KS-13834 PERFORATOR
(TROUBLE RECORDER)
DESCRIPTION

CONTENTS

1. GENERAL

1.01 This section describes the KS-13834 perforator used for recording troubles in a number of common control switching systems. It also refers to the cards used with the perforator to record troubles.

1.02 An important maintenance feature of a number of common control switching systems, such as the No. 5 crossbar, is the arrangement whereby circuit troubles occurring during handling of a call are automatically recorded on a trouble recorder card in approximately 1-1/2 seconds. This arrangement offers considerable advantage over lamp-type trouble indicators which must be held out of service while a record of the lamp indications is made. Automatic trouble recording greatly increases the rate at which trouble records can be made and provides more effective means for analyzing troubles.

1.03 The following Bell System Practices cover information on the maintenance and use of the trouble recorder perforator and the associated cards.

BSP Section	Title
034-305-701	KS-13834 Perforator - Apparatus Requirements and Adjusting Procedures
034-305-801	KS-13834 Perforator - Piece-part Data and Replacement Procedures

Trouble Recorder Cards

1.04 Fig. 1, page 16, shows the trouble recorder card used in the No. 5 crossbar system before and after being perforated with a trouble record. Trouble recorder cards are approximately 16-3/8 inches long, 3-7/8 inches wide and 0.006 inch thick. The cards, which are supplied in packs of 400, are wrapped and sealed in waxed paper to protect them against dampness.

1.05 Trouble recorder cards used in switching systems other than the No. 5 crossbar, are similar to the card shown in Fig. 1, except for the printed designations at the indicating positions on the card. The printed designations identify an item of information which may be furnished by the circuit while the trouble record is being made, such as identification of the call and the units handling it and reference to specific trouble indicating points in the circuit.

1.06 During the preparation of a trouble record, the card is perforated in nine successive operations and moved forward in the perforator after each operation. Upon completion of the trouble record, the card is ejected from the perforator and an unperforated card is moved into position for its first perforating operation.

2. DESCRIPTION

General

2.01 The KS-13834 perforator is approximately 30-1/2 inches long, 12-3/4 inches wide, 26 inches high, and weighs about 250 pounds. Because of its size and weight, special precautions must be taken when mounting or removing a perforator.

2.02 Figs. 2 and 3 show the front and rear views, respectively, of the perforator with the covers removed. The perforator is made up of nine major components which are listed below together with a reference to the figure on which the component is shown. The functional relationship of the various components is shown in Fig. 4, on page 17.

Motor and Pulley Assembly (Fig. 3)

Punch Actuator Consisting of Cam Drive and Front and Rear Selectors (Figs. 2 and 3)

Punch and Card Feed Including Chaff Bin (Figs. 2 and 3)

Cam Switch (Fig. 3)

Clutch Drive (Fig. 2)

In Bin (Fig. 3)

Out Bin (Fig. 2)

Latch (Fig. 2)

Hand Drive (Fig. 2)

With the exception of the punch actuator, all components can be removed from the perforator for maintenance. All components except the punch actuator and the punch and card feed can be replaced as complete units.

Motor and Pulley Assembly

2.03 The motor and pulley assembly is mounted at the rear of the perforator as shown in Fig. 3 and provides the power for operating both the card perforating and card moving mechanisms. The 1/6-hp, 48-volt dc shunt wound motor runs at a nominal speed of 1675 rpm. The motor is connected to one of the eccentric shafts of the cam drive by a V belt. An idler pulley is provided to maintain belt tension and facilitate removal of the belt.

2.04 To insure proper operation of the perforator, the motor is equipped with a pulley assembly (Fig. 5) which includes an adjustable flange and an overload clutch. The

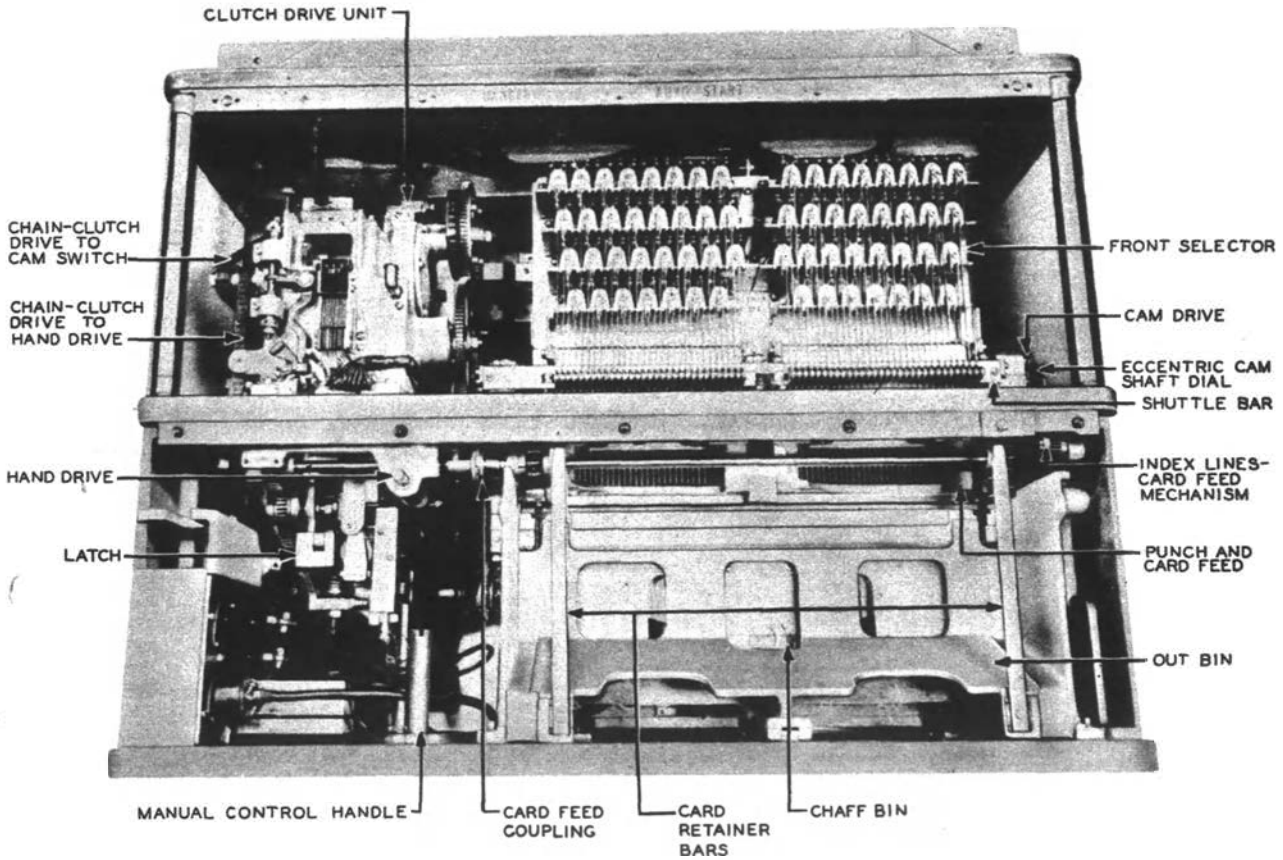


Fig. 2 - KS-13834 Perforator (Front View)

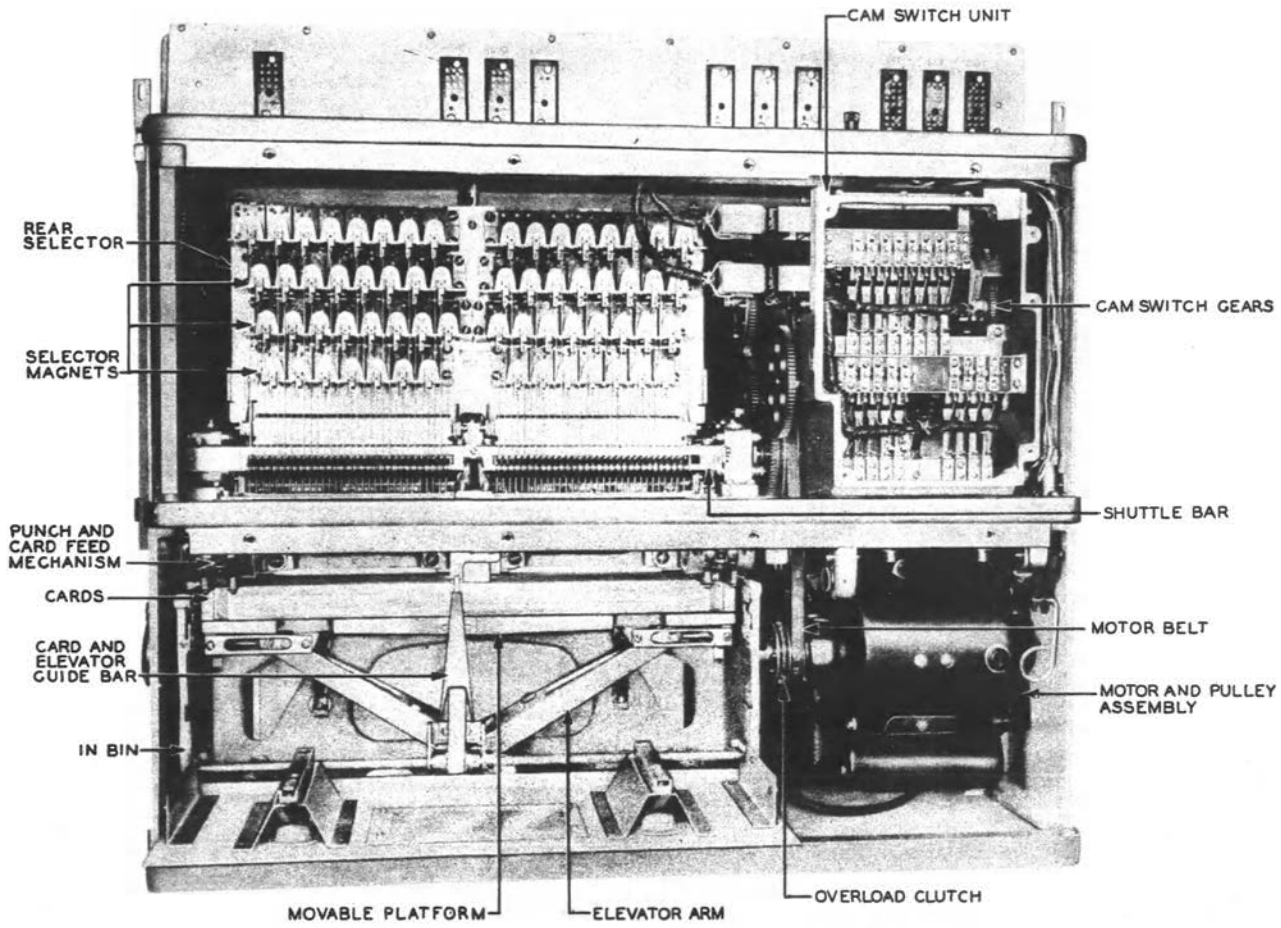


Fig. 3 - KS-13834 Perforator (Rear View)

adjustable flange provides means of adjusting the speed of the eccentric shafts of the cam drive within the required limits. The overload clutch causes the pulley to slip and prevent damage to the perforator mechanism under an overload such as might be caused by the jamming of a card in the perforator.

2.05 Referring to Fig. 5, the adjustable flange of the pulley is located at the right side of the belt. The setscrew in the wide flange, at the left side of the belt, locks the adjustable flange in position. Loosening the setscrew permits turning the adjustable flange to increase or decrease the width of the V notch of the pulley. This changes the effective diameter of the pulley which determines the speed of the eccentric shafts of the cam drive.

2.06 The overload clutch is shown in Fig. 5. Referring to the figure, a coil spring, wrapped around a flat spring, holds six rollers in place between a driving member pinned to the motor shaft and a driven member which is part of the wide flange of the pulley. As the motor shaft rotates, the pulley is driven through the rollers since under normal loads the coil spring is strong enough to hold the rollers in engagement with both the driving and driven members of the clutch. However, the coil spring is not strong enough to hold the rollers in place against the high torque developed when an overload occurs. Under this condition, the rollers are forced out of engagement with the driving member and the clutch slips.

Punch Actuator

2.07 The punch actuator consists of the cam drive and the front and rear selectors. The cam drive actuates the punches selected by the magnets of the two selectors during each perforating operation.

Cam Drive

2.08 Referring to Fig. 4 on Page 17, the two eccentric shafts B and C, which rotate continously, make a complete revolution during each of the nine perforating operations that make up a trouble recording cycle. The shafts, which are driven from the motor

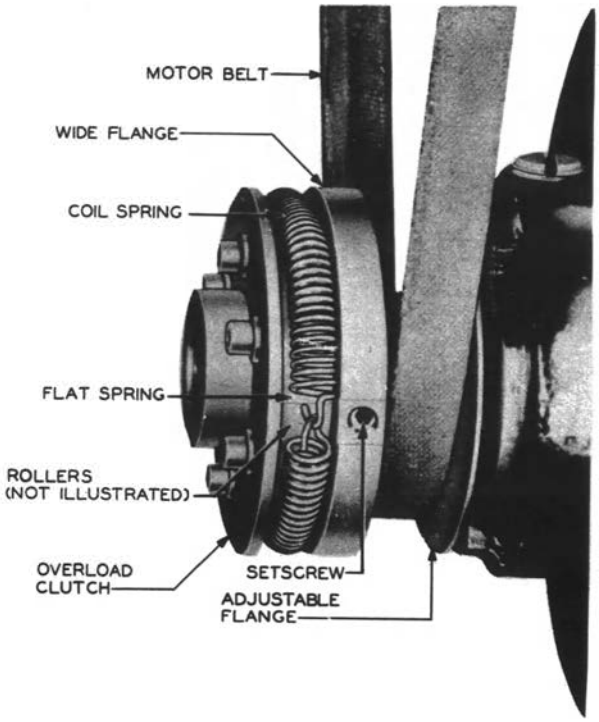


Fig. 5 - Pulley Assembly

and pulley assembly, are supported by end and center bearings not shown in the figure. Each eccentric shaft drives a pair of yokes by means of cams at both ends of the shafts. In order to simplify the schematic, Fig. 4 shows only one yoke with a portion of its shuttle bar at the front. The ends of the yokes slide between rollers as shown in the figure. Each pair of yokes carries a shuttle bar, one bar extending across the front of the cam drive, and the other across the rear. The shuttle bar at the front is also shown in Fig. 2 and the bar at the rear in Fig. 3.

2.09 As shown at the left end of eccentric shaft C, in Fig. 4, each cam is always in contact with two rollers on its associated yoke, and drives the yoke through these rollers. The cams impart an oscillating motion to their associated yokes and shuttle bars, the two bars moving in and out together during each complete rotation of the eccentric shafts. During this oscillating motion, the shuttle bars remain stationary for short intervals at their extreme in and out positions. These intervals of rest are referred to as the dwell periods of the shuttle bars. The punches to be operated are selected during an OUT dwell period of the shuttle bars and the perforating operation is performed during the succeeding IN dwell period. The graduated dial mounted on the right end of eccentric shaft, C, as shown in Fig. 4, is used to coordinate the operation of the cam drive with the other components of the perforator.

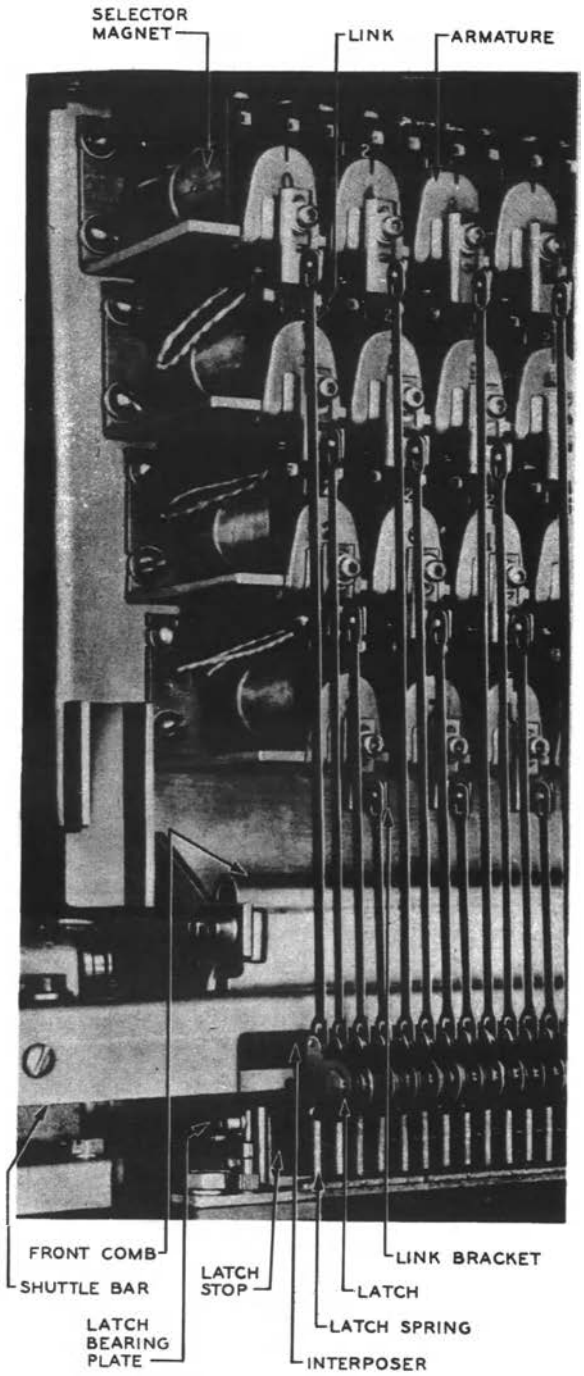


Fig. 6 - Selector

Selectors

2.10 The two selectors are mounted directly above the cam drive, one at the front, and the other at the rear of the perforator, as shown in Figs. 2 and 3, respectively. The selectors function under control of the circuit for which the trouble record is being made and select the punches to be operated during each perforating operation.

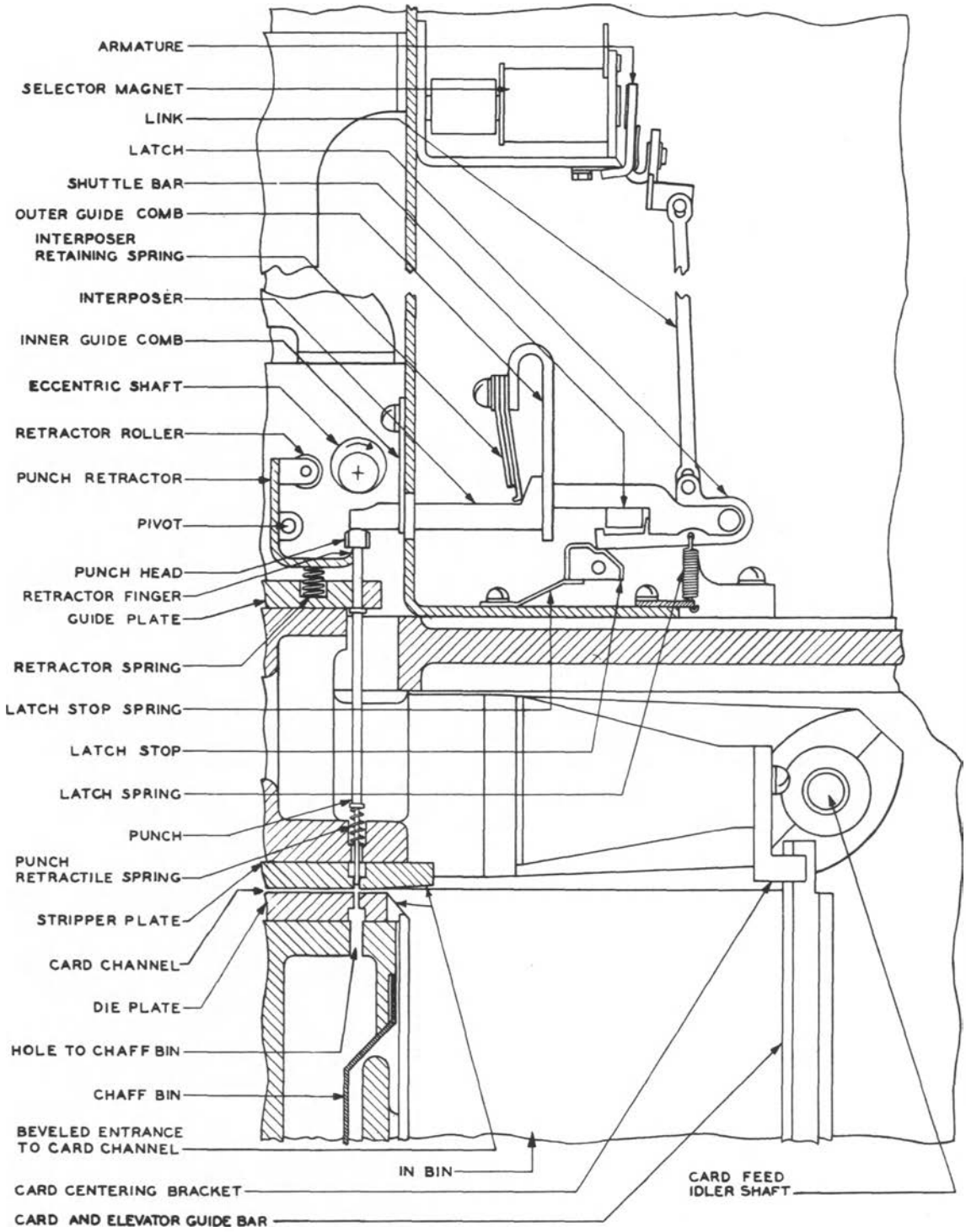


Fig. 7 - Selector Magnet, Interposer, Punch, and Associated Parts

2.11 As shown in Figs. 2 and 3, each selector contains 62 magnets mounted in four horizontal rows, making a total of 124 selector magnets. The bottom row of each selector contains 14 magnets, and the other three rows, 16 magnets each.

2.12 Since the trouble recorder card has a total of only 120 indicating positions in the two rows which are perforated simultaneously, only 120 of the selector magnets are ordinarily used. The four extra magnets are not wired in the circuit, and thus, their

associated punches remain inoperative. However, they may be used as spares in place of magnets which have become defective. If so used, they perforate the card in the space between the two groups of indicating positions shown in Fig. 1.

2.13 The armature of each selector magnet is linked to a latch which is pivoted on a movable bar called an interposer, as shown in Figs. 6 and 7. A punch is associated with each interposer. The interposer rests on top of the shuttle bar and normally a coil spring holds its latch against the latch stop, out of engagement with the shuttle bar. Under this condition, the interposer retaining spring (Fig. 7) prevents the interposer from moving as the shuttle bar oscillates beneath it.

2.14 When a selector magnet is energized during an OUT dwell period of the shuttle bar, its link raises the latch on the associated interposer to engage the bar. The latch and interposer then move with the bar over the high portion of the latch stop. Outer and inner guide combs (Fig. 7) keep the interposers in their proper vertical positions. The high portion of the latch stop will hold the latch in engagement with the shuttle bar even though the selector magnets are de-energized.

2.15 The inner end of each interposer is located directly below one of the eccentric shafts of the cam drive and rests on the head of its associated punch. When the interposer is in its normal or OUT position, its inner end clears the eccentric shaft as shown in Fig. 7. However, when the interposer is moved to its IN position, the eccentric shaft drives the interposer and its associated punch downward, thereby making a perforation in the trouble recorder card.

Punch and Card Feed Including Chaff Bin

2.16 Fig. 8 shows the front of the punch and card feed which is mounted in the perforator directly below the cam drive. In this view the out bin has been removed from the perforator. The punch and card feed includes a nest of punches and dies for perforating the card, as well as the mechanism for moving the card after each perforating operation.

Punch Assembly

2.17 The punch assembly consists of 124 punches mounted in two rows of 62 each. Each row of punches is located directly below one of the eccentric shafts of the cam drive, with 31 punches on either side of the center bearing of the shaft. Each punch passes through the guide and stripper plates as shown in Fig. 7. Retractile springs near the lower end of each punch support unoperated punches when the punch retractor is swung downward during a perforating operation as described in 2.20. In the unoperated position, the lower end of all punches are above the card channel formed by the gap between the stripper and die plates.

2.18 When a punch is operated as described in 2.15, it makes a perforation in the trouble recorder card and enters a hole in the die plate shown in Fig. 7. This hole extends to the chaff bin mounted directly below the die plate. Punchings from the card thus drop into the chaff bin.

2.19 Associated with each group of 31 punches is a punch retractor, the function of which is to restore operated punches to their normal position after a perforating operation. Fig. 7 shows a section of the punch retractor which is mounted on pivots at each end. The portion of the retractor below the pivots has 31 pairs of fingers, each pair engaging the underside of the head of a punch. The section view shows one finger of a pair engaging the head of a punch. A roller is mounted at each end of the retractor above the pivot. These rollers are engaged by the eccentric shaft as described in 2.20.

2.20 Referring to Fig. 7, operation of one or more punches swings the associated punch retractor downward. During this movement, the fingers on the retractor arm leave the heads of unoperated punches which are held in the unoperated position by their retractile springs (2.17). After the eccentric shaft has operated the punches to perforate the card, the shaft engages the rollers on the punch retractor and swings it upward. This movement restores the operated punches to their normal position. Springs below the lower portion of the retractor keep the retractor rollers away from the eccentric shaft except during the punch lifting movement just described.

Card Feed Mechanism

2.21 The card feed mechanism has the following functions.

(1) To move the top card from the in bin at the rear of the perforator into position for its first perforating operation.

(2) To move the card in eight steps into position for the remaining eight perforating operations.

(3) To eject the perforated card into the out bin at the front of the perforator. During this operation, an unperforated card is moved from the in bin as stated in (1).

2.22 The card feed mechanism is driven from the card feed drive shaft at the front of the perforator as shown in Figs. 4 and 8. The schematic, Fig. 4, shows the relation of the shaft to other parts of the perforator. The shaft is driven continuously or intermittently from the clutch drive (2.37), as required, during various stages of the trouble recording cycle.

2.23 Two card feed chains, one at each side of the punch and card feed assembly, (Figs. 4 and 8) are driven by sprockets on the card feed drive shaft. Each chain also passes over a sprocket on an idler shaft at the rear of the perforator. One of the idler shafts is shown in Fig. 9.

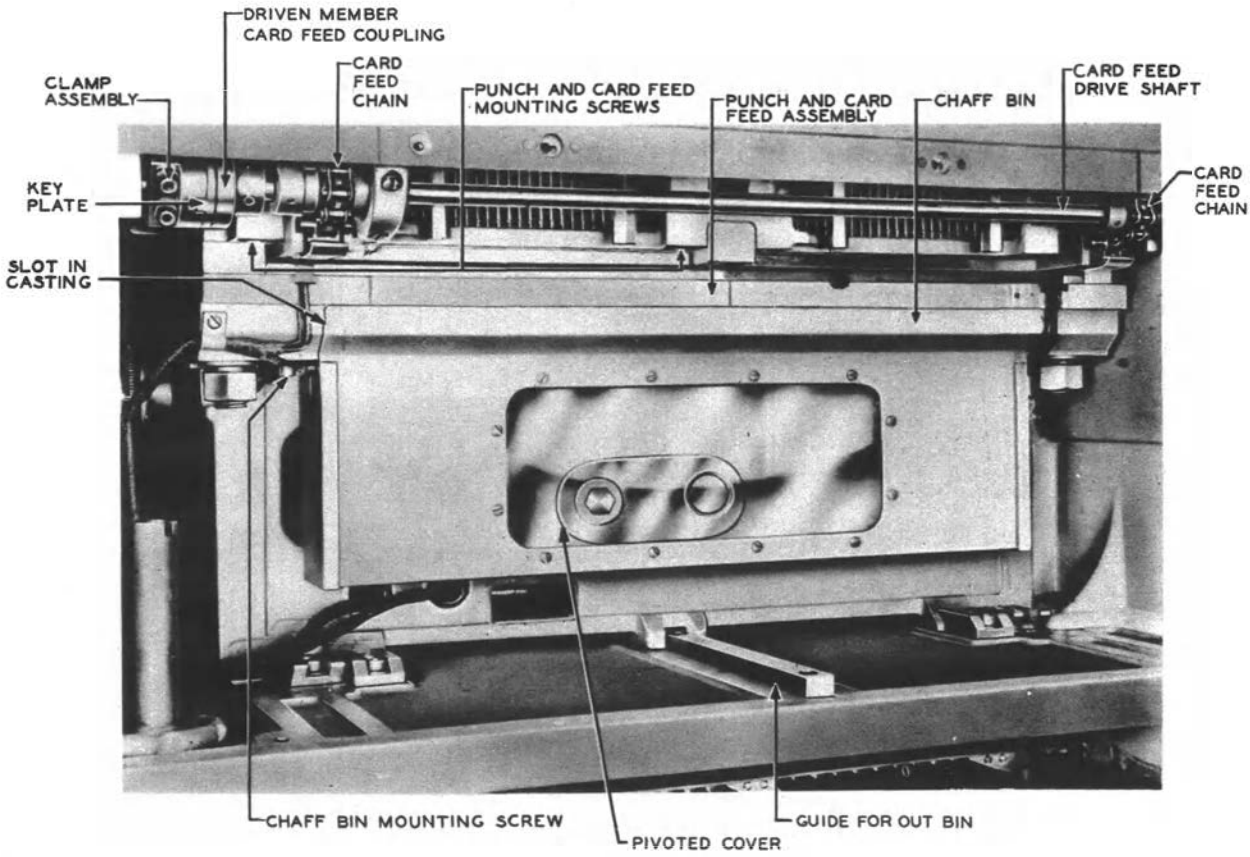


Fig. 8 - Punch and Card Feed Assembly Including Chaff Bin (Out Bin Removed)

2.24 Each chain carries four card hook shoes and four alarm contact spring assemblies. The card shoes and the spring assemblies, respectively, are evenly spaced on the chain. One of the card hook shoes is shown on the portion of the chain passing over the idler sprocket in Fig. 9. A short distance ahead of this shoe on the chain is the 2-pronged spring of an alarm contact spring assembly.

2.25 One card hook shoe on each chain engages a card to move it from the in bin through the card channel. The alarm contact spring assemblies ahead of the hooks engaging the card, ride on the card as it passes through the card channel. In normal operation, the card acts as an insulator between the alarm contact springs and two insulated contact strips on the plate which are in the motor control circuit. If a card fails to enter the card channel or becomes jammed during passage, the alarm contact springs leave the card and close a circuit with the two contact strips. This causes the motor control circuit to remove power from the perforator and also operates an alarm which indicates that the perforator is out of service.

2.26 Fig. 10 shows details of a card hook shoe mounted on the chain. As shown in the figure, a double-ended spring holds the shoe against the card hook plate which forms a link in the chain. The edges of the two projections designated A and B on the shoe (Fig. 10) engage the edges A and B, respectively, on the trouble recorder card shown in Fig. 1. As these projections extend beyond the surface of the shoe slightly less than the minimum thickness of a card, they engage only the top card in the in bin.

2.27 The top card in the in bin is held against the bottom of the chain guide channel (Fig. 9) at both sides of the punch and card feed, as described in 2.53. When the card hook shoes engage a card, as described in 2.26, the card is moved into the card channel for perforation. Due to friction, there is a tendency for the second card from the top in the in bin to move with the top card. In order to prevent this, two throat assemblies are provided, one at each side of the entrance to the card channel. Fig. 9 shows the throat assembly at the left side. In this figure the in bin has been removed from the perforator.

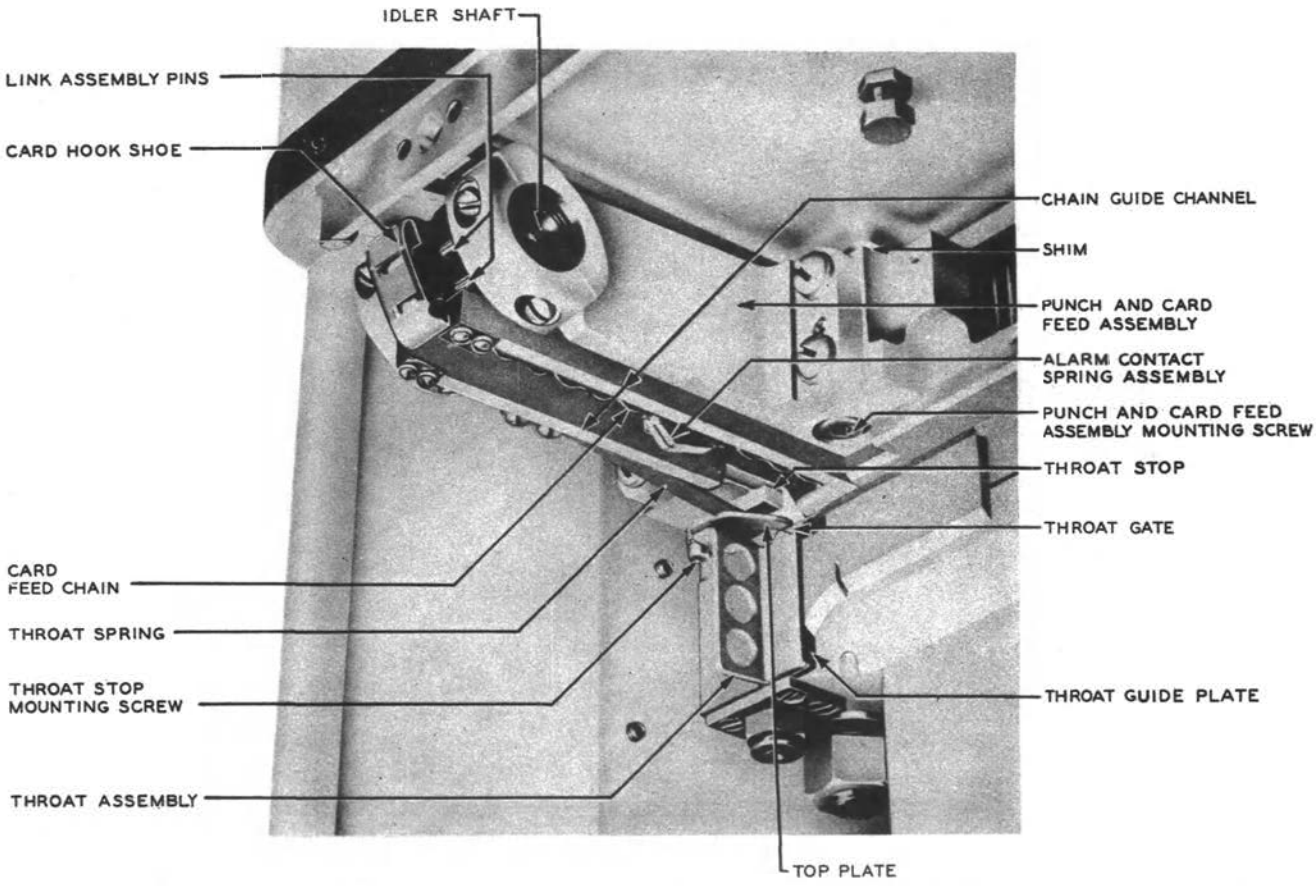


Fig. 9 - Punch and Card Feed Assembly
(In Bin Removed)

2.28 Referring to Fig. 9, the throat assembly consists of a horizontal top plate fastened to a vertical member which is mounted so that it has a slight up and down movement on the punch and card feed assembly. Upward movement of the throat is limited by the top plate engaging the throat stop shown in the figure. This stop may be swung outward to permit removal of the throat. A flat spring maintains downward pressure on the top plate, the underside of which normally rests on the top card in the in bin. In Fig. 9, the throat is in its lowest position since the in bin has been removed from the perforator.

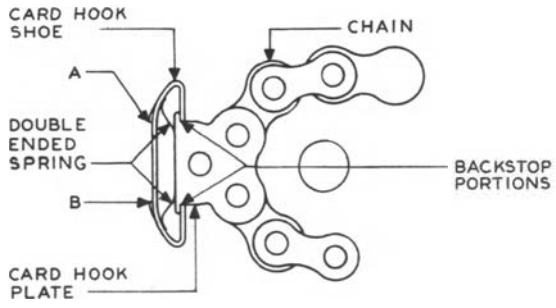


Fig. 10 - Card Hook Shoe

2.29 The gap between the top plate and a saw-tooth projection on the vertical member of the throat assembly provides the gate through which a single card can pass. This gap is approximately 50 per cent larger than the maximum thickness of a card. The top of the saw-tooth projection forming one side of the gate is made narrow to minimize jamming of a bowed card. The inner surfaces of the throat gate, as well as the edges of the stripper and die plates forming the entrance to the card channel, are beveled to facilitate the card entering the channel. The beveled entrance to the channel is shown in Fig. 7. Two pads, mounted on the inside of the in bin door, hold several cards at the top of the bin against the vertical member of the throat to facilitate proper card feeding. When the top card is engaged by the card hook shoes, the card is pushed through the throat gates and enters the card channel.

Chaff Bin

2.30 The chaff bin is mounted directly below the punch and card feed assembly as shown in Figs. 7 and 8. The function of this bin is to catch punchings produced during perforation of the cards. As shown in Fig. 8, the chaff bin has a transparent window facing the out bin, through which the level of the accumulated punchings may be seen. This window is visible through the center hole in the out bin when the out bin is empty as shown in Fig. 2.

2.31 A circular hole is provided in the center of the transparent window of the chaff bin. This hole is normally closed by a pivoted cover having a circular embossing which fits in the hole. Swinging the cover upward permits inserting a vacuum cleaner hose through the hole to clean out the bin. This may be done without removing the out bin, which however, must be empty. The chaff bin in some perforators does not have the hole in the window. In such cases, it is necessary to remove the chaff bin from the perforator in order to empty it.

Cam Switch

2.32 The cam switch, which is the coordinating unit of the perforator, consists essentially of cam-operated contacts for controlling the various circuits of the perforator. The cam switch has a transparent cover and is mounted above the motor at the rear of the perforator as shown in Fig. 3.

2.33 The cam switch has the following functions.

(1) To indicate to circuits seeking a trouble record whether the perforator is busy or idle.

(2) To control the connections between the circuits being checked, and the selector magnets of the perforator during a trouble recording cycle. A different group of connections is made for each of the nine perforating operations.

(3) To control the circuits to the clutch drive and the latch, operating and releasing these components at the proper times in the trouble recording cycle.

(4) To send the TRC (trouble record complete) signal at the end of a trouble recording cycle, to the circuits for which the record was made, thus releasing the circuits.

2.34 As shown in Fig. 4, the cam switch has three camshafts M, K, and L. Shaft M is geared to eccentric shaft B of the cam drive. When the motor is running, shaft M rotates continuously and at the same rate of speed as the eccentric shafts of the cam drive. Shafts K and L are geared to shaft J, which is chain driven from the clutch drive, and rotate only when a card is being moved. The L shaft makes one revolution and the K shaft three revolutions, during each complete trouble recording cycle. An idler sprocket on the chain drive maintains chain tension.

2.35 A total of seventeen cams are mounted on the three cam switch camshafts. Eight cams are mounted on the K shaft, five cams on the M shaft, and four cams on the L shaft. Associated with each of the seventeen cams is a contact spring assembly. These cam-operated contact springs make and break connections to the external circuits at the proper times during the trouble recording cycle, and also control the operation of the clutch drive and latch.

2.36 Graduated dials are provided on each of the camshafts of the cam switch, on one of the eccentric shafts of the punch actuator and on one of the external gears of the clutch drive in order to coordinate operation of the various components of the perforator.

Clutch Drive

2.37 The clutch drive is mounted at the front of the perforator to the left of the selector, as shown in Fig. 2. The clutch drive transmits continuous or intermittent motion to the card feed, the latch, and the cam switch, as required, during the trouble recording cycle. Figs. 11 and 12 show the front and rear views of the clutch drive respectively. In these views, the clutch drive unit has been removed from the perforator.

2.38 The clutch drive has the following two functions.

(1) To rotate the card feed drive shaft N (Fig. 4) and the two camshafts K and L (Fig. 4), intermittently, as the trouble recorder card is moved from the first to the succeeding eight perforating positions. At each perforating position, the shafts remain stationary while the perforating operation is being performed.

(2) To rotate the card feed drive shaft and the two cam shafts, continuously, while a perforated card is moved from the last (ninth) perforating position and ejected into the out bin. Simultaneously, an unperforated card is moved from the top of the in bin to the first perforating position.

2.39 Referring to Fig. 4, the two input shafts D and E of the clutch drive, which are geared to eccentric shaft B of the cam drive, rotate continuously while the motor is running. The two shafts with their input drive gears are also shown in Figs. 11 and 12. The function of these two shafts and details of several parts of the clutch drive are described in the following paragraphs.

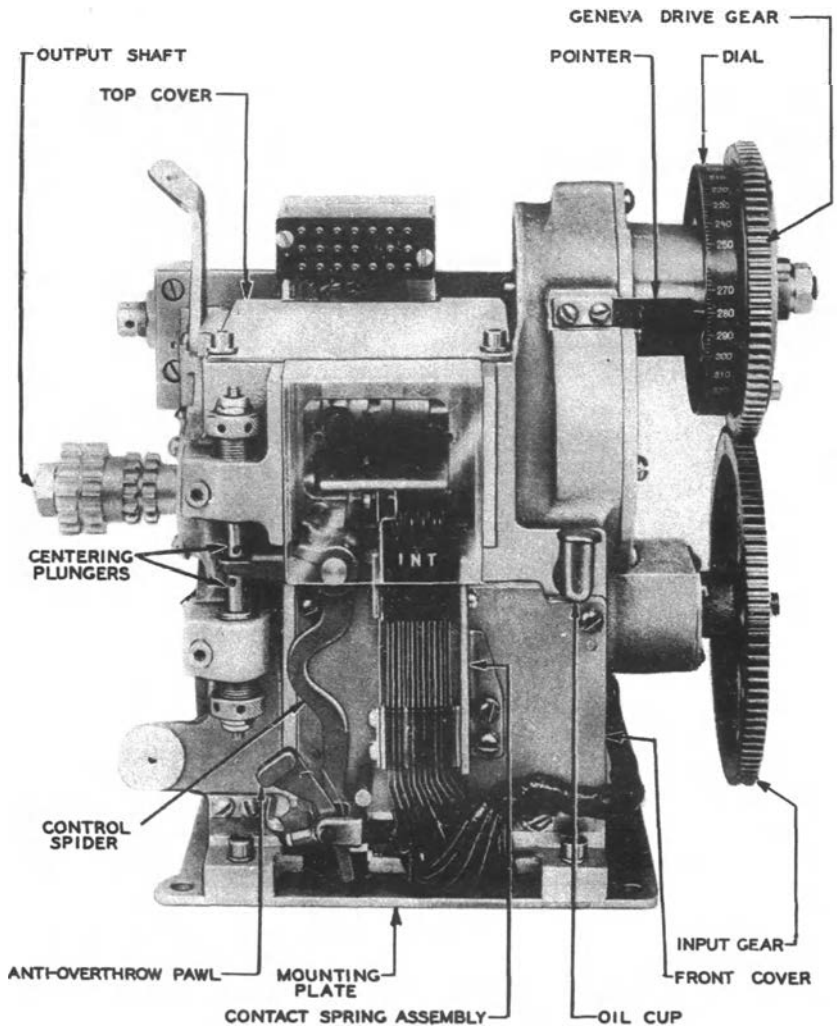


Fig. 11 - Clutch Drive (Front View)

2.40 As shown in Fig. 4, the driving member of a cone-type friction clutch is mounted on shaft D. When this clutch is engaged, shaft D transmits continuous rotation to shafts G and H. Shaft E carries the driving member of an 8-position geneva intermittent drive. Intermittent rotation from the geneva drive is transmitted to shafts F and H when the 8-jaw positive drive clutch on the geneva shaft is engaged. Therefore, the output shaft H transmits continuous or intermittent motion to the card feed shaft N and the camshafts K and L, depending on whether the continuous (cone) or intermittent (8-jaw) clutch is engaged. The uniform acceleration and deceleration provided by the geneva drive prevents overshooting of the mechanism at the end of each step in the intermittent motion and the card is thus accurately positioned for each perforating operation.

2.41 Referring to Fig. 4, the driving member of the geneva consists of a disc which carries the drive pin (1) and the circular convex surface (2). The geneva wheel has eight slots (3) between which are circular concave surfaces (4) of a slightly larger radius than the convex surface (2) on the driving disc. As the driving member rotates, the pin (1) enters one of the slots (3) and rotates the geneva wheel 1/8 turn. As the pin leaves the slot, the surface (2) on the driving disc engages the surface (4) on the wheel, and prevents the wheel from turning until the surfaces separate as the pin enters the next slot. During one complete rotation of shaft E the geneva wheel makes 1/8 turn and remains stationary for a short period thus providing the intermittent motion required during the perforating operations.

2.42 The continuous and intermittent clutches are controlled by the solenoids shown in Figs. 4 and 12. The solenoids have a common plunger which operates a control shaft by means of the forked arm shown in the figures. The linkage between the control shaft and the driven members of both clutches is shown

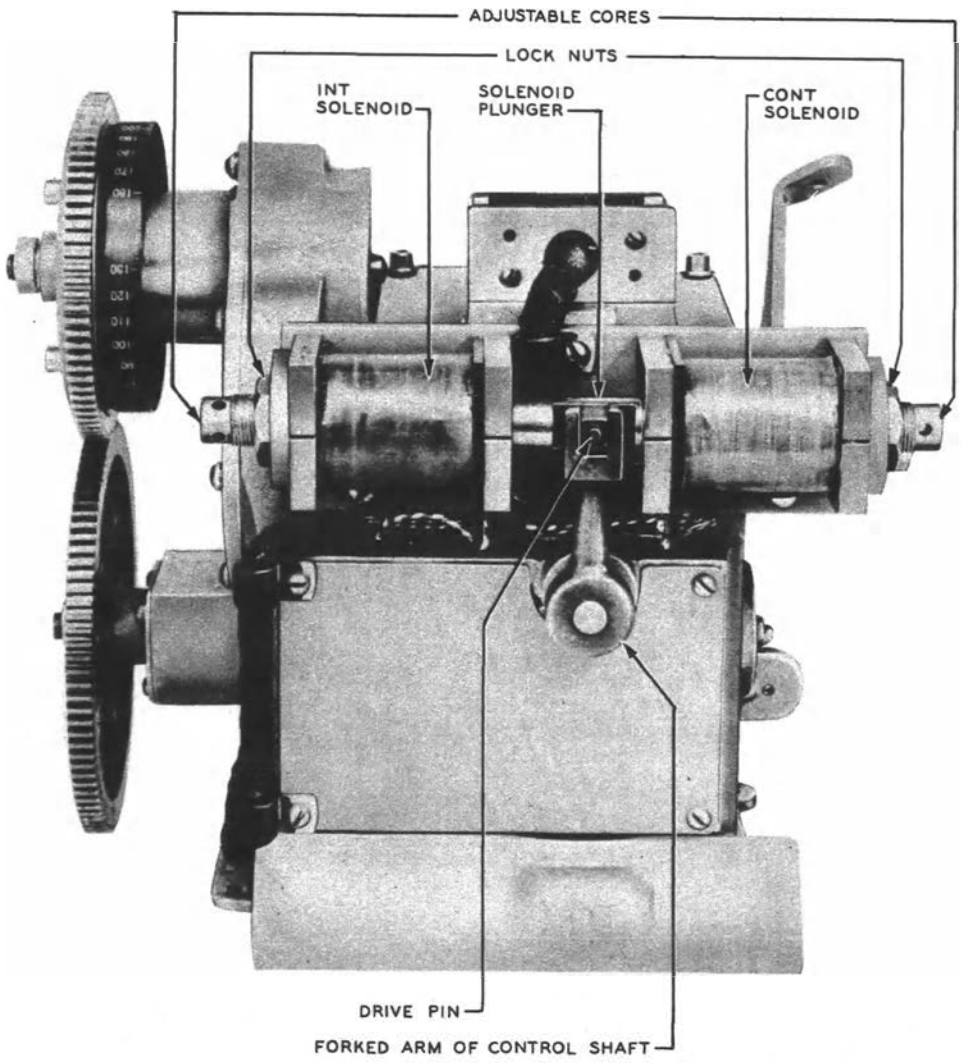


Fig. 12 - Clutch Drive (Rear View)

schematically in Fig. 4. When the continuous solenoid operates, the continuous clutch is engaged. Similarly, when the intermittent solenoid operates, the intermittent clutch is engaged.

2.43 The antioverthrow pawl, pivoted at the end of the control spider as shown in Figs. 4 and 11, prevents the intermittent clutch from re-engaging at the end of a trouble recording cycle. When the continuous clutch is disengaged at the end of a cycle, there is a tendency for the clutch control lever to swing beyond its neutral position. If this overthrow was not controlled, the intermittent clutch might re-engage and the perforator would approach its home position under power with probable damage to the mechanism. The action of the antioverthrow pawl in preventing this is described in 2.44.

2.44 Referring to Fig. 4, the control spider swings in a counterclockwise direction when the continuous clutch is engaged at the end of the last perforating operation. During this movement, the antioverthrow pawl is rotated clockwise to a vertical position on the spider by the lower leg of the pawl engaging the cocking stop on the frame located at the right of the pawl as shown in the view at the upper left corner of Fig. 4. When the continuous clutch is disengaged, the control spider swings clockwise. The pawl remains in a vertical position during this motion of the spider, due to the inertia of the weighted upper section of the pawl. While the pawl is in this position, the horizontal leg engages the forward stop on the frame and blocks the passage of the control lever beyond its neutral position. As the control spider rebounds slightly, the pawl leaves its forward stop and

is returned to its normal position, shown in Fig. 11, by a light retractile spring mounted between the pawl and the spider. With the pawl in its normal position, the spider and its associated parts are free to move through the neutral position when the intermittent clutch is engaged during the next trouble recording cycle.

2.45 Figs. 4 and 11 show the two plungers on the left side of the clutch drive unit that center the control shaft in the neutral position. As shown in the figures, the centering arm of the control spider extends between the tips of the two plungers. The upper plunger moves upward upon engagement of the intermittent clutch and the lower plunger moves downward when the continuous clutch is engaged. Since each plunger moves from its normal position against the pressure of a spring, the plungers absorb some of the shock as the clutches engage.

2.46 A contact spring assembly is mounted on the front of the clutch drive as shown in Fig. 11. These springs are actuated by an arm on the control spider when the intermittent clutch is engaged. The contact springs are in circuits which coordinate the functions of the clutch and latch during a trouble recording cycle. The graduated dial mounted at the end of shaft E (Fig. 4) indicates the proper relationship of the clutch drive with respect to other components of the perforator.

Latch

2.47 The latch is mounted below the clutch drive of the perforator, as shown in Fig. 2. The functional parts of the latch are shown schematically in Fig. 4 and a view of the latch removed from the perforator is shown in Fig. 13.

2.48 The latch unit has the following two functions.

(1) To stop the perforator mechanism at the end of a trouble recording cycle as quickly as practicable in order to limit the over-all time of the cycle. This involves controlling the stopping impact due to inertia of the parts in order to prevent damage to the mechanism.

(2) To lock the perforator mechanism in the home position until the start of the next trouble recording cycle.

2.49 Referring to Fig. 4, a gear on shaft N drives the latch gear which is mounted freely on the latch shaft P. The latch gear drives shaft P through the heavy spring which is mounted between the gear and the drive collar secured to the shaft. This spring, which is referred to as the overtravel spring because of its second function described in 2.51, is mounted so that it exerts a strong torque opposing the normal rotation of shaft P. Also secured to shaft P are the overtravel disc, the brake and backward stop cam, and the forward stop cam. Shaft P makes one revolution during each complete trouble recording cycle.

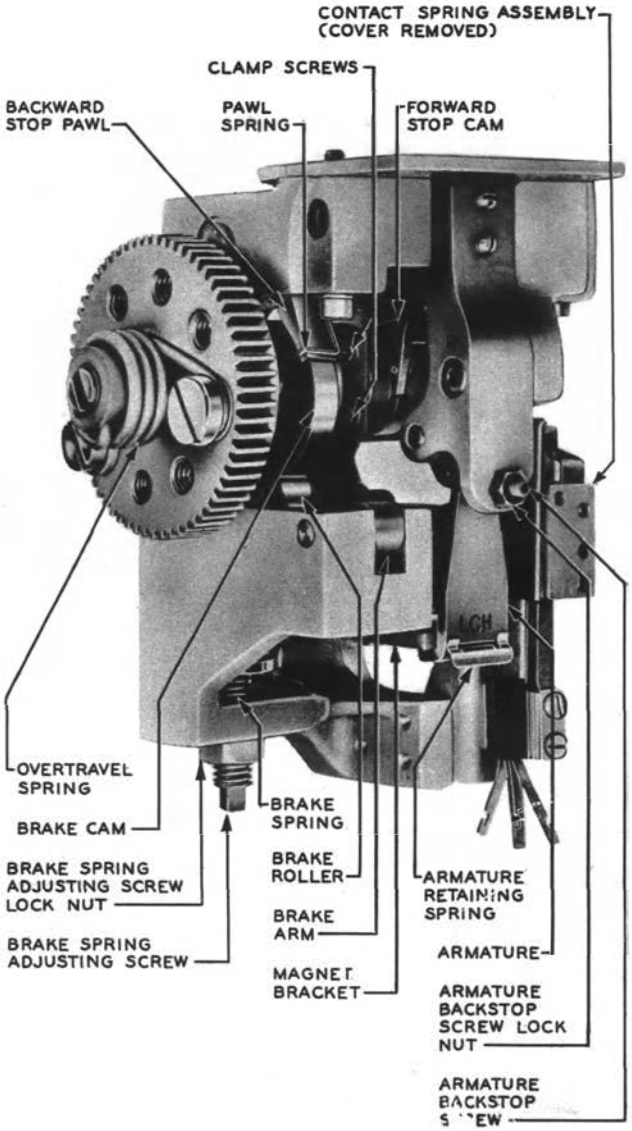


Fig. 13 - Latch

2.50 As the perforator approaches its home position at the end of a perforating cycle, the brake and backward stop cam on shaft P engages its associated brake roller to retard rotation. Shaft P is stopped at the home position by the forward stop cam on the shaft, engaging the forward stop pawl which is properly positioned for this purpose by the latch magnet armature being in the unoperated position. The backward stop pawl then engages the notch in the brake and backward stop cam and locks shaft P against backward rotation. The perforator is now locked in its home position. At the start of the succeeding trouble recording cycle, the latch magnet operates, disengaging the forward stop cam, thus permitting normal rotation of the latch shaft and perforator mechanism.

2.51 While shaft P is now locked in the home position, the inertia of the perforator mechanism drives the latch gear beyond this position against the torque of the overtravel spring. During the overtravel, the stop pin in the gear moves forward in the slot of the overtravel disc. The spring absorbs the inertia with only slight overtravel and then returns the latch gear and perforator mechanism to the home position where the stop pin on the gear engages the end of the slot in the overtravel disc as shown in Fig. 4.

2.52 Associated with the latch armature, is a 2-make contact spring assembly shown in Figs. 4 and 13. These springs are actuated by a pin on the forward stop pawl which closes the contacts when the armature operates and the forward stop pawl is clear of the cam. The springs are in circuits which coordinate certain functions of the perforator with the operation of the latch magnet.

In Bin

2.53 The in bin, which is mounted at the rear of the perforator, as shown in Fig. 3, serves as a storage bin for the stack of unperforated cards. The stack of cards is supported on the elevator platform which always keeps the top card of the stack against the bottom of the chain guide channel (Fig. 9) in position to be engaged by the card feed mechanism.

2.54 The card and elevator guide bar is pivoted on a shaft located at the front of the bin. In its upright position, this guide bar engages notches in the elevator platform, the cards, and the bottom of the punch and card feed assembly. This accurately locates the card stack for proper feeding of the top card with respect to the punches. The cards on the platform are held between two guides at the rear of the bin and two guides on the bin door. Card follower pads, near the top of the door, maintain inward pressure against the upper cards in the stack when the door is closed. This facilitates the engagement of the top card by the card hooks of the card feed mechanism.

2.55 The in bin is provided with latches which lock the elevator platform in its lowest position to facilitate loading the bin. Closing the in bin door releases the latches and permits the platform to rise. The platform is raised by means of a spring attached to the elevator arms. This spring rests on rollers at the bottom of the bin which keep the turns of the spring concentric with the pivot shaft of the elevator arms and also prevent binding of the spring on the shaft. The spring maintains proper upward pressure on the elevator platform for card feeding regardless of the number of cards on the platform.

2.56 The in bin has a capacity of approximately 450 cards. When the stack of cards in the bin has been reduced to approximately 50, an alarm is sounded to indicate the need for reloading the bin.

Out Bin

2.57 The out bin is mounted at the front of the perforator, as shown in Fig. 2. This bin is the receptacle into which the card feed mechanism ejects a card after its perforation has been completed. The cards may be easily removed from the bin by swinging the two card retainer bars downward. When the bin is empty, the center opening at the rear of the bin provides access to the chaff bin for cleaning out the punchings, as described in 2.31.

Hand Drive

2.58 The hand drive consists of a stub shaft geared to the card feed drive shaft, as shown schematically in Fig. 4. The stub shaft is located below the clutch drive at the front of the perforator, as shown in Fig. 2. The shaft is turned manually by a detachable handle, which when not in use is placed over a stud at the bottom of the perforator, as shown in Fig. 2.

2.59 The hand drive is used to operate the perforator mechanism manually when checking the perforator or clearing jammed cards. In order to operate the perforator from the hand drive, it is necessary to release the latch by manually depressing the armature of the latch magnet. Before the hand drive is used, it is important that the power from the motor and clutch circuits be disconnected by removal of the MP and CONT plugs, to avoid injury to personnel or damage to the apparatus.

3. OPERATION OF PERFORATOR

General

3.01 This part describes the operation of the KS-13834 perforator in recording troubles on a trouble recorder card.

Seizing the Trouble Recorder

3.02 When a trouble occurs during the handling of a call, a circuit which has access to the trouble recorder puts in a bid for the preparation of a trouble recorder card. The cam switch of the trouble recorder perforator indicates to the circuit whether the trouble recorder is busy or idle. If the trouble recorder is idle, it is seized by the circuit requesting the trouble record and made busy until the trouble record has been completed. During this period, other circuits encountering troubles will not be able to connect to the trouble recorder.

3.03 The circuit in trouble is connected to the trouble recorder perforator through 18 multicontact relays associated with the trouble recorder circuit. These relays, called scanning relays, have 60 contacts each and are operated two at a time by the cam

switch of the perforator. The trouble recorder card is advanced by the card feed mechanism as each successive pair of scanning relays is operated. Thus, the 120 contacts of each pair of scanning relays, successively, close circuits to the 120 punch selector magnets of the perforator during each of the nine steps of the trouble recording cycle. This permits the operation during each step of the cycle of those punches required to record on the card the conditions existing in the circuit.

Making The Trouble Record

3.04 The perforator motor starts as the trouble recorder is seized for the preparation of a trouble record. The cam switch of the perforator then operates the first pair of scanning relays. The portion of the external circuit connected to this pair of scanning relays can thus operate those punch selector magnets required to record the conditions existing in this portion of the circuit. (This is repeated for the other portions of the circuit as the remaining pairs of scanning relays are successively operated by the cam switch.)

3.05 As described in 2.09, the two shuttle bars of the cam drive move in and out together with stationary or dwell periods at their extreme in and out positions. Punch selector magnets are always operated while the shuttle bars are in their OUT dwell position. Operation of a selector magnet brings the latch of its interposer into engagement with the shuttle bar at this time. Then, when the shuttle bar moves inward, it carries the interposer with it, the latch riding over the high portion of the latch stop shown in Fig. 7. The high portion of this stop will hold the latch engaged with the shuttle bar if the selector magnet should release prematurely. At the IN dwell position of the shuttle bar, the interposer permits the eccentric shaft of the cam drive to force the associated punch downward and perforate the card.

3.06 During the punching operation, the selector magnets which were operated are released. The operated punches are restored to their normal position by the fingers of the punch retractor described in 2.19. The shuttle bars move to their OUT dwell position carrying the previously operated interposers with them since the interposer latches are held in engagement with the shuttle bar by the high portion of the latch stop. When the shuttle bar reaches the OUT dwell position, the latches drop to the low portion of the latch stop and are thus disengaged from the shuttle bar.

3.07 The intermittent solenoid of the clutch drive now operates, engaging the clutch of the geneva drive. The output shaft of the clutch drive rotates the card feed drive shaft sufficiently to advance the card to the position for the next punching operation. The two cam switch shafts, K and L (Fig. 4) are simultaneously rotated sufficiently to correspondingly advance the circuit operation and the external circuit operates punch selector magnets through the next pair of scanning relays. This step of the perforating cycle is then completed as described in 3.05 and 3.06.

3.08 As the trouble recorder card moves through the successive steps of the perforating cycle, the cam switch operates the proper pair of scanning relays at each step. When the nine perforating operations have been completed, the intermittent clutch is released and the circuit for which the trouble record has been made is disconnected from the trouble recorder.

3.09 The continuous solenoid then operates engaging the cone clutch. The output shaft of the clutch drive rotates the card feed drive shaft and the perforated card is ejected into the out bin. At the same time the top card in the in bin is moved into position for its first punching operation. As the perforator approaches its home position, the cam switch causes the continuous solenoid to release, disengaging the cone clutch. At the same time, the latch operates to stop the perforator mechanism and lock it in its home position. The perforator may now be seized to make another trouble record.

4. MAINTENANCE

General

4.01 This part refers to information which is provided for the maintenance of the KS-13834 perforator. This information includes requirements, adjusting procedures, piece-part data for the replacement of parts, procedures for analyzing trouble recorder cards, and alarms associated with the perforator.

Requirements and Adjustments

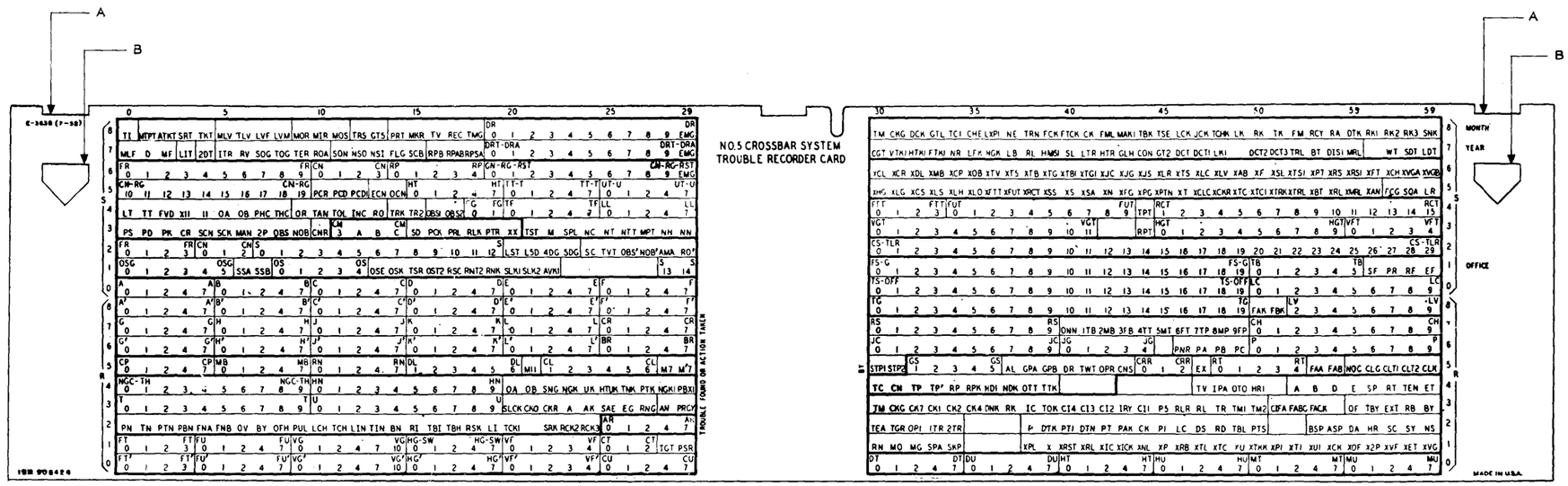
4.02 General information and all requirements and adjusting procedures for the perforator are covered in Section 034-305-701. Methods of loading the in bin, extracting stuck cards, and removing the perforated cards are also covered in this section as well as a list of the effects and possible causes of irregularities in perforator performance.

Replacement of Parts

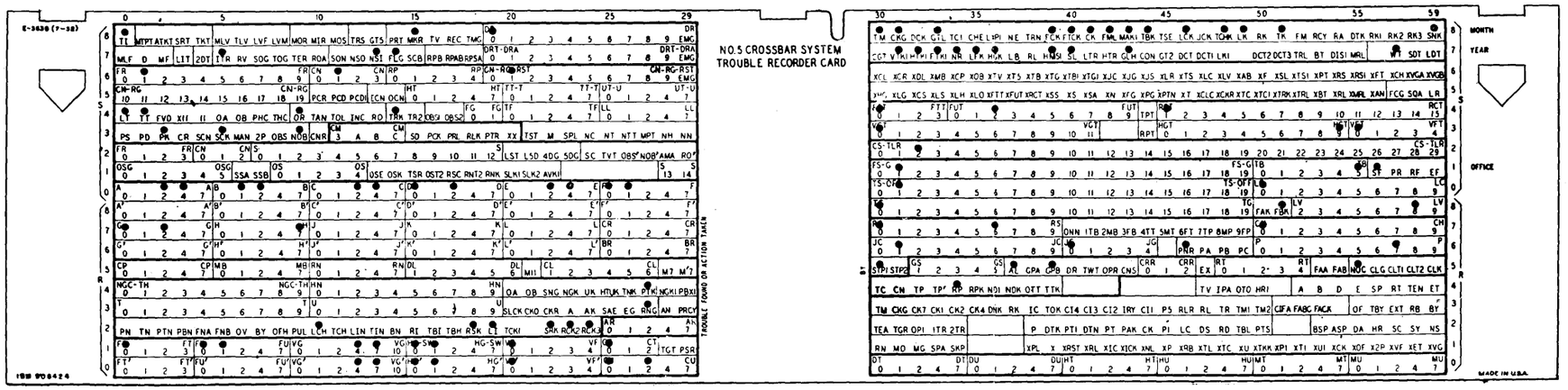
4.03 Piece-part data for ordering parts of the KS-13834 perforator as well as the approved procedures for replacing these parts are given in Section 034-305-801. An index in Part 2 of the section lists all replaceable parts of the perforator and also refers to the replacement procedures for these parts. This section also includes the procedures for storing and transporting a spare perforator and the recommended procedure to be followed when it is necessary to remove or mount a perforator on a frame.

Analysis of Trouble Recorder Cards

4.04 BSP sections are available covering the procedures to be followed in analyzing trouble recorder cards for various circuits. These sections include a description of the trouble recorder card, circuit information such as sequence charts which are helpful in analyzing troubles, and an explanation of the analysis of one or more typical troubles in the circuits involved.

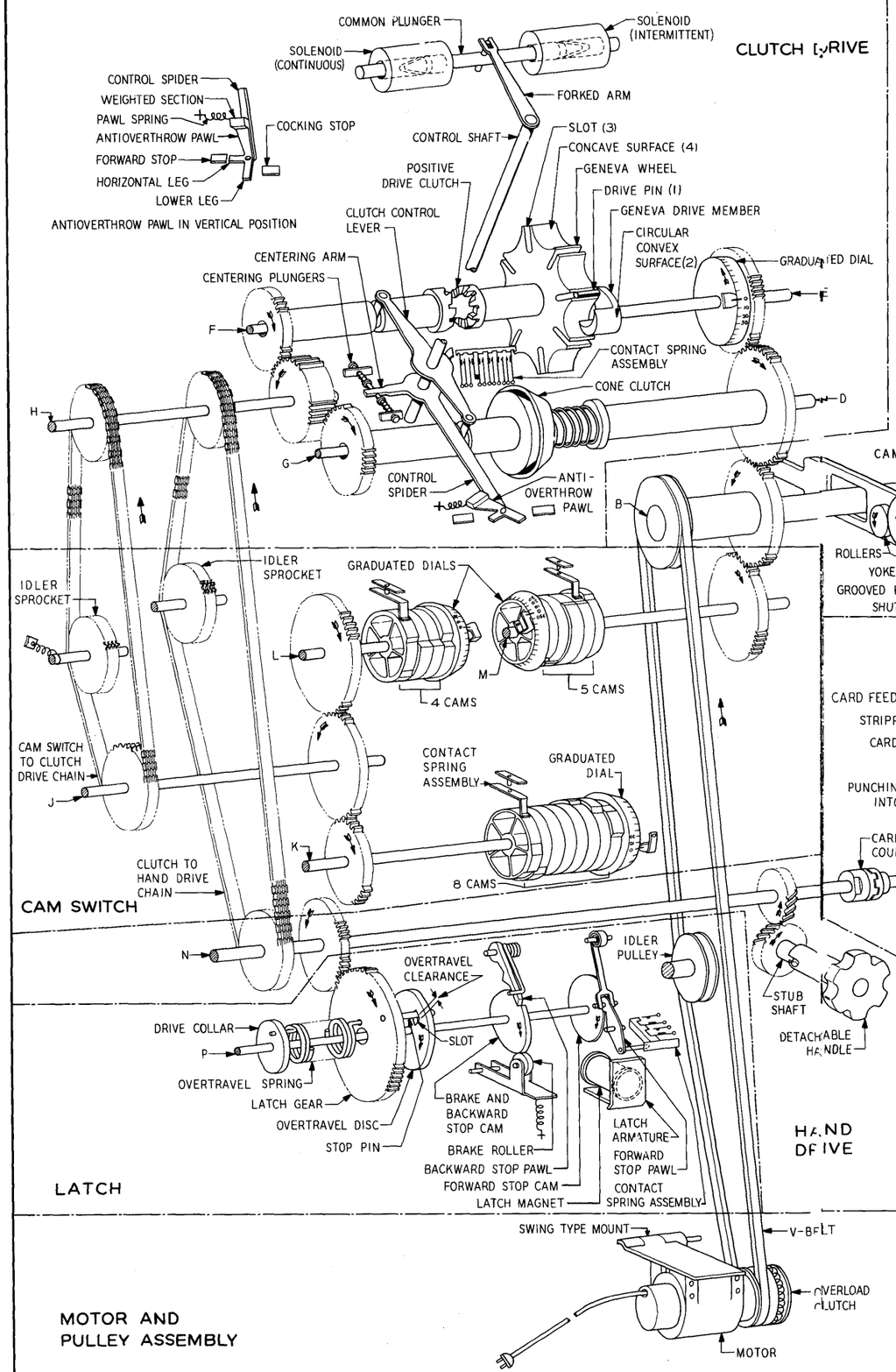


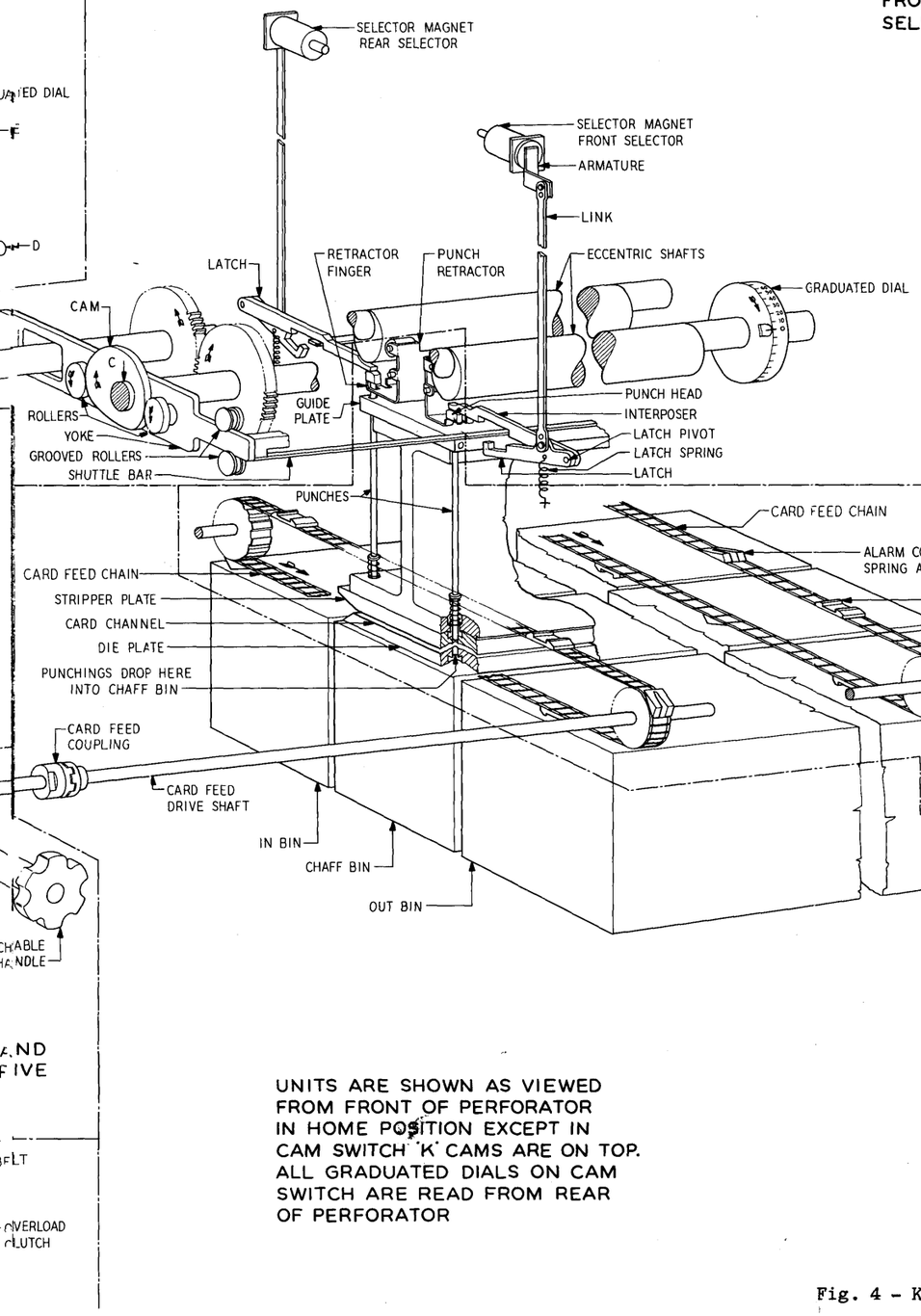
UNPERFORATED CARD



PERFORATED CARD

Fig. 1 - Trouble Recorder Card Used in No. 5 Crossbar





UNITS ARE SHOWN AS VIEWED FROM FRONT OF PERFORATOR IN HOME POSITION EXCEPT IN CAM SWITCH 'K' CAMS ARE ON TOP. ALL GRADUATED DIALS ON CAM SWITCH ARE READ FROM REAR OF PERFORATOR

Fig. 4 - KS-13834 Perforator - Mechanical Schematic