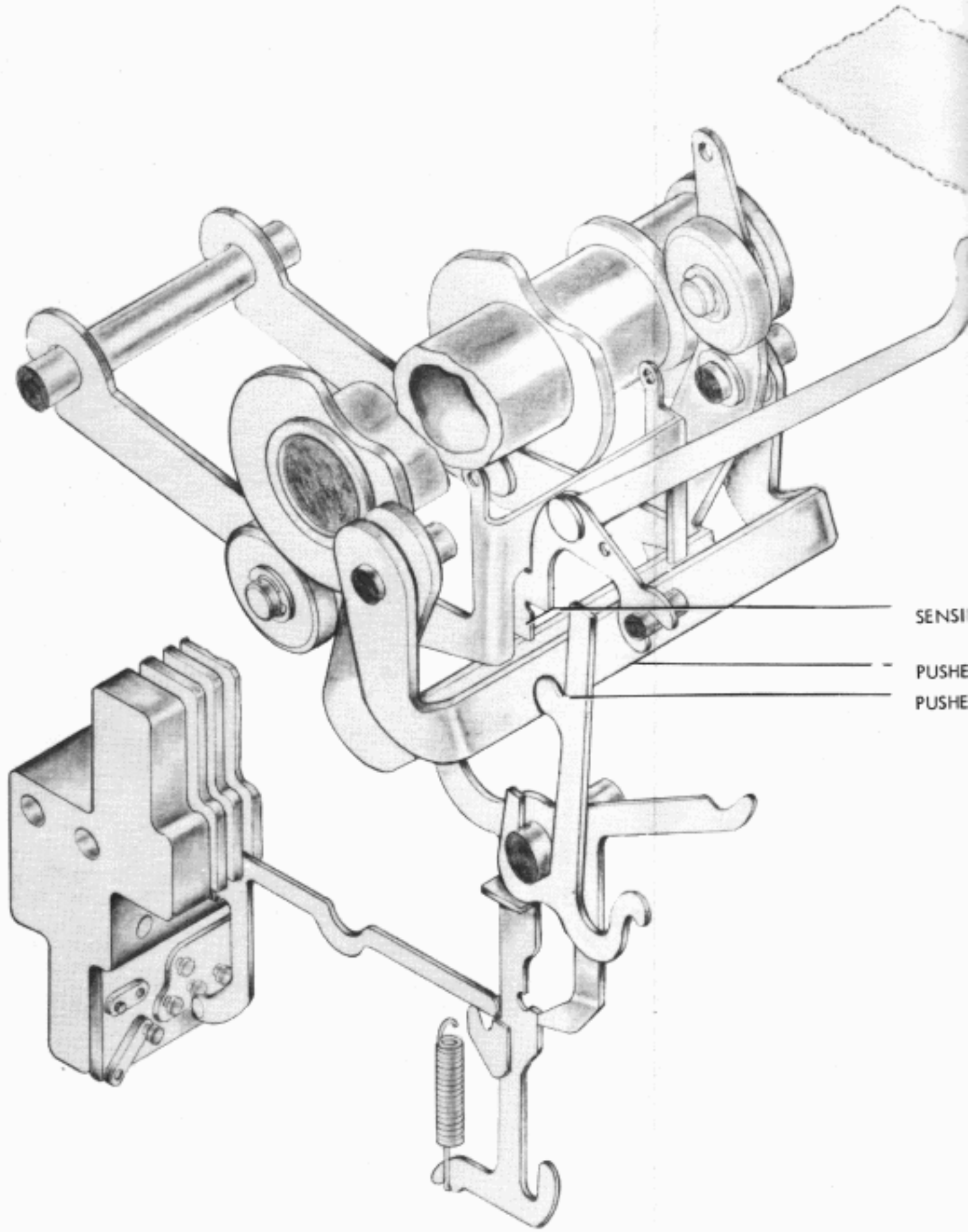


FIGURE 2-8 PUSHER BAIL

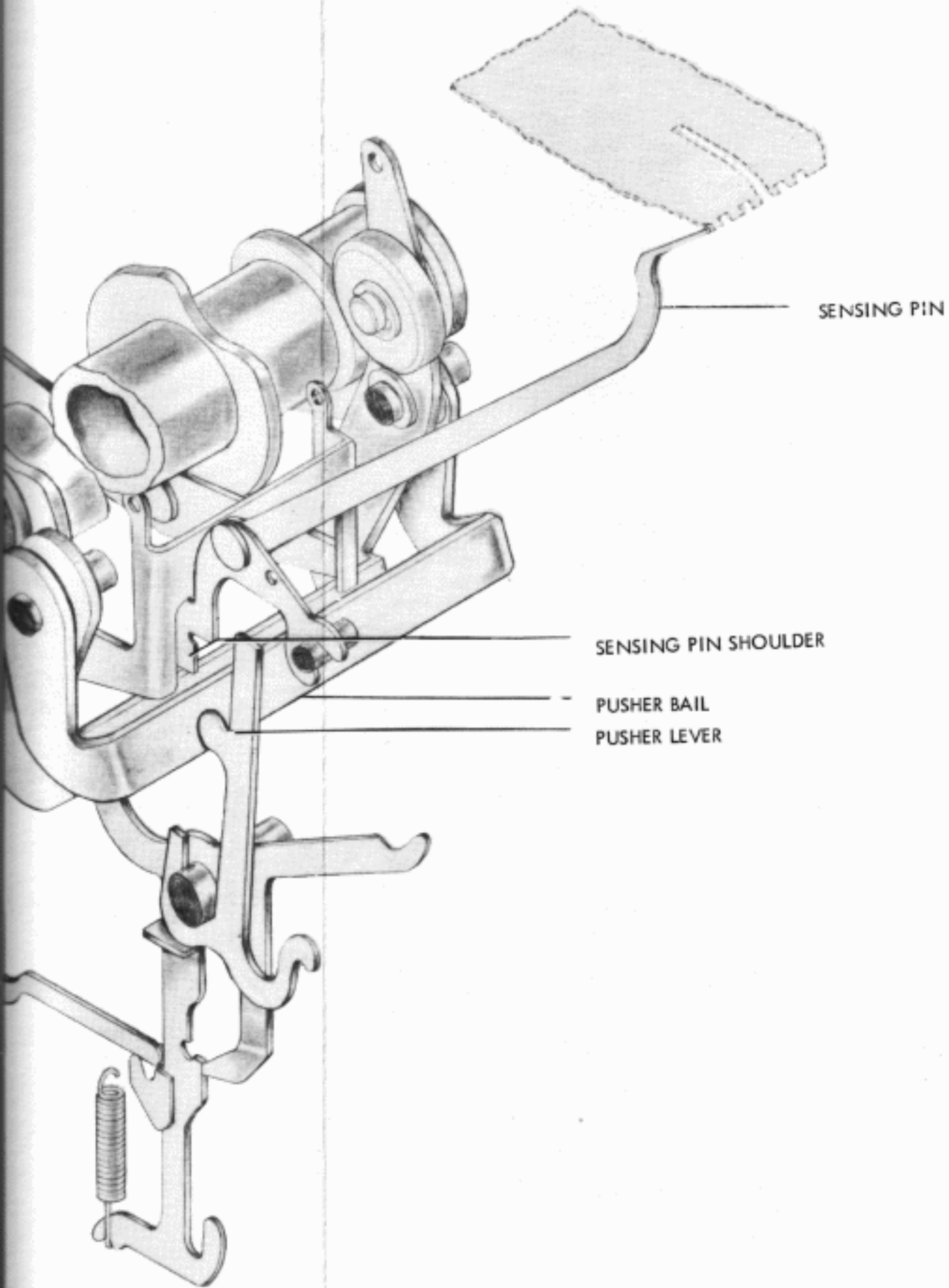


FIGURE 2-8 PUSHER BAIL

SENSING BAIL ROLLER

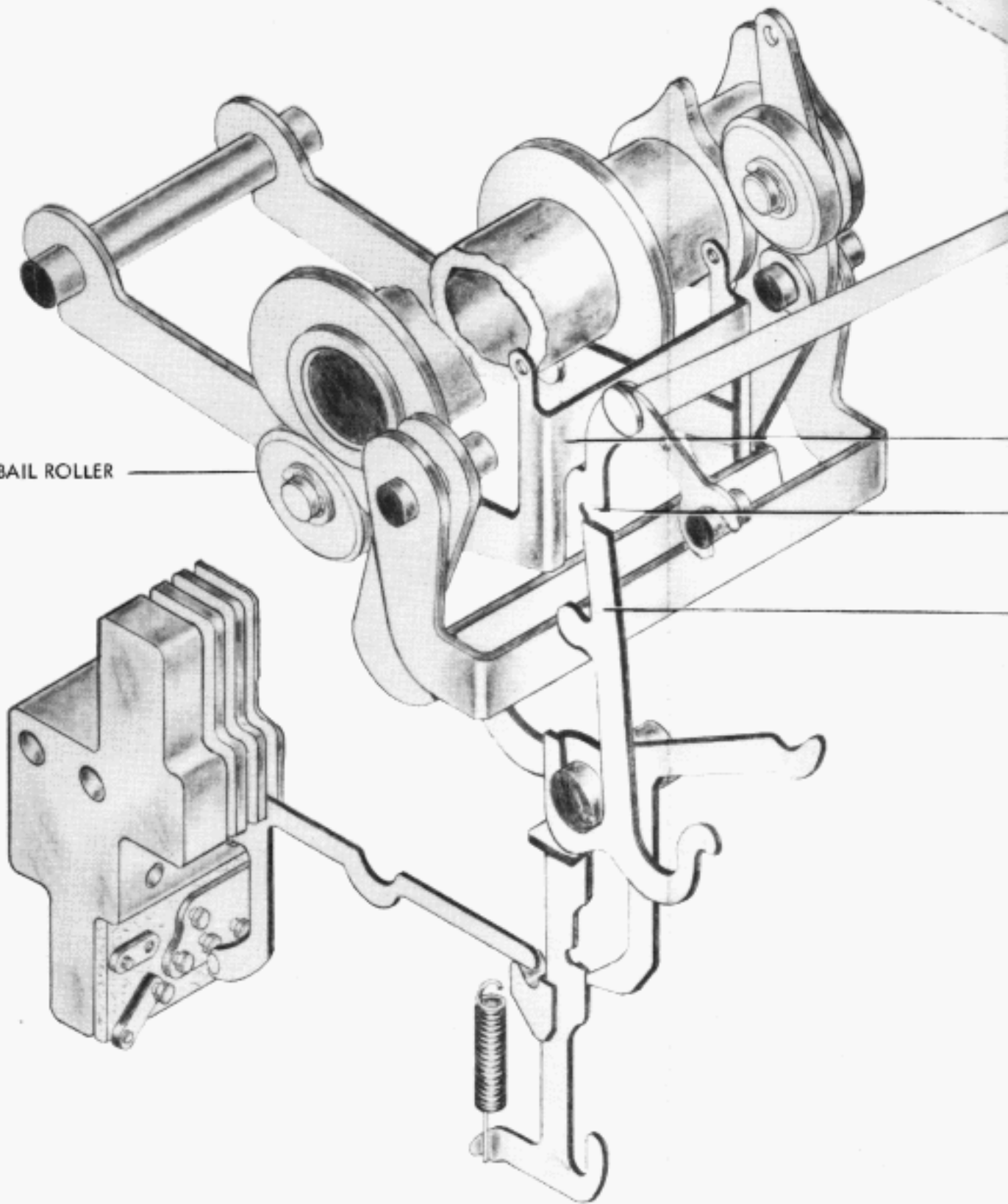


FIGURE 2-9 SENSING BAIL

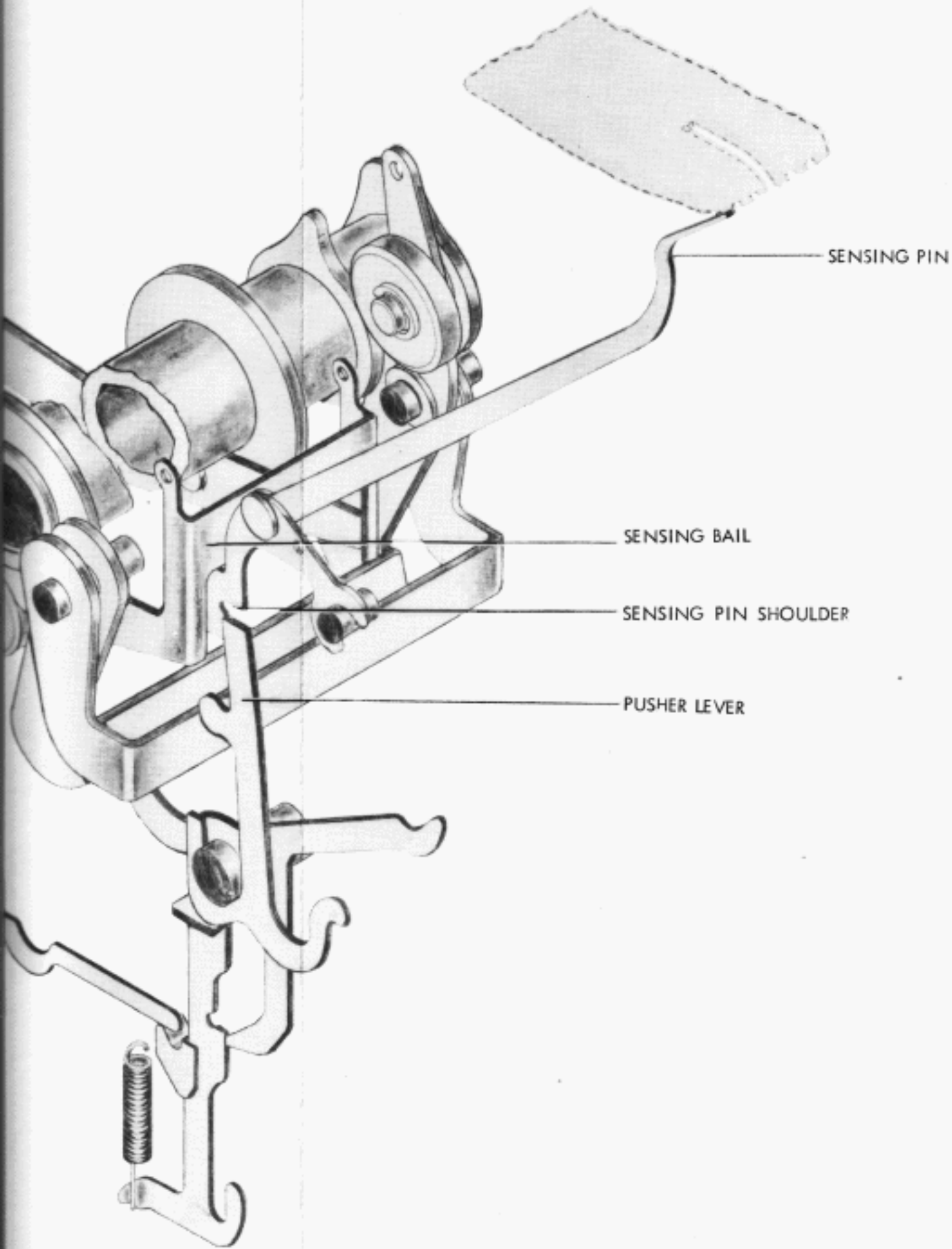


FIGURE 2-9 SENSING BAIL

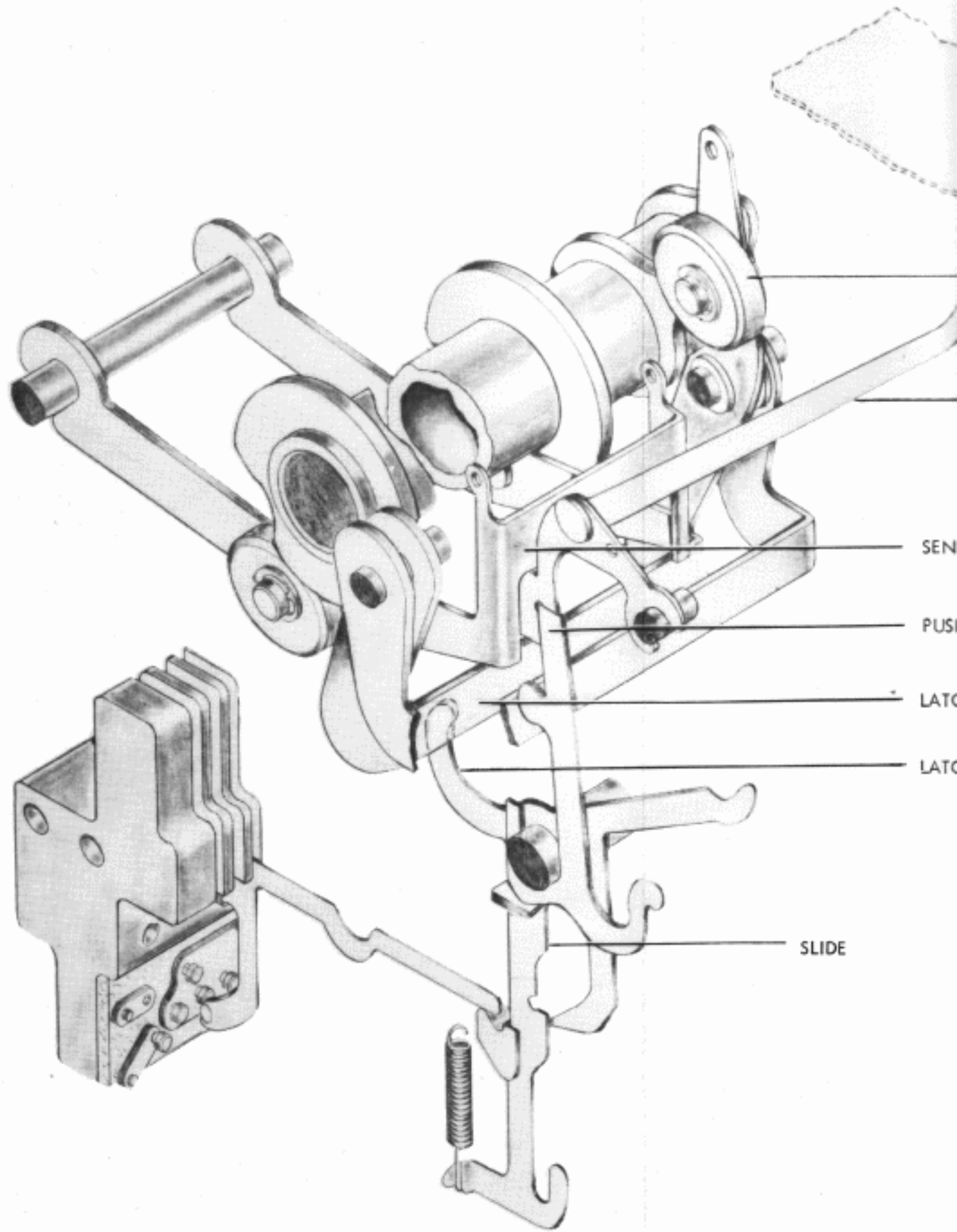


FIGURE 2-10 LATCH BAIL



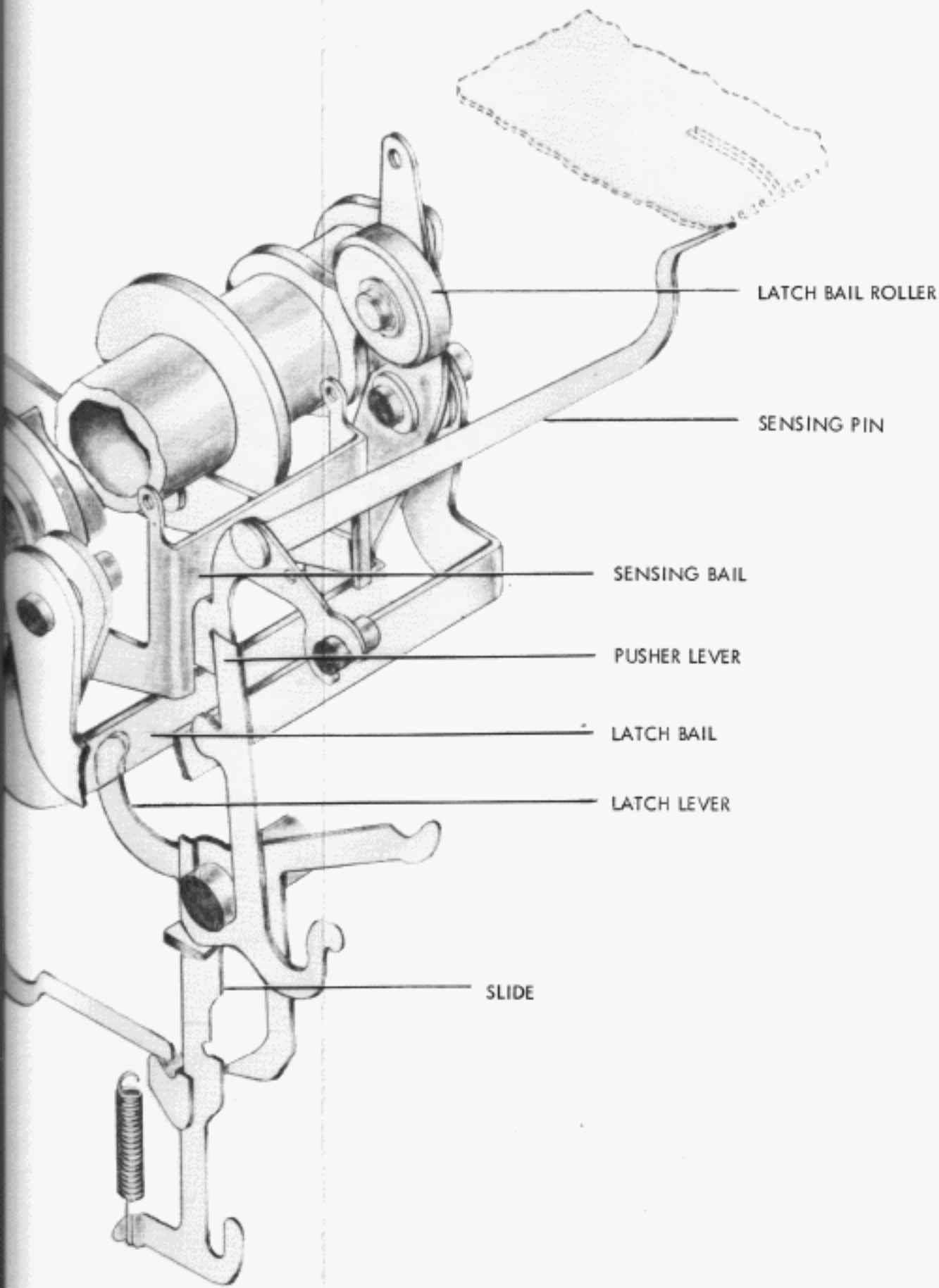


FIGURE 2-10 LATCH BAIL

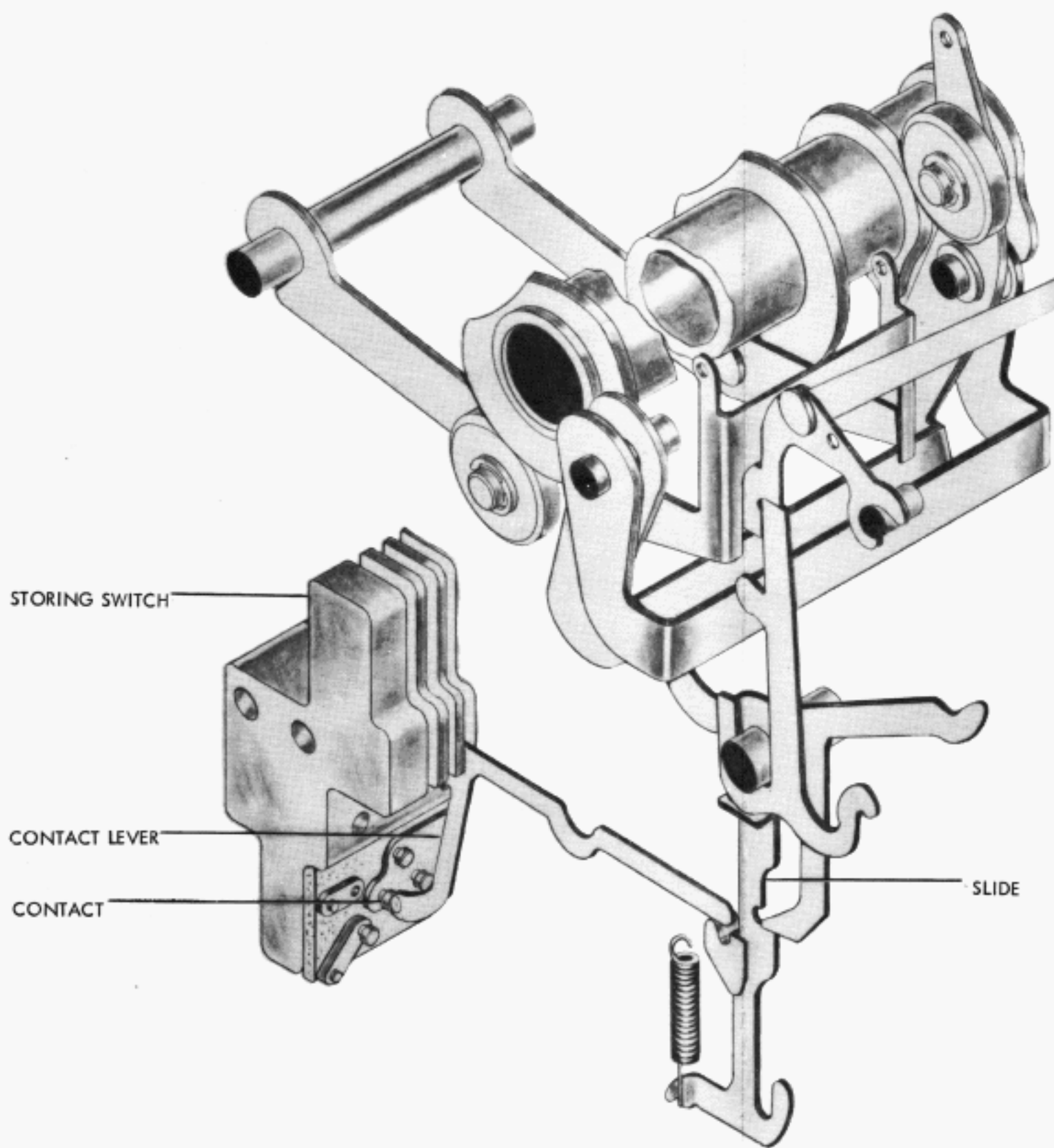


FIGURE 2-II STORING SWITCH

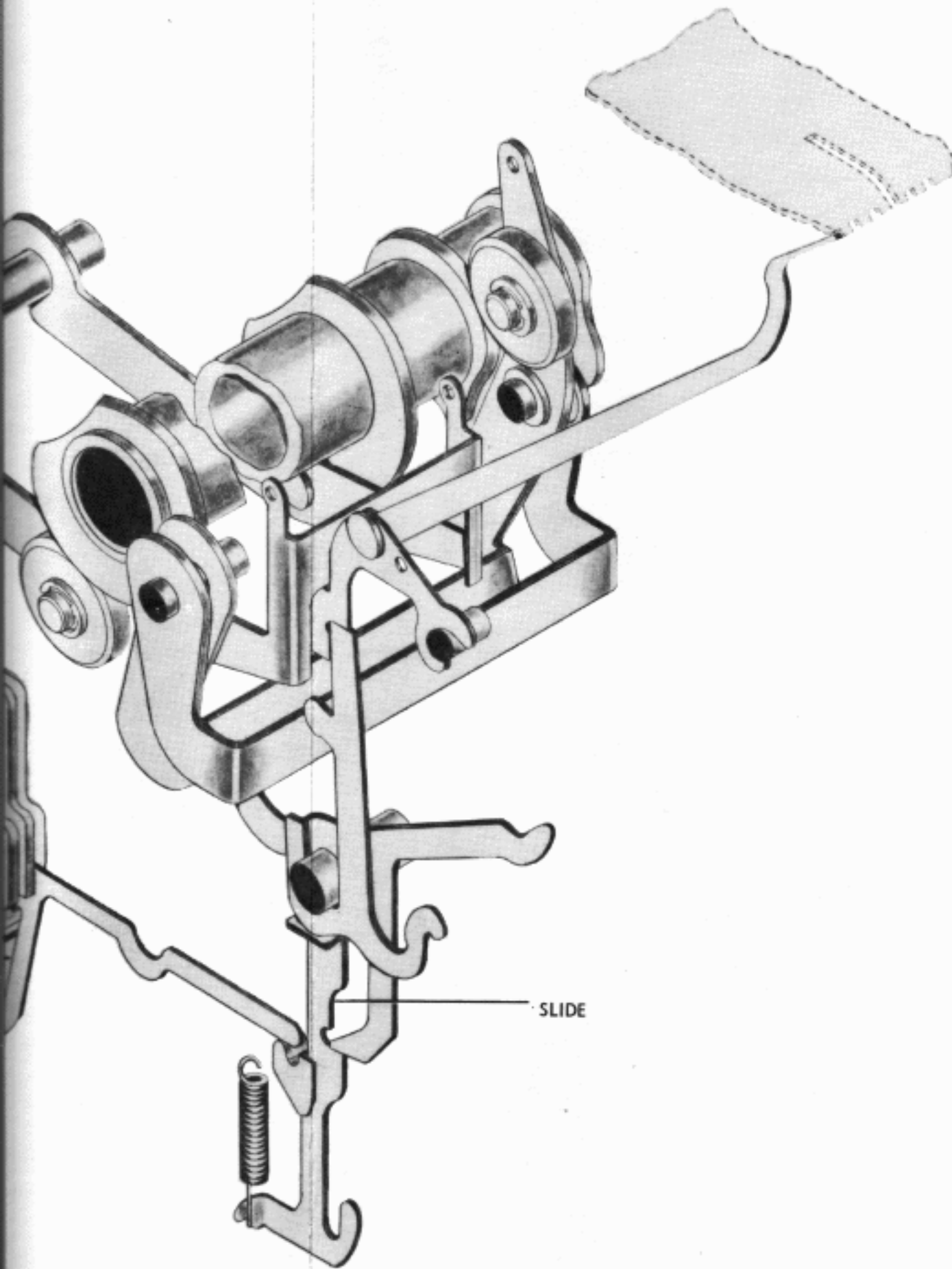


FIGURE 2-11 STORING SWITCH

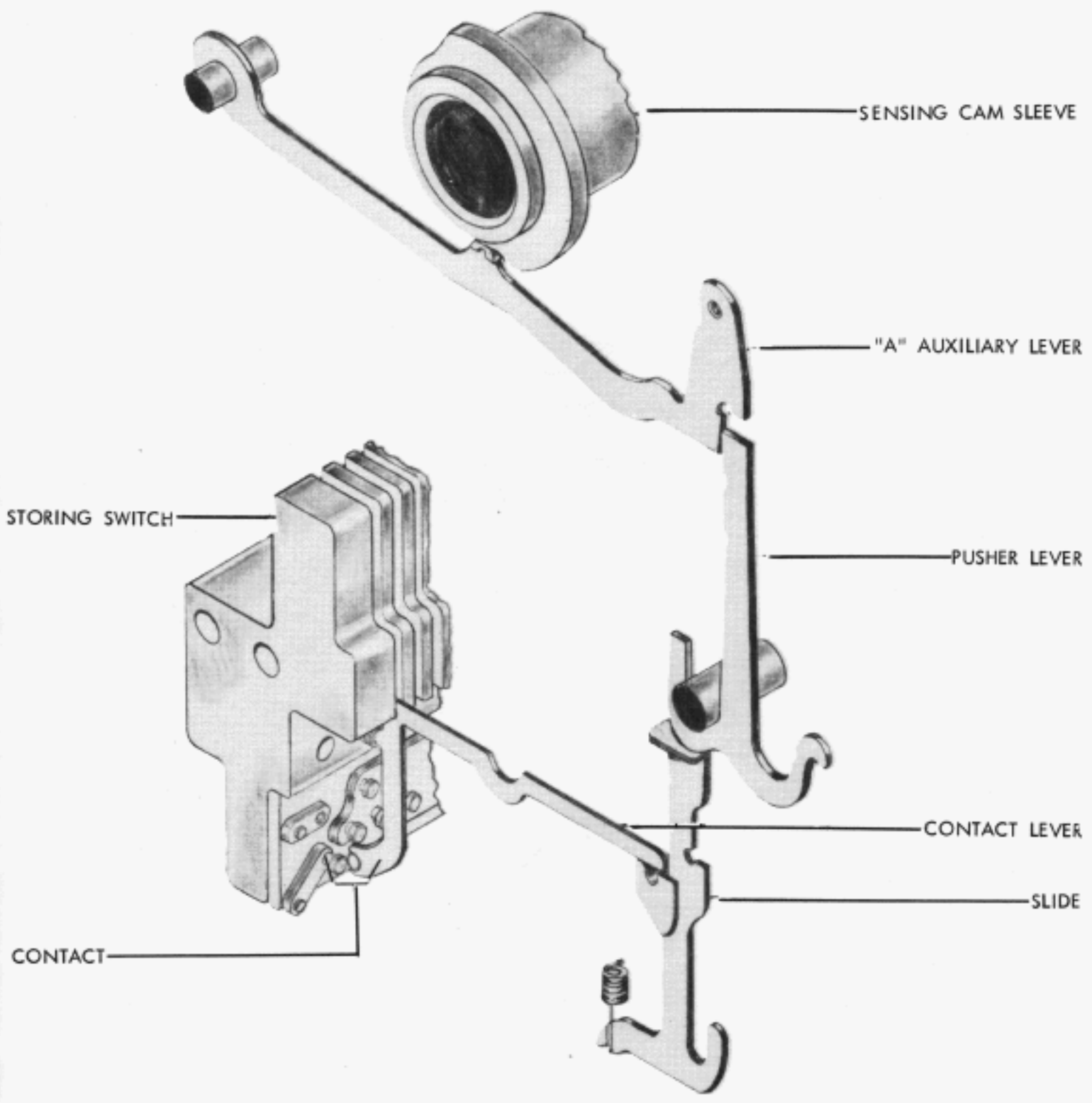


FIGURE 2-12 AUXILIARY CONTACTS

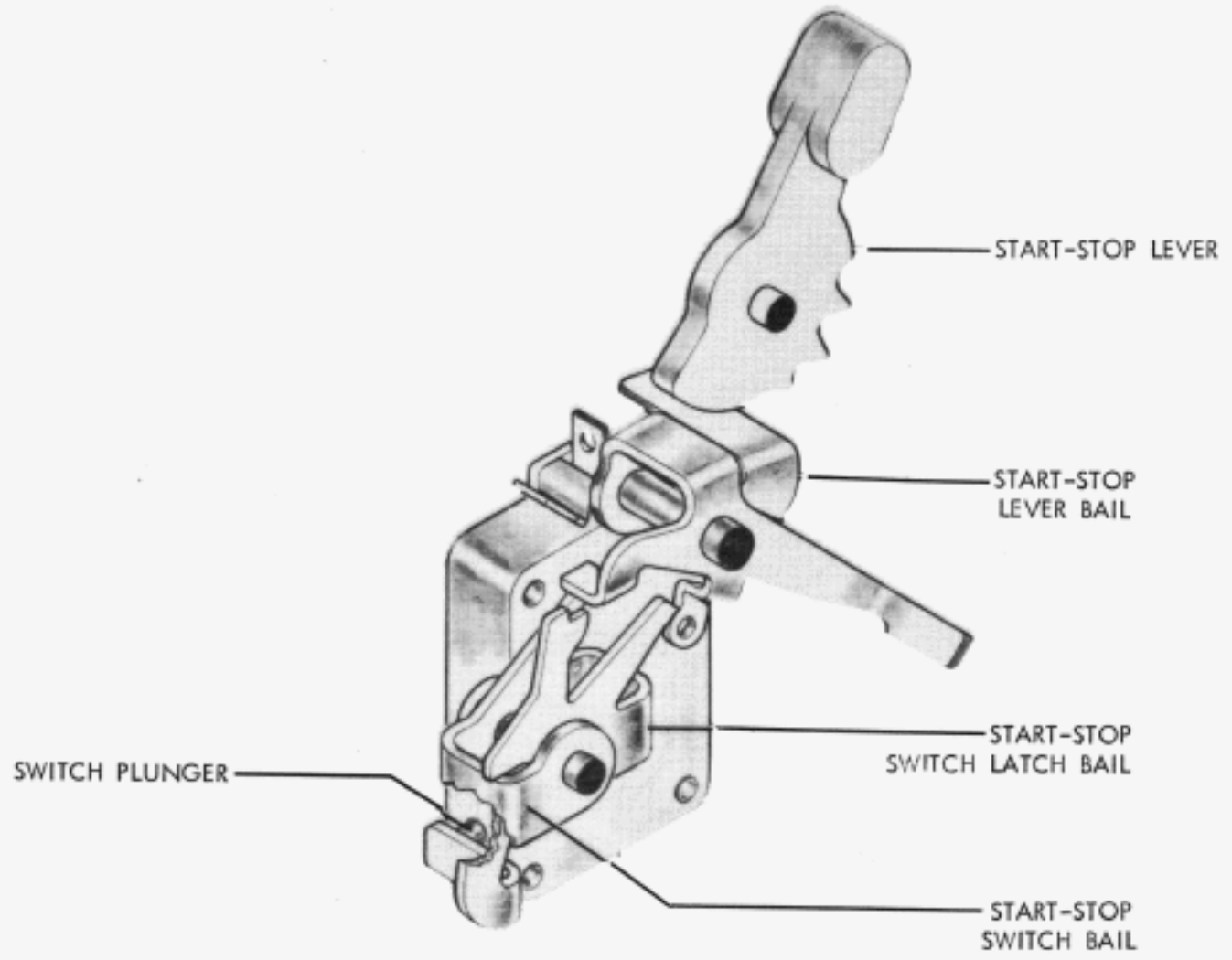


FIGURE 2-13 START-STOP LEVER

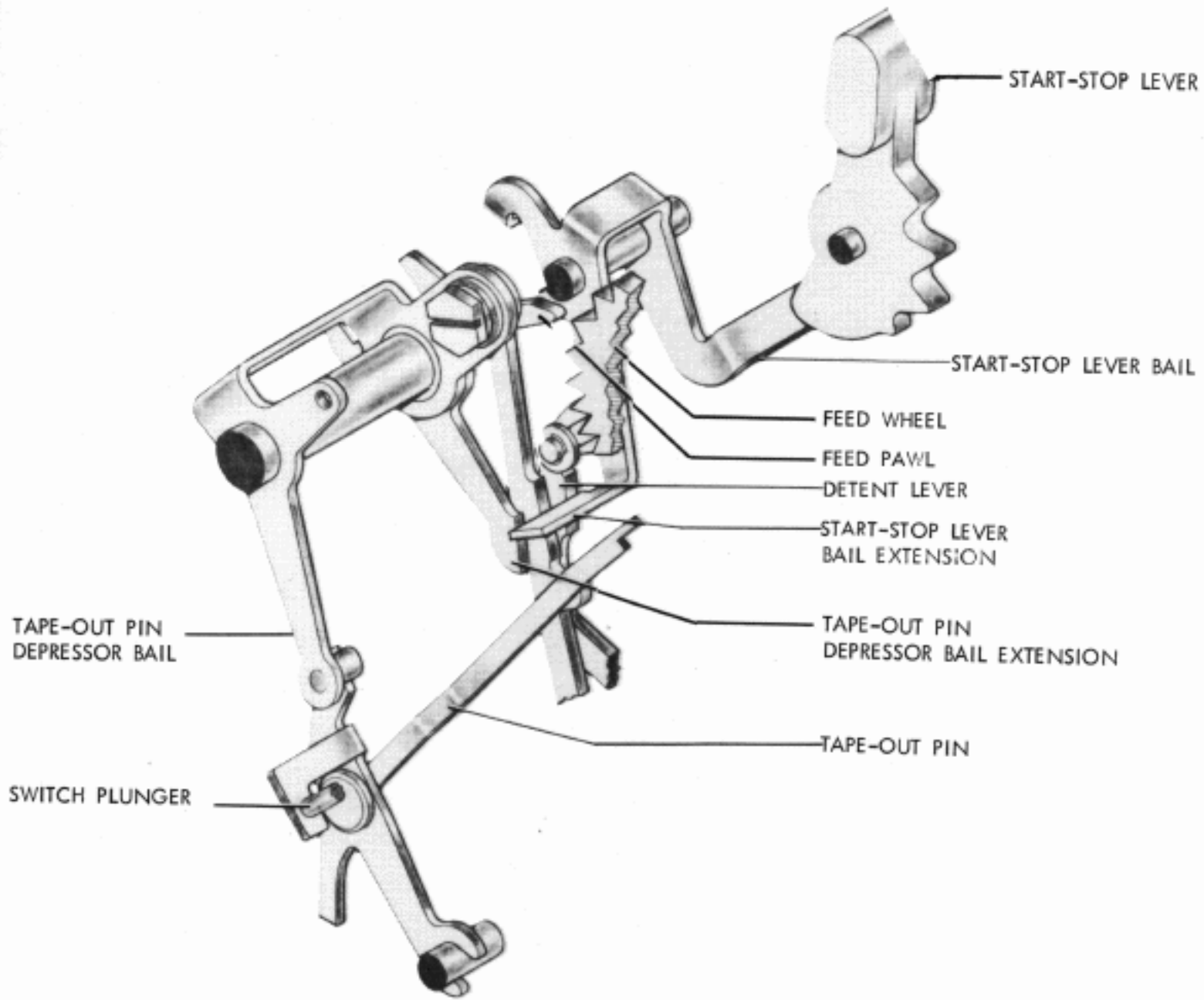


FIGURE 2-14 FREE WHEELING

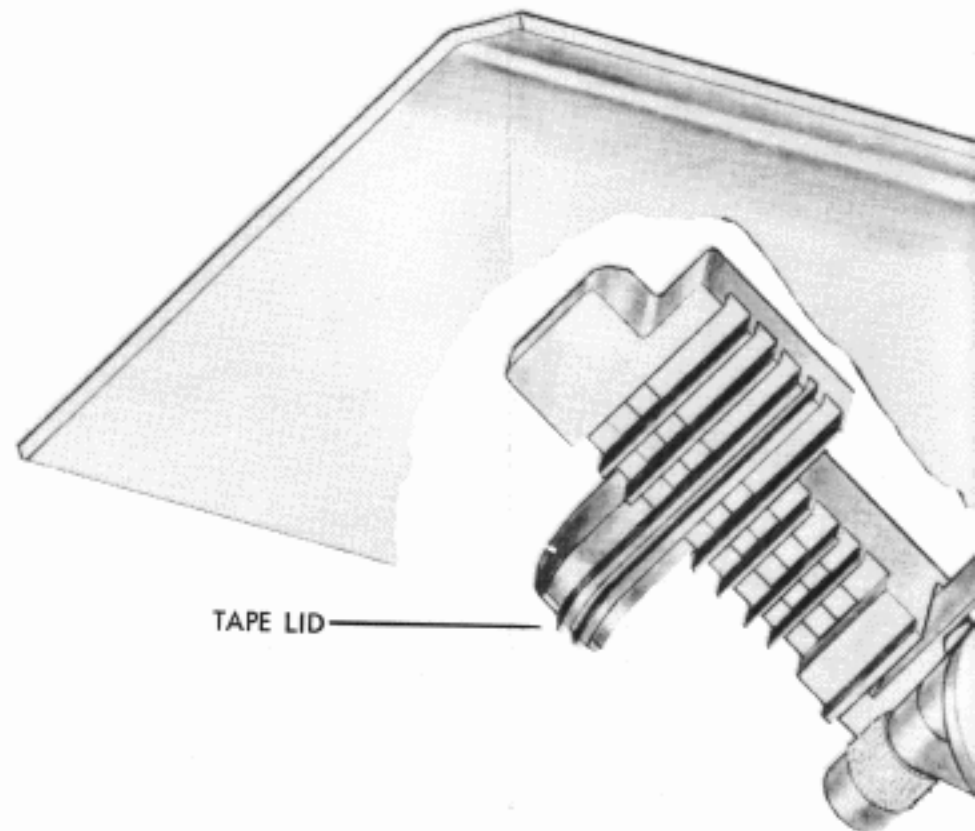


FIGURE 2-15 TA

START-STOP LEVER

START-STOP LEVER BAIL

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SION

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BAIL EXTENSION

IN

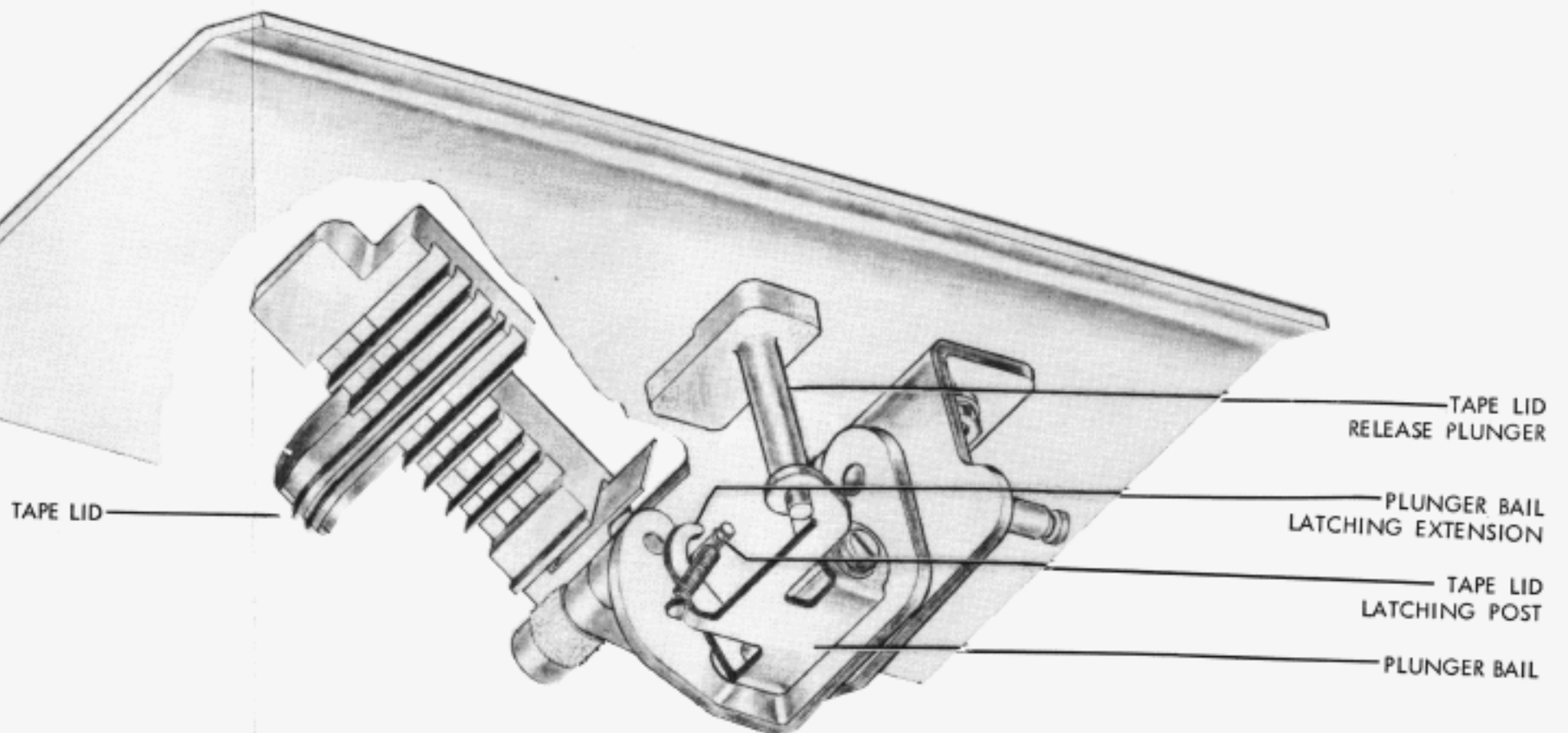


FIGURE 2-15 TAPE LID