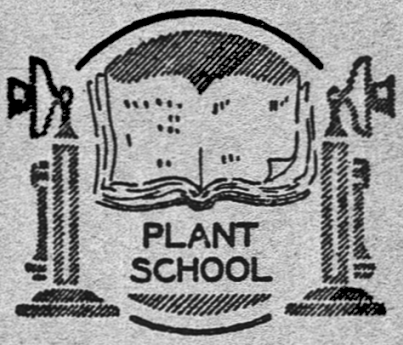
ILLINOIS BELL TELEPHONE CO.



SUBSTATION BULLETIN 3

THE 7A COIN COLLECTOR

ILLINOIS BELL TELEPHONE COMPANY

PLANT TRAINING SCHOOL

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April 1932

INDEX

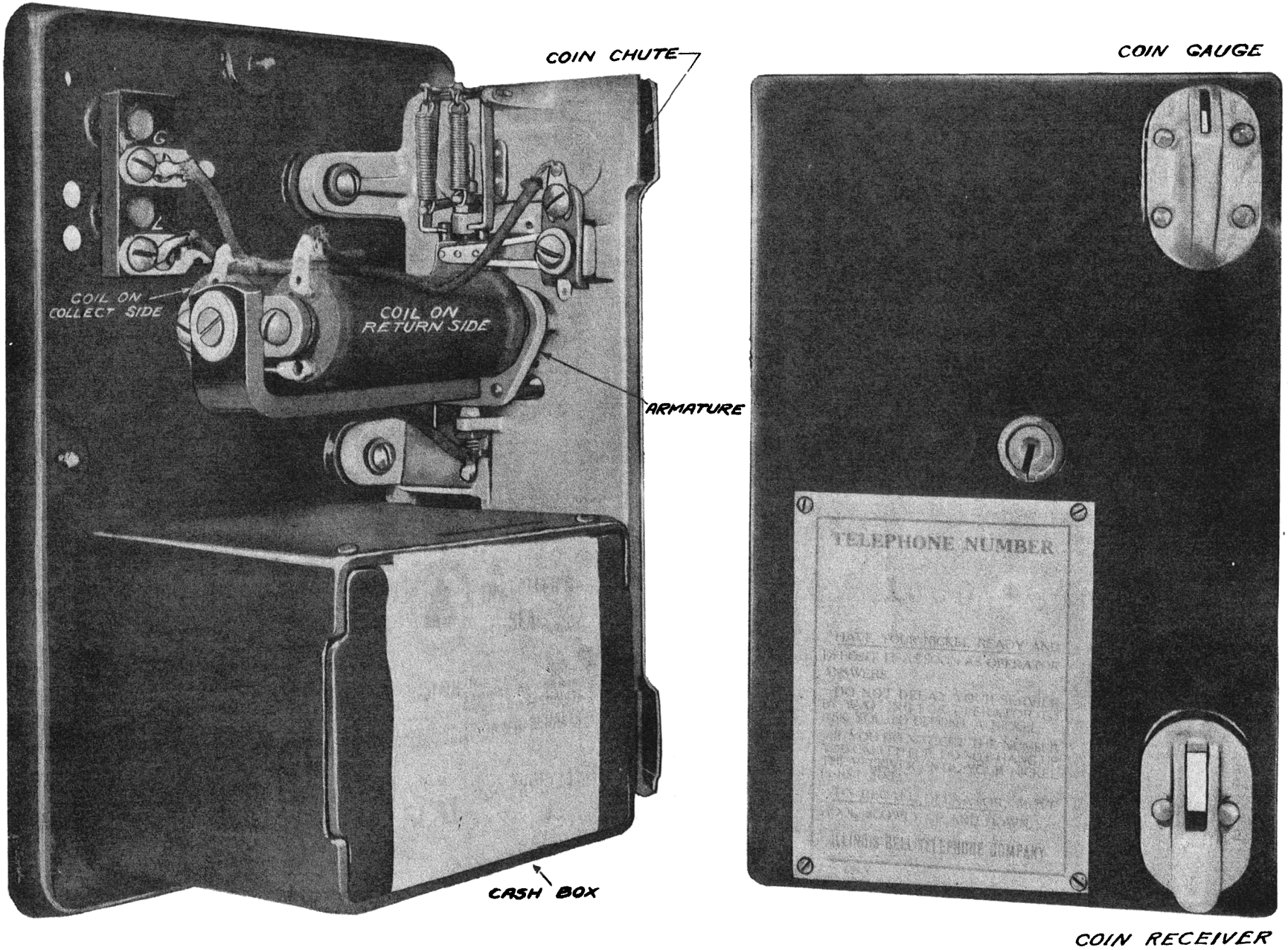

FIGURE 1

1. 2.

THE 7A COIN COLLECTOR

INTRODUCTION: Figure 1 illustrates the 7A type coin collector with the cover removed. It consists essentially of a coin chute, a cash box, an electromagnet and an armature with associated mechanism arranged to control the collection or return of the coin by the operator. The coin chute consists of a cast mounting plate (Fig. 2) and an aluminum or stamped sheet brass cover or side plate (Fig. 3), which together provide a runway through which the coin may be collected or returned.

The coin collector is connected to the tip side of the line the coin circuit being normally open until it is mechanically closed by the dropping of a nickel or slug, as described later.

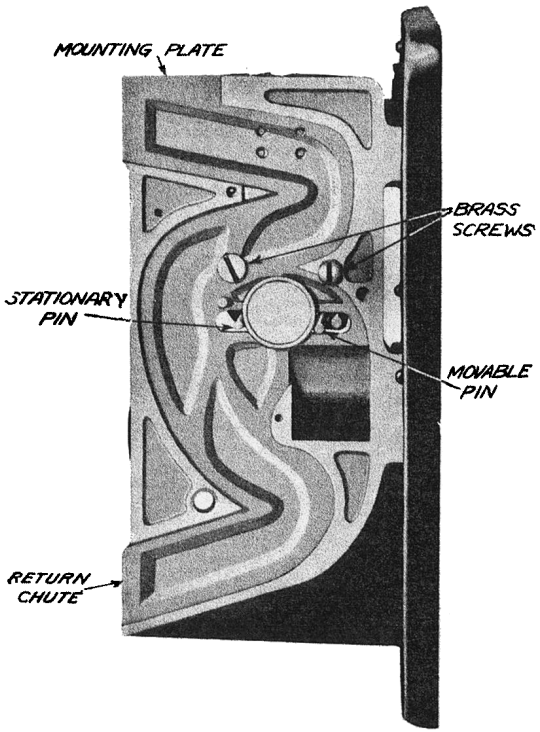

FIGURE 2

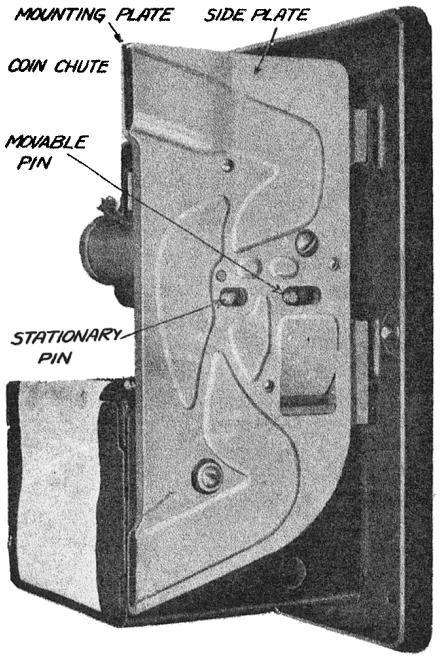

FIGURE 3

OPERATION: The coin, after being placed in the coin gauge, sometimes called the deposit escutcheon (Fig. 1), passes into the coin chute and down the upper runway until it strikes against two pins on the armature. These pins, as indicated in Figures 2 and 3, extend across the runway through slots in the brass mounting plate and side plate at a point where the runway divides, and hold the coin until it is collected or returned. The pin on the left side, as illustrated in Figure 4 which shows the armature removed from the box, is called the stationary pin and is fastened rigidly to the armature. The other pin, called the movable pin, extends horizontally through a hole in the armature and is held in place by a pivoting arm (Fig. 4) which extends vertically downward through a hole underneath so that the pin has a slight movement sideways. The movable pin is provided with a contact point 7 (Fig. 4) which strikes against the contact post 8 when forced outward by the weight of the coin, thus closing the coin box circuit. The two coils C1 and C2 (Fig. 1) of the electromagnet are rigidly fastened to the brass mounting

plate by means of two brass screws (Fig. 2) which engage the pole pieces. The armature is located between the coils and the brass mounting plate. This method of mounting requires a specially designed armature having holes through which the pole pieces extend, thus allowing movement in relation to them.

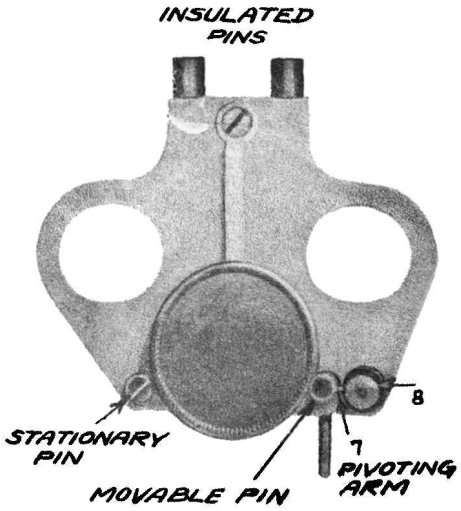

FIGURE 4

The coin box electromagnet is constructed and operated on the same general principle as the polarized ringer described in Substation Bulletin 4J. The armature is pivoted at the top and bottom so that it can swing toward either coil. Two levers, described in detail later, rest against two insulated pins on top of the armature (Fig. 4) and provide tension to hold the armature in its normal position and also restore it to normal after being operated.

The operator, as explained in detail later, collects the coin by the operation of a collect key in the A board circuit which in most offices connects negative 110 volt direct current to the tip side of the line. This current passing through the coils operates the armature toward the coil on the collect side, a movement which withdraws the movable pin from the runway and allows the coin to drop through the collect runway into the cash box. When the coin has dropped below the pins, the nickel contacts 7 and 8 (Fig. 4) are opened.

The operation of the return nickel key in the A board cord circuit connects positive 110 volt direct current to the line which operates the armature toward the coil on the return side.

In this case the stationary pin is withdrawn from the runway and the coin passes through the return slot to the coin receiver or return escutcheon on the cover (Fig. 1). Should a second coin be deposited while the first is being held between the armature pins, it will roll over the first coin into the return runway and coin receiver.

One side of the coin collector circuit is bridged to the tip side of the telephone line and the other is connected to ground as illustrated in Figure 5. The telephone line is permanently connected to the coil on the return side (Fig. 5). The circuit passes through the coils and hold-over spring to contact post 8 (Figs. 4 and 5). Contact post 8 extends through and is insulated from the armature terminating in a thin strip of sheet brass called a connector (Fig. 6) which is fastened to and insulated from

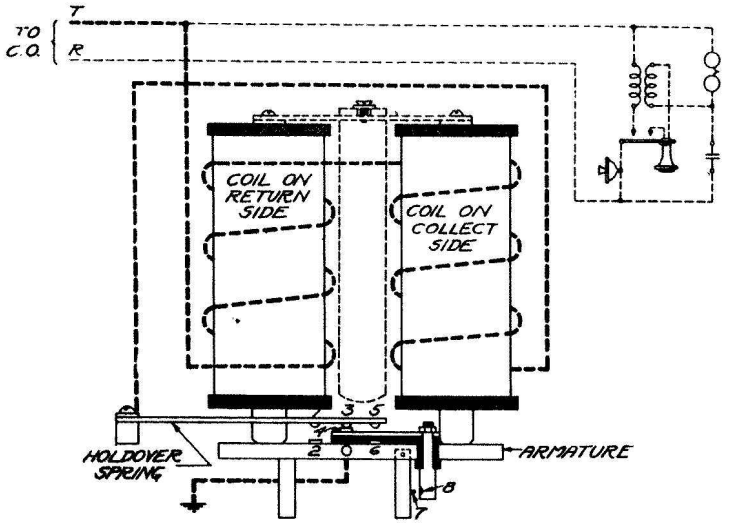

FIGURE 5

the coil side of the armature. There are three contact points, 2, 4, and 6 (Figs. 5 and 6) on the armature. Contact points 2 and 6 are set in the armature and are thus electrically connected to contact point 7 on the movable pin. Contact point 4 is a projection on the connector and is electrically connected to contact post 8.

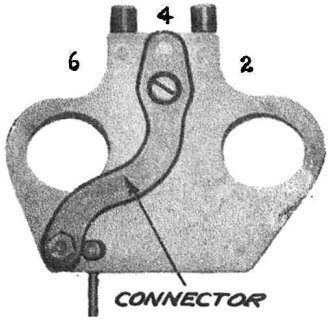

FIGURE 6

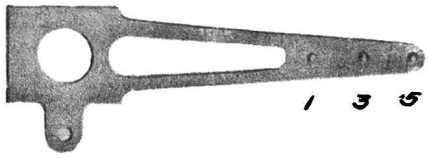

FIGURE 7

The electrical connection between the armature and the coils is completed by means of these three contacts and the hold-over spring (Figs. 5 and 7) which is mounted horizontally between the armature and the coils (Fig. 8). The hold-over spring is also provided with three contact points 1, 3, and 5, (Figs. 5, 7, and 8) corresponding to the three contacts on the upper face of the armature. Normally contacts 3 and 4 (Figs. 5 and 8) are closed thus connecting the coils to contact post 8. The bottom pivot of the armature is permanently connected to the top or ground binding post (Fig. 1)

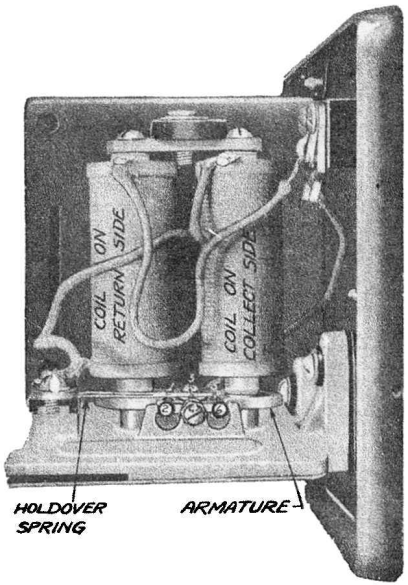

FIGURE 8

The circuit of the coin collector is normally open at the nickel contacts 7 and 8 (Fig. 5) until mechanically closed by the weight of the coin resting upon the pins, this action establishing the signalling circuit to the central office as indicated by the heavy lines in Figure 9.

When the armature is operated to the return or collect position, the circuit is transferred from the middle set of contacts on the hold-over spring to one of the outer sets as determined by the movement of the armature. Contacts 1 and 2 are closed when the armature is attracted toward the coil on the front or re-

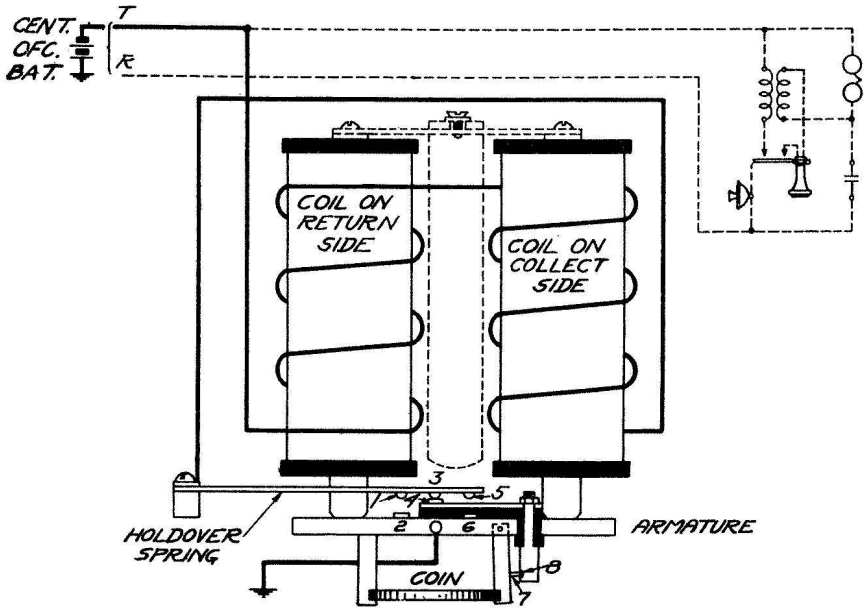

FIGURE 9

turn side (Figs. 10 and 11) by the positive 110 volt current from the central office. Contacts 5 and 6 (Fig. 12) are similarly closed when the armature is attracted toward the coil on the rear or collect side by the operation of the collect key. The contacts are adjusted so that either of the outer sets make before the middle set breaks also before the opening of the nickel contacts by the release of the coin, thus maintaining the continuity of the circuit until the operator releases the nickel key and the armature is restored to normal. The hold-over spring, therefore, permits the coin collector circuit to remain closed after the nickel contacts have been opened, due to the release of the coin, as long as the armature is operated toward either coil. This method of holding the circuit closed while the armature is operated, is needed to insure the armature pulling far enough to allow the coin to fall through and to keep the circuit closed long enough to operate the central office coin pilot lamp signal.

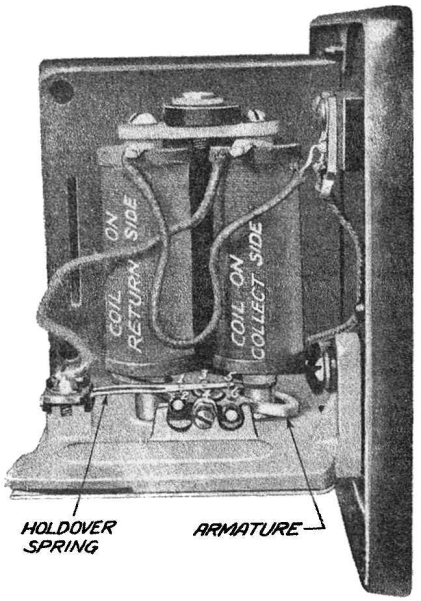

FIGURE 11

CENTRAL OFFICE OPERATIONS: Figure 13 illustrates the general arrangement of an A board coin detector posi-

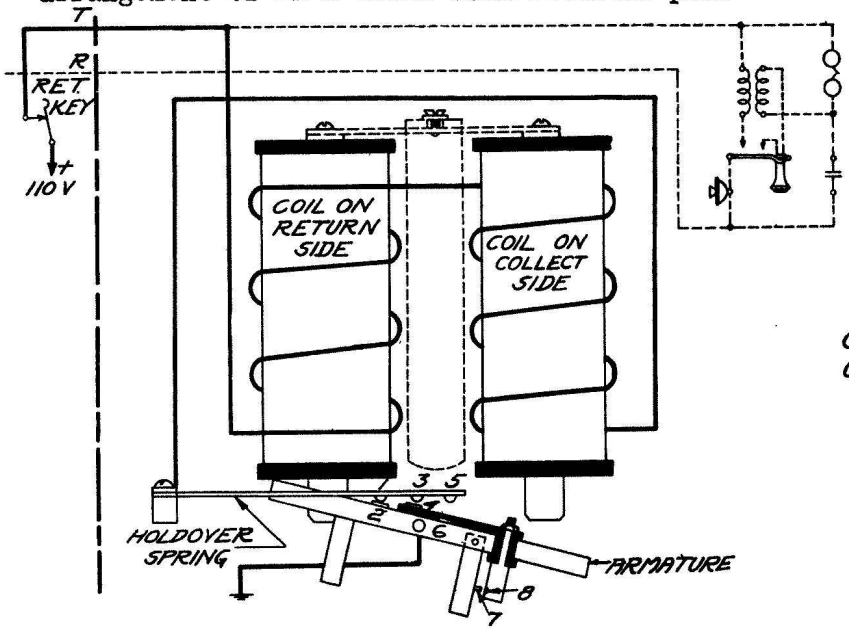

FIGURE 10

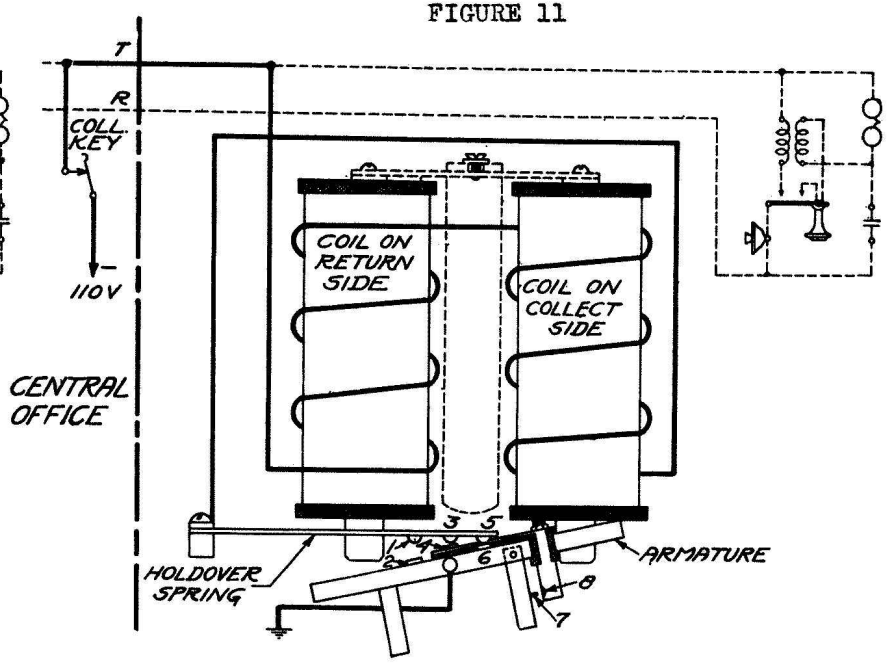

FIGURE 12

tion. Subscribers' lines are bridged to answering jacks and line lamps for the purpose of making outgoing calls. The out trunks which originate on the A board (Fig. 13) terminate on cords at various B boards (not shown). The connection

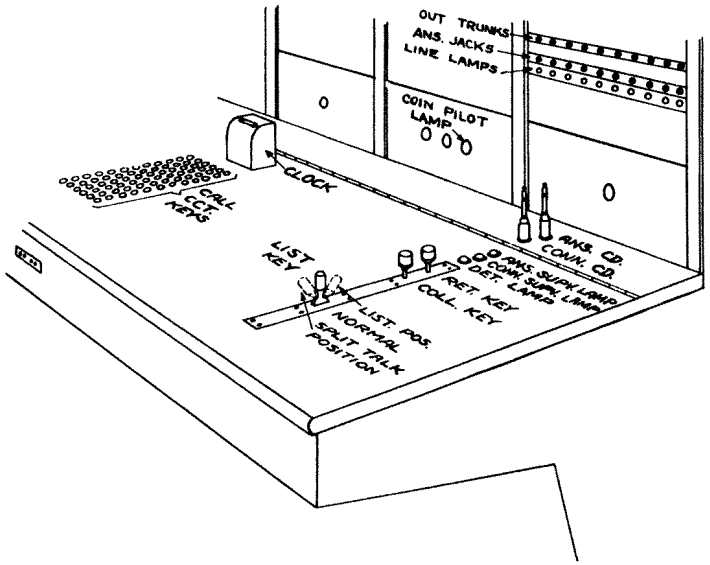

FIGURE 13

between an answering jack and an out trunk is completed by means of a cord circuit. Each position is designed for 17 cord circuits, only one being shown in Figure 13 to simplify the drawing. The cords are arranged in pairs, each pair being provided with a listening key, nickel collect and return keys, and three supervisory lamps.

The operator answers a call by inserting a back or answering cord (Fig. 13) in the answering jack and connects her telephone to the line by operating the associated listening key to its listening position. The connection is completed by inserting the front or connecting cord in the jack of an outgoing trunk. The answering and connecting cord supervisory lamps indicate to the operator when the parties flash the receiver hook or when they disconnect. The detector lamp is

used to determine whether or not the coin has been deposited on a nickel last line as explained later. The coin pilot lamp is common to all the collect and return keys in the position. The dropping of the coin into the chute mechanically

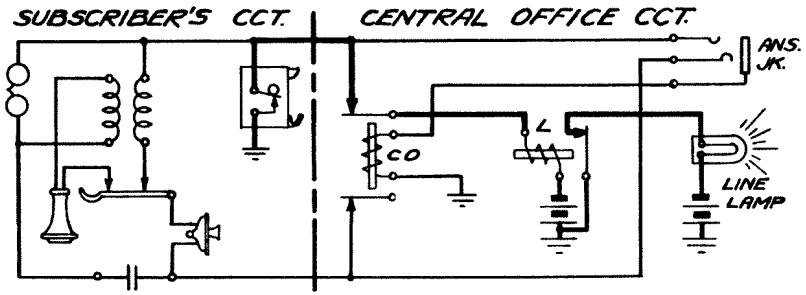

FIGURE 14

closes the nickel contacts 7 and 8 (Fig. 9) as previously described and establishes circuits to either

a - light the line lamp (Fig. 13) on a nickel first line.

b - extinguish the detector lamp (Fig. 13) on a nickel last line.

A nickel first line requires the dropping of a coin in the coin box in order to signal the operator. The dropping of a coin establishes a circuit (as indicated by the heavy lines in Figure 14) which lights the line lamp in the A board associated with the subscriber's line, thus signalling the operator. When the operator answers the call by inserting an answering cord in the answering jack, the line lamp is extinguished.

On a nickel last line, the coin is dropped into the coin box after the operator has answered the call, the line lamp on this class of service being lighted by the removal of the receiver from the switch hook. The dropping of the coin causes the coin relays of the A board coin circuit (Fig. 15) to operate and close the talking circuit between the answering and connecting cords (Fig. 13) thus completing the connection between the calling and the called parties. If

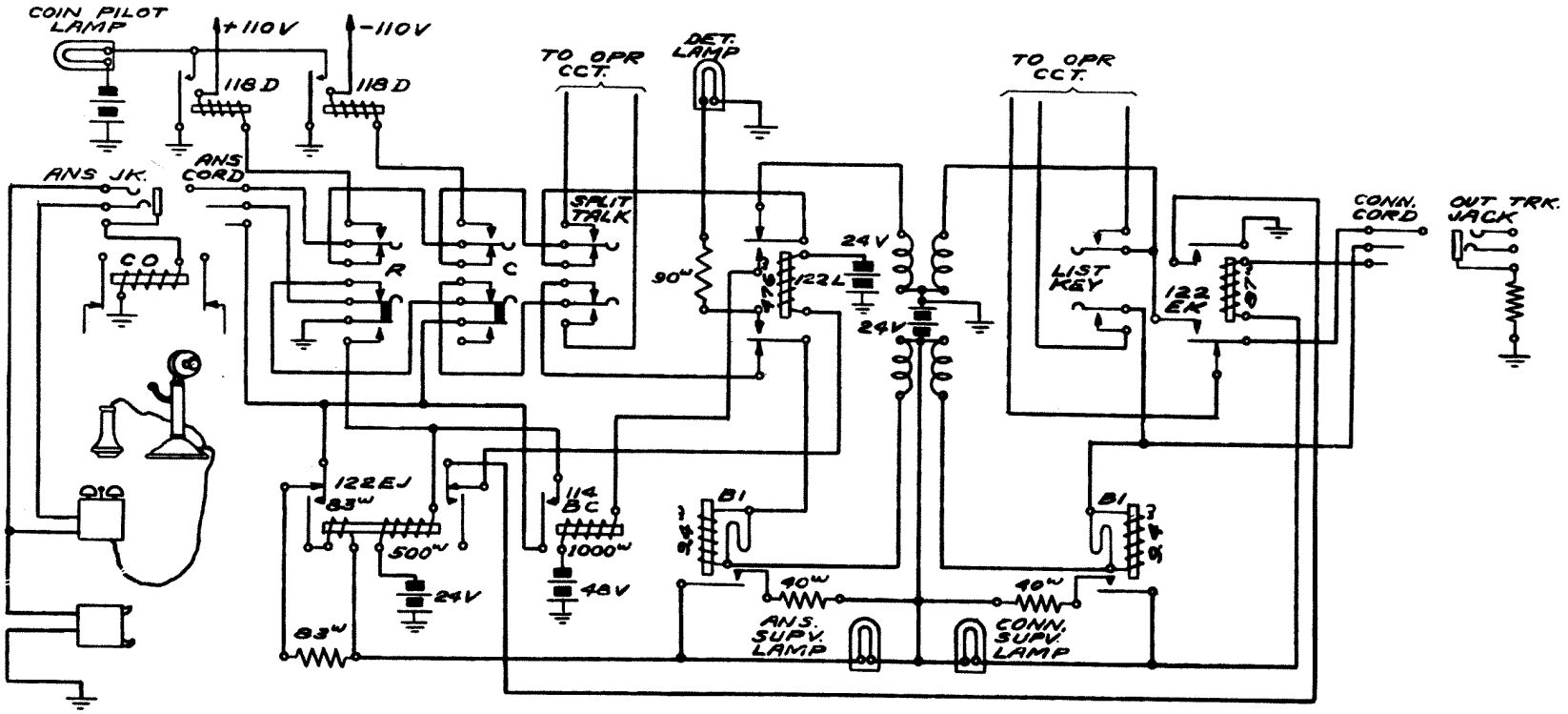

FIGURE 15

the subscriber should fail to immediately drop a coin after the operator answers, the detector lamp (Fig. 13) will light when the connecting cord is put up, but the circuit between the calling and called parties will not be closed through, due to a cut-off relay in the coin detector circuit, which operates and remains operated until the coin is deposited. The operator may talk to the calling party at this time by operating the listening key to the split talking position (Fig. 13) (See Figure 15 for detailed circuit). The coin pilot lamp on the central office A board (Fig. 13) is lighted when the operator collects or returns the coin and remains lighted as long as either key is depressed due to the coin box circuit being closed through the hold-over spring contacts after the armature has been operated, as previously described. The lighting of the coin pilot lamp indicates to the operator that the coin circuit has been closed through the operated nickel contacts.

ASSEMBLY AND ADJUSTMENT: The various parts of the coin box must be correctly adjusted in order that the box can function properly at all times. With the exception of troubles caused by defective coins and slugs, foreign material, etc. in the slot, the majority of coin box trouble cases are due to faulty adjustments. In actual practice adjustments are usually made with the box assembled, but in order to demonstrate the various adjustments in a clearer way, it is assumed in the following description that they are made as the box is assembled.

Nickel Contacts: The nickel contacts should be adjusted so as to make good contact when the coin is deposited, as illustrated in Figure 4. When the contacts are in the normal nonoperated position, that is, before the coin is deposited, there should be approximately .012" clearance (the thickness of the .012" leaf of the bell gauge) between the contacts 7 and 8 (Fig. 5) which is sufficient to insure a break in the circuit. The space between the contacts is increased by bending the adjusting arm (Fig. 16) away from the armature with a screwdriver and is decreased by bending the arm toward the armature with the fingers or pliers if necessary. If corroding of the armature causes the pivoting arm (Fig. 16) to stick, the

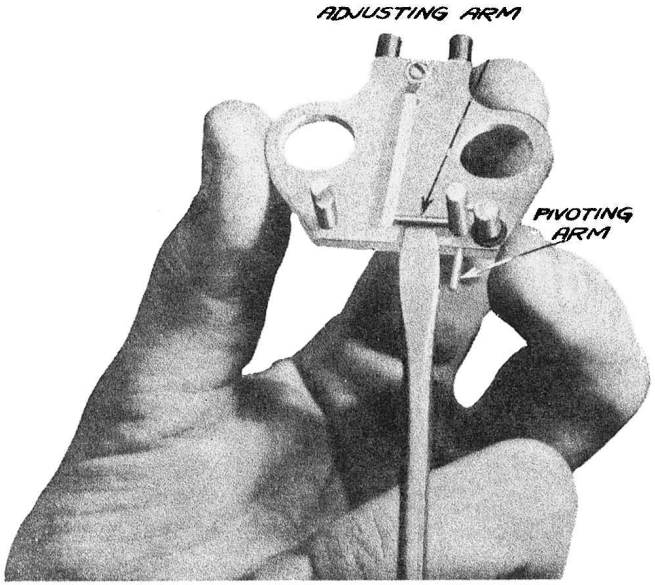

FIGURE 16

armature should be replaced, as the pin is fastened in under pressure and may become loosened if once removed.

Contact Spring: The contact spring (Fig. 17) provides tension to break the nickel contacts when the coin is released. Care should be taken that the contact spring is so adjusted that it permits the weight of the coin

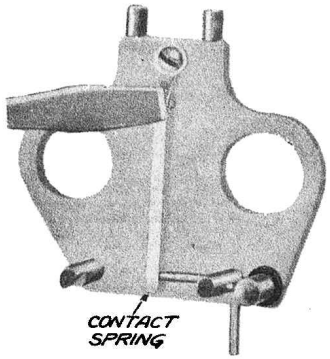

FIGURE 17

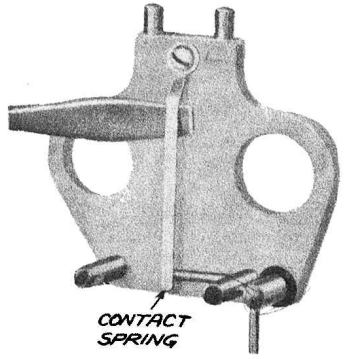

FIGURE 18

to close the contacts and yet has tension sufficient to open them after the coin is released.

Figure 17 shows how tension is applied to the spring with a screwdriver, this adjustment being made by pressing against the shoulder of the spring. The method of decreasing the tension is illustrated in Figure 18. This adjustment requires a little practice to accomplish

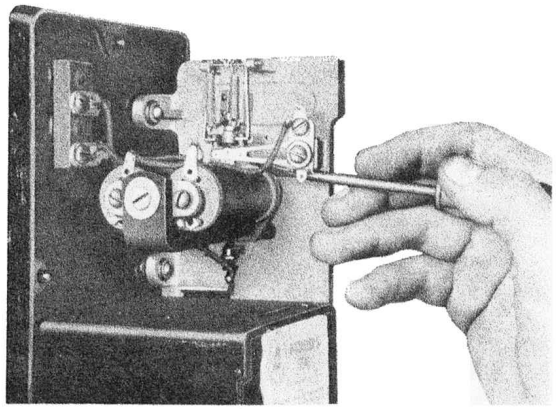

FIGURE 19

in a satisfactory manner without removing the armature from the box. Figure 19 shows how the spring can be adjusted with the box assembled.

Armature: The armature is one of the most important pieces of mechanism in the box and is frequently the cause of trouble. When mounting the armature it is essential that the brass extension lugs (Fig. 20) on the brass mounting plate should extend through the exact center of the large holes in the armature measuring from top to bottom. The armature may be moved up or down to obtain this adjustment by means of the top and bottom pivot screws. The illustrations show the coils out but it is not necessary to remove them to adjust the armature. When the armature is centered in the proper position, the bottom locknut should be tightened with long nose pliers, as illustrated in Figure 20. The top pivot screw should then be adjusted so as to prevent any side motion or play of the armature but not with enough pressure to

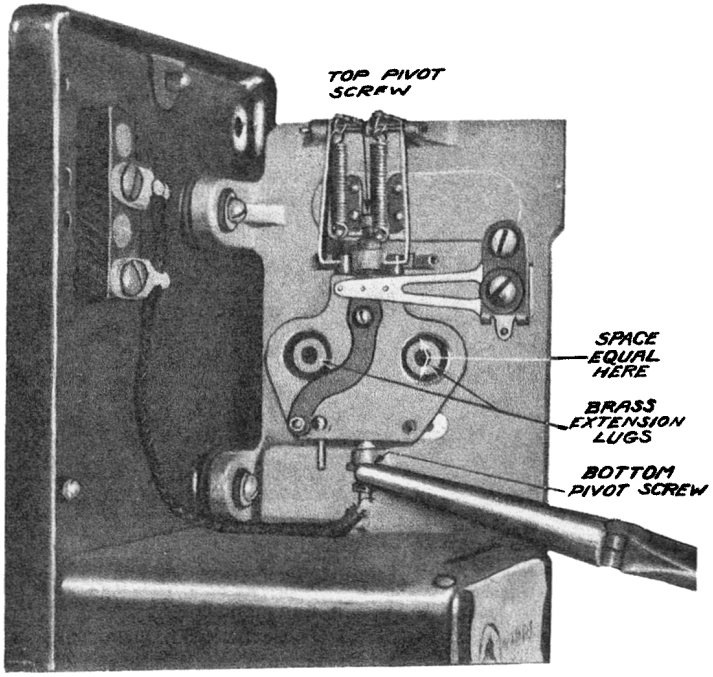

FIGURE 20

cause the armature to bind.

The top locknut can be tightened by placing a screwdriver against the locknut and tapping the screwdriver with the hand as illustrated in Figure 21.

Care should be taken that the locknuts are tight so as to avoid trouble. This can be checked by lightly forcing the screwdriver

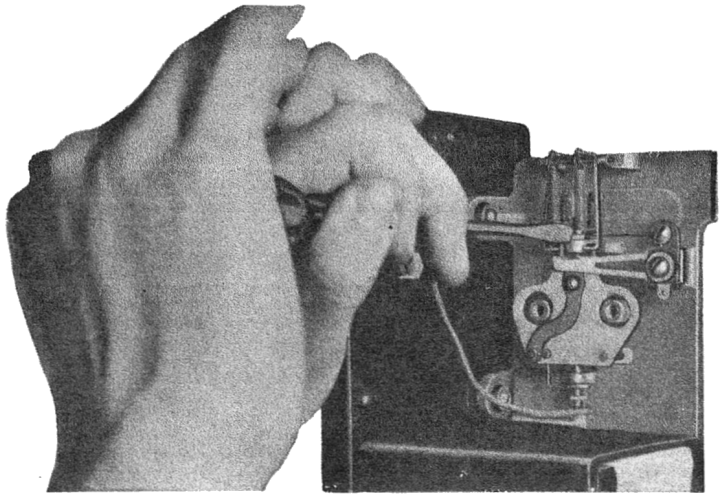

FIGURE 21

against the locknuts to see if they are loose.

The armature should swing easily on the pivots without binding when moved back and forth with the finger, but should not have any side motion when a slight pressure is exerted sideways as indicated in Figure 22.

Coils: The coils are fastened to the framework by means of two brass screws as shown in Figure 23, the screw having the flat head being used in the hole that is counter-sunk, as it is necessary for the coin to pass over this screw.

The strength of the permanent magnet is important and it should be of sufficient strength to hold its own weight on the cash box frame

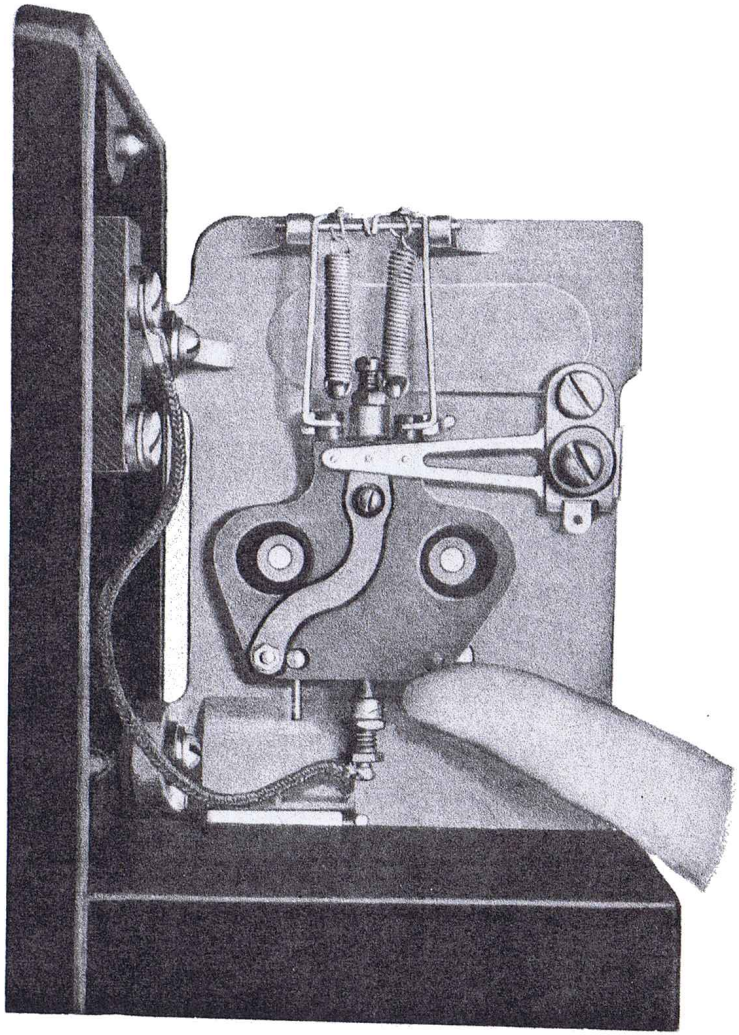

FIGURE 22

as illustrated in Figure 24. When mounted, the permanent magnet should be the same distance from both coils and care should be taken to see that all screws on both coils are tight.

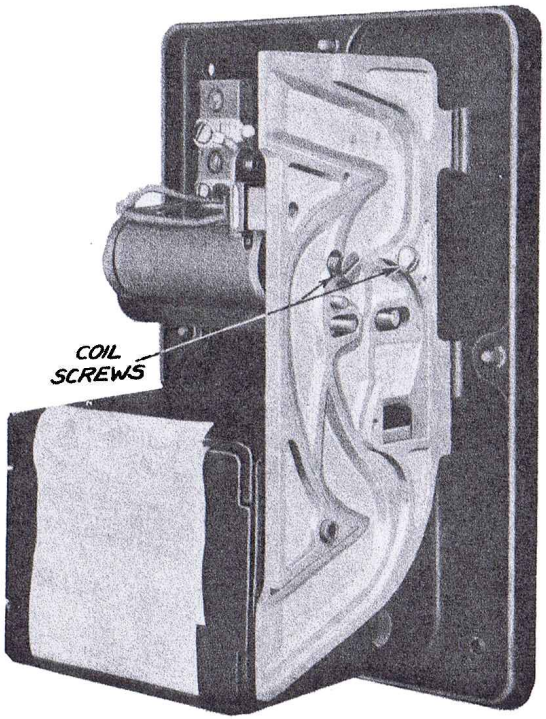

FIGURE 23

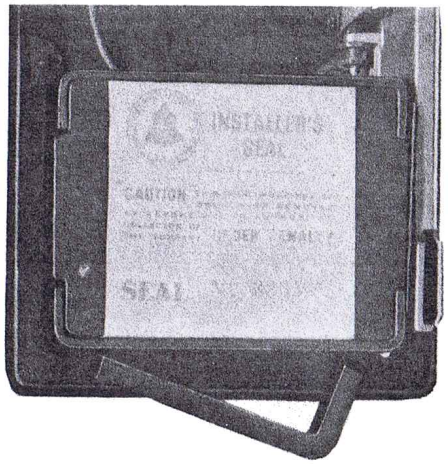

FIGURE 24

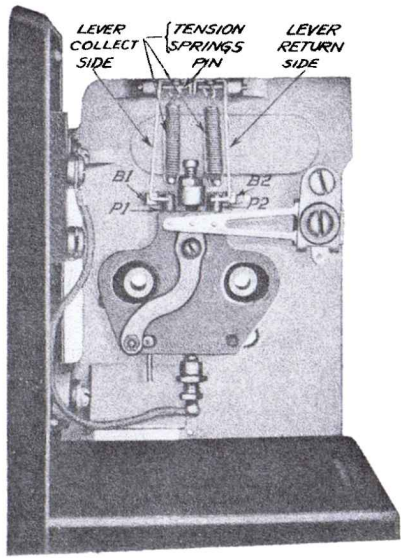

FIGURE 25

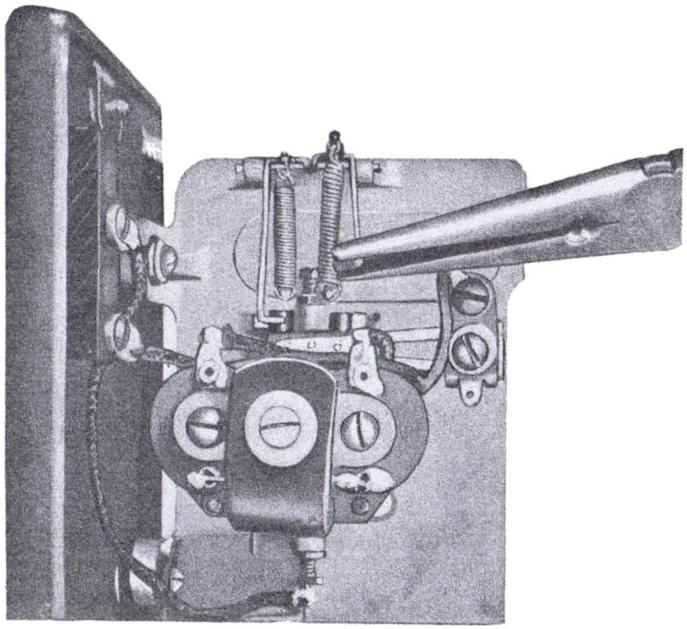

FIGURE 26

Levers: The levers that hold the armature in its normal position hinge on a pin (Fig. 25) which is fastened to extension arms on the frame, as shown. The coiled tension springs tend to hold their respective levers against the brass lugs on the frame. When the armature is operated toward the coil on the return side, the insulated pin on the return side of the armature (Fig. 25) strikes against the lever on the same side, thus forcing it away from the frame. When the coin circuit is opened, the tension of the lever against the insulated pin restores the armature to normal. The lever on the collect side performs a similar function when the coin is collected.

The levers should be adjusted so as to hold the armature straight across the face of the coils, as shown in Figure 9. This adjustment can only be checked accurately by looking down from the top of the box, using a flashlight if necessary. The L shaped end of the levers should

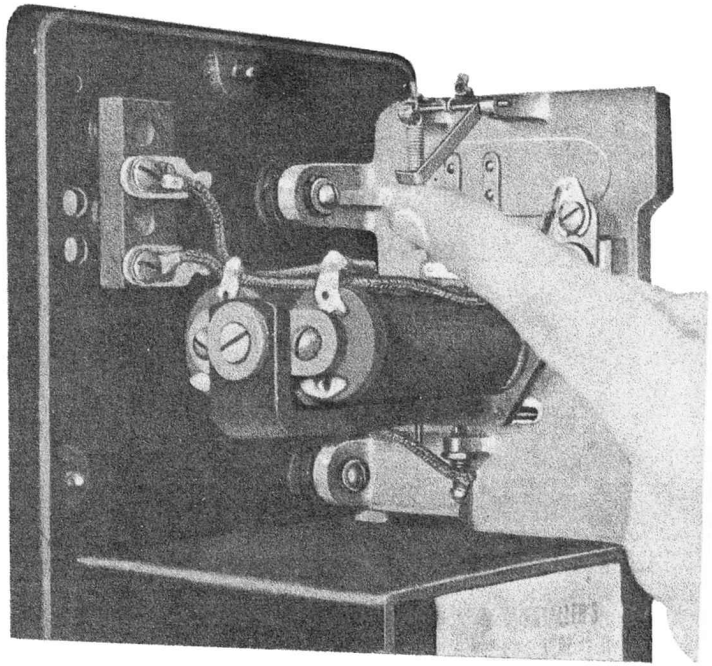

FIGURE 27

normally rest against the brass lugs B1 and B2 (Fig. 25) on the frame and should also rest against the insulated pins P1 and P2 (Figs. 25 and 4) on the top of the armature with sufficient pressure to prevent the armature from having any play.

The lever is adjusted by bending the end of the L shaped portion either in or out with a pair of long nose pliers, as shown in Figure 26, care being taken that the lever does not bind at the hinge.

The lever may be tested for binding by removing one of the tension springs and raising the associated lever which should drop to its normal position by its own weight as indicated in Figure 27.

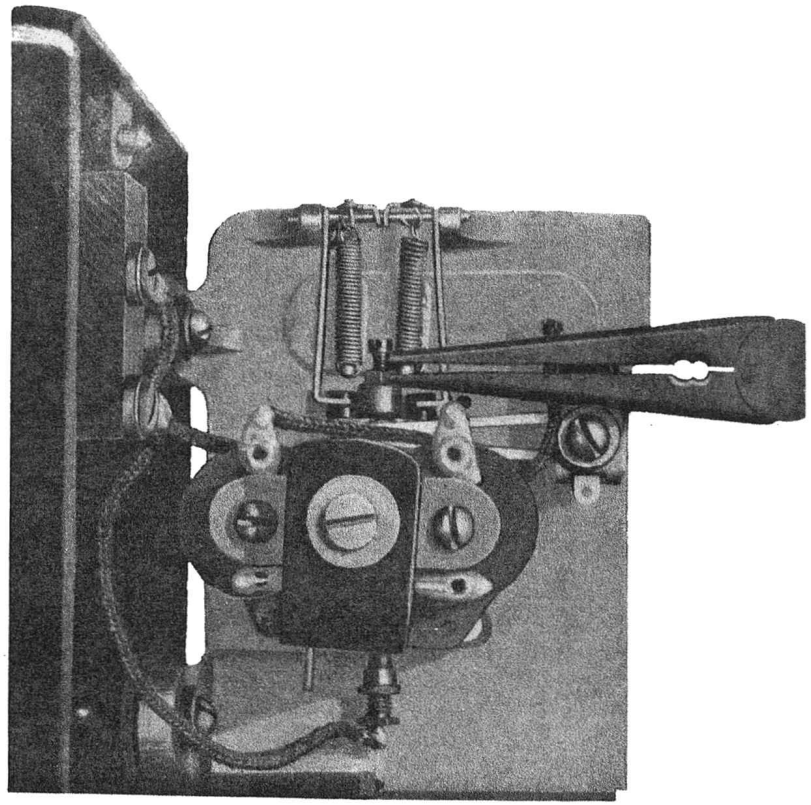

FIGURE 28

When the levers are properly adjusted there should not be any looseness or play between the armature and the levers. This can be determined by placing the fingers of one hand on top of the levers, as shown in Figure 29, and trying the armature for side motion with the other hand.

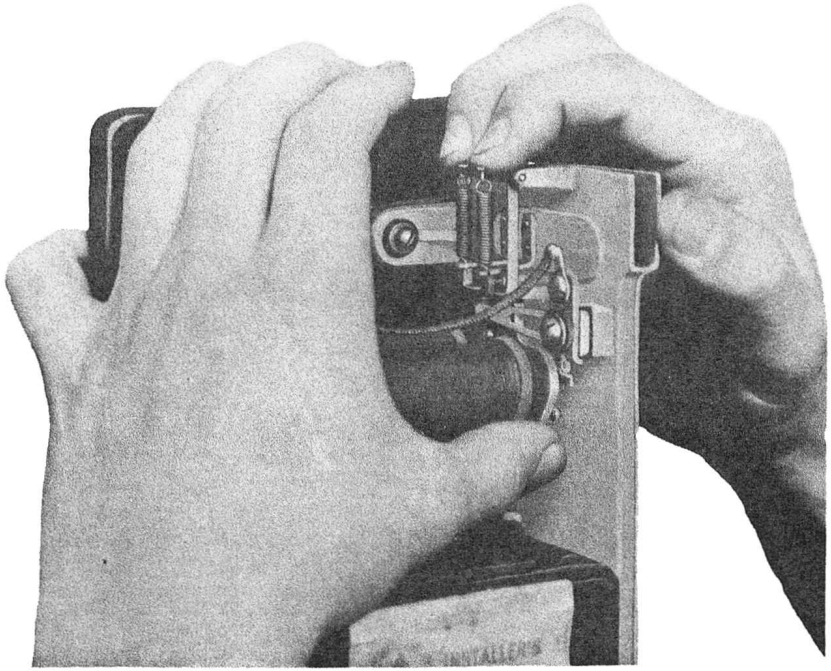

FIGURE 29

The alignment of the armature may be tested by pressing the fingers alternately on top of the levers as shown in Figures 30 and 31. If there is any movement in the armature one or both of the levers are out of adjustment. The armature should be straight across the coils after the foregoing adjustments have been made.

The armature is adjusted to operate on nickel collect or return current, but not on the lower voltage line signalling or talking current. For this reason the tension springs and levers are also used to prevent the armature from operating until a coin key at the central office is operated. If the tension springs are too weak the armature may be operated to collect the coin by the 48 volt line battery. For this reason

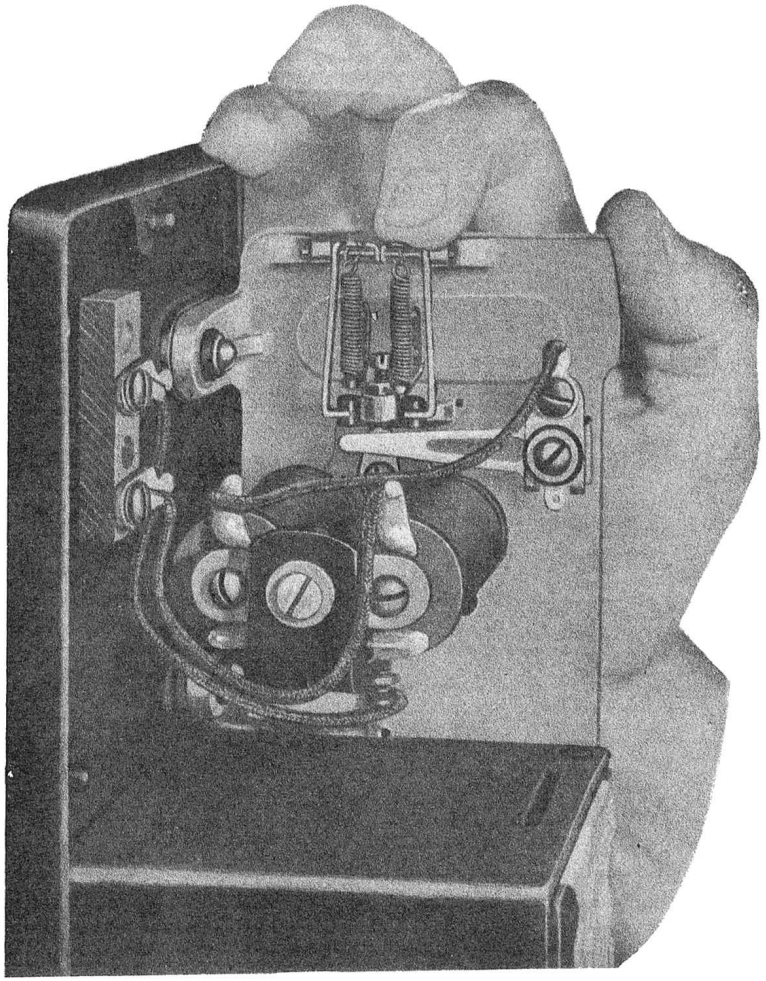

FIGURE 30

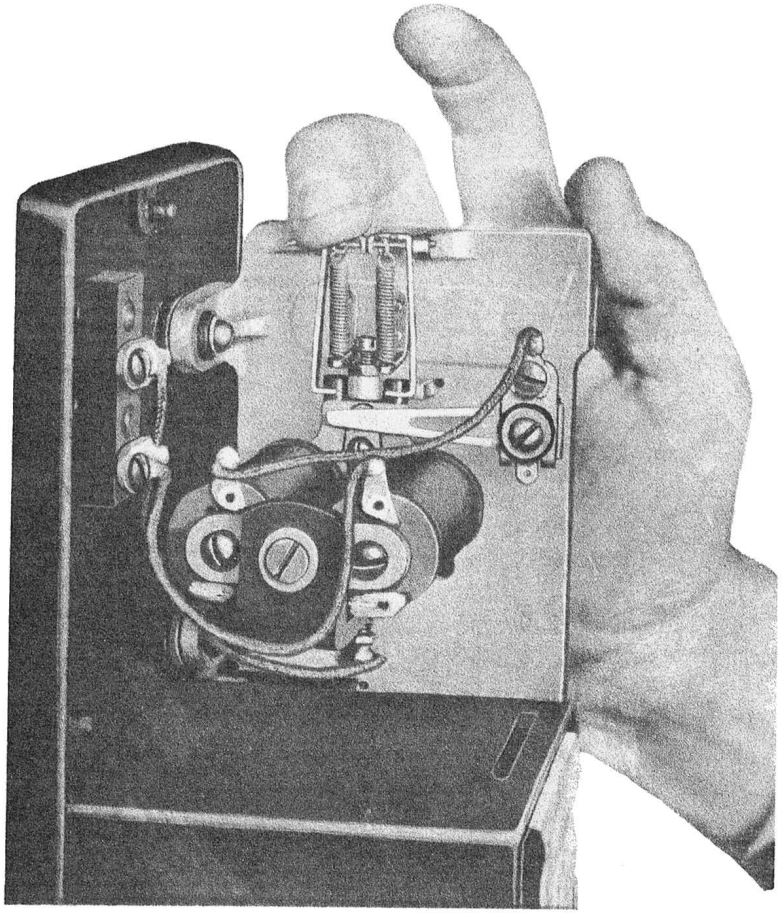

FIGURE 31

they should have sufficient tension to overcome the magnetic force of the normal line battery and restore an operated armature after the release of the nickel key at the central office. If there is too much tension in the springs, the armature cannot be operated by the nickel current.

Hold-Over Spring: The contacts of the hold-over spring should be in

line with the corresponding contacts on the armature and the hold-over spring should have sufficient tension to insure good contact at the center of the armature (Fig. 9). Too much tension on this spring tends to retard the operation of the armature. A close adjustment is necessary between contact points 1 and 5 and 2 and 6 on the spring and armature respectively. However, if the contacts are adjusted too close, the vibration of the armature will cause a repeated nickel signal at the central office. The contacts must be so adjusted that the coin cannot be released before contacts 1 and 2 or 5 and 6 are closed. This is necessary so that the operator can control the movement of the armature after the nickel contacts have been opened due to returning or collecting the coin. If they were not so adjusted, the armature would only move so as to release the coin and then, the circuit being open, the armature would immediately restore to normal catching the coin between the movable pin and the side plate. The contacts should be adjusted so that if a thin nickel is placed between the side plate and either of the pins, the associated contact will be closed. This test should be made with the ar-

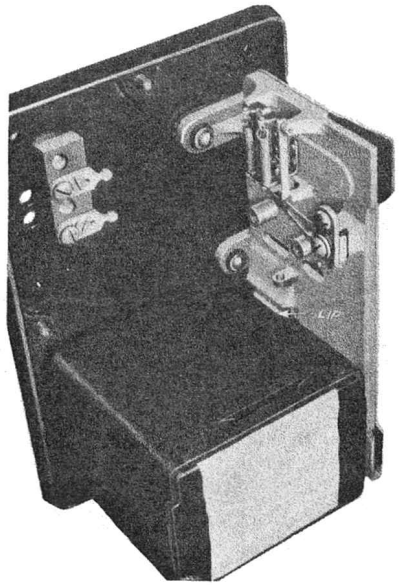

FIGURE 32

mature in both the return and collect positions.

Side Plate: A piece of fiber is used to insulate the mounting plate from the frame. Care should be taken that the lip (Fig. 32) of the side plate is over and above the insulation when the side plate is in position. This can be determined satisfactorily by looking below the armature, using a flashlight, if necessary. Figure 33 shows four screws A, B, C, and D used to fasten the side plate to the mounting plate.

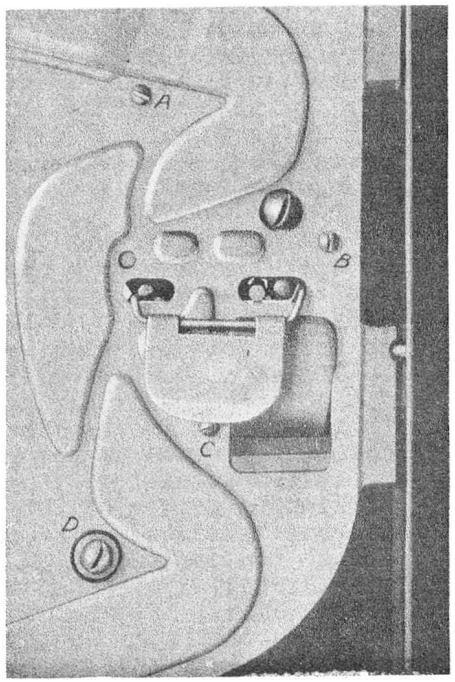

FIGURE 33

TESTING: The 7A coin box can be tested for proper operation with the central office A operator. Before making the test, a 7A coin deflector, which causes the coin to be returned regardless of whether the return or collect key is operated, should be placed on the side plate as shown in Figure 33. When the cover has been replaced on the box, the operator should be requested to operate the collect key three times, the coin being reinserted each time it is returned. The coin will be returned, but the proper operation of the box can be detected by the sound as the coin strikes the 7A coin deflector when the armature is operated, and its return is retarded slightly. The operator should then be requested to operate the return key twice, the coin in this case being returned immediately. The collect key should be operated once more as an additional check.

To secure the proper tension, the springs are adjusted with long nose pliers as illustrated in Figure 28. These adjustments can be more accurately made in offices that are equipped to vary the current flowing through the coin collector. This is referred to as a current flow test.

In such offices, it is customary to make these tests whenever trouble is experienced with the mechanism.

To make a current flow test, the repairman or installer places a coin deflector, replaces the cover as was done in previous test, and requests the tester to call him. When tester calls, a coin is deposited and the tester establishes a 40 milliampere current flow through the coin collector circuit, first in one direction and then in the other. The coin should not be collected or returned on this current. If it is, it will be necessary to increase the tension on either or both springs until this requirement is met. The tester will then increase the current to 60 milliamperes in the return direction which should operate armature and return coin. It will then be necessary to again deposit coin so a similar test can be made to the collect side. If the mechanism fails to operate on this 60 milliampere current, the tension must be decreased until the coin is collected and returned satisfactorily, in which case it would be necessary to again make the 40 milliampere test to make sure tension has not been decreased too much.

TROUBLE ON 7A COIN COLLECTORS: The following section is not intended as a method of clearing trouble, but simply to aid the inexperienced employee in reasoning the causes of coin box trouble. The most frequent cause of coin box mechanical trouble is due to conditions that cause a failure of armature to operate, armature to stick, or release slowly after operation.

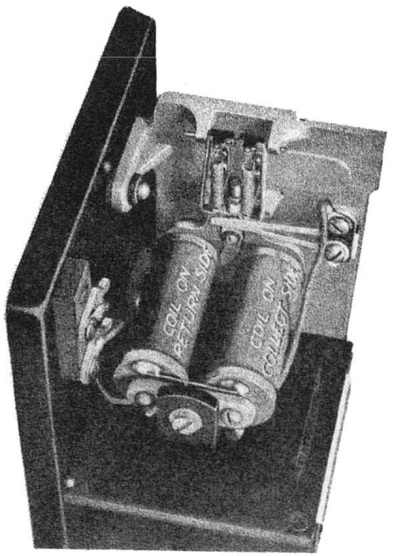

FIGURE 34

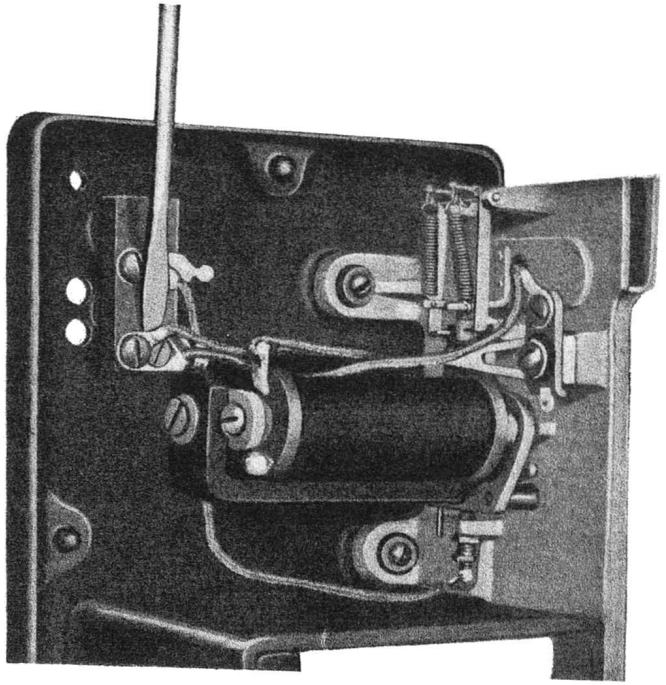

FIGURE 35

Some of the things that cause these conditions are as follows:

Operation

(a) Partially shorted coil.

(b) Weak permanent magnet.

(c) Too much tension on tension springs.

(d) Defective ground connection.

(e) Armature too far from coil.

(f) Permanent magnet too far from one coil.

(g) Armature binding.

(h) Wrong type of coil.

Armature Sticks In Operated Position

(a) Armature too high.

(b) Armature too low.

(c) Armature too close to coils.

(d) Not enough tension on tension springs.

A quick test to determine whether a coil is weak or partially shorted is to reverse or turn the coils over as illustrated in Figure 34. This can be done without disturbing the wiring by removing the permanent magnet and turning the coils over as a unit, this action placing the front coil on the return side and vice versa. If trouble is caused by the same coil after it has been reversed, it should be replaced.

The ground lead should be checked to make sure that a solid connection is made at the grounding point. A quick test may be made by placing a screwdriver across the binding posts (Fig. 35) which should cause a sharp click in the receiver if the ground is satisfactory. A test should be obtained from the test desk if there is any doubt that the ground connection is not satisfactory.

Final test on a coin box should always be made with the cover on, as the cover may affect the strength of the magnetic circuit; also as a means of determining that the coin gauge and coin receiver on the cover (Fig. 2) line up with the runway. A new coin should be used if possible in testing as it will indicate more easily a defective mechanism. Several successive operating tests, as previously described, should be made after clearing trouble to make sure that the coin box is operating properly.

TROUBLE CODE: The following chart shows the code numbers used in reporting the various cases of trouble on coin collectors.

CODE NO.	TROUBLE	CAUSE
1	Escutcheon	Broken coin gauge or coin receiver.
2	Side Plate or Runway	Bent side plate.
3	Permanent Magnet	Weak or misfit permanent magnet.
4	Foreign Material	Such as paper, dirt, pins, etc.
5	Defective Coin	Defective or wet coins or slugs.
6	Gong	Not used on 7A Coin Collector.
7	Coil	Open or shorted coil.
8	Tension Spring	Tension spring out of adjustment.
9	Coins piled in Cash Box	
10	Full Coin Box	
11	Armature Adjustment	
12	Restoring Arm Adjustment	Not used on 7A Coin Collector.
13	Hopper	Not used on 7A Coin Collector.
14	Contact Spring	Contacts or contact spring out of adjustment.