

# FIELD MAINTENANCE OF NO. 12-TYPE PRINTER SET AND ASSOCIATED APPARATUS

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## SCOPE

These specifications are intended to serve as a field handbook in the work of maintaining No. 12 Type page printers. It is assumed that those using these specifications will be familiar with the operation of the apparatus and the method of disassembling and assembling it. The specifications therefore contain only the data necessary in adjusting apparatus at a printer station and other information required in the field.

## TOOL KIT

It will normally be found desirable to carry a tool kit containing the following:

### Telephone tools

- Electric soldering copper
- 5" diagonal pliers
- 6" side-cutting pliers
- Long nose pliers
- 4" regular screwdriver
- 6½" cabinet screwdriver
- 3½" cabinet screwdriver
- Tack or riveting hammer
- Lineman's knife
- Portable light or flashlight
- 6" flat file
- No. 7 sash tool (round brush)

### Printer tools (Western Electric Co. ordering number)

- \*No. 46 tool, wrench for acorn nuts on No. 7114 (M) motor-generator set
- No. 62 gauge, spring balance 0-700 grams
- No. 70 gauge, spring balance 50-0-50 grams
- No. 96 tool, angle screwdriver
- No. 10-A tuning-fork, for checking distributor speed
- No. 150 tool, test lamp handles
- No. 172 tool, push hook for springs
- No. 173 tool, pull hook for springs
- \*No. 309 tool, for use in reassembling No. 7114 (M) motor-generator set

### Printer tools (Morkrum-Kleinschmidt Co. ordering number)

- 1—4840 (M) wrench (for ¾" and ⅝" heads)
- 1—4839 (M) wrench (for ½" and ⅞" heads)
- 2—4838 (M) wrench (for ⅞" and ⅜" heads)

\*Required only where stations using the No. 7114 (M) motor-generator set are involved.

## TOOL KIT

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- 2—138-36 (M) wrench (for  $\frac{1}{4}$ " and  $\frac{3}{8}$ " heads)
- 2—138-128 (M) wrench (for  $\frac{3}{8}$ " heads)
- 1—138-23 (M) socket wrench (for  $\frac{3}{8}$ " head)
- 1—138-22 (M) special screwdriver
- 1—138-137 (M) spring bender
- 1—138-139 (M) carborundum stone, for governor contacts
- 1—138-44 (M) .004" gauge
- 1—138-125 (M) .010" gauge
- 1—4873 (M) .015" gauge
- 1—138-126 (M) .020" gauge
- 1—4874 (M) .030" gauge
- 1—72003 (M) contact-adjusting tool

**Note:** If a complete set of tools for maintaining No. 10-A printer sets is available, it is not necessary to order either the Western Electric or Morkrum-Kleinschmidt printer tools listed above except the five thickness gauges, the carborundum stone and, where a No. 7114 (M) motor-generator is used, the No. 46 and 309 tools.

### Spare Parts

The No. 12-C package of small parts together with any additional parts called for in standing instructions.

### Miscellaneous supplies

- 1 Bell System short-handled typewriter brush
- 1 No. 1-A burnisher
- Veedol medium cup grease
- 1 No. 522-J pocket oiler filled with a medium light oil such as "Oildag P-2" or Mobiloil "Arctic."
- Small container filled with carbon tetrachloride
- Pieces of No. 00 sandpaper
- Piece of solder
- Piece of cheesecloth
- Roll of friction tape
- Bell System ribbon for L. C. Smith typewriter
- 1 Code No. KS-5000 E. Edelman's "Gem" oil and grease gun (fill at shop with "Oneida" grease) required only for sets operating on alternating current power supply and using the No. 7114 (M) motor-generator set.

Optional (for use where it is desirable to check line current or control circuit current at subscribers' stations)

- 1 Weston Model 280 single range milammeter, scale 0-75 mil-amperes.
- 1 Weston 280 leather case  
or
- 1 Weston Model 280 triple range volt-ammeter, scale 150-15-1.5 volts and 15-1.5-.15 amperes.
- 1 Weston Model 280 leather case.

## MAINTENANCE ROUTINES

At each maintenance visit, whether to clear a reported trouble or to make a routine inspection, the work outlined below should be done. Routine inspections (visits made to a station specifically for inspection at shorter intervals than one month) should be made only as required by standing instructions. A thorough check of the apparatus should be made at approximately monthly intervals, as specified below, for stations operating on an eight-hour steady traffic basis.

When a visit is made to a station to clear a trouble close to the time of a routine inspection or a monthly inspection, the work specified below should be done after the trouble is cleared. The next inspection may then be omitted.

When any adjustments are checked they should be made to conform to the standard adjustments given later in these specifications. Provided the apparatus is operating satisfactorily, adjustments other than those specified should not be checked. **Do not** remove any spring to check its tension unless the machine is in trouble.

### NO. 12-A PRINTER

#### At Each Maintenance Visit

1. Check the printing, replacing the ribbon if necessary. (The operator should normally take care of replacing ribbons.) See that the ribbon oscillator is working properly in its guide and that the ribbon is feeding correctly.
2. Check strength of printing blow. Make sure that the action is being secured by the striker cam and not by the safety cam.
3. Clean the type if the operator does not do this.

#### Monthly Inspection

At monthly intervals the following should be done in addition:

1. Lubricate all bearing surfaces as called for in the lubrication chart following this section.
2. Inspect the motor commutator and brushes for wear, noting if the brush spring tension is correct, and that the brush has free movement in the holder. Clean the commutator and replace the brushes if necessary.
3. Check the operation of the air cushion stop for the carriage and adjust if necessary.
4. Inspect the printing to see if it is necessary to have the type realigned.
5. **Do not** oil the type bars or selector plungers.

**NO. 12-AL OR 12-AH KEYBOARD DISTRIBUTOR**

**NO. 12-AL OR 12-AH RECEIVING DISTRIBUTOR**

**At Each Maintenance Visit**

1. Check the speed with a No. 10-A tuning-fork, both for rate and constancy. Readjust governor if speed is too fast or too slow. (Not more than 5 black spots should pass a given point in 10 seconds.) Adjust when distributor motor is warm, if possible. If speed is variable, clean governor contacts, governor slip rings, governor brushes, distributor motor commutator, and distributor motor brushes.

**Monthly Inspection**

At monthly intervals the following should be done in addition:

1. Lubricate as specified in the lubrication chart following this section.
2. Inspect the motor commutator and brushes for wear, noting if the brush spring tension is correct and that the brush has free movement in the holder. Clean the commutator and replace brushes if necessary.
3. Inspect the No. 4642 felt washer adjacent to the 6th pulse contact for wear and permanent compression, making sure that there is clearance between the 4644 washer at the end of the receiving cam drum and the 6th pulse contact.

**KEYBOARD MECHANISM**

**At Each Maintenance Visit**

Check operation with "Line-Test" key in "Test" position to see that keyboard transmits all letters and characters properly.

**Monthly Inspection**

At monthly intervals the following should be done in addition:

Lubricate as specified in the lubrication chart following this section.

**LINE RELAY OR CONTROL RELAY**

**Do not** clean the relay contacts or change the adjustment of any line relay or control relay unless trouble is being experienced which is apparently due to faulty relay operation at the time of test.

## NO. 7114 (M) MOTOR-GENERATOR SET (Single-Unit Two-Bearing)

### At Each Maintenance Visit

Start and stop the motor-generator, watching its performance carefully. If it fails to start normally or does not run quietly, investigate and clear the trouble.

### Monthly Inspection

At monthly intervals the following should be done in addition:

1. Inspect the commutator for sparking, wear of commutator, length of brushes and ease of movement of brushes in brush holders.
2. Clean the commutator if this is required.
3. Clean the starting mechanism if this is required.
4. Wipe off all of the exterior surfaces of the machine with cheesecloth. This should be done only when the machine is idle.  
**Do not use cotton waste.**

**Note:** Lubrication is required only once every six months.

### Overhauling

Once every eighteen months disassemble the machine and thoroughly clean it as outlined later under the maintenance information. This work should preferably be done in a printer shop rather than in the subscriber's office.

## NO. 71508 (M) AND NO. 71510 (M) MOTOR-GENERATOR SET

### At Each Maintenance Visit

Start and stop the motor-generator, watching its performance carefully. If it fails to start normally or does not run quietly, investigate and clear the trouble.

### Monthly Inspection

At monthly intervals the following should be done in addition:

1. Lubricate as specified in the lubrication chart following this section.
2. Inspect the commutator for sparking, wear of commutator, length of brushes and ease of movement of brushes in brush holders.
3. Clean the commutator if this is required.
4. Clean the starting mechanism if this is required.
5. Wipe off all of the exterior surfaces of the machine with cheesecloth. This should be done only when the machine is idle. **Do not use cotton waste.**

## TWO-UNIT FOUR-BEARING MOTOR-GENERATOR SET WITH FORT WAYNE BOX-TYPE PANEL

### At Each Maintenance Visit

1. Feel the bearings to see that they are not unduly warm.
2. For a machine equipped with oil rings, inspect the bearings to make sure that the oil rings are carrying at least a thin film of oil.
3. Check the generator voltage. It should be 115 volts with one printer running when the motor-generator is cool. (That is, when it has just been started after several hours' shutdown.) Always make sure that printer is disconnected before starting motor-generator.

### Monthly Inspection

At monthly intervals the following should be done in addition:

1. Lubricate as specified in the lubrication chart following this section.
2. Inspect the commutator for sparking, wear of commutator, length of brushes and ease of movement of brushes in brush holders.
3. Clean the commutator if this is required.

## LUBRICATION CHART

**Note:** In lubricating small parts apply only a single drop of oil so that the oil remains on the part and does not flow off. Too much oil will give unsatisfactory results.

### NO. 12-A PRINTER

#### Oil Cups on Printer

Fill with a medium light oil such as Oildag P-2 or Mobiloil "Arctic." For new printers placed in service or if new wicks are installed in the oil cups, fill again after the first two weeks' service.

#### Motors Equipped with Grease Cups

Fill cups with Veedol medium cup grease. Test wicks for free movement in cups. If wicks are hard, tap with a screwdriver handle and apply medium light oil to soften them. See that wicks touch the shaft.

### **Motors Equipped with Waste-packed Bearings**

Apply six to ten drops of oil to each bearing by means of the oilhole provided for this purpose. In doing this, tilt printer unit so that the oil flows into the bearings.

### **Typebars and Typebar Ball Bearings**

Do not apply oil or lubricant of any kind.

### **Selector Plungers**

Do not apply oil or lubricant of any kind to selector plungers.

### **Spacer Cut-out Lever**

Do not apply oil or lubricant of any kind to spacer cut-out lever.

### **Carriage Return Drum Spring**

Apply a few drops of medium light oil.

### **Gear Teeth**

Apply Veedol medium cup grease sparingly.

### **Carriage Return Spring**

Apply a few drops of medium light oil.

### **Dash Pot Plunger**

Lubricate with medium light oil.

### **Anchors for Heavy Springs**

Apply Veedol medium cup grease.

### **All Other Bearing Surfaces Not Listed Above**

Apply a few drops of medium light oil.

**NO. 12-AL OR NO. 12-AH KEYBOARD DISTRIBUTOR**

**NO. 12-AL OR NO. 12-AH RECEIVING DISTRIBUTOR**

### **Felt Friction Clutch Washers**

Apply a few drops of medium light oil. When new, these washers should be given more liberal and frequent lubrication for a time until they are well soaked with oil.

### **Motor Shaft Worm and Gear Teeth**

Apply Veedol medium cup grease sparingly.

### **Motor Grease Cups**

Fill with Veedol medium cup grease. Test wicks for free movement in cups. If wicks are hard, tap with a screwdriver handle and apply medium light oil to soften them. See that wick touches the shaft.

### **Lower Pivoting Pin of Start Magnet Armature**

Lubricate sparingly with medium light oil.

### **Thrust Bearing (Front Bearing) of Keyboard Distributor**

Apply a few drops of medium light oil to the front bearing of the sending camshaft.

### **Distributor Camshafts**

Apply a drop or two of medium light oil in the oilholes provided and also to the bearings.

### **All Other Bearing Surfaces Not Listed Above**

Apply a few drops of medium light oil.

## **KEYBOARD MECHANISM**

### **Bearing Surfaces of Keys**

Apply Veedol medium cup grease sparingly.

### **All Other Bearing Surfaces**

Oil sparingly with medium light oil.

## **LINE RELAYS OR CONTROL RELAYS**

**Do not** apply oil or lubricant of any kind.

## **NO. 7114 (M) MOTOR-GENERATOR SET**

### **(Single-Unit Two-Bearing)**

Once every six months lubricate the bearings by means of a grease gun inserted in the grease plug hole on the top of each bearing housing. "Oneida" grease should be used. The use of any other

grease or of any oil may cause trouble. The bearing chamber should be filled about one-third full of grease, an amount corresponding to approximately .2 cubic inch of grease for each bearing. This amount of lubricant is furnished by two-thirds of a turn from a Western Electric Company Code No. KS-5000 E. Edelman's "Gem" oil and grease gun. Care should be taken that no more than the amount of grease specified is used. The grease should be packed into the gun without air pockets. Turn back the handle of the grease gun to remove the pressure before removing the gun from the bearing, as otherwise the grease will continue to ooze from the gun. See that no dirt gets into the bearings and that the screw plugs are replaced in the holes after lubricating the bearings.

**Do not** use any lubricant on the commutator surface.

**Do not** oil the starting mechanism.

Once every eighteen months the machine should be disassembled and cleaned as outlined later under "Adjustments, No. 7114 (M) Motor-Generator Set."

#### **NO. 71508 (M) OR NO. 71510 (M) MOTOR-GENERATOR SET**

Apply six to ten drops of medium light oil to each bearing by means of the oilholes provided for this purpose.

**Do not** use any lubricant on the commutator surface.

**Do not** oil the starting mechanism.

#### **TWO-UNIT FOUR-BEARING MOTOR-GENERATOR SET WITH FORT WAYNE BOX-TYPE PANEL**

**For a machine equipped with oil rings—**

Make sure that overflow on each bearing is not plugged up.

Replenish the oil in the bearings if necessary, filling to the overflow point. Use a good grade of dynamo oil, such as that used for power machines in central offices.

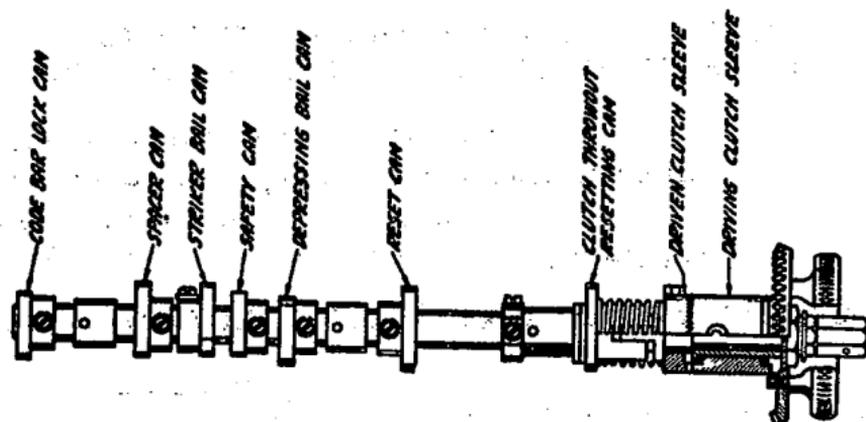
Every six months drain the oil and refill to overflow point with kerosene. Let this stand for about five minutes, then run the machine for five minutes. Stop the machine, drain the kerosene thoroughly and refill to overflow point with a good grade of dynamo oil.

When the machine is located in a dirty or dusty place, the bearings should be cleaned out more frequently.

**For a machine equipped with waste-packed bearings—**

Apply six to eight drops of medium light oil to each bearing by means of the oil pipe fitted for this purpose.

## ADJUSTMENTS, NO. 12-A PRINTER



*Figure 1—Main Shaft and Clutch Mechanism*  
(Looking at Printer from Rear)

For maintenance purposes it is very often desirable to set up a character combination in the printer unit and rotate the main shaft slowly by hand in order to observe the operation of the printer. This can be done readily by depressing the proper selector magnet armatures for the combination desired by pressing on the armature screws and then tripping the sixth pulse magnet armature, which will permit the main shaft to be rotated by turning the hand wheel fastened to the driving side of the clutch. At the completion of a revolution it will be noticed, however, that the driven portion of the clutch does not throw out, since in operation this depends on the momentum of the parts. The clutch teeth will grate on each other if the hand wheel is turned further. The clutch may be thrown out, however, by pressing down on the spacer rocker.

In the adjustments which follow, the spring tensions for the heavy springs need not be accurate; the values, however, are given for information. Many of the adjustments can only be made with the platen casting removed from the printer unit. This is removed by unscrewing the four mounting screws in its top.

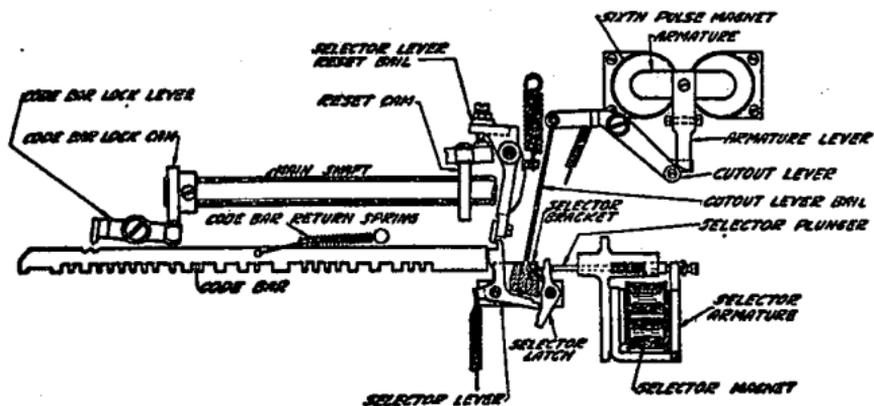


Figure 2—Selector Mechanism

### Selector Unit

In order to measure the tension of the springs associated with the selector unit, this unit should be removed by unscrewing the three screws which mount it on the under side of the printer.

The tension of a **selector latch spring** is measured by holding the selector lever in the unoperated position against the casting and pushing against the extreme top end of the latch, as shown in Figure 3. The scale should read from 3 to 3½ ounces, or 85 to 100 grams when the latch begins to move.

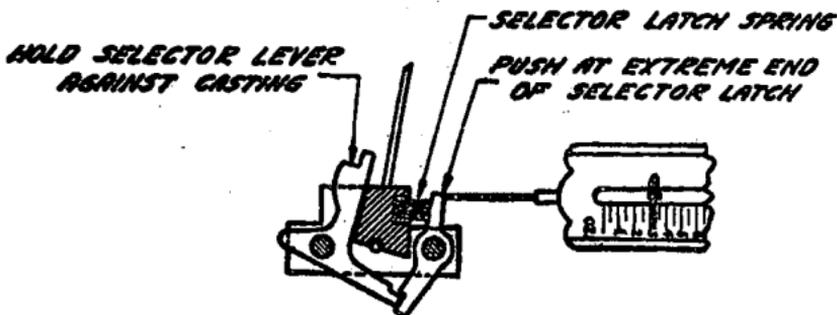


Figure 3

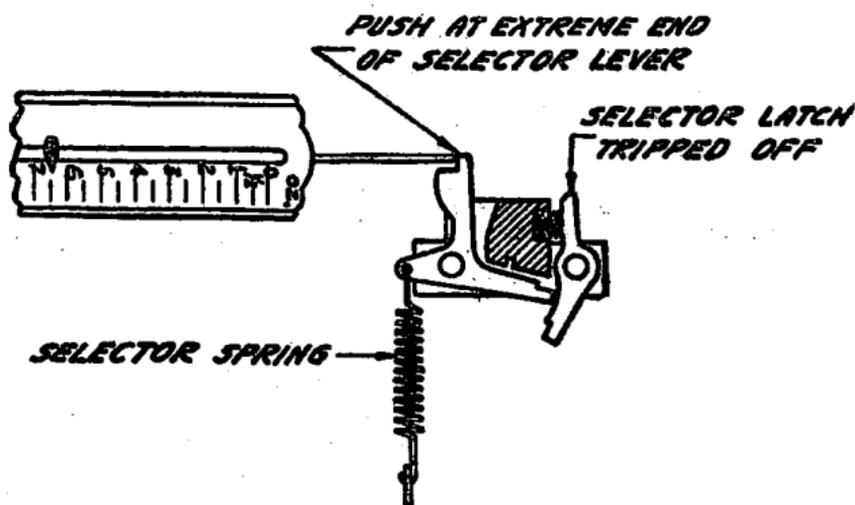


Figure 4

The **selector lever** spring tension should be such that when the selector lever is in its tripped-off position it will require a push of approximately 6 to 7 ounces, or 170 to 200 grams, at the extreme upper end of the lever to just move it. (See Fig. 4.)

To measure the **selector plunger spring** tension the selector magnet must be removed. The spring balance should read approximately  $\frac{1}{2}$  ounce, or 15 grams, when the end of the plunger is pushed in flush with the guide.

Before the next two adjustments are made the selector unit should be replaced in the printer, care being taken not to bend the selector plungers.

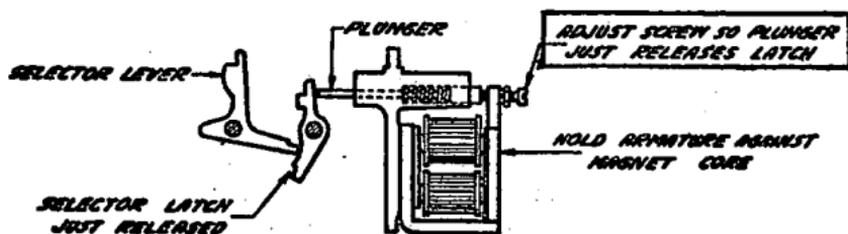


Figure 5

The adjustment of the **selector magnet armature screws** should be such that when the armature is held firmly against the magnet core the plunger will just release the selector latch. After this adjustment is made the lock nut should be tightened. (See Fig. 5.)

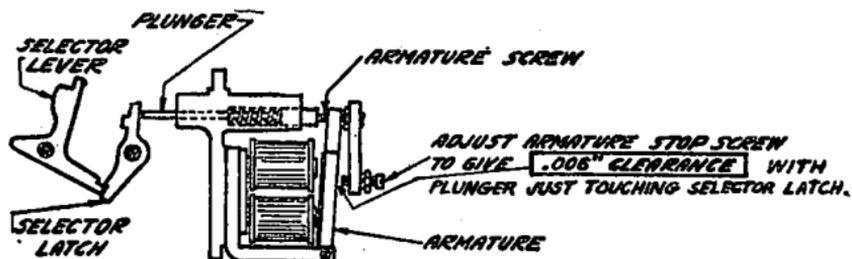


Figure 6

The **selector armature stop screws** should be adjusted so that with the plunger just touching the selector latch there will be a clearance of approximately .006" between the armature and the stop screw. (See Fig. 6.)

With the main shaft turned so that the reset bail roller is on the lowest part of the cam, set the **adjusting screw** on the reset bail so that the selector lever is reset with an overtravel of .010" at the notch in the selector latch. This adjustment is indicated in a note on Fig. 7.

When the previous adjustment has been made, rotate the main shaft until the roller is on the highest part of the cam and trip the selector latches so as to release the selector levers. There should be not less than .010" clearance between the selector levers and the reset bail blade. (See Fig. 7.)

The spring tension of the **selector lever reset bail** should be such that with the roller on the high part of the cam (main shaft clutch disengaged), as shown in Fig. 7, it will require a pull of approximately 10-12 pounds to move the bail. The spring balance should be hooked under the upper end of the casting and pulled upward.

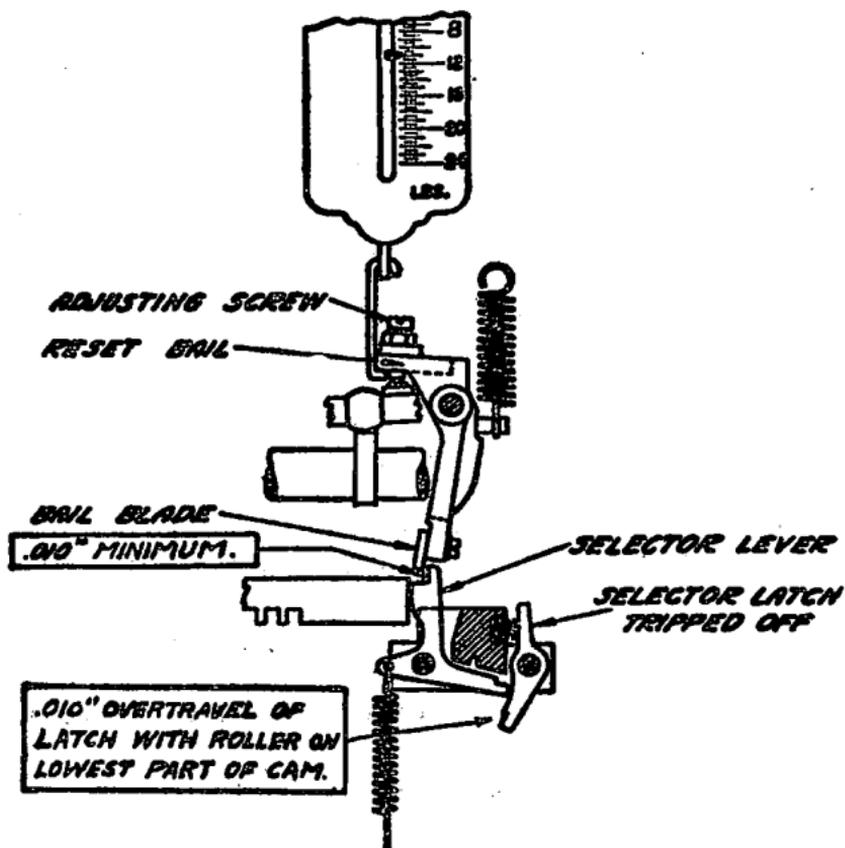


Figure 7

### Sixth Pulse Unit

The sixth pulse magnet armature when held operated should clear the clutch throwout lever by from .010" to .015", the throwout lever being in its "up" position, as shown in Fig: 8. The clearance is varied by adding or removing shims between the armature and armature lever.

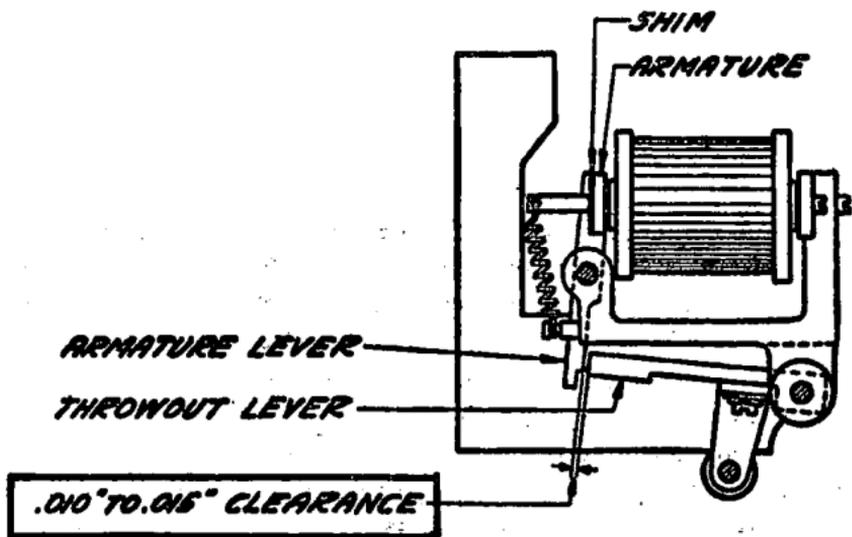


Figure 8

To check the **sixth pulse armature spring**, unhook it from the armature and pull upward with the balance in the eye of the spring until the eye is opposite the post or spring bracket (not shown in the figure) from which it was unhooked. The tension should be between 8 and 9 ounces, or 225 to 255 grams.

The **sixth pulse cutout lever screw** should be adjusted so that when the sixth pulse magnet armature lever and the clutch throwout

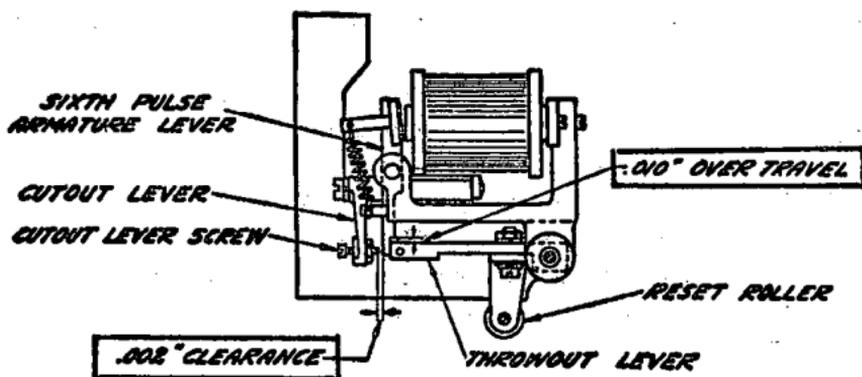


Figure 9

lever are engaged and the sixth pulse cutout lever is in its normal position there will be a clearance of not more than .002" between the armature lever and the cutout lever screw. (See Fig. 9.)

The **sixth pulse cutout spring** tension should be approximately 1 ounce, or 25 to 30 grams, when it is unhooked from the cutout lever and extended until the spring eye is opposite the hole in the lever from which it was unhooked. The lever should be held in a position which prevents the sixth pulse magnet armature from operating.

Adjust the **cutout screw plate** so that the sixth pulse armature is locked by the cutout lever when in its unoperated position just as reliably and with as much margin as it is unlocked by the cutout lever when the latter is operated by tripping the selector unit.

### Clutch and Gears

The **main clutch spring** pressure should be such that it will require a pressure of  $4\frac{1}{2}$  to  $5\frac{1}{2}$  pounds to move the driven portion of the clutch from the driving part. To measure this the main shaft may be rotated about 90 degrees from the stopped position so as to bring the projection on the driven portion of the clutch into a position convenient for attaching a spring balance.

The **clutch throwout lever travel** is adjusted by positioning the reset cam roller bracket which is screwed to the throwout lever. (See Fig. 9.) The overtravel of the throwout lever when restored should be about .010". In order to gain access to the bracket for adjustment it is first necessary to remove the selector magnet unit.

The tension of the **clutch throwout lever spring** is measured by unhooking the spring from the end of the sixth pulse armature bearing and pulling upward until the spring is normally extended. The tension should be from  $2\frac{1}{2}$  to 3 pounds, or 1100 to 1400 grams.

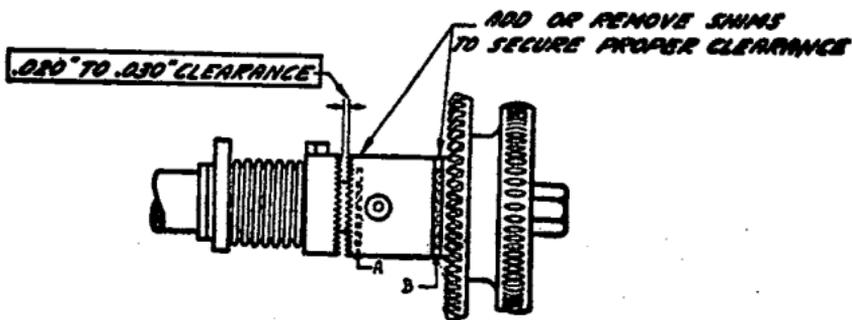


Figure 10

The **clutch teeth clearance** should be from .020" to .030" when the clutch is fully disengaged, as shown in Fig. 10. Make sure that the clutch is fully disengaged by pressing down on the spacer rocker, thus forcing the roller into the indent in the spacer cam. To secure the proper clearance add or remove shims at "A" in the figure. If the adjustment of the gears is satisfactory, shims removed at "A" should be inserted at "B" and vice versa, in order to preserve this adjustment.

The **driving gear and motor pinion** should be set so that the teeth engage over their whole length with a slight amount of play between them. The position of the pinion can be adjusted along the motor shaft by loosening the clamping screw. To secure the proper amount of play between the teeth, shims may be added or removed from the space shown at "B" in Fig. 10. To do this it is necessary to remove and disassemble the driving clutch and gear. An alternate adjustment is to vary the position of the motor if this is possible.

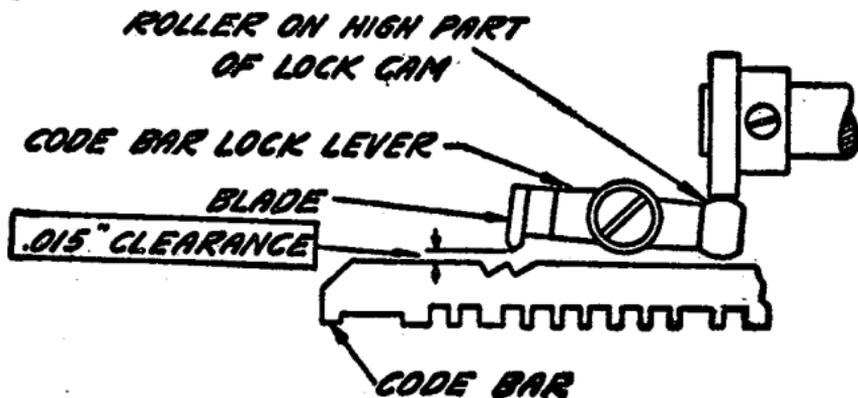


Figure 11

## Code Bars

The **code bar lock lever blade**, when the roller is on the high part of the cam, should clear the code bars by from .012" to .018" as shown in Fig. 11. This is given for information only since adjustment in the field is not practicable except by grinding the blade in case of too small clearance.

The tension of the **code bar lock lever spring** should be such that the lever blade when in the code bar notches will require a pull of between 3 and 4 pounds to move it when the spring balance is hooked under the blade and pulled upward.

The tension of the **code bar return springs** is most easily measured by turning the printer over frontward so that the code bars are horizontal one above the other and reaching in between the push bars from the under side with a No. 62 gauge. The gauge may be hooked on one of the code bar notches and pushed sidewise. It should require a push of  $3\frac{1}{2}$  to 4 ounces or 100 to 115 grams to move a code bar.

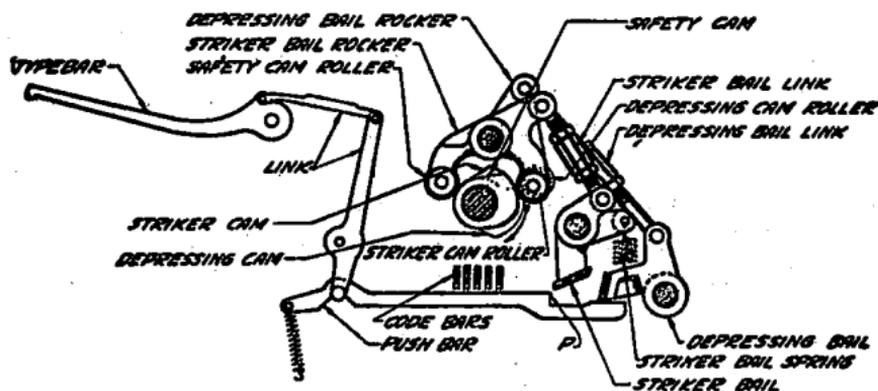


Figure 12—Striker and Depressing Bail Mechanism

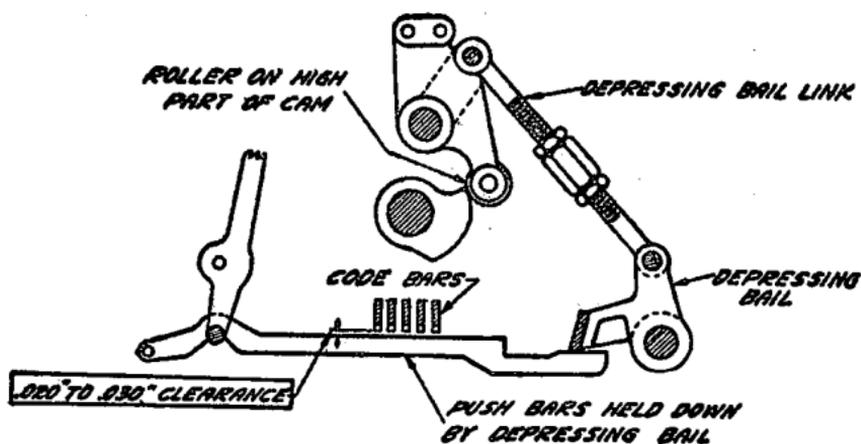


Figure 13

### Depressing Bail

The **depressing bail link** is adjusted by first turning the main shaft until the clutch is fully disengaged. The depressing bail roller will then be on the high part of its cam and the bail blade will be depressing the push bars. There should be from .020" to .030" clearance between the push bars and the code bars. The proper clearance is secured by adjusting the length of the depressing bail link. (See Fig. 13.)

The tension of the **depressing bail spring** should be such that with the depressing bail roller resting on the low part of the cam a spring balance hooked in the front screw hole of the ribbon throw cam on the depressing bail rocker will require a horizontal pull of from 22 to 32 ounces or 625 to 900 grams toward the front of the printer in order to just move the bail.

### Push Bar Spring Tensions

Before checking the tensions of push bar springs the main shaft should be turned so that the depressing bail clears the push bars and allows them to rest against the code bars. The tension of the push bar springs may then be measured by hooking a spring balance either in the corner of the push bar notch which is engaged by the striker bail or directly in front of the depressing bail as stated in the table below and pulling perpendicularly to the push bar so as to just move it away from the code bars.

The tensions should be as follows:

Name Push Bar Spring	Perpendicular Pull Required to Move Bar	Place Where Balance Is Hooked to Bar
Character	3¼ to 4¼ oz. or 95 to 120 grams	Corner of push bar notch
Shift	6½ to 7½ oz. or 185 to 210 grams	Directly in front of de- pressing bail
Unshift or Release	2½ to 3½ oz. or 70 to 100 grams	Directly in front of de- pressing bail
Bell	3½ to 4½ oz. or 100 to 125 grams	Directly in front of de- pressing bail
Line Feed	4½ to 5½ oz. or 130 to 155 grams	Directly in front of de- pressing bail
Carriage Return	12 to 18 oz. or 340 to 510 grams	Directly in front of de- pressing bail

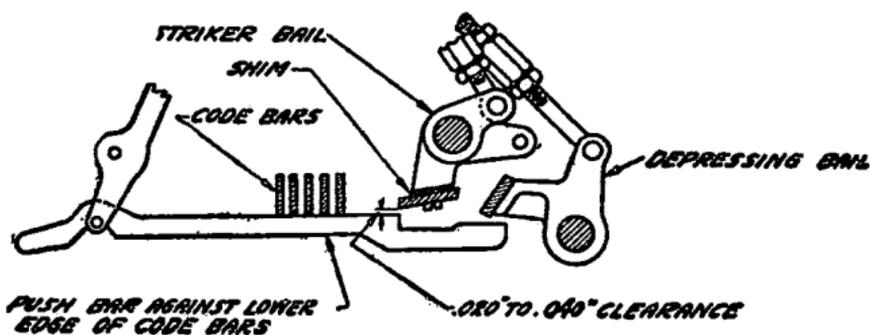


Figure 14

### Striker Bail

Before adjusting the **striker bail blade** turn the main shaft until the depressing bail permits the push bars to rise and rest against the code bars. The upper edges of the push bars are now in line with the edge of the striker bail blade. There should be from .020" to .040" clearance between the edge of the push bar and the bail blade. If the clearance is not great enough, remove shims between the blade and casting. (See Fig. 14.) Changes in striker bail blade adjustments affect the typebar cut-off adjustments and may affect line feed and shift adjustments and these should be rechecked when changes in the blade adjustments are made.

To adjust the **striker bail link** the main shaft should be rotated until the clutch is fully disengaged. The striker bail roller will then be on the high part of its cam and the depressing bail will be holding the push bars down. There should be .030" to .040"

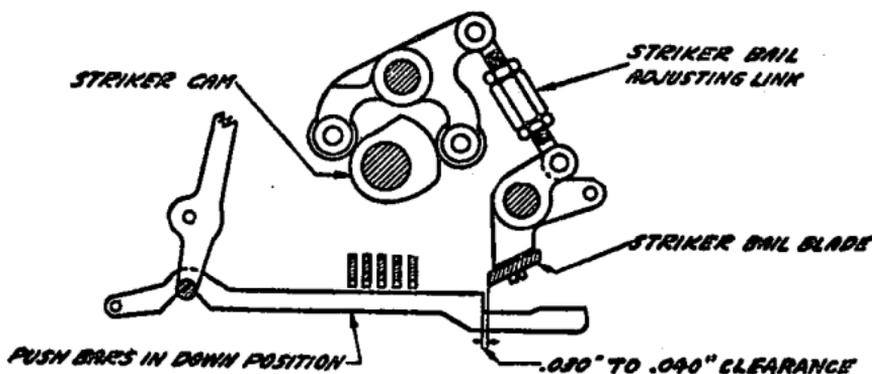


Figure 15

clearance between the edge of the striker bail blade and edge of push bar notch. The proper clearance is secured by lengthening or shortening the striker bail adjusting link. (See Fig. 15.)

The **striker bail spring** is adjusted for good printing by turning the adjusting screw on the left-hand rear side of the printer. The blow should be no stronger than necessary for clear printing, since an excessive blow wears the ribbon rapidly and may cause breakage of parts. An adjustment may be given as follows. Set up the "T" combination and turn the shaft slowly until the "T" bar just drops off the striker bail. A balance hooked over the striker spring post should record a pull of not more than 5 to 6 pounds to start the bail moving when pulling upward in line with the spring. Since this requires removal of the platen top, it may be more convenient to turn the printer over and pull on the other end of the spring until the bell crank moves from its stop.

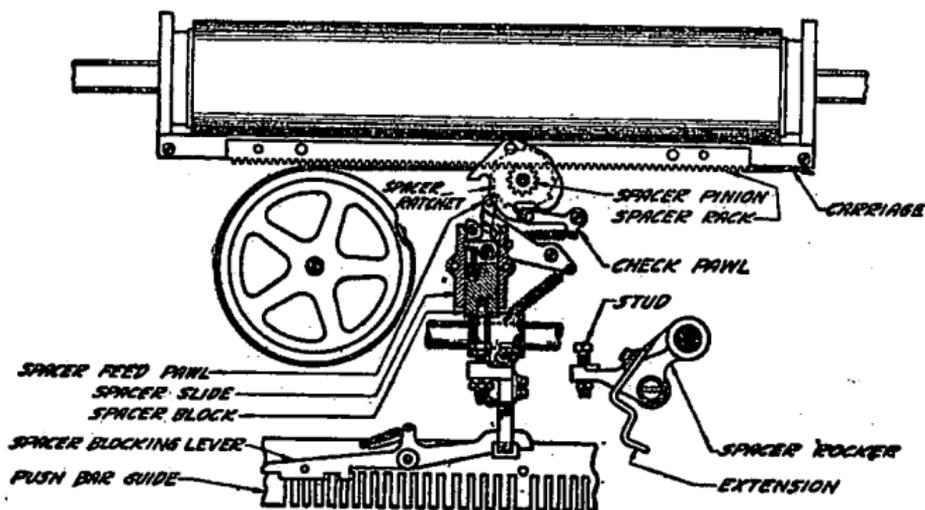


Figure 16—Spacing Mechanism

### Spacing Mechanism

The **spacer feed pawl spring** tension should be such as to require a pull of not less than  $\frac{1}{4}$  oz. or 7 grams at the pawl post to start the pawl moving away from the ratchet teeth.

The **spacer check pawl spring** tension is measured by holding the spacer block up so that the spacer ratchet notch is away from the point of the spacer ratchet and hooking the balance in the spring hole. It should require a pull to the right of approximately 2 ounces or 55 grams to just move the check pawl off the ratchet wheel.

The **spacer plunger spring** tension should be 20 to 22 ounces or 565 to 625 grams when the plunger is in its downward position and the spring is normally extended. This is best measured by removing the platen top from the printer and hooking a balance or gauge to the lower end of the spring and pulling until the tension is just removed from the spring anchor, as evidenced by the spring eye starting to move. The plunger should move freely in its slot.

Adjust the **spacer cutout lever** eccentric so that there is from .010" to .020" clearance between the stunt push bars and the cutout lever when the stunt push bars are resting on the code bars. (See Fig. 17.)

The **spacer cutout lever spring** can be checked by revolving the main shaft so that the spacer rocker extension is away from the cutout lever and hooking the spring balance in the hole near the left end of the lever. It should require a force of  $\frac{1}{2}$  to  $\frac{3}{4}$  ounce or 15 to 20 grams to move the lever.

The **spacer rocker extension** shown in Fig. 17 is blocked by the spacer cutout lever when any one of the stunt push bars is selected and this blocking action prevents the spacer rocker from operating. The adjustment of the spacer rocker extension should be such that after the eccentric is adjusted as outlined above, a .020" gauge inserted between the eccentric and the spacer cutout lever (point "A" in Fig. 17) will permit the spacer rocker extension just to pass through the slot. The extension may be shifted by loosening the clamping screw. When a stunt is operated the extension should be properly blocked by the cutout lever.

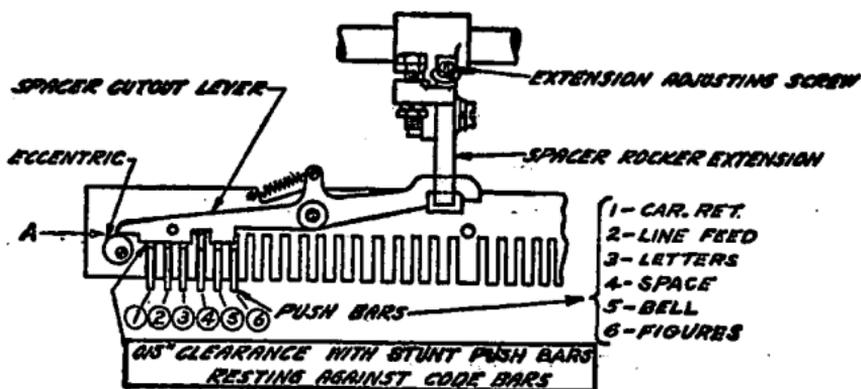


Figure 17

The **spacer adjusting screw** should be adjusted so that the feed pawl rotates the spacer feed ratchet far enough to engage the check pawl with an overtravel of .010" as shown in Fig. 18. To make this adjustment it is necessary to have the platen casting in place on the printer.

In cases where the **unshift on space feature** is not required, printers may be equipped with a small part or clip to prevent the space bar from entering the notches in the code bars. The clip is

slipped over the space bar and under the comb separating the pull bars in such a way that the space bar is restricted from entering the notches in the code bars when the "space" combination is set up. The printer will then unshift only on the "letters" selection.

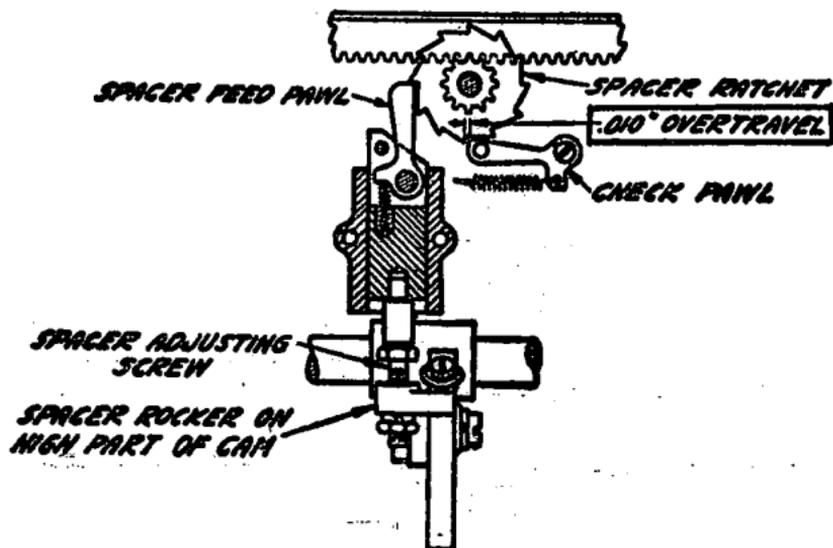


Figure 18

### Line Feed Mechanism

The line feed lever spring should have a tension such that 15 to 17 ounces or 425 to 480 grams are required to move the lever to a vertical position when a spring balance is hooked in the fork at its upper end and pulled backward perpendicular to the lever.

The line feed lever adjusting screw should be adjusted so that there will be a clearance of approximately .030" between the lever and the end of the screw, when the line feed combination is set up and the main shaft is rotated until the striker bail is just leaving the notch in the line feed push bar. (See Fig. 19.)

The line feed pawl is operated from the line feed lever through a line feed pawl lever spring, the function of which is to prevent breakage of parts should the platen become jammed. In such a

case the spring by extending takes up the motion which would be transmitted to the pawl. With the feed pawl in its operated position and the spring balance hooked to the post on the line feed pawl lever, it should require a pull, toward the rear of the printer, of 9 to 13 pounds to extend the spring. (See Fig. 19.)

The **line feed pawl lever eccentric stop screw** should be adjusted with the line feed detent removed and the line feed pawl lever held operated against the stop. There should be approximately .006" clearance between the line feed pawl check tooth and the ratchet tooth. The clearance between each tooth on the ratchet and the check tooth should be noted and the stop readjusted for the tooth with the smallest clearance. (See Fig. 19.)

Operate the line feed pawl lever until the tooth which showed the greatest clearance with respect to the pawl check tooth is next to pass the check tooth. Then with the line feed pawl held in the operated position and the platen shaft knob held in such a way that there is no clearance between the line feed pawl "feeding" tooth and the tooth on the ratchet, adjust the **line feed detent spring** so that the roller is in the hollow between two teeth. The roller of the detent spring should bear against the ratchet wheel with a force of from 6 to 7 pounds. (See Fig. 19.)

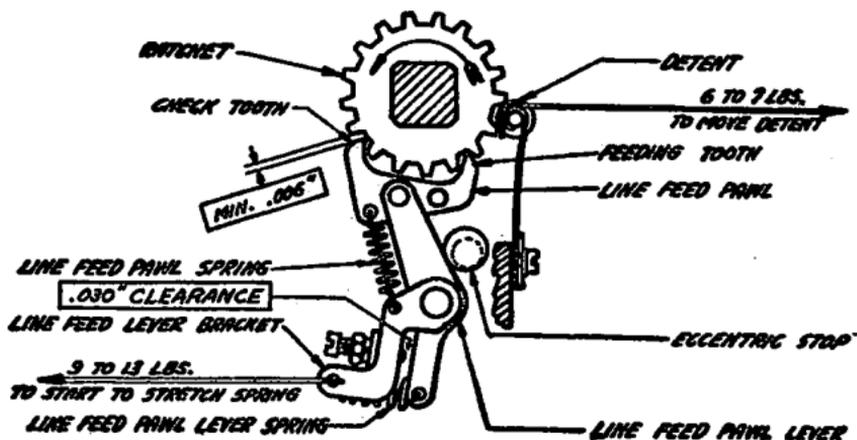
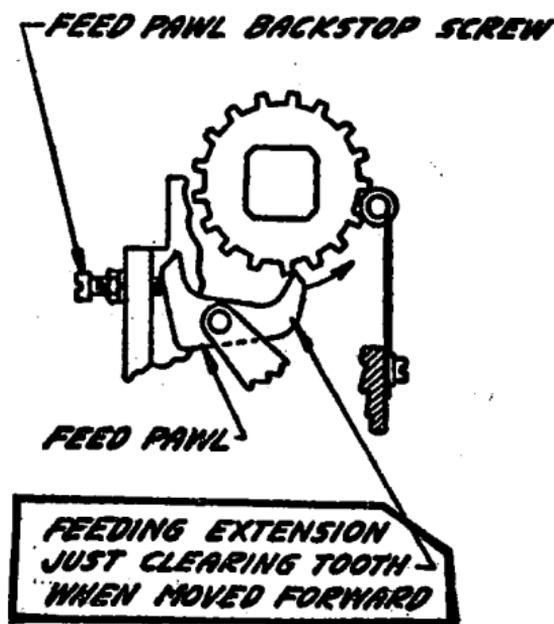


Figure 19

Adjust the **line feed pawl backstop screw** so that when the line feed lever is operated the feeding extension on the feed pawl just clears the tooth on the line feed ratchet behind the one it will next engage as shown in Fig. 20.

After all line feed adjustments have been made, it is well to check the clearance between the edge of the striker bail blade and the edge of the line feed push bar notch when the line feed combination has been set up and the main shaft rotated by hand to the point where the line feed push bar has just entered the notches in the code bars. If the clearance is not sufficient for reliable engagement of the push bar by the striker bail, check the adjustment of the backstop screw. If reliable operation does not result, this probably indicates trouble in the line feed shaft.



*Figure 20*

## Carriage Return Mechanism

The **carriage release arm** should be bent so that when the carriage is in the returned position the tooth of the lock pawl will clear the block on the carriage return link by .040".

With the carriage in the returned position there should be at least .010" clearance between the lock pawl and the anchor post for the lock pawl spring.

The printer should print exactly 72 characters per line before the carriage return link is moved sufficiently by its engagement with the stud on the carriage to prevent further spacing. This may be adjusted by bending the end of the carriage return link.

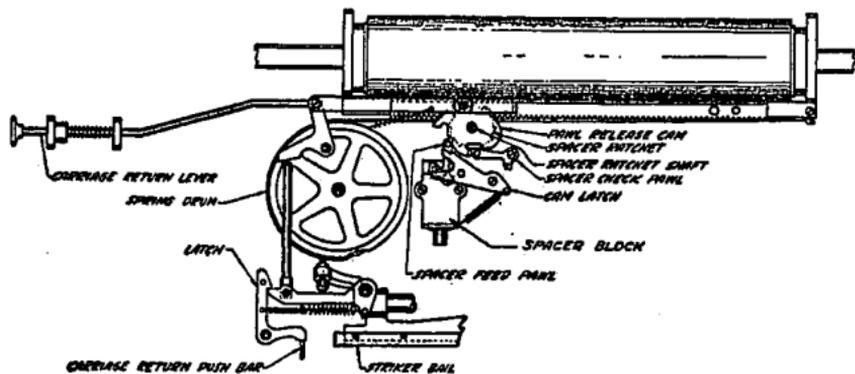


Figure 21—Carriage Return Mechanism

Adjust the **carriage return reset screw** in the striker bail casting extension so that the carriage return lever and latch engage with .020" overtravel when the striker bail is in its most forward position as shown in Fig. 22.

The **reset pawl spring** tension should be 1 to 2 ounces or 30 to 55 grams measured at the hole in the upper end of the pawl by pulling horizontally until pawl just starts to move. Release rod should be held down while taking this measurement.

The **release rod spring** tension should be 1¾ to 2 pounds or 800 to 900 grams measured by pushing down on top of release rod.

The tension of the **cam latch spring** should be 1½ to 2½ ounces or 45 to 70 grams measured with the spacer plunger in its downward position by hooking a balance or gauge over the notch in the upper extension of the latch and pulling vertically downward.

The **lock pawl spring** tension should be  $1\frac{1}{2}$  to  $2\frac{1}{2}$  ounces or 45 to 70 grams measured with the carriage in the returned position by hooking a balance or gauge in the spring hole of the pawl and pulling in line with the spring.

The **carriage return link spring** tension is measured by engaging the block on the link and pulling in line with the link. It should require from 3 to 4 ounces or 85 to 110 grams to start the link moving. This should be done after returning the carriage and then spacing one space.

It should require from 1 to 3 ounces or 30 to 85 grams to start the **manual carriage return push rod** moving after it has been adjusted, by positioning the collar on the rod, to have  $\frac{1}{16}$ " clearance between the end of the rod and the nut on the carriage return link.

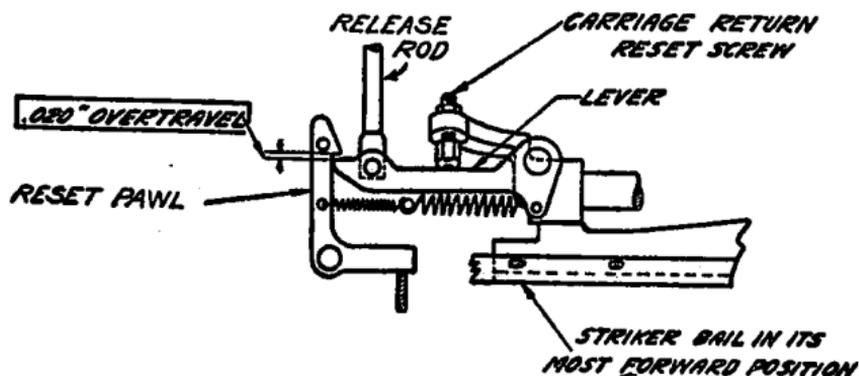


Figure 22

**Carriage return drum assemblies** are slightly adjustable in their mounting holes and should be positioned so that the plane of the drum is in line with the draw-strap in order that the strap will tend to wind centrally on the drum rather than to one edge where it may slip off. In cases where trouble is being experienced due to draw-straps slipping off the drum, the drum assembly should be moved to a better position.

The spring tension of the **carriage return drum spring** should be approximately 38-40 ounces or 1080-1130 grams, measured when the carriage is fully returned to its right-hand position for the printing of a new line, by hooking a spring balance or gauge in the hole just above the thumbscrew of the paper tearing edge and pulling to the left in line with the travel of the carriage. The reading should be taken at the point where the carriage first starts to move. The carriage return drum spring is adjustable by an escapement on the rear of the drum.

The **dashpot** or air buffer is adjusted in conjunction with the carriage return spring. The valve screw in the end of the dashpot

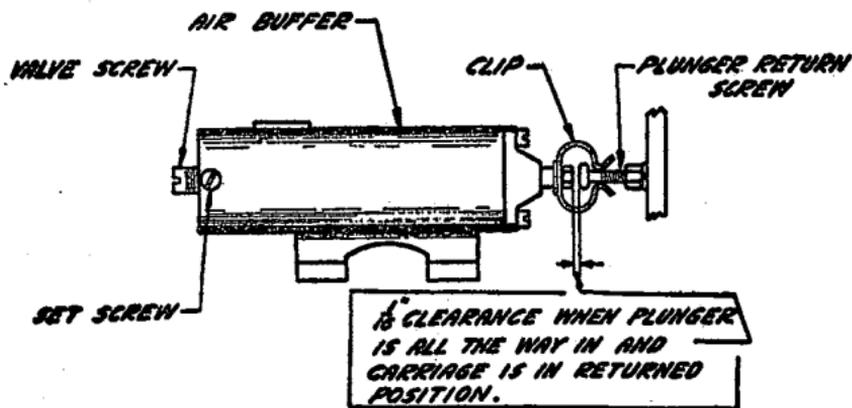


Figure 23

is locked by a set screw and shall be adjusted so that the carriage is stopped without bouncing and with minimum shock. (See Fig. 23.) The **plunger return screw** should be adjusted so that when the carriage is in its returned position and the plunger is pushed all the way in, there will be a clearance of  $\frac{1}{16}$ " between the end of the screw and the nut on the end of the plunger. The **clip** should be adjusted so that it engages the plunger return screw properly to pull the plunger out when the carriage spaces for the next line after being returned.

At the right-hand end of the platen is provided an adjusting collar to vary the returned position of the carriage. This collar, which strikes a washer on the platen shaft after each carriage return, is kept from turning by a clamping screw through the split housing

into which it is screwed. It should be adjusted so that the first and second letters of a line are not printed either too close together or too far apart. When the collar is adjusted so that the letters are evenly spaced at the beginning of the line, the clamping screw should be tightened. After a large movement of the adjusting collar for varying the position of the carriage, the space adjustment should be checked.

### **Ribbon Handling Arrangement**

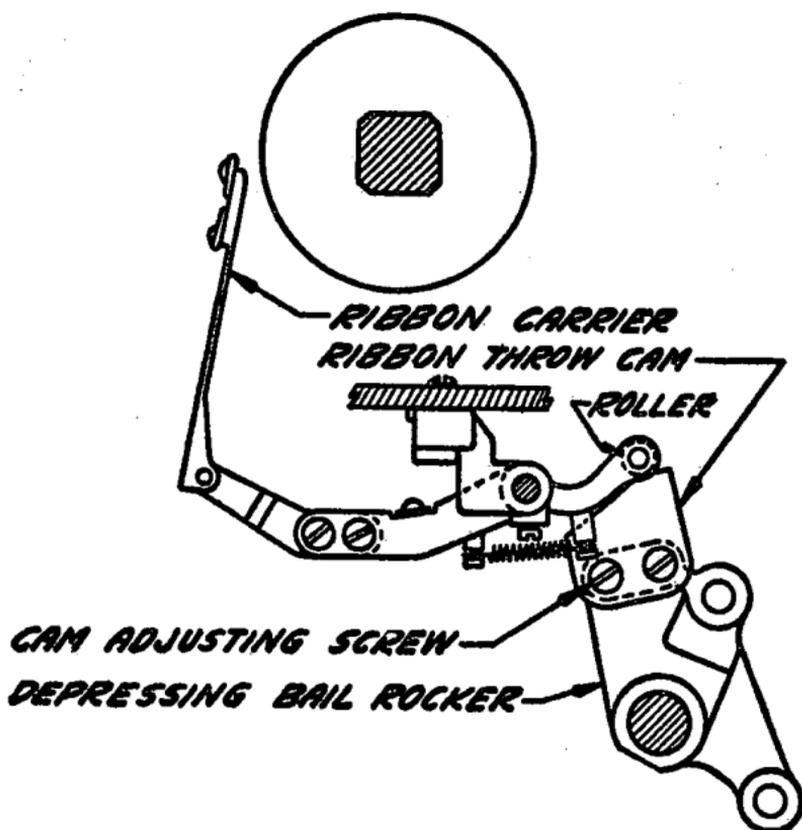
In late printer units the ribbon is fed by means of a pawl actuated from the spacer block of the spacing mechanism. This pawl acts on a ratchet wheel on which a holding pawl also bears. Both the **ribbon feeding and holding pawls** should have sufficient tension to bear firmly against the ratchet wheel and the edge of each pawl should be parallel with the edges of the teeth on the ratchet wheel. Aside from this the **feeding pawl** should require no adjustment. The **holding pawl** should be so adjusted that when the spacer block is actuated the ribbon feed ratchet wheel will travel one tooth plus an overtravel on the holding pawl of approximately  $\frac{1}{2}$  tooth at the instant the check pawl drops behind the tooth on the spacer ratchet. This adjustment can best be made with the printer top removed, actuating the spacer block by hand.

The **ribbon reverse gears** on the platen casting should mesh properly. They may be adjusted by loosening the set screws which hold them to the shafts.

The **ribbon reverse link detent** is adjusted by loosening its mounting screw and moving it to a position so that it fits snugly into the notches so as to keep the gears properly engaged.

The **ribbon reverse pawls** are adjusted with the ribbon spools removed. The right and left-hand eccentric stop plates beneath the spools should be adjusted in turn so that they will just permit the lower ends of their corresponding reverse pawls to engage the horizontal bevel gears between teeth when the reverse gears are out of mesh. Do not run the printer with both spools removed, as breakage of ribbon parts may result due to the gears at each end of the ribbon mechanism feeding in opposite directions at the same time.

With the ribbon adjusting lever in the extreme right-hand position (opposite stencil position) and the clutch disengaged, adjust the height of the **ribbon throw cam** so that the ribbon carrier will be



*Figure 24*

moved downward just far enough to bring the top of the ribbon below the bottom of the printed letter. The tilt of the cam should be such that when the ribbon carrier is up the type will strike the ribbon about  $\frac{1}{8}$ " from the edge.

The **ribbon carrier** or **ribbon actuating arm** is provided with an adjustable stop not shown in the figure for limiting the overthrow of this part when actuated by the ribbon throw cam. The threaded stud of the stop should be adjusted so that there will be a clearance of about  $\frac{1}{32}$ " between the head of the stud and the platen casting

when the ribbon adjusting lever or regulating lever is thrown to the stencil position. This will mean that the ribbon carrier can be moved just a trifle beyond the stencil position. This adjustment is more readily made with the platen top removed from the printer.

The **oscillator spring** tension should be such that it will require a force of  $2\frac{1}{2}$  to  $3\frac{1}{2}$  ounces or 70 to 100 grams applied to the screw of the oscillator stop to just start the ribbon carrier moving.

**To Change a Ribbon.** As in most typewriters, the **ribbon** is automatically fed from one spool to another and when the end is reached, it is automatically reversed by a special mechanism. The ribbon reverse may, if desired, be accomplished manually by moving a small knob at the upper left front of the machine from one side to the other. The ribbon should be changed when all of it is wound on the right-hand spool; if necessary this may be done manually by holding the manual ribbon reverse lever in the neutral position so as to free the spools and turning the right-hand spool by means of the small thumb wheel. When all the ribbon is wound upon the right-hand spool, the thumbscrew holding each ribbon spool in place should be removed and the ribbon spools lifted off. The end of the ribbon should be detached from the left-hand spool, and the old ribbon and the right-hand spool discarded. A new ribbon for an L. C. Smith typewriter should preferably be used. This type of ribbon is supplied on a right-hand spool. The end of the ribbon should be attached to the left-hand spool by hooking it over the small arrow point. Both spools should then be put in place on the machine and the nuts holding them replaced. When the ribbon is inserted in the ribbon guides, the replacement is completed. It should be noted that the right-hand spool unwinds in a clockwise direction and the left-hand spool in a counter-clockwise direction. If a ribbon for an L. C. Smith typewriter is not available, any standard  $\frac{1}{2}$ " typewriter ribbon of good quality may be used but it will have to be rewound from the spool on which it comes to one of the spools on the machine and both of the spools on the machine used with the old ribbon must be retained. A ribbon having an eyelet at the ends should have the ends cut off before being placed in service. A poor quality ribbon will tend to fray on the edges and will cause trouble in the reversing mechanism.

**Caution:** Do not operate the machine while both ribbon spools are removed, since this will result in breakage of parts in the ribbon feeding mechanism.

### **Ribbon Feeding Mechanism Formerly Used**

The ribbon feeding mechanism formerly used, which does not provide for continuous ribbon feeding, should be adjusted as outlined above, except that the first paragraph dealing with the feeding and holding pawls should be omitted.

### **Shifting Mechanism**

The first two of the four following adjustments should be made in the sequence given.

With the type-basket in its unshifted position, loosen the **upper shift limit nut** and adjust the **stop** so that the upper and lower portions of the letters print equally well. Lock the nut carefully. (See Fig. 25.)

Back off lower shift limit nuts and then set the **shift latch adjusting screw** so that figures will be in alignment with letters when the carriage is in its shifted position. (See Fig. 25.)

Adjust the **lower shift limit nuts** so that there will be .010" clearance between the shift latch and the shift latch screw when the basket is held up by hand. Be sure to tighten the lock nut.

Set the **shift bell crank adjusting screw** so that the shift latch screw overtravels the shift latch by .004" when the striker bail blade is just leaving the shift push bar. (See Fig. 25.)

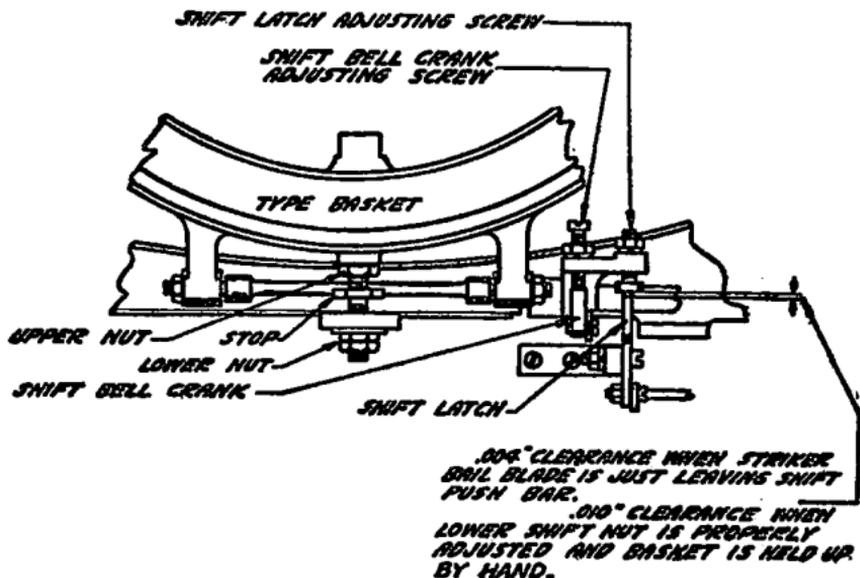


Figure 25

### Platen Pressure Rolls and Typebars

In cases where platen rolls become soiled or glazed, they may be cleaned by rubbing with a cloth moistened with alcohol, until the dirt or glaze is removed.

To adjust the pressure roll spring tensions it is necessary to remove the platen roll from the square shaft and the spacer rack and roller release shaft from the platen roll assembly. The pressure roll springs will then be accessible. A spring balance hooked to the end of a spring should measure a tension of 18 to 22 ounces or 510 to 625 grams. Bend the springs to obtain the proper tension. It is essential that the pressure on all four corners of the roll carrier be equal. See that all rollers rotate with the platen roll.

In feeding paper where a number of copies are required, especially where roll paper is used, better results will usually be obtained if a sheet of plain white paper is tightly wrapped around the platen two or three times. Another expedient frequently of service in such cases is to reduce the pressure of the platen pressure rollers.

The typebars should be carried to a point about 1" from the type guide by the striker bail and the actual striking accomplished by the momentum of the typebar. The distance that the typebars will be carried by the striker bail depends upon the height that the push bars rise into the notches of the code bars. This height is limited by the position of the push bar upstop. This upstop is adjusted by loosening the screws at either end. In making this adjustment be sure that the ends of the upstop are at the same height. Try the two extreme letters, which should cut off at the same point of their travel. (See Fig. 26.) The tails of the typebars should pass into the type guide freely.

### **Worn Platen Rolls**

Platen rolls for the No. 12-A printer are originally covered by the Ames Supply Company, 564 West Randolph Street, Chicago, Illinois. The grade of rubber used is known as "No. 2" medium rubber and this is shellacked to the metal tube which is knurled to prevent the rubber slipping on it. In manufacture, the rubber after being placed on the tube is ground down to a diameter of 1.750" plus or minus .005" so that all parts of the surface of the rubber are equidistant from the shaft. Worn platen rolls may be re-covered by local concerns doing this kind of work or they may be sent to the Ames Supply Company for re-covering. When re-covering rolls it is important to remember that the diameter of the roll should be held to within reasonably narrow limits but not necessarily as close as those for manufacture. It should also be remembered that a medium or soft grade of rubber will ordinarily be preferable to the hard grade unless the rolls are to be used for making a large number of carbon copies.

### **Bell Mechanism**

With the type-basket in its shifted position and the depressing bail in its up position, set the **letter "S" push bar adjusting screw** so that there is .004" clearance between its head and the bottom of

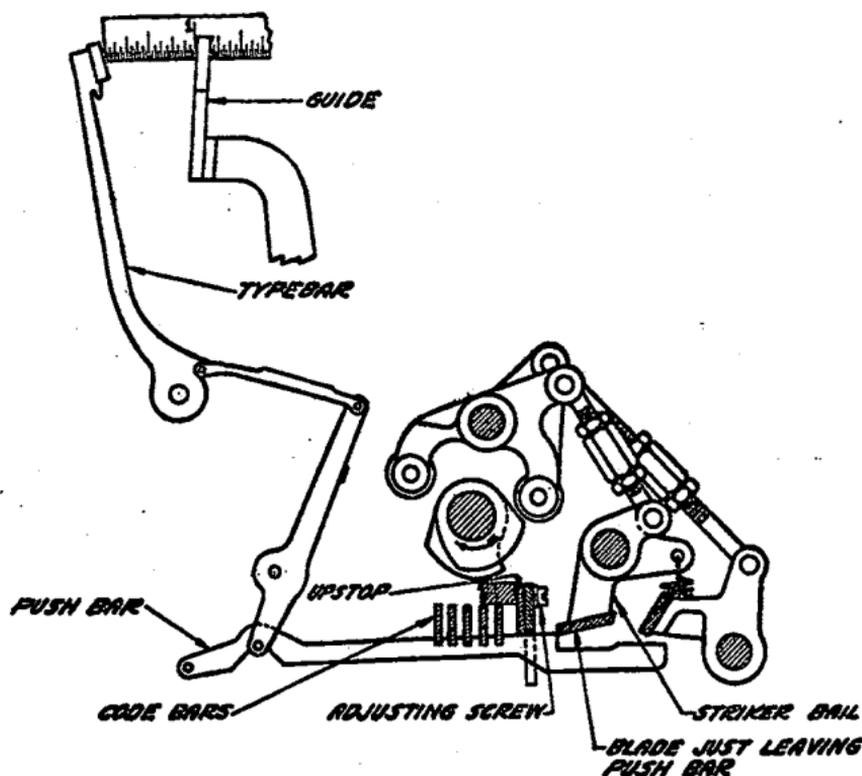


Figure 26

the shift bar extension. Then place the type-basket in its lower position and adjust the plate which carries this screw so that there is a .010" clearance between the side of its head and the side of the extension on the shift push bar. With the type-basket still in its lower position, set the bell push bar adjusting screw so that there is .004" clearance between its head and the bottom of the shift push bar extension. Then shift the type-basket and move the plate which carries this screw so that there is .010" clearance between the side of the head and the side of the shift push bar extension. (See Fig. 27.)

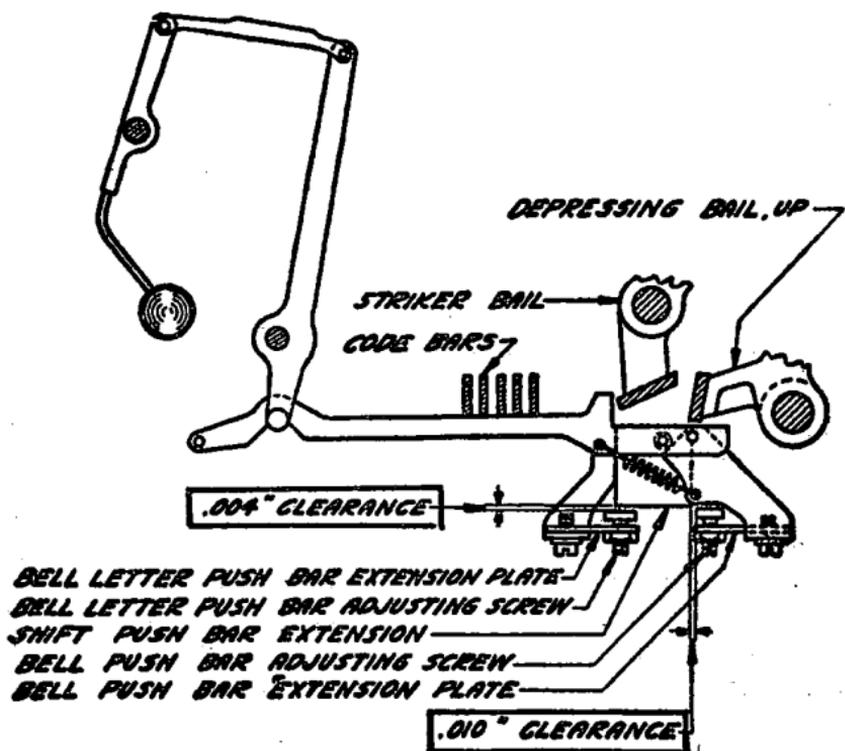


Figure 27

The bell push bar extension plate spring should have a tension of  $\frac{1}{2}$  to 1 ounce or 14 to 28 grams when measured by a horizontal pull applied to the bell push bar adjusting screw.

### Printer Adjustments Affecting Operating Margins on Line Circuits

The adjustment of principal importance in the No. 12-A printer unit in affecting operating margins of the set when receiving is that of the selecting magnets and latches. Information is given above regarding the adjustment of these parts. They should be held as nearly uniform for the different magnets of each printer as practicable. They may be tested by having power on the set and then manually tripping the receiving start magnet and observing the operation of the selecting magnets. Gradually increase the speed of the distributor and observe if any of the selecting magnets begins to fail to operate long before the others do. If so, it is possible that that magnet needs some attention.

### **Adjustments for No. 12-S Printer Cover**

The No. 12-S printer cover is equipped with an adjustable tearing edge and an adjustable filler and guide plate to the rear of the tearing edge. The tearing edge should be positioned so as to tear off the copy between lines of printing and the rear filler positioned so as to lead the paper from the paper apron out through the slot. It is desirable to position the filler as far forward as possible so as to make the slot narrow and reduce the noise of operation. It should not be moved so far forward, however, as to interfere with the motion of the paper apron of the printer carriage.

### **Hints on Disassembling the Printer**

To remove the top platen casting it is only necessary to remove the four corner screws. When the top is replaced, however, be sure that the lower end of the spacer block registers with the adjusting screw in the spacer rocker; also be sure to slip the bell-crank on the line feed shaft into the forked end of the vertical line feed lever.

The main shaft may be removed by taking out the screws which hold the two brackets carrying the rocker shaft and the screws which hold the casting on which are mounted the sixth pulse and the throwout mechanism. The selector reset bail must also be removed by loosening the set screw and pulling out its shaft and the wire bail must be unhooked from the sixth pulse cutout.

The main shaft bushings may be removed by removing the cams and slipping them off. Note that there is a hole in the under side of each bushing which engages a dowel in the main casting. There is also an oilhole approximately opposite this dowel hole. In replacing the bushing at the clutch end of the shaft, adjust the end play collar by means of the two screws that hold it to the shaft so that this bushing has the slightest appreciable end play between the collar and the throwout resetting cam.

It should be noted that there is a saw slot through the thinner part of each cam so that when cam screws are replaced they should be very well tightened with a strong screwdriver in order to spring this part of the cam and clamp it firmly on the shaft.

The striker bail shaft and the depressing bail shaft may be removed by unscrewing the oiler adapter and pushing the shaft endwise.

The push bars may be removed easily by unhooking the spring and pushing the front end upward out of engagement with the vertical sublevers.

The vertical sublevers may be removed by loosening the two clamps which bear upon the curved fulcrum rod and slipping this rod along until the desired sublever is free. The front end of the horizontal link which connects the sublever to the typebar may be sprung open and unhooked from the typebar. In replacing be sure the end of the link is fully closed. The use of a follow rod, pushed after the fulcrum rod until the sublever to be removed is reached, will be found of assistance in keeping the other sublevers in place. After replacing the sublever, the follow rod is pushed out by the fulcrum rod.

### **Replacement Parts**

Since the No. 12 type printer makes use of certain mechanisms originally designed for use in the L. C. Smith typewriter, certain replacement parts sometimes can be obtained from the nearest typewriter supply house carrying parts for L. C. Smith typewriters. Before employing parts thus obtained in any printer, care should be taken that the typewriter parts coincide exactly with the printer part which they are used to replace. In certain cases the typewriter parts have not been found sturdy enough to stand up under the strain of printer operation and specially designed parts have had to be developed for use in the printer. The carriage return drum spring is an example of this.

# ADJUSTMENTS

## NO. 12-AL OR 12-AH KEYBOARD DISTRIBUTOR NO. 12-AL OR 12 AH RECEIVING DISTRIBUTOR

### Keyboard Mechanism

#### Sending Contacts

The keyboard contact springs should ordinarily be adjusted for a gap of .018" to .022" between the sending contacts when the springs are held open by the contact levers. (See Fig. 28.) To open the contacts, depress the blank key and rotate the flywheel until the desired contacts open. Bend the front (thick) contact spring to secure the proper contact break.

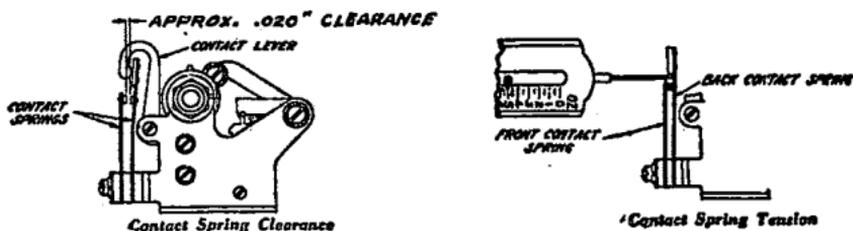


Figure 28

When a contact spring is closed, it should require a force of approximately  $4\frac{1}{2}$  to  $5\frac{1}{2}$  ounces or 130 to 155 grams applied to the back thin spring above the contact point to open it.

If either the spring tension or the gap is incorrect, the contacts will not close properly and distorted signals may result. In order to change the tension of the contact springs, the use of the No. 72003 (M) contact adjusting tool will be found effective in bending the springs.

#### Adjustment of Sending Contacts to Give More Accurate Signals

Adjustment of the contact springs as outlined above will be satisfactory for many cases. Where more accurate signals are required, as, for instance, where keyboard sending is used on a long circuit operated at high speed, the method of adjustment outlined below

may prove advantageous. This consists of comparing the signals sent from the No. 12-type keyboard with those sent by a No. 5 type distributor in good adjustment. In making these adjustments it may be necessary to depart somewhat from the adjustments specified above for an approximate adjustment.

The No. 12-type keyboard to be adjusted should be adjacent to a printer set employing a No. 5-type distributor so that the two keyboards may be operated alternately when connected to the same dummy or local circuit. In what follows, the use of a No. 10-type set is assumed, although the instructions, except for details of circuit connections, apply equally well for a No. 13-type set. If the entire No. 12-type set cannot conveniently be placed beside a No. 10-type set (maybe a monitoring printer set in test room), it will be sufficient to use the No. 12-type keyboard unit by itself, since this unit can easily be connected into the circuit of a No. 10-type set as outlined below:

Connect two wires to keyboard distributor terminals 7 and 8 and to 110 volt d-c. or a-c. power as required by the motor of the keyboard distributor. Connect a  $\frac{1}{2}$ -mf. or 1-mf. condenser between keyboard distributor terminals 7 and 11 and two wires from keyboard distributor terminals 13 and 14 to terminals C-7 and C-8 of the outlet box of the Western Electric set. Remove the strap between terminals C-7 and C-8.

The line current should be .060 ampere and the speeds set correctly for joint operation. The No. 5-type distributor should be in good condition with the brushes trimmed to give both limits of orientation range. The orientation readings should be taken when sending RYRY in turn from both the Western Electric and No. 12-type keyboards. It is desirable to adjust the contacts of the No. 12-type keyboard so that the range found when sending from the No. 12-type keyboard will agree with that found when sending from the Western Electric keyboard within  $\frac{3}{32}$ " or 5.1% at each end of the range for operation at 368 operations per minute or within  $\frac{1}{8}$ " or 6.8% for 239 operations per minute.

1. If the receiving range measured on the ring when sending from the No. 12-type keyboard is approximately equal in magnitude to that measured for the Western Electric keyboard but displaced or shifted from the range obtained for the latter, the start contact of the No. 12-type keyboard does not open at the proper moment and all the impulses are slightly earlier or slightly later than they should be with respect to the beginning of the start impulse. The start contacts should be adjusted by bending the thick spring, increasing or decreasing the contact break until the proper relation is obtained

between the start impulse and the signaling impulses, as indicated by the range measured at the receiving face of the distributor agreeing with that obtained when sending from the Western Electric keyboard. Opening the start contacts further will shift the range to the right and reducing the contact break will shift the range to the left. The spring tension of the thin spring should be 130 to 155 grams when the contacts are closed. Adjustment of this spring tension to other values probably will have no appreciable effect on timing the start impulse.

2. If the measured range when receiving from the No. 12-type keyboard is less than that when receiving from the Western Electric keyboard and the center of the ranges do or do not coincide, the signals are biased or distorted, and the start contact may be not properly adjusted. Check the contacts for the selecting pulses to make sure that they have a normal adjustment of .020" contact break and 130 to 155 grams contact pressure measured at the thin spring when the contacts are closed. After this is done, the range on RYRY should again be noted. If the center of the range just measured does not nearly agree with the center of the range when sending from the Western Electric keyboard, the start contact should be adjusted as explained in the paragraph just preceding so that the centers will be made to very nearly agree. If the range is small, the individual impulses should be checked up by sending the letter E, line feed, space, carriage return and letter T individually from the No. 12-type keyboard while the orientation range is measured for each individual impulse. The ranges should be recorded and compared with each other and with the ranges obtained when the same signals are sent from the Western Electric keyboard. The errors produced at each limit of the range should also be noted. If the impulse transmitted is **longer** than normal the tendency will be to pick up adjacent pulses so that A would be printed for E; either I or A for line feed; N or I for space; O or N for carriage return; and O for T. If the impulse is **short**, it may be lost entirely at the extreme limits, resulting in receipt of blank tape combination which causes no printing. If the impulse is too long the contact break should be decreased. When the contact break is correct, the same range within the limits above specified will be obtained from the No. 12-type keyboard as from the Western Electric keyboard. (For high-speed operation, adjusting the maximum range will give practically the same results as adjusting as outlined above while the low-speed operation adjusting for maximum range will normally give a slight bias to "spacing.") If it appears that the range is correct for some of the impulses and incorrect for the others, the contacts for the latter impulses should be worked on. When the contacts are thus individually adjusted to give ranges

which are properly or uniformly located on the face of the receiving distributor, the range obtained on sending RYRY or other copy should be considerably greater than that obtained before adjustment. It may be found after the adjustment of the contacts that the start contact requires some further adjustment similar to that previously given in order to make the middle of the range noted for signals from the No. 12-type keyboard coincide approximately with the middle of the range noted for signals from the Western Electric keyboard.

### **Locking Latches and Locking Loop**

Depress the "Ltrs." key slowly and note the travel of the locking latches to the right of the locking loop knife edge. Then depress the blank key and note if all locking latches are moved an equal distance to the left of the locking bail knife edge. If necessary, shift the position of the contact bracket slightly in order to make the travel equal on either side.

Adjust the position of the **locking lever shaft** in the elongated holes so that the locking levers overlap the ends of the contact levers (goosenecks) with a clearance of .004" when the locking levers are in the non-selected position.

The **locking loop spring** tension should be such that when the transmitting shaft is rotated until the locking loop roller is resting on the low part of the cam, it will require a pull of 4 to 5 ounces or 115 to 140 grams to just start the locking loop moving, the balance or gauge being hooked in the spring hole and pulled in line with the spring.

### **Key Lever Springs**

Each **key lever** is held up by a **spring** which may be adjusted by bending. (See Fig. 29.) The normal openings between the ends of all springs, excepting the spring for the space key lever, should be about  $1\frac{3}{8}$ " to give the best "touch" to the keys. The space key lever spring should have an opening between the ends of about  $1\frac{1}{8}$ ". It should require not more than  $7\frac{1}{2}$  ounces or 210 grams to depress any key, measurement being made with a push balance at the key top. Before adjusting the key lever springs, be sure that the key levers move freely in their front and rear slotted guides.

The **key lever springs** should not press sidewise against the side surfaces of the key levers so as to bind them. Experience indicates

that no binding will occur if when a spring is pushed sidewise away from a key lever, it springs back to within  $\frac{3}{8}$ " of side surface of key lever, but does not rest against it.

### **Clutch Mechanism**

The rear bearing bracket for the transmitter shaft is provided with an adjustable bushing, clamped by two nuts, one on each side of the bracket. This bushing forms a thrust bearing for the shaft and should be adjusted so that the shaft will have an end play of .002".

When the **clutch** is fully disengaged (see Fig. 29), as in the stopped position, there should be from .005" to .015" clearance between the clutch teeth. This adjustment may be made by adding or removing shims between the mounting bracket and the nut on the stud which pivots the clutch lever.

To measure the clutch lever spring tension, hook the spring balance or gauge just over the spring hole in the clutch lever and pull in line with the spring. It should require from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  ounces or 45 to 70 grams to move the lever away from the low surface of the driven member of the clutch.

The trip-off pawl spring should measure from  $2\frac{3}{4}$  to  $3\frac{3}{4}$  ounces or 80 to 105 grams when extended to normal length. Unhook spring at top to measure.

It should require from 9 to 12 ounces or 255 to 340 grams to separate the clutch teeth when the clutch is engaged, measured by hooking a balance or gauge to the projection on the driven member and pulling in line with the shaft.

The next four adjustments should be made in the order given.

Adjust the position of the trip-off pawl stop plate so that there will be from .040" to .060" clearance between the key levers and the universal bar.

Adjust the lever pawl eccentric so that there will be from .050" to .060" between the trip-off pawl and the clutch lever pawl when the trip-off pawl is resting against the stop plate.

Adjust the trip-off pawl eccentric so that the notched part of the trip-off pawl will overlap the clutch lever pawl by approximately .045" for keyboards with the non-repeat key action. For keyboards with the repeat key action, the trip-off pawl eccentric is not used and the notched part of the trip-off pawl fully overlaps the clutch lever pawl. The number of washers under the head of the rear mounting screw for the stop plate should be such as to allow a clearance of approximately .005" between the trip-off pawl and these washers at the part of the stroke when this clearance is a minimum.

The clutch lever eccentric should be adjusted so that when the clutch lever is held against the low surface of the driven member of the clutch, the clutch lever pawl will have no play between this eccentric and the clutch lever pawl eccentric.

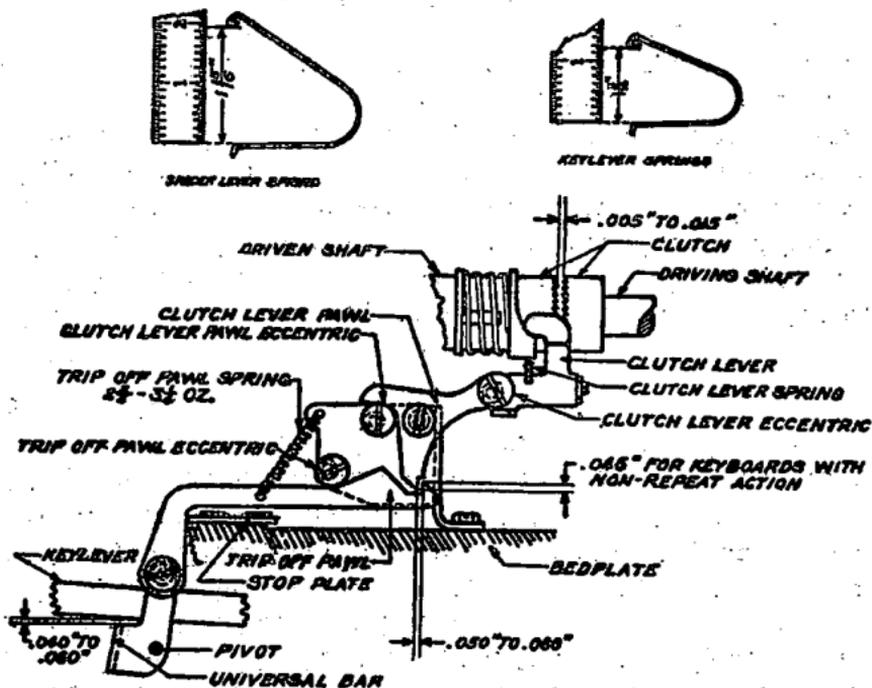


Figure 29

## Receiving Distributor Mechanism

### Contact Springs

The receiving contact springs should be adjusted for a contact break of from .008" to .012" using the No. 72003 (M) contact adjusting tool. The force required to open a contact when closed should be approximately  $4\frac{1}{2}$  to  $5\frac{1}{2}$  ounces or 130 to 155 grams measured just above the contact on the back thin spring. Check the contact gaps after adjusting contact spring pressure.

The goosenecks should ride on the cam so that they pass through the center of the indents. This adjustment is made by adjusting the contact bracket.

### Clutch

This clutch will not require any great amount of attention if the felt friction washers are kept soft with lubricant. The felt friction washers when new require more liberal and frequent lubrication for a time until they are well soaked with oil. The clutch spring is compressed between two collars so that no adjustment of the clutch spring is possible except by disassembling the cam arrangement and stretching or compressing the spring. The clutch torque should be from 16 to 18 ounces or 455 to 510 grams, measured at the notch in the stop cam with the goosenecks held away from the cam. The clutch should be run for a time before measuring so that the parts will be warm or at normal operating temperature.

If it should be necessary to disassemble the cam mechanism for the replacing of a spring or felt washer, the motor worm gear, rear gear wheel on camshaft, worm pinion and front bearing bracket must be removed before the cam assembly can be slipped forward and out of the rear bearing.

### Start Magnet

The tension of the **start magnet armature spring** should be such that it will require a pull of  $1\frac{1}{2}$  to 2 ounces or 45 to 55 grams applied at the upper extremity of the start magnet armature to start it moving from the stop cam when the armature is on the low part of the cam.

The start magnet assembly should be adjusted in position so that the start magnet armature clears the outer edge of the projecting notch on the stop cam by from .005" to .008" when the armature is pulled over by the magnet to release the cam and so that the armature face is parallel to the face of the stop cam. The start magnet armature should move freely without binding on its lower pivoting pin.

### **Motor and Governor Brushes**

The **motor** of the receiving distributing unit, or the keyboard and distributor unit, should be given the usual attention given to motors used in printer sets. The brushes should be renewed when short, the commutator kept clean and the grease cups filled as specified in the lubrication chart.

The **governor brushes** should be positioned so that they ride on the center of the collector rings and the pressure between brushes and collector rings should be from 3 to 4 ounces or 85 to 110 grams when the brushes are in place in the brush holder. This pressure may be measured by removing the brush holder block and compressing the brushes until they project only about  $\frac{1}{32}$ " from the end of the holder. The brushes when remounted in place should project about  $\frac{1}{32}$ " from the end of the brush holder.

### **Governor Contacts**

**Governor contacts** should be cleaned by removing them from the governor and rubbing them over a No. 138-139 (M) carborundum stone resting on a desk or table. To remove the contacts, take off the cover of the governor and loosen the contact fastenings, using two No. 138-36 (M) wrenches for the purpose. When the contacts are removed, remove also any dust or dirt which has accumulated in the housing. In replacing the contacts align them properly and tighten them securely.

### **Adjustment of Cable**

The cable of local wiring for both the keyboard distributor and the receiving distributor should be adjusted so that it will not rest on the base casting where it might become damaged from prolonged contact with oil.

## **DISTRIBUTOR UNIT ADJUSTMENTS AFFECTING OPERATING MARGINS ON LINE CIRCUITS**

The distributor adjustments which affect the margins of operation of the printer set on line circuits and which are particularly important in high speed operation are the following:

1. Speed setting and stability of governing.
2. Setting of orientation.
3. Adjustments of sending and receiving contacts.
4. Adjustment of receiving start magnet.

All these adjustments are described in these specifications. The sending and receiving contacts should be kept clean and free from oil.

### **CHECKING DISTRIBUTOR SPEED**

#### **With Tuning Fork**

The No. 10-A tuning fork should be used in all cases where accurate setting of speed is required. The fork should be held by its handle, taking care that the forked portion is not grasped, as this will interfere with its vibration. Start the fork by striking it on the hand, arm or knee, then hold the shutter close to the eye, with the plane of vibration at right angles to the line of vision, and look through the shutter at the rotating target on the governor. If the distributor speed is slow, the black spots on the target will appear to be moving in a direction opposite to the direction of rotation, while if too fast the spots will appear to be moving in the direction of rotation. If not more than 5 black spots pass by a fixed point in 10 seconds, the speed is close enough to the desired value for normal operating conditions. It is desirable to set the speed when the distributor motor is warm, if this is possible. It usually will be necessary to illuminate the target by means of a portable electric light or a flashlight.

Since one target can be used for checking several different speeds, it is advisable to obtain approximately the speed to be checked before using the fork. An approximate speed setting may be made by the method outlined later. For reference a list is given below of the targets available with their code numbers and the speeds checked by each target when a No. 10-A tuning fork is used.

Keyboard distributors and receiving distributors are furnished with either of two motor gear ratios; namely, 5 to 1 and 7 to 1. The high speed distributors (designated by the letter "H" following the code number of the distributor) have a receiving cam gear ratio of 5 to 1 and are suitable for speeds from 263 to 368 operations per minute. The low speed distributors (designated by the letter "L") have a gear ratio of 7 to 1 and are suitable for speeds from 188 to 263 operations per minute.

Printer Operations per Minute	Line Frequency in Dots per Second	Code No. of Target	No. of Black Spots on Target	Type of Distributor	Free Speed Receiving Shaft
187.8	11.6	1-C	14	No. 12-AL	214.6
*207.5	12.8	7111 (M)	19	"	237.2
*239.0	14.8	7106 (M)	11	"	273.1
262.9	16.3	7105 (M)	10	"	300.4
262.9	16.3	1-C	14	No. 12-AH	300.4
*290.5	18.0	7111 (M)	19	"	322.0
306.7	19.0	1-A	12	"	350.5
*334.6	20.7	7106 (M)	11	"	382.3
*368.1	22.8	7105 (M)	10	"	420.6

Speeds marked \* are those considered satisfactory for joint operation of No. 12-type sets with Nos. 10 and 13-type printer sets, the requirement being that the line frequencies should be approximately equal for the different types of printers.

### "Free Speed" Method

This method is only approximate and should not be used except in emergencies without final checking with a tuning fork. At stations equipped with a keyboard which is arranged to repeat when a key is held down, hold down any key and count the number of operations per minute. Ordinarily, counting the number of operations in ten seconds and multiplying by six should be sufficiently accurate to obtain a setting which is to be refined by the use of a tuning fork. At stations arranged for receiving only, it will be necessary to hold the armature of the start relay in an operated position and to count the revolutions per minute of the receiving shaft of the distributor when it is running free. If selections can be set up on the printer, it will be possible to count the operations per minute under this

condition. A column showing the free speed of the receiving shaft in revolutions per minute, which is the same as the printer operations per minute with the shaft running free, is included in the speed table given above.

### **METHOD OF ORIENTING**

At the front end of the receiving cam roller there is provided a clamping screw which when loosened permits the notched member which engages the start magnet latch to be shifted on the cam. This shifting varies the stopped position of the cam. Reference marks on the cam roller permit reading the limits of the range for satisfactory operation. For uniformity it is well to consider the left-hand mark the starting point, the next mark No. 1 (end of division 1), the third mark No. 2, and so on. In some cases, particularly at low speeds, only one limit of the range can be determined, since the closing of the sixth pulse magnet contacts occurs at about the end of the seventh division and the range beyond this point cannot be measured because the cam rotates continuously. **Units shipped from the factory have their orientation set so that they will handle a maximum of bias either marking or spacing.**

### **Printers Operating in the Loop Circuit of Telegraph Repeaters**

In the case of a set which is to operate in a loop circuit of a telegraph repeater, the orientation setting made at the factory will normally give the best results. This setting, therefore, should not be changed.

If for any reason the factory setting has been departed from and it is desired to approximate it, this may be done as outlined below:

The orientation setting should be made with the printer operating on as nearly perfect signals as possible, such as when operating from its own sent signals in its regular loop circuit with the loop current properly adjusted, or when receiving under the same conditions from a nearby No. 10 or No. 13-type printer set. Before making a setting, the line relay adjustment should be checked, also the speed of operation and the adjustment of the sending and receiving contacts and the start magnet. If receiving from another set, the speed of the

other set and the adjustment of the sending face and brushes or sending contacts should be checked. For high speed operation (368 operations per minute), a range of orientation from the end of the third or fourth division to the end of the seventh usually is obtained, and for normal speed (239 operations per minute) it usually is from the end of the fifth to the end of the seventh division. The settings which have been found to be the most satisfactory are:

- (a) For 368.1-o.p.m. set the orientation about  $2\frac{1}{2}$  divisions from the measurable limit.
- (b) For 239.0-o.p.m. set the orientation about  $1\frac{1}{2}$  divisions from the measurable limit.
- (c) For intermediate speeds the proper setting can be estimated from the above.

The settings arrived at by the above procedure should not be changed unless a recheck by the same method shows them to be incorrect. If the line signals become biased or vary sufficiently to cause errors, the "line-up" of the circuit should be corrected rather than the orientation setting changed to accommodate the defective signals.

### **Printers Connected Directly to the Line Circuit**

Where the line circuit is well insulated and of low capacity, the factory setting of orientation will normally give good results. Where, however, the printer set is directly connected to a circuit having appreciable leakage or capacity so that the line signals have a definite tendency to be biased either to marking or spacing, the best results will be obtained by making a special adjustment of the orientation. This should be done by receiving signals from all sending stations on the circuit under average conditions, measuring the range of orientation and making a setting to best accommodate the various sending stations.

# ADJUSTMENTS OF NO. 7114 (M) MOTOR-GENERATOR SET (SINGLE-UNIT TWO-BEARING)

## Ball Bearings

The bearings are of the separable ball-bearing type and consist of three parts, as follows:

1. The inner ring or ball race on the shaft.
2. The ball cage and balls.
3. The outer ring which in the alternating current end bears against a shoulder turned in the bearing chamber and in the direct current end bears against a coil spring centered by a copper washer at one end and a steel washer at the other end. A steel plate with a copper and felt washer is drawn up against the inside surface of each bearing housing by means of four screws through holes in the end shield making the bearing tight to prevent the lubricant from escaping from the bearings to the inside of the machine.

## Disassembling and Assembling the Motor

In disassembling the motor for cleaning the bearings use socket wrench Western Electric Code No. 46 tool and a screwdriver. Before removing the end shields it is necessary to remove the acorn nuts from the tie rods, to take out the tie rods and to remove the four screws at the center of each end shield which held the steel and copper washers in place. If these screws will not come out of their place in the end shield readily, they may be pulled out by using a match tapered to fit in the slot in the screw head. (Note: The screws in the direct current end are slightly longer than those in the alternating current end. This should be watched in replacing the screws.) The end shields may now be taken off and the bearing parts disassembled. The parts in the end shield on the direct current end may be removed for cleaning, while those in the alternating current end need not be removed. The metal housing containing the balls in each bearing can be forced off the shaft with a screwdriver. Do not attempt to remove the balls from their housing. Care should be taken not to damage any of the parts.

In assembling the motor, to facilitate lining up the screw holes in the steel plate, copper washer and end shield for the purpose of replacing the four clamping screws, use Western Electric No. 309 tool which has been provided for this purpose. This tool is a threaded

stud which is introduced through one of the holes in each of the parts and screwed into one of the holes in the steel plate. Be sure that the felt washer has been assembled between the steel plate and copper washer before this is done, placing the copper side out. On the alternating current end the steel plate and copper washer are cut on one side so as to clear the right-hand brush holder of the starting mechanism. All screws should then be put in place and securely tightened.

In assembling the motor be sure to replace the parts in the direct current end in order. The copper washer centering the coil thrust spring should be placed in the end shield first, then the coil spring and then the steel washer centering the coil spring. The spring should fit into the recesses provided for it in each washer and the steel centering washer should have its cupped side toward the bearing. Replace the ball housings on the shaft. Replace the end shields, tie rods and acorn nuts, securely tightening the latter with socket wrench Western Electric No. 46 tool. Test the machine to make sure that it operates properly before replacing in service.

### **Brushes and Commutation**

The brushes provided are carefully fitted before the set is shipped and should give service for a considerable period without special attention. If trouble is experienced from sparking on the commutator, remove the end shield on the direct-current end and if the brushes are found to be worn down to  $13/32$ " or very nearly to this dimension, replace them with new brushes, making sure before tightening the bolts which hold the brushes that the brush surfaces are square with the commutator and that the brushes make contact on approximately three-quarters of their surfaces. If necessary to fit the new brush to the commutator, this should be done with a strip of No. 00 sandpaper against the commutator, pulling it back and forth under the brush.

### **Overhauling**

This should be done in a printer shop rather than on the subscriber's premises. Once every 18 months disassemble the machine and thoroughly clean it. Blow the dust from the windings with dry compressed air or with a small bellows. Take the machine apart as outlined above.

Thoroughly clean the end shields, ball bearings and bearing chambers. The ball bearings and the parts removed from the end shield on the direct current end should be cleaned by washing in commercial carbon tetrachloride. The inside of the end shield on both the direct current and the alternating current ends should be wiped out with a cloth dipped in commercial carbon tetrachloride. After the parts are reassembled and before the end shields are replaced, the bearing chambers should be repacked, the fresh lubricant ("Oneida" grease) filling the bearing chamber about one-third full of grease. Replace the felt bearing washers if they are worn.

Clean the brushes on both the direct current and alternating current ends with carbon tetrachloride. Check the brush springs for length and tension. Replace the brushes if necessary. Clean the commutator and the slip rings with a piece of cheesecloth dipped in carbon tetrachloride. If the commutator is worn have it resurfaced. (In removing the brushes it is well to mark them so that they can be properly replaced in the brush holders from which they were taken.)

### **Troubles**

If trouble is experienced in operation look over all nuts and bolts to see if they are tight and make sure that the rotating element is free to turn in its bearing; that is, that the bearings themselves are in good condition and that there is no mechanical obstruction to prevent rotation.

Hot bearings may be due to worn out or dirty grease, not enough grease or damaged bearings. Remove the end shield and inspect the steel balls of the inner and outer ball ring surfaces. Roughness may be due to grit in the lubricant. Remember that the bearing may be hot enough to burn the hand and still be at a safe operating temperature. The maximum allowable temperature rise (measured by a thermometer) is 50 degrees C.

Electrical troubles should be checked for the following:

That the fuses are not blown.

That all connections are properly made in the different circuits.

That a-c. voltage is actually available at the motor terminals.

Test to determine that the supply voltage is correct, particularly on private power plants.

## ADJUSTMENTS, NO. 71508 (M) AND NO. 71510 (M) MOTOR-GENERATOR SETS

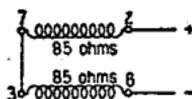
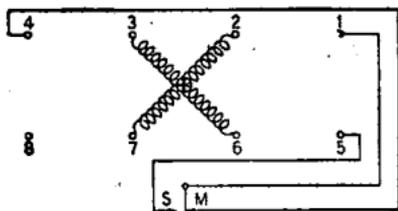
These motor-generators are two-unit, four-bearing machines with bearing waste-packed for lubrication. They should require very little attention beyond the inspection and lubrication called for in the maintenance routines. After long periods of service it may be necessary to sandpaper the commutator or slip rings if they have become roughened or pitted. Only very fine sandpaper, No. 00 or finer, should be used, care being taken to avoid personal injury when using it with the machine running.

## ADJUSTMENTS, TWO-UNIT FOUR-BEARING MOTOR-GENERATOR SET WITH FORT WAYNE BOX-TYPE PANEL

For maintenance data covering other than the points concerned in inspection and lubrication, see other information covering these motor-generator sets.

## USE AND ADJUSTMENT OF NO. 215-A RELAY

The No. 215-A relay used as the line relay in No. 12-type printer equipment is a polar relay. For use in circuits operated by the "open and close" method, one winding is connected in the line circuit and biasing current is fed through the other winding. The arrangement of the relay windings and terminals is shown in Figure 30. Only the latest type of No. 215-A relay having lock nuts on the pole pieces and "anti-chatter" contacts on the armature should be used.



Series Aiding Closes on 4 (Marking Contact)

Figure 30—No. 215-A relay

The following outlines a form of mechanical adjustment for the No. 215-A relay which may be followed where a mechanical adjustment is to be given for putting the relay into operating condition. Adjusting the relay on a test-table, as is done with the relays for the carrier or metallic telegraph systems, is desirable where this can be done.

### 1. Clean Contacts.

- (a) Back off both pole pieces until an air gap of approximately  $\frac{1}{16}$ " is obtained between each pole piece and the armature.
- (b) Clean the contacts. One method now employed is to use a very fine grade of emery paper similar to "000 French Emery Paper" around a thin flat blade, rubbing the contacts carefully until any projections or "build-ups" are removed and then blowing out any resulting dust. In cleaning the armature contacts, the armature should be supported in its mid position by the opposite contact screw, to avoid bending the contact springs.

### 2. Remove Magnetic Dust from Pole Pieces and Armature.

- (a) Inspect the relay carefully and if necessary clean the pole pieces and armature with a tool such as a No. 1-A burnisher around the end of which have been wound one or two layers of friction tape. In using this tool, the taped end should be pressed against the pole pieces so that any foreign particles will be embedded in the tape. A burnisher around which tape has been wrapped should not, of course, be used subsequently for cleaning contacts unless it has been thoroughly cleaned with carbon tetrachloride.

### 3. Adjust Contacts.

- (a) Adjust the contacts so that there will be .002" clearance between the armature and each contact, giving a total contact travel of .004". Check this travel with a thickness gauge.

#### 4. Adjust Pole Pieces.

- (a) Turn up the pole pieces until the armature will remain just in the central position without touching either contact. This position may be determined by adjusting the pole pieces relative to each other, so that the armature will approach the condition of sticking on either contact as nearly as possible and then backing them up slightly until the armature will stand equidistant between the contacts. The proper adjustment will give an air gap of approximately .006" to .008" between the armature and the pole pieces when the armature is held against either contact.

After the relay has been adjusted according to the above outline, it may be partially checked by operating it in a printer set and noting the orientation range. If the range is normal, this may be taken as a fair indication that the adjustments have been satisfactorily made.

### ADJUSTMENT OF CONTROL RELAYS

The control relays now used are provided with both front and back contacts so that they may be used for "break control" or "make control," as desired, by merely making the necessary adjustments. When a control relay is used for "break control," the "make" contact (back contact) should be bent out of the way. Relays are adjusted at the factory for "break control."

#### For Use as "Break Control Relay" (See Fig. 31)

1. Contact break, relay operated—.025" to .030".
2. Contact pressure, relay unoperated—140 to 170 grams.
3. Make contact (front contact) to be bent away.
4. Normal operating current—.050 ampere. (Plunger should pull up all the way on current of .040 amp. on test.)

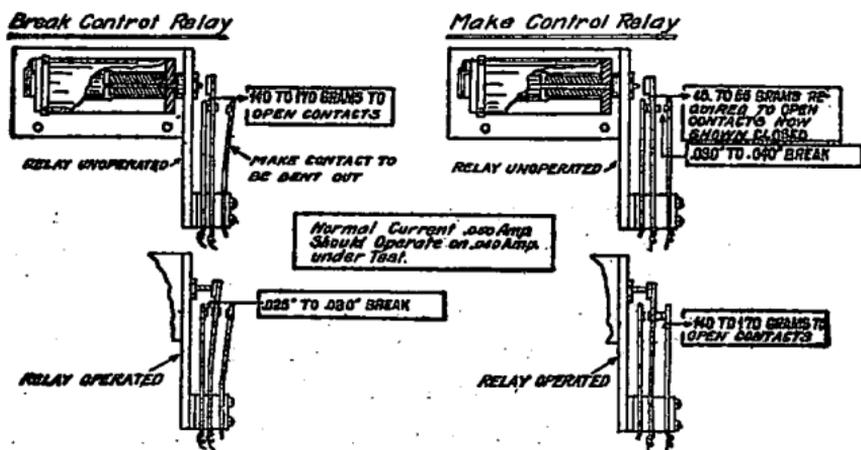


Figure 31

## For Use as "Make Control Relay" (See Fig. 31)

1. Contact break, relay unoperated—.030" to .040".
2. Make contact pressure—140 to 170 grams.
3. Pressure to open "break" contacts, relay unoperated—45 to 55 grams.
4. Normal operating current—.050 amp. (Plunger should pull up all the way on current of .040 amp. on test.)

## Adjustment of Control Relays Formerly Standard

The "break contact" type of control relay is arranged to stop the motors of the printer set when the control circuit is closed and to start the motors of the set when the control circuit is opened. The adjustments of the "break contact" control relay are as follows:

1. Contact pressure,  $3\frac{1}{2}$  to 4 ounces, or 100 to 110 grams.
2. Contact break, relay operated,  $\frac{1}{32}$ " minimum.
3. Clearance between plunger and operating spring with plunger back against its stop, approximately  $\frac{1}{32}$ ".
4. Normal operating current to be .060 ampere. (The relay should operate to open the contacts on .045 to .050 ampere, but should be used with a current of .060 ampere.)

The "make contact" type of control relay is arranged to start the motors of the printer set when the control circuit is closed and

to stop the motors of the set when the control circuit is opened. The adjustments of the "make contact" control relay are as follows:

1. Contact pressure,  $3\frac{1}{2}$  to 4 ounces, or 100 to 110 grams.
2. Contact break, relay unoperated, .020 to .025".
3. When the relay is de-energized,  $\frac{1}{4}$  to  $\frac{1}{2}$  ounce or 7 to 14 grams applied at the end of the operating spring should be required to move the spring away from the plunger.
4. Normal operating current to be .075 ampere. (The relay should operate to close the contacts on .065 ampere but should be used with a current of .075 ampere.)

## CONVERTING SETS IN THE FIELD

### Conversion of Line Relay from "Open and Close" to Polar Operation

For operation on "open and close" impulses, the No. 215-A line relay is provided with biasing current, the standard circuit being shown in Figure 31. The line or loop current on a marking impulse should hold the relay armature over to the marking contact connected to relay terminal No. 4. Where the printer is operated in a telegraph loop, care should be taken to pole the loop correctly at the telegraph board.

When converting a set so as to operate on a polar circuit, it will be necessary to make minor changes in the connections to the relay connecting block as indicated in Figure 32. The wires connecting to terminals 2 and 7 should be unsoldered and taped up separately. The wire connecting to terminal 3 should be moved to terminal 2 and terminals 3 and 7 should be strapped. The line wires should be connected to the line fuses in such a way that the signals will not be received inverted.

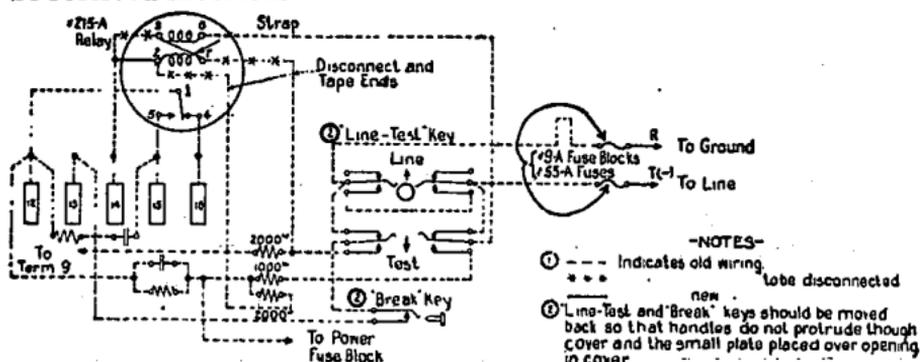


Figure 32—Connections to No. 12 Type Set

### **Converting No. 12-A to No. 12-B Sets**

The No. 12-A printer set does not use control relay equipment, while the No. 12-B set is provided with this equipment. Either type of set may be converted to the other type by properly changing the power control equipment. The wiring for connecting this control equipment is provided in all sets.

As outlined above, the control relay now used is provided with both front and back contacts so that it may be used for "break control" or "make control" as desired by making the necessary adjustment. To change a No. 12-A set to a No. 12-B set it is necessary to secure the No. 7113 (M) control relay and accessories, consisting of the control relay assembly, control circuit fuses, spark-killer resistance and condenser, condenser strap and mounting screws. This apparatus should be mounted and connected in accordance with the circuit drawings following this section. Since, when the "break contact" control relay is used, opening the control circuit starts up the printer sets, it will be necessary if the power switch rather than a key is used at the main station to start and stop the machines, to turn the starting switch at the main station upside down so that the start and stop indications on the cover will be correct.

The control relay without accessories is covered by Catalogue No. 72484 (M).

### **Converting No. 12-AL to No. 12-AH Distributor Units**

Since No. 12-AL receiving distributors and No. 12-AL keyboard distributors differ from their corresponding No. 12-AH units only in the gear ratio of the motor worm and pinion gears, it is feasible to convert the low speed units to high speed or vice versa in the field where such conversion is desired. The change is made by replacing the pinion or gear wheel which is driven by the motor worm gear and lowering or raising the driving motor so that proper mesh of the gears is obtained. This is done by adding or removing the heavy washers or posts under the motor feet. Shims are provided on all units so that close adjustment is possible. The gears should mesh properly with only a very slight clearance in all positions of a revolution. The pinions for the low speed or AL units have 42 teeth which

give a ratio of motor revolutions to receiving shaft revolutions of 7 to 1, while the pinions for the high speed or AH units have 30 teeth giving a corresponding ratio of 5 to 1.

### **Converting Sets from A. C. to D. C. Operation or Vice Versa**

When it is desired to change sets from operation on A. C. to operation on D. C. or vice versa, and where the equipment can readily be reused, it will normally be desirable to interchange complete printer and distributor units, rather than replace the motors by motors of the other type. No. 12 type sets for operation on A. C. require the provision of a small motor-generator and accessories. However, there may be cases where it is desirable to modify existing printer and distributor units to operate on the other type of current supply. In such cases, the motors on these units will have to be removed and other motors substituted in their place. In addition, in the case of the distributor unit the spark-killer for the governor contacts must also be modified.

The detailed information required for modifying printer and distributor units by changing motors as indicated above is shown on Morkrum-Kleinschmidt Drawings 824, 825, 826, 829, 830 and 850. It is suggested that copies of these drawings be obtained by each printer shop to assist with the ordering and installation of the parts required when such changes are to be made and to serve as a supplement to the printer catalogues in respect to the ordering information for certain motor mounting parts not yet listed in the catalogues. These drawings are available and may be ordered by specifying:

“ . . . copies Morkrum-Kleinschmidt Drawings  
824, 825, 826, 829, 830 and 850.”

Drawing 824 shows the parts required when changing a direct current printer unit to 60-cycle alternating current by substituting a Holtzer-Cabot alternating current motor for the direct current motor. **(The use of the Holtzer-Cabot motor has been discontinued on new printers, this motor having been replaced by the General Electric motor shown on Drawing 826. The following is given for information only and for the exceptional case where the Holtzer-Cabot motor is to be used.)** The parts required for this change are:

- 1 6660 (M) Motor
- 3 6035 (M) Motor Screws
- 1 6633 (M) Motor Plate
- 2 6036 (M) Screws
- 2 8183 (M) Nuts
- 1 70746 (M) Bevel Gear—52 Teeth

Drawing 826 shows the parts required when changing a direct current printer unit to 60 cycle alternating current by substituting a General Electric alternating current motor for the direct current motor. The parts required are:

- 1 70835 (M) Motor
- 1 70746 (M) Bevel Gear—52 Teeth

Drawing 825 shows the parts required to change an alternating current printer unit with either Holtzer-Cabot or General Electric motor to a unit to operate on direct current. The parts required when the printer at present is equipped with a Holtzer-Cabot motor are:

- 1 3888 (M) Motor
- 2 1113 (M) Motor Screws
- 12 2846 (M) Washers
- 2 3292 (M) Nuts
- 1 9491 (M) Motor Guard
- 1 3227 (M) Bevel Gear—54 Teeth

The parts required when the printer at present is equipped with a General Electric motor are:

- 1 3888 (M) Motor
- 1 3227 (M) Bevel Gear—54 Teeth

Drawing 850 shows the parts required to change a direct current printer unit to 50-cycle alternating current. The parts required for this change are:

- 1 71657 (M) Motor
- 1 70989 (M) Bevel Gear—53 Teeth
- 1 70990 (M) Pinion—15 Teeth
- 2 3271 (M) Shims

Drawing 829 shows the parts required to change motors on a keyboard distributor from alternating current to direct current or vice versa. The part required when changing to alternating current is:

- 1 70756 (M) Motor

The parts required when changing to direct current are:

- 1 4543 (M) Motor
- 1 5427 (M) 1000-ohm resistance unit (or 18-BH resistance)
- 1 6609 (M) Insulator
- 2 6610 (M) Straps

Drawing 830 shows the parts required to change motors on a receiving distributor from alternating current to direct current or vice versa:

The part required when changing to alternating current is:

- 1 70756 (M) Motor

The parts required when changing to direct current are:

- 1 4543 (M) Motor
- 1 5427 (M) 1000-ohm resistance unit (or 18-BH resistance)
- 2 3094 (M) Insulators
- 2 7129 (M) Straps
- 4 33-195 (M) Screws

The following points should be remembered in connection with the work of modifying units:

1. In replacing printer motors, it will in general be necessary to adjust the pinion along the motor shaft to secure engagement of the teeth over their entire length, and to add or remove shims determining the position of the driving gear, to secure a slight amount of play between the teeth of the gear and the pinion.
2. In the case of the distributor motors, it may be necessary to add or remove shims (furnished with the distributor and normally located under the heads of the motor mounting screws) under the four supporting points of the base and to move the motor laterally or longitudinally, taking advantage of clearances between mounting holes and screws until the alignment is such as to give a minimum of gear noise.
3. The direct current distributor units are equipped with a 1000-ohm resistance, connected between one terminal of the motor resistance block and distributor terminal No. 11, whereas alternating current units are without this resistance, the connection between the two terminals being strapped. These connections are shown by comparing Figure 33 with Figure 34, or by referring to the Morkrum-Kleinschmidt drawing of the printer base.
4. All printer bases supplied at present by the manufacturer are wired for alternating current operation, and when sets are converted to direct current the base connections should be modified in the usual way, as shown by Figure 34.

### **Converting Sets to Repeat Keyboard**

No. 12-type keyboard distributors normally are supplied, arranged so that they do not repeat characters when the key levers are held depressed, only one character being sent out for each depression of the key. Where it is desired to provide the repeat action, the trip-off pawl eccentric should be removed and a small piece of metal of the necessary thickness added to project under the trip-off pawl. A set of six thin washers is furnished for this purpose with each keyboard, washers sufficient to give the proper thickness being mounted under the head of the rear screw which holds the trip-off pawl stop plate in place of the washer regularly furnished. The piece added

should project under the trip-off pawl to prevent it from moving downward and disengaging from the clutch lever pawl. As a temporary expedient, a bent Gem clip may be used in place of the thin washers.

### Eliminating the "Unshift on Space" Feature

As stated above, in cases where the "unshift on space" feature is not required, No. 12-A printers may be equipped with a small part or clip to prevent the space bar from entering the notches in the code bars. The clip is slipped over the space bar and under the comb separating the pull bars in such a way that the space bar is restricted from entering the notches in the code bars when the "space" combination is set up. The printer will then unshift only on the "letters" selection.

## LOCATING LINE TROUBLES

Printer line circuits can in general be divided into two classes: (1) short line circuits which can be set up so that they will operate satisfactorily over long periods of time without attention except in actual cases of line trouble and, (2) long line circuits which may have repeaters at one or more points and which, because of the length of circuit and the repeater apparatus involved, require supervision by telegraph repeater attendants from time to time. The latter class of circuits should preferably pass through stations where proper attention can be given them in the way of checking line current and observing the operation of the circuit as, for instance, by monitoring with a monitoring printer set. Circuits falling into the class of short line circuits can usually be operated satisfactorily without being cut in at a test board for supervision and without arrangement for monitoring. **The provision of a printer set, specifically for monitoring purposes in connection with circuits of this type, is not contemplated.**

In the larger centers where most of the short line circuit development would normally occur, it will usually be desirable to establish some sort of printer shop in which spare apparatus and parts, etc., may be kept. If a spare set is available, the location and clearing

of trouble on short line circuits will in many cases be facilitated through the provision of a circuit from the printer shop to the "group" testing bureaus through the areas of which the majority of the circuits run. This will permit the spare set in the printer shop to be connected to any of these printer circuits which are thought to be in trouble.

In cases where this arrangement is not readily practicable, time will frequently be saved in clearing trouble on short line circuits if the steps indicated below are taken in the order given.

When trouble is experienced the machine appearing to be in trouble should be operated on local test. If the trouble persists in this condition, it is likely that the machine itself is in trouble rather than the line circuit or a machine at another station. The subscriber should be instructed to operate the machine at his station on local test before reporting a case of trouble so that information regarding the performance of the machine on local test may be available. If a report is received of trouble which still shows up in the same way when on local test, it should normally be necessary to send a repair man only to the station making the report.

If, however, the subscriber reports that the machine operated properly on local test, it is likely that the difficulty is due either to speed trouble or to line trouble. In the case of a network having several machines which can be connected together by switching arrangements, trying the machines in different combinations should indicate whether the speed of one machine is off or whether there is line trouble on any particular part of the circuit.

When the trouble is localized on one leg of a network or when only two stations are involved, the rest of the work required in locating the trouble can usually be done by a repair man sent to the main station on the circuit. The speed of the printer at the main station should first be checked. The line current should then be checked by means of a millammeter put in place of the line fuse on the printer set. If the line current is above or below the specified value, the reason therefore should be located and the current adjusted. If it is unsteady, the source of power for the line circuit should be checked or a search made for a point in the circuit where a poor contact may be present as, for instance, at protector springs. When power for the line circuit is furnished from both ends of the circuit or from the

## LOCATING LINE TROUBLES

main station only, a ground on the line may be detected by having the operator at the distant station push in the break key for a few seconds, the reading of the milammeter being noted while the break key is depressed. A reading other than zero will indicate that the line is grounded at some point or that the insulation is defective.

If the line current is found to be within the specified limits, the distant station should be asked to write a test message, and the character of the errors received should be noted. Gaining or losing the first or fifth impulse while the others are received correctly indicates in most cases that the speed of the distant printer is off. Losing pulses indiscriminately denotes light line signals or poor distributor contact. Gaining pulses indiscriminately denotes heavy line signals or lengthening of the signals due to dirty distributor contacts.

If the indications point to line trouble, open the printer line circuit at the line fuse and ask the wire chief to test the circuit, telling him that it should show clear when tested toward you. If this part of the circuit proves to be in proper condition, the remainder of the circuit will have to be tested.

In carrying out the tests outlined above, care should be taken to employ the tests which require action by the operator at the distant station only after the other tests have been made and have failed to locate the trouble.

## **LOCATING MACHINE TROUBLES**

### **Losing or Gaining Impulses**

If after adjusting a selector armature or backstop screw the lock nut is not tightened, the screw may work loose, causing a failure of that particular pulse.

This may happen to the selector reset bail adjusting screw. If this screw works loose, the clearance between the bail and the selector levers in the set position will be decreased until finally the levers cannot move far enough to set the code bars completely.

If the code bar locking bail does not rise far enough to permit the code bars to move freely when they are being set or fails to lock them properly after they are set, errors will occur which will appear to be due to lost or gained pulses. Such trouble could be due to the screws holding the blade on the bail or the screw which holds the cam to the shaft coming loose, or to a broken spring.

A bent connecting clip or a loose or broken wire leading to any of the selecting magnets would, of course, cause a lost pulse. Such a condition can easily be found by inspection.

Occasionally a typebar may become bent, causing it to strike the side of the guide. This will result in a failure to print this letter and in some cases the trouble will appear to be due to a lost pulse. For instance, a space for an "N" could easily be due to this cause, while apparently it is due to the loss of a fourth pulse.

It is assumed that the maintenance man will check the adjustment of the receiving distributor contacts, the speed setting and the governor brushes in a case of trouble of this nature.

### **The First Letter of the Line Prints Lighter or Heavier than the Others**

This is generally due to the carriage return lever failing to latch after it has been tripped. If the carriage return reset screw in the striker bail extension is improperly adjusted so that it fails to reset the lever immediately after it is tripped, an extra load is placed upon the striker bail when it is printing the first letter of the line. This may result in faint printing of this letter or the letter may be printed by the action of the safety cam instead of by the striker spring, in which case the impression will be exceptionally heavy.

If the resetting screw is adjusted so that it resets the lever with a large amount of overtravel it may cause faint printing at any part of the line.

### **Carriage Fails to Return All the Way**

This may be due to the failure of the carriage return locking devices to hold the spacing and check pawls out of engagement with the spacing ratchet. It may also be due to the carriage return spring not being wound up sufficiently or the carriage not being free on its shaft. Then again it may be due to the needle valve of the dashpot being screwed in too far.

### **Failure to Space After a Carriage Return**

This generally would be due to a failure to trip-off the carriage return locking devices.

### **First and Second Letters of Each Line Unevenly Spaced**

This probably is due to incorrect adjustment of the collar at the right end of the platen, this collar allowing the carriage to return either too far or not far enough to allow the spacing check pawl to engage a tooth on the spacer ratchet properly. To remedy this, unloosen the clamping screw and readjust the collar until even printing is obtained.

### **Spacing with a Stunt, Such as Line Feed or Figures**

This would be due to improper adjustment of either the position of the spacer cutout lever or the spacer rocket extension.

### **Failure to Space After a Stunt**

This would be due to failure of the spacer cutout lever to return quickly to its normal position, due to a bind or perhaps to gummy oil between the back of the lever and the push bar comb to which it is attached.

### **Uneven Printing (Some Letters Faint)**

This may be due to the two ends of the upstop bar being set at different heights. Under such circumstances the typebar stroke at one side of the type basket will be cut off at a different place from that at the other side. Of course, if a certain letter is persistently faint the trouble is perhaps due to the typebar not being free in the type guide. A very slight amount of friction at this point, due to the type pallet rubbing against the side of the guide, will absorb much of the momentum imparted to the typebar by the striker bail, though this trouble of course can be caused by undue friction in any part of the linkage from the push bar to the typebar.

### **Failure of a Stunt**

In general, the persistent or occasional failure of any stunt should call for a checking of the adjustment of that particular part of the mechanism. After a long period of operation, parts may wear suffi-

ciently to necessitate a readjustment to compensate for the wear. It is also well to bear in mind that where one part acts upon a number of other parts, there may be slight variations in the parts which make it advisable to check the adjustment with reference to several rather than one only. This is particularly true of the depressing and striker bail adjustments. In the case of the depressing bail there may be a slight variation in the distance between the push bar and the code bars and when most of the push bars are held clear of the code bars there may be one still in contact with the code bars. None of the adjustments of the printer require absolute exactness and in some cases even .010" more clearance than is prescribed is tolerable.

If a printer develops a fault which is not cleared readily by individual readjustments, it is best to check every adjustment in the printer. First, however, make certain that the trouble is not due to some other piece of apparatus upon which the printer depends for its operation.

### **Printer Fails to Start**

If it does not respond to any signal combination, turn the hand wheel of the main shaft to determine whether or not the shaft turns freely. A lock nut on the striker bail or depressing bail link may have been left loose, allowing the link to change its length, and cause the mechanism to jam. Of course, if the printer is not oiled for a long period of time, the main shaft can become seized in a bearing. If the main shaft is free and the motor does not turn, examine the table clips to see if they are making contact with the printer clips and also if they are alive. If there is voltage on the clips make sure that the circuit is not broken between the clips and the motor. If the circuit is complete examine the motor brushes.

If the motor runs but the printer does not operate, see whether the selecting magnets are operating. If they are not, the trouble may be in the table clips, or the receiving distributor or the common return wire may be broken. If the selecting magnets are operating properly, but the clutch does not engage, test whether the sixth pulse magnet is receiving current. A faulty adjustment of the sixth pulse armature travel or of the throwout lever might prevent the clutch from engaging even though the magnet is receiving current in the proper manner. A faulty adjustment of the sixth pulse cutout or

undue friction in its bearings would have the same effect. Much trouble can be avoided if all adjustments are securely locked after they are made.

### **Failure of the Ribbon to Reverse**

Check all adjustments of the reversing mechanism and see that all gears in the ribbon feeding train are properly meshed. See that all parts move freely.

### **Printer Double Trips**

This is, the main shaft fails to stop at the end of each revolution.

This may be due to a broken sixth pulse armature spring or to a faulty adjustment of the throwout lever reset roller. It may also be due to the latching edge of the sixth pulse armature lever becoming rounded.

The printer will behave in a similar manner if the motor speed is too low. The gearing is such that at its normal speed it will drive the main shaft fast enough to receive signals at the rate of sixty words per minute. If the supply voltage is abnormally low or if there is undue friction in the motor bearings the speed will be so reduced that the starting and stopping of the main shaft will be irregular. Of course, an open armature coil will also reduce the speed of the motor. With a supply voltage of 110 volts the motor speed should be about 1800 r.p.m.

### **Printer Spaces on Blank Signal**

Printers equipped with the sixth pulse cutout mechanism do not space on the blank signal. If the adjusting screw is not properly adjusted to block the sixth pulse armature when no selecting magnets have been operated, the spacing will not be suppressed. A trouble of this kind may also be due to the sixth pulse cutout lever not moving freely.

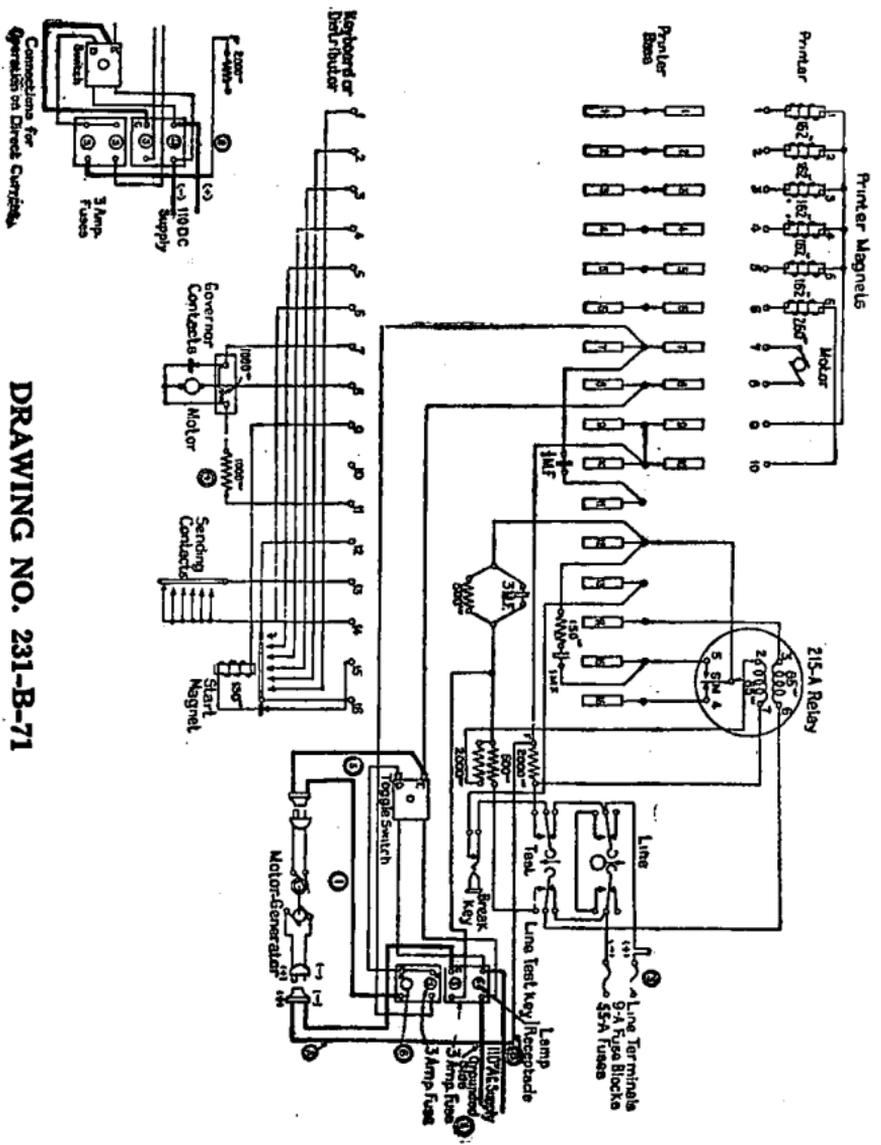
### **Distributor Operates as Though Line Is Open**

After a patch or a change in the circuit has been made, the start magnet of the distributor may trip continuously as though the circuit were open, although the circuit is actually closed. Trouble of this nature is due to the line relay being improperly poled. Line or loop circuits should be properly poled so that patching or switching can be done correctly.



**NOTES ON DRAWING NO. 231-B-71. See Opposite Page**

- ①Connections shown by heavy lines are to be made by installer.
  - ②Connections are shown for printer set employing keyboard distributor unit. Connections for set employing receiving distributor are the same as above excepting that the sending contacts are omitted and distributor terminals 13 and 14 are strapped.
  - ③Loop of wire is provided here for connecting to line resistances when required.
  - ④Omitted on A. C. Units.
  - ⑤These connections for A. C. supply. For D. C. see drawing at left.
  - ⑥Use 6 ampere fuse for 7114 (M) motor-generator.
- 
- Use 10 ampere fuse for 71508 (M) motor-generator (50 cycles).
  - Use 10 ampere fuse for 71510 (M) motor-generator (60 cycles).
  - ⑦Line relay current values should be approximately as follows:
    - Line Test Key in "Line" Position**  
Biasing current = .029 ampere.  
Line current to be = .060 ampere.
    - Line Test Key in "Test" Position**  
Biasing current = .012 ampere (with signaling current flowing).
    - Signaling current .036 ampere.
  - ⑧End of wire from F on new bases as supplied is dead ended near fuse block.

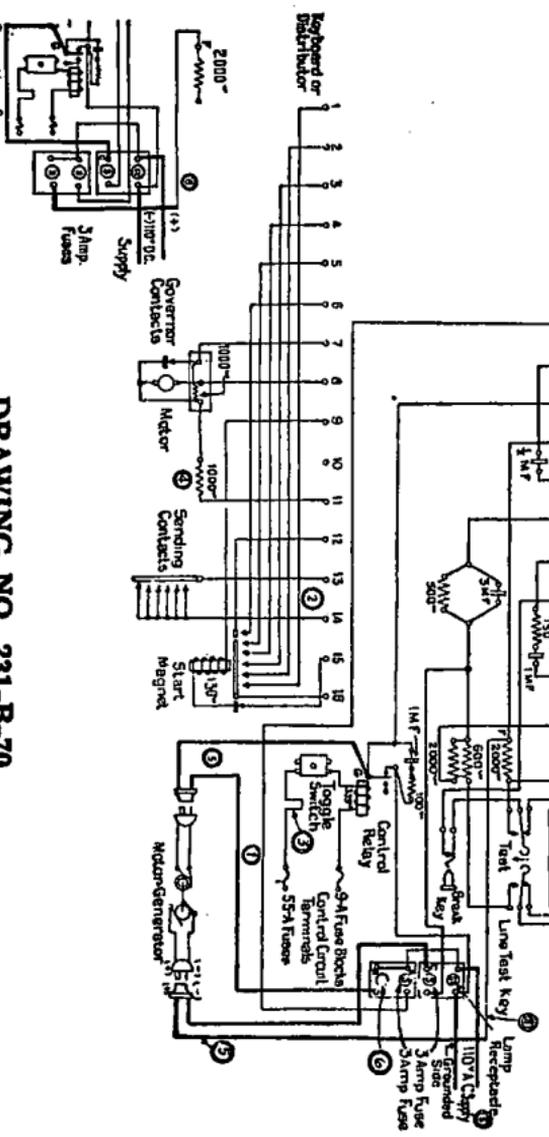
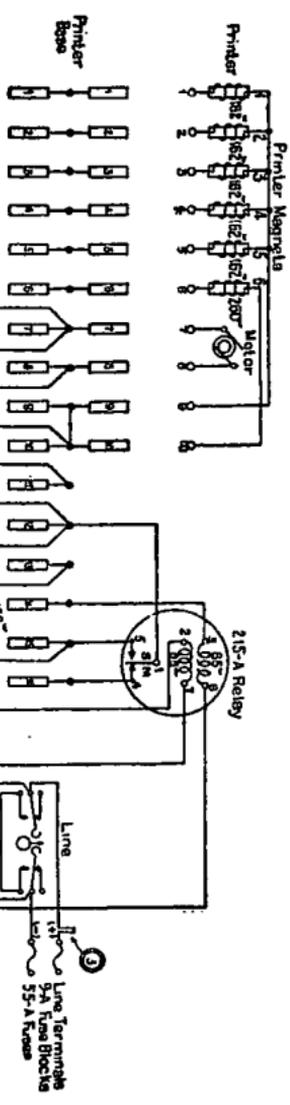


**DRAWING NO. 231-B-71**

**No. 12-A Page Printing Telegraph Set for Operation on A. C. or D. C. Supply**  
 (For Notes, see opposite page)

**NOTES ON DRAWING NO. 231-B-70. See Opposite Page**

- ①Connections shown by heavy lines are to be made by installer.
- ②Connections are shown for printer set employing keyboard distributor unit. Connections for set employing receiving distributor are the same as above excepting that the sending contacts are omitted and distributor terminals 13 and 14 are strapped.
- ③Loop of wire is provided here for connecting to line resistances when required.
- ④Omitted on A. C. Units.
- ⑤These connections for A. C. supply. For D. C. see drawing at left.
- ⑥Use 6 ampere fuse for 7114 (M) motor-generator.
  
- Use 10 ampere fuse for 71508 (M) motor-generator (50 cycles).
- Use 10 ampere fuse for 71510 (M) motor-generator (60 cycles).
- ⑦Line relay current values should be approximately as follows:
  - Line Test Key in "Line" Position**  
Biasing current = .029 ampere.  
Line current to be = .060 ampere.
  - Line Test Key in "Test" Position**  
Biasing current = .12 ampere (with signaling current flowing).
  - Signaling current = .036 ampere.
- ⑧End of wire from F on new bases as supplied is dead-ended near fuse block.



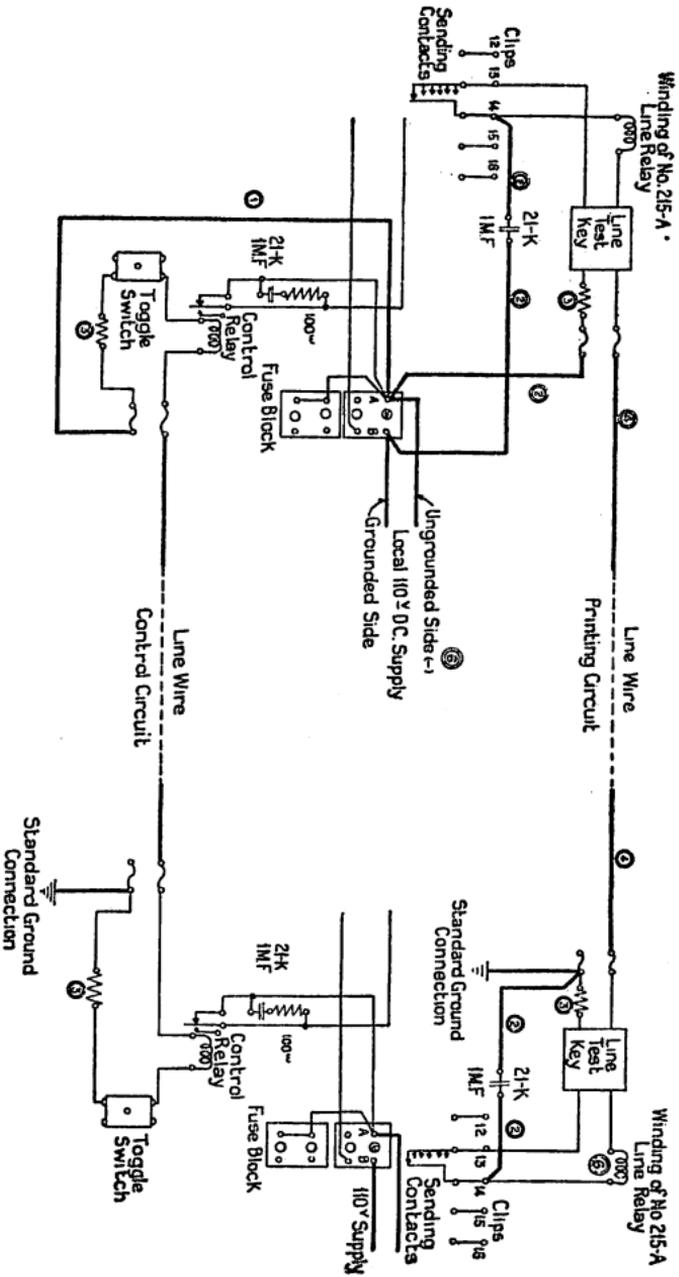
Connections for  
Operation on Direct Current

**DRAWING NO. 231-B-70**

**No. 12-B Page Printing Telegraph Set for Operation on A. C. or D. C. Supply**  
(For Notes, see opposite page)

**NOTES ON DRAWING NO. 235-B-14. See Opposite Page**

- ①Connections shown in heavy lines are to be made by installer.
- ②No. 18 Gauge "Deltabeston" fixture wire or other approved electric light wire to be used here.
- ③Line resistances are to be No. 18 type and should be mounted in spare positions on resistance bracket when required. Wire loops are provided in the set for connection to line resistances, which should be selected so that the signaling circuit current will be approximately .060 ampere and divided so that approximately half will be at each
  - ④For detailed internal connections of printer set see Drawing 231-B-70.
  - ⑤For printing circuit connections see Drawing 235-B-16.

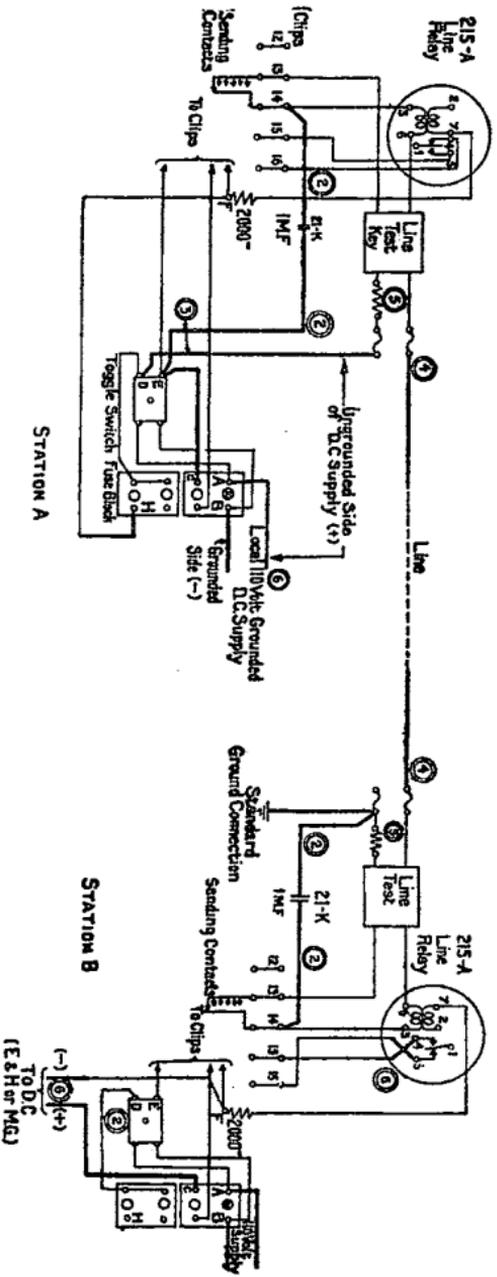


**DRAWING NO. 235-B-14**

**Line Circuit Connections of Two No. 12 Type Page Printing Telegraph Sets Employing a Control Circuit for Starting and Stopping the Printer Motors Grounded D. C. Supply at One Station**  
 (For Notes, see opposite page)

## NOTES ON DRAWING NO. 235-B-16. See Opposite Page

- ③Connections shown in heavy lines are to be made by installer.
- ③No. 18 Gauge "Deltabeston" fixture wire or other approved electric light wire to be used here.
- ③If it is desired to have line circuit remain closed when switch is thrown to "Off" position, these wires should connect to terminals marked "A" and "B" of fuse block.
- ③Line wire should be connected to line fuse which connects directly through line-test key to line relay winding. Wire to be used here is 19 Olive Inside Wire.
- ③Line resistances are to be No. 18 type and should be mounted in spare positions on resistance bracket when required. Wire loops are provided in the set for connection to line resistances, which should be selected so that the line current will be approximately .060 ampere and divided so that approximately half will be at each end of the line circuit.
- ③If the grounded side of the supply at Station A for furnishing line current is of negative polarity as shown, the normal power connections shown here and on Drawing 231-B-71 will be used at Station A. At Station B, however, it will be necessary to interchange the wires connecting to Terminals 4 and 5 of the relay connecting block as shown above and to reverse the polarity of the D. C. supply so that "F" will be negative and "C" positive.
- If the grounded side of the supply at Station A is of positive polarity, it will be necessary to interchange the wires to Terminals 4 and 5 at Station A, since "F" will be negative and "C" positive, which is the reverse of normal conditions. At Station B in this case, no change from the normal power connections shown on Drawing 231-B-71 will be required.
- ③In cases where a control wire is used, current for the control circuit may be obtained by connecting to the D. C. supply in a manner similar to that shown for obtaining signaling line current. See Drawing 235-B-14.

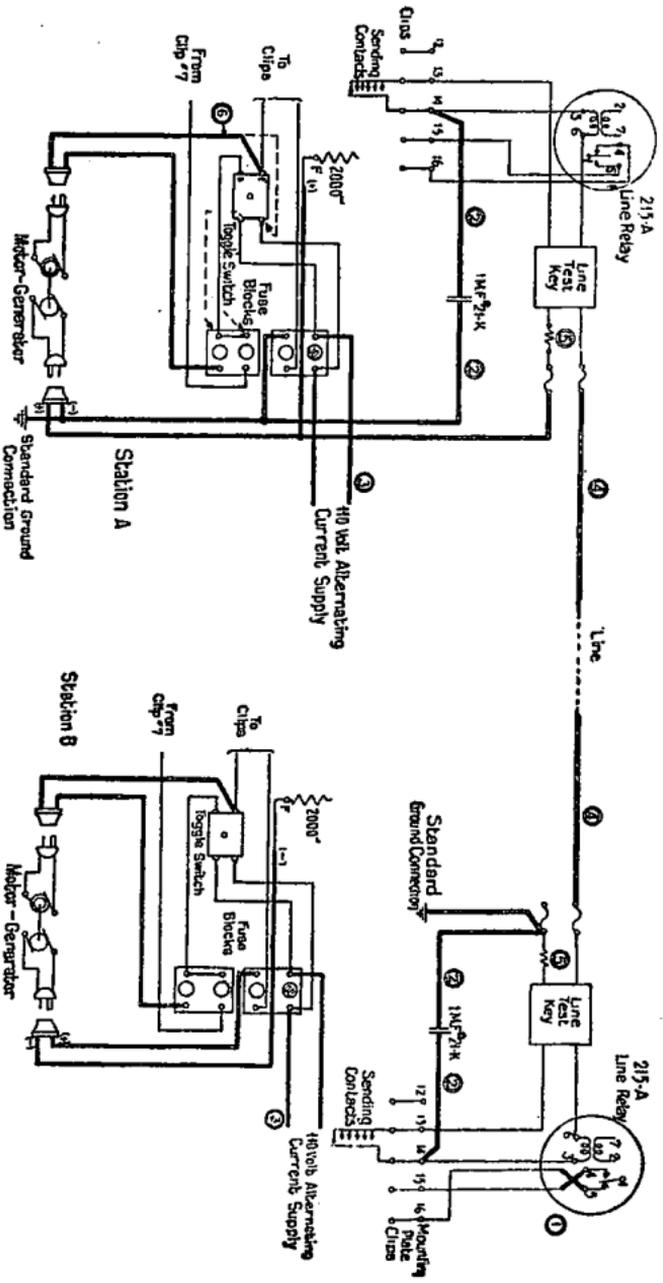


**DRAWING NO. 235-B-16**

**Line Circuit and Power Connections for No. 12 Type Sets When Local 110 Volt Grounded Direct Current Supply Is Used to Supply Line Current**  
 (For Notes, see opposite page)

**NOTES ON DRAWING NO. 218-B-32. See Opposite Page**

- ③Connections shown in heavy lines are to be made by installer.
- ③No. 18 Gauge "Deltabeston" fixture wire or other approved electric light wire to be used here.
- ③Re-enforced lamp cord may be used here or where wire is subjected to possibility of mechanical injury, pipe conduit or B. X. armored cable should be used (No. 14 gauge wire).
- ③Line wire should be connected to the line fuse which connects through line-test key directly to line relay. Wire to be used here is No. 19 Olive Inside Wire.
- ③Line resistances are No. 18 type resistances and are to be mounted in spare positions on resistance bracket when required. Wire loops are provided
- ③If it is desired to have the line circuit remain closed when the printer set at Station A is shut down it will be necessary to connect the A. C. leads for the motor-generator to the other side (live side) of the toggle switch and install a suitable snap switch on the printer base for controlling the starting and stopping of the motor-generator as shown by dotted lines, strap on lower fuse block to be removed.

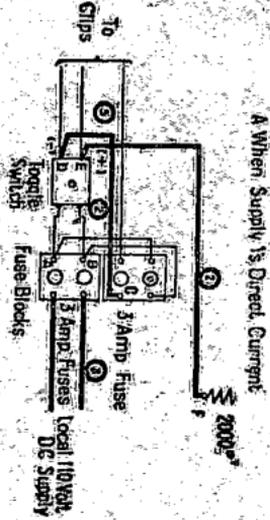


DRAWING NO. 218-B-32

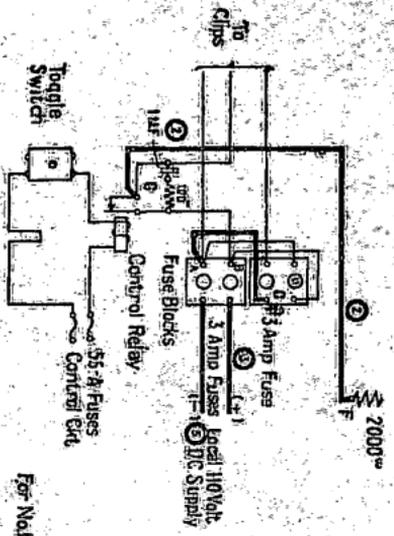
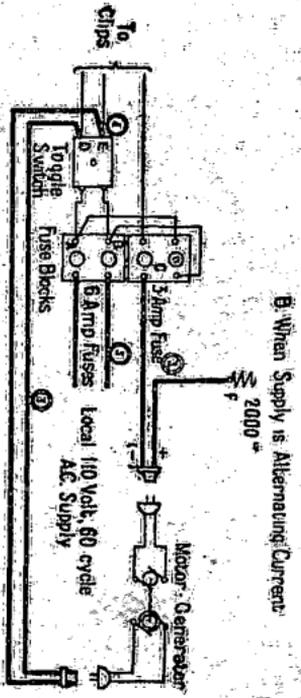
Line Circuit Connections for No. 12 Type Sets When 110 Volt Alternating Current Supply Only Is Available and Line Current Must Be Supplied from One Printer Station  
 (For Notes, see opposite page)

**NOTES ON DRAWING NO. 218-B-30. See Opposite Page**

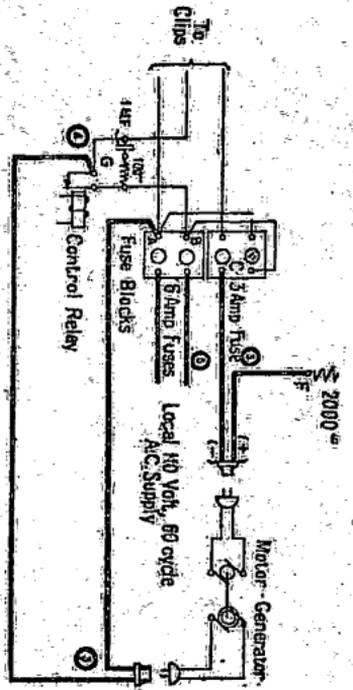
- ①Connections shown in heavy lines are to be made by installer.
- ②Connecting wire here used may be No. 18 Gauge "Deltabeston" fixture wire or other approved electric light wire.
- ③Re-enforced lamp cord may be used here, unless wire is subjected to possibility of mechanical injury, in which case pipe conduit or BX armored cables should be used. (Wire size No. 14 gauge.)
- ④If motor-generator is used to supply line current in addition to its regular printer load and it is desired that the line current be not interrupted when the printer set is shut down, it will be necessary to connect the A. C. leads for the motor-generator to fuse terminals "A" and "B" through a suitable snap switch mounted on the side of the table top for controlling the starting and stopping of the motor-generator.
- ⑤In case it is desired to use this 110-volt D. C. source to supply line current, it may not be possible to connect polarity as shown.



For No. 12-A Sets where control relay is not used



For No. 12-B Sets where control relay is used



**DRAWING NO. 218-B-30**

Power Supply Connections for No. 12 Type Page Printing Telegraph Sets Shipped Prior to September 1, 1927

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