

## HORIZONTAL SORTER

### GENERAL

The punched cards are fed into this machine horizontally from a magazine and are electrically arranged into any desired relationship. There are thirteen pockets in the machine, twelve of which are for the corresponding position in each column of the card.

Any desired cards may be automatically selected from a group and placed in their corresponding pockets, while the remaining cards will be placed in the "R" pocket without disturbing their original relationship.

### SPEED

This machine is designed to operate at a speed of 360 to 400 cards per minute, and must not under any circumstances be operated in excess of 400 cards per minute.

### CAPACITY

Each card pocket holds approximately 800 cards. However it is well not to allow more cards to accumulate in any pocket than can be conveniently removed with one hand. The feeding magazine has a card capacity of approximately 900 cards and it can be fed continuously.

### CURRENT REQUIREMENTS

This machine has a maximum starting current of 6.5 amperes and a maximum running current of 2.0 amperes.

### OPERATION

To set the brush in position for sorting any given column on the card, revolve the operating handle until the pointer is opposite the number corresponding to the column on which the cards are to be sorted. Next place the punched cards face down in the magazine (printed side down) with the top edge toward the card knives and put the pressure weight on. If it is desired to sort all positions on the card from 9 to 12 inclusive (regular sorting) all the commutator switches must be as shown in Fig. 1. Should it be desired to sort or select any one or more numerals in a given column it will be necessary to pull down all commutator switches EXCEPT those corresponding to the positions to be selected. Fig. 2 illustrates the commutator with the switches arranged to select 6-3-0 positions, which will be sorted into their corresponding pockets, the remaining cards sorting into the "R" pocket in their original sequence.

### PRINCIPLE OF HORIZONTAL SORTING (See Figs. 3 and 4)

The principle upon which this machine operates is as follows: Cards are fed horizontally from a magazine and pass directly under the card brush A and

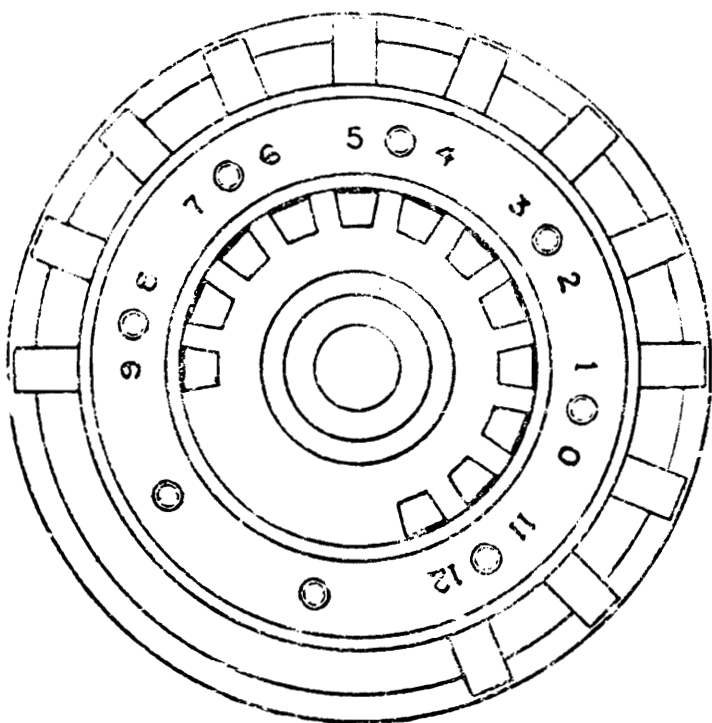


Fig. 1

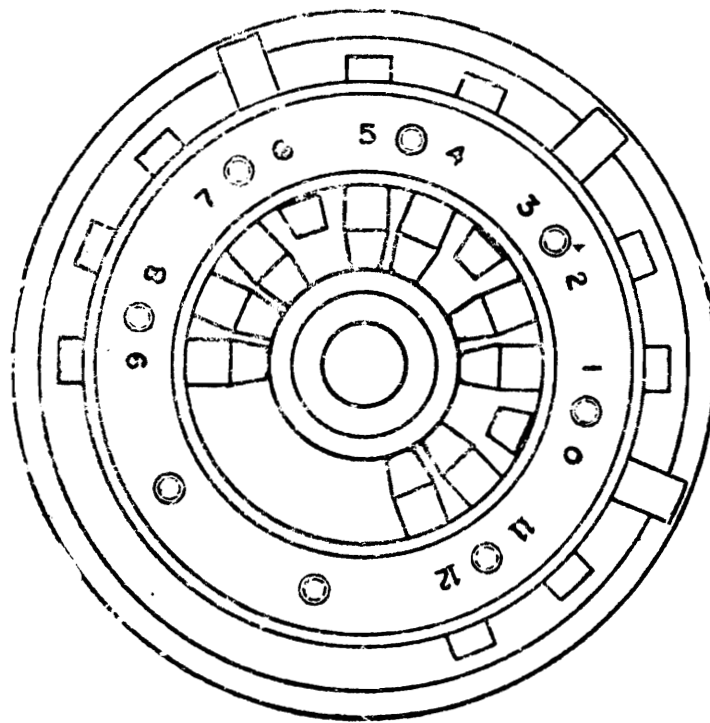


Fig. 2

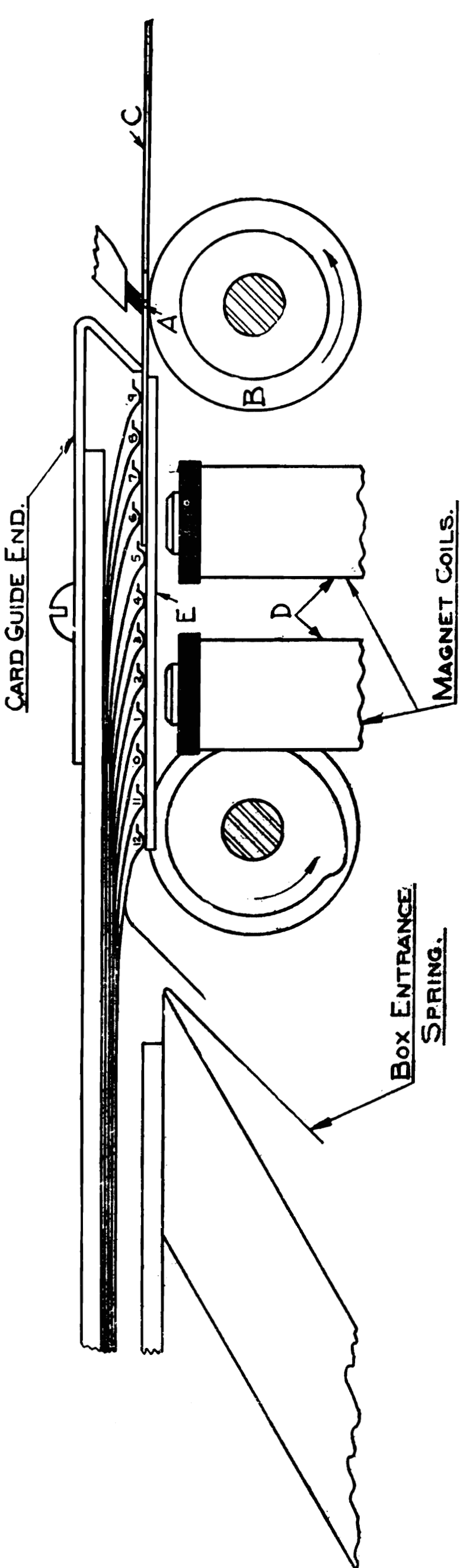


Fig. 3

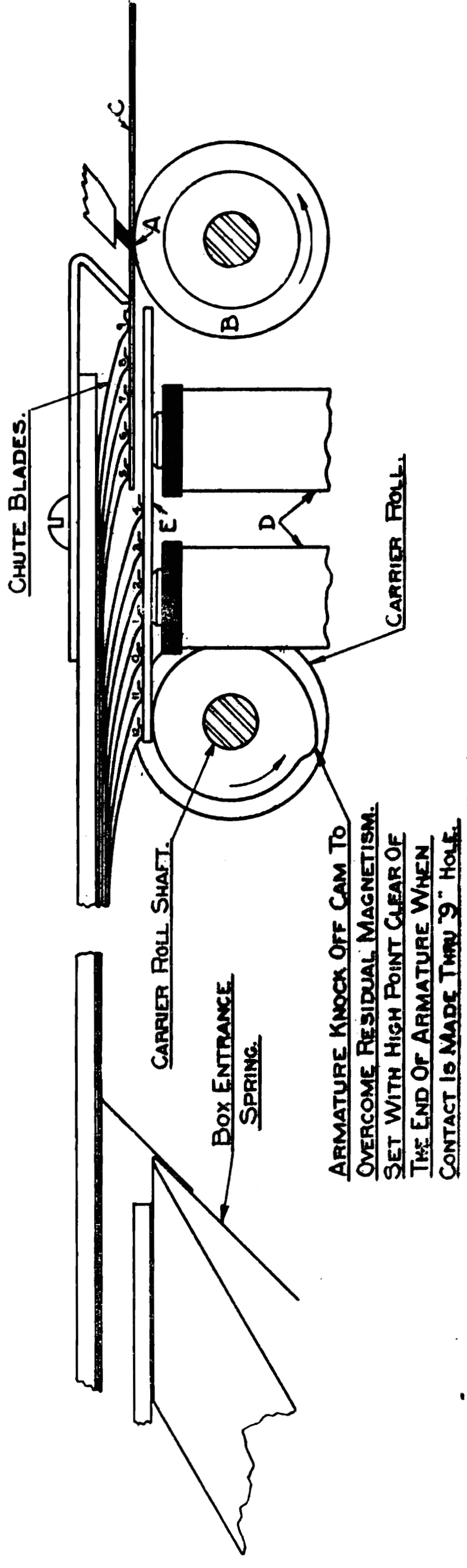


Fig. 4

ARMATURE KNOCK OFF CAM TO  
 OVERCOME RESIDUAL MAGNETISM.  
 SET WITH HIGH POINT CLEAR OF  
 THE END OF ARMATURE WHEN  
 CONTACT IS MADE THRU 9" HOLE.

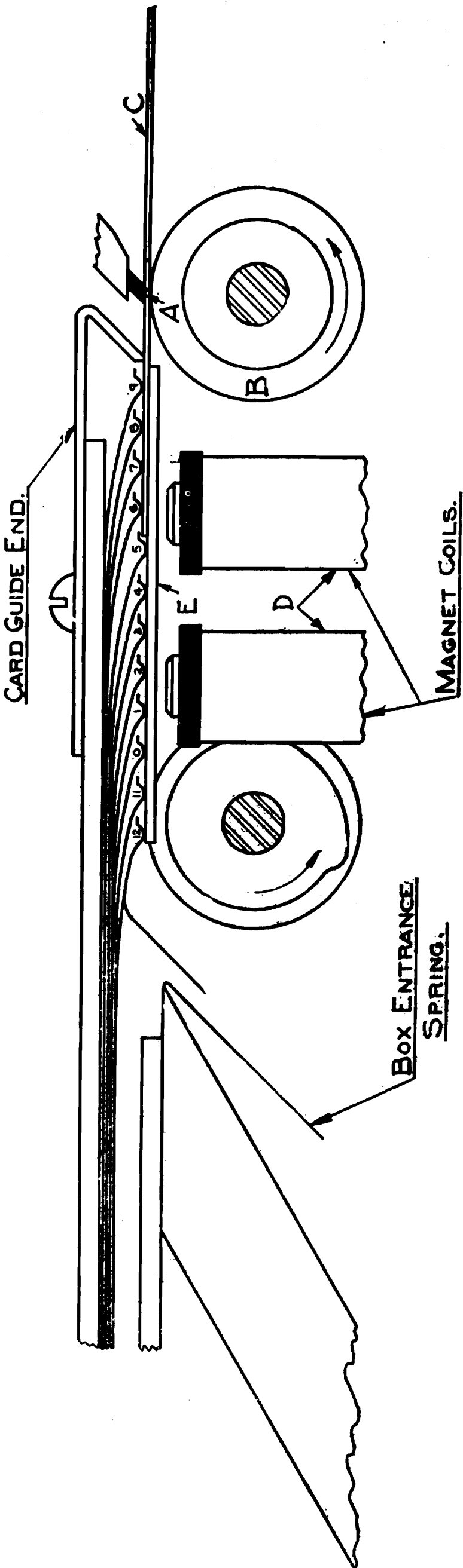


Fig. 3

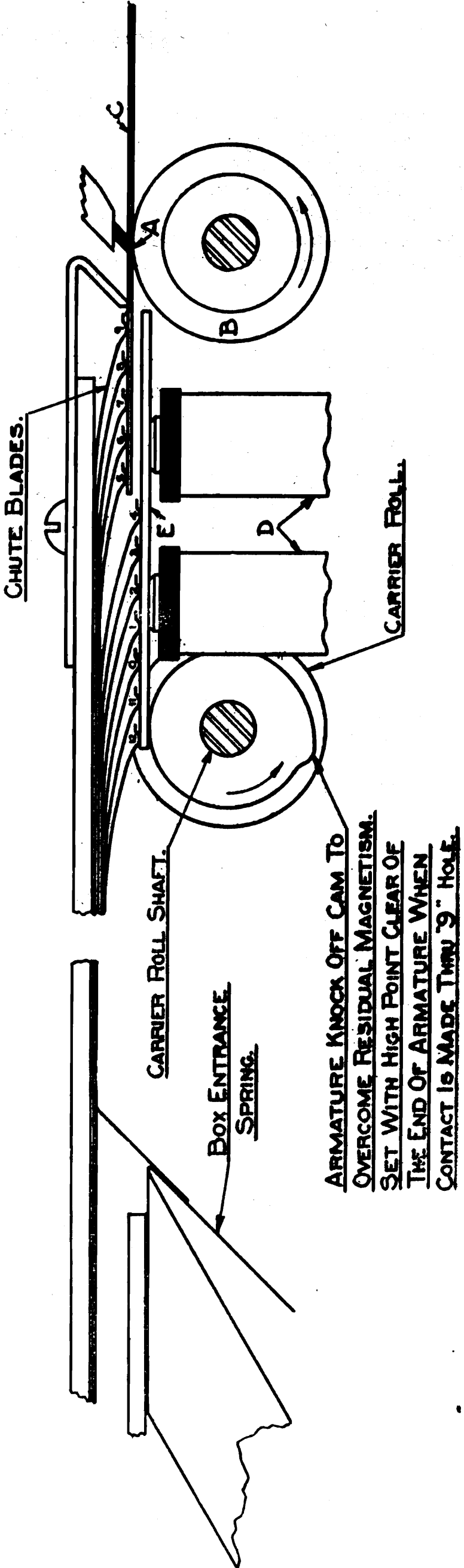


Fig. 4

ARMATURE KNOCK OFF CAM TO  
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SET WITH HIGH POINT CLEAR OF  
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over the brass roll B. Assuming that the card C is punched "4" it will have traveled under the 9, 8, 7, 6 and 5 chute blades as shown in Fig. 3. The brush makes contact completing the selecting circuit. The sorting magnet D thus becomes energized attracting the armature E, and the 4, 3, 2, 1, 0, 11 and 12 chute blades follow down with the armature E thus creating an opening between the 5 and 4 chute blades (See fig. 4), through which the card is conveyed by carrier rolls to its respective pocket. If a blank or unpunched card is fed into the machine the brush A fails to make contact with the brass roll B; therefore the sorting magnet D does not receive an impulse and the armature E will not pull down. Consequently, the card is carried into the "R" pocket.

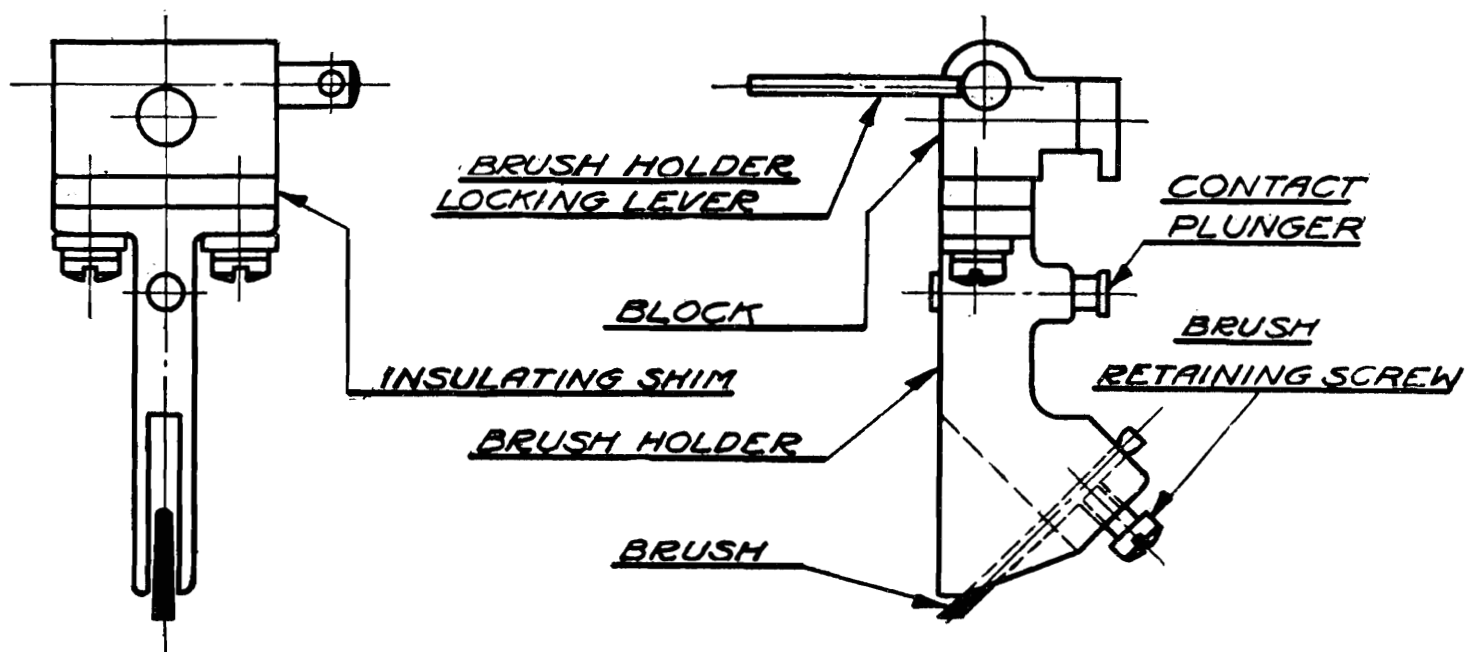


Fig. 5

### THE CARD BRUSH

To insert a new card brush, raise the operating handle one-half turn until it is directly opposite its normal position.

This has raised the brush holder from the brass contact roll. The brush holder locking lever (See fig. 5) can now be raised to the position shown and the brush holder assembly removed. Next loosen the brush retaining screw and pull out the defective card brush.

When a new brush is inserted it must be timed in the following manner: Feed a card punched "8" by hand until the card brush makes contact through the punched hole. When contact is made the end of the 9 chute blade should overlap the card  $1/64$ " to  $1/32$ " maximum (See "A", fig. 6). There must not be less than  $1/64$ " overlap of the chute blade on the card when turning the machine by hand. With the card brush in this position the commutator should be set so that its inner brush is making full contact on the 8 segment. (See "B", fig. 6). When replacing the brush holder assembly follow the above instructions in the reverse order. Do not lower the handle and allow the brush to touch the brass roll until the brush holder is clamped in place.

### THE COMMUTATOR

The commutator controls the circuit through the sorting magnet. It has three brushes known as inner, center and outer. These brushes should be adjusted so that they project out of the holder  $3/16$ ". They must be carefully set so that all three will be in line with each other.

To check the timing of the commutator brushes as well as the card brush proceed as follows: Feed a card punched "8" by hand until the brush makes contact through the punched hole. When contact is made the end of the 9 chute blade should overlap the card  $1/64$ " to  $1/32$ " maximum (See "A" fig. 6). There must not be less than  $1/64$ " overlap of the chute blade on the card when turning the machine by hand. With the card brush in this position the commutator should be set so that its inner brush is making full contact on the 8 segment as shown at "B" fig. 6. The center and outer brushes have only to be set for the proper projection as described above. The commutator is fastened to its shaft with two set screws.



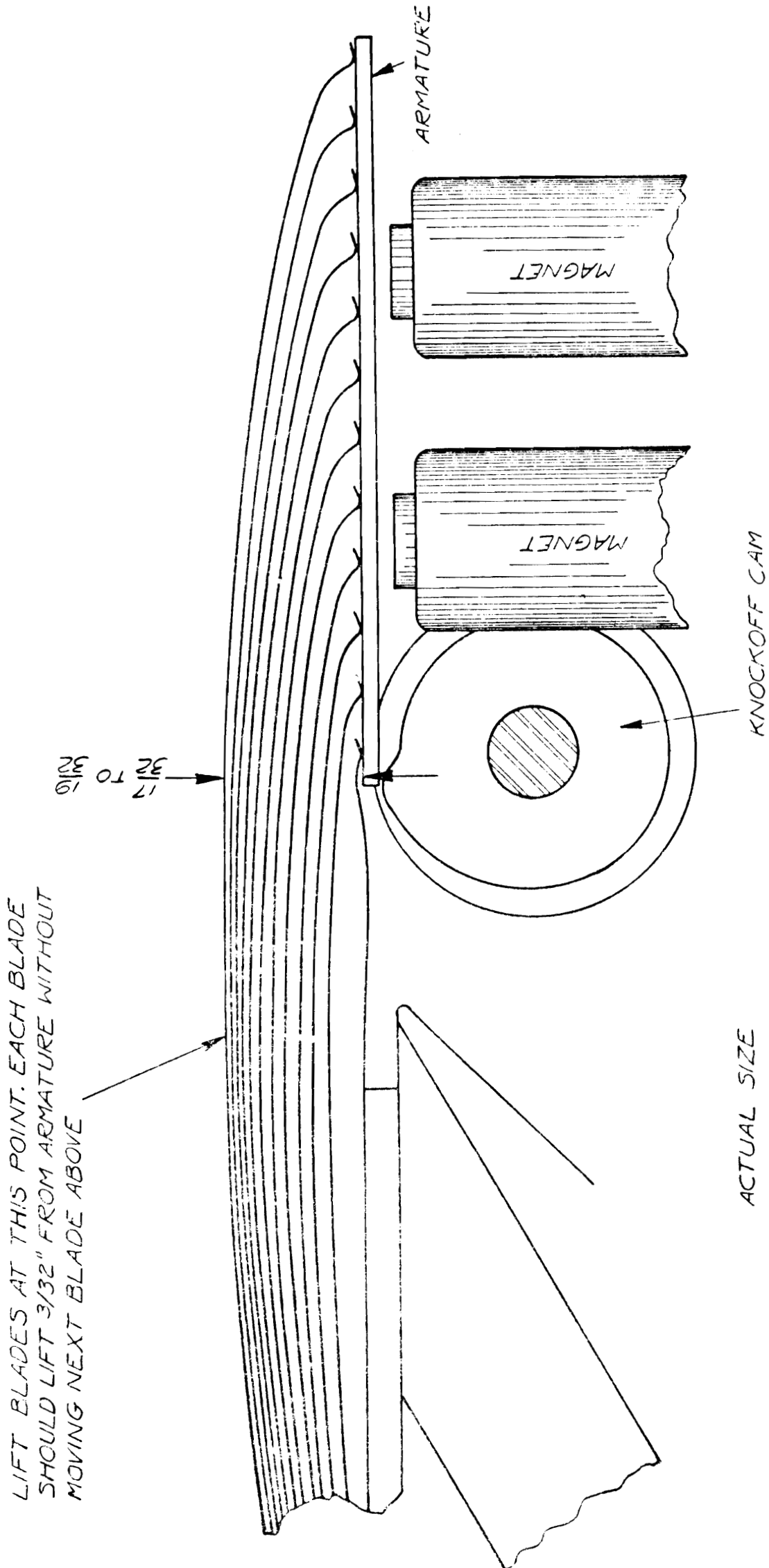


Fig. 7



### CHUTE BLADE ADJUSTMENTS (See Fig. 6)

It is very important that the chute blades be properly adjusted laterally in relation to the right hand end casting. The end of the 9 chute blade should be 2-13/16" from the right hand end casting (See fig. 6) with the card guide in place. The distance from the end of one blade to the next should be 1/4". In other words, the 9 chute blade should be 2-13/16" as shown and the distance from the right hand end casting for each chute blade should increase by exactly 1/4". This adjustment is set when the machine is assembled but in case a chute blade has to be replaced it must be adjusted as described above. A gauge is provided for making these adjustments.

By referring to fig. 6, you will observe the shape of the ends of the chute blades. A tool is provided for bending the ends of the blades. The extreme end of the chute blades should be from .012" to .018" above the top of the armature as shown. The .012" gauge should pass under all chute blades without striking the ends, but the .018" gauge should not pass under. When the chute blades are adjusted according to these two gauges, the ends of the blades will not be less than .012" nor more than .018" above the top of the armature.

It is imperative that the chute blades be properly shaped to give correct tension and freedom of movement. The blades should be so shaped that they will lay in position without touching the blades above or below, with a clearance of 1/32" to 3/64" as shown in fig. 7.

After all chute blades have been shaped as illustrated in fig. 7, the entire set should be lifted at a point central above the "R" box beginning with the "12" blade. It is well to use a long, thin screwdriver or similar tool with which to lift the chute blades, raising all blades by lifting the "12" blade. As each blade is lifted, it should move upward about 3/32" without raising the blade above it. When all blades are properly adjusted, the distance from the top of the card guide plate (at a point near the "12" blade) to the top of the "9" chute blade should be from 17/32" to 19/32" as shown in fig. 7.

The card guide end (refer to "C") should be set so that there is a clearance of .008" between it and the card line plate. There should also be a clearance of 1/64" between the card guide end and the "9" chute blade.

When installing new chute blades and making the lateral adjustment care should be taken to see that formed lip on rear end of blade does not interfere with action of brass card deflector spring. It may be necessary to bend this part of the blade to accomplish above.

### MAGNET UNIT ADJUSTMENTS

This unit must be very carefully and accurately adjusted as follows:

1. The magnet armature should have from .040" to .045" travel and when its residuals are touching the front cores, there should be an air gap of .005" between the armatures and the cores nearest the pivot point. These adjustments are obtained by shimming between the magnet yoke and housing on the earlier type machines and by four magnet yoke adjusting screws on the later type machines. The adjustments should be checked by putting current on the magnet, using the regular serviceman's test outfit with a 40 or 50 watt bulb in place of the one furnished with the outfit. The armature stop studs may have to be filed slightly so that both studs will be touching the armature when there is no current on the magnet.

2. When the armature is in its normal position (the magnet de-energized) its surface where the chute blades rest must be flush with the card guide plates at the end nearest the feeding mechanism and about .005" below the surface of the card guide plates at the end nearest the knockoff cam.

3. The armature stop rod must be adjusted after the magnet unit is assembled in the machine. The purpose of the stop rod is to cushion the armature when it is attracted to the cores, thus reducing the noise. The stop must be adjusted up as high as possible in order that the noise while operating will be minimum but there must still be sufficient travel of the armature (.040" to .045" with the current on the magnet) to insure proper sorting. If this armature stop rod is adjusted up too high, the machine may sort "low" or tear the cards.

4. The armature pull spring must be adjusted after the unit is assembled in the machine. Put sufficient tension on this spring to just pull the armature

to the stop studs on the card guide plate when the magnet is de-energized, then give the adjusting screw an additional three-quarters of a turn and set the check nut. If the tension on this spring is too great, the machine will sort "low" when selecting, on the contrary, if the tension is too weak, the machine may sort "high" or all cards go into the "9" pocket.

5. The armature knockoff cam (D, fig. 10) is to overcome residual magnetism. It is pinned on the shaft in such a position that its high point will be just past the end of the armature when the brush makes contact through a "9" hole.

#### REMOVAL OF MAGNET UNIT

To remove the magnet unit assembly proceed as follows:

Remove the card feed mechanism cover.

Disconnect wires leading to the sorting magnet and brass contact roll feed brush.

Remove card guide plates (Fig. 8).

Unhook the armature pull spring and remove the armature.

Remove taper dowel pins from magnet housing by turning in on the 10-32 nuts. Turning in on the nut loosens or draws the taper dowel slightly so that it can easily be pulled out.

Loosen the lower card guides.

Remove the 5/16" cap screw which holds the filler blocks and magnet housing and at the same time hold the magnet housing assembly with the left hand. The magnet unit can now be removed for inspection or repair.

When replacing the magnet unit assembly care should be taken to see that it is properly lined up. Place a steel scale or straight edge across the lower card guides, contact roll and card guide plates which should all be in perfect alignment and known as the card line.

#### THE THROAT AND CARD KNIVES (See fig. 9)

The throat block and throat knife should be so adjusted that an .008" and not a .010" thickness gauge will pass thru the opening three ways as shown in fig. 9. To obtain this adjustment proceed as follows: Raise the throat knife slightly and move the throat block until its high point is directly in line with outside surface of the throat knife, move knife down until the .008" and not the .010" thickness gauge will go thru the opening horizontally. Then set the throat knife adjusting screws. If the throat knife and throat block have been properly set, the .008" and not the .010" thickness gauge will pass thru the opening, (1) horizontally, (2) at an angle of about 30 degrees, and (3) should follow thru when held down on the radius of the throat block.

The card feed knives are adjustable and should be set evenly on each side for a projection of .004" to .0045". A gauge is provided with two notches in it at opposite ends, one notch marked "GO" is cut .0045" deep and the opposite end marked "No Go" is cut .004" deep. When adjusting the card knives it is necessary to first remove the card magazine guides and then loosen the clamping screws that hold the knife in place and turn either in or out on the adjusting screws as the case may be to raise or lower the feed knife (See fig. 9). If the knife is properly adjusted the "Go" end of the gauge will pass over the feed knife on either side, and the "No Go" end will not pass over the projection. The knife must project evenly all the way across and it is obvious that both knives must be adjusted alike.

#### INDEX HEAD AND FEEDING MECHANISM (Fig. 10)

If necessary to remove the first upper feed roll the entire index head mechanism must be removed as follows:

Remove the card brush as outlined under "The Card Brush."

Remove straight dowel pins E, one on each side of the mechanism.

Remove taper dowel pins by turning in on the 10-32 nut G. This draws or loosens the taper dowel pin which can then be easily removed.

Remove both front card guides (See fig. 9).

Disconnect the wire that feeds the brush holder contact rail.

Lift front feed roll slightly and insert a common pin or piece of wire in the holes F, one in each side casting. This pin or piece of wire which is inserted must engage in a slot provided in the spring plunger so as to prevent the plunger and spring from jumping out when the index head mechanism is removed.



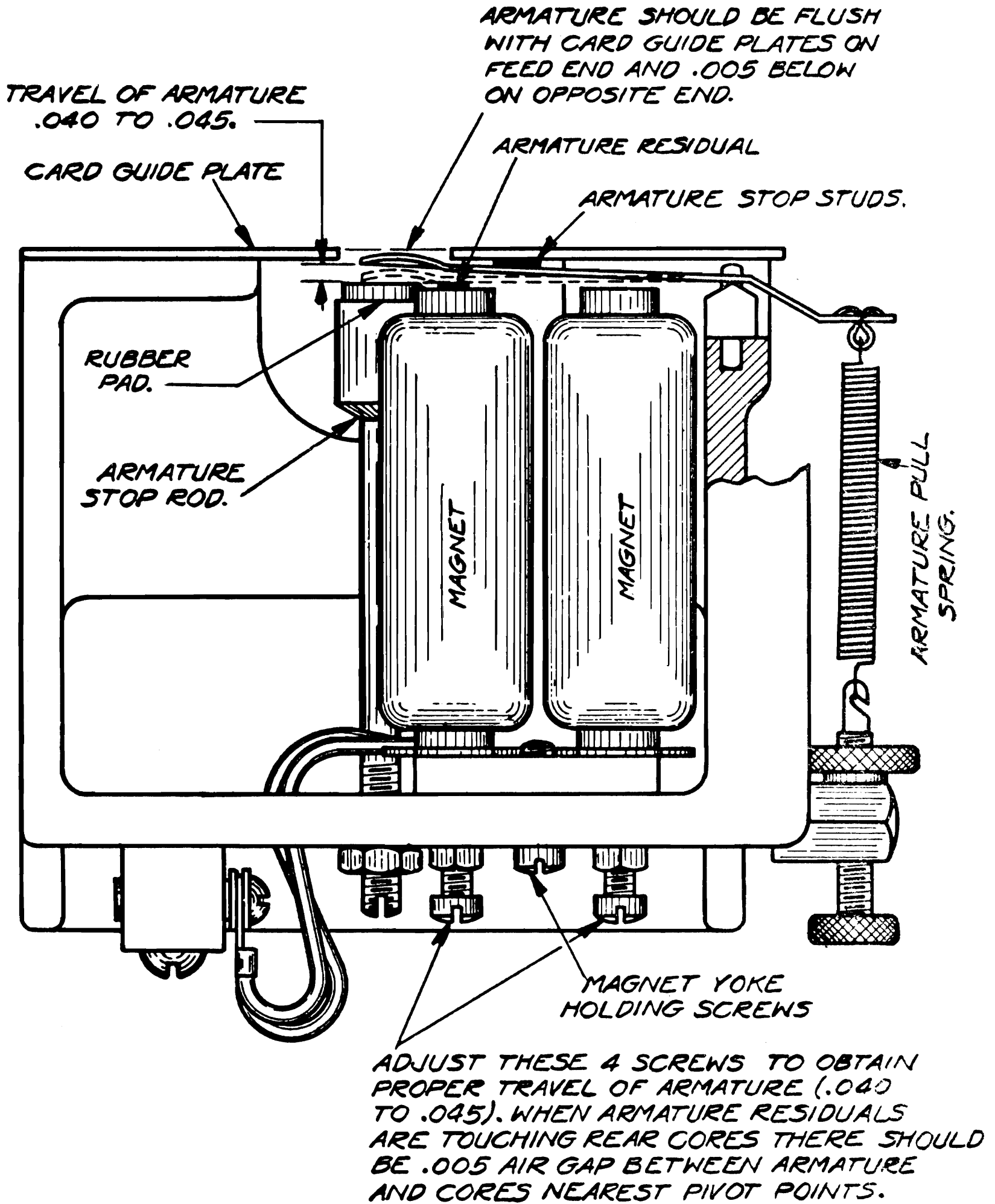


Fig. 8

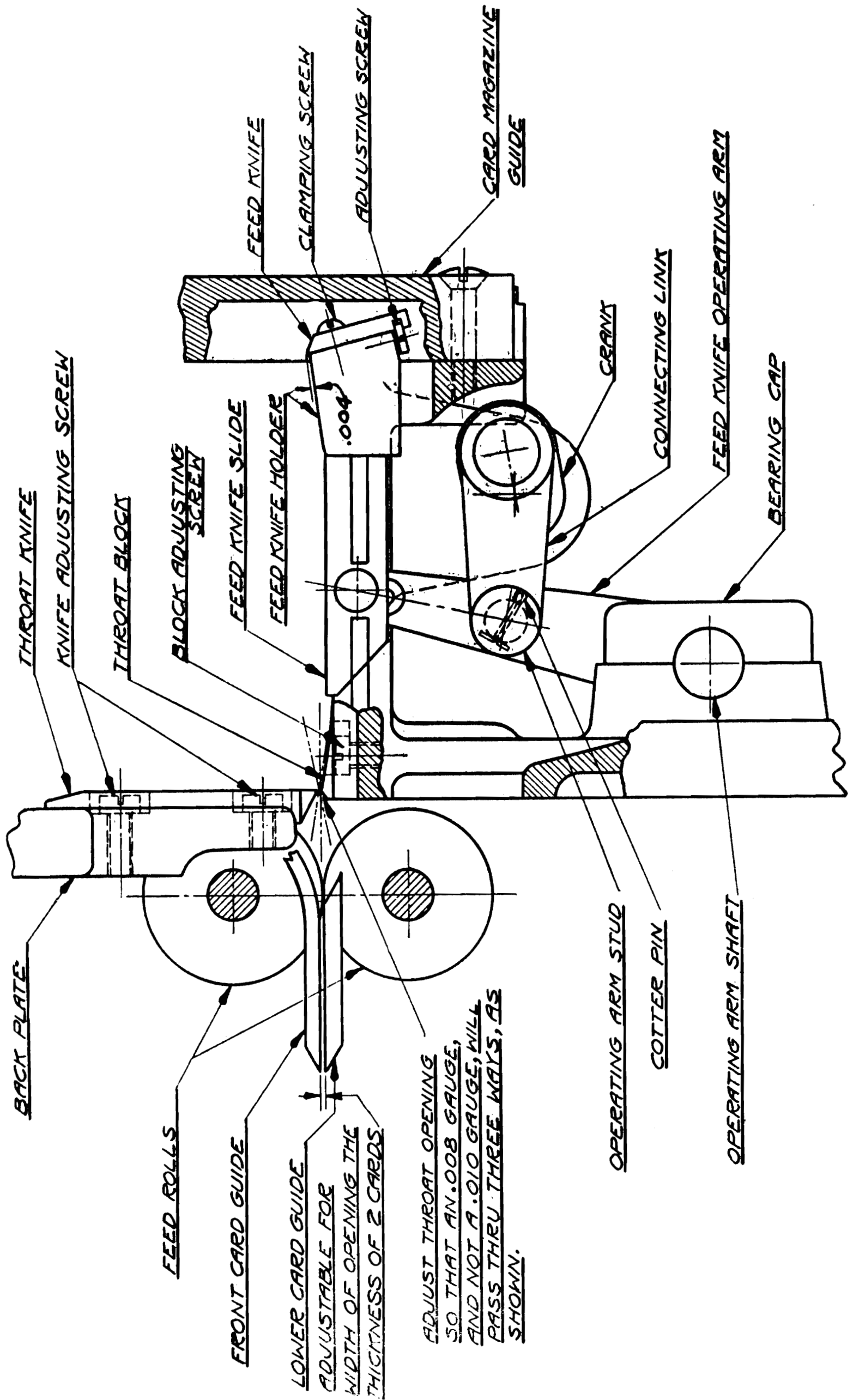


FIG. 9

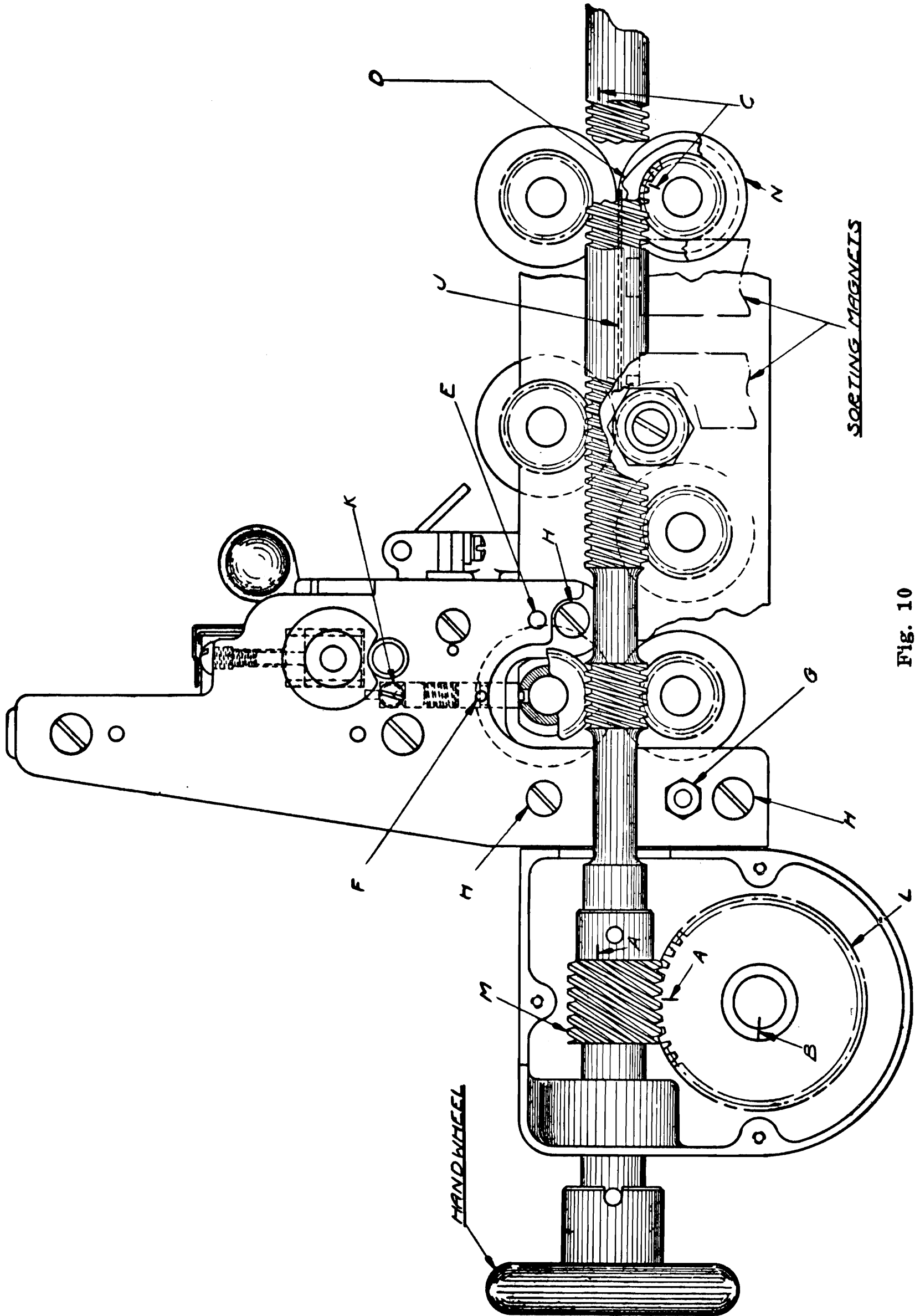


FIG. 10

Remove screws H on both sides and the entire index head mechanism may then be lifted off.

If the bronze worm gear L that drives the feed knife operating arm shaft is removed, care must be taken to see that it is properly timed when replaced. To remove this gear proceed as follows:

Remove the reverse friction lock so that the machine may be turned backwards.

Turn the machine by hand until the taper pin, which holds gear L, is horizontal and the large end is towards the hand wheel. Then drive out the taper pin from the hub of gear L.

Remove bronze gear L by turning the machine backwards and at the same time prying the gear off. Remove the connecting link by drawing cotter pin. The feed knife crank shaft can then be removed.

When replacing gear L mesh it with its worm driver M so that the marks A on both worm gear and its driver coincide. The scribed line B on the hub of gear L and the feed knife operating arm shaft must also coincide. If the lower feed shaft assembly N should be removed for any reason, spot marks C on the worm gear and worm shaft must also coincide, otherwise the knockoff cam D will be out of time. When contact is made thru a 9 hole in the card the knockoff cam C should be clear of the armature J (See fig. 10).

### FEED ROLL ADJUSTMENTS

It is very important that the first three feed rolls be accurately adjusted for tension so as to insure even feeding of cards. The adjustment of the first feed roll is controlled by screws (K, fig. 10) which are located horizontally in the front and rear side frames of the index head. These screws have a cone shaped end which operate at right angles against a spring plunger which also has a cone shaped end. If for any reason the adjusting screw is removed, it cannot be replaced until the spring plunger is pushed down. This is accomplished by inserting a steel rod, similar to a sorting needle, thru the 3/32" hole directly over the spring plunger.

The tension on the first feed roll should have an even pressure of six to eight pounds adjusted equally on each side. The tension on the second and third feed rolls should be four to five pounds adjusted equally on each side. All feed rolls except the first are adjusted as to tension by the flat steel springs which operate against the feed roll bearings. These springs, with the exception of those on the second and third feed rolls, should be adjusted so that there will be just sufficient tension to insure the cards feeding straight.

### POCKET STOP MECHANISM

The pocket stop mechanism consists of a contact operated by a shaft to which is connected an individual lever from each of the thirteen pockets. When sufficient cards are in the pocket to cause the stacker table to press against any one of these levers, the shaft is turned in such a manner that it opens the contact and stops the machine.

The pocket stop contact is connected in series with the card lever contact. Therefore, opening the pocket stop contact has the same effect as opening the card lever contact, viz., to stop the machine.

The pocket levers must work very freely. To relieve binding loosen the two end bearings and adjust until the shaft oscillates very freely.

The stacker tables must work very freely in order to insure proper operation. Obviously, a sluggish or binding stacker table, or a stacker spring with too much tension, will prevent the pocket stop contact from opening easily.

### PURPOSE AND ADJUSTMENT OF RELAYS

**G. E. Type Heavy Duty Motor Relays (fig. 11)**—The relays used in the motor circuit are somewhat different in appearance from any relays previously used in tabulating machine equipment. However, the principle of operation is the same as any of our regular four post relays, that is, the circuit thru the contact points is entirely separate from the circuit thru the coils.

The purpose of two relays located electrically either side of the motor, is to open the motor line at two points simultaneously, thus distributing over a large metallic surface, an otherwise destructive arc.

These relays should require no adjusting other than to see that the armature works freely and that the armature tension springs are adjusted equally so that both armatures will release at the same time.

**Card Control Relay**—The purpose of this relay is to prevent starting the machine while feeding cards by hand or in other words, to prevent starting the machine by any method other than depressing the start key.

**Brush Relay**—This relay picks up when the card brush makes contact thru the punched hole in the card and its purpose is to lock the selecting circuit for the remainder of each card cycle.

**Adjustments**—1. Line up contact points with pivot screws and set finger tight. Back off one screw 1/6 turn and lock check nuts.

2. Set armature square with base by use of contact and stop screws. Lock the top screw in this position.

3. Move the magnet cores by screws on back of slate base for .012" air gap between armatures and cores on card control relay and .005" on brush relay.

4. Adjust lower screw for .012" air gap between contact points on the card control relay and .008" on brush relay.

5. The tension on armature pull spring of brush relay should be just sufficient to overcome gravity with relay turned upside down.

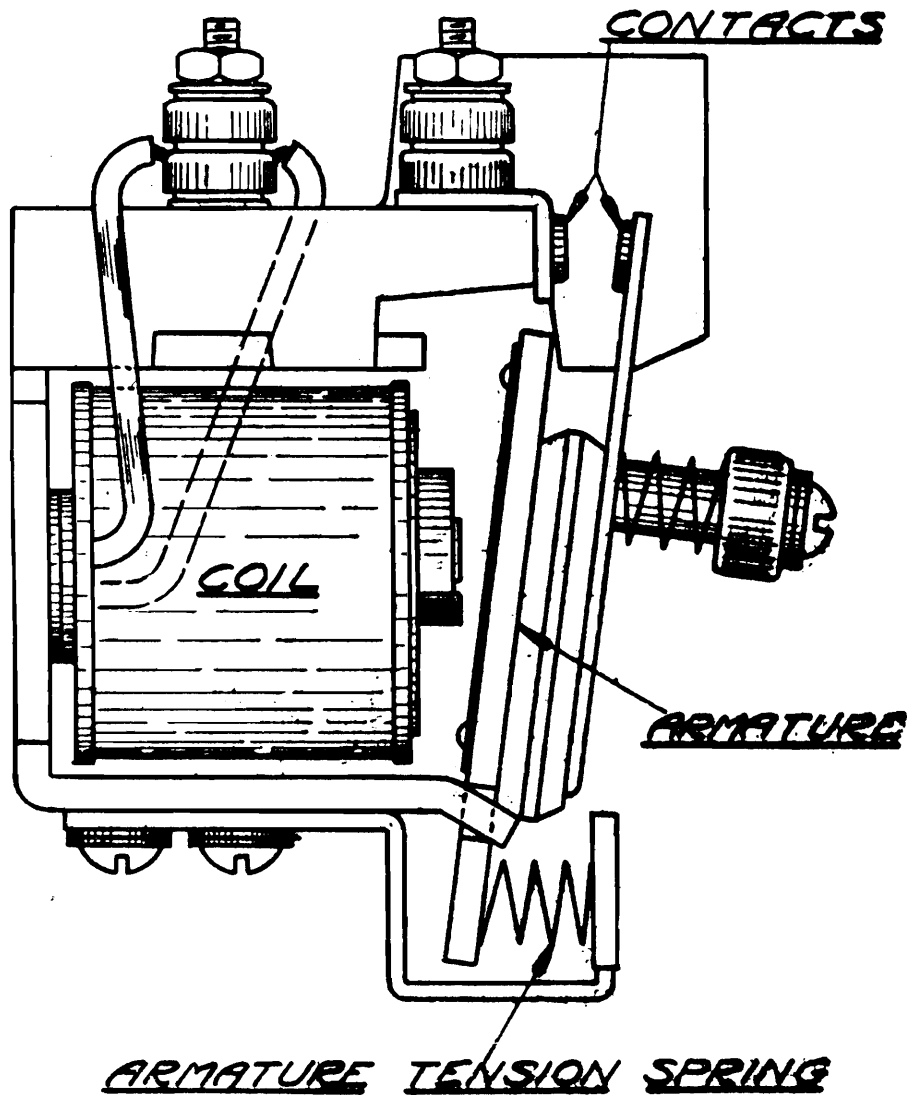


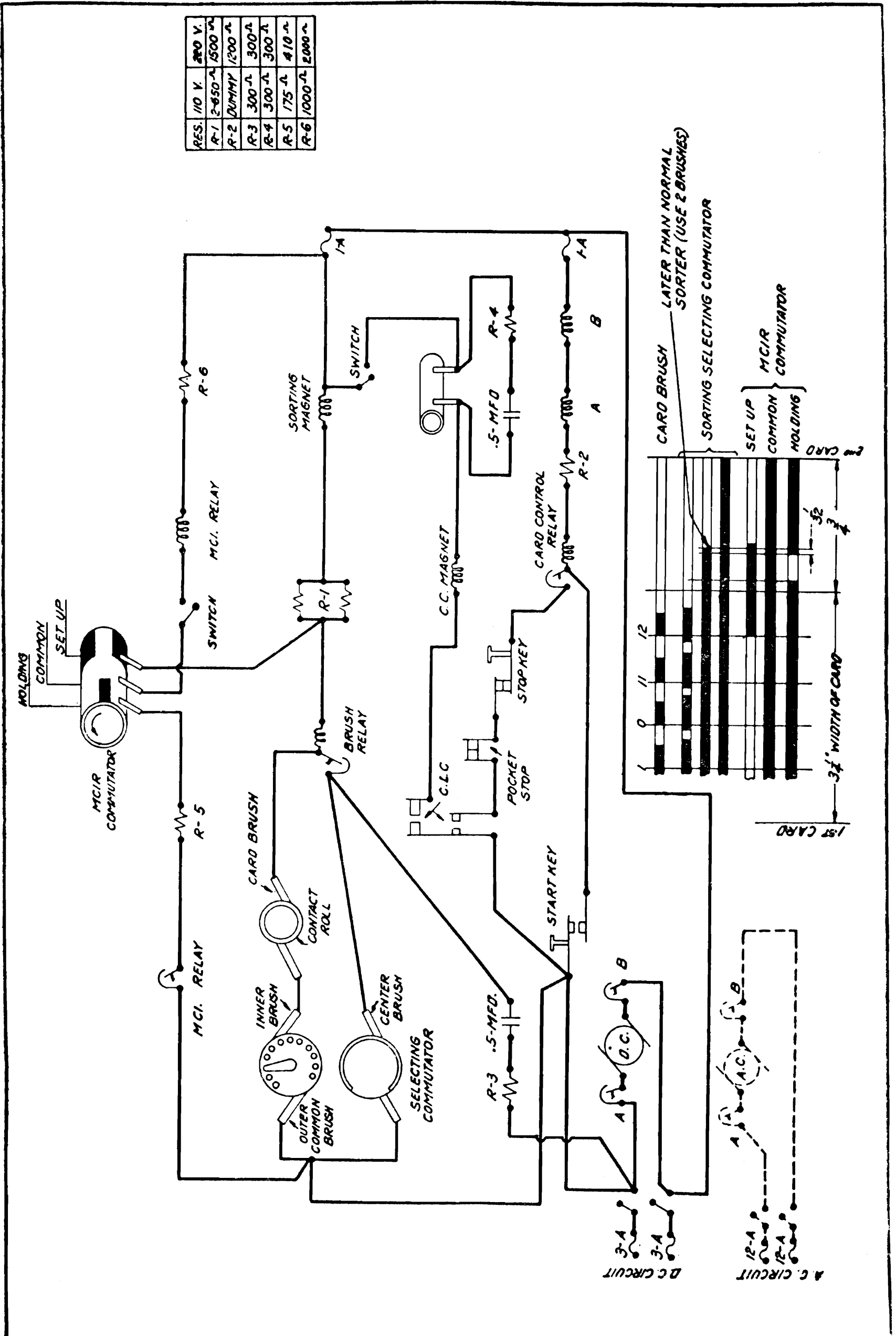
Fig. 11

## CIRCUITS

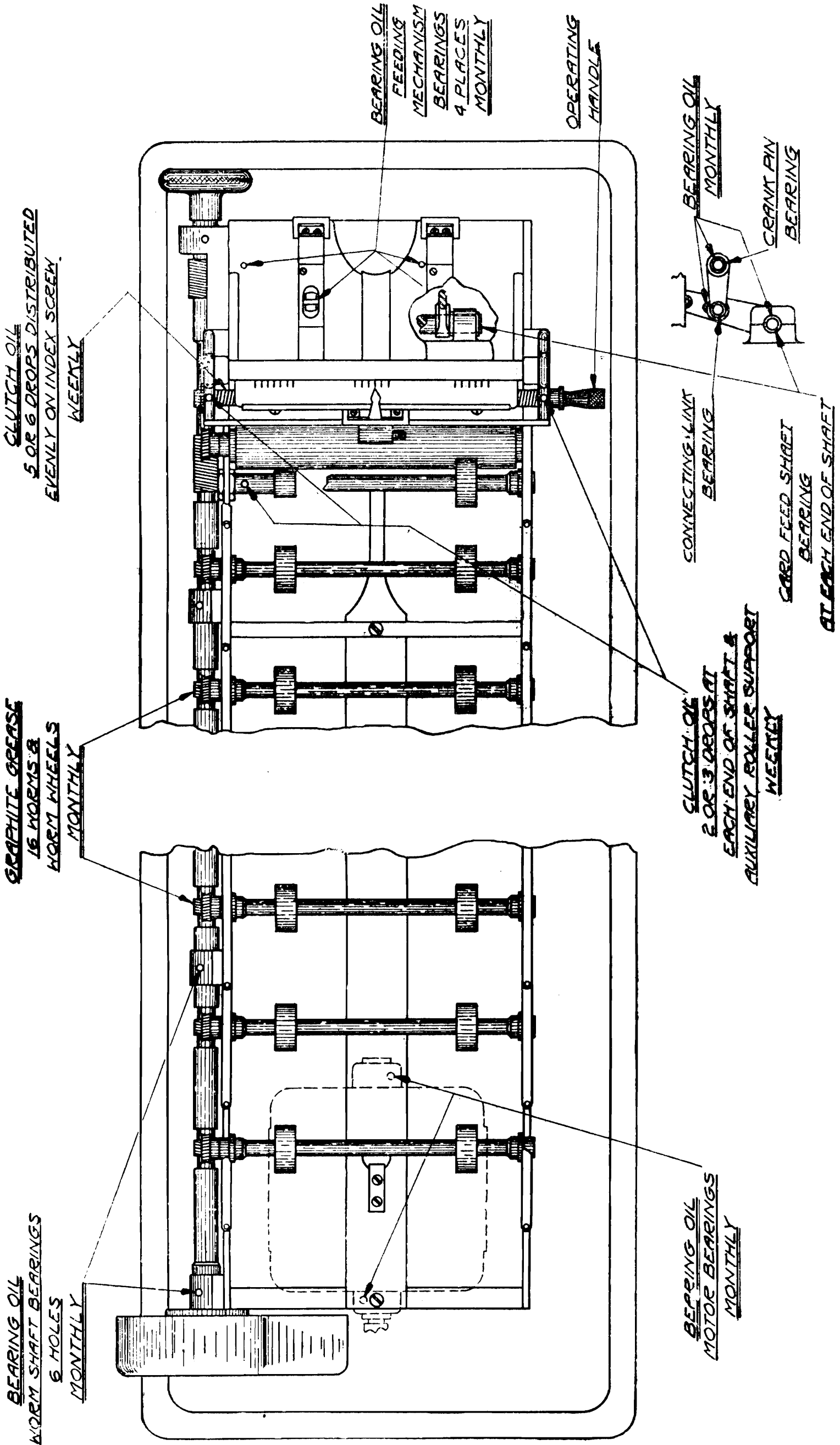
**Start Circuit**—The following circuit is completed when start key is depressed: D. P. switch, start key contacts, coils of card control relay, resistance R-2, coils of A and B relays, 1 ampere fuse to other side of line. This energizes card control relay, also A and B relays starting motor.

**Motor Running Circuit**—The following circuit is maintained as long as cards are feeding: D. P. switch, card lever contacts, pocket stop contact, stop key contact, gooseneck and points of card control relay, coil of card control relay, resistance R-2, coils of A and B relays, 1 ampere fuse to other side of line.

**Selecting Circuit**—The following circuit will be completed when card brush makes contact thru the punched hole in card: D. P. switch, common brush of commutator, inner brush of commutator, contact roll, thru hole in card, card brush, coils of brush relay, resistance R-1, sorting magnet, #1 ampere fuse to







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other side of line. When this circuit is completed it energizes the brush relay and sorting magnet.

**Sorting Magnet Holding Circuit**—The following circuit is maintained thru the sorting magnet for the remainder of each card cycle as follows: D. P. switch, common brush of commutator, gooseneck and points of brush relay, coils of brush relay, resistance R-1, coils of sorting magnet, 1 ampere fuse to other side of line. This circuit completes a holding circuit thru the points of brush relay and keeps the sorting magnet energized.

**A. C. Drive**—Any Horizontal Sorter may be equipped with an A. C. drive motor. When such is the case only the motor runs on A. C., the control and sorting circuits still operating on D. C. This relieves the D. C. generator of the heavy starting and running current of the drive motor.

The motor (1/4 h. p.) may be arranged to operate on either 110 or 220 volts, any frequency. The motor furnished is always single phase because if the commercial A. C. is polyphase, the motor may be connected on any one of the phases. If several machines are to be connected to a polyphase system, approximately the same number of motors should be connected to each phase, thus keeping the phases balanced. The question of balancing phases, properly fusing the supply line, etc., should be handled by the customer's electrician.

Machines already in the field may be equipped with an A. C. drive motor in the following manner:

The relay cabinet is assembled and wired ready to be installed on the present machine and electrical connections between the relay cabinet and the rest of the machine should be made in accordance with wiring diagram.

The direct current connecting cord is furnished with a standard separable plug, while the alternating current connecting cord is furnished with a large size polarized plug. Great care must be exercised not to connect the A. C. motor to the D. C. supply.