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IBM
ACCOUNTING MACHINES

CUSTOMER ENGINEERING MANUAL OF INSTRUCTION

ELECTRIC PUNCH

TYPE 011

INTERNATIONAL BUSINESS MACHINES CORPORATION
NEW YORK, NEW YORK

CONTENTS

	Page
INTRODUCTION	1
OPERATION	2
MECHANICAL AND ELECTRICAL PRINCIPLES	8
Essential Elements of a Punch	8
Selecting the Punch	8
Interposer Locks	12
Card Rack, Dog and Escapement	12
Rock Shaft Assembly	13
Space Key	14
Release Key	14
T Lever	14
Main Spring Governor	14
REMOVAL PROCEDURES	16
Procedure for Removing Key Assembly	16
Procedure for Removing Key Assembly and Mechanism Holder	17
Procedure for Removing an Interposer	18
ADJUSTMENTS	19
Main Spring	19
Dog Carrier	19
Skip Lifter Position	19
Toggle Link	20
Magnet Yoke	20
Bell Crank Eccentric Screws	21
Armature Back Stop	21
Punch Magnet Contact	22
Circuit Breaker	22
Escapement	23
Space Bar Adjusting Screw Block	23
Space Bar Adjusting Screw	23
Space Bell Crank	23
Card Punching Registration	23
Rack Stop, Left	23
Rack Stop, Right	23
CIRCUIT DESCRIPTION	24
Selenium Rectifier	24
LUBRICATION PROCEDURE	26

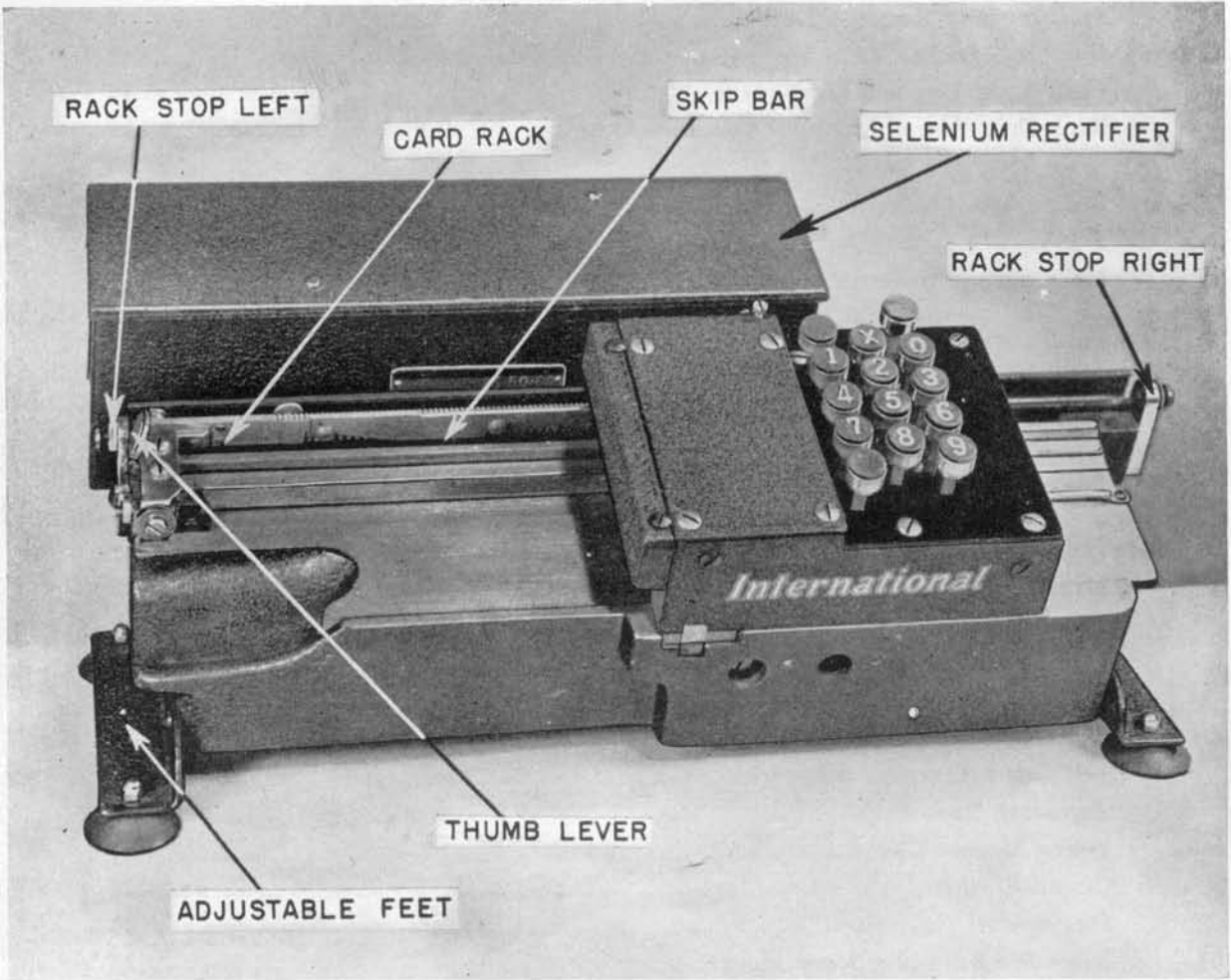


Figure 1

THE IBM ELECTRIC PUNCH TYPE 011

INTRODUCTION

The IBM Electric Punch provides the means of transcribing information from original documents to IBM cards. It establishes the records to be handled by all other IBM Accounting Machines; therefore, the part that it plays is of utmost importance in the IBM Accounting method.

The principal features of the Type 011 Electric Punch are illustrated in Figure 1.

Figure 2 shows a close-up of the keyboard. The space key is located near the front of the keyboard. Each depression of the space key moves the rack one column to the left, without punching a hole in the card.

At the rear of the keyboard is the release key. When the release key is depressed, the rack is released by the escapement mechanism and moves to its extreme left position.

The other keys on the keyboard are the twelve punching keys, 0 to 9 inclusive, X and 12. The 12 key is the unmarked key just to the left of the X key. As any one of these keys is depressed, a corresponding hole is punched in the card, and the rack spaces one column toward the left. Power for both of these functions is furnished by an electromagnet, energized by the depression of the key. Thus, when operating these twelve punching keys, the operator merely closes a contact to energize the magnet and makes selection of the proper punch pin. All other power is furnished by the electromagnet. The IBM Electric Punch, therefore, requires very little manual effort to operate.

Interlocks prevent depression of more than one of these punching keys at one time. The machine may be specified to operate from one of the following four power supplies: 110 D. C., 220 D. C., 110 A. C., and 220 A. C.

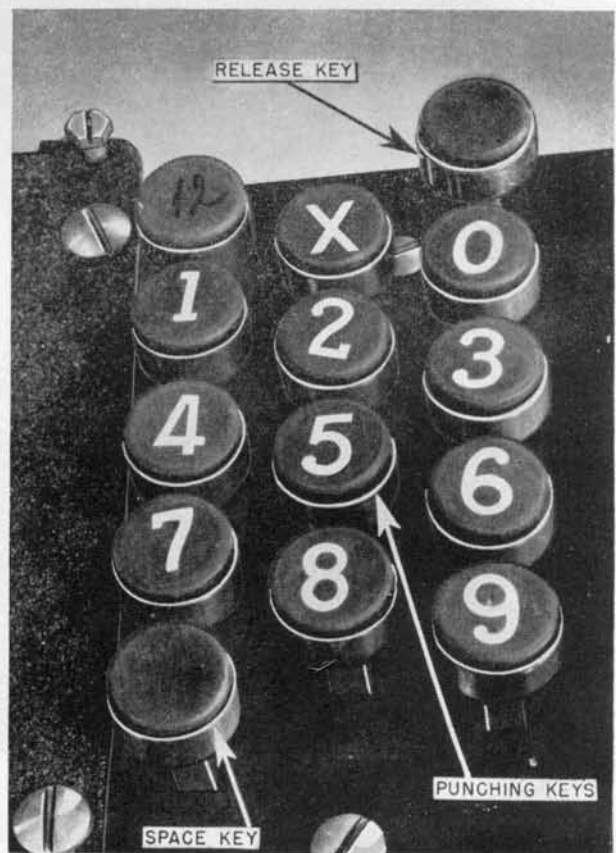


Figure 2

OPERATION

With the rack released to its extreme left position, insert a card in the machine, face up, with column No. 1 at the left. Be certain that the left end of the card is under the retainer on the card feeder assembly, left (Figure 3). Using the thumb lever at the left end of the rack, push the card to the right until column No. 1 is under the die. There is no main line switch on the machine; punching may begin as soon as the machine is plugged into an outlet of the proper power supply.

The machine is operated by the right hand with the touch system. The index finger operates the 12, 1, 4, and 7 keys; the middle finger the X, 2, 5 and 8 keys; and the ring finger the 0, 3, 6 and 9 keys.

The operator should sit in a position and at a height so that the fingers of the right hand easily reach all of the keys. Adjustable feet make it possible to tilt the machine at an angle best suited to the operator.

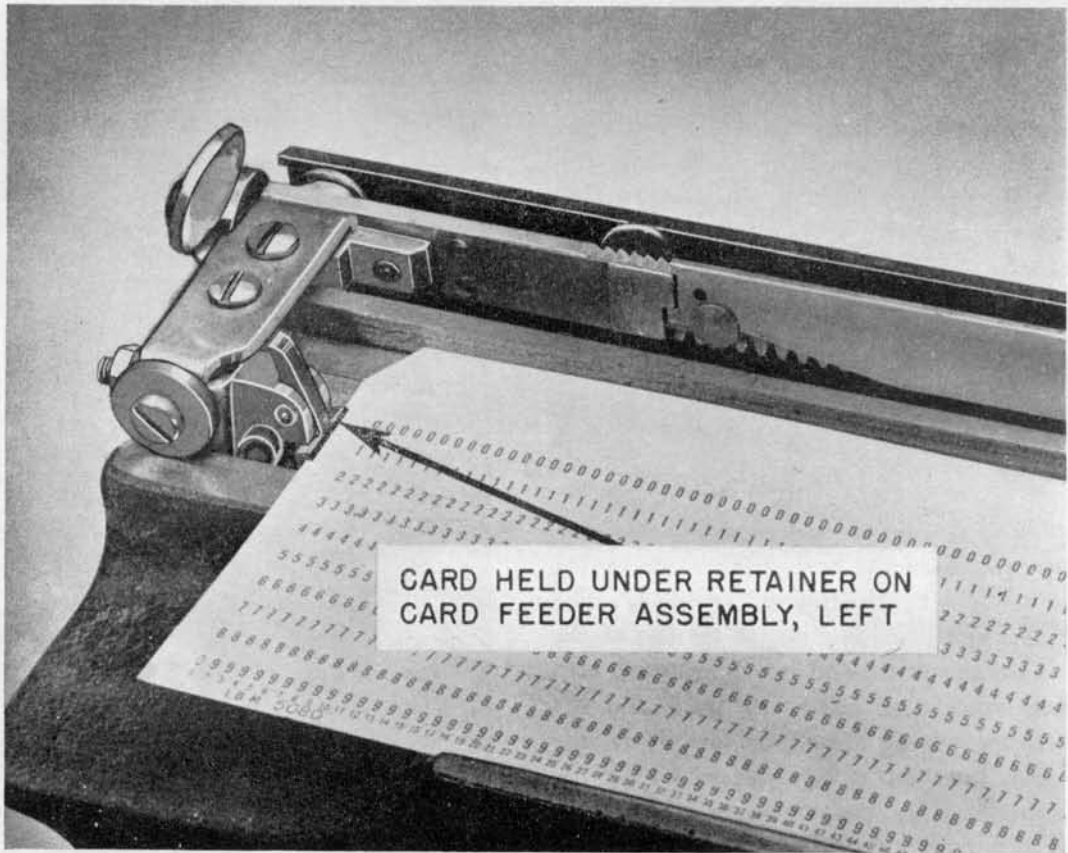


Figure 3

The X key, in addition to punching a hole, performs a special function known as X skipping, which may be likened to tabulation on a typewriter, that is, skipping from within a given field to a predetermined point or column. This skipping is under control of the X key together with a skip bar. Generally speaking, separate skip bars are required for each design of card with a different arrangement of fields. Figure 4 shows the method of inserting a skip bar in the rack of a key punch.

Depression of the X key punches a hole in the X position of the card and operates the escapement mechanism for one space, as does any other punching key, but in addition, it operates the skip lifter, causing it to project above the skip bar. This results in skipping, provided a skip bar is in the rack and is cut to effect a skip on the particular column involved. The depression of any other punching key or the space key retracts the skip lifter to its normal position.

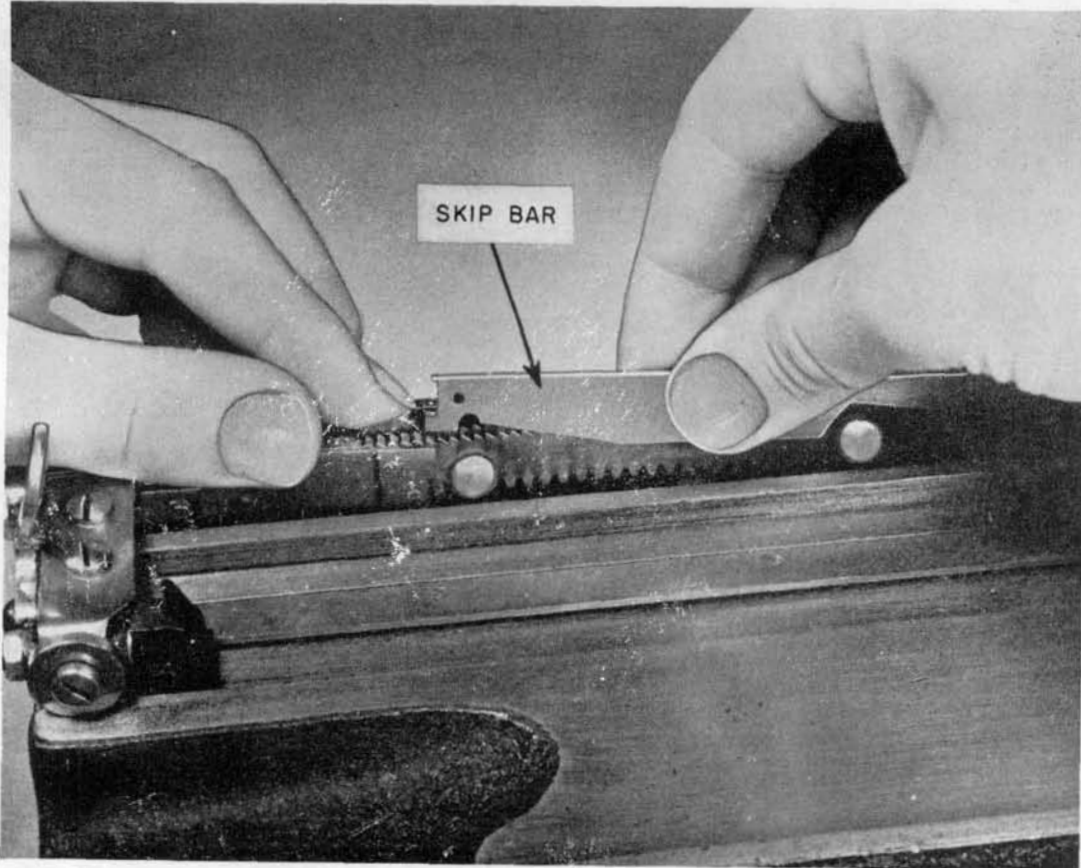


Figure 4

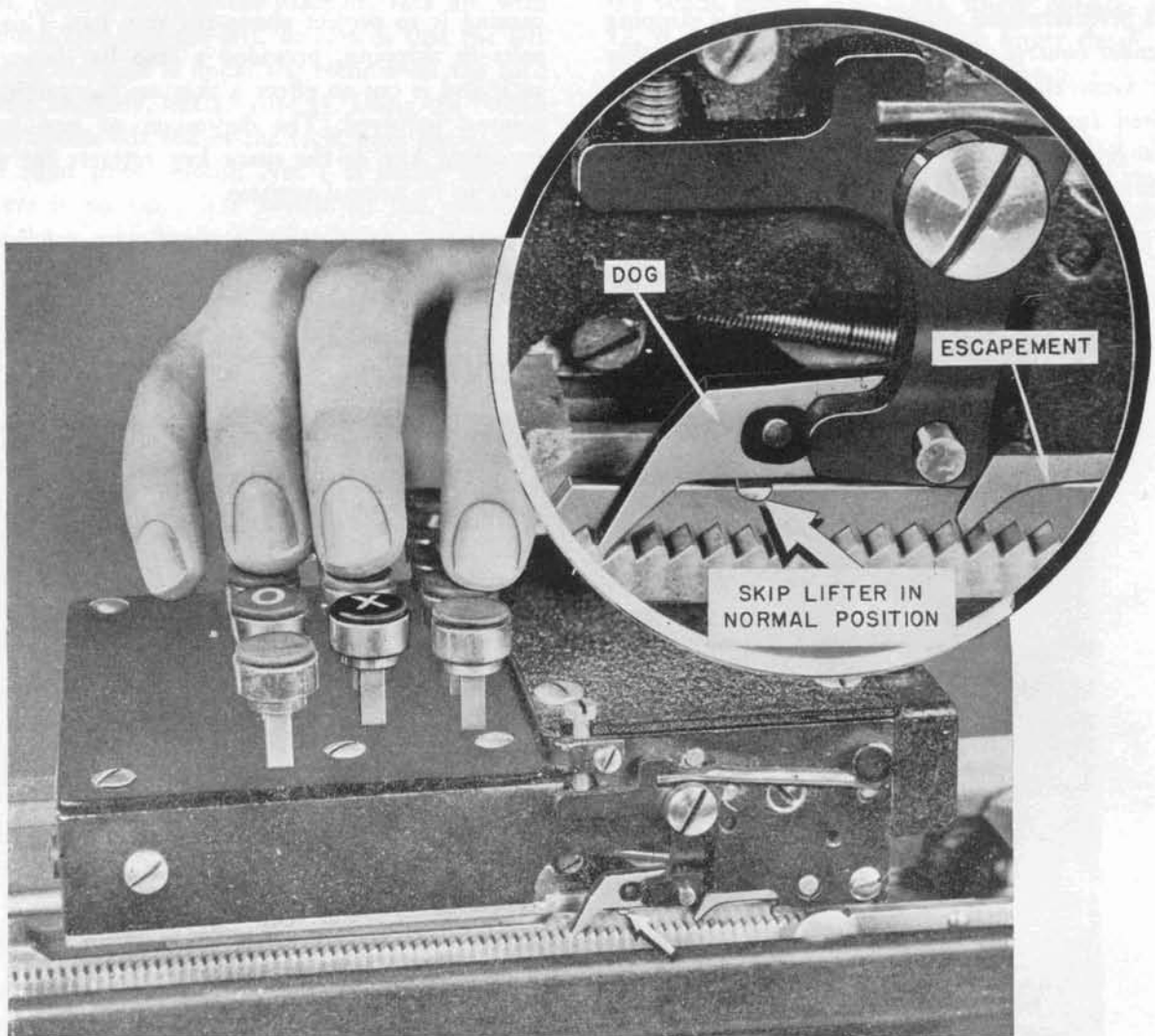


Figure 5

Figure 5 indicates the escapement mechanism and shows the skip lifter in the normal position before depression of the X key.

Figure 6 shows the skip lifter after depression of the X key. Note that this has caused it to project farther from the machine. Note, also, that the

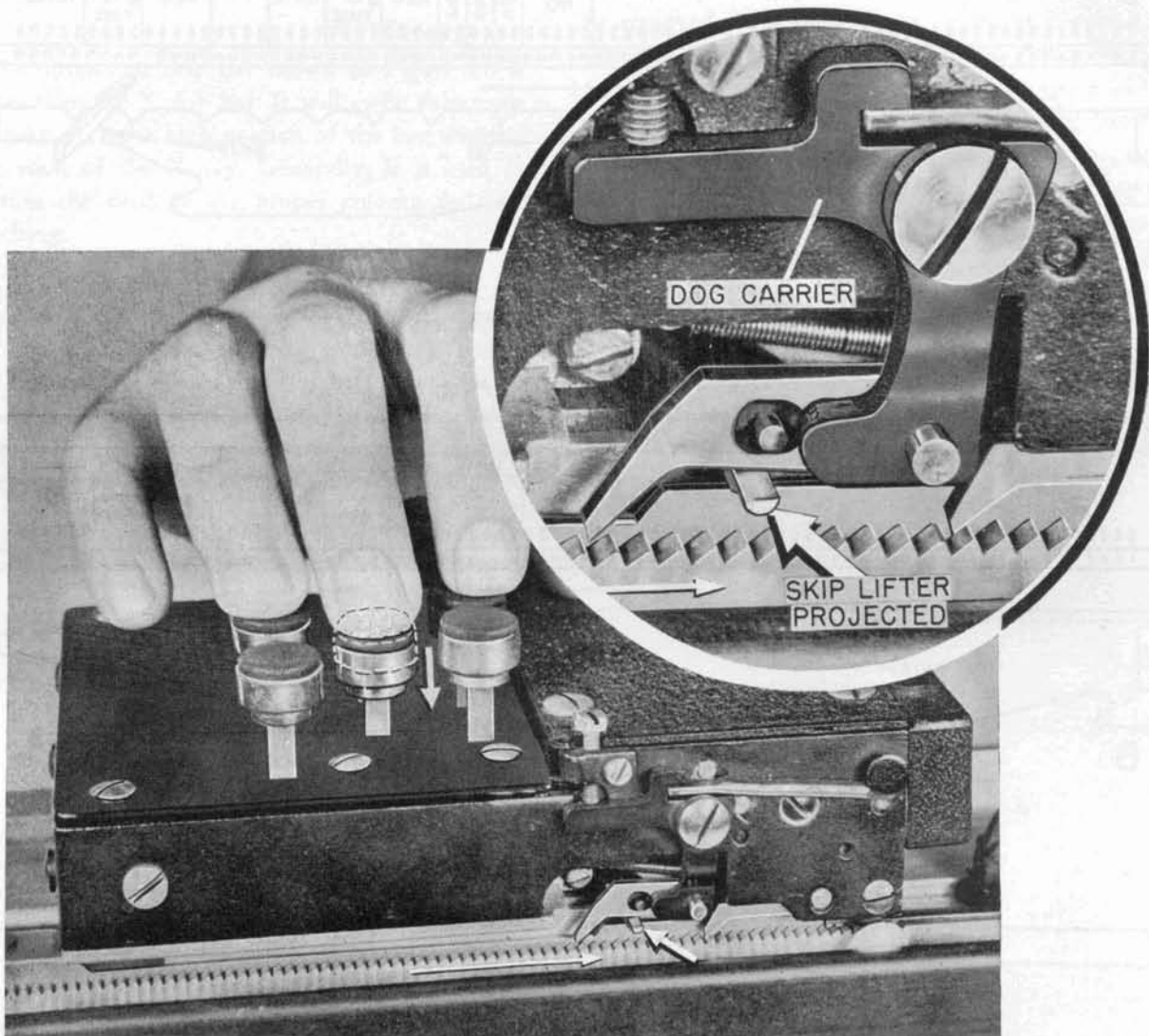


Figure 6

portion of the skip lifter now above the skip bar is thicker (vertically) than in Figure 5, thus lifting the dog from the rack teeth. The rack will, therefore, begin its skipping and will continue until the

first low cut in the skip bar permits the skip lifter to drop, thus allowing the dog to engage the rack teeth again. This stops the rack in position to continue the punching.

The X skip bar used for the operation just described is shown in Figure 7A. Also indicated with this bar are skip lifters shown in normal and skipping positions.

The automatic skip bar shown in Figure 7B is higher than the X skip bar. It will cause automatic skipping over the high portion of the bar without depression of the X key. Generally, it is used to position the card at the proper column to start punching.

Figure 7C shows a combination skip bar, that is, one which embodies the features of both the X skip bar and the automatic skip bar. Combination skip bars should be designed so that an X skip is never followed by an automatic skip without an intervening depression of some punching key other

than an X key, because a projected skip lifter will jam on the high portion of an automatic skip bar.

Any type of skip bar can be readily inserted in or removed from the rack as shown in Figure 4. The card rack must be released to the extreme left by depressing the release key, and the space key should be depressed to insure that the skip lifter is in its normal position. When inserting a bar, be certain that the right end is placed behind the supporting stud and that it is securely locked in position at the left end.

A margin stop is provided which can be used to limit the travel of the rack to the right when inserting a card. This stop can be moved by raising it slightly so that it is disengaged from the teeth of its rack. Figure 8 shows this margin stop and the rack.

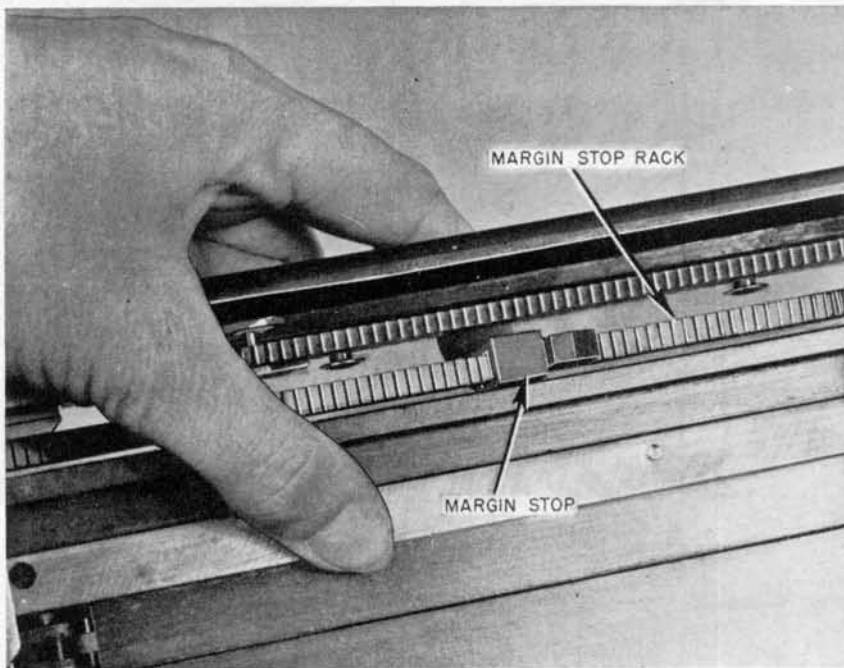


Figure 8

MECHANICAL AND ELECTRICAL PRINCIPLES

Essential Elements of a Punch

Every punch consists of three essential elements: the punch itself, a die, and a stripper. Even a conductor's hand punch will have these three basic parts. Figure 9 illustrates their operation.

The die serves as a base to hold the card while the punch cuts the hole in the card. The stripper serves as a guide for the punch and as a means of stripping the card from the punch after the latter has cut the card.

Selecting the Punch

In the case of the IBM card, there are 12 punch-

ing positions in a single column; therefore, the machine has 12 punches mounted in a row, as shown in Figure 10.

The method of selecting the proper punch is also illustrated by Figure 10. Assume that the motor plate, which is normally in a position $\frac{1}{2}$ inch above the tops of the 12 punches, has a stroke of $\frac{1}{4}$ inch. None of the punches will be struck by the plate when it descends. However, if an interposer $\frac{3}{8}$ inch thick is moved into position over the top of any of these punches when the plate descends, it will depress the particular punch without disturbing the others, as shown in Figure 11.

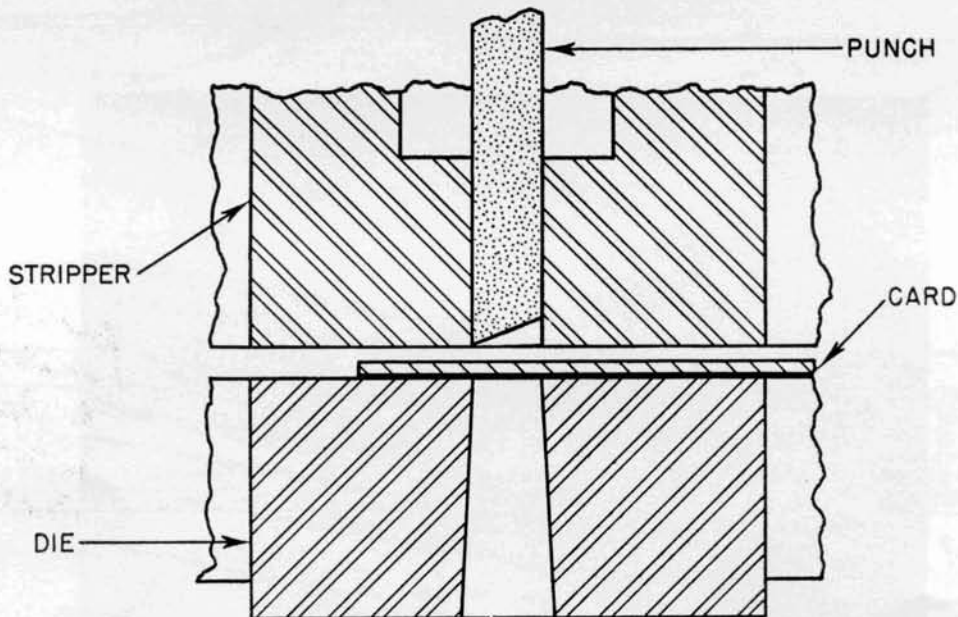


Figure 9

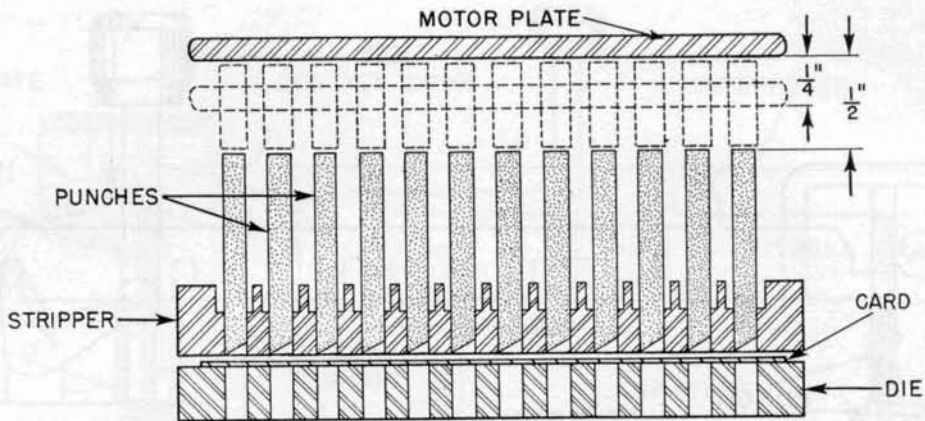


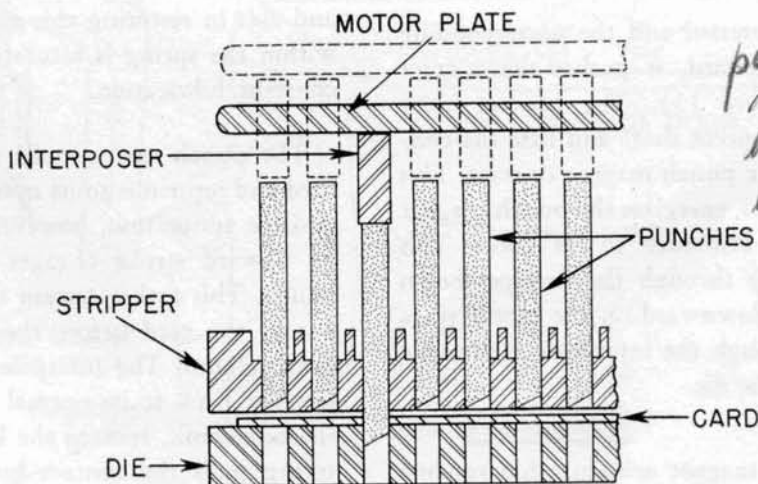
Figure 10

This interposer principle of selecting the punch to be operated is generally applied in all IBM card punching machines in one form or another.

On all of the key punching machines, there are 12 interposers, each individually operated by a key on the keyboard. The sketch in Figure 12 is representative of one position.

As the key is depressed, it operates the bell crank

to move the interposer to the left under the motor plate. When the motor plate descends, the punch corresponding to the key depressed will be forced through the card. Similarly, if any other key is depressed, its interposer will move forward to be depressed by the motor plate, and a hole will be punched in the card corresponding to the key selected. Note the felt pad through which the punches are inserted just above the stripper. This



*punches are
motor plate driven
in terms
spring restored
motor plate restored*

Figure 11

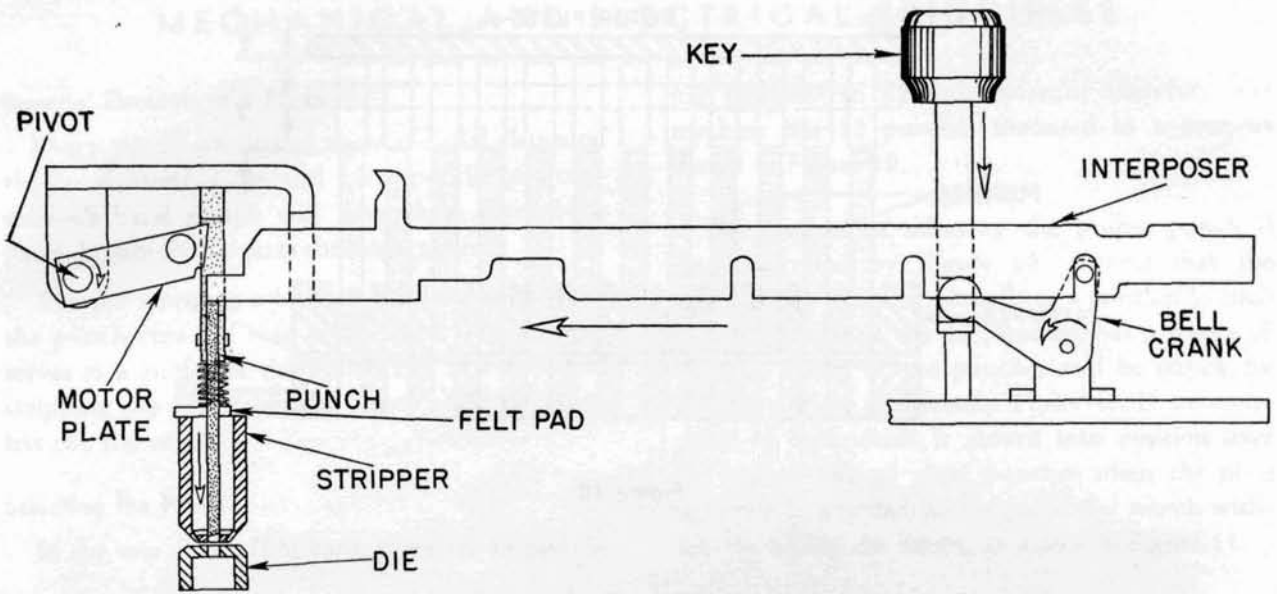


Figure 12

provides a means of lubricating the punches, as this pad can be kept saturated with light oil.

The motor plate is operated through a linkage by a two-coil punch magnet mounted under the base.

As the key is depressed and the corresponding interposer moves forward, it pushes the contact door forward (Figure 13). The contact door is revolved about its pivot shaft and lifts the contact hook, closing the punch magnet contact. This contact, when it closes, energizes the punch magnet which attracts the armature to its cores. This movement, operating through the linkage shown in Figure 13, pulls downward on the motor plate which, in turn, through the interposer, drives the proper punch into the die.

When the punch magnet armature has reached the limit of its travel, the circuit breaker operates against the foot of the contact hook and allows the punch magnet contact to spring open, de-

energizing the punch magnet. The armature, now being released, is pulled back to its original position by the armature return spring shown in Figure 14. The motor plate and linkage are thereby returned to their original positions. The toggle link spring (Figure 25) prevents the toggle link from remaining in a dead center or straightened out position, and aids in restoring this mechanism. A felt wick within the spring is saturated with oil to provide constant lubrication.

The punch spring pulls the punch out of the card and returns it to its normal position. To insure positive restoration, however, the motor plate on its upward stroke engages with the top of the punch. This makes certain that the punch will be out of the card before the card advances to the next column. The interposer spring pulls the interposer back to its normal position and, through the bell crank, returns the key. The contact hook spring pulls the contact hook down and against the punch magnet contact; the entire mechanism is then back in its original position and ready for the next key to be depressed.

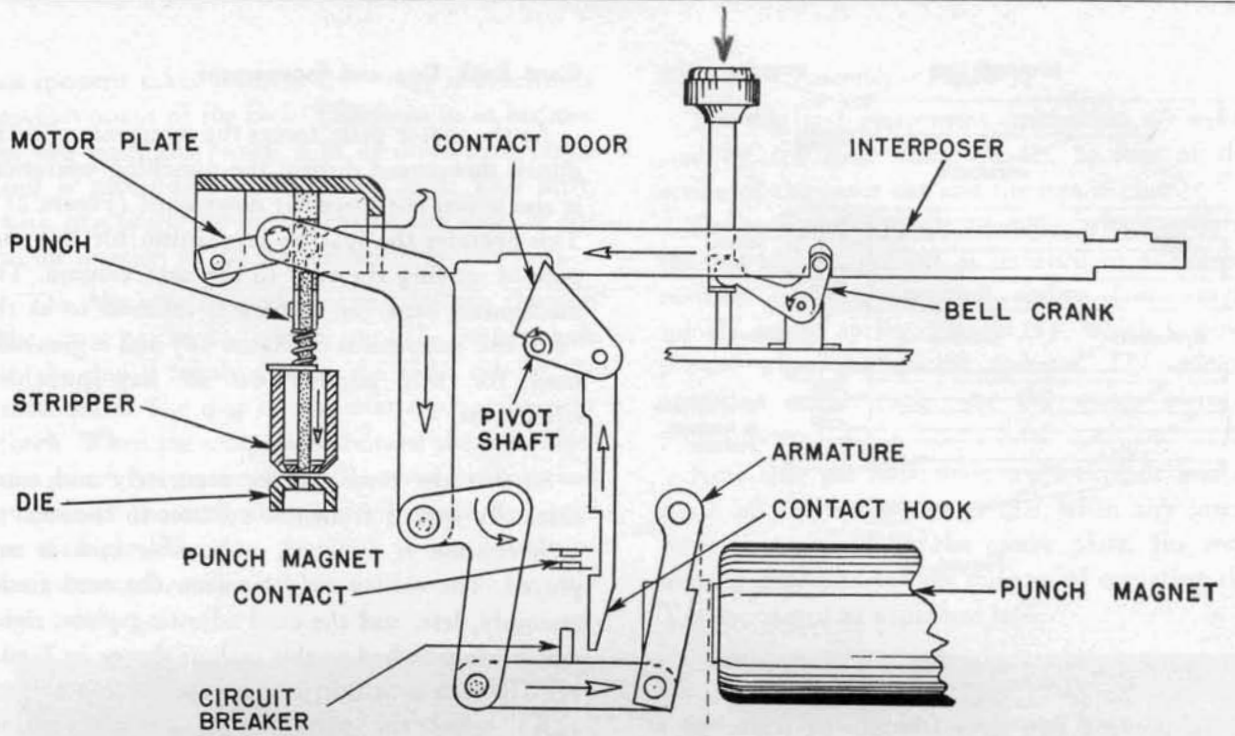


Figure 13

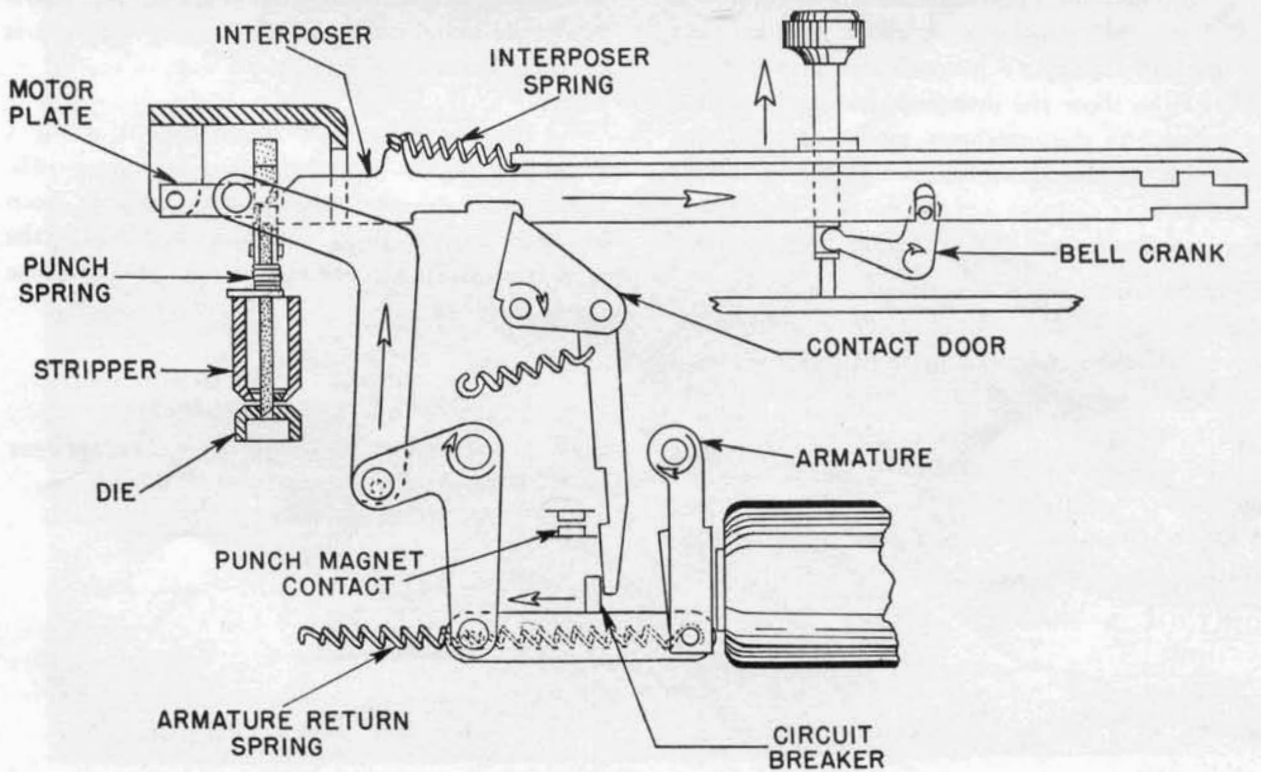


Figure 14

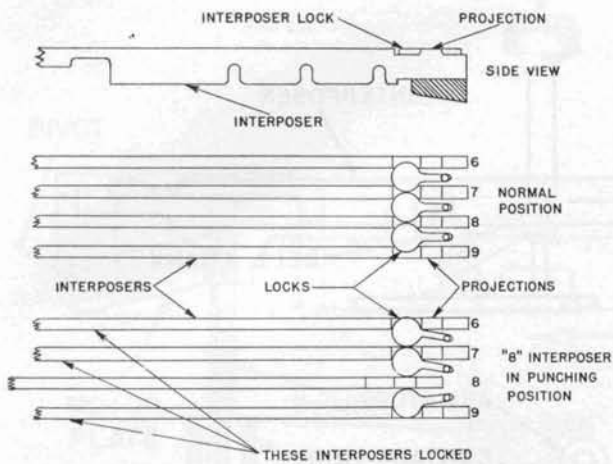


Figure 15

Interposer Locks - Figure 15

To prevent two keys from being depressed at the same time and punching two holes in the same column, the interposers are provided with locking devices. The interposer lock, or banjo, fits between the interposers and operates as shown in Figure 15.

The interposer locks pivot about pins between the interposers. There is just sufficient play between the locks to allow one interposer to move forward at a time. As the interposer moves forward, the projection on the interposer spreads the interlocks apart, locking all other keys to prevent their being depressed until after the preceding hole has been punched.

Card Rack, Dog and Escapement

As the motor plate forces the interposer and the punch downward during the punching operation, it also moves the space bar downward (Figure 21). This operates the spacing mechanism for the purpose of moving the card to the next column. The mechanism used for spacing is referred to as the "dog and escapement" (Figure 16) and is generally used for this purpose on all key punching equipment.

So that the card may be accurately and automatically spaced from one column to the next as each column is punched, a movable rack is employed. The card is held between the card feeder assembly, left, and the card adjusting plate, right, which are attached to this rack as shown in Figure 17. The rack is held firmly against the dog (Figure 16A) when the punch is in normal position. Tension for this is supplied by the main spring (Figure 17). Note that this tension has forced the dog back so that the left side of the oversize hole in the dog presses firmly against the rock shaft. Also note that in the normal position, the rack is prevented from escaping by the dog.

As the hole is punched in the card, the dog is lifted out of the rack as shown in Figure 16B. However, note that the escapement has been lowered into the rack, and now it prevents the rack from escaping. The shift from the dog to the

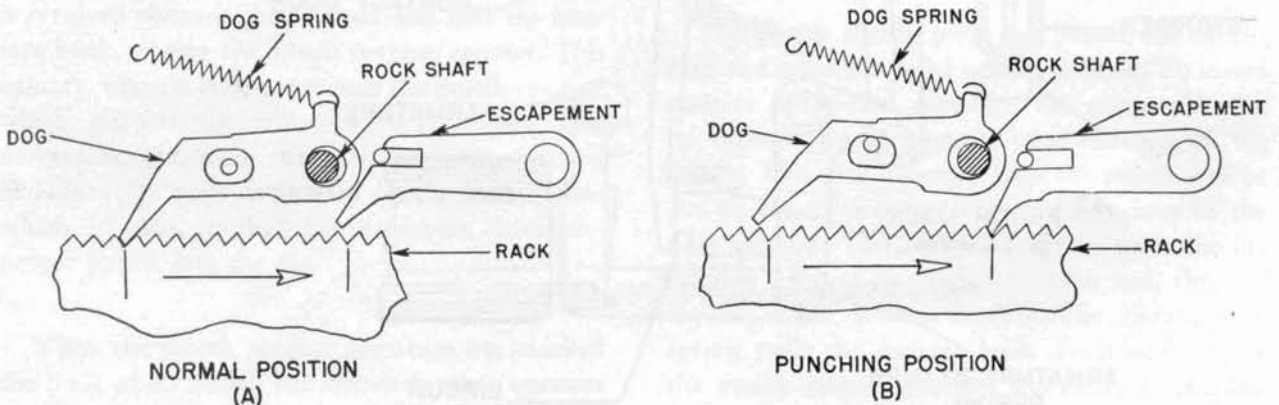


Figure 16

escapement takes place so that there is practically no movement of the rack. This must be so because, at this time, the punch is in its downward travel and is protruding through the card. This shift, with practically no movement of the rack, is due to the position of the dog carrier (Figure 6).

The dog, now free, advances to the left, through the action of the dog spring, until the oversize hole in the dog is firmly against the right side of the rock shaft. The dog is now overlapping the next tooth. When the escapement releases the rack after the punch has returned to its normal position and is clear of the card, the rack will move one space to the right. The dog, dropping to the bottom of the new tooth, will allow the card to advance only one column.

Rock Shaft Assembly - Figure 17

The dog and escapement mechanism are operated by the rock shaft spindle, because of the action of the space bar and the motor plate.

The rock shaft spindle assembly, which operates the dog and escapement, is returned to its normal position by a compression spring (rock shaft spindle return spring, Figure 28), which is compressed when the spindle operates. The spacing operation occurs each time the motor plate is pulled down.

Note that the rock shaft itself extends underneath all the interposers so that when any interposer is depressed by the motor plate, the rock shaft is depressed for the purpose of operating the T lever, as will be explained later.

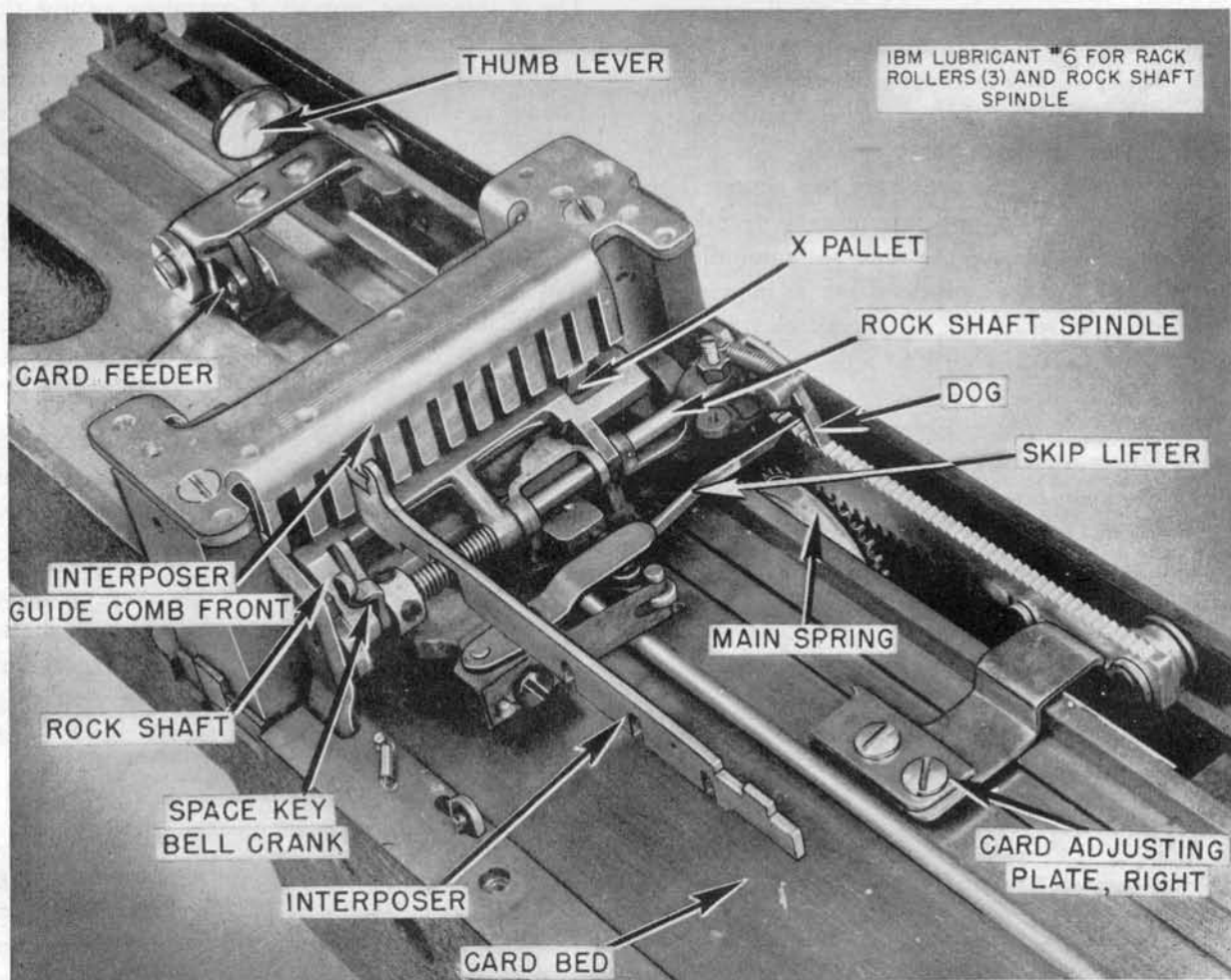


Figure 17

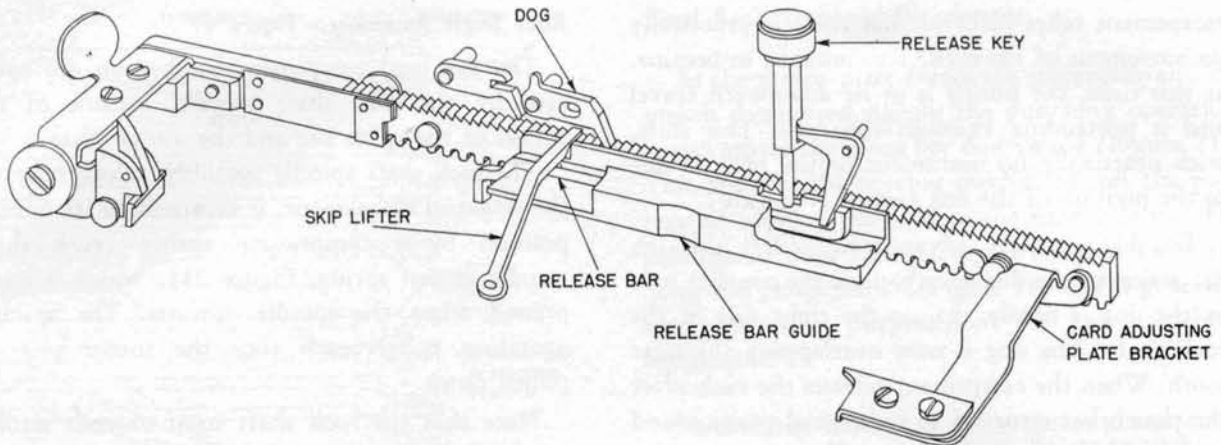


Figure 18

Space Key

The space key operation of the spacing mechanism differs from spacing with a punching operation in that there is no movement of the motor plate. The space key interposer manually performs the spacing operation through a bell crank on the front end of the rock shaft spindle. The punch magnet contact is not closed by this action. The motion of the space key interposer is translated into motion to operate the rock shaft spindle, so that the dog and escapement act as previously explained. The space key bell crank may be seen on the rock shaft in Figure 17.

Release Key - Figure 18

The object of the release key is to eject a card (move the rack to the extreme left position) from any position. Depressing the key moves the release key bell crank, which causes a release bar to move to the right; this in turn raises the skip lifter, which raises the dog independent of the escapement; and allows the rack to move to the limit of travel to the left. Once the release key is depressed, the rack must move the entire distance to the left, as the release bar can be restored to its normal position only by the movement of the card adjusting plate bracket as it strikes the left end of the release bar.

T Lever - Figures 19 and 22

When the X key is depressed, the X interposer moves to the left, the punch magnet is energized,

and the motor plate pushes the interposer down. A hole is punched in the X position in the column. The X interposer, instead of operating against the rock shaft like the other interposers, operates against a special section of the rock shaft under it known as the X pallet. When the X interposer is pushed down by the motor plate, the X pallet operates a T lever and projects the skip lifter for the purpose of skipping groups of columns. At the same time, the escapement mechanism is operated in the normal manner by the motor plate, space bar, and a portion of the rock shaft. This function of the X key is similar to that of the TAB key on a typewriter.

It will be noted that the T lever assistor, by its fixed position, insures that the T lever will be turned when the X pallet or the rock shaft operates against it.

The operation of any numerical key or space key, which causes the movement of the rock shaft, will restore this skip lifter to its normal position. This is done by means of the T lever operating ear on the rock shaft, which forces the T lever back to its normal position.

Main Spring and Governor - Figure 20

The main spring furnishes the power for moving the rack to the left. The purpose of the governor is to prevent the spring from driving the rack too rapidly. This is accomplished by two brake shoes which are thrown outward against the drum by

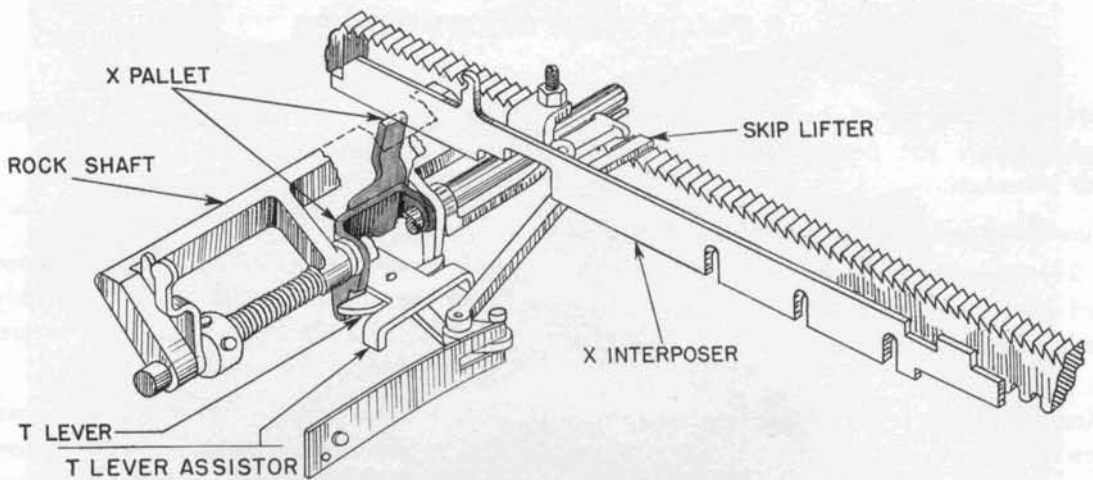


Figure 19

centrifugal force when the rack tends to move too rapidly for a distance of several columns.

The governor shown in Figure 20 has been removed by taking out the three screws holding it to the spring assembly, and the two screws which hold the spring and gear assembly to the base are exposed. Before removing either of these two screws, set the rack in its 80th column position, and hold the gear with one hand as the screw is removed and the gear demeshed from the rack. This prevents the spring from unwinding rapidly. It is important to follow this pro-

cedure and let the spring unwind slowly, otherwise breakage of the spring will probably result.

The gear may be lifted off, exposing the spring. Note the loop on the inner end of the spring. This must be engaged in the eye in the hub of the gear when the gear is replaced. If a new spring is to be installed, it may be transferred from the C clamp, in which a new spring is wound, to the spring housing without being unwound.

The IBM Electric Punch uses a red loop spring.

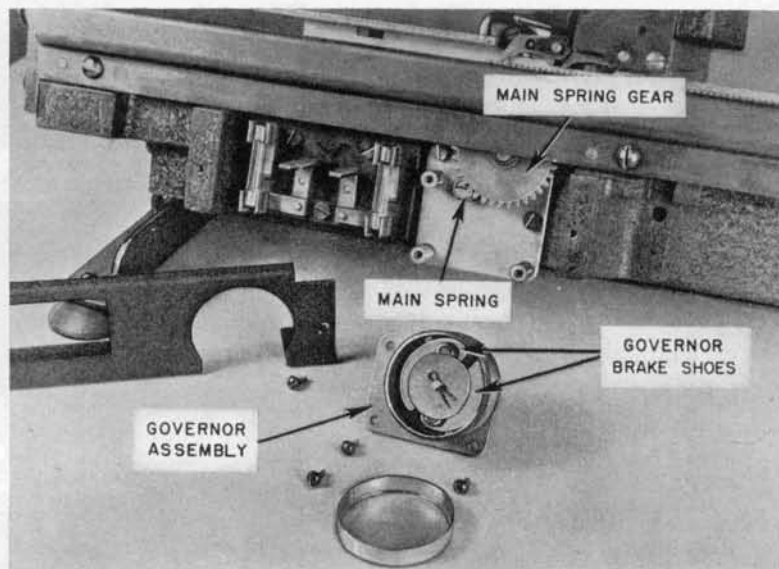


Figure 20

REMOVAL PROCEDURES

Before any removal of parts or units is attempted, be sure the power connection to the machine is broken.

Procedure for Removing Key Assembly - Figure 21

The key assembly with all interposers may be removed as a unit. This procedure might be used if it is necessary to remove or replace the rock shaft.

1. Remove the cover over the interposer springs (4 screws).
2. Remove the cover over the motor plate (2 screws).
3. Remove the rear wall plate assembly which is the cover across the rear of the key assembly and mechanism holder (3 screws).
4. Remove the cover across the front of the key assembly and mechanism holder (2 screws).

5. Remove the motor plate and interposer guide comb together (2 screws).

6. Unhook contact hook spring at one end.

7. Remove two oval head screws and one fillister head screw which hold the key assembly to the base at the front. These three screws are located to the right of the space key.

It is now possible to lift the key assembly up and to the right. The rack should be toward the right so that there is no interference between the release bar and the card adjusting plate bracket.

Note: Extreme care must be used in removing this unit so that the skip lifter is not broken, because it normally rides in a recess in the release bar guide. Care must be exercised also in lifting the contact hook from its slot in the base.

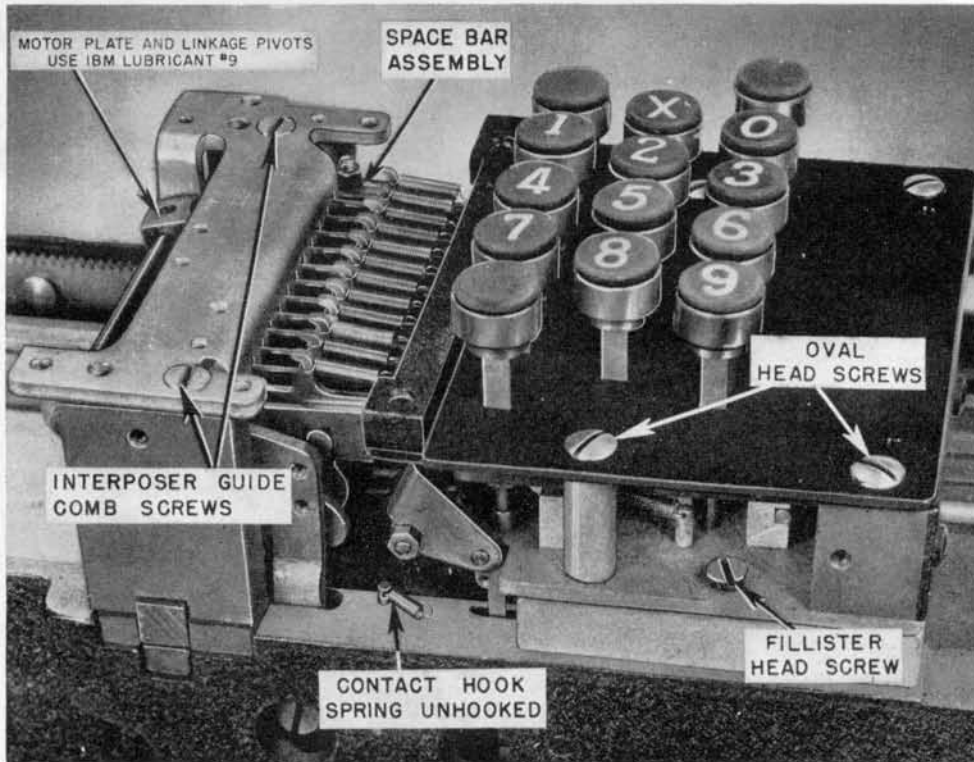


Figure 21

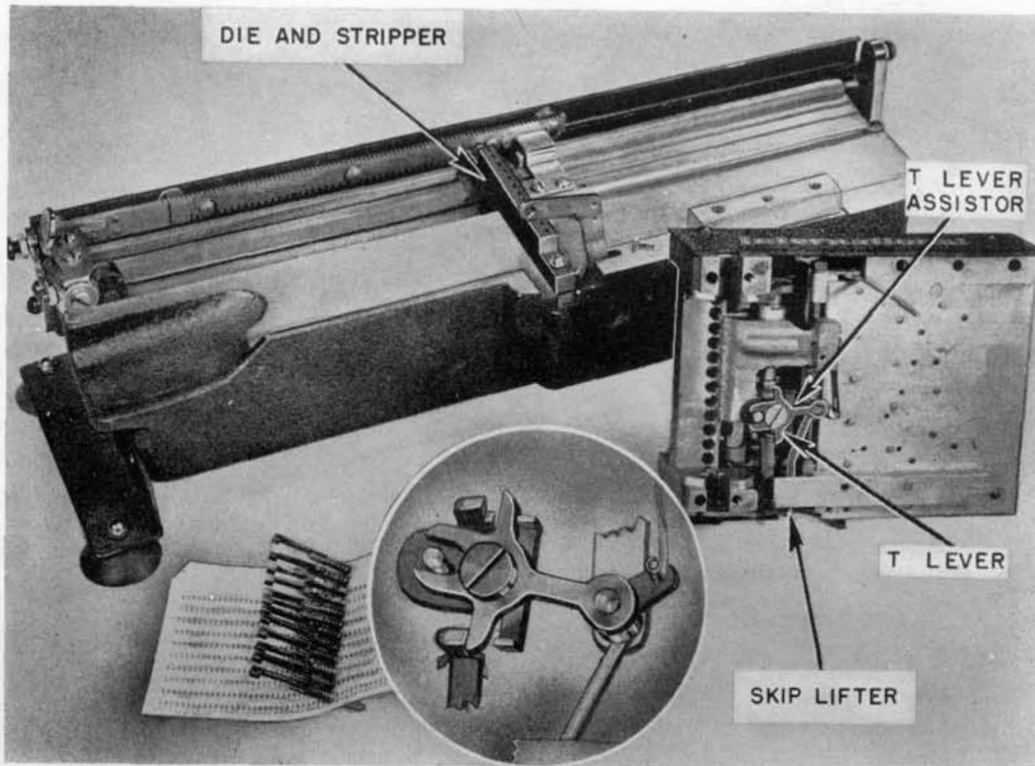


Figure 22

Procedure for Removing Key Assembly and Mechanism Holder - Figure 22

This procedure of removing the key assembly and mechanism holder as a unit might be used if it were necessary to replace the die and stripper assembly or the T lever assembly.

1. Punch a card in all positions, 9 to 12, so that it may be used for storing punches and springs when they are removed.

2. Remove covers over motor plate and interposer springs.

3. Remove motor plate and guide comb (2 screws, Figure 21).

4. Remove punches and punch springs. Punches must be kept in order so they can be reinstalled in their original positions. This can best be done by forcing them through the card in the positions corresponding to their positions in the machine.

5. Remove front cover and unhook the contact hook spring. Also remove the fillister head screw through the key guide plate lower, just in front of the 9 key. Replace this cover and tighten in place

to help hold the key assembly to the mechanism holder.

6. Remove two oval head screws through key guide plate upper near the front.

7. Remove two screws from the bottom of the base going up into the mechanism holder (loosen fuse cover for the rear one).

8. Remove from the top of the mechanism holder, the two long screws which hold it to the base.

The entire top unit can now be lifted up and to the left, leaving the die and stripper with the base. Care should be exercised that the contact hook is not damaged as it is pulled out of the base. Also, watch for shims, similar to small washers, on top of the dowel pins through the die and stripper. Sometimes these shims stick to the mechanism holder. Figure 22 shows this unit removed from the base. Note that in the inset the T lever has been shown in the position as it would be after an X has been punched. This would hold the skip lifter in a projected position. In the larger picture, it has been shown in the normal position.

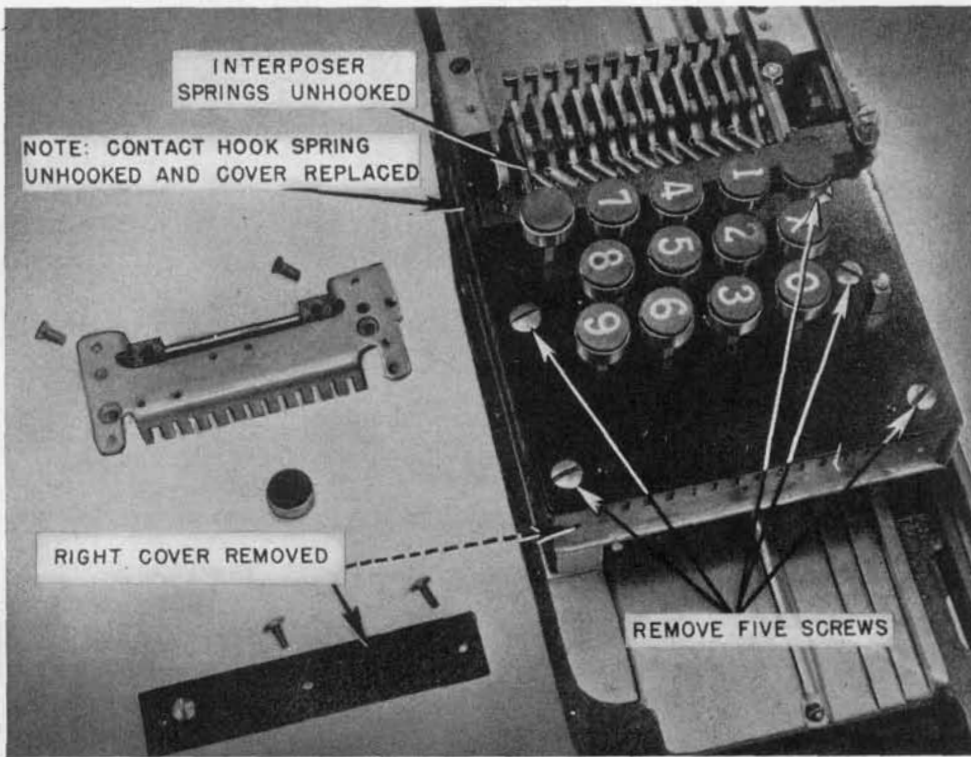


Figure 23

Procedure for Removing an Interposer - Figure 23

It is best to have the machine level before beginning disassembly of this unit, so that the spacers will remain in their original places and in an upright position.

Assuming that the machine is completely assembled, the following procedure may be used.

1. Remove three covers, one over the motor plate, one over interposer springs, and one at right end of key assembly. To facilitate removal of the latter, a threaded hole is provided near the front end; one of the holding screws removed may be screwed into it to force the plate free.

2. Unhook all interposer springs from the interposers, leaving them attached to the upper key guide plate.

3. Remove the cover from the front of the key assembly (2 screws) and unhook the contact hook spring; then replace this cover. Unhooking the spring releases the tension of the contact door

from the interposers, and tightening the front cover back in place prevents shifting of the interposer guide comb right.

4. Remove the motor plate and interposer guide comb.

5. Remove the top from the release key assembly by unscrewing it.

6. Remove the five screws from the top key guide plate.

7. Each key may now be removed individually by pushing its interposer to the right and lifting the key. As soon as each key is out, restore its interposer to the normal position to the left, so there will be no interference with interposer locks.

8. Lift up the top key guide plate to remove interposers.

A reverse procedure may be used for reassembly. Caution must be used in the proper placement of four spacers under the top key guide plate, particularly the small one through which the space key passes at the bottom.

ADJUSTMENTS

Main Spring - Figure 24

The main spring should have one and one-half turns' tension. When installing this spring, the card rack must be to the extreme left in position to punch a hole in the 80th column. Fasten the main spring assembly to the base with one screw, which will help hold it while the gear is given one and one-half turns' tension.

Mesh the gear with the rack teeth, using the screw as a pivot. Put in the other screw and tighten both. Use care so that the spring does not unwind with a snap.

Dog Carrier - Figure 24

Be sure the rack is free of binds. Adjust the dog carrier adjusting screw so that when the space key

is depressed and the dog releases the rack, there will be only the very slightest forward movement of the rack to the escapement. Check this at several places on the rack. Be sure that there is no backward movement at any place on the rack. The locking screw must be loosened before attempting to change the adjustment. Be certain also that the dog carrier is free to move on its mounting screw.

Skip Lifter Position - Figure 24

An adjustment is necessary to obtain the proper lateral position of the skip lifter in relation to a skip bar in the rack. Position the lifter so that upon reaching the end of a skip on a bar, the dog will be dropped to strike no farther than two-

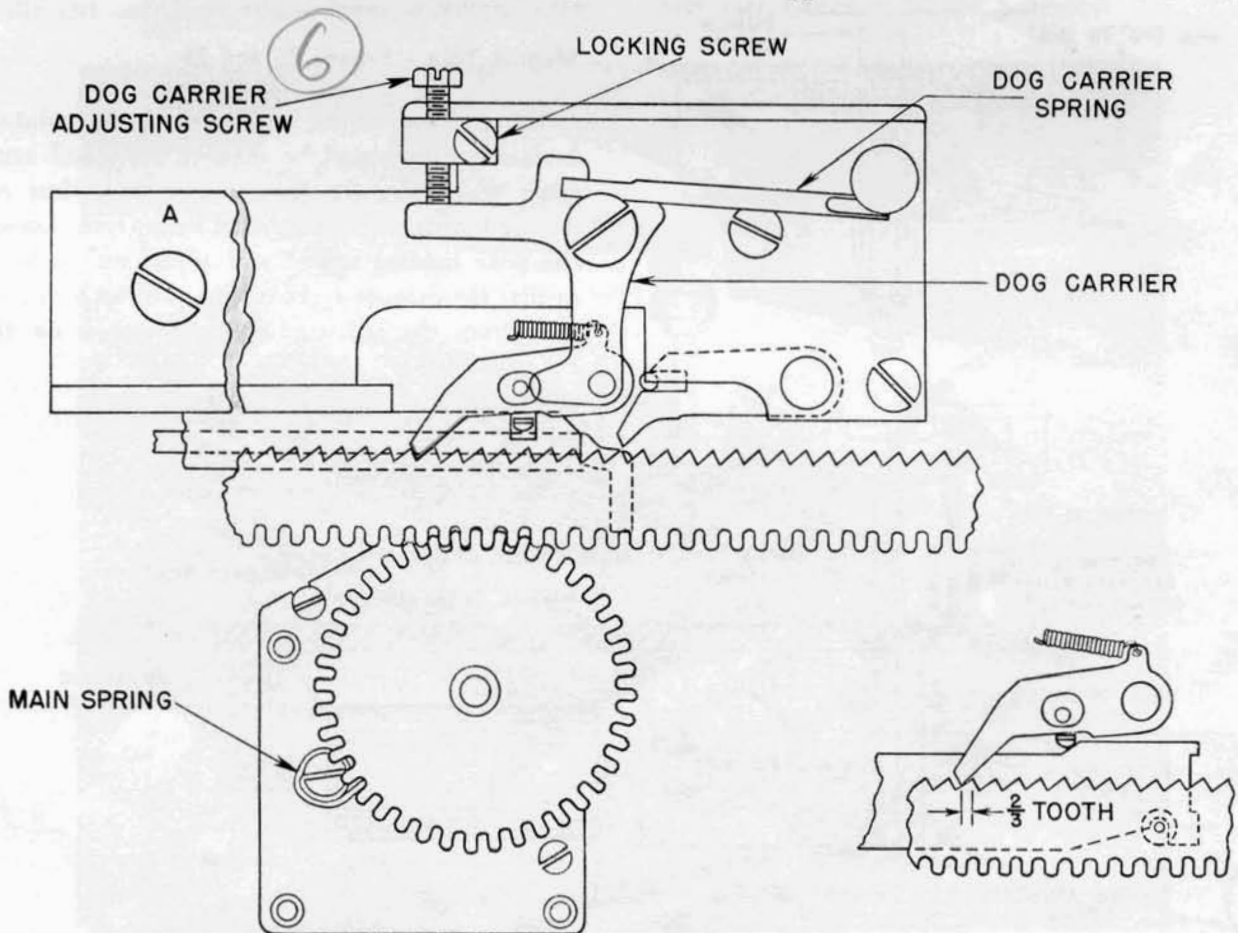


Figure 24

thirds of the way down on the tooth (inset, Figure 24). The skip lifter is supported in the release bar guide; therefore, to obtain the adjustment, it is necessary to shift the key assembly at the rear, because the release bar guide is supported by the key assembly. The screw in the rear end of the interposer guide comb, right (A, Figure 24), passes through an oversize hole in the rear cover. It is, therefore, possible to shift the key assembly slightly. The screw used in this position must have a large head with a flat underside, so the adjustment will not change when tightening the screw. Before adjusting the position of this unit, it is necessary to loosen the three screws holding the key assembly to the base at the front.

Toggle Link - Figure 25

The toggle link limits the forward movement of the armature. Its purpose is to permit the armature to travel only to a vertical position. Adjust it so that at the extreme forward movement, the armature is at right angles to the base. This is set with a square at the factory.

For field use, a measurement of $2 \frac{13}{32}$ inches from the web of the base casting to the nearest edge of the armature will produce approximately the right-angle condition. Note: Be certain that the magnet cores are not interfering with the movement of the armature. Also, check to see that the toggle link operates freely and that the adjusting screw is not twisted when the locking nuts are tightened.

Magnet Yoke - Figures 25 and 26

The purpose of this adjustment is to maintain a clearance between the magnet cores and armature when the armature is attracted, thus reducing both noise and residual magnetism. Loosen the yoke holding screws and adjust the bushings so that the magnet cores will be .010 inch to .012 inch from the armature *when power is on the*

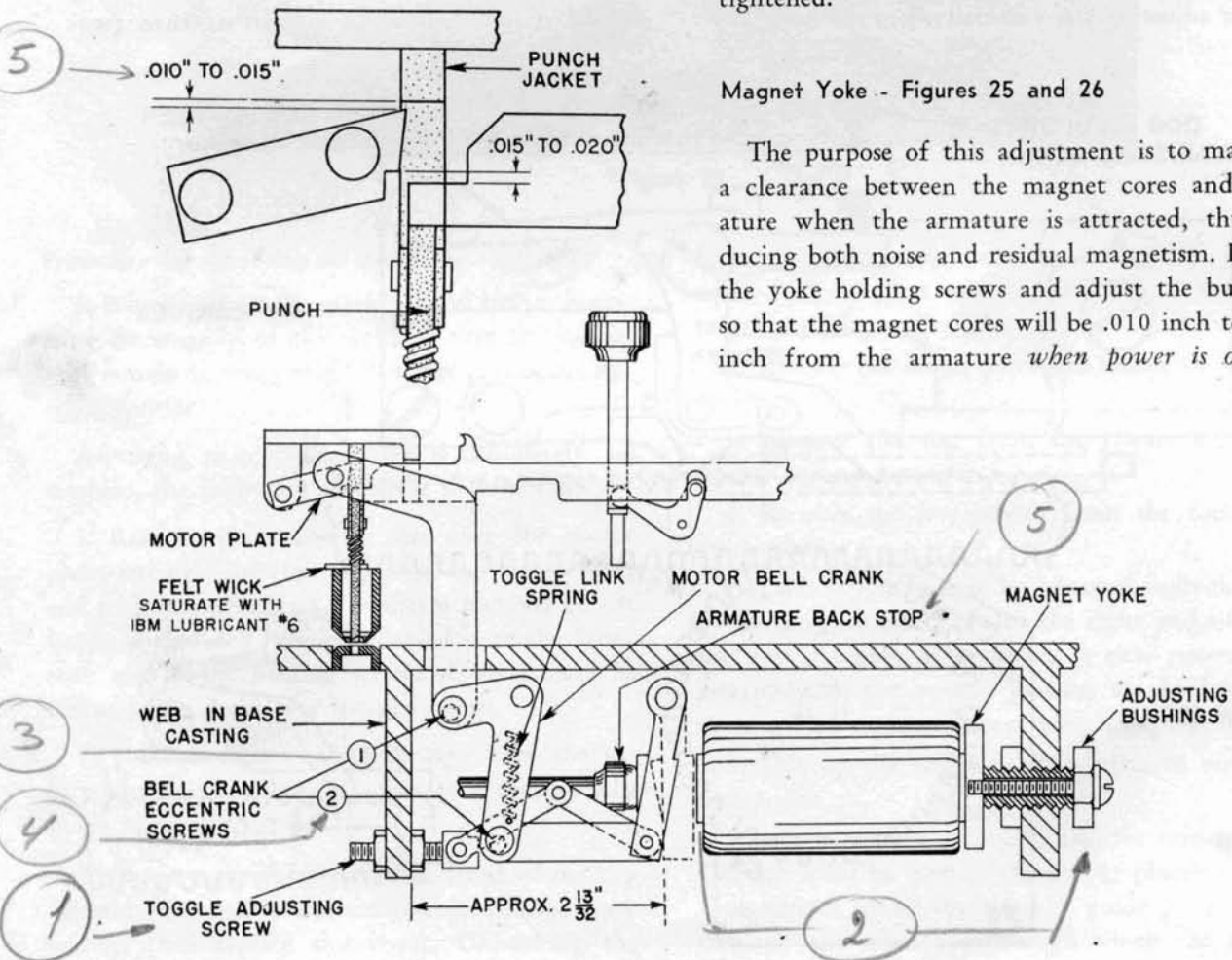


Figure 25

magnets. Two thicknesses of IBM cards will serve best as a gauge. There should be a heavy drag on the cards and it must be even on both magnets. Note: The punch magnet contact must be shorted to energize the magnets, and this can best be done by laying a small screw driver across the terminals of the condenser. Since the condenser and punch magnet contact are in parallel, the effect is the same as shorting directly at the contact.

Bell Crank Eccentric Screws - Figure 25

Two screws are provided to give a wide range when adjusting the position of motion of the motor plate. The motor plate should be pulled downward far enough to drive the heel of the punch .008 inch into the die when the armature is fully attracted. This insures that the punchings will be fully cut out. First adjust lower eccentric screw

(2), Figure 25, to a central position and tighten nut. Next, adjust upper eccentric screw (1) for an approximate .008 inch travel of punch into die. Then re-adjust lower eccentric (2) for the final accurate .008 inch adjustment. This lower eccentric may then be used at later times, if it becomes necessary to make minor adjustments because of wear.

Armature Back Stop - Figure 25

This is adjusted to obtain .010 inch to .015 inch clearance between the punch jacket and the motor plate, when the motor plate is in its upper position (insert, Figure 25). This should automatically produce a clearance of .015 inch to .020 inch between the lower edge of the motor plate and the interposer. Check at 12 and 9 punches.

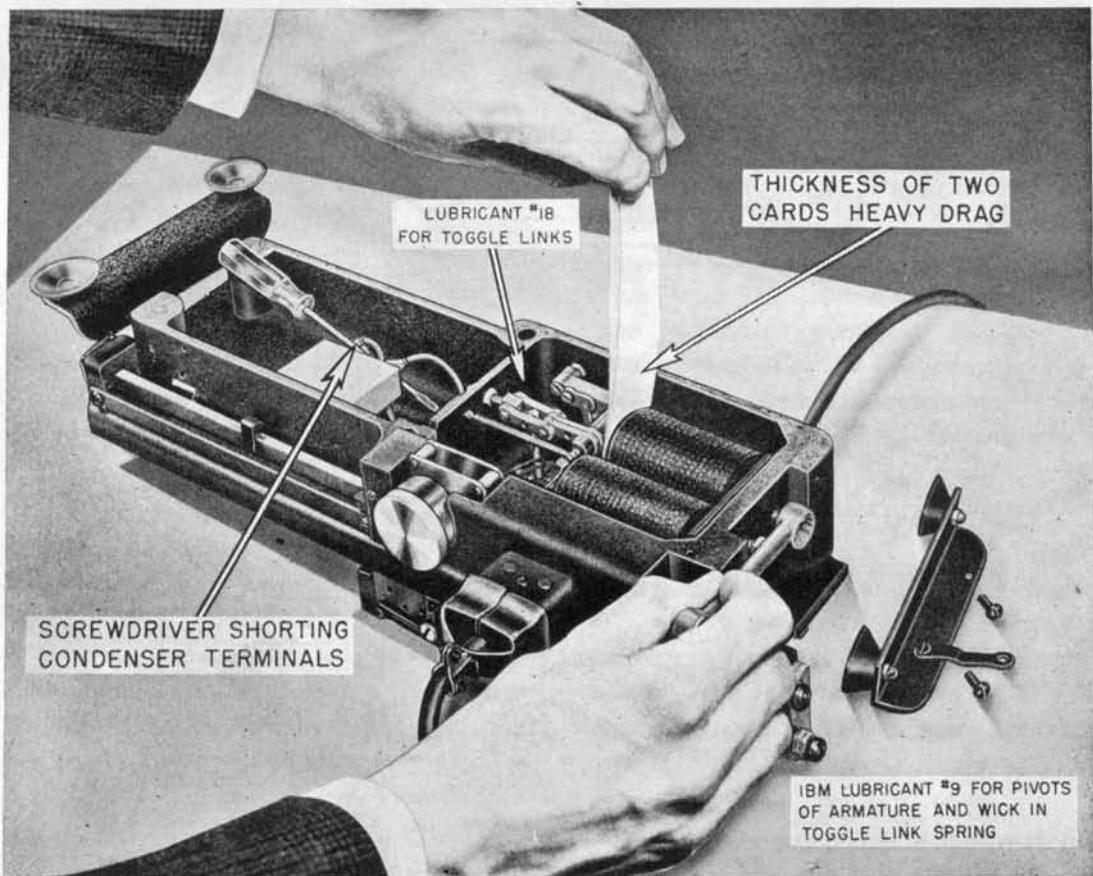


Figure 26

Punch Magnet Contact - Figure 27

The straps of the punch magnet contact must have sufficient tension against their supports to prevent fluttering or double shuffle. At the same time, the tension must be light enough, especially on the lower strap, so that the touch is not too heavy. Adjust the brass support of the upper strap by bending so that the contacts will close $1/64$ inch before an interposer reaches its limit of travel to the left. This will automatically produce an overlap of $1/32$ inch between motor plate and interposer, when contact is made (insert, Figure 27).

The air gap at the punch magnet contact should be $.012$ inch to $.015$ inch. This is obtained by bending the lower support. A hole in the front casting, just below the space key, aids in making

this adjustment (Figure 1). After final adjustment, check for "slipping by." By this is meant the failure of the contact hook to engage the punch magnet contact on the second of two successive and rapid key depressions. If this condition occurs, it very probably indicates that the lower support of the contact must be bent upward slightly.

Circuit Breaker - Figure 27

The purpose of the circuit breaker is to open the punch magnet contact each time after a punch has been driven through the card. To adjust, loosen the holding screw and shift the circuit breaker so that the contact hook is tripped off just before the armature reaches its limit of travel.

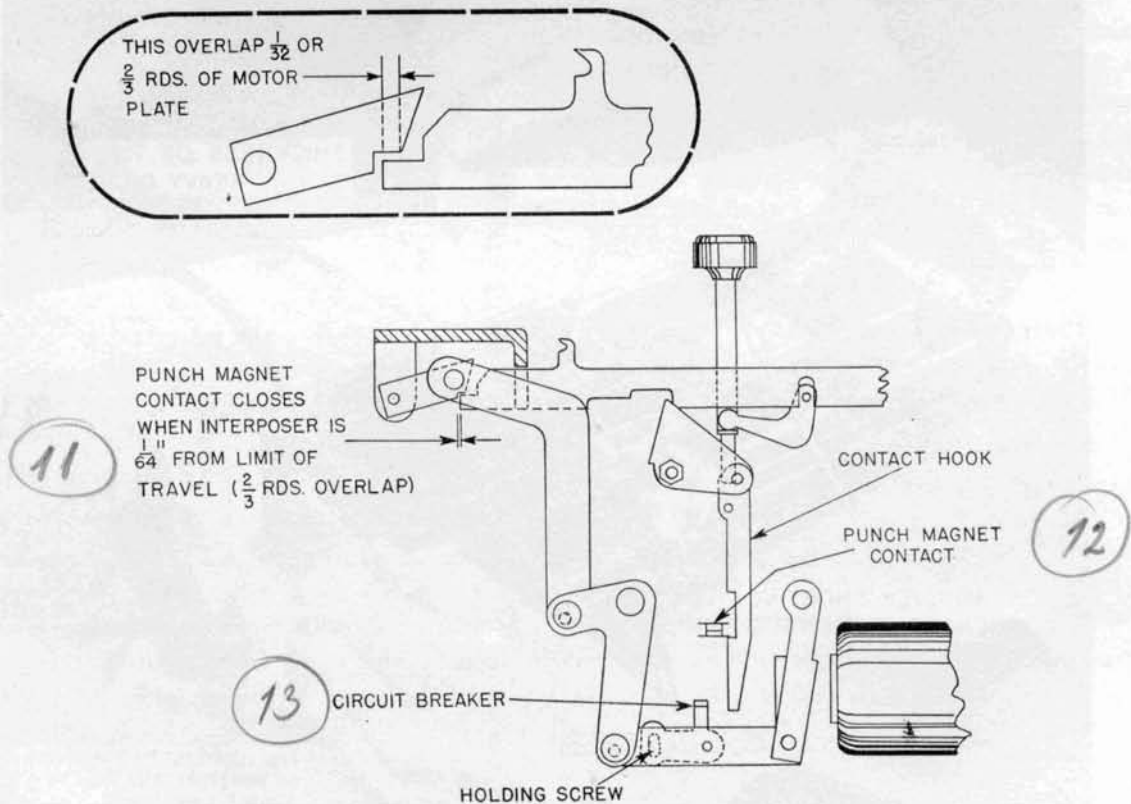


Figure 27

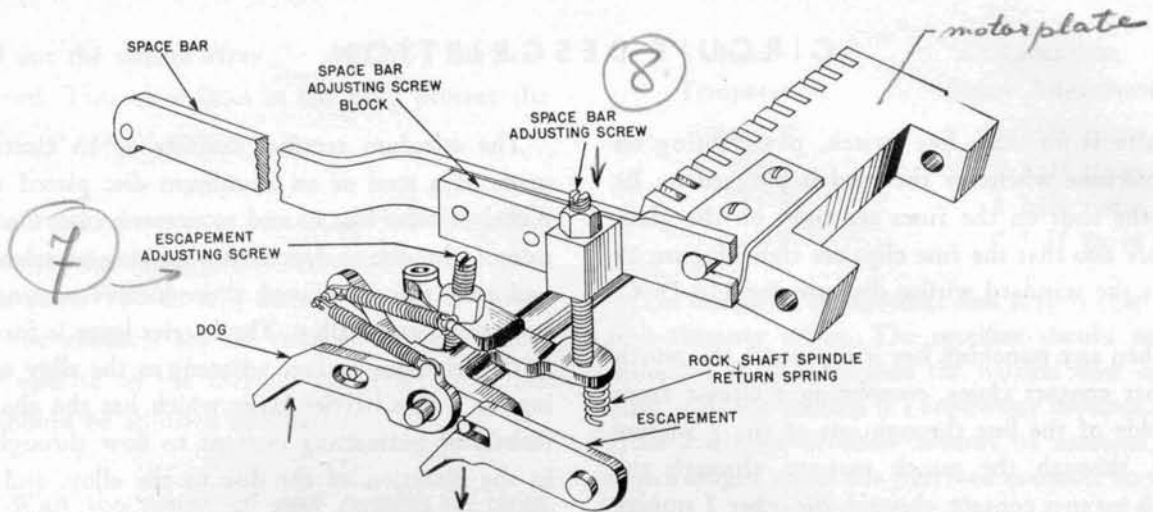


Figure 28

Escapement - Figure 28

This adjusting screw governs the clearance between the escapement and the rack with the motor plate up. Check by depressing release key and moving rack back and forth. The clearance should be not more than $1/64$ inch with rack in normal position. Also, check by raising rack just enough to remove up and down play. Escapement should not drag on rack teeth.

Space Bar Adjusting Screw Block - Figure 28

This block is adjustable laterally on the space bar by means of two holding screws, and governs the amount and timing of the movement imparted to the rock shaft spindle assembly by the space bar. It should be adjusted so that the escapement releases the rack tooth when the toe of the punch has just disappeared into the stripper.

Space Bar Adjusting Screw - Figure 28

This screw governs the amount of lift imparted to the rock shaft spindle assembly and, consequently, to the dog. It should be adjusted so that the dog rises $1/64$ inch to $1/32$ inch above the rack teeth when the armature is pulled up to its maximum limit toward the cores. Note: Re-check the adjustment just made on the adjusting screw block. These two adjustments may have to be made together.

Space Bell Crank

The space key should raise the dog $1/64$ inch to $3/64$ inch above the rack teeth. This is adjusted

by shifting the collar which engages the space key bell crank (Figure 17) on the front end of the rock shaft spindle.

Card Punching Registration

The purpose of this adjustment is to make sure that holes will be punched in proper lateral registration so that they will be accurately sensed in subsequent machine operations. Adjust the position of the card in the rack by positioning the card adjusting plate, right (Figure 17). In order that the card will be carried snugly and without buckling, it may also be necessary to insert or remove shims from the card feeder assembly, left. Use card registration gauge for checking. The card should be placed on the gauge face up and with the 80th column end against the end guide of the gauge. The holes should line up with the markings on the gauge. Be sure dog carrier adjustments are correct before making registration adjustments.

Rack Stop, Left - Figure 1

Loosen locking nut and adjust screw so that it just touches rack, when rack is in position to punch a hole in the 80th column. Be sure that 80th column hole is in correct registration, but that rack can move no farther after punching in this column.

Rack Stop, Right - Figure 1

Set rack in position to punch a hole in column 1. Loosen locking nut and adjust screw for $.020$ inch to $.025$ inch clearance to end of rack.

CIRCUIT DESCRIPTION

There is no main line switch, power being on the machine whenever the cord is plugged in. Be sure the ends on the fuses are tight on the glass. Be sure also that the fuse clips are tight. Figure 29 shows the standard wiring diagram for 110 D. C.

When any punching key is depressed, the punch magnet contact closes, completing a circuit from one side of the line through one of the 2 ampere fuses, through the punch magnet, through the punch magnet contact, through the other 2 ampere fuse, and out the opposite side of the line. This energizes the punch magnet, drawing the armature toward the cores. Just before it reaches the cores, the circuit breaker knocks the contact hook away, causing the contact to open; thus, the magnet is de-energized and the armature returns to normal. When this circuit is broken at the contact, an arc occurs. The condenser, or capacitor, wired in parallel with the contact, prevents this arc from being destructive since it is able to absorb the arc, discharging the condenser when the contact is next closed.

Selenium Rectifier - Figure 30

Figure 1 shows a machine equipped with a rectifier for operation of the machine on A. C., the rectifier permitting only D. C. to reach the punch.

The selenium rectifier consists of an electrode made of a steel or an aluminum disc plated with nickel or otherwise coated to prevent rust. On one side of the disc is deposited a coating of selenium and over this is sprayed a conductive coating of low temperature alloy. The barrier layer is formed at the selenium surface adjacent to the alloy coating. It is this barrier layer which has the characteristic of permitting current to flow through it, in the direction of the disc to the alloy, and yet prevents the flow of current in the reverse direction. More technically speaking, the resistance of the rectifying element is low in the forward direction (plate to alloy) but high in the reverse direction. When such a device is connected in an A. C. circuit, it permits current to flow in only one direction even though the A. C. reverses each half cycle.

The filter capacitor is used to smooth out the D. C. since the output at the rectifier terminals is a pulsating D. C. The capacitor charges to the peak value on the half cycle when current flows. On the half cycle, when the A. C. is reversed, it discharges its stored electrical energy and thus maintains a reasonably steady flow of D. C. by filling in the gaps between the peaks.

The bleeder resistor of 15,000 ohm value is connected across the terminals of the capacitor to

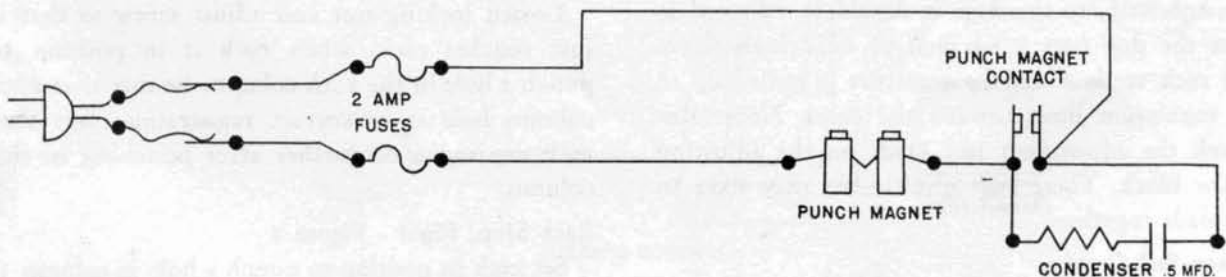


Figure 29

bleed out the charge after the wall plug has been removed. Two glass fuses in the plug protect the rectifier in case of shorts.

The overload contacts protect the selenium unit against excessive heat caused by overload. Temperatures above 75° C. will damage the unit; therefore, the contacts are set to open at this point. They operate on the thermal (bimetal) principle and should be adjusted as follows:

Room Temperature	Clockwise Screw Adjustment
65° F	10 half turns
75° F	9 half turns
85° F	8 half turns
95° F	7 half turns

The design of the rectifier case is such that there is a chimney effect. The rectifier should not be mounted so as to impede the natural flow of air. Also, it is best to keep it a reasonable distance away from radiators or other sources of external heat which might cause the overload contacts to open.

Punches equipped with rectifiers (for 110 volts A. C. only) can also be operated on D. C. However, there is some voltage loss in the rectifier and a deforming of the barrier coating may occur so that it may fail when subsequently connected to A. C. Operation on D. C. is not recommended except for occasional short intervals.

For more complete information and servicing data, refer to EAM Manual Section entitled "Selenium Rectifiers for IBM Equipment."

1. With the power off and rectifier at room temperature, adjust the contacts to just touch. Check the adjustment with lock-nut tight by tapping case to note a slight vibration of the contacts.
2. Note position of adjusting screw. Determine room temperature and increase tension by use of adjusting screw, according to the following chart.

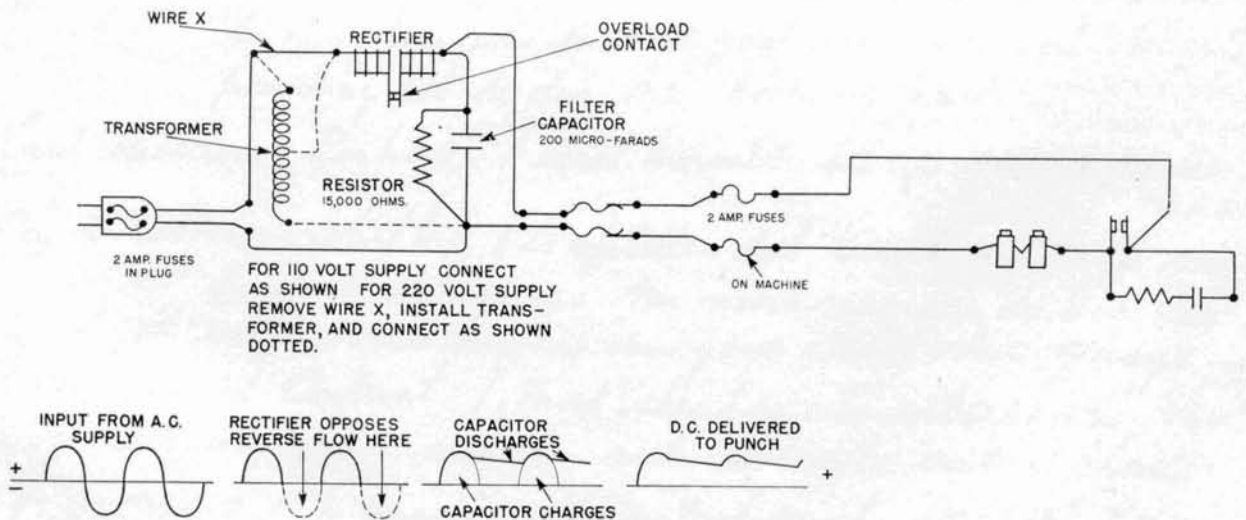


Figure 30

LUBRICATION PROCEDURE

Refer to Figures 17, 21, 25 and 26, as well as the following, for proper oiling and greasing of machine.

Apply only enough oil to lubricate the parts desired. Remember that excessive oil will spread to other parts of the mechanism where it may be the cause of improper operation. Parts to be lubricated should be clean before the oil is applied, otherwise its lubricating capacity will be diminished.

Lubrication for the Type 011 punch is recommended as follows:

Felt wick above die	IBM Lubricant # 6
Toggle link pivot points	IBM Lubricant # 18
Toggle link spring wick	IBM Lubricant # 9
Rack rollers	IBM Lubricant # 6
Rock shaft spindle	IBM Lubricant # 6
Motor plate and linkage pivots	IBM Lubricant # 9
Armature pivots	IBM Lubricant # 9
Punches	IBM Lubricant # 6

In addition to the points indicated above, the punches may be lubricated by punching through an oiled card. Put IBM Lubricant #6 on a card from top to bottom and covering five to ten columns. Then insert the card in the rack and operate each punch through the oiled portion several times. The space key may be held down while all punching keys are operated once, then released to space one column and repeat.

If the machine uses a long dog, care must be used that oil is kept off the rack teeth, dog, and escapement. These parts operate most satisfactorily when clean and free from oil. The long dog can be identified by the span of eleven teeth between the dog and escapement, as indicated in Figure 16.

If a short dog is in use in the machine, it is not necessary to keep the rack teeth free of oil. In fact, it is advisable to apply a small amount of IBM Lubricant #6 to the rack teeth to minimize wear. The short dog allows a span of only ten teeth between the dog and escapement.

March 1962 IBM 011 Adjustments for Punch Dept.

- 1 - Armature right-angle on the base. To 2-13/32". Figure 25.
- 2 - Magnet Yoke. Adjusting Bushings at the end of the housing See Figures 25 and 26. 2 cards heavy drag, 1 card loose.
- 3 - Bell Cranck Adj Screw 1. Attract armature See Fig.26 and with 10 Cards between armature and punch magnet, punches should just thatching punched card in the card bed.
- 4 - Bell Cranck Adj Screw 2. Attract armature See Fig.26 and with 4 Cards between armature and punch magnet punches should just go throug the card. See also figure 25.
- 5 - Armature Back Stop. See Figure 25. Adjust for a clearance of .010" to .015" inch between motor plate and punch jacket with not energized magnets.

March 1962 IBM 011 Adjustm. for Spacing and on gauge punching.

- 6 - Dog Carrier Adj. Screw. See Fig.24 Adjust so that the rack only very slightly moves with changing dog and escapement.
- 7 - Escapement Adjustm. Screw. See Fig.28. Adjust so that when Carriage is in the very left position and by lifting up the carr. the escapement should just clear the tooth of the rack.
- 8 - Space bar Adj. Screw. See Fig.28 and 16. Dog lifting pin in the middle of the hole. Adj. is OK if with attracted magnets the dog is 1/32" inch above the rack.
- 9 - Card Retainer Right. Adjust so that punching is on gauge.
- 10 - Card Retainer Left. Adjust so that card just snug lies between retainers. (Do not readjust the Dog Carrier adjustment screw anymore otherwise the card is off gauge punched).
- 11 - Punch Magnet Contact. See Fig.27. Contact has to close as interposer 5/64" has moved. Adjust upper contact blade.
- 12 - Air Gap. Contact opening must be .010" to .012" Inch. Adjust with lower contact blade. Do not adjust the gap to small otherwise dubbel punching will occur.
- 13 - Circuit Breaker. See Fig.27. With punch magnet attracted must open just before the armature reaches its travel limit.
- 14 - Use two fingers on different key's repeatedly after each other to check of contact hook everytime travels under punch magnet contact.