THE MODEL 15 TELETYPE [R]

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CONTENTS


TYPING UNIT
THUMB SCREWS (3)
BOTH SIDES
KEYBOARD UNIT
THUMB SCREWS (2)
THE M15 TELETYPE
(WITH COVER REMOVED)

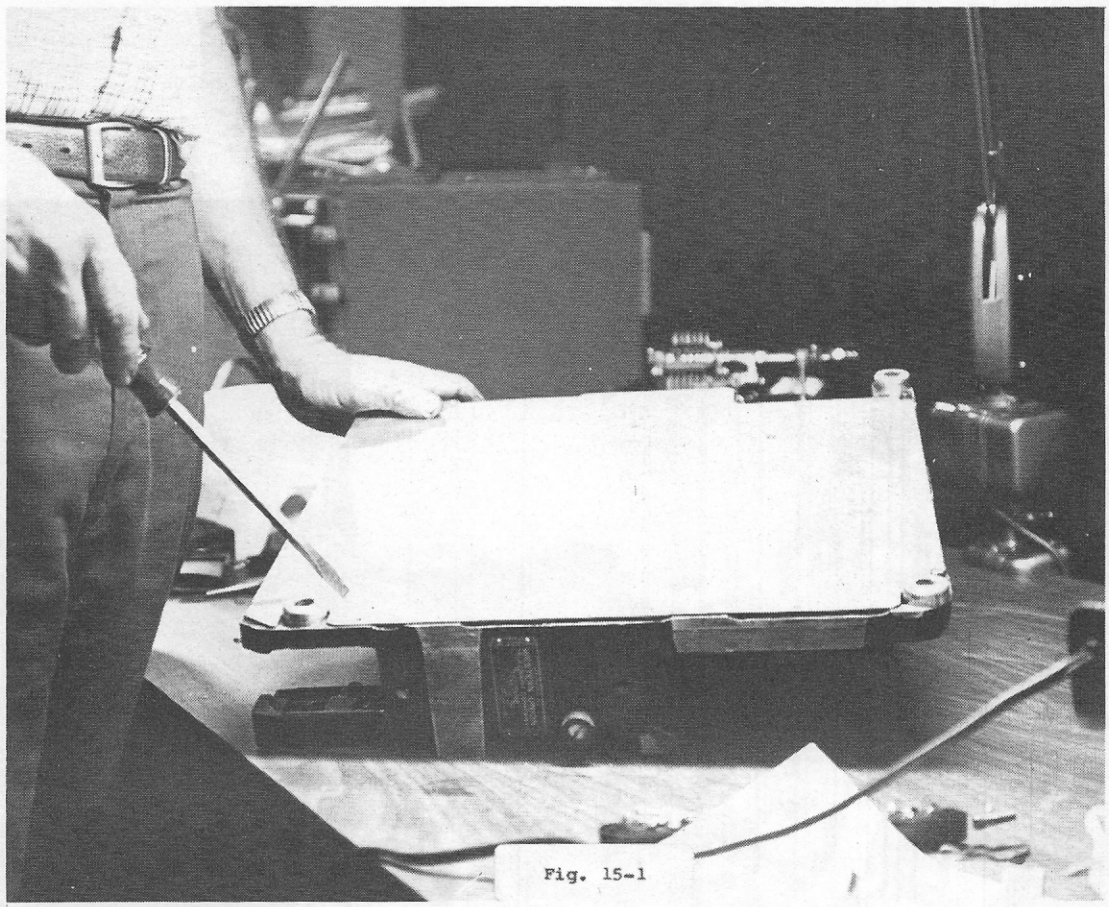


Fig. 15-1

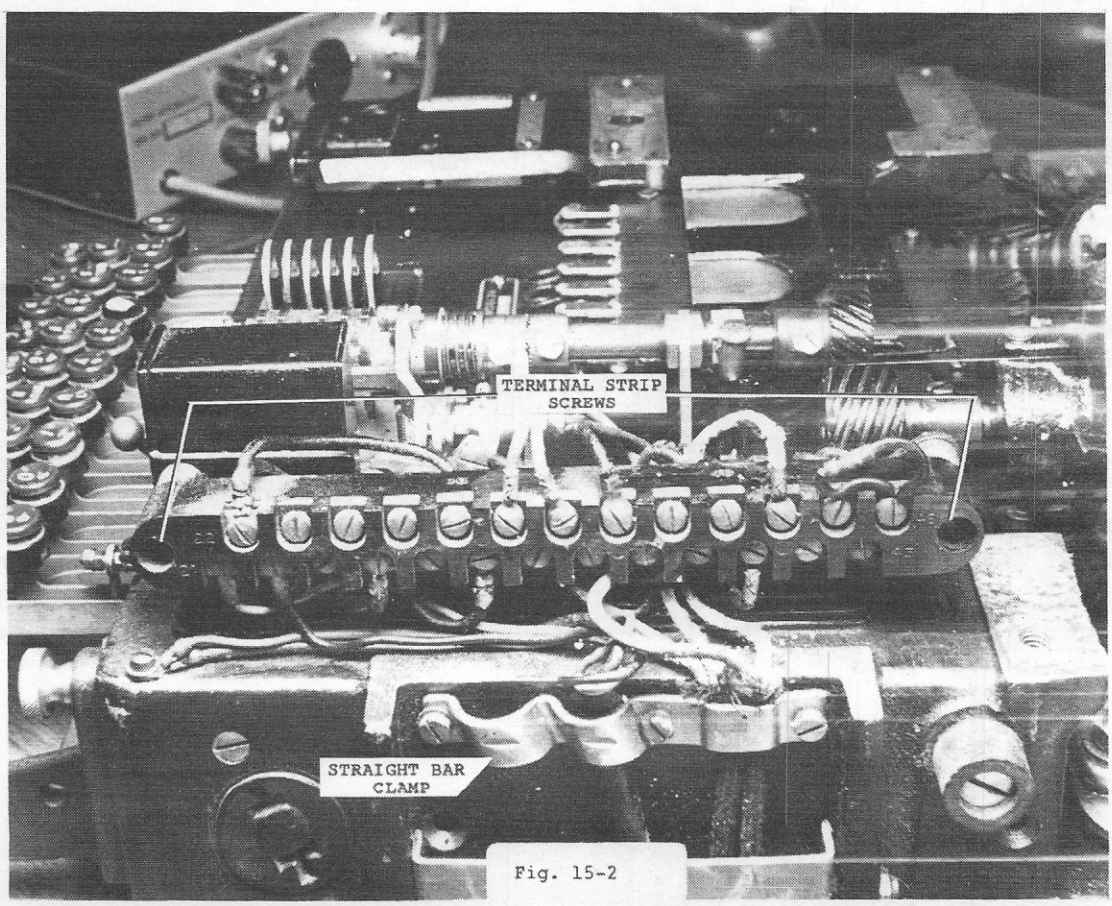



Fig. 15-2

## A. REWIRING A MODEL 15 TELETYPE MACHINE

Model 15 machines have a lot or wiring, usually in poor condition, in their bases. Such wiring should be stripped out and discarded. After all, only six wires are required to provide complete connections. An hour or so of work should provide neat electrical installation.*

In preparation for such work, the TTY machine is placed on a workbench. No power connections this time; do not plug the TTY into any wall power outlet. The TTY cover is lifted straight up and out, it is set aside. After removing three large thumb screws (two on the left side and one on the right), the typing unit is lifted off and set aside. Next, the keyboard unit is pulled out (after loosening two small thumb screws, one on the left and the other on the right). Finally, the bottom plate of the TTY base is removed; just take out the four corner screws. Save these screws, including all loose parts, as most of them are usable. Fig. 15-1.

1. Remove all old power and signal cords from the terminal strip on the right side of the base. Loosen the straight-bar clamp (three screws) in order to release the cord. Fig. 15-2.

2. Remove two long screws holding the terminal strip to the TTY

* The rewiring is optional. Some people may prefer to leave the original base wiring alone, if it appears in good condition, in spite of the complexity.

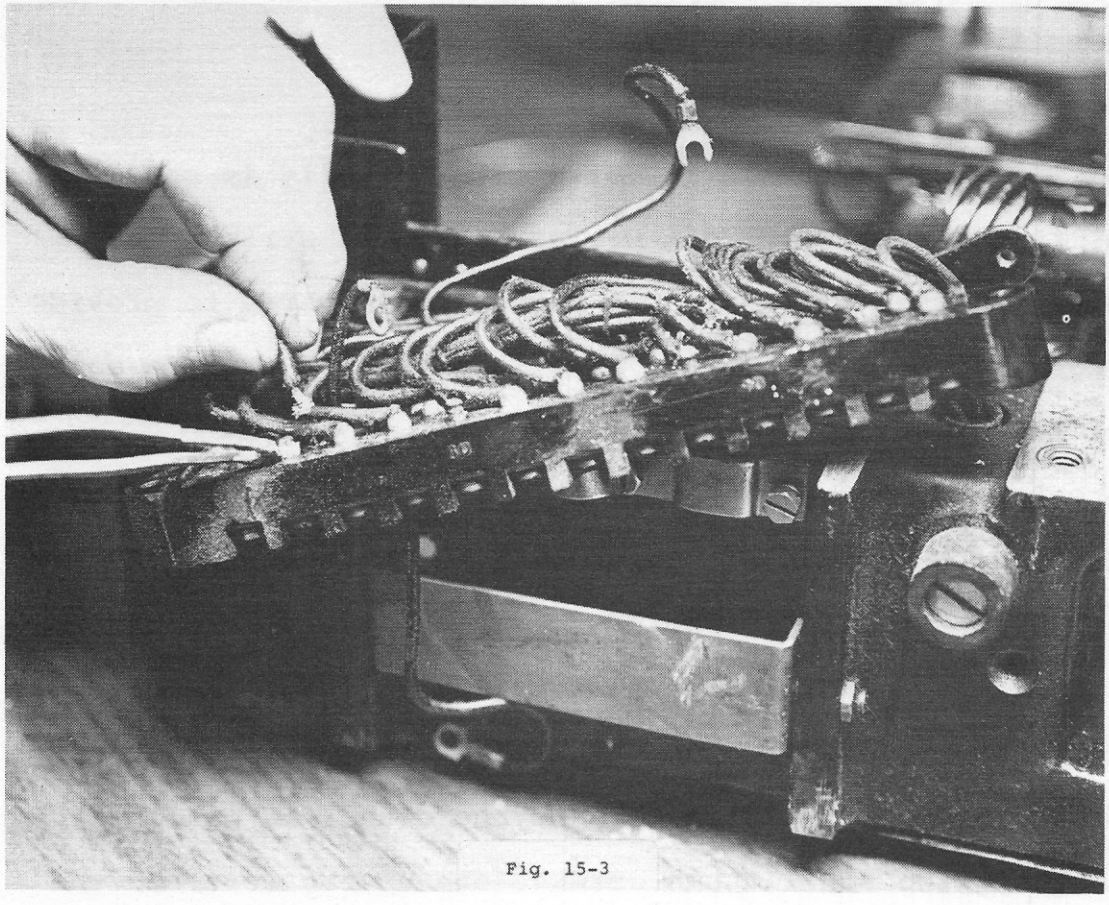


Fig. 15-3

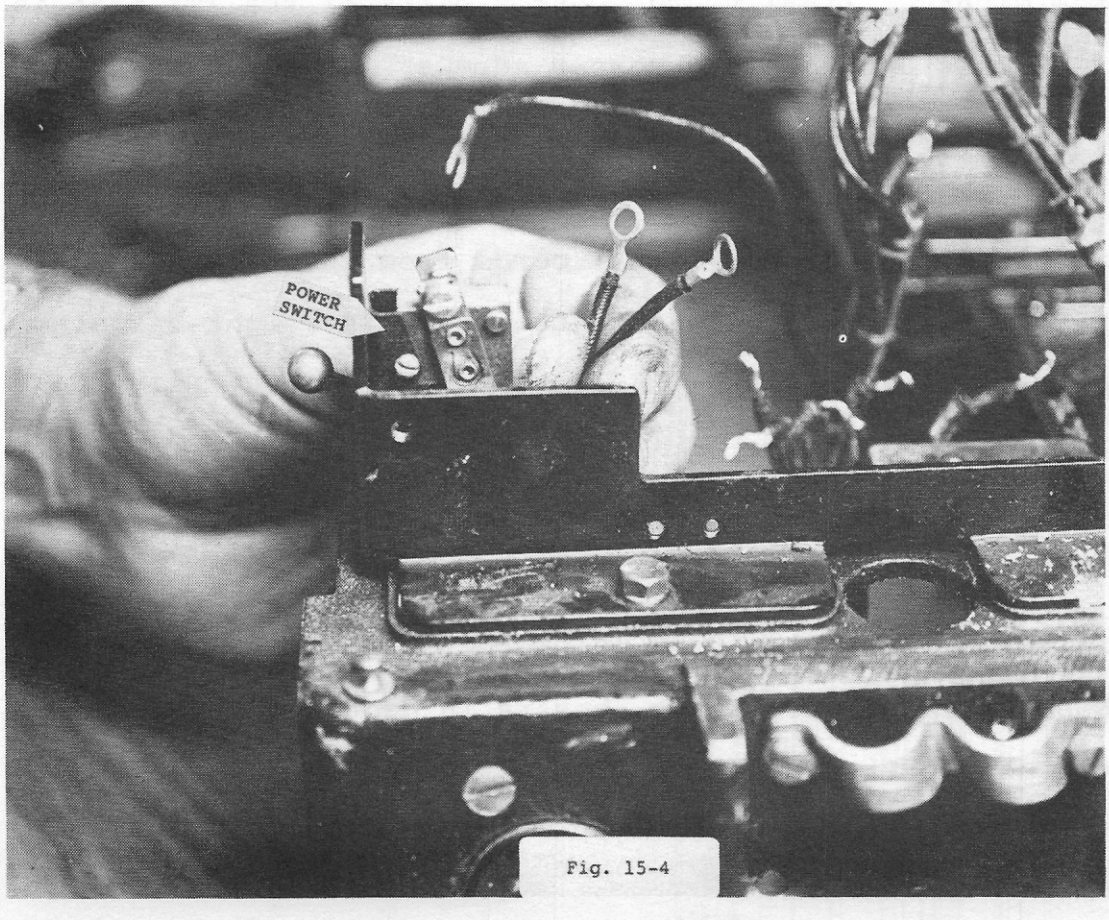



Fig. 15-4

base. Save these screws, along with the two metal spacers.

3. Using a hot (100-watt size) soldering iron, unsolder all connections from the pins on the back side of the terminal strip. Using a pair of long nose pliers, pull each wire off each pin, after it has been heated well enough to assure easy unsoldering and pulloff. After all wires have been removed, set the terminal strip aside. Fig. 15-3.

4. Uncover the power switch (remove the black cover, after loosening two screws just behind the cover. DO NOT LOSE THE INSULATING FIBERBOARD WHICH IS INSIDE THE COVER BOX. Remove the old wires from this switch. Fig. 15-4.

5. On the left front corner of the base there is a Send-Receive-Break switch assembly. Unsolder all wires going to this part. If desired, the assembly can be removed and discarded. It is, however, recommended that it be left on the base, for possible future use.

6. Turn the base upside down. There is a maze of old wires inside. TAKE IT ALL OUT. Remove the wire clamps. Unsolder all connections going to the keyboard and motor slip-contact assemblies. Pull the old wires out through the various holes. Cut through the cabling going through a large hole to the rear deck of the base. Fig. 15-5.

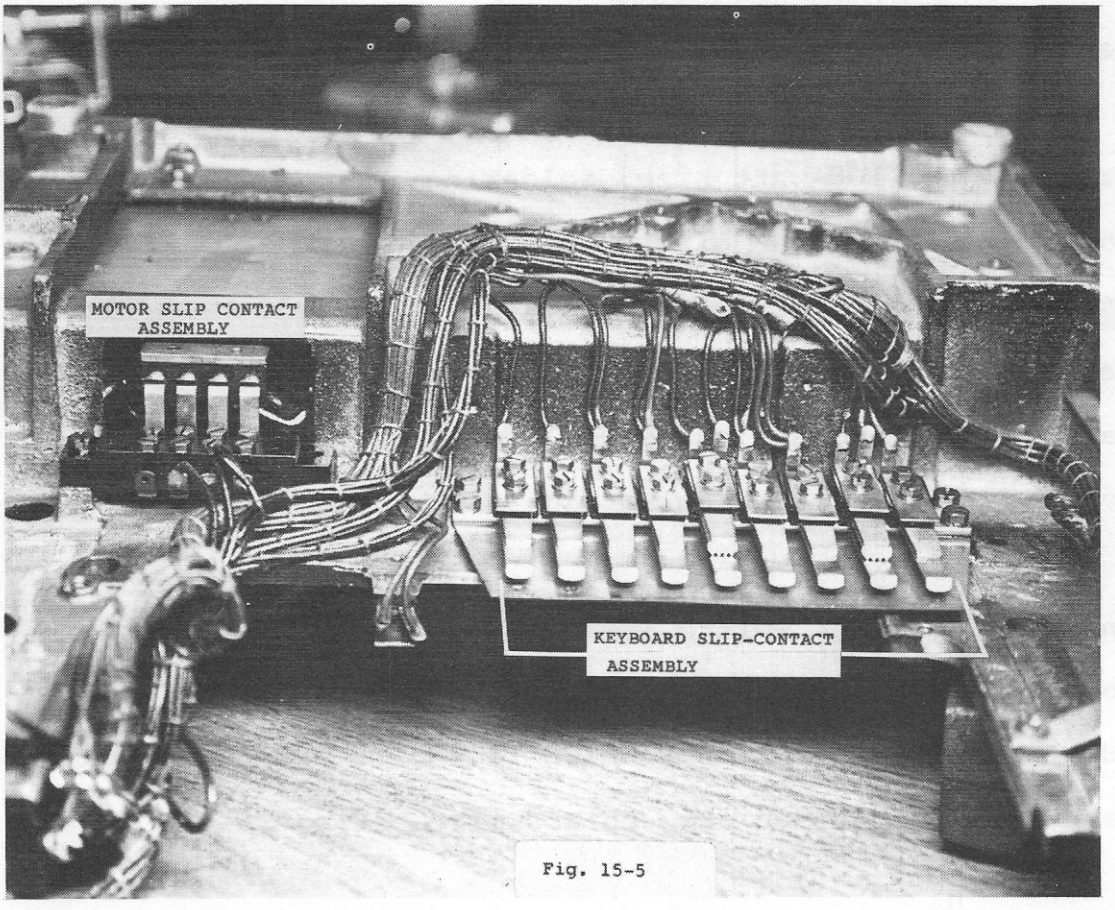



Fig. 15-5

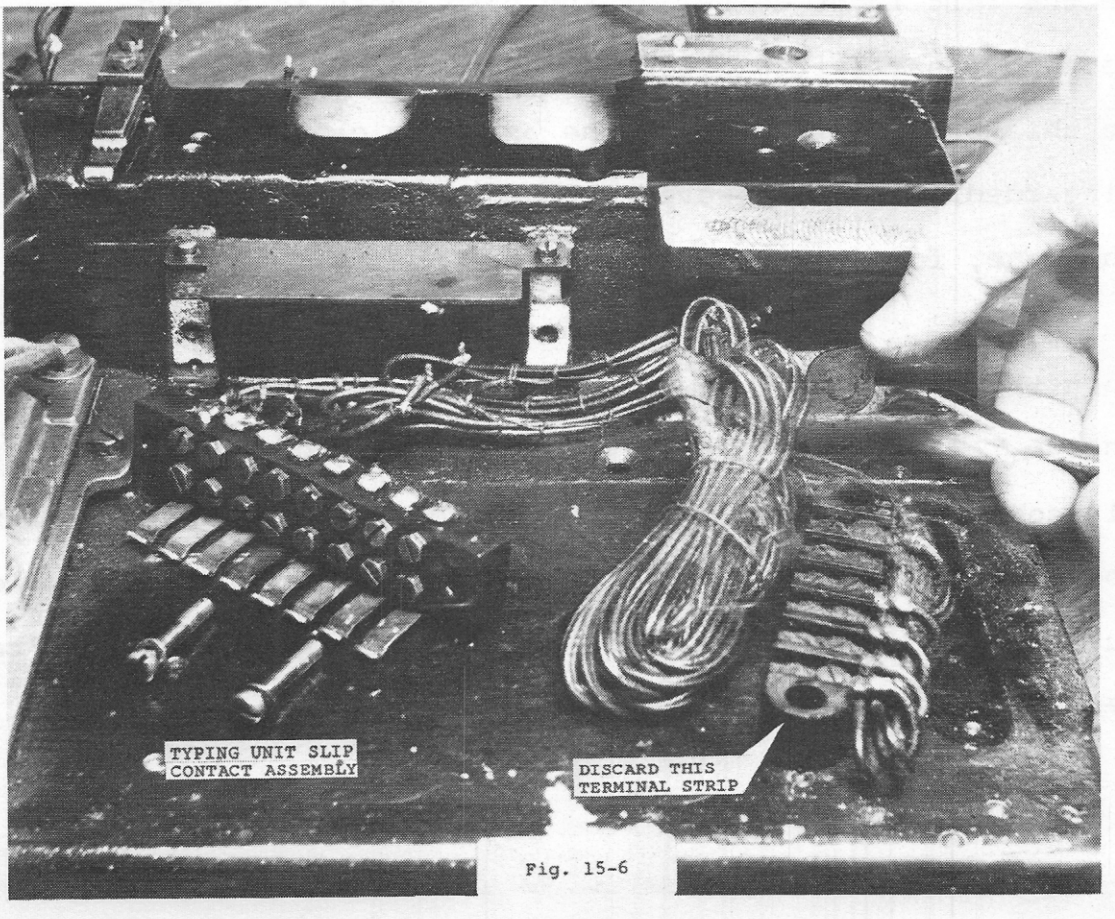



Fig. 15-6

7. With the base topside up, remove two screws holding the typing-unit slip-contact assembly. Unsolder and pull all old wires. Discard the small terminal strip which is on the left rear corner of the base deck, but save the typing-unit slip-contact assembly. Fig. 15-6.

8. You should have a base completely bare of all old wiring. Clean it up, with a rag, going after all oily spots and areas. A little naptha will help. Fig. 15-7.

The base is now ready for installation of new wires. We will use good quality insulated wire; do not use rubber covered wire, because oil causes rubber to deteriorate. Obtain some Number 18 gauge stranded wire from a hardware store; it should be well covered with plastic insulation. Obtain, also, some No. 6 solder lugs, as we will be needing them to make certain connections. VACO has a stack of plastic boxes containing solder lugs; get the lug that has a hole to pass a No. 6 screw; this style is preferable to the spade lugs also available.

9. Wiring the Motor Power Connections...

a) Take a length of plastic-insulated wire and solder one end on Pin 23 on the terminal strip (which, by this time, has been remounted on the base). Fig. 15-13. Run this wire through the hole in the base and downward underside to the motor slip-contact assembly. Solder the wire to one slip contact as shown in Fig. 15-8.

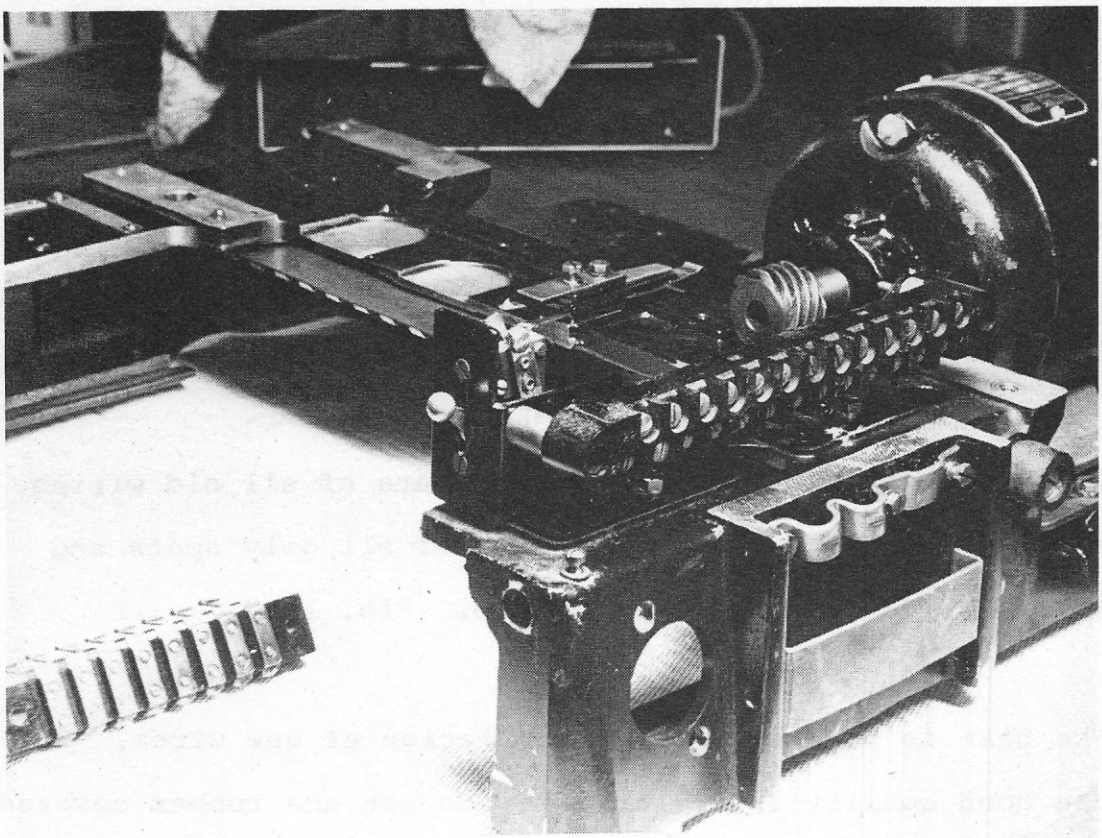


Fig. 15-7

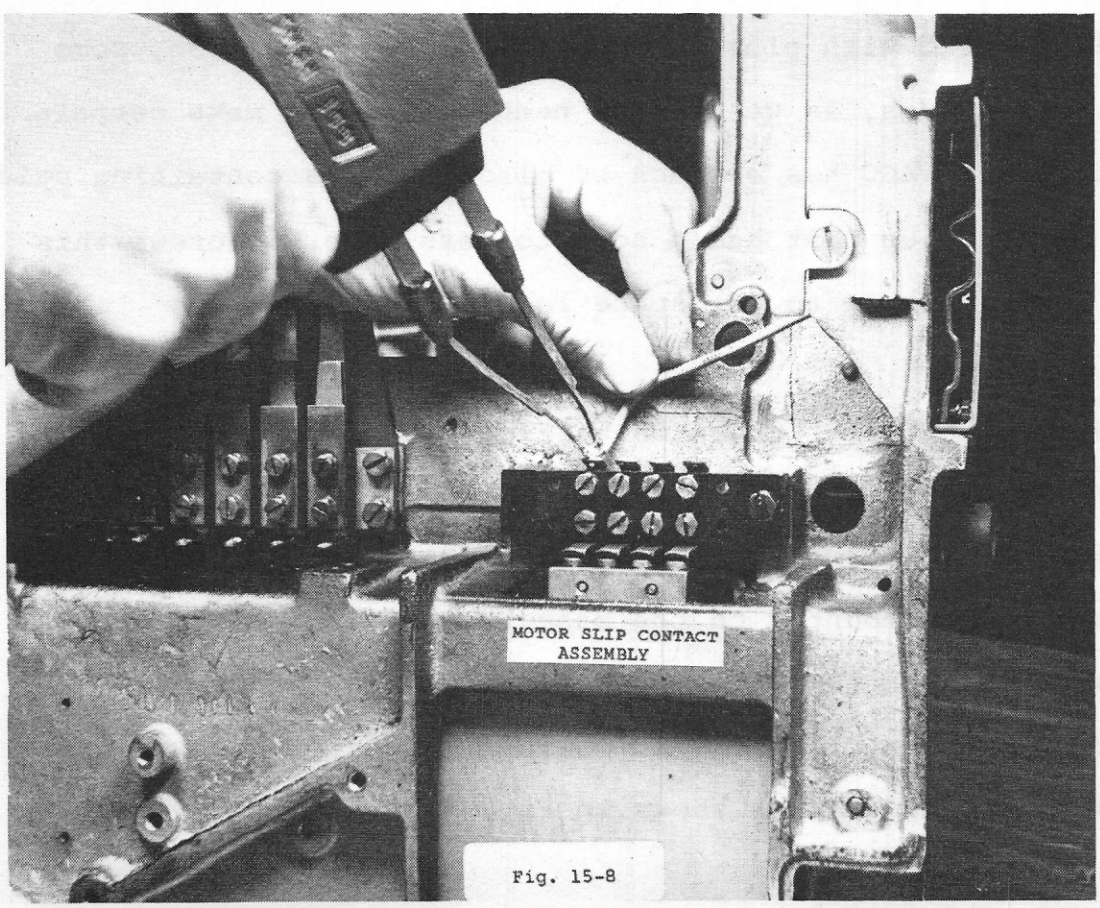



Fig. 15-8

b) Attach another length of wire to Pin 21 on the terminal strip; run this wire through the base to the power switch. Mount a solder lug on the end of this wire, and screw it on one side of the switch. Attach a new piece of wire (with solder lug mounted) to the other side of the power switch; run this wire out and attach it to another slip contact on the motor slip-contact assembly. See Fig. 15-9. This completes the motor power connections.

10. Wiring the Keyboard Connections...

a) Take a length of plastic insulated wire; solder one end on Pin 31 on the terminal strip. (Fig. 15-13). Run this wire through the base to #4 slip contact on the keyboard slip-contact assembly. Be sure to route the wire close to the inside corners in the base, as the keyboard will fit into this confined space.

b) Using a short piece of wire, make a jumper connection from #4 slip contact to shorting contact on #5 slip contact.

c) Run a wire from #5 slip contact to pin 33 on the terminal strip. This completes the keyboard connections in the base. (Fig. 15-10).

11. Wiring the Magnet Connections...

a) Take a length of plastic insulated wire; solder one end on Pin 43 on the terminal strip. (Fig. 15-13). Run this wire through the base, going through two holes, to the rear deck of the base. Attach this wire to the #3 slip contact

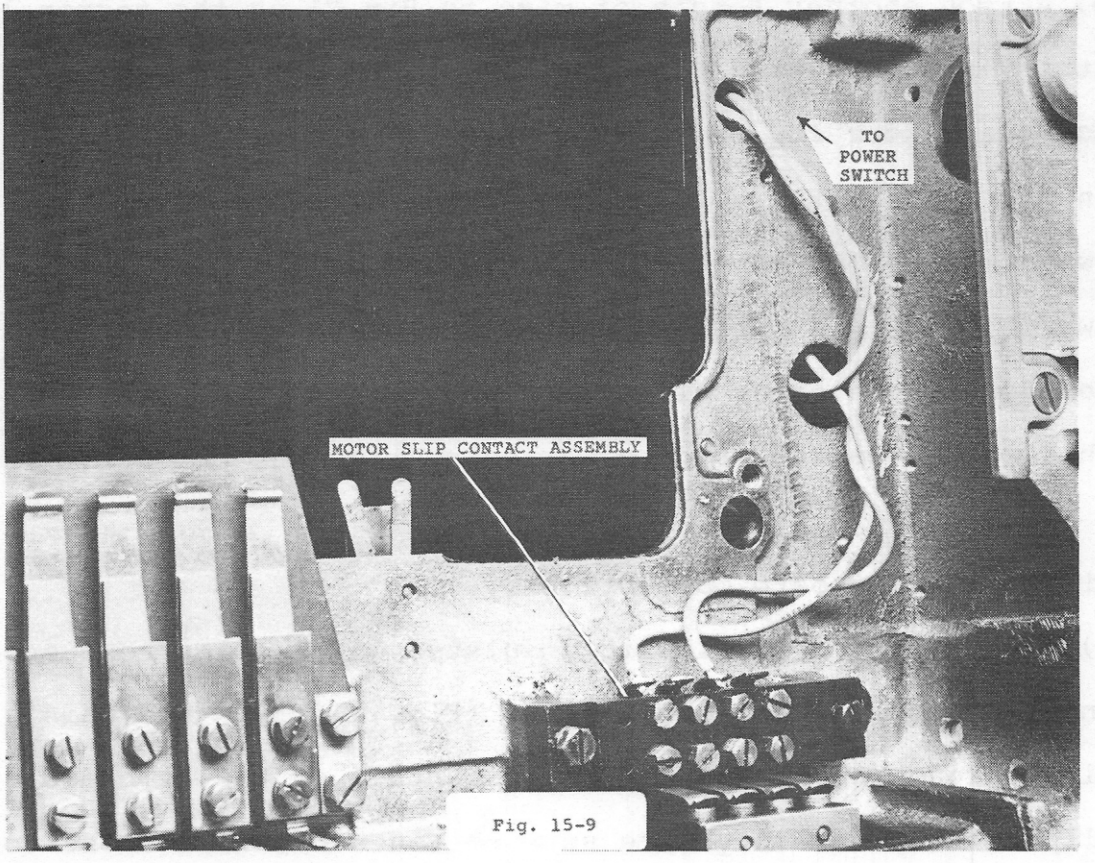



Fig. 15-9

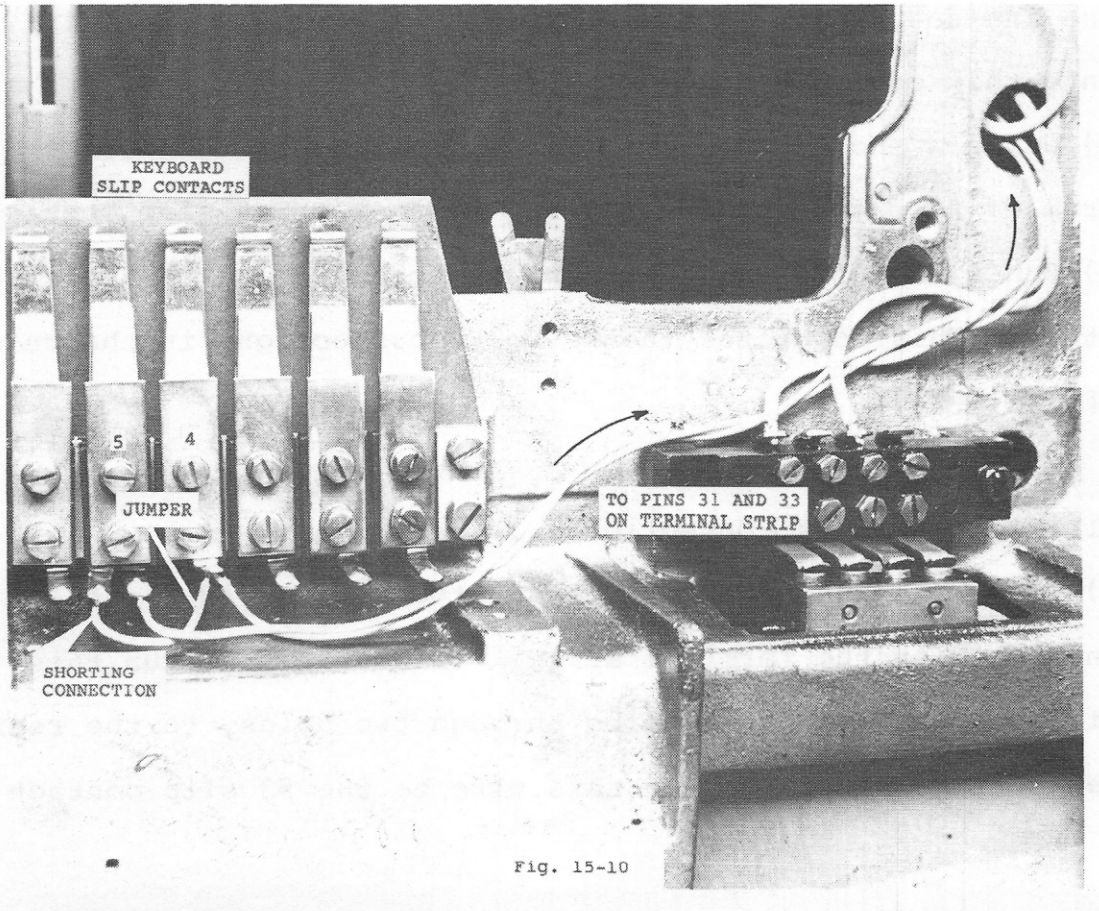



Fig. 15-10

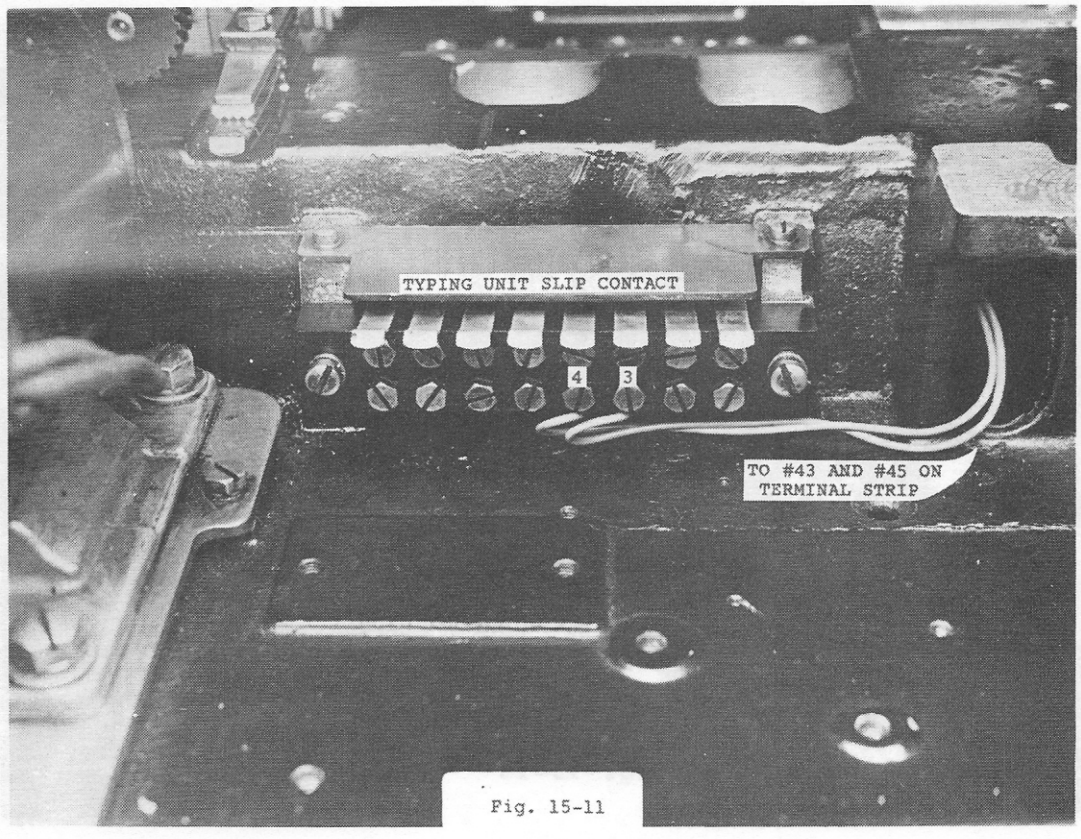



Fig. 15-11

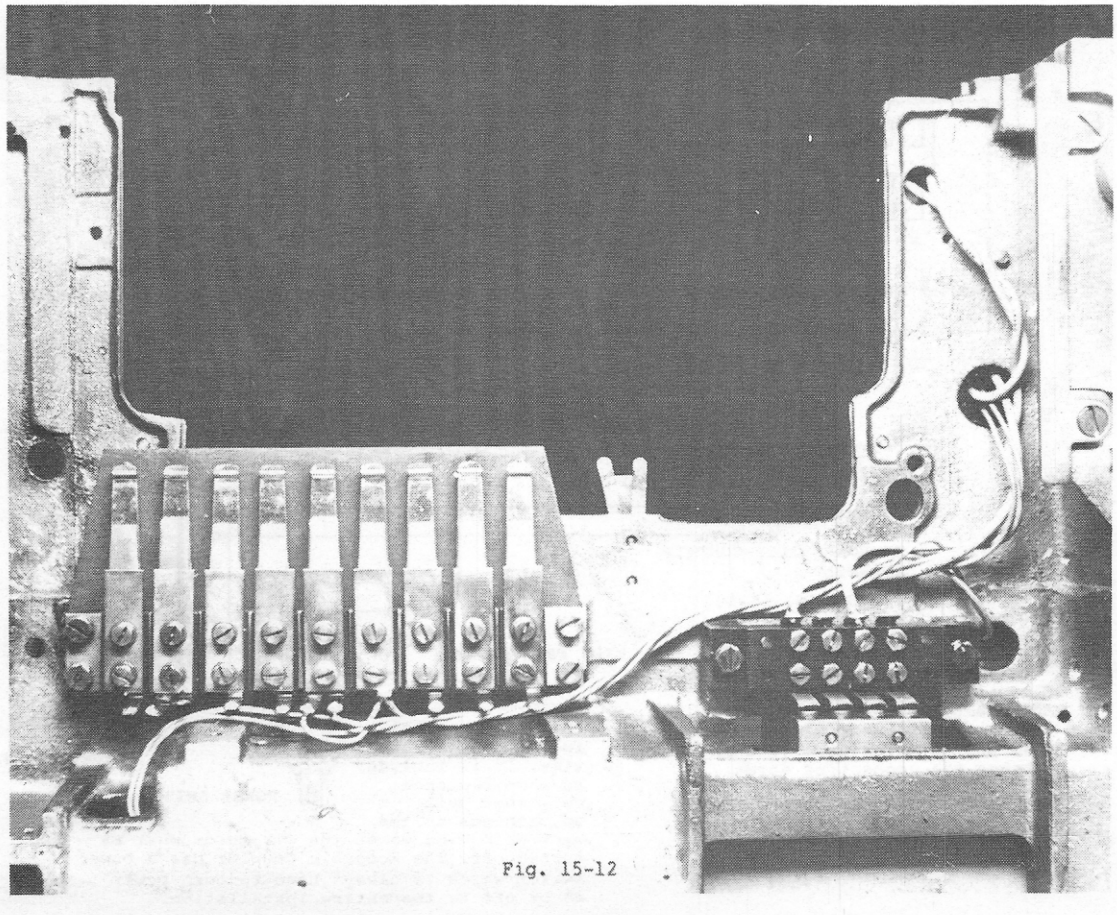


Fig. 15-12

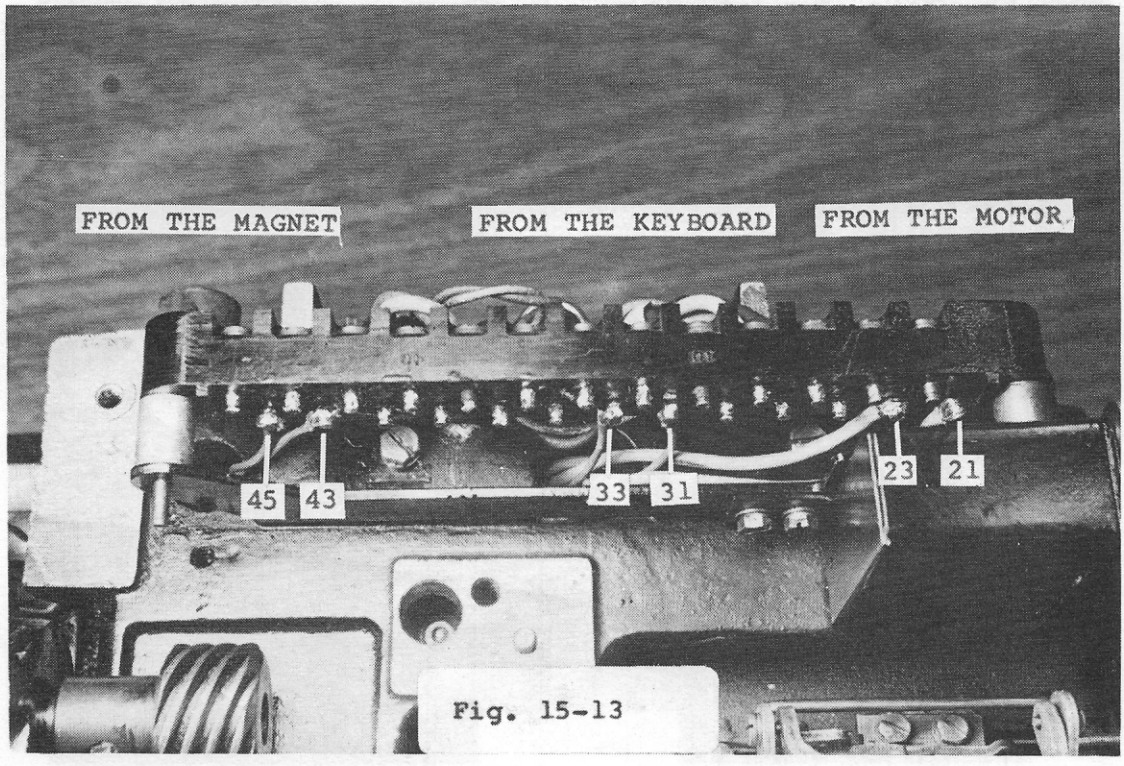
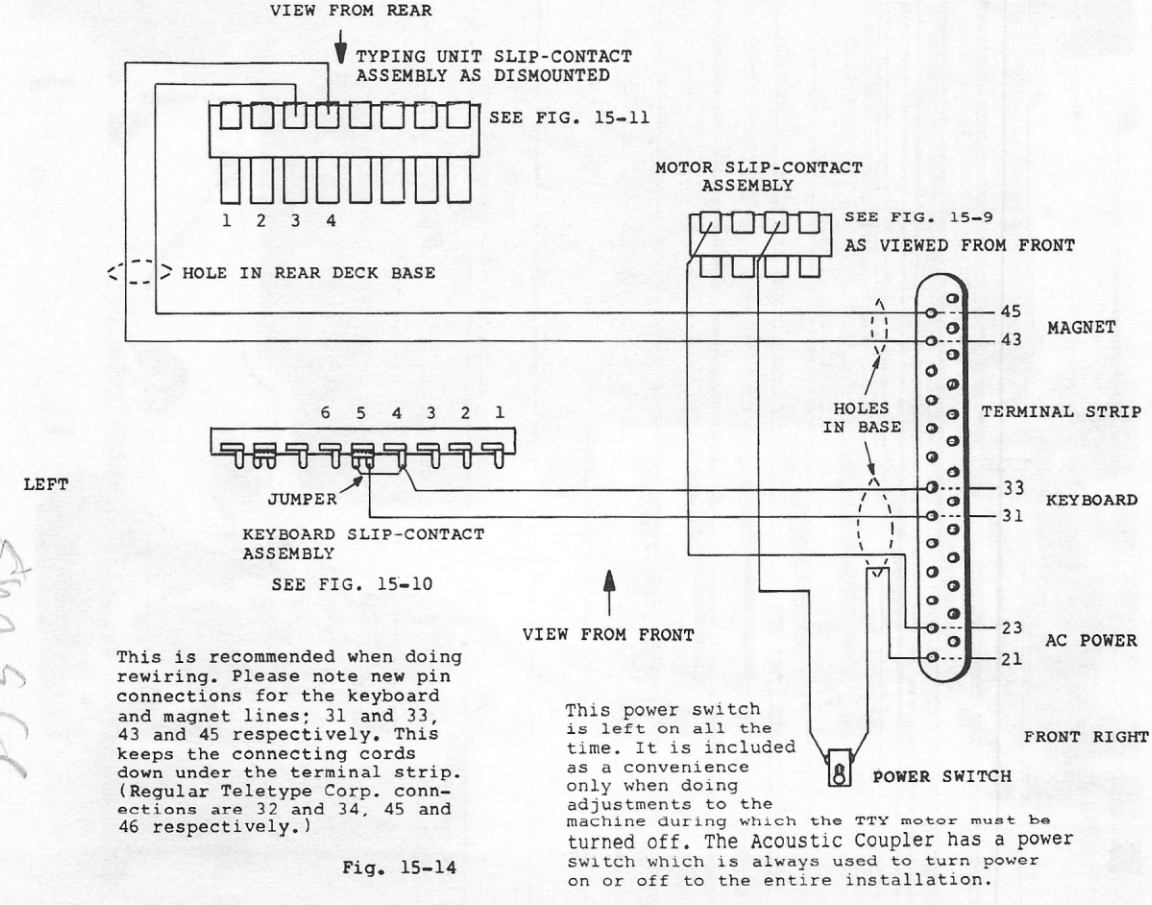



Fig. 15-13




This is recommended when doing rewiring. Please note new pin connections for the keyboard and magnet lines; 31 and 33, 43 and 45 respectively. This keeps the connecting cords down under the terminal strip. (Regular Teletype Corp. connections are 32 and 34, 45 and 46 respectively.)

This power switch is left on all the time. It is included as a convenience only when doing adjustments to the machine during which the TTY motor must be turned off. The Acoustic Coupler has a power switch which is always used to turn power on or off to the entire installation.

Fig. 15-14

on the typing-unit slip-contact assembly.

b) Run another piece of wire between Pin 45 and #4 slip contact on the typing-unit slip-contact assembly. Fig. 15-11.

12. Be sure to bundle all wires so they will lay close to the deep corners and recesses inside the base. If necessary, use some linen string or nylon fish line to lace the wires together into a cabling. This will provide a neat installation. See Fig. 15-12. Also, see Fig. 15-13. The M15 base wiring diagram is in Fig. 15-14.

This completes the clean up and rewiring of the M15 base. Now, all we need to do, to make connection to the Acoustic Coupler box, is to make up a set of three cords and plugs. Depending on the TTY installation, the distance may be 3 ft. between the M15 machine and the coupler, or it might be 6 or 8 feet. In general, 6 feet would be about right.

Procure two 6-ft. lengths of two-wire black vinyl-covered lampcord, size 18 wire stranded; one 6-ft. length of three-wire black vinyl-covered power tool cord, size 18 wire stranded; one 3-pin safety-ground power plug; and two phone plugs--one to be red and the other to be black. Switchcraft plugs are available from an electronic supply store; quite likely all materials can thereby be obtained. Be sure to buy some VACO solder lugs (crimp type) although soldering wires into lugs is recommended. #6 lugs will have holes; no spades.

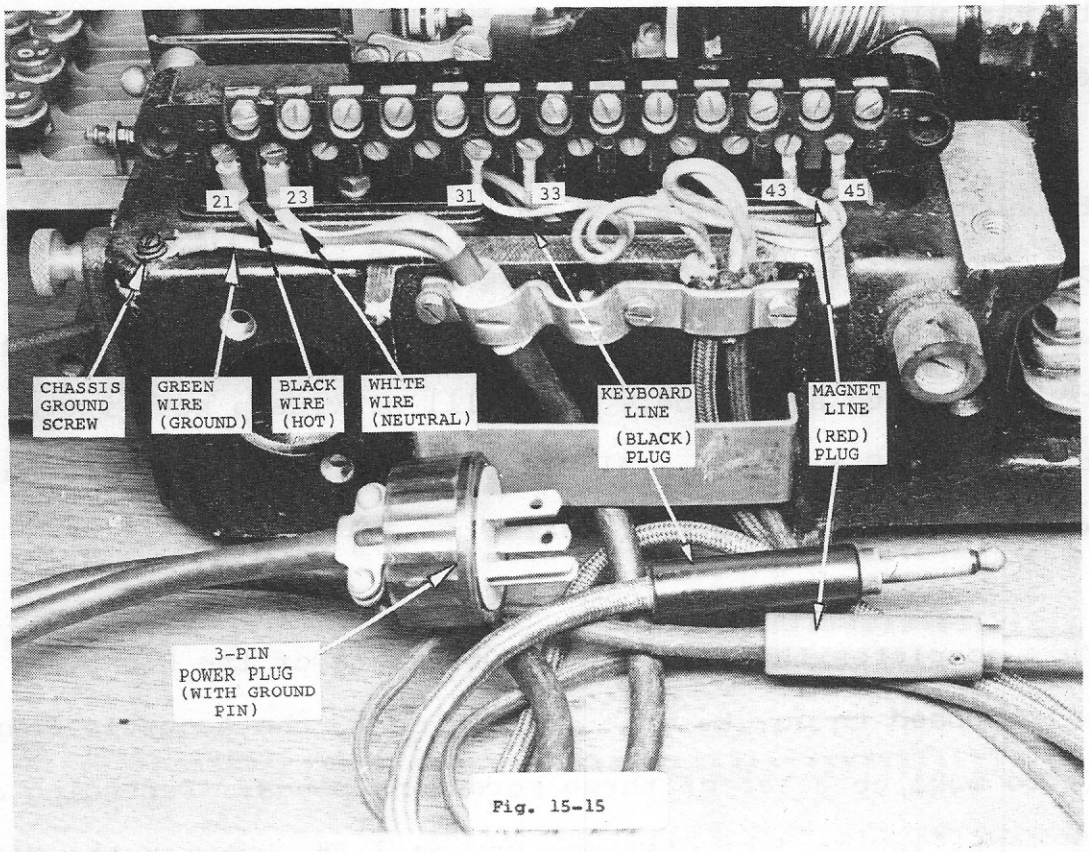



Fig. 15-15

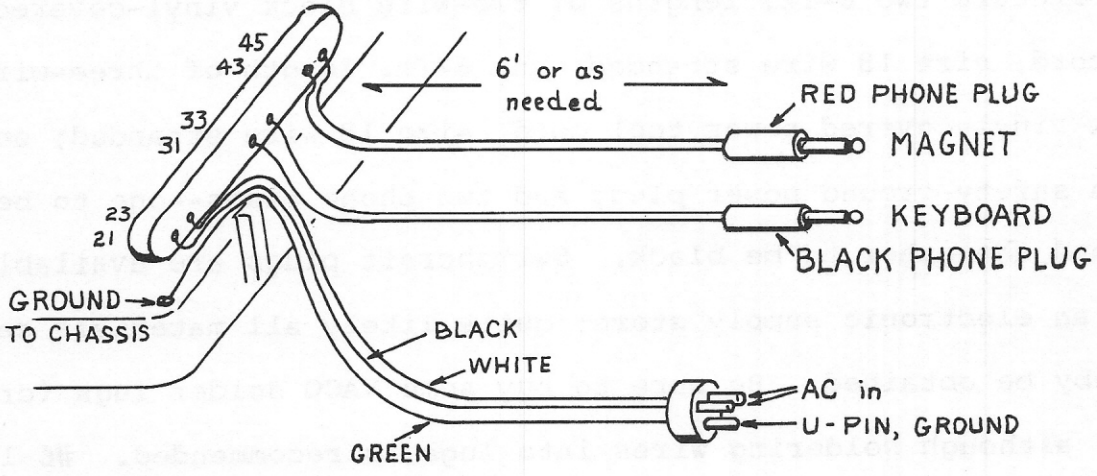



Fig. 15-16

If existing cords and plugs, which came with the M15 machine, are in good condition, they can be used. Fig. 15-15 shows the complete plug and cord sets, attached to the M15, ready for use with an Acoustic Coupler. Fig. 15-16 shows the connections and arrangement of the plugs and cords. Be sure to clamp the cords to the side of the M15 base, using the bar clamp.

ATTENTION:

Note carefully the green ground wire from the machine base's ground screw to the U-shaped grounding pin on the power plug. This is important to assure a safe TTY installation. (Again, see Figs. 15-15 and 15-16.)

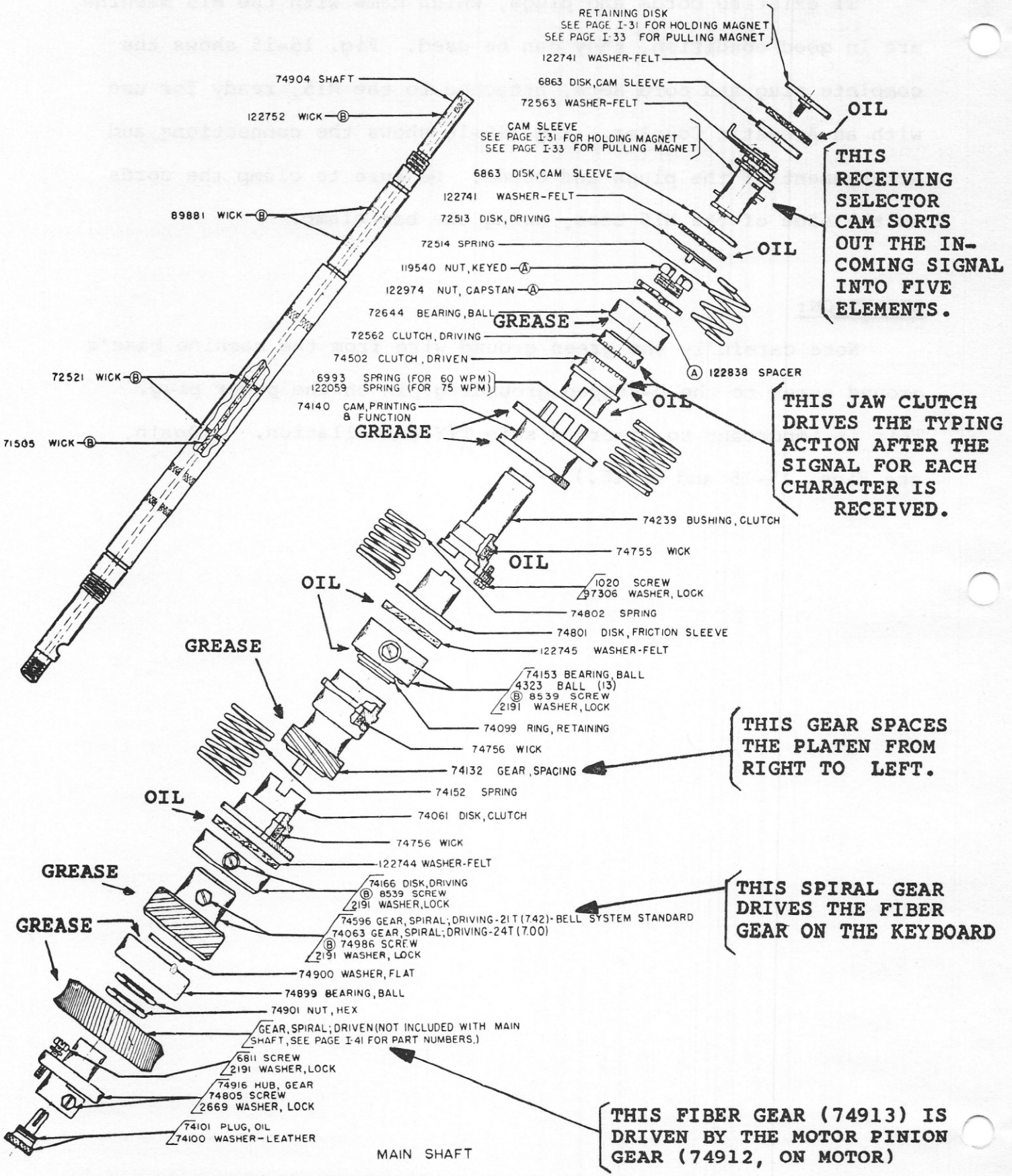

RETAINING DISK
SEE PAGE I-31 FOR HOLDING MAGNET
SEE PAGE I-33 FOR PULLING MAGNET
122741 WASHER-FELT
6863 DISK, CAM SLEEVE
72563 WASHER-FELT
OIL
CAM SLEEVE
SEE PAGE I-31 FOR HOLDING MAGNET
SEE PAGE I-33 FOR PULLING MAGNET
THIS RECEIVING SELECTOR CAM SORTS OUT THE INCOMING SIGNAL INTO FIVE ELEMENTS.
74904 SHAFT
122752 WICK (B)
89881 WICK (B)
6863 DISK, CAM SLEEVE
122741 WASHER-FELT
72513 DISK, DRIVING
72514 SPRING
OIL
119540 NUT, KEYED (A)
122974 NUT, CAPSTAN (A)
72644 BEARING, BALL
GREASE
72562 CLUTCH, DRIVING
74502 CLUTCH, DRIVEN
(A) 122838 SPACER
72521 WICK (B)
6993 SPRING (FOR 60 WPM)
122059 SPRING (FOR 75 WPM)
OIL
THIS JAW CLUTCH DRIVES THE TYPING ACTION AFTER THE SIGNAL FOR EACH CHARACTER IS RECEIVED.
74140 CAM, PRINTING & FUNCTION
GREASE
71505 WICK (B)
74239 BUSHING, CLUTCH
74755 WICK
OIL
OIL
1020 SCREW
97306 WASHER, LOCK
74802 SPRING
74801 DISK, FRICTION SLEEVE
122745 WASHER-FELT
GREASE
74153 BEARING, BALL
4323 BALL (13)
(B) 8539 SCREW
2191 WASHER, LOCK
74099 RING, RETAINING
74756 WICK
THIS GEAR SPACES THE PLATEN FROM RIGHT TO LEFT.
74132 GEAR, SPACING
74152 SPRING
OIL
74061 DISK, CLUTCH
74756 WICK
122744 WASHER-FELT
GREASE
74166 DISK, DRIVING
(B) 8539 SCREW
2191 WASHER, LOCK
THIS SPIRAL GEAR DRIVES THE FIBER GEAR ON THE KEYBOARD
GREASE
74596 GEAR, SPIRAL; DRIVING-21T (7.42)-BELL SYSTEM STANDARD
74063 GEAR, SPIRAL; DRIVING-24T (7.00)
(B) 74986 SCREW
2191 WASHER, LOCK
74900 WASHER, FLAT
74899 BEARING, BALL
74901 NUT, HEX
GEAR, SPIRAL; DRIVEN (NOT INCLUDED WITH MAIN SHAFT, SEE PAGE I-41 FOR PART NUMBERS.)
6811 SCREW
2191 WASHER, LOCK
74916 HUB, GEAR
74805 SCREW
2669 WASHER, LOCK
74101 PLUG, OIL
74100 WASHER-LEATHER
THIS FIBER GEAR (74913) IS DRIVEN BY THE MOTOR PINION GEAR (74912, ON MOTOR)
MAIN SHAFT

Fig. 15-17

## B. OILING THE MODEL 15 TELETYPE

Like any machine, the teletypewriter requires periodic oiling, greasing, and other maintenance. Usually this is done at least once a year, especially if the equipment is in occasional service. One must judge for himself as to how often the lubrication should be done. There are several areas where oil is definitely required from time to time; other areas can "get by" and need only drops of oil if they appear dry. In general, rotating parts demand careful attention; sliding parts are not so critical. Rotating parts include shafts, clutches, gears, bearings, cams, and the like. Sliding parts are such items as levers, plungers, rods, etc.

A recommended oil is SAE10 machine oil, obtainable from Montgomery Ward Co. (Cream-separator machine oil) or from dealers who sell machine tools. Try an industrial hardware store. Do not use automobile oil, as it contains additives. As for grease, for lubricating cams, gears, and sliding parts, obtain some front-wheel axle grease from an automobile service station. A small jar will hold plenty, and should keep for years.

To do a lubrication job on the Model 15, we must uncover the machine and disassemble it into several parts. In this way, we can easily get at all the points needing oil or grease. The typing unit, as mentioned, is removable; just remove three thumb screws, and it can be lifted off.

Remove the ink-ribbon spools, and lay them aside. Turn the typing unit upside down on some secure surface, such as a work

bench. Place a block of wood underneath so as to support the moveable type carriage and to protect its sensitive parts. In this way, the upside down machine will be secure, and its main shaft will be easily accessible.

The Model 15 has a main shaft. It does the hardest work in the machine; hence it demands proper lubrication. See Fig. 15-17. This is an exploded diagram showing the parts relationship; in particular, note the fiber gear (74913) at the bottom. Apply grease to this gear, also to its associated motor gear (74912). Apply grease to the several cams, right on their top surfaces, spreading a thin layer around. Meanwhile, apply dabs of grease to the rollers bearing on these cams. If the two ball bearings appear dry, put some grease there. You can use your finger to apply grease to the various parts concerned. A little grease is sufficient on the cams and bearings; the gears should be well greased.

The main shaft has four clutches, composed of metal discs bearing on felt washers. Those parts particularly must be kept oiled. If the felts go dry, they tend to heat up more and thus wear out faster. Actually, felt type clutches will last many years, even in 24-hour service, provided they are kept oiled. It is simple to oil the felts; all that is needed is an oilcan, filled with SAE10 machine oil.

Now, in order to do a good oiling job in a felt clutch, the opposing metal discs must somehow be pried apart. We use a screwdriver, having a 1/4-inch wide blade; however this screwdriver should be specially modified for the job. New screwdrivers have

sharp-cornered edges; such could bite into the metal discs, thus causing nicks. One screwdriver (an old one will do fine) should have its corners filed smooth. See Fig. 15-18. With this screwdriver placed in position and twisted slightly, the metal discs can be separated, permitting some oil squirted into the felt. Ten drops, more or less, should result in a saturated felt. Better to have a slight excess of oil, as the felt takes time to absorb it completely. Fig. 15-19.

The four felt clutches are given this treatment. Incidentally, there is a fifth clutch, of a different type; this has serrated teeth - used for driving the typing action. This jaw clutch does heavy work, hence be sure to put some oil in between the teeth. See Fig. 15-22. Pry the clutch apart, using the screwdriver, to allow the oil to work its way in. Figs. 15-20, 15-21.

There are three springs coiled around the main shaft. Be sure to put a few drops of oil through each of these springs, in order to lubricate the splines of the clutches involved. Fig. 15-23.

Now, upend the typing unit in its (left side) selector end. Pull the oil plug (See end of mainshaft in Fig. 15-17) off the end of the mainshaft, and fill it with as much oil as it will take. Fig. 15-24. Allow it to stand for half an hour or so, then refill if necessary. Put the oil plug back on. This should suffice. Teletype servicemen use a special pressure type oil can to oil this shaft - which has a long piece of felt inside.

Place the typing unit right side up, in normal position. There are various other points for oiling and greasing. Looking into the front, there are two oil cups, on the ends of an

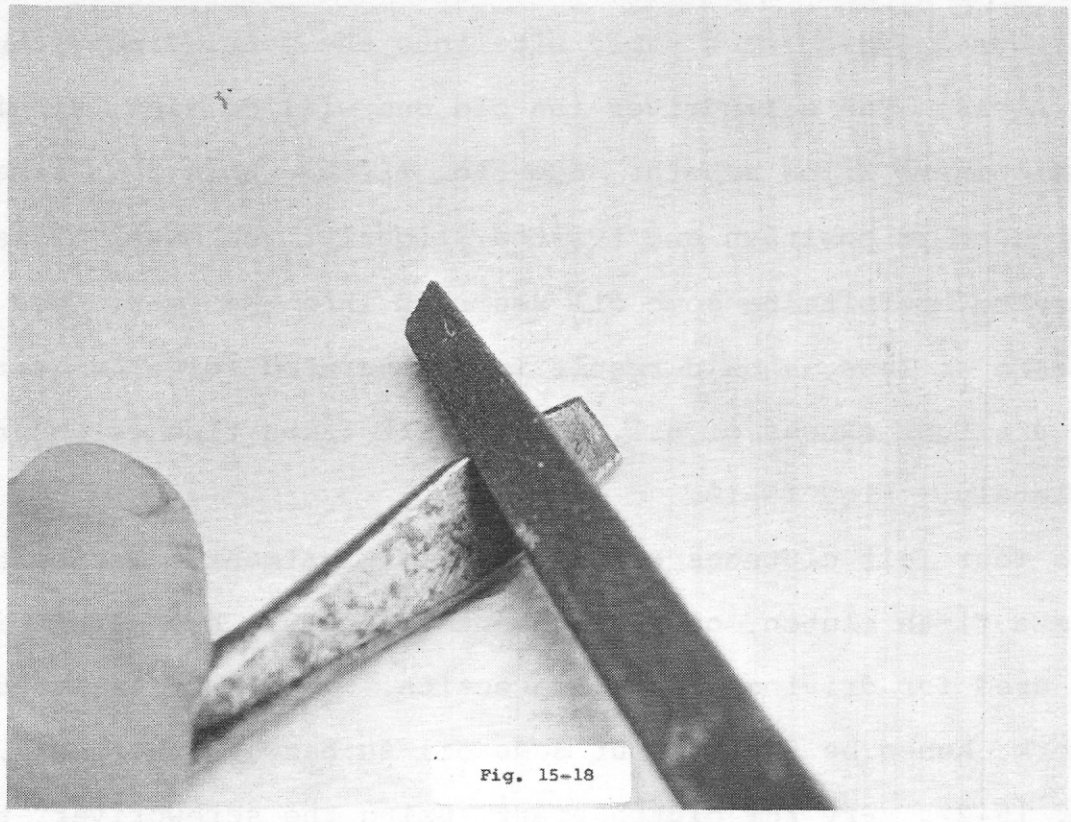


Fig. 15-18

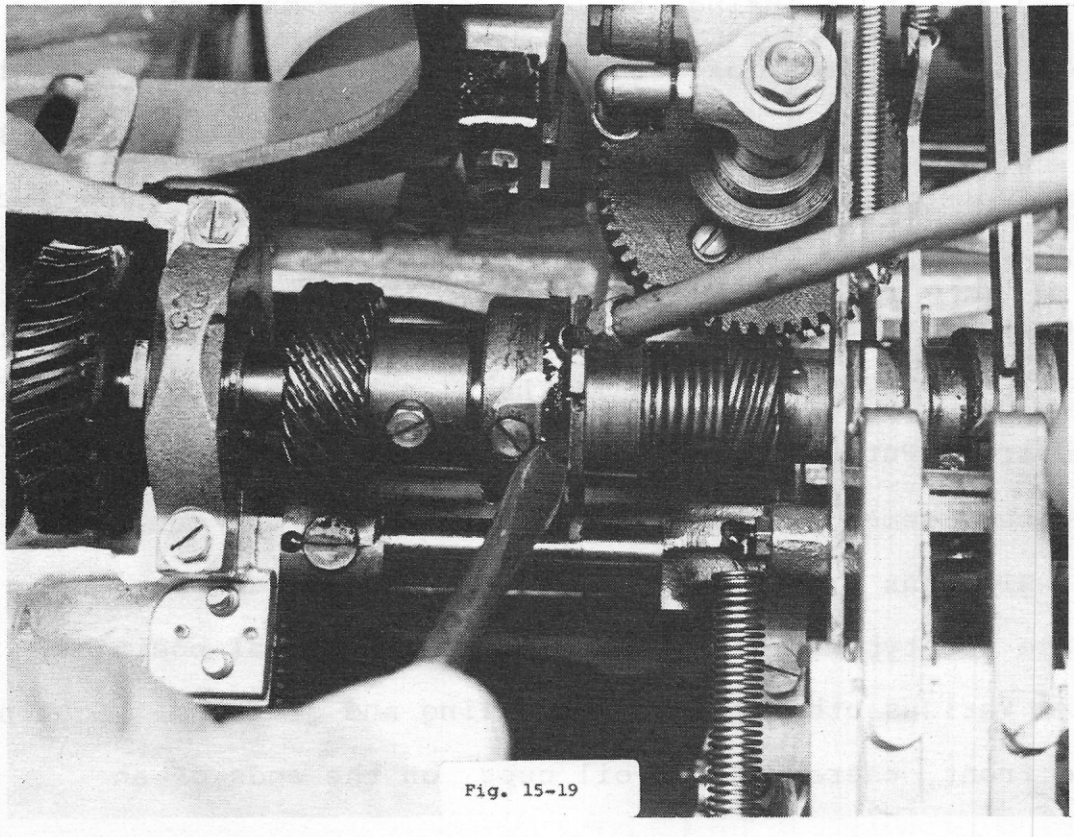


Fig. 15-19

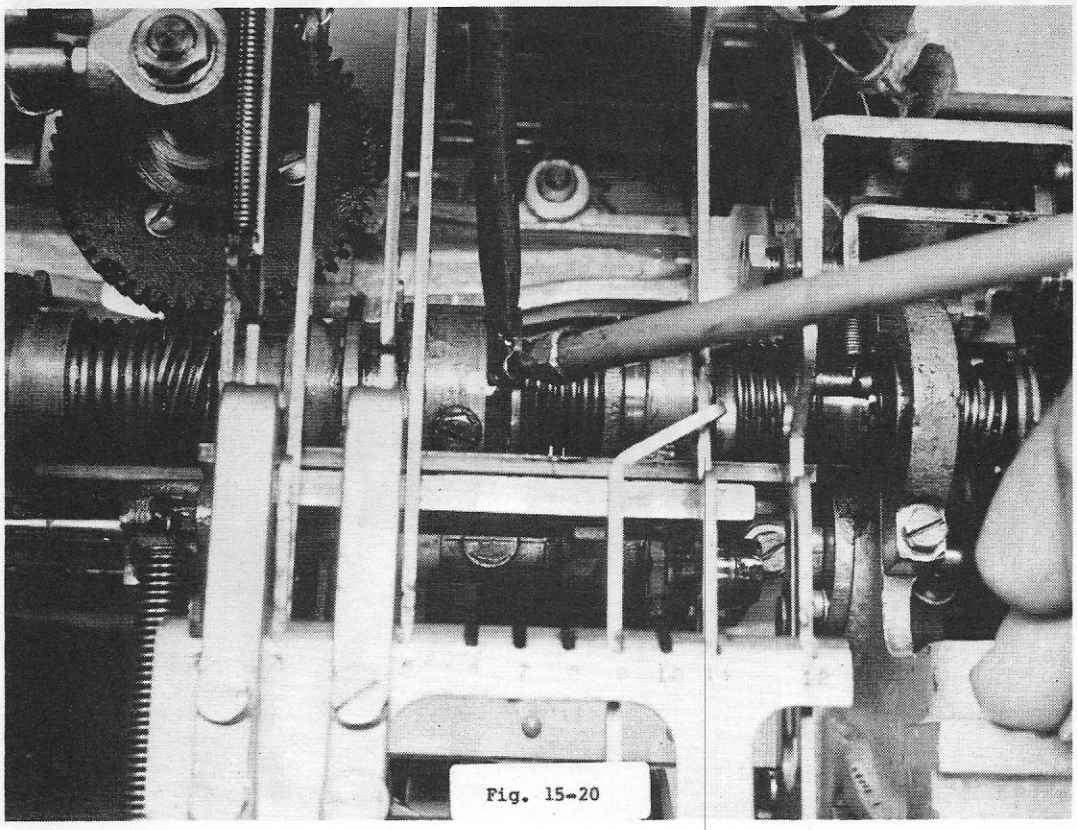


Fig. 15-20

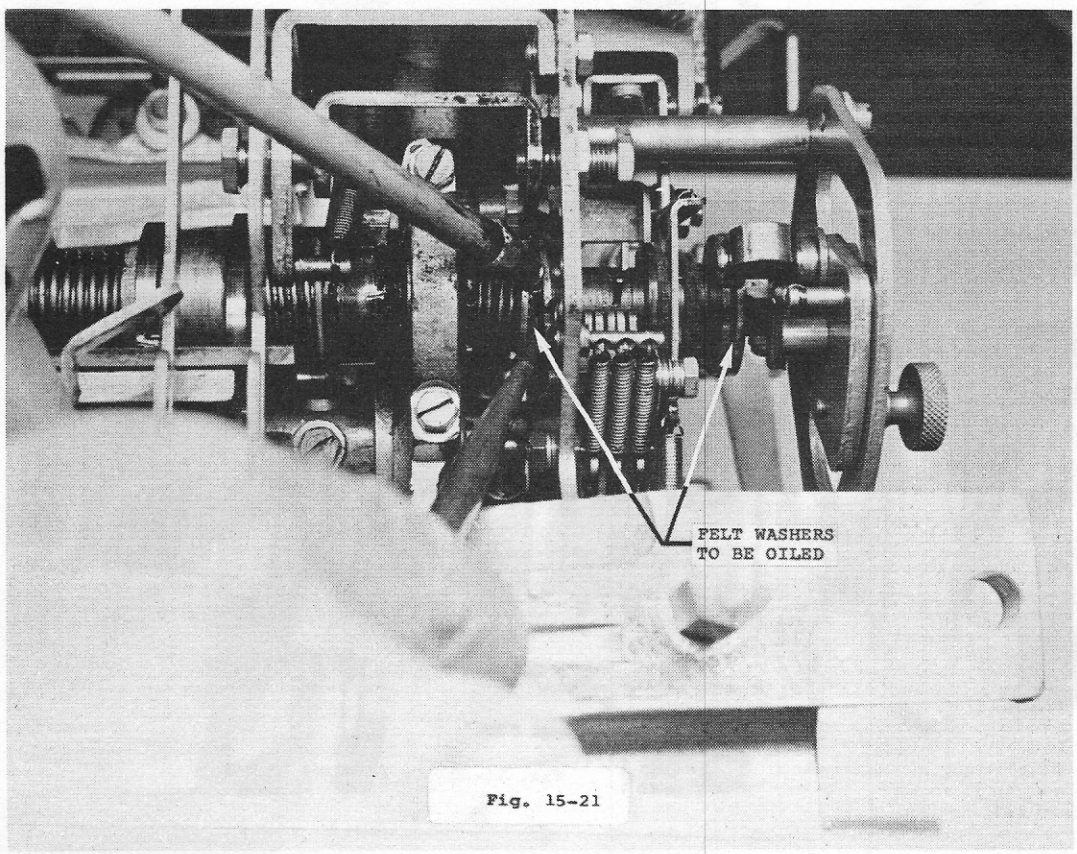



Fig. 15-21

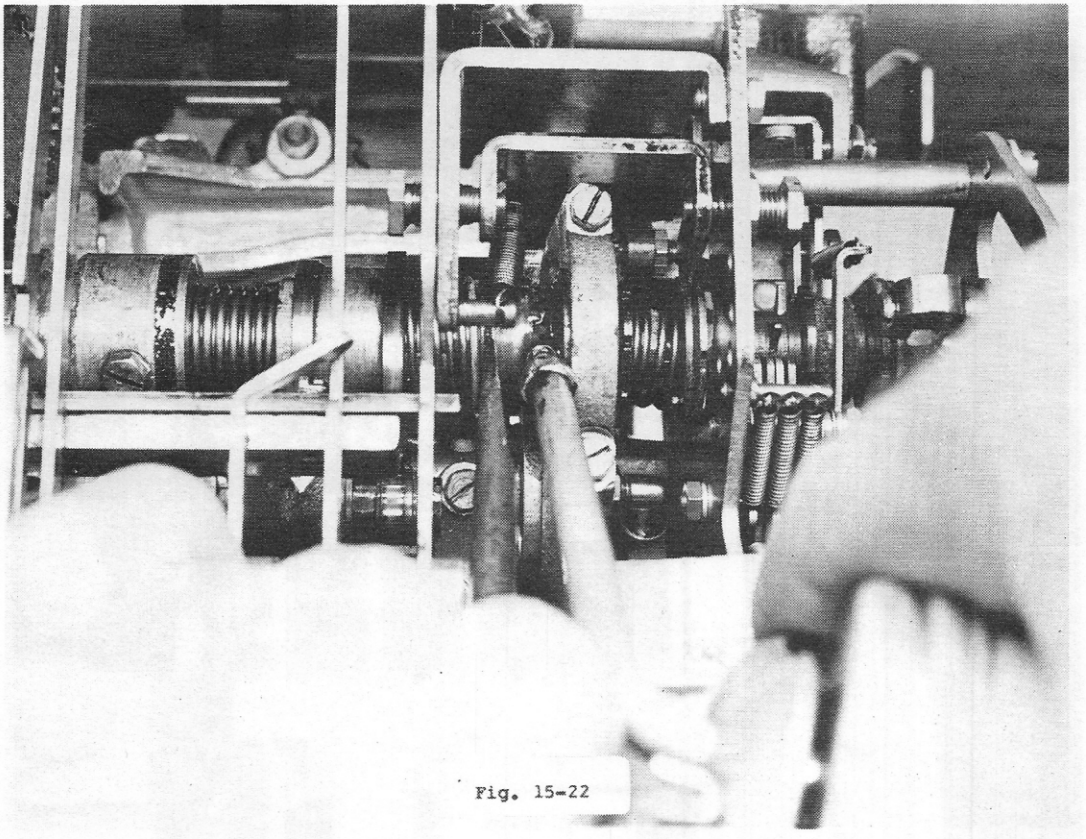


Fig. 15-22

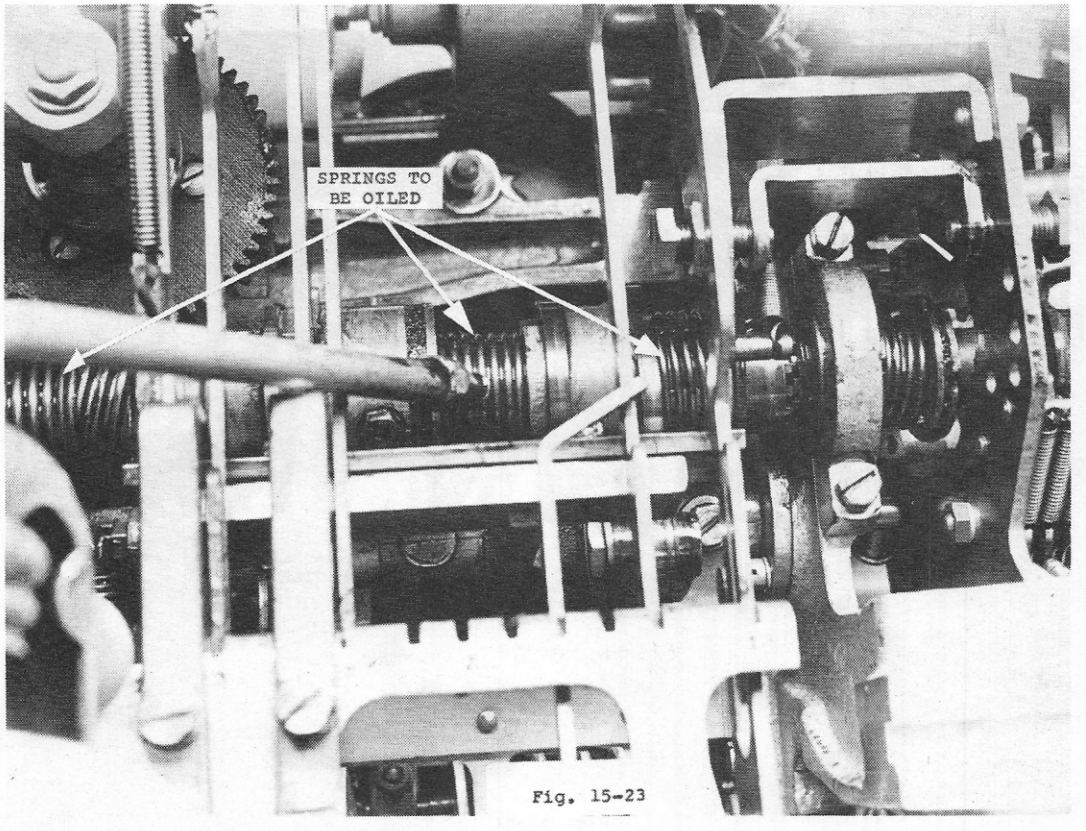



Fig. 15-23

oscillating shaft. They are close between the frames. Fill these cups with oil. Fig. 15-24A and Fig. 15-24B.

The typing carriage must be removed for further lubrication attention. It is quite easy to get it off the track, by following the procedure given below:

1) Push the flat ended lock bar on the left to release the carriage return. Fig. 15-25.
2) Push the carriage unit about half way to the right, and hold it there. Fig. 15-28.
3) Pull the dashpot lever all the way to the left. This will lock the carriage in place. Fig. 15-25.
4) Note a small lever, holding a (right margin) adjusting screw. Push this lever slightly to the rear. Fig. 15-26.
5) Holding the carriage, release the carriage return. (See Step 1)
6) Push the carriage almost off the track, then lock it in place. (See Step 3)

There is a strong carriage return spring wheel in the typing unit. In order to avoid having it unwind by itself, it is necessary to hold this spring wheel by hand, while unhooking the carriage return strap from the carriage and hooking the strap to a convenient anchor point.

7) Place your thumb on the end of the strap, so that its end won't fall off the spring wheel's circumference. Fig. 15-27. (This is a view of the rear of the typing unit.)
8) Now, grasping the spring wheel firmly, turn it slightly to the right so as to slacken the strap. You will see that the wheel is quite strong, so keep a hold on it. Fig. 15-27.

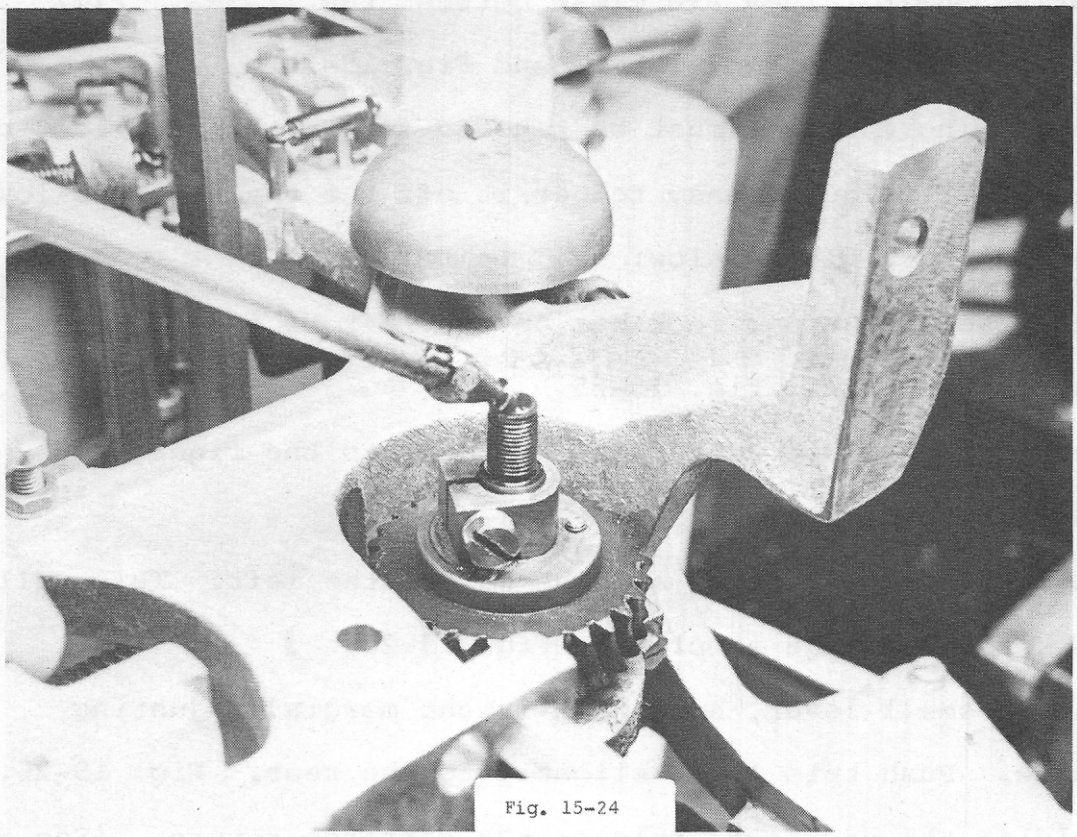


Fig. 15-24

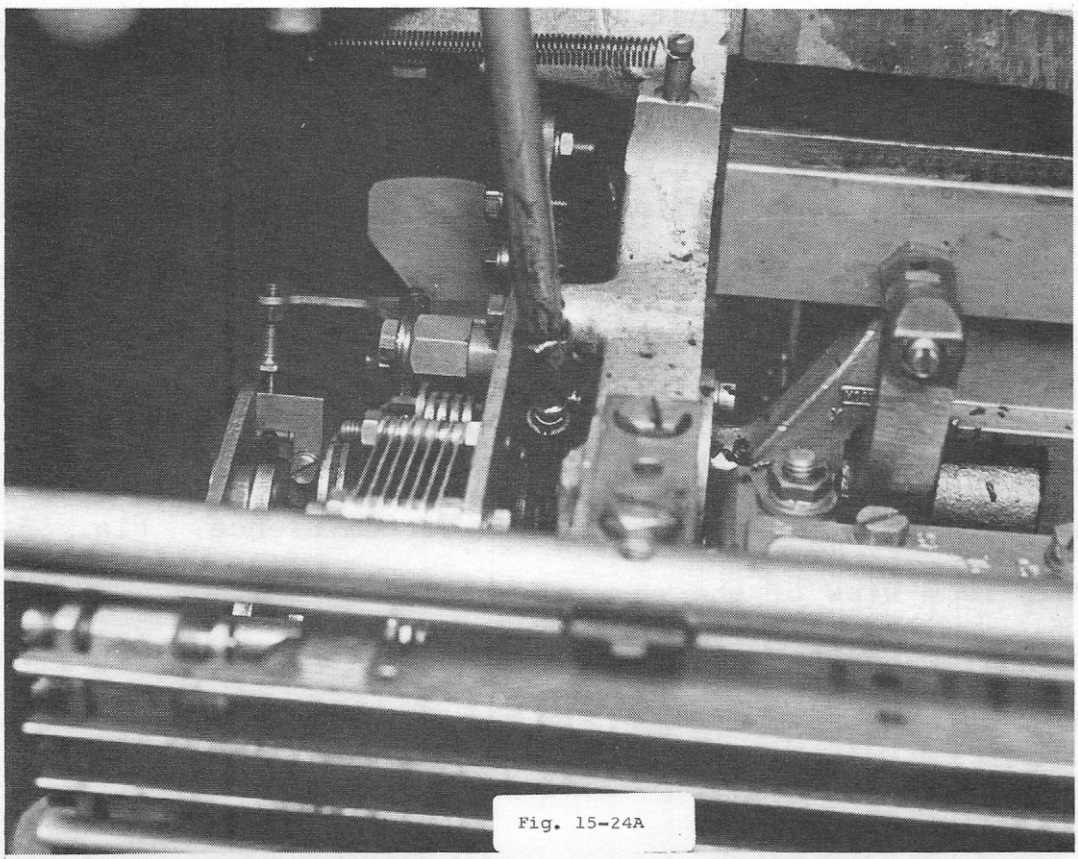


Fig. 15-24A

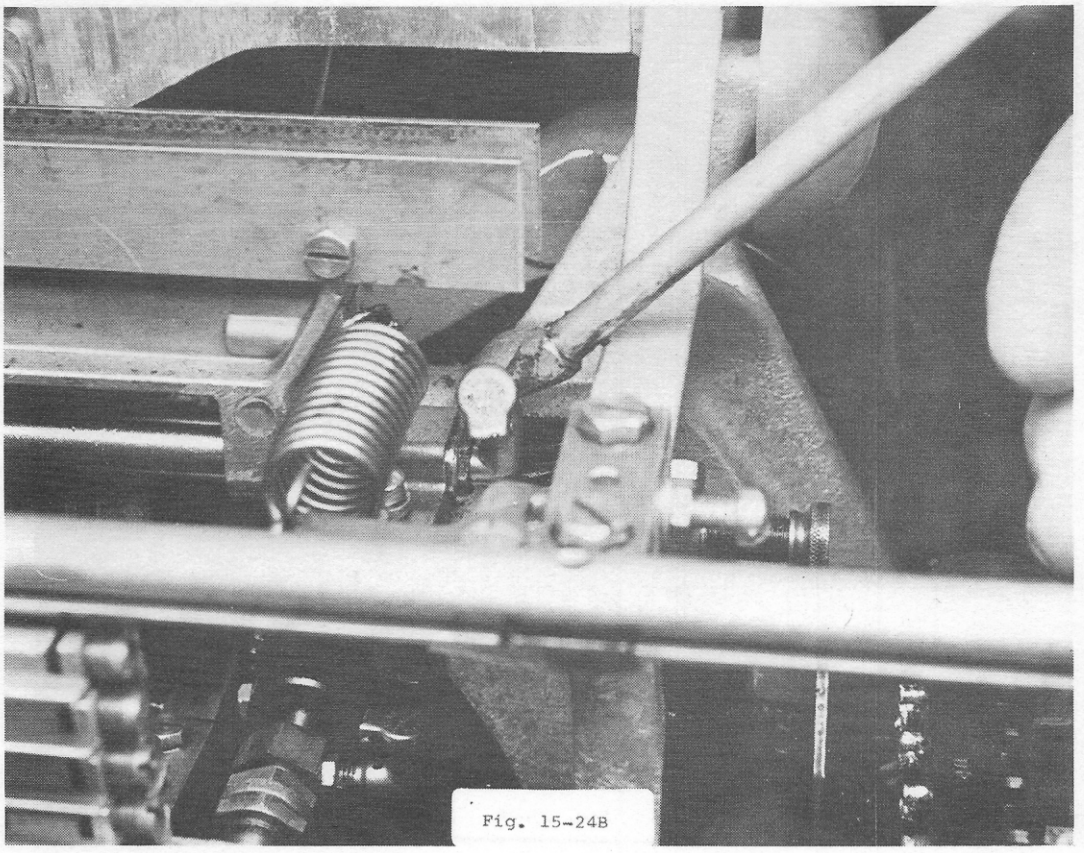


Fig. 15-24B

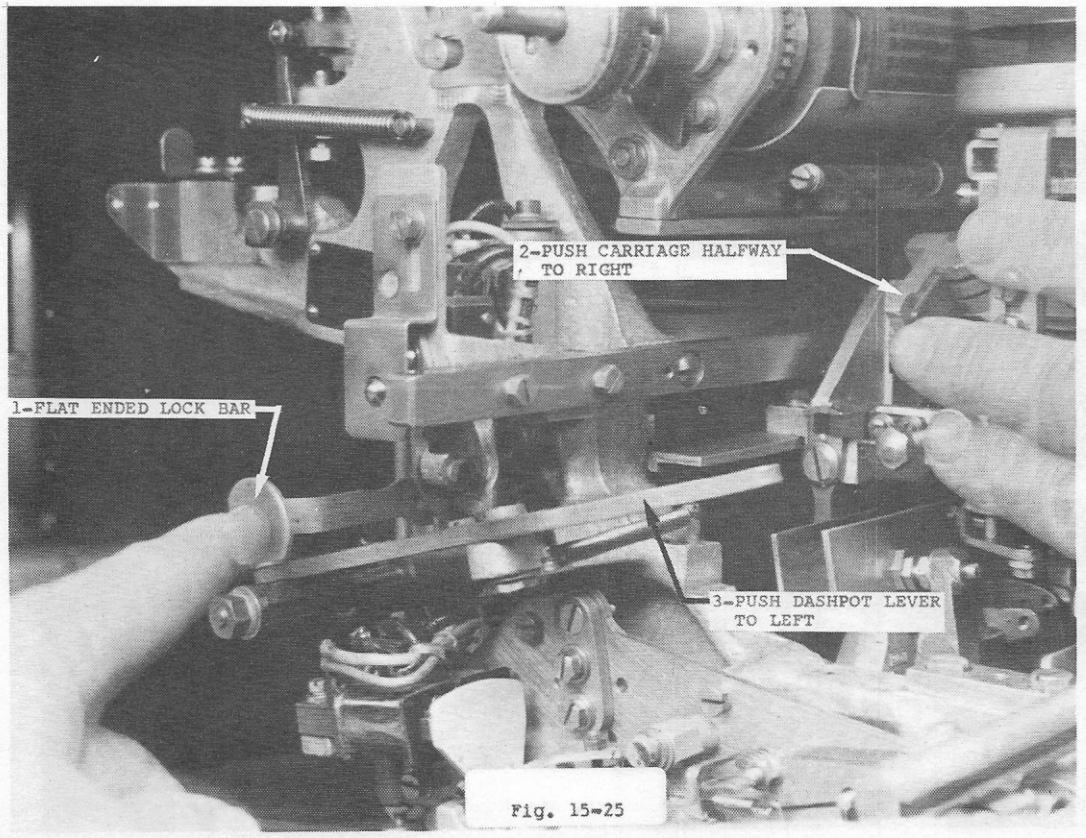



Fig. 15-25

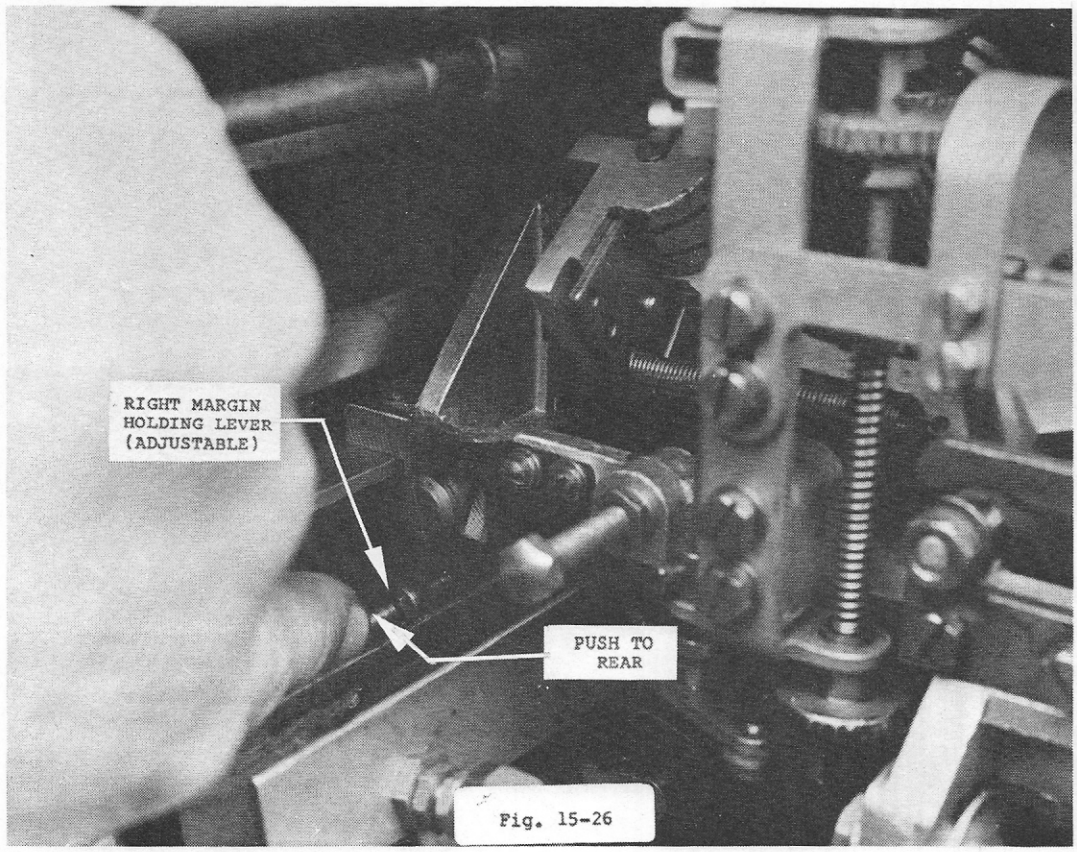



Fig. 15-26

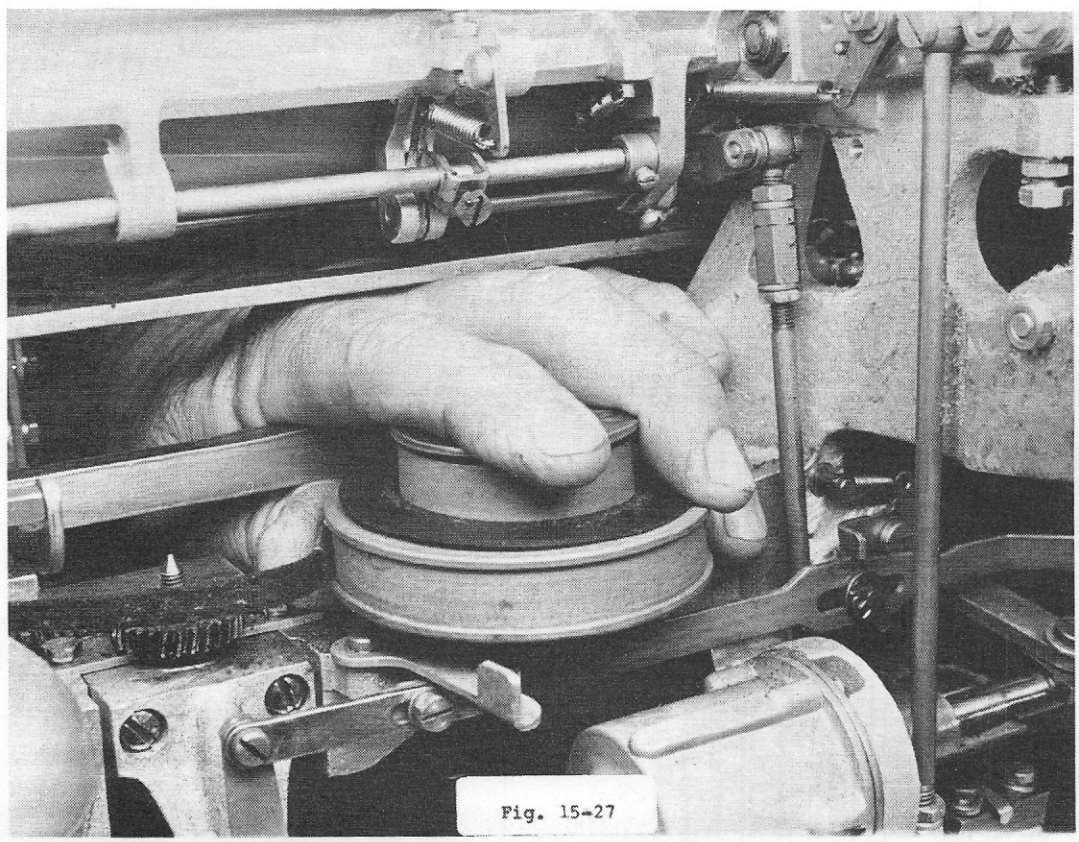


Fig. 15-27

9) Unhook the other end of the strap and place it over a suitable anchor point. Fig. 15-28 and Fig. 15-29.

10) Making sure the strap is hooked, you can then allow the spring wheel to move to the left by itself. Take it easy while releasing the wheel! The strap will be held safely.

11) The carriage is now free and can be slid to the right, off the track.

Remounting the carriage is essentially a reverse of the above procedure. Just to be clear, we will describe the following steps.

12) Place the left roller on the track, and take note that the retaining bolt enters the track slot. Fig. 15-30.

13) Move the carriage gently, and keep it in a near normal position. It should glide in. Use a slight pressure, if necessary.

14) You will note that the ends of the bell cranks (the L shaped levers) approach the ends of the vanes - those six parallel bars on the front of the typing unit. Fig. 15-31. Engage the upper vane with the upper ball crank.

15) Continue engaging the bell cranks on the vanes.

16) You will engage only two or three vanes. Now you must look underneath the typing unit from the right end. There is a ball-wheel (Fig. 15-32); it must be pushed forward in order to get it in between the two blades of the printing bail. (The two long parallel bars are just below the platen.)

Oftentimes, it is easy to get the ball wheel in between the blades. A little patience may be necessary, sometimes, and at the same time, be gentle in getting the carriage back into position.

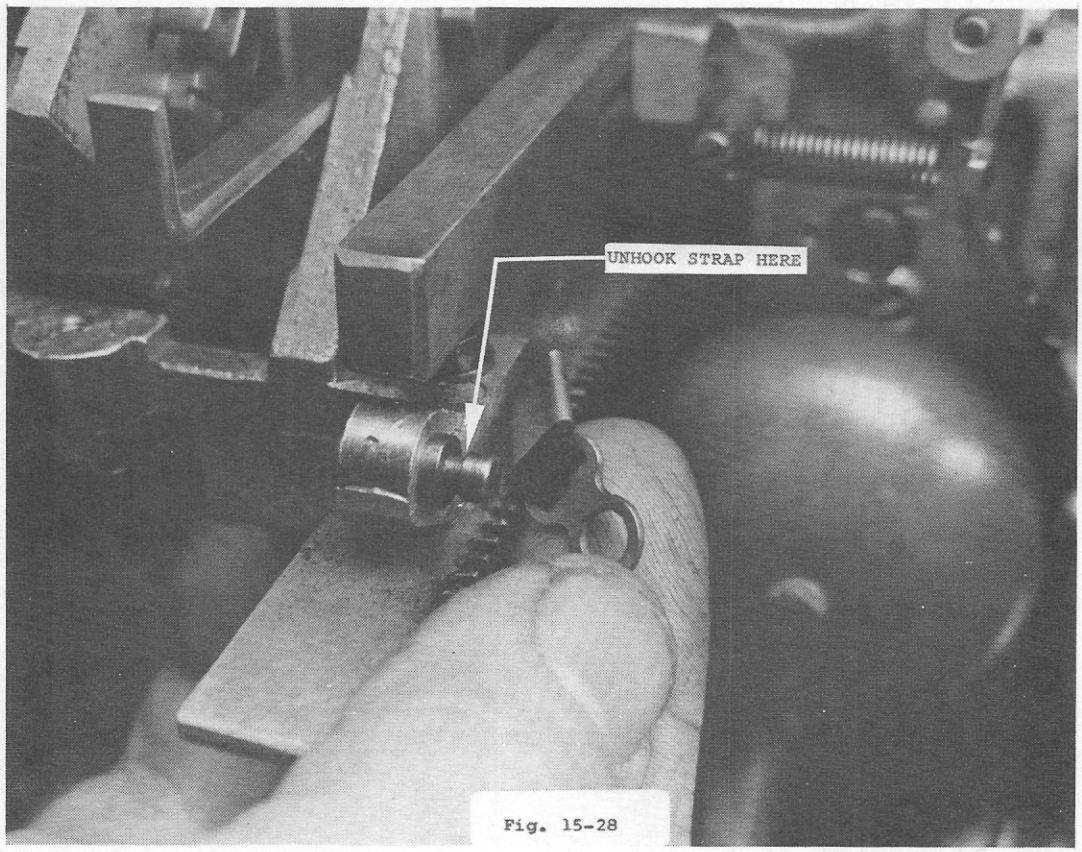



Fig. 15-28

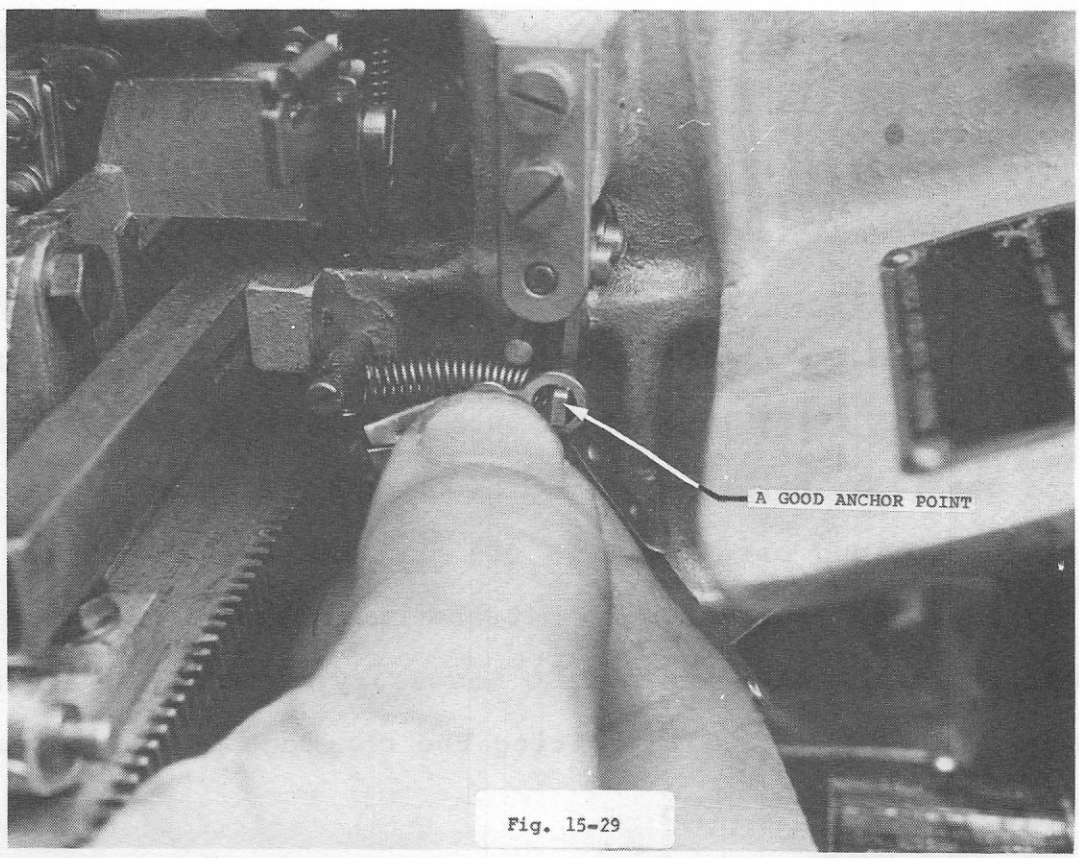



Fig. 15-29

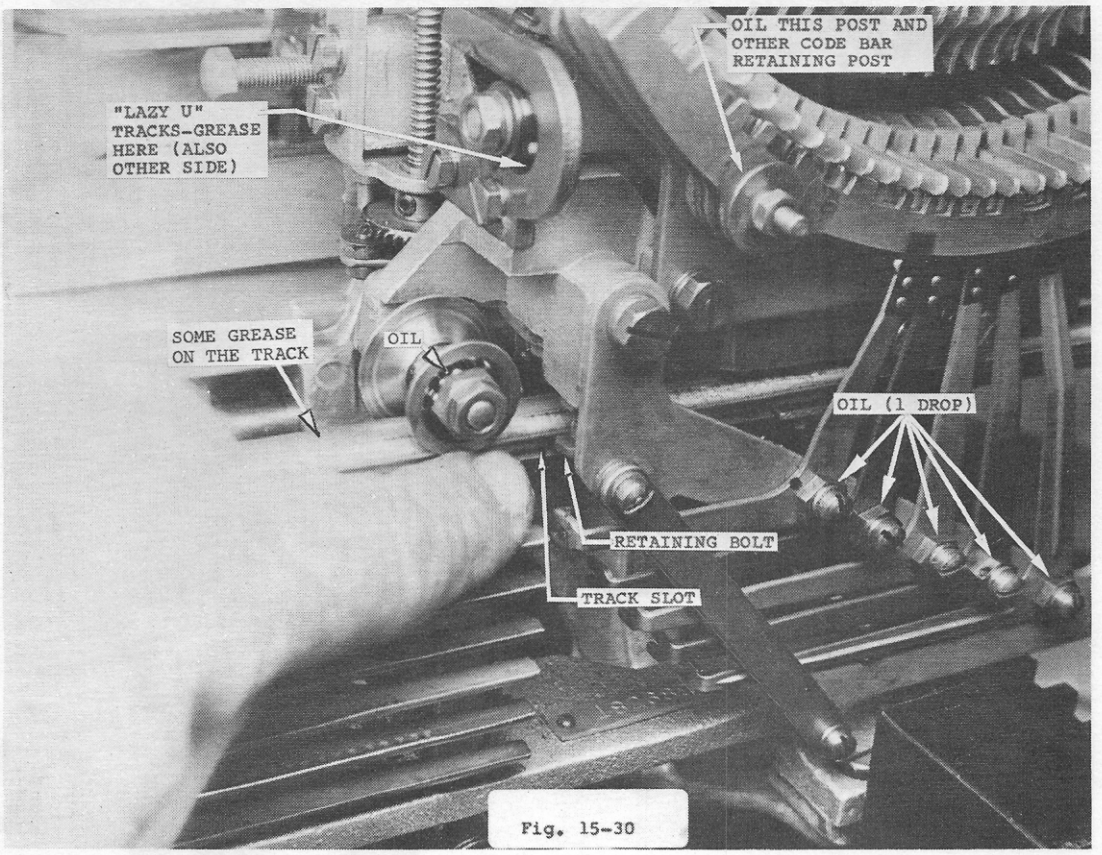



Fig. 15-30

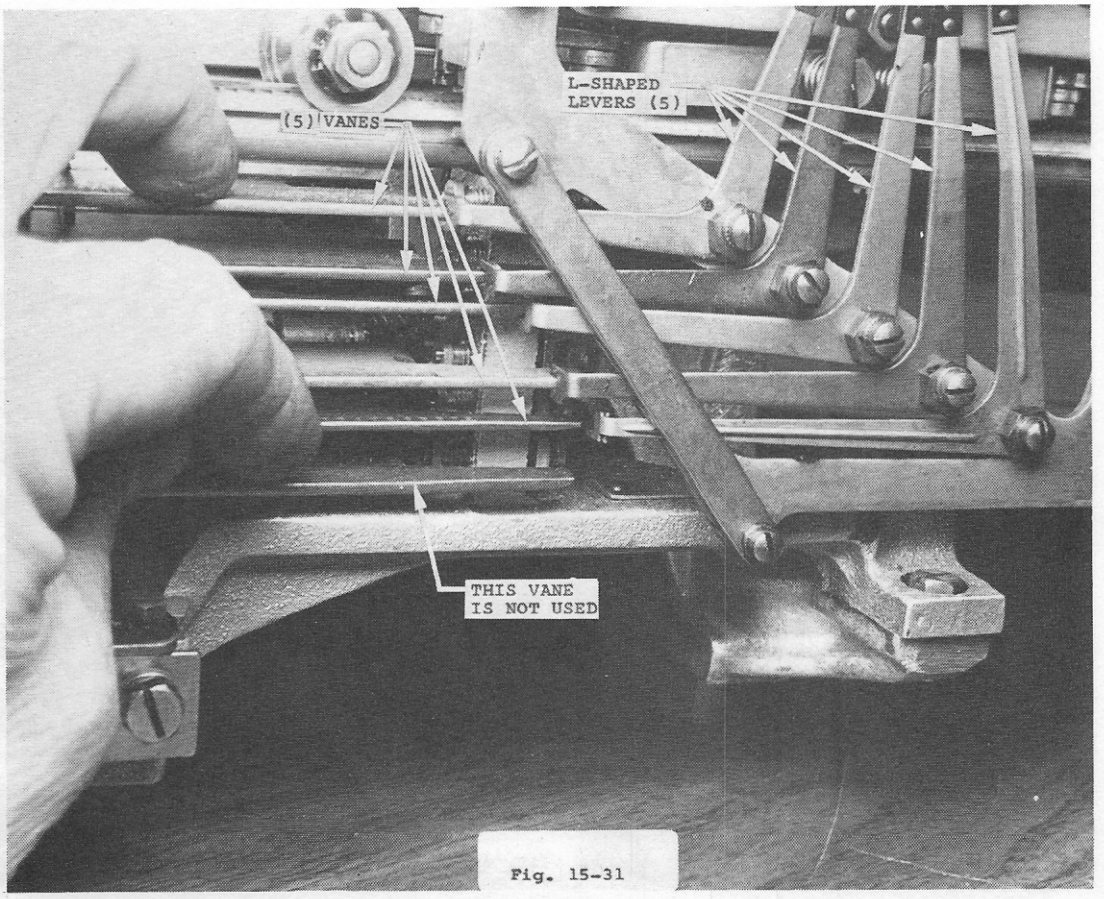



Fig. 15-31

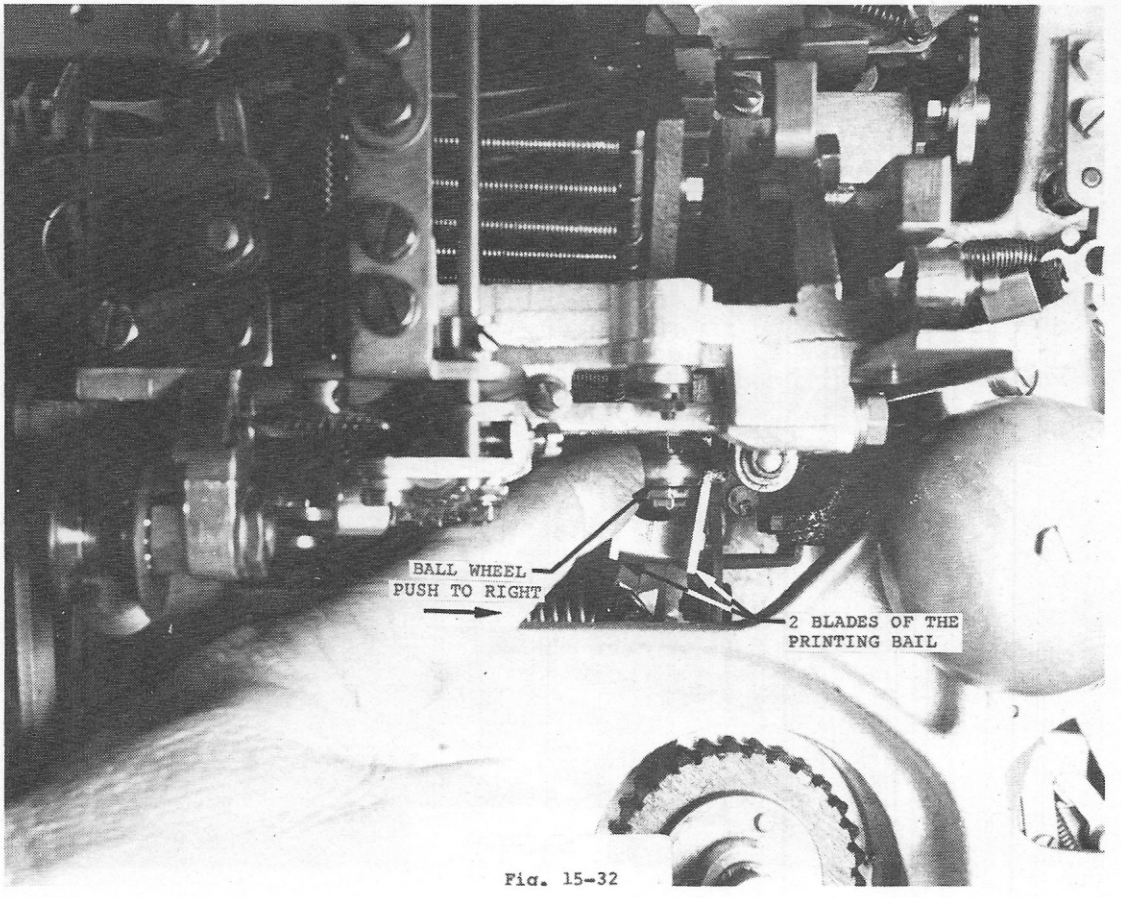



Fig. 15-32

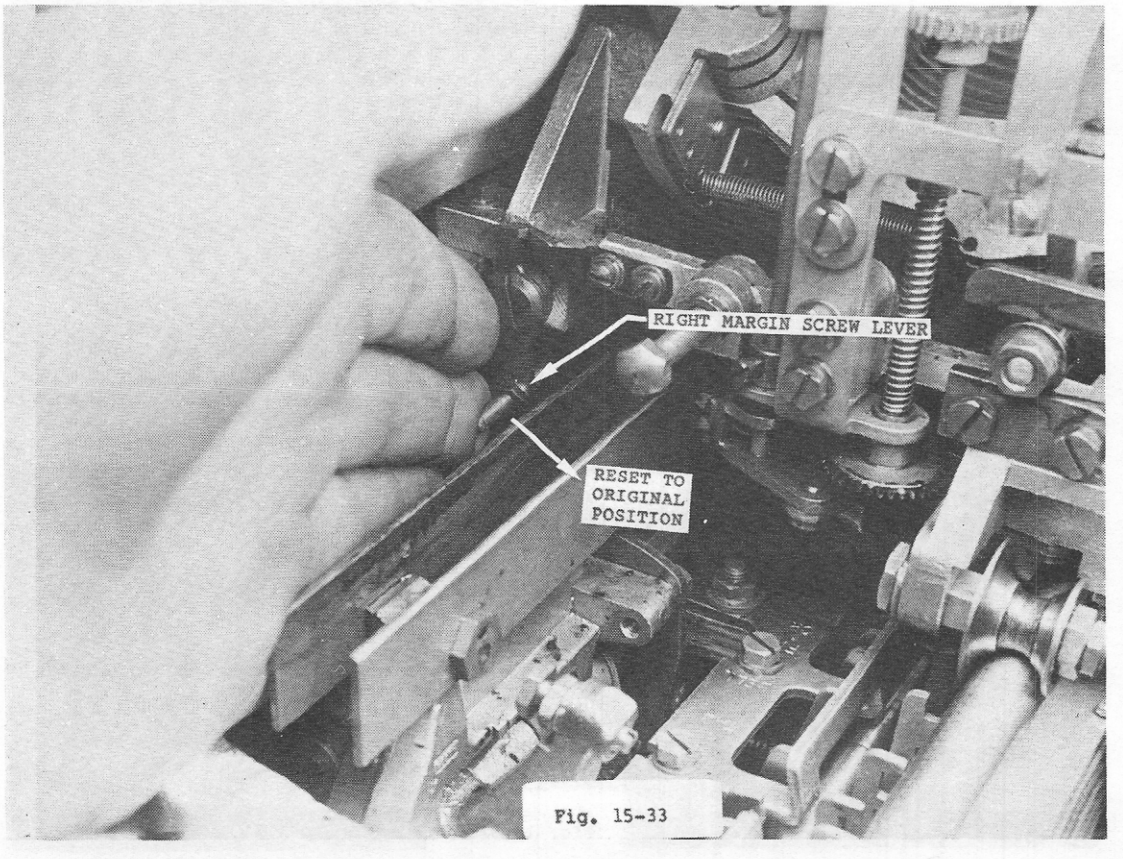



Fig. 15-33

Be sure that the right roller go upon the track with its adjacent retaining bolt slipping into the track's slot.

It may be easier, if the motor's fan is turned so as to rotate the mainshaft slightly. When doing this, always rotate this shaft in a counter clockwise direction - never clockwise (viewed from the right side of the typing unit). The printing bail should move forward; then the ball wheel can slip in between the blades.

17) Complete loading the bell cranks onto the vanes. You may have to press the carriage return lever (the flat ended lever on the left of the typing unit) to release the carriage return. The carriage should now move to the left in a smooth manner.

18) With the carriage moved to the right, almost off the vanes but not quite, lock the carriage return by pushing the dash pot lever all the way to the left.

19) Grasp the carriage return spring wheel firmly, as in step (7). Rotate it slightly to the right to slacken the carriage return strap.

20) Unhook the other end of the strap from its anchor post and place the strap's end on the carriage's strap holding bolt.

21) You can gently release the spring wheel. Take care, grasp the carriage so it does not slam to the left. It can however be locked in place by operating the dashpot lever first (Step 18).

22) Release the carriage, by pressing the carriage return lever (the flat ended lever on the left of the typing unit).

23) Now, push the carriage about half way to the right, reach in

the back to reset the right margin screw lever to a vertical position. Fig. 15-33.

This completes the mounting of the carriage on the typing unit. A little patience, with strict following of the above steps, should inspire confidence on the part of the person doing service work on this mechanism.

The Carriage Itself...

With the carriage out of the typing unit, we will see about lubrication, along with necessary adjustment as may be needed (See Fig. 15-34).

If the ribbon spools are on the carriage, remove them and lay them aside. Turn the carriage upside down to inspect the ball wheel (which goes between the blades of the printing bail in the typing unit). Move this ball wheel forward and backward to see that the action is smooth. Put a little grease on the sliding parts, and a little oil on the rollers. You might as well check the various small parts to see that they have oil.

Sometimes the ribbon reversing mechanism gets out of adjustment. Operate one of the ribbon reversing "ribbon slots" by moving it to the rear, and at the same time push the ball wheel rearward. You should see to it that the horizontal shaft moves to one side. Try the other ribbon slot and see that the horizontal shaft moves to the other side. In this way, you can be sure that the ribbon reversing system is operating properly. At least, take note how the system operates, so you will be in a good position to make an adjustment if ever necessary.

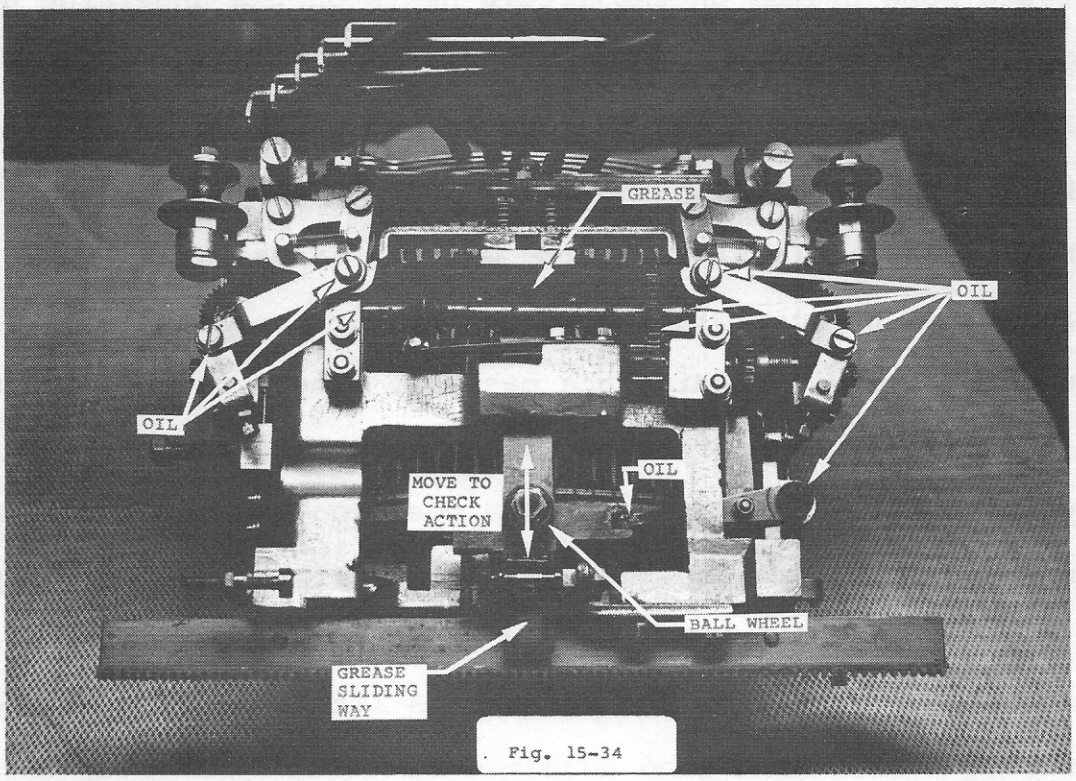



Fig. 15-34

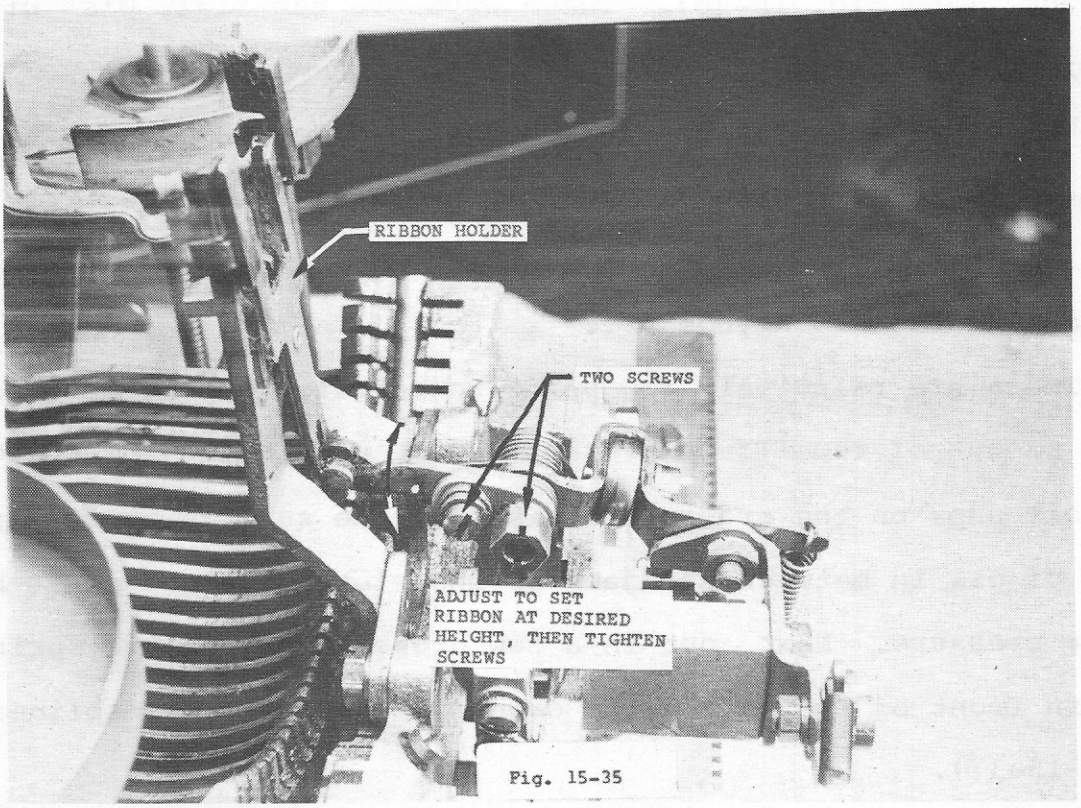



Fig. 15-35

Place some grease on the little gears on the underside of the carriage.

Run a little oil along the curved rod which holds all the type bars. This rod is at the rear, just in the area where the type bars enter their slots. Wipe off the excess oil.

Sometimes the oscillating ribbon holder does not lower itself far enough to permit reading the message. There is an adjustment (this adjustment can be reached without removing the carriage from the typing unit. Set platen in FIGS position and use a long screw driver) to permit lowering the oscillating ribbon holder. Fig. 15-35 shows two screws; both are loosened, then the ribbon holder is pushed down a little, then clamp the screws. A little patience in doing this should arrive at a good adjustment.

Place some grease on the sliding ways on both sides of the carriage. (See Fig. 15-30). These ways are the "lazy U's" with roller wheels inside.

The type faces can be cleaned, using a rag dampened with naptha. Be sure to wipe over and around each type face. (Fig. 15-36)

Lubricating the M15 Keyboard...

There are relatively few parts to be oiled on the keyboard. Slide it out of the TTY base. Apply some oil to the front and rear oil cups on the transmitting shaft. Be sure to apply a few drops of oil in between the jaws of the clutch, forced apart by finger pressure. Next, put in a few drops of oil in the spring just in front of the clutch, in order to lubricate the splines. (Fig. 15-37).

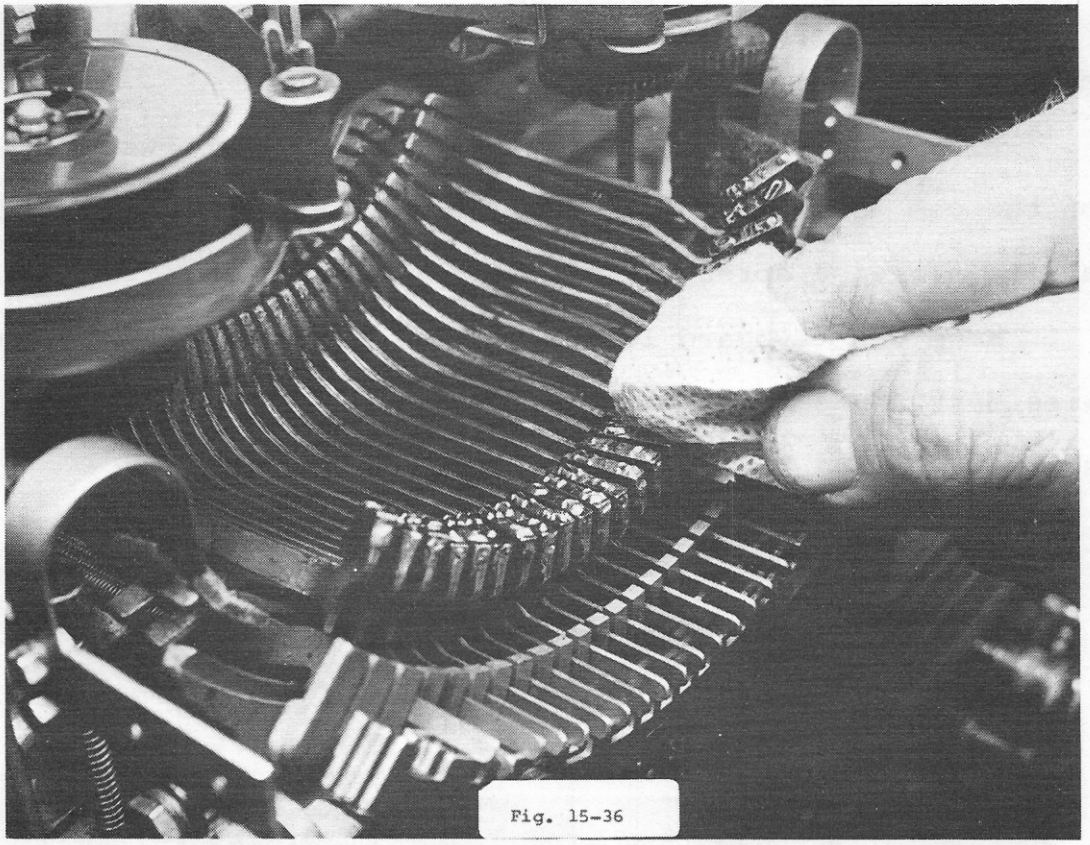


Fig. 15-36

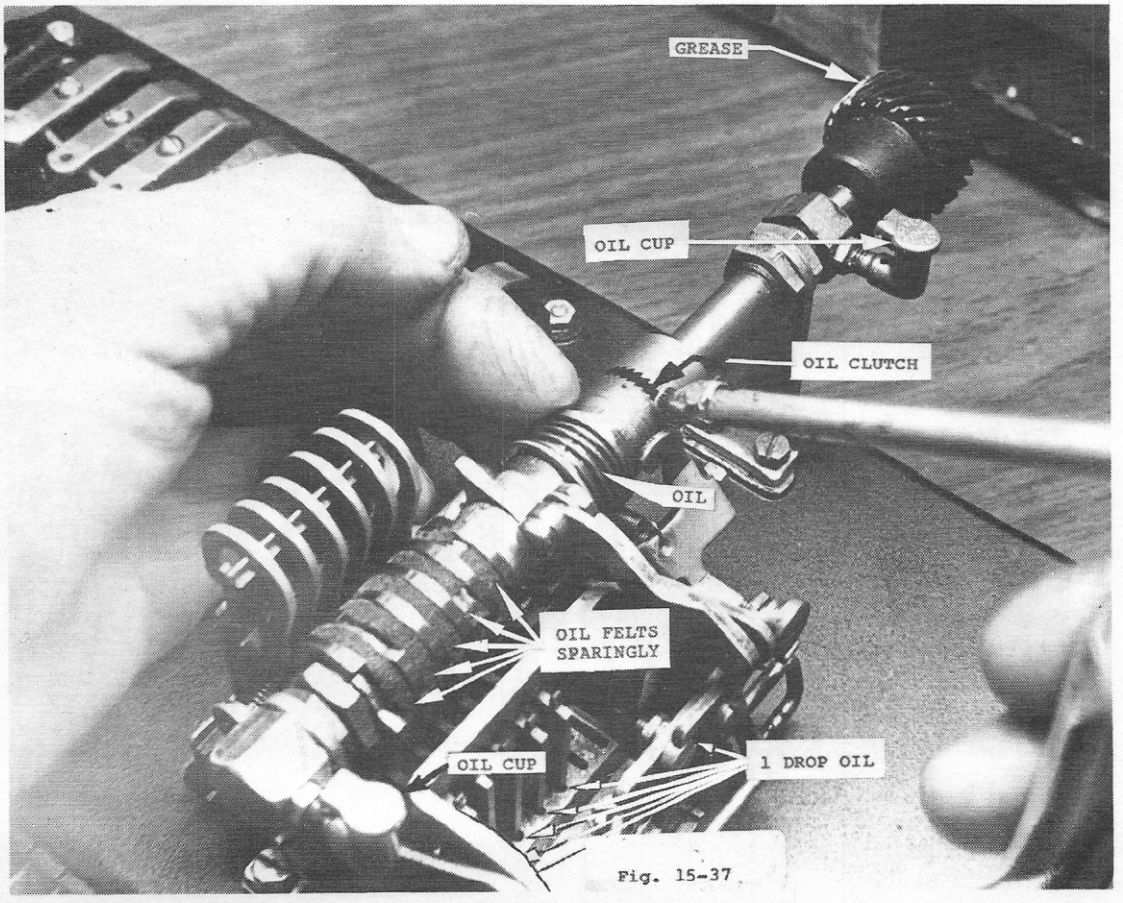



Fig. 15-37

Turn the keyboard over, and you can put some oil on the code-bar rollers at both ends. (Fig. 15-38)

Place a few drops of oil on the felts in between the cams on the cam assembly. (See Fig. 15-37). If there are no felts, a little grease spread thinly on the cams will serve.

Keep the keyboard levers clean. Use a small paintbrush to wipe dust and dirt from the key levers, particularly from the slots where the key levers enter the keyboard base.

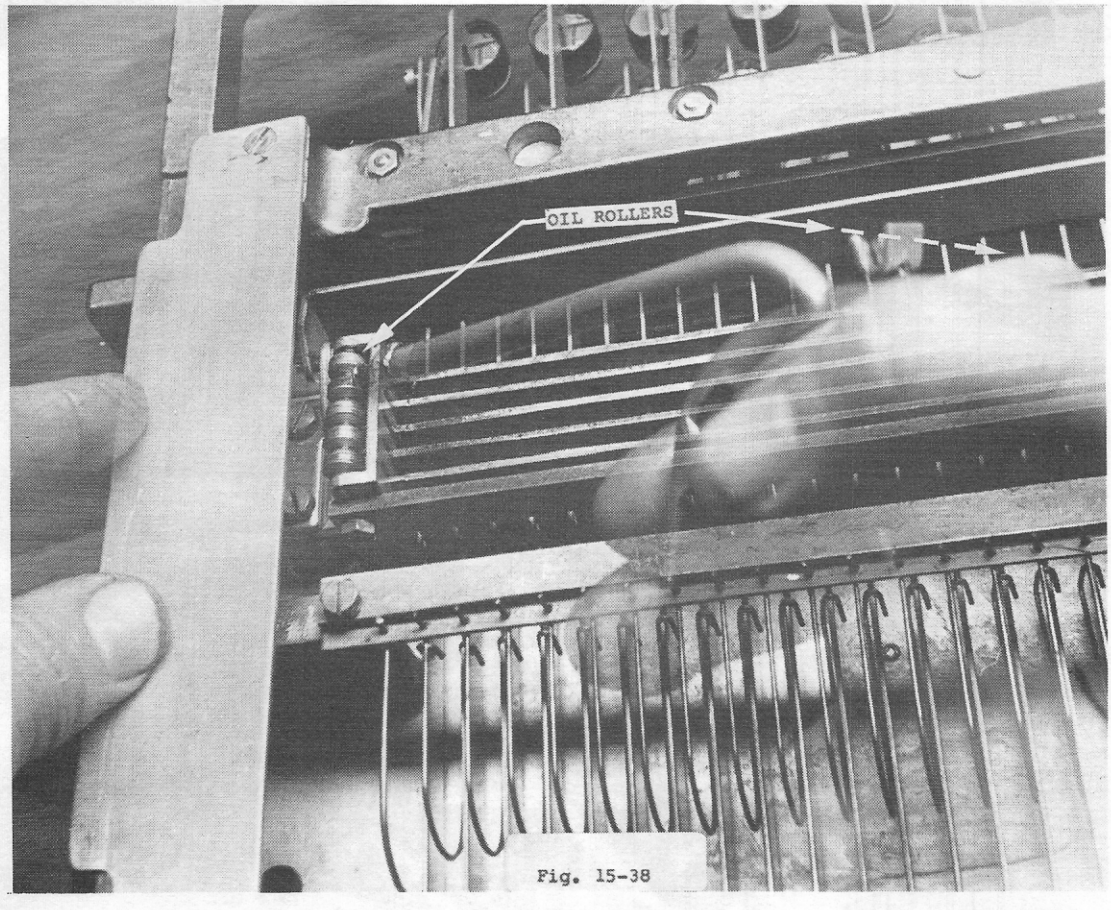



Fig. 15-38

## C. CONTACTS ON THE M15 KEYBOARD

Most communication troubles can be traced to poor contacts in keyboards. They may be dirty or be improperly gapped. Either or both, they result in distorted signals. In other words, we want properly adjusted contacts to assure clean, bias-free generation of TTY signals.

The contacts are the row of six vertical strips of metal showing on the left side of the transmitting cam assembly under the "question-mark" contact levers (Fig. 15-39).

The contact assembly can be taken apart for cleaning. Removal of two outer screws takes the assembly off the transmitting cam frame; removal of the two inner screws permits disassembly of the contact assembly. Unsolder the two wires from the contact plates (Fig. 15-39).

Place the disassembled contact parts (Fig. 15-40) in a bowl of naptha for a few minutes to dissolve oil and dirt. Wipe the parts clean, and reassemble. If necessary, install new wires between terminals 4 and 5 and the contact plates.

Be gentle in replacing the contact assembly under the question-mark contact levers. Incidentally, it is well to know that these levers, like most parts in the Teletype machines, are made of hardened material - quite brittle and breaks off easily if bent over. Hence, do not bump or force these parts.

An alternative method of cleaning contacts is to use tobacco pipe cleaners. As shown in Fig. 15-41 and 15-42, this method is quite a time saver when on a customer call. A piece of tobacco

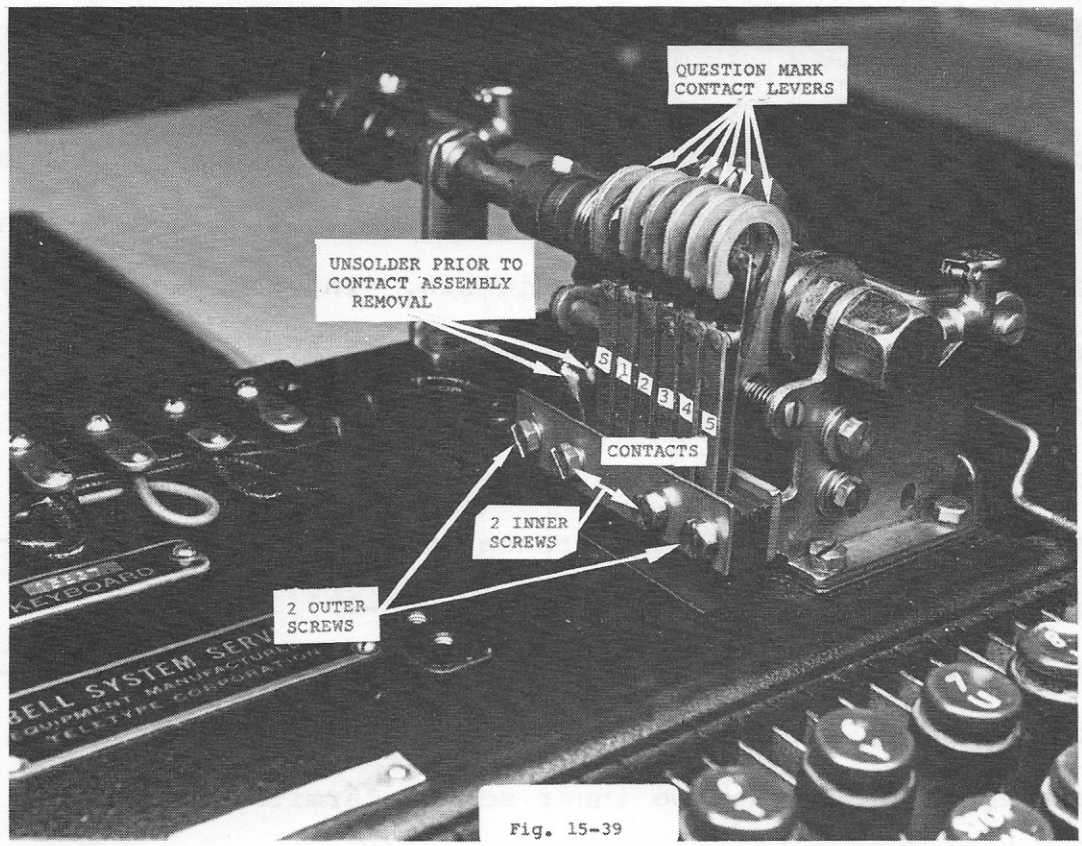



Fig. 15-39

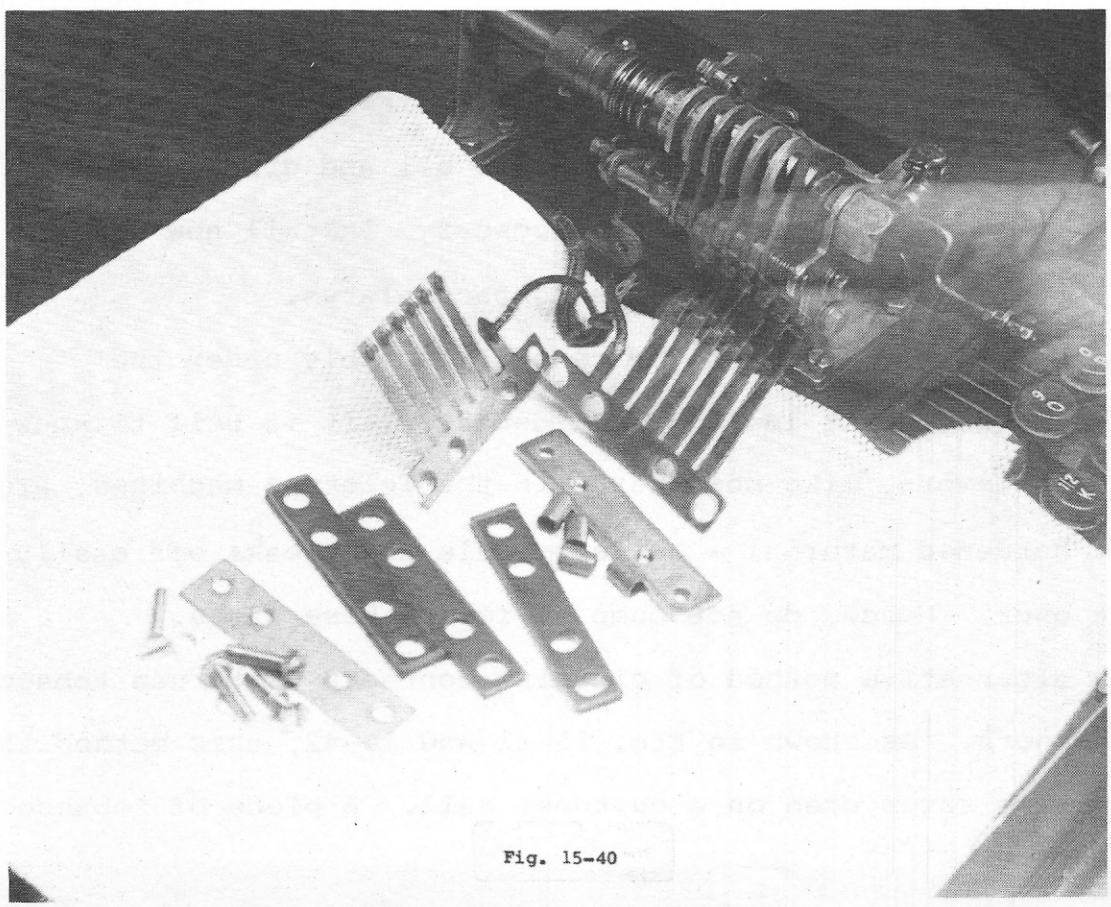


Fig. 15-40

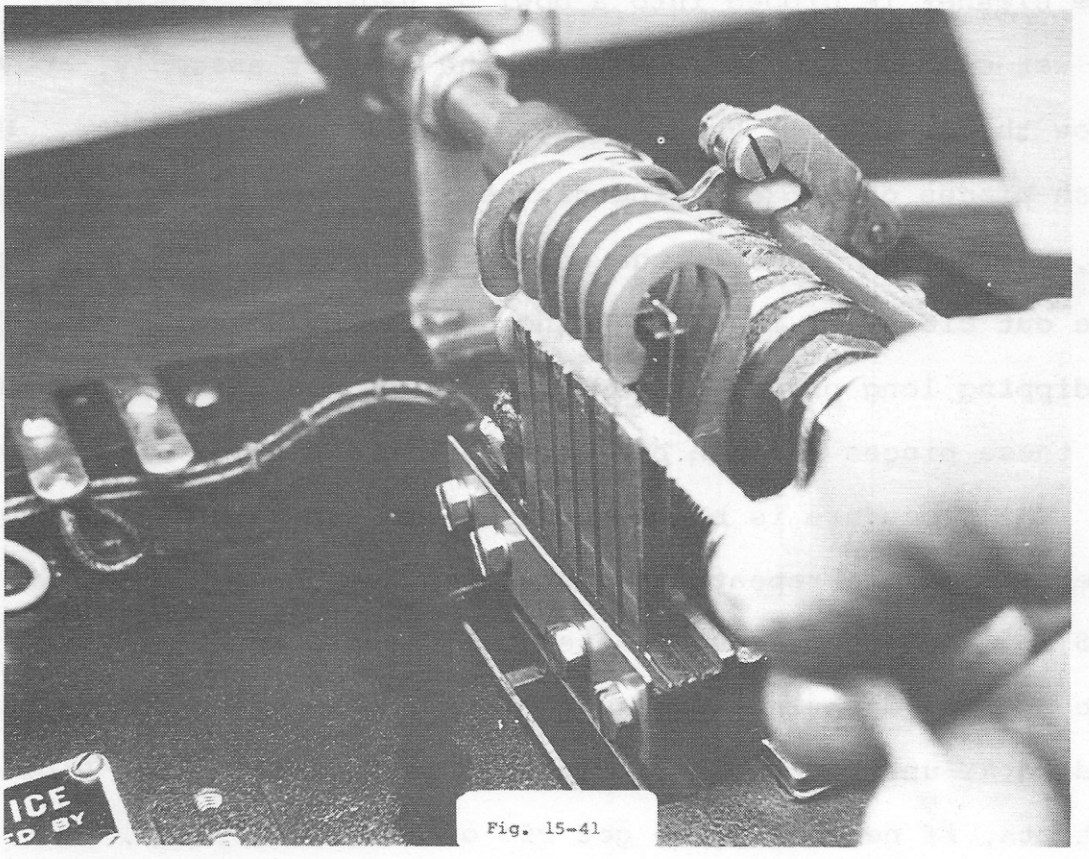



Fig. 15-41

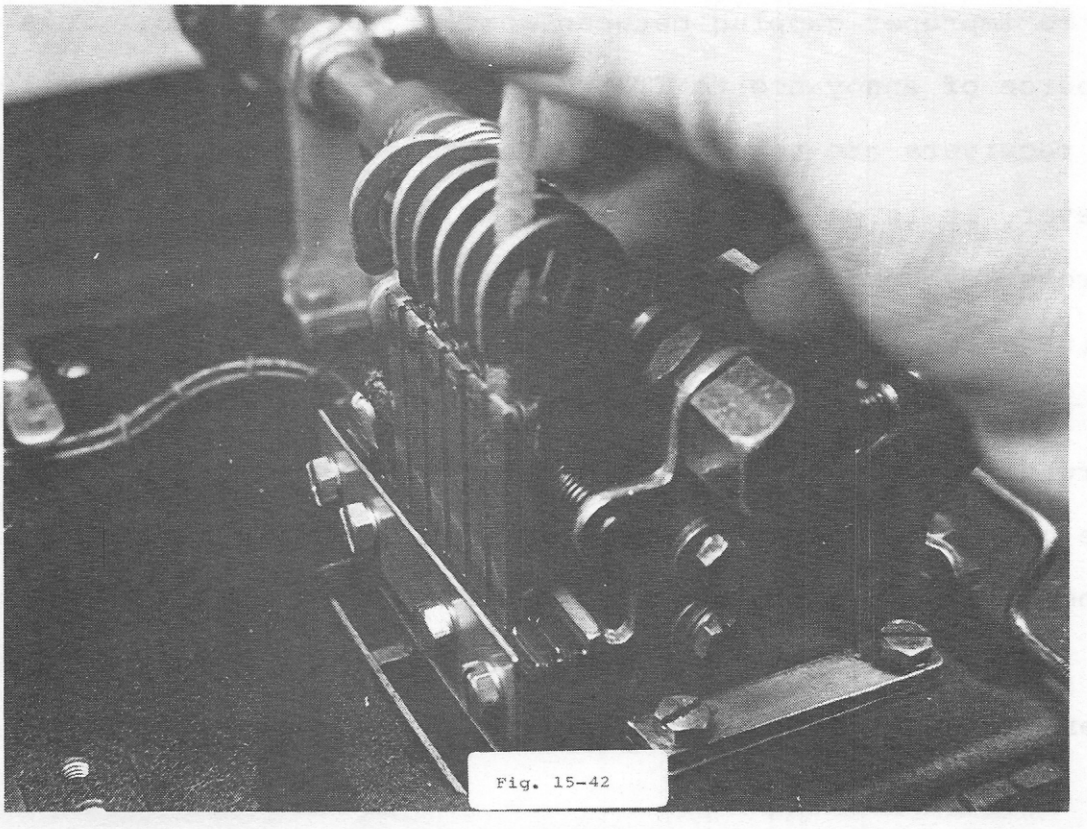


Fig. 15-42

pipe cleaner is dipped into a bowl of naptha or "Energine", then the wet cleaner is passed through the contact assembly, above and below the contacts. Very likely, it will come out dirty. Use fresh pieces of tobacco pipe cleaner, and keep swabbing all over, top, bottom,and sides of the contacts, until the cleaners finally come out clean. A final cleaning job is given the contact faces, by dipping long pieces of bond paper into the Energine, then passing these pieces through between the contact faces (Fig. 15-43).

The procedure is best done with the TTY machine running. The paper strips are repeatedly passed between the contacts, while LTRS key is being tapped. After the cleanup work is done, the keyboard may misprint, due to lint in between some contacts. Keep sending RY until the signal finally clears itself up. Blow on the contacts, if necessary, to get rid of lint.

Rather frequently, the M15 keyboard develops distorted signals, due to improper gapping between some of the contacts. This can be a source of annoyance to TTY receivers in the TDI network. Most TTY receivers are tolerant of moderate degrees of signal distortion. However, it is well to describe some simple adjustments which would improve keyboard performance and thus improve the overall reliability of communications.

As mentioned, there are six contacts in the M15 keyboard. The rearward contact is called the start-stop contact, while the next five contacts, coming forward, are for bits 1, 2, 3, 4 and 5 respectively (See Fig. 15-39).

Gaps between contacts are quite critical. Too wide a gap (over .02 inch, say) introduces spacing bias as well as possible

transition clicks. Too short gaps (less than .015 inch) introduces marking bias. Our experience indicates that the average gap lies between .015 and .020 inch. Many keyboards seem to generate the best possible averaged signal with .017 inch gap between all contacts including the start-stop contact.

There have been quite a few keyboards with the start-stop contact having too wide a gap - even as much as .030 inch. This leads to a bouncing contact and "double action" in the typing unit, that is, a character is received, followed immediately by a LTRS selection. Hence, the affected keyboard must be operated at below 30 WPM, on account of double action.

Naturally, a properly-gapped contact system results in a clean TTY signal, one having zero bias. This gives the TTY receiver the best possible chance of receiving a character properly, in spite of distortions along the line. This of course assumes that the TTY receiver has been found to be in good condition; has a wide range measurement of say 80 points, and is centered in the range.

The range finder scale on the M15 machine is calibrated to read from 0 to 120. A reading of 100 points corresponds to perfect selection of a precise 22-millisecond bit, from leading edge to following edge. However, the mechanical selector requires a finite time to sample over the entire 22 millisecond bit. Best we can do is to ascertain whether the mechanical selector provides a range span of at least 80 points. Thus, if the teletypewriter receives correctly on any range-finder setting between say 20 points (low end) and 100 points (high end), we find that the selector is

operating very well, and we are sure that the (receiving) TTY is in good adjustment.

A good signal source for checking TTY range is to receive a signal from a known zero-bias transmitter-distributor, having a message tape such as THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK. This also checks all the letters of the alphabet and some of the functions as well. If one gets range-finder readings of 20 to 100 with errorless printing, he is fairly certain of a good typing unit. He can use it to check its keyboard, and thus be certain, at least roughly, how much bias the keyboard may have. In other words, if the keyboard reads 20 to 100 on the range finder, the keyboard's bias is quite close to zero, and it can be depended upon to be close enough for all practical purposes.

This is a long story, but some mention has been made to indicate to the TTY owner a need for a careful check on his keyboard, with what available test equipment he may have. A Stelma TDA-2 Distortion Analyzer would be an ideal instrument to check keyboards, but such specialized equipment is hard to find, let alone difficult to use except by those with much experience.

At any rate, if a TTY owner uses his range finder to test his keyboard, he won't be far from perfectness if he finds a range span of 70 or 80 points from a low reading to a high reading. Low might be 10 and high might be 80, or low = 25 and high = 105 - at least 70 or 80 points difference indicates a good keyboard contact adjustment.

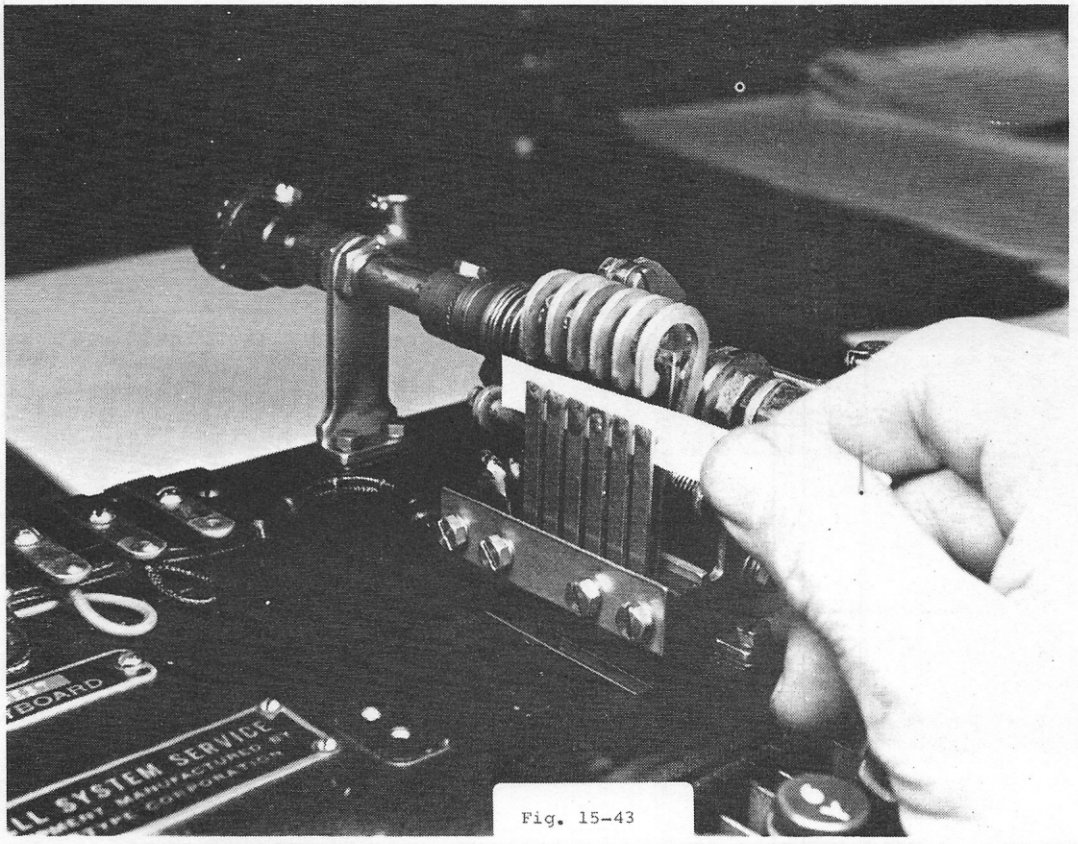



Fig. 15-43

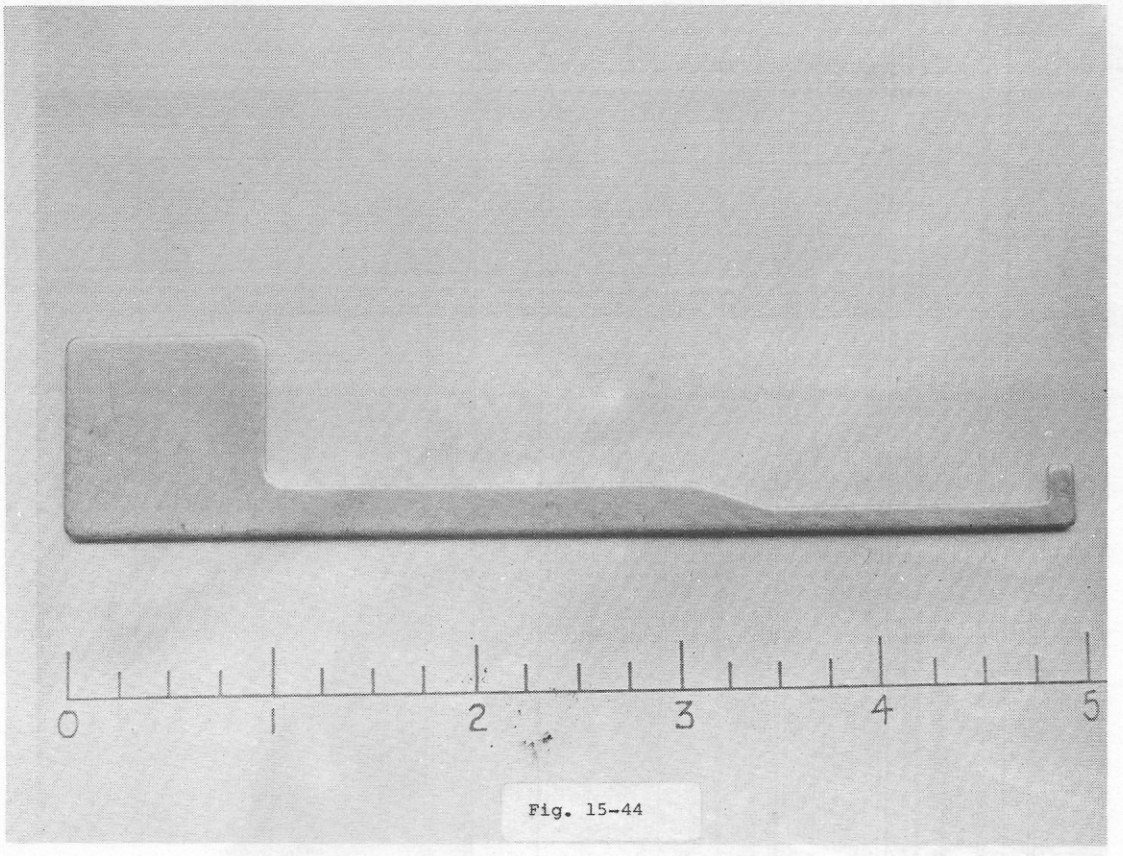



Fig. 15-44

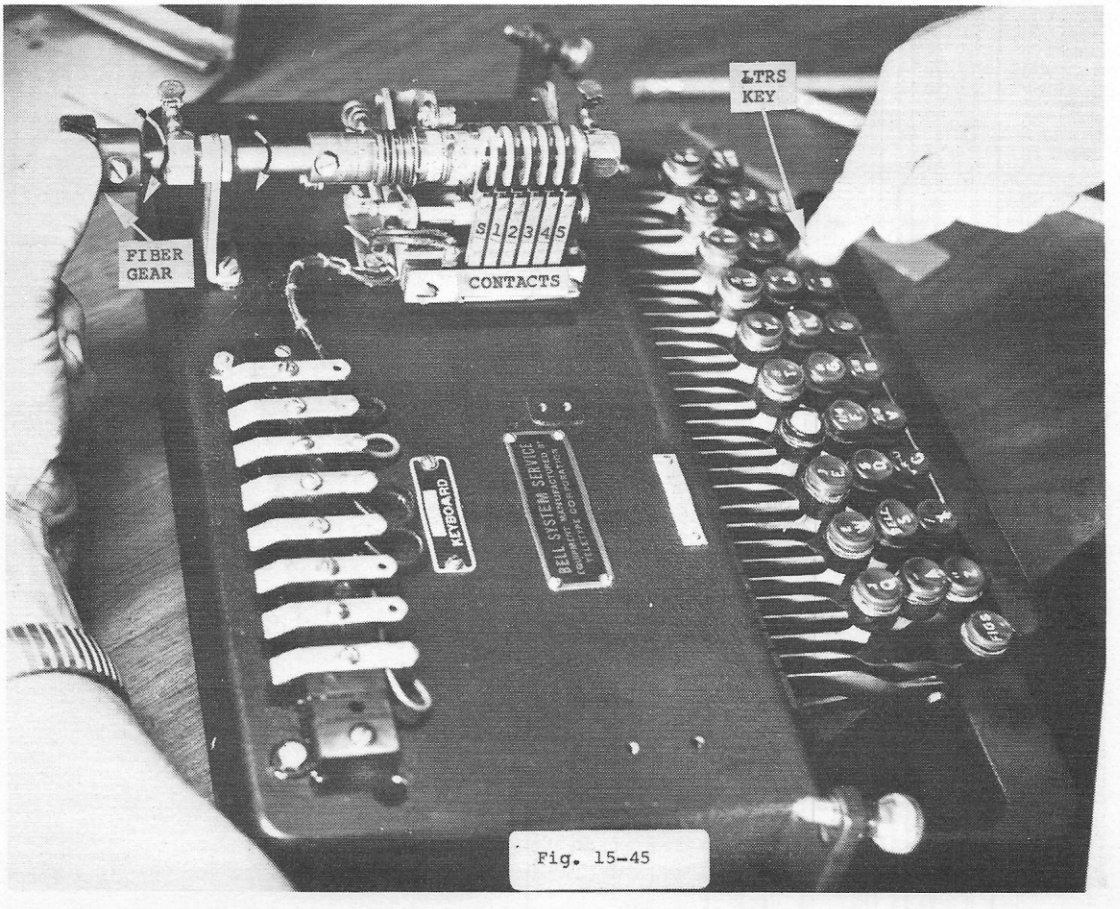



Fig. 15-45

## D. PROCEDURE FOR ADJUSTING CONTACTS ON A M15 KEYBOARD

A special tool is convenient for adjusting the individual contacts on the keyboard. It is shown in Fig. 15-44. It is available from Teletype Corp.; however it might be made up out of a piece of galvanized iron sheet, 1/16-inch thick. It should be hardened. However, a piece of coat hanger wire could be bent to a similar shape.

Further, a gauge will be needed to indicate a .020-inch gap. A suitable spark plug gap gauge will do satisfactorily.

1. Take the keyboard out of the M15 base, and place the keyboard on a workbench, with good lighting overhead.
2. As shown in Fig. 15-45, turn the fiber gear over and forward to yourself. Give it a spin to make sure the transmitting cam is properly latched.
3. Press LTRS key, then turn the fiber gear slightly up, over, and towards you until the start-stop contact opens. This is the first contact on the left of the row of six contacts. When this is done, all six contacts will be open, ready for inspection and gauging (See Fig. 15-45).
4. Take the .020-inch gauge (a spark plug gauge) and feel the gap between each contact and its opposite mate. This should give a good indication as to gap settings in the keyboard (See Fig. 15-46.)
5. Should a given gap be too wide, take the special tool and insert it as indicated in Fig. 15-47. Turn the handle gently, and see that that contact is bent in towards a correct gap.

SMEC

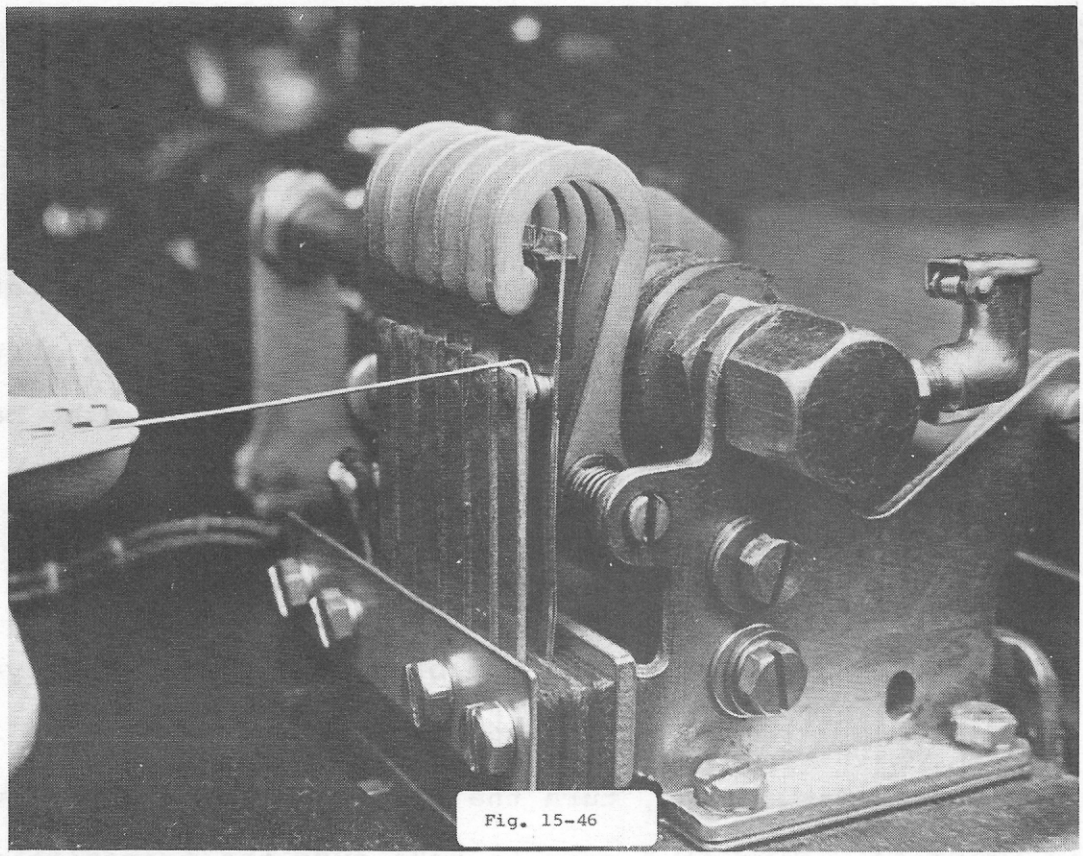


Fig. 15-46

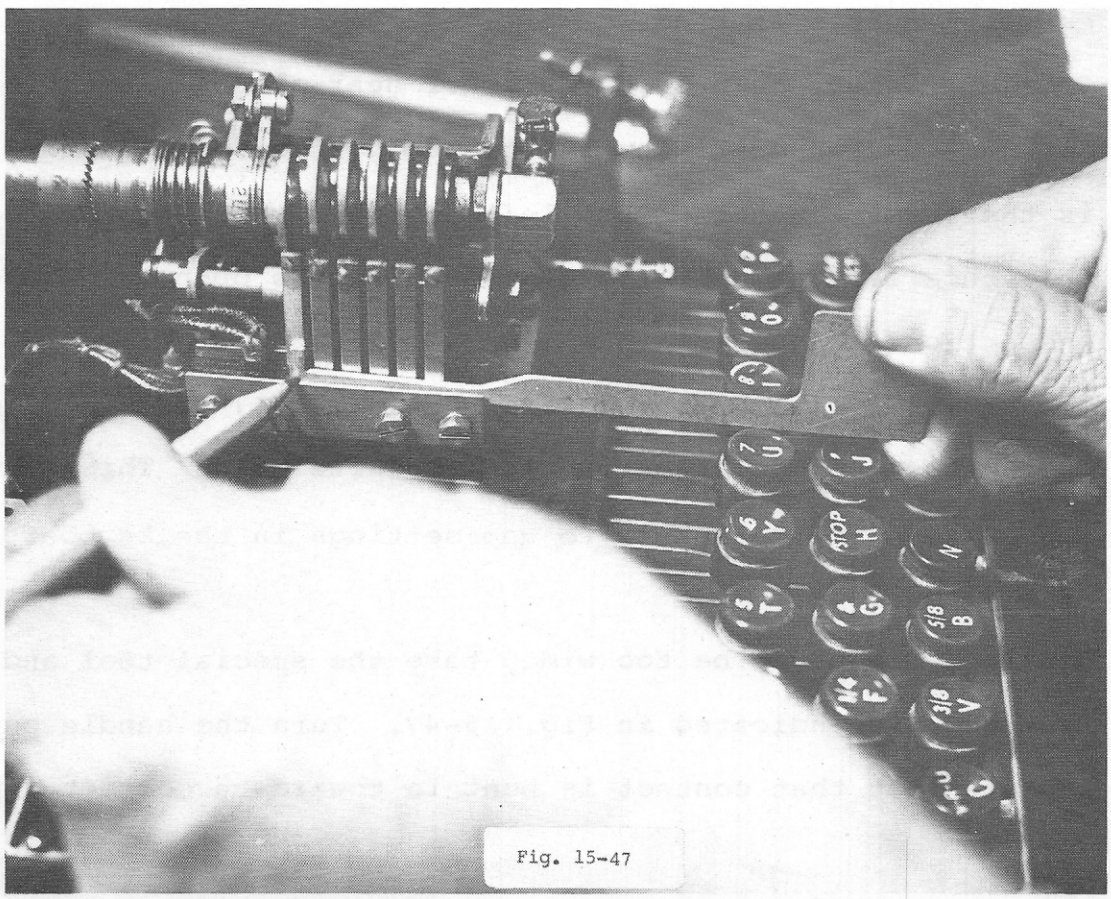



Fig. 15-47

6. If the gap is too narrow, insert the tool in between the rows of contacts and bend outward the contact in question. Fig. 15-48 shows this.

In general, take it easy on the tool. Each contact is rather easily bent, so a little finger pressure on the tool goes quite a ways.

The procedure described above should provide close-to-optimum contact gaps. Range finder measurements can of course, be taken as a check on keyboard contact adjustment. At any rate, the keyboard should have less than 5% bias. For instance, a range finder low point may be 20 on a known perfect signal, and it becomes 25 on the keyboard signal - the 5 difference reflects as a percentage of bias from a supposedly zero bias reference.

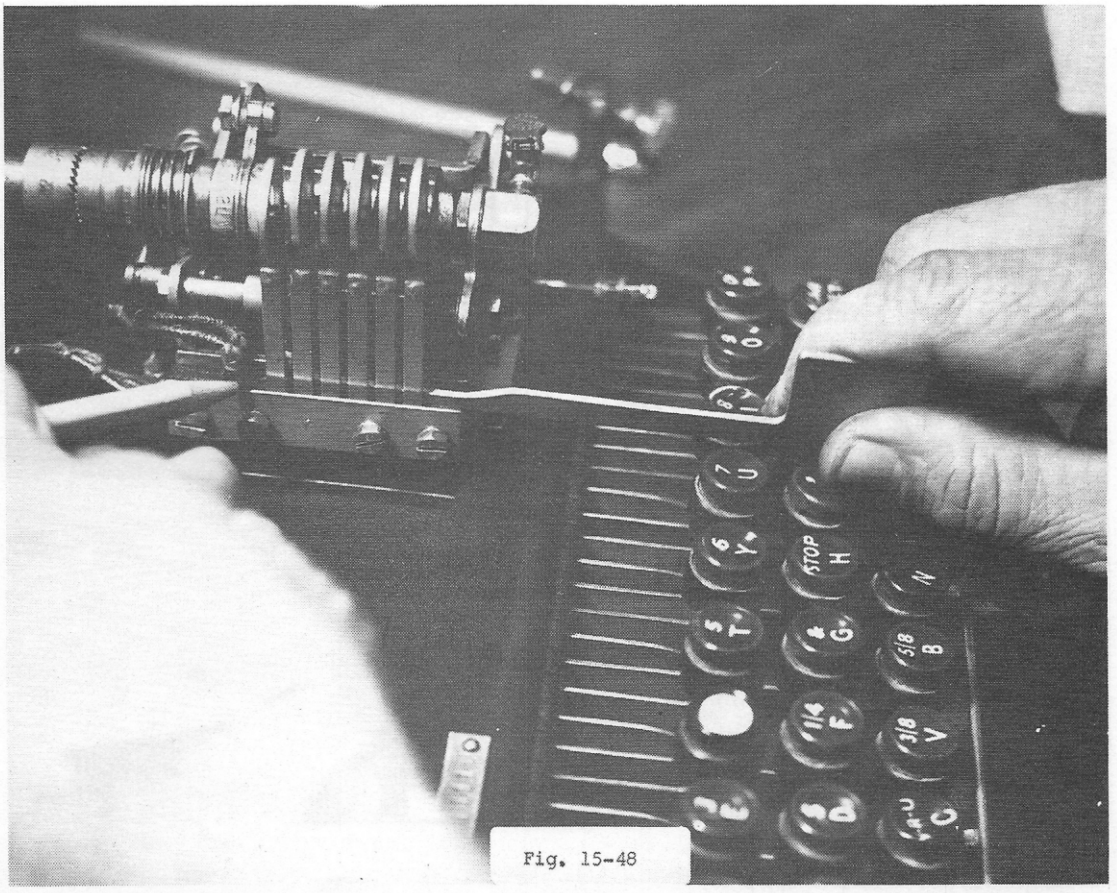



Fig. 15-48

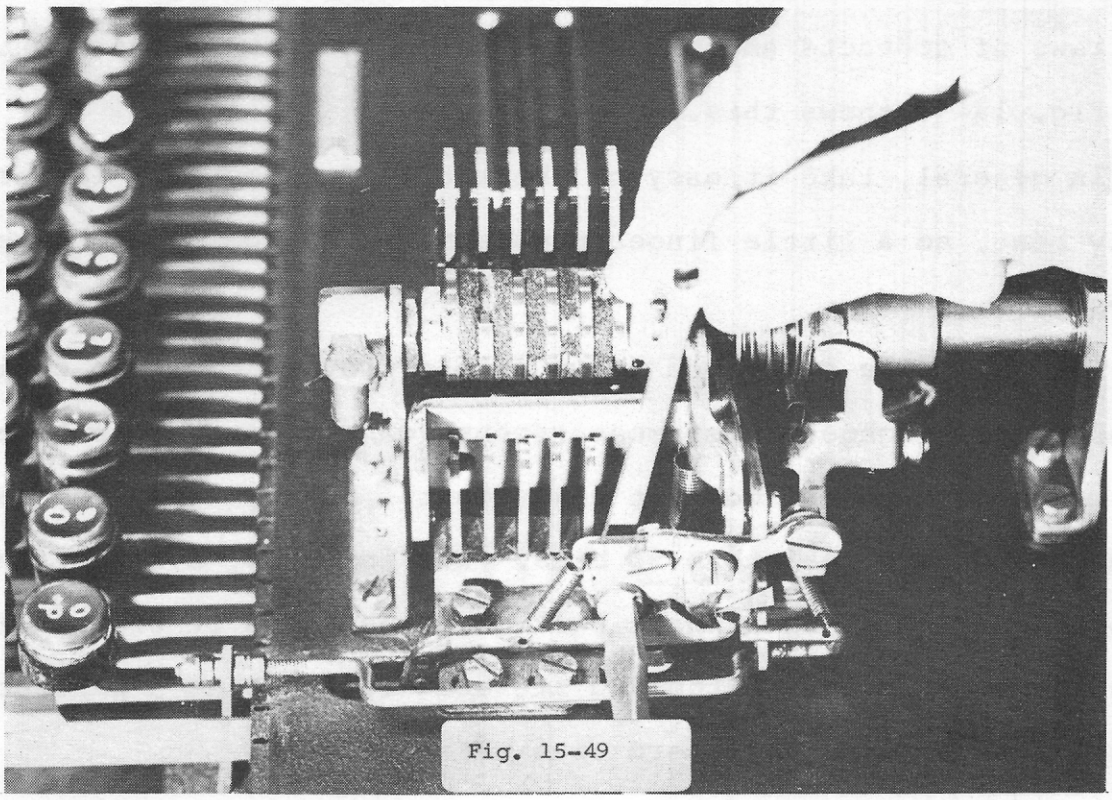


Fig. 15-49

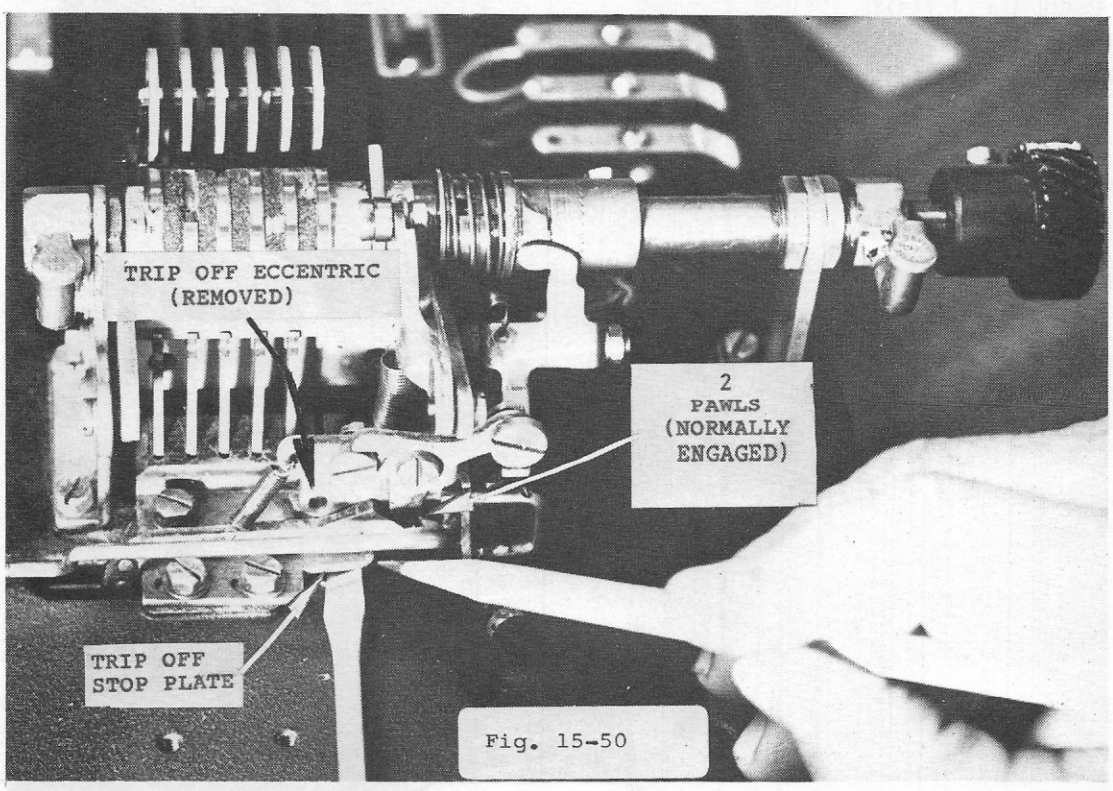



Fig. 15-50

## E. MODIFICATION OF A MODEL 15 KEYBOARD FOR EASY ACTION

For a fast typist, the Model 15 keyboard is sometimes a source of frustration. That is, unless he is good at rhythmical typing, the keyboard tends to kick back, thus resulting in dropped letters. This means that the typist has to go at about 45 to 50 WPM at maximum.

Here is a procedure for converting a M15 keyboard to repeat action. Two simple adjustments are involved. A cam-headed screw is removed from an indicated location (See Fig. 15-49). Further, a metal projection is bent up (see Fig. 15-50). The latter part is called the trip-off stop plate.

What has been done is to eliminate the trip-off pawl eccentric, which formerly slipped the trip-off pawl off the intermediate pawl. In other words, both pawls are continuously engaged. Repeat action is obtained on any one key. The typist will now find that he can "synchronize" his fingers to the keyboard and be able to type at a maximum 60 words per minute for long periods of time without skipping or dropping letters.

This modification will make many Model 15 owners and operators quite happy. The resulting feel is very good, considering the keyboard as it stands.

Figs. 15-51 shows the parts involved.

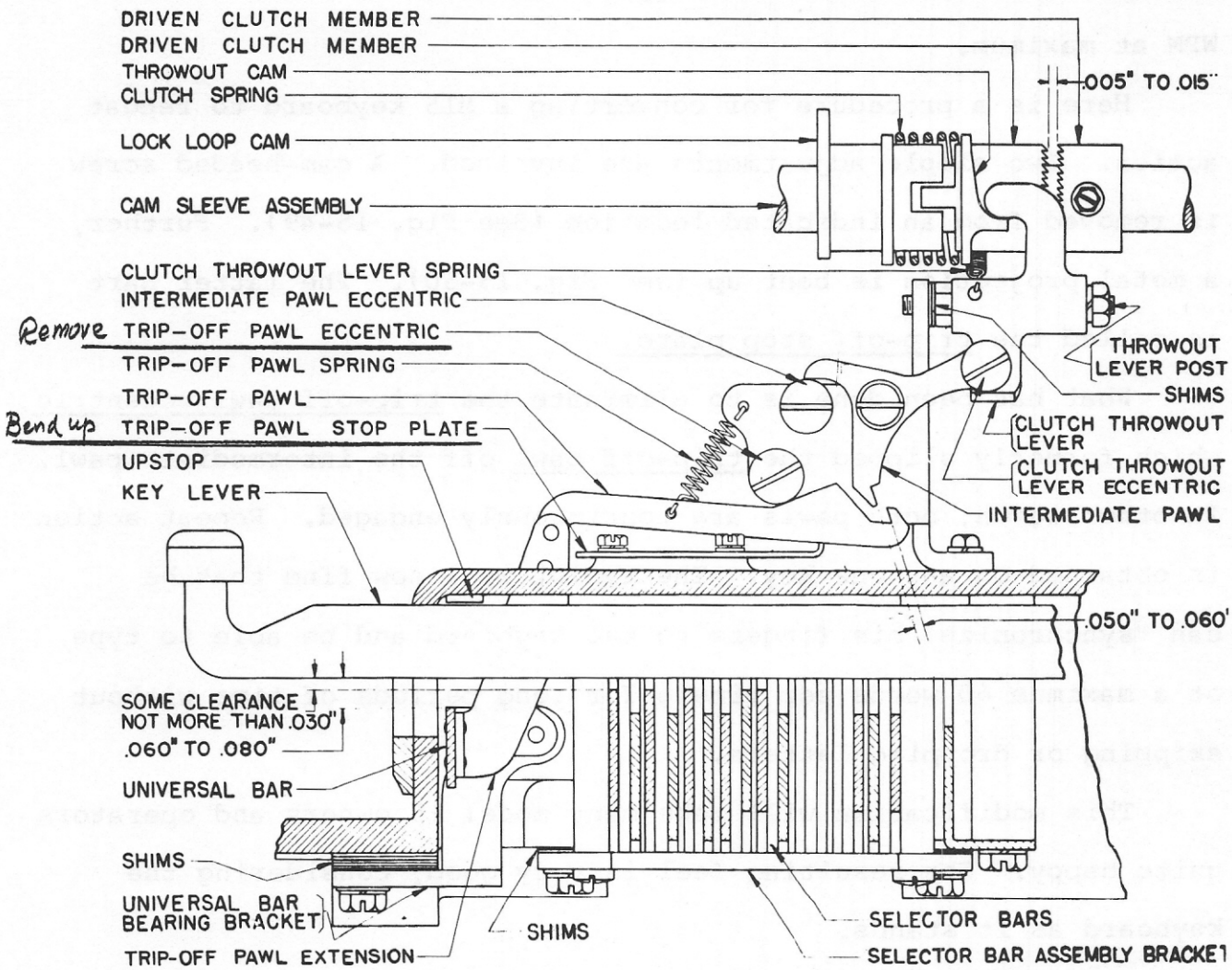

DRIVEN CLUTCH MEMBER
DRIVEN CLUTCH MEMBER
THROWOUT CAM
CLUTCH SPRING
.005" TO .015"
LOCK LOOP CAM
CAM SLEEVE ASSEMBLY
CLUTCH THROWOUT LEVER SPRING
INTERMEDIATE PAWL ECCENTRIC
Remove
TRIP-OFF PAWL ECCENTRIC
THROWOUT LEVER POST
TRIP-OFF PAWL SPRING
SHIMS
TRIP-OFF PAWL
Bend up
TRIP-OFF PAWL STOP PLATE
CLUTCH THROWOUT LEVER
UPSTOP
CLUTCH THROWOUT LEVER ECCENTRIC
KEY LEVER
INTERMEDIATE PAWL
.050" TO .060'
SOME CLEARANCE
NOT MORE THAN .030"
.060" TO .080"
UNIVERSAL BAR
SHIMS
UNIVERSAL BAR BEARING BRACKET
SHIMS
SELECTOR BARS
TRIP-OFF PAWL EXTENSION
SELECTOR BAR ASSEMBLY BRACKET

Fig. 15-51

## F. GEARS ON CERTAIN WESTERN UNION MODEL 15 KEYBOARDS

It is known that there exist two styles of keyboards, as in use on Teletype Model 15 machines, coming from Western Union sources. Briefly speaking, the gears on the end of the keyboard cam shaft differ in size.

Care is needed to be sure that each such keyboard mates correctly with the typing unit involved. Should a certain keyboard be placed with an incorrect typing unit, one of two things will result: (1) the keyboard shaft will not be properly driven, or (2) the fiber gear will not fit correctly and is indicated by that the keyboard is difficult to push into the machine base. DO NOT FORCE THE KEYBOARD IN!!

There exist two "signaling code patterns"; they are commonly referred to as the Bell System Standard 7.42-unit pattern and the Western Union 7.00-unit pattern. As far as signaling is concerned in the nationwide telephone-teletypewriter network for the deaf, either pattern is quite compatible, with absolutely no problems inasmuch as they both generate the basic 45.5 Baud signal. As a matter of interest, the 7.42-unit system operates at about 61 words per minute, while the 7.00-unit system operates at about 67 words per minute. They can still intercommunicate very well, as mentioned. It is just that the 7.00-unit keyboard feels a little bit faster in use.

As indicated on the attached copies out of the Model 15 parts book, the part numbers for the gears involved are as follows: (See Fig. 15-52).

7.42-UNIT CODE (Bell System Standard) Gear Size

Transmitting Keyboard Shaft Gear is #74595 1.100 in. dia.

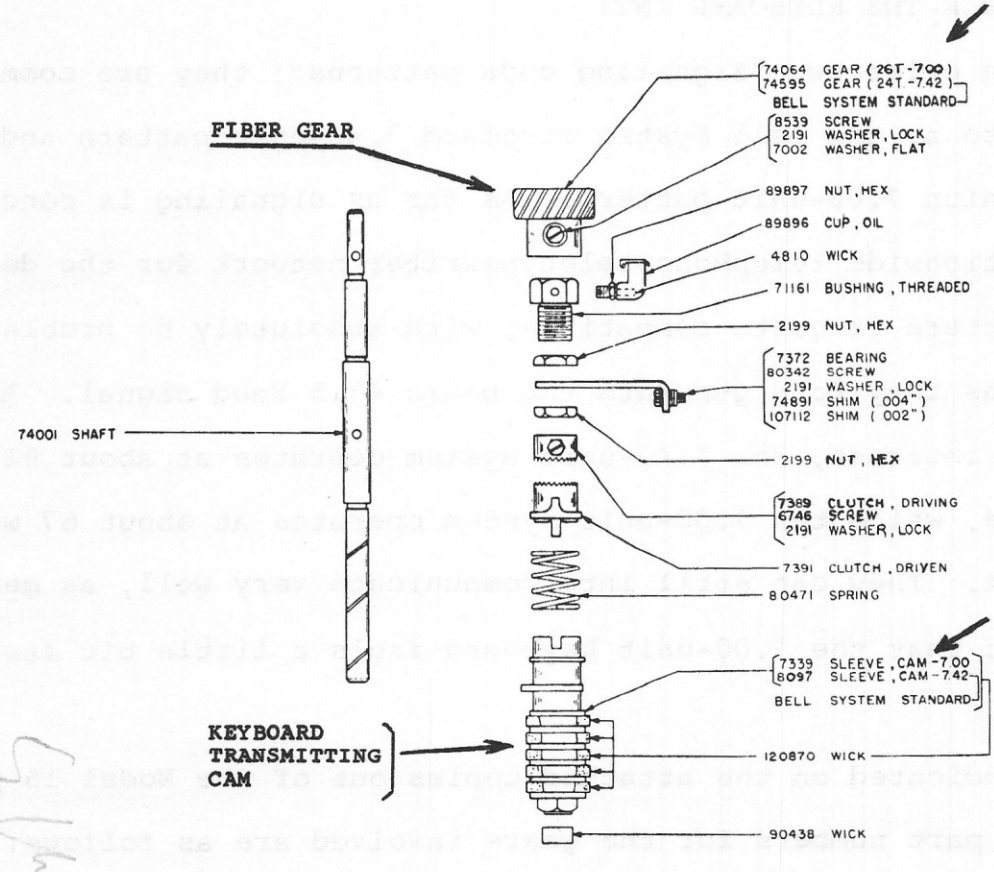
Main Shaft (Typing Unit) Gear is #74596 1.407 in. dia.

7.00-UNIT CODE (Western Union)

Transmitting Keyboard Shaft Gear is #74064 1.197 in. dia.

Main Shaft (Typing Unit) Gear is #74063 1.301 in. dia.

Take note that the keyboard cams are different on both 7.42 and 7.00 unit setups. Hence, if a cam is taken out to replace another, be sure that their type numbers correspond. Should different cams be swapped, they will result in incorrect signaling patterns, with confusion on all concerned. Needless to say, do not swap fiber grears, unless their numbers are the same.




TRANSMITTING SHAFT PARTS

**TELETYPE MODEL 15 KEYBOARD PARTS**
**(Note the 7.00 and 7.42 unit cams and gears; do not mix them.)**

Fig. 15-52

## G. THE SELECTOR MECHANISM ON A M15 TELETYPE

This is one of the two most critical areas in the Teletype machine; the other being the keyboard contacts. The selector mechanism is on the left side of the typing unit; it is the one with a range finder scale (Fig. 15-53). We will describe it very briefly.

The incoming Teletype signal has a series of pulses, coming one-after-the-other in a certain time interval. When no signal is coming in, the machine is resting in a MARK condition. During this time, the magnet holds the armature to its pole faces because of a 60 mA MARK current flow. When a signal comes in, the very first pulse is a no-current condition, called SPACE. The magnet releases the armature during this time; an extension of this armature hits the pin on the top of the range finder assembly. The receiving cam is unlatched, and it rotates. During the subsequent cyle, the incoming five pulses, 1, 2, 3, 4, 5, of either MARK or SPACE, are sensed and transferred through "swords" to the "T" levers, which then actuate the upper five vanes on the front of the typing unit to set up the selection for the character just received. Near the end of the selection cycle, a jaw clutch is tripped to cause the mechanical printing cycle to take place - resulting in a typing out of a character (letter or number) on the paper.

In general, the selector mechanism is full of critical adjustments, best left to an experienced Teletype serviceman. Our experience thus far has been that the selector mechanism - and, for that matter, the entire typing unit - has been one of the most

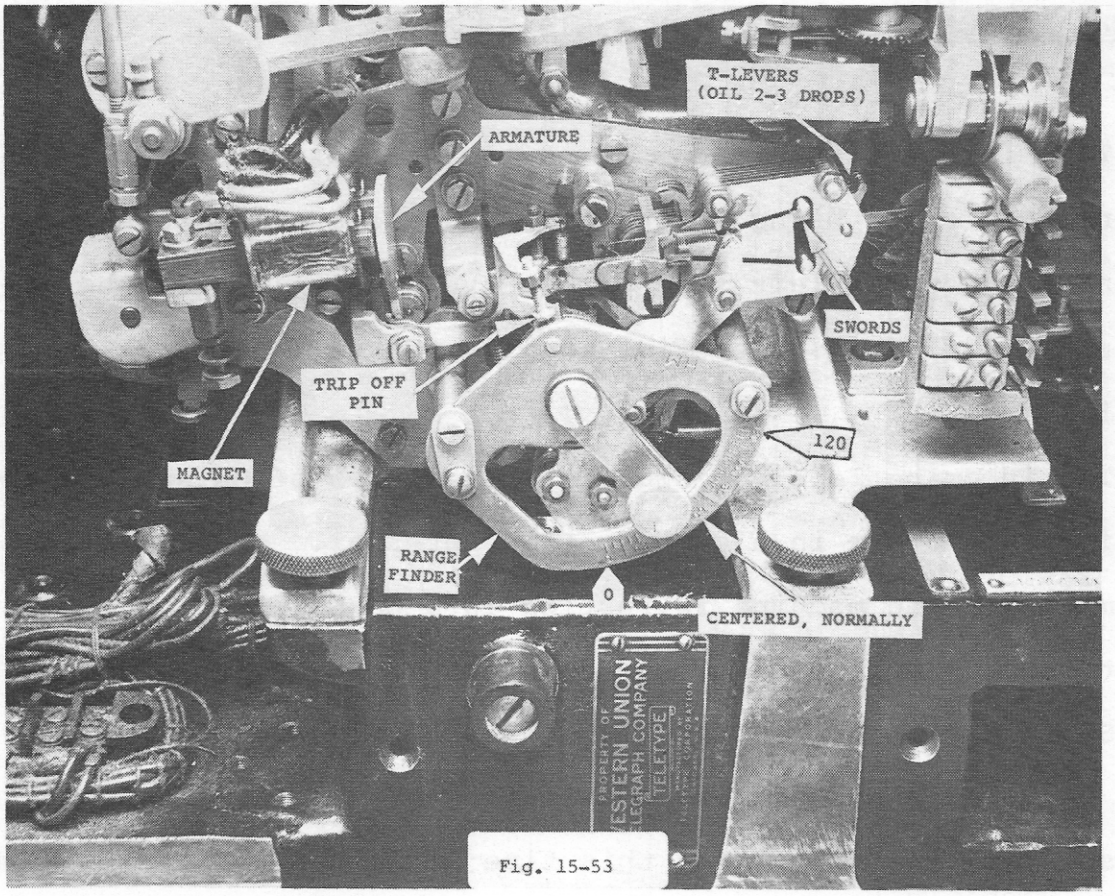



Fig. 15-53

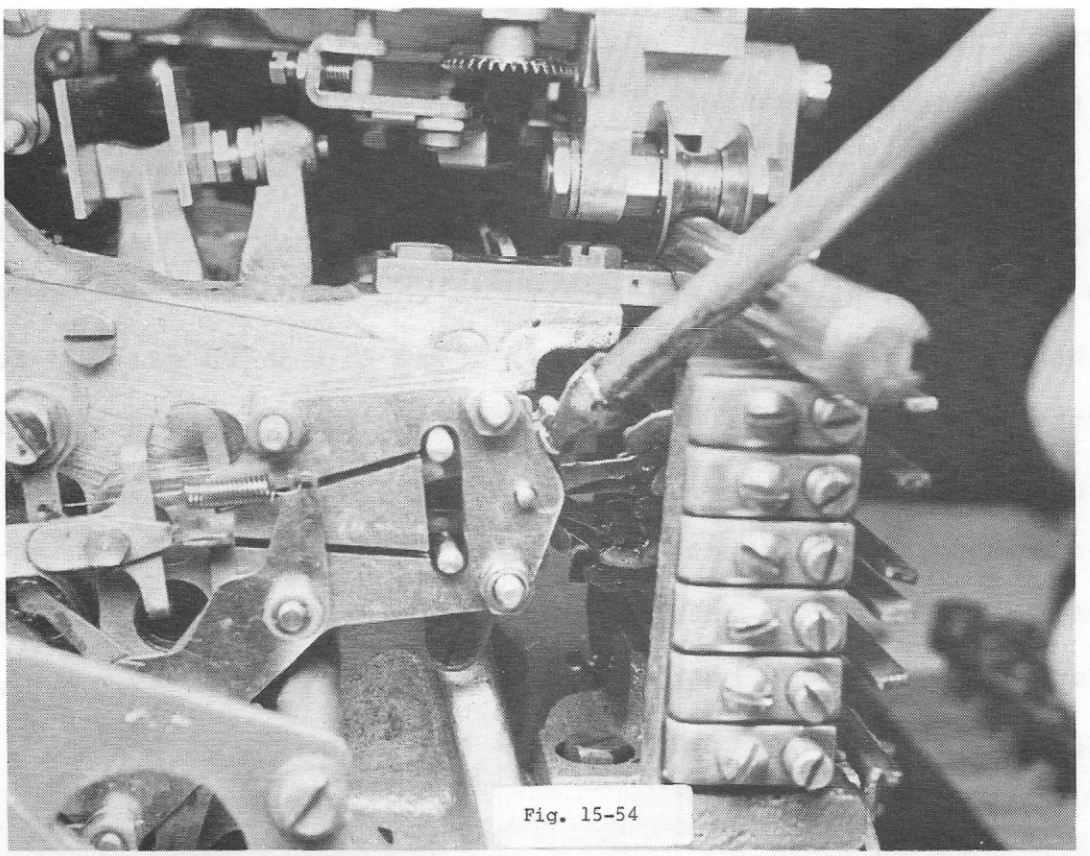


Fig. 15-54

reliable portions of the Teletype machine. That is, the average TTY machine, as in use in the TDI network, should be in good operating condition. As explained before in the Keyboard Contact Adjustment section, the range finder will provide an indication as to the performance of the selector mechanism.

Tips on Proper Care of the Selector Mechanism...

1. Keep the felts oiled on the selector cam.
2. DO NOT ALLOW OIL ON THE SELECTOR MAGNET ARMATURE.
3. Apply a little oil, very little only, to the "T" lever area; this will provide optimum lubrication to the selector mechanism area. See Fig. 15-54.

The reason for the admonition in step 2 is that oil on the surface of the armature is quite upsetting to the timing in the selector area. Oil causes the armature to stick to the pole faces of the magnet. Should this ever happen, or if the selector has "gone bad", take a piece of bond paper and pass it in between the armature and the pole faces of the magnet. This should remove any oil film from the armature area. See. Fig. 15-55. The TTY should be running; operate any key on the keyboard while passing the piece of paper in between the magnet and the armature.

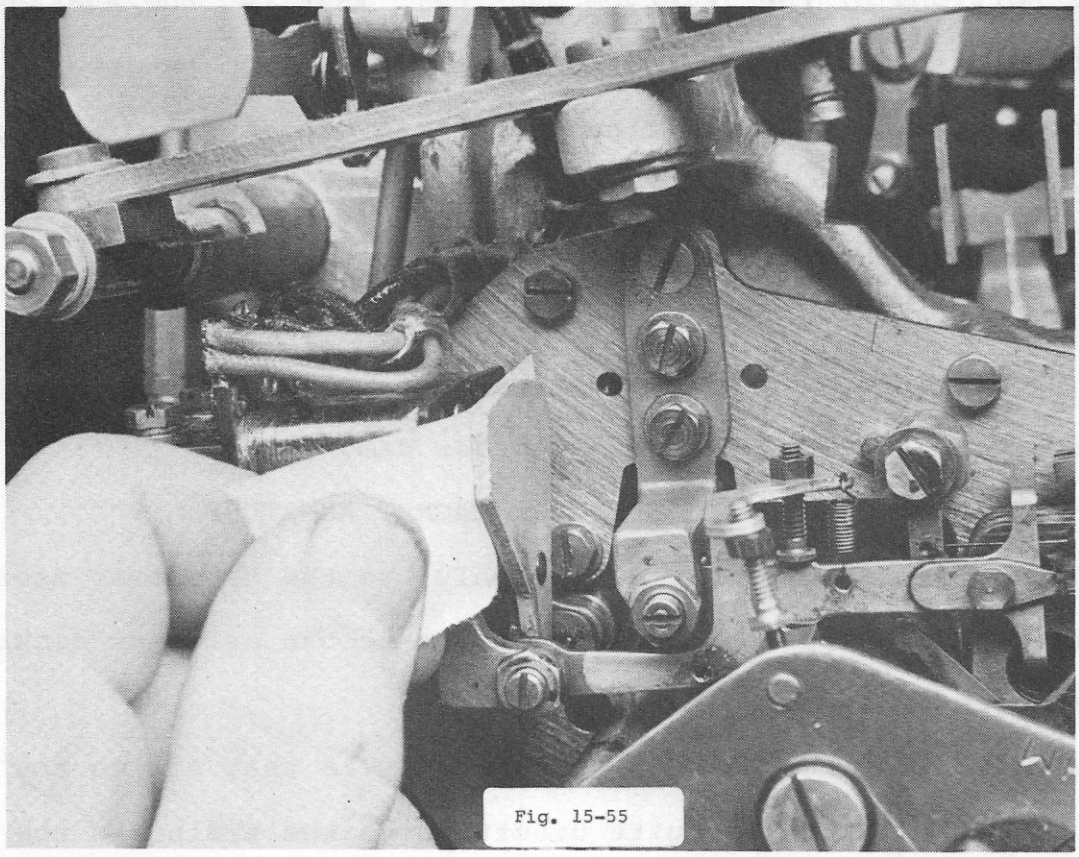


Fig. 15-55

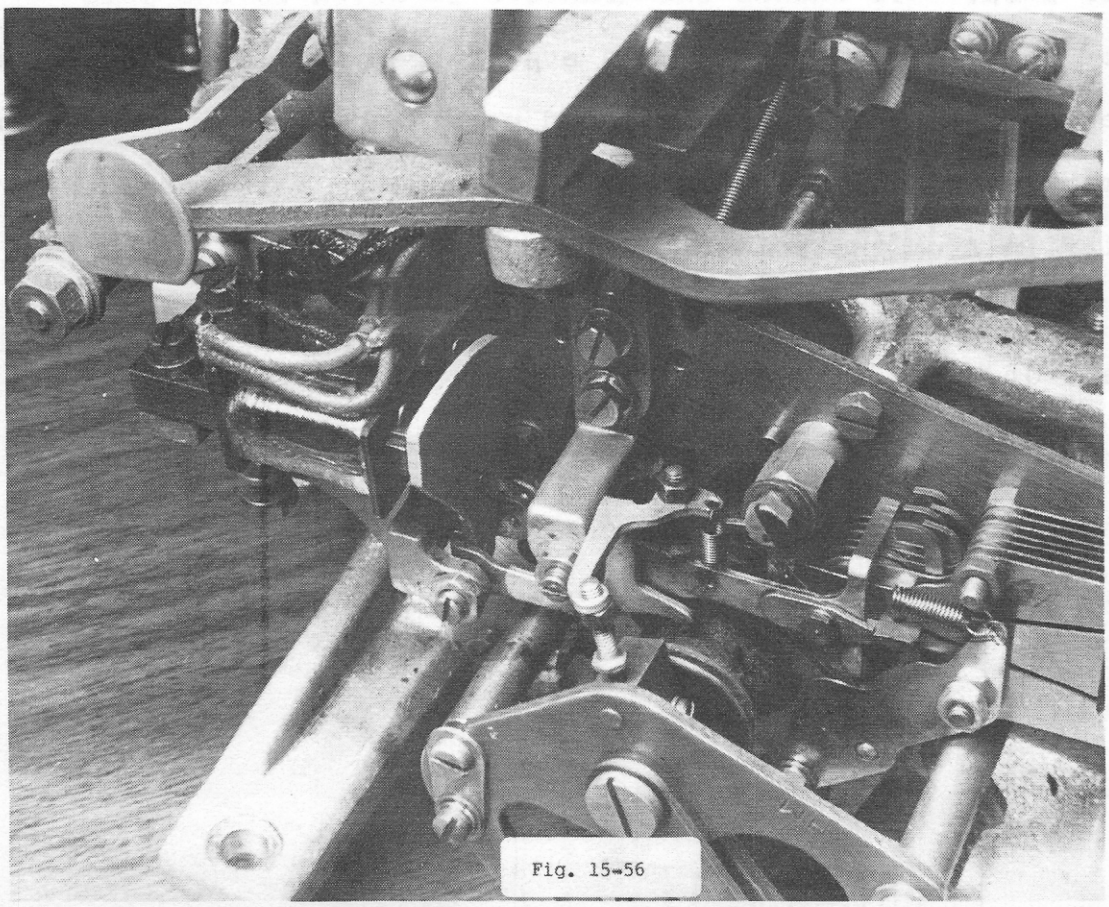


Fig. 15-56

## H. TWO DIFFERENT TYPES OF SELECTORS ON MODEL 15

As a matter of reference, M15 machines have two different types of selectors - one is called Pulling Magnet (Fig. 15-56), and the other is called Holding Magnet (Fig. 15-57). As far as performance is concerned, either will work as well as the other. However, they call for different adjustments; also they are somewhat dissimilar in electric drive requirements.

The Pulling Magnet System uses two 105-ohm coils in series (total resistance 210-ohms) and is always operated on a 60-70 mA magnet-line current basis.

The Holding Magnet System can be used on either a 20 mA or a 60 mA magnet-line current basis. The set up is arranged as follows: the two coils (each 100-ohms resistance) are placed in series for operation on a 20 mA line; a 5000-ohm resistor is connected across the seriesed coils for surge absorption. On a 60 mA line, the coils are placed in parallel, and the 5000-ohm resistor is not required. Typing units, having holding-magnet selectors, usually have switches to select parallel (P) or series (S) as necessary, so coil wires need not be manipulated. Fig. 15-58. Incidentally, the measured resistance of a 60 mA holding-magnet setup is 50-ohms; this is for information when doing continuity tests using an ohmmeter.

Acoustic couplers, in use in the TDI network, provide 60-70 mA magnet-line currents - suitable for either pulling-magnet or holding-magnet selectors. Just be sure the latter selector is set up to have its coils in parallel; (P) position on switch.

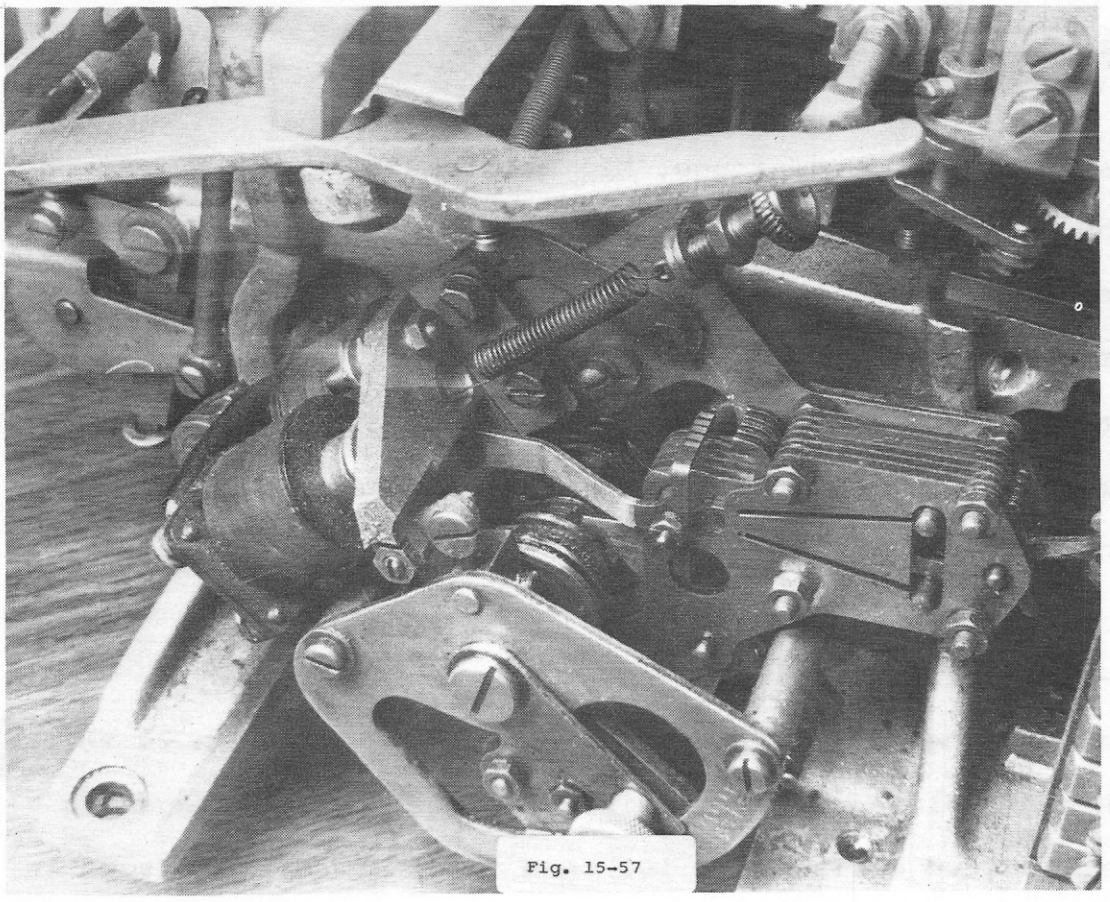


Fig. 15-57

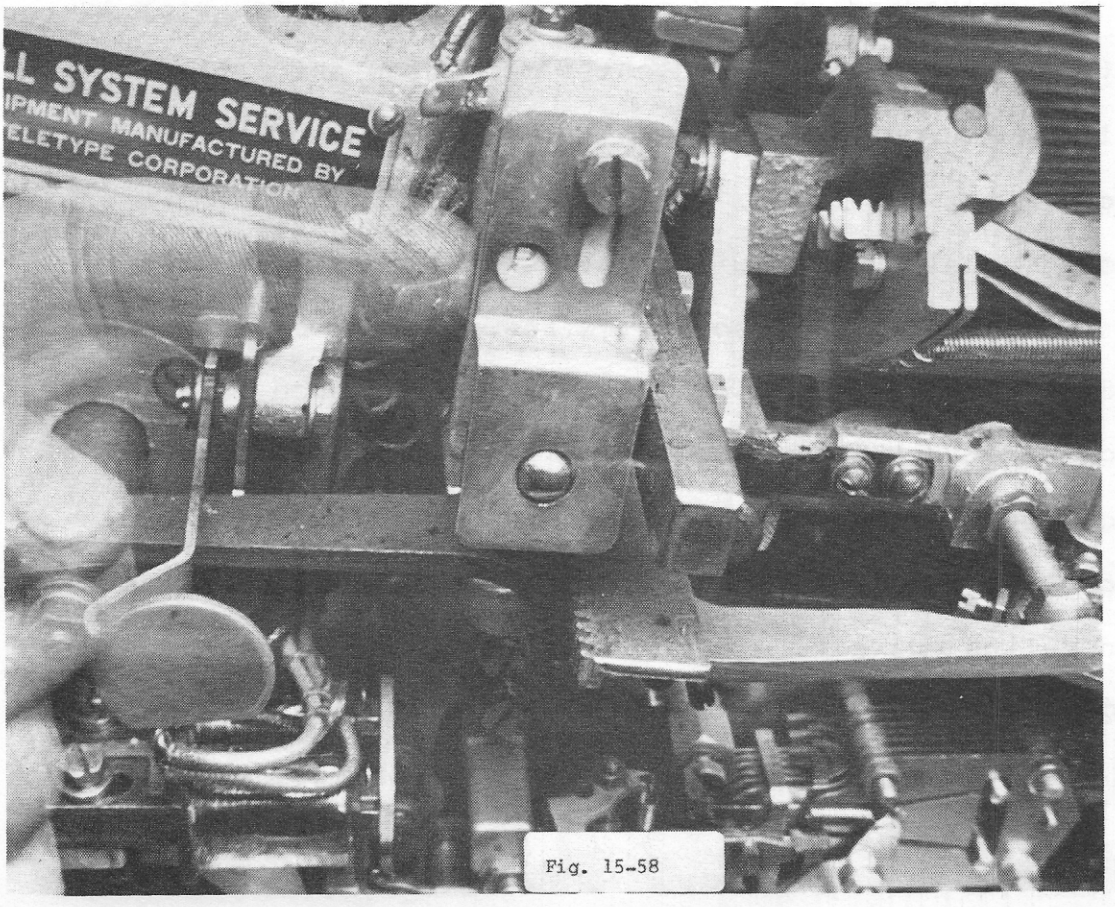



Fig. 15-58

## I. MOTOR GEARING ON MODEL 15 TELETYPE

Inasmuch as the TDI network is on a 60-wpm nominal speed rating (also referred as 45.45 Baud), all teletypewriter machines must conform to this standard speed, so that anyone can communicate with another.

M15 machines from most places arrive with the proper 74912 pinion, 74913 fiber gear combination already installed. Such machines are ready to use on the TDI network. However, there are many recent Bell System M15 units having 75-wpm gearings. These units must be fitted with new 60-wpm gears in order to conform to the TDI standard. The required 74912 and 74913 gears are obtainable from several sources at reasonable prices - around $10 a pair.

It is very easy to change gears. On the motor, the pinion gear can be removed simply by taking out a set screw and then pulling the old gear off. See Fig. 15-59. It may be necessary to loosen the motor base by unscrewing two screws, one on each side of the motor (Fig. 15-60) so that the motor base can be tilted upwards to clear the top of the M15 base. As for the typing unit, it is upended so that its left side sits on the workbench top. The fiber gear is accessible (Fig. 15-61); all that is needed is to take its clamp screw out, and then the fiber gear (along with its hub) will slip off (Fig. 15-62). Remove the hub from the old fiber gear by taking out three long screws. Install this hub on the new 74913 gear, and tighten all three screws securely thereupon. Remount the new gear on the end of the M15

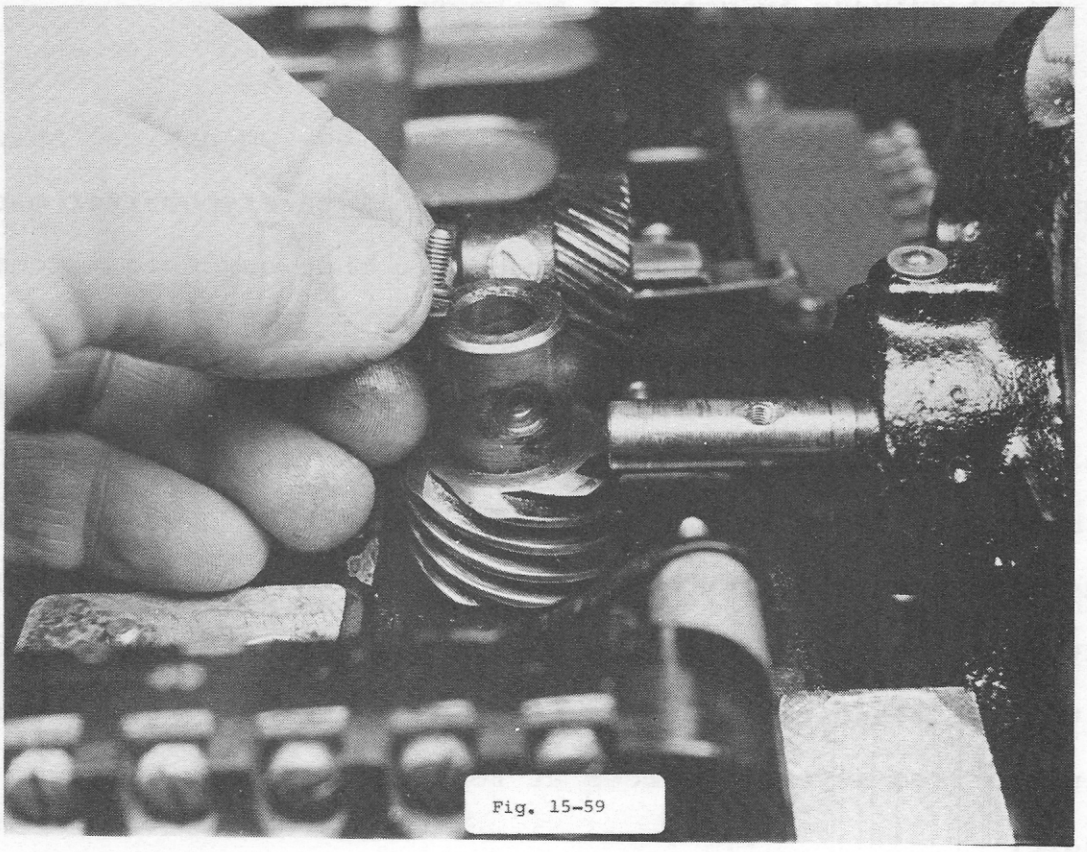


Fig. 15-59

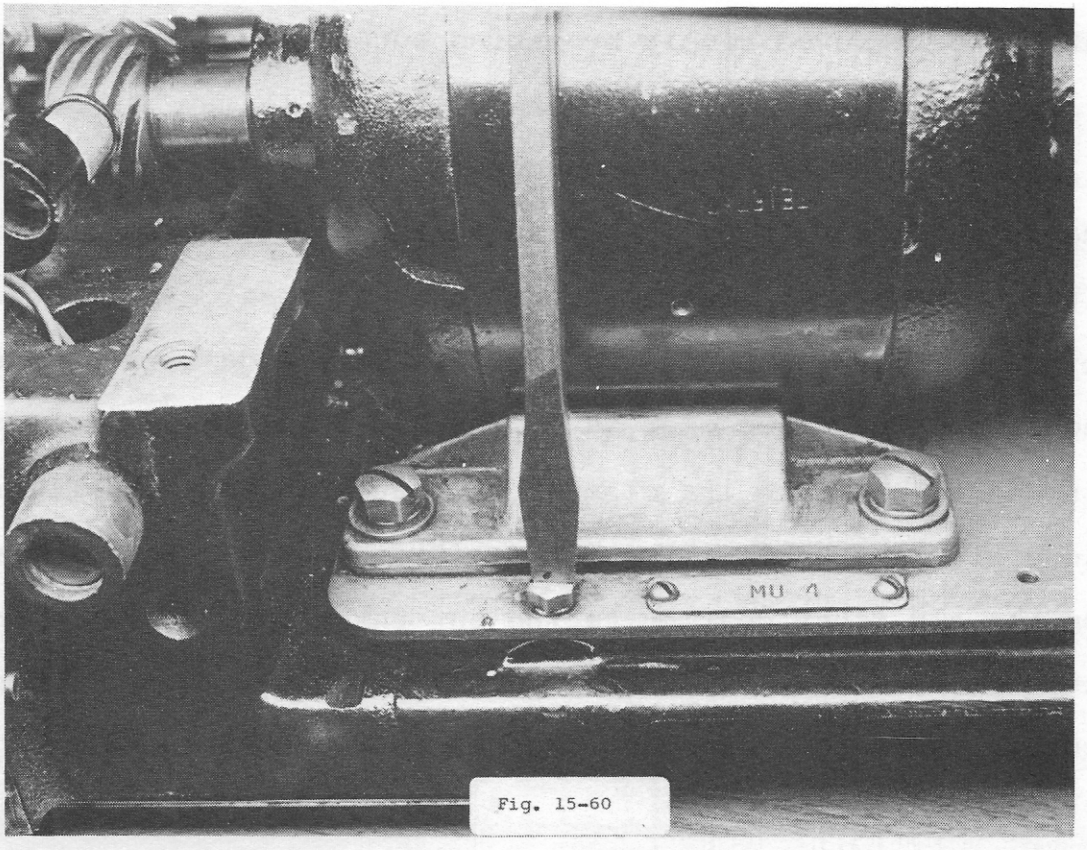



Fig. 15-60

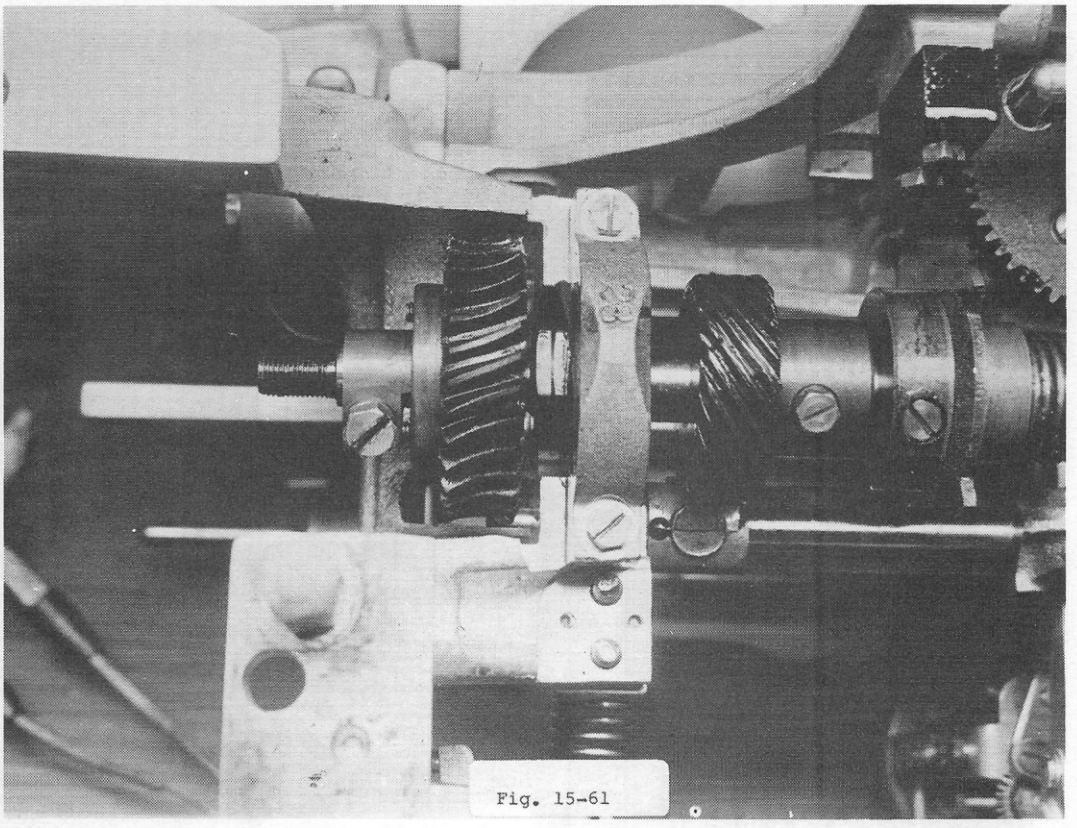


Fig. 15-61

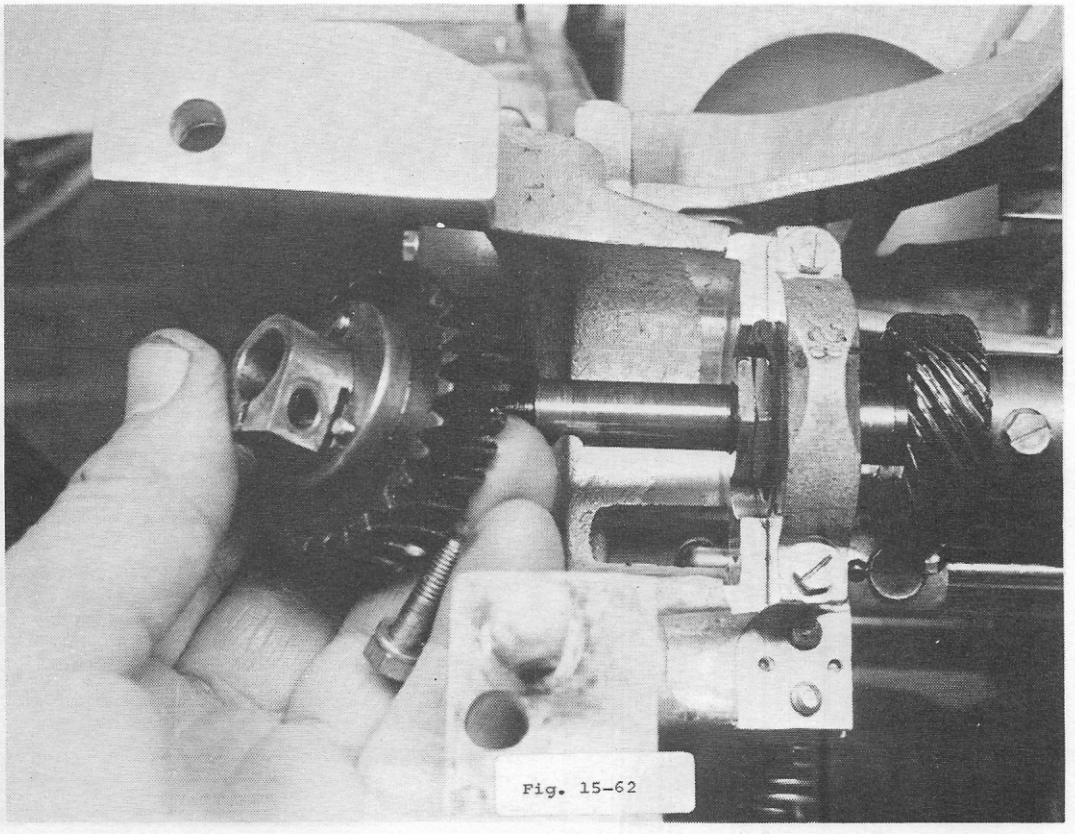


Fig. 15-62

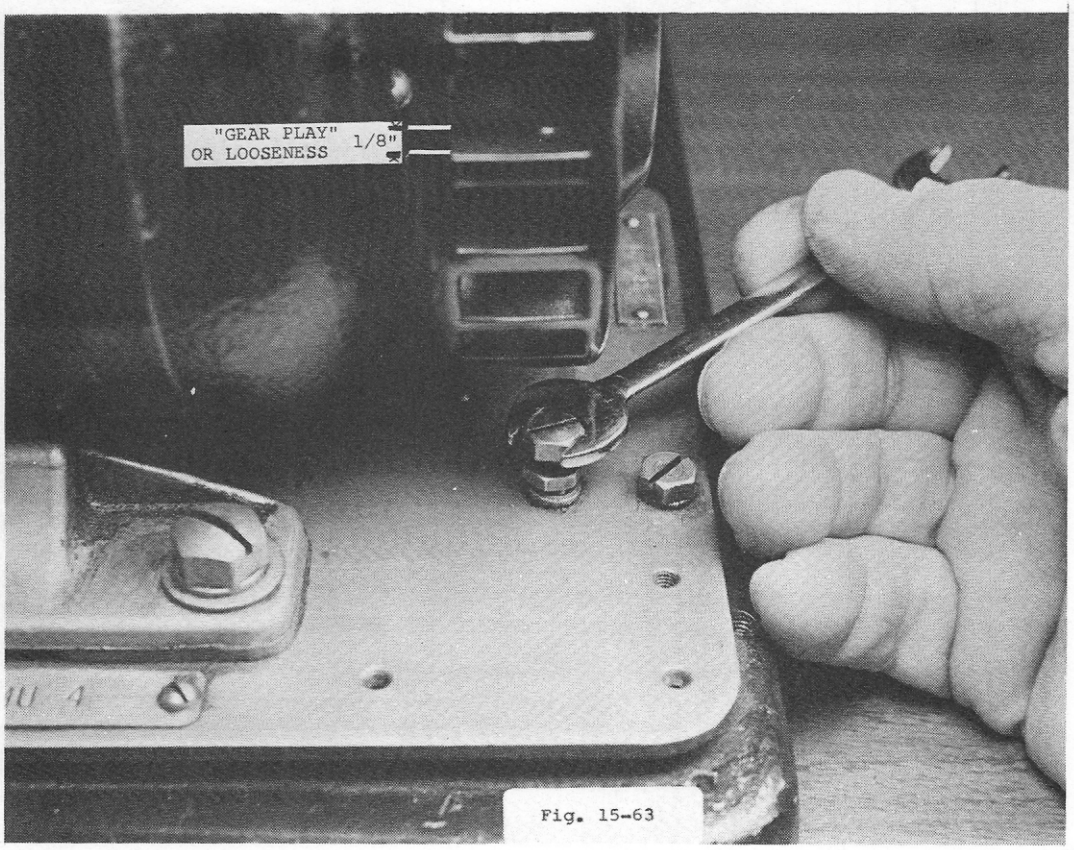



Fig. 15-63

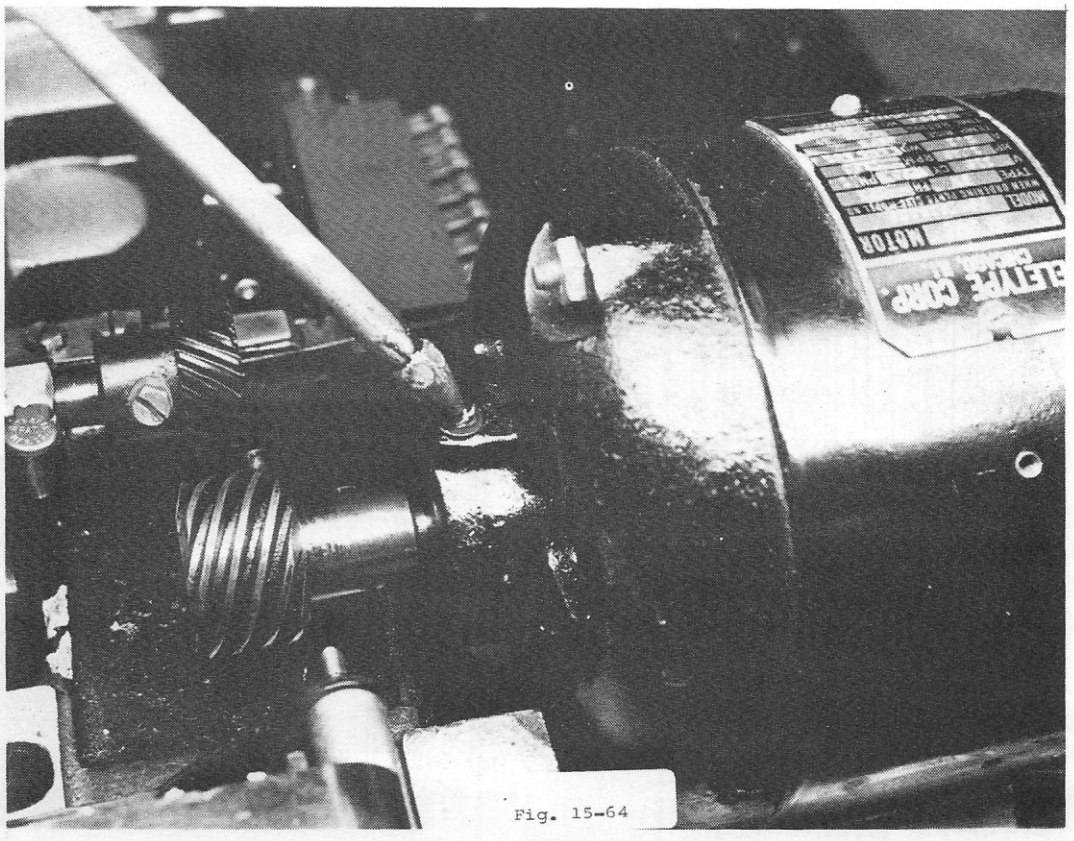



Fig. 15-64

mainshaft. See that the notch on the shaft lines up through the clamp screw hole. Insert the clamp screw and tighten it securely. This completes the gear change.

Even though the gears have been changed, there should be little need for adjustment of "gear play" or looseness between the two gears. In general, there should be a slight play - not too tight - this can be checked for by turning the motor fan wheel by hand. About 1/8 inch movement on the circumference before the fiber gear moves will be the right amount of play.

If the new gears need adjustment, this is quite easily done by tilting the motor base forward or backward so as to open up or reduce the looseness between the gears. There are two push-pull screws at the rear of the motor base; one screw is loosened, the other screw (with its jam nut free) is turned clockwise to increase the looseness, or counter-clockwise to decrease the looseness (See Fig. 15-63). After the required 1/8-inch movement on the fan wheel is obtained, tighten the first screw and then set the jam nut firmly on the second screw. Recheck the looseness afterwards. Naturally, the side screws, holding the motor base to the M15 base, must be kept tight.

Oiling the motor bearings can be done using an oilcan. One or two drops only to each bearing; place the oilcan spout on the oil cup and put in one drop (Fig. 15-64). Do this to the other oil cup, accessible through the fan wheel circumference. BE SURE TO GREASE THE MOTOR PINION GEAR AND THE FIBER GEAR. Use auto front axle grease or Vaseline. Keep the motor base screws tight, also be sure the pinion set screw is tight, likewise the hub clamp screw.

## J. BAUD RATE IN TELEGRAPH SYSTEMS

Teletypewriter systems have several "wpm" speeds, also customarily referred to as baud speeds. For the 5-level code system, there exist several speeds, as listed below:

| | | | |
|---|---|---|---|
| 60 wpm = 45.45 Baud | Bell System, many years | TTY M15 |
| 66 wpm = 50 Baud | Telex, international, WU | TTY M15 |
| 75 wpm = 56.8 Baud | Bell System, recent | TTY M15 |
| 100 wpm = 74.2 Baud | Bell System, newer | TTY M28, 32 |

Western Union has many Teletype units running at 50-Baud (66 wpm) speed; hence they are available and must be changed to 60 wpm by means of appropriate gears.

(SAVE THE 66 wpm GEARS FOR POSSIBLE INTERNATIONAL USE)

(Change gears on both TD and Printer Units)

On the M19 units, the transmitter distributor units have gears sized to match the required speed in use with such M19 sets. Using calipers, measure the diameter of the fiber gear on the vertical shaft of the TD in question. The dimension of such gear for each speed is given below:

| | | | |
|---|---|---|---|
| 60 wpm = 45.45 Baud | Fiber Gear dia. 1-7/8 inch. | |
| 66 wpm = 50 Baud | Fiber Gear dia. 1-13/16 inch. | 7.42 UNIT CODE ONLY |
| M14 TD's 75 wpm = 56.8 Baud | Fiber Gear dia. 1-3/4 inch. | |
| 100 wpm = 74.2 Baud | Fiber Gear dia. unknown | |

There have been some special M15's designed to run 100 wpm. I have never seen such units.

Western Union also may have some 7-unit TD's, besides the 7.42 unit things described above. Fiber gear diameters are

altogether different. Be sure to note that the STOP segment is appreciably longer than the other segments on the TD faceplate. For the 7.42-unit code, the correct type number for the faceplate is 77070.

WPM and BAUD rates are "the same" for both 7-unit and 7.42-unit patterns. Gear ratios differ, however, so be sure that you have the correct pattern before ordering new gears for replacement purposes. This applies only to Transmitter Distributors.

KSR Printer units are completely compatible with 7-unit and 7.42-unit patterns, adhering to the WPM-BAUD rating. It is just that the 7-unit keyboard/TD is slightly faster (65-wpm) compared to the 7.42-unit keyboard/TD (61-wpm).

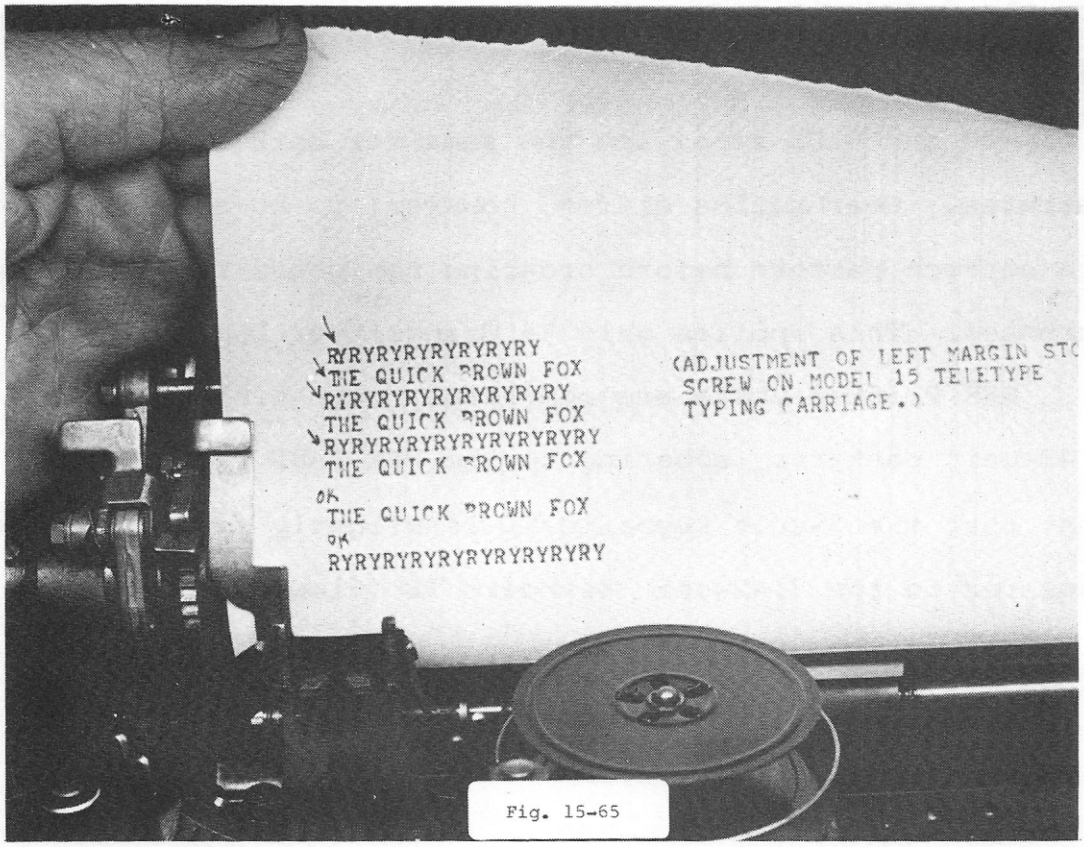



Fig. 15-65

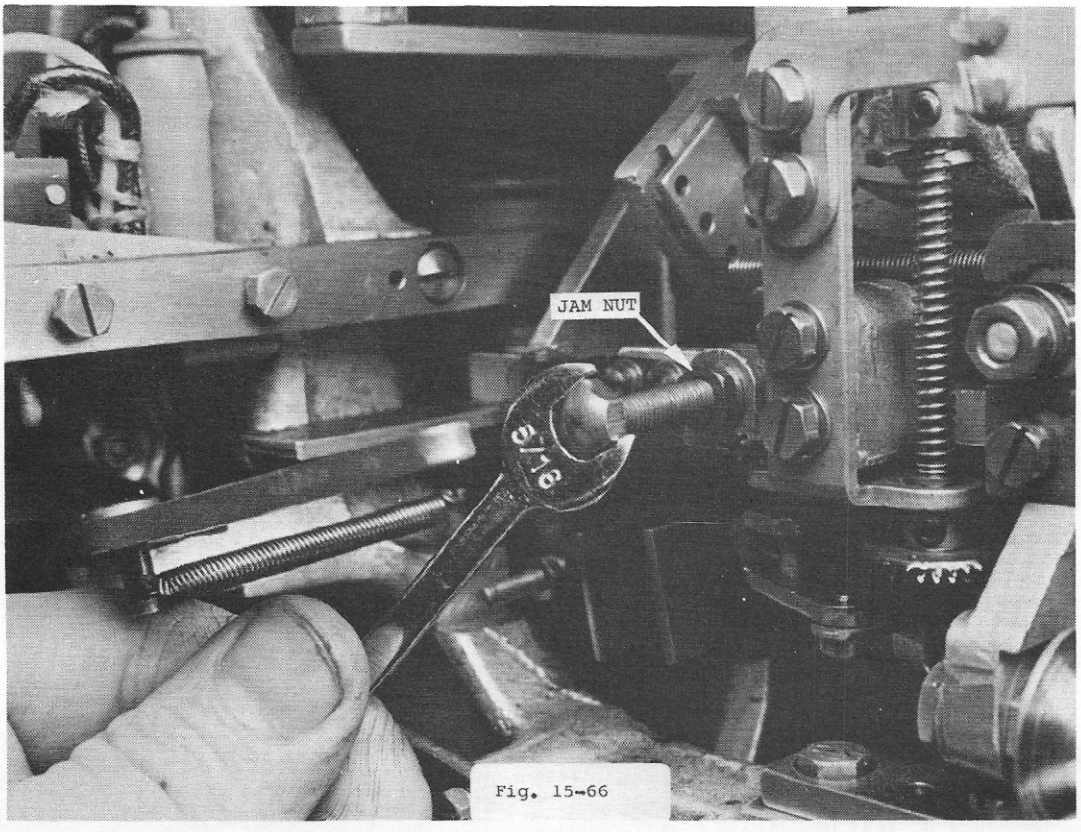



Fig. 15-66

## K. LEFT MARGIN ADJUSTMENT ON MODEL 15 TELETYPE

Sometimes, the left margin is uneven, as shown in Fig. 15-65. It is easy to correct this; there is a left margin screw on the left side of the typing unit. The screw is held in place by a jam nut. Loosen this jam nut first before turning the left margin screw; see Fig. 15-66. As much as two turns either way may be required to even up the left margin. In general, rotate the screw two turns clockwise (screwing in); this will clean up the margin, although it may permit an extra letter added to the total line = 73 characters instead of the normal 72-characters line. Or just unscrew the left margin screw two turns or as required to even up the left margin, and have a total of 72 characters to the line. Be sure to tighten the jam nut after the adjustment has been made.

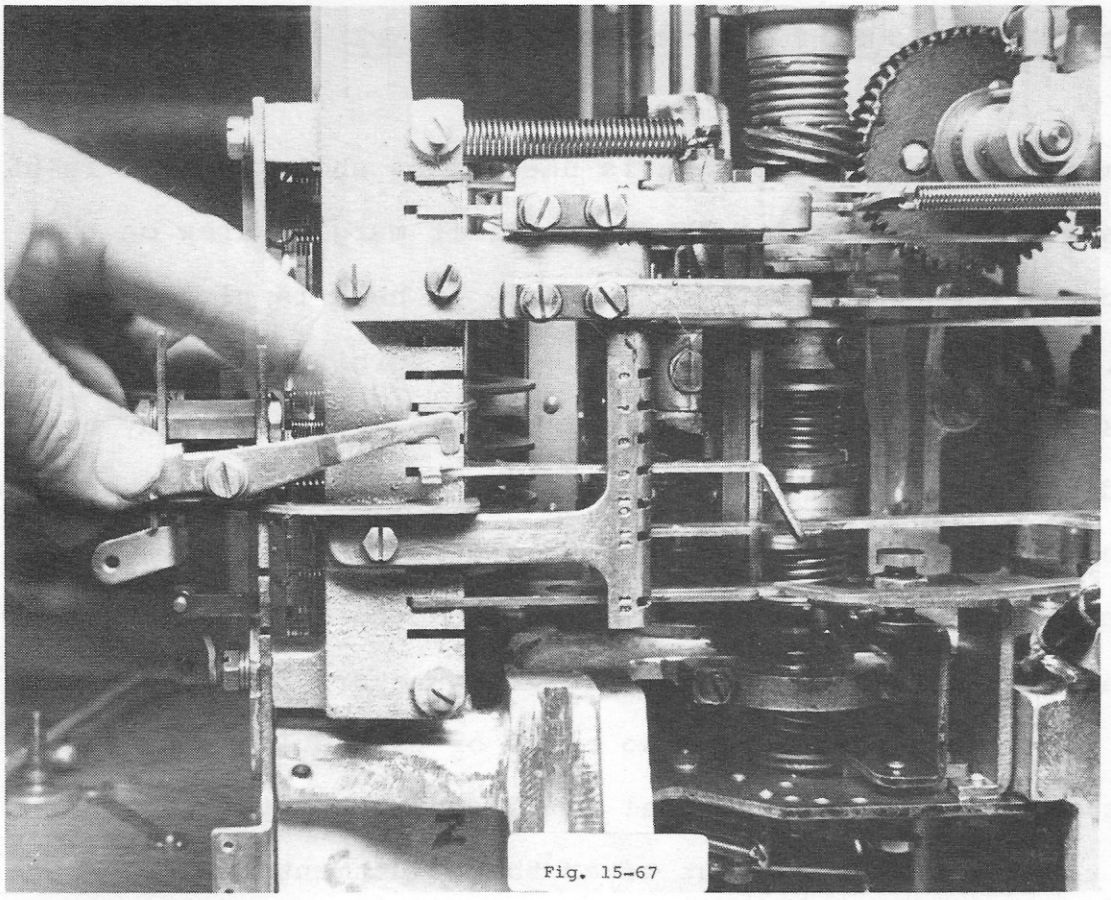


Fig. 15-67

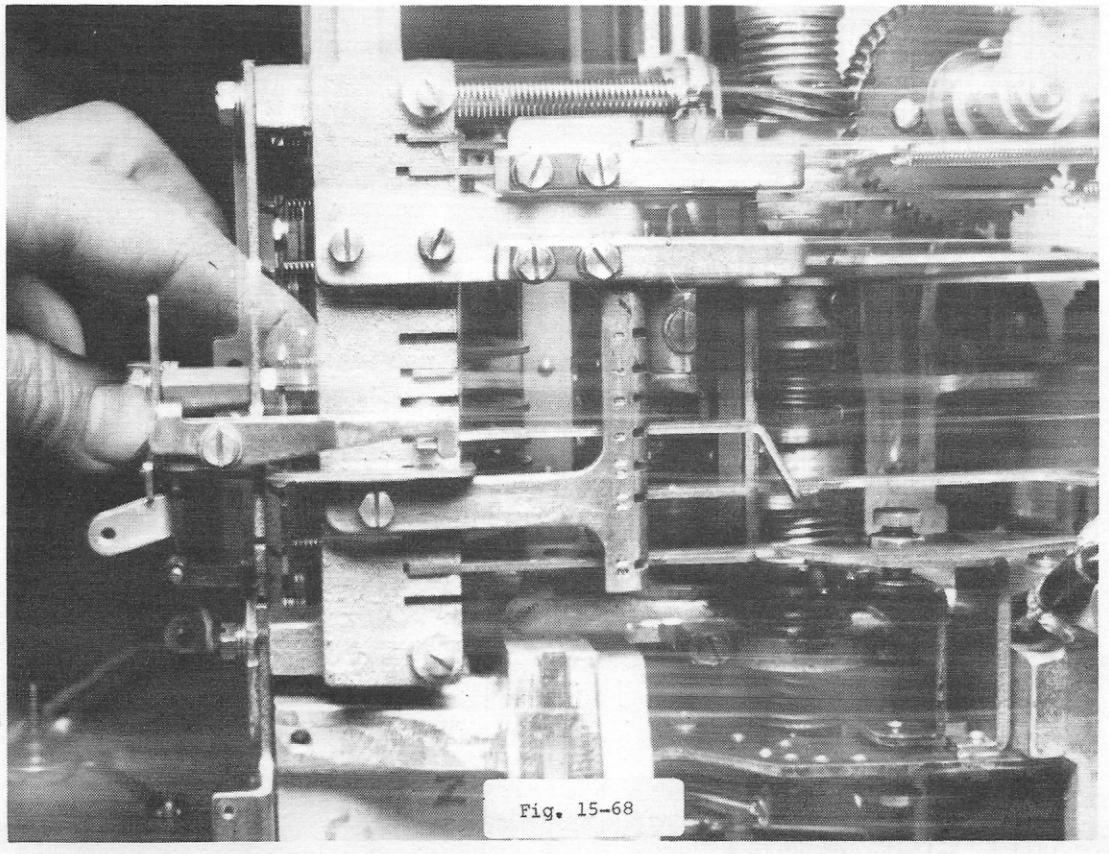


Fig. 15-68

## L. UNSHIFT-ON-SPACEBAR - MODEL 15 TELETYPE

Teletype machines can be arranged for unshift on spacebar operation. This means that typing in FIGS position will be unshifted down to LTRS on hitting the spacebar. This means that some operators depend on the spacebar to downshift their machines instead of using the LTRS key. This is inconvenient to TTY receivers not having this feature; that is, resulting printout at the other end is in numbers instead of words. This is an undesirable condition, leading to annoyance on the far end.

The machine can have its unshift on spacebar feature disabled. This is accomplished by moving a certain lever under the typing unit. In order to get at this lever, it is well to remove the typing unit in order to get at this lever. Fig. 15-67 shows the lever retracted, for unshift-on-spacebar feature. To take it out, merely push the lever into position to engage a pin, see Fig. 15-68. The lever has a screw which may require loosening and then tightening.

## M. WESTERN UNION MODEL 15-19 TELETYPEWRITERS

Nowadays, increasing numbers of Teletype Model 15 and 19 sets are coming out of Western Union sources. Many of them are "handovers" from Bell System, when the latter sold its Teletypewriter Exchange (TWX) network to Western Union some two years ago. Hence, such TWX equipment will be found to be quite standard, albeit some operate at 75 wpm, and others operate at 60. Virtually all such TWX machines have holding-magnet selectors, wired for 60 mA operation.

However, there exist other Model 15-19 types, as used in Telex service. A number of such units have been released and they have been found to be appreciably different in some characteristics from the Bell System machines. For instance, Telex, an European innovation, operates at 66 wpm, and, as a result, the Western Union Telex machines are geared for such speeds. Even the Telex Model 19 table is quite differently wired, as compared to the TWX Model 19.

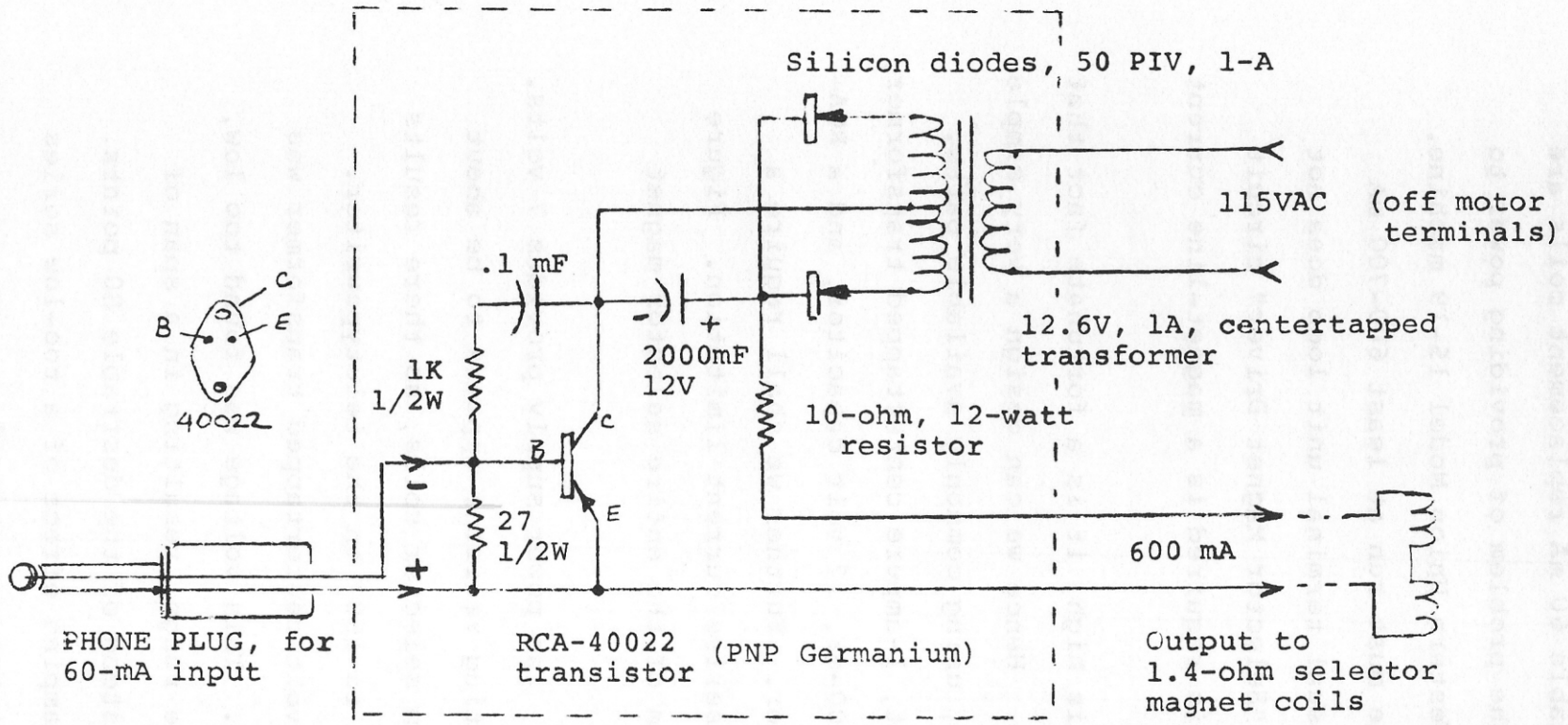
Further, the Telex machines use pulling-magnet selectors. There have been some 60 mA units; however there do exist certain units having "low resistance" selector magnets, requiring high current for operation. As an illustration, we can measure the DC resistance of a typical Bell System TWX pulling magnet selector; it is 200 ohms. For the Western Union Telex pulling magnet selector, it is 1.4 ohms! These coils are otherwise identical in dimensions; hence it is possible to swap coils to convert a Telex machine to 60 mA operation, if that should be necessary.

In the event that no suitable 60 mA replacement coils are available, we are faced with the problem of providing power to the 1.4 ohm coils in a given Western Union Model 15-19 machine. It has been determined that one must run at least 600-700 mA to operate those coils! The usual terminal unit loop does not provide such current; hence a "Selector Magnet Driver" circuit is needed. Essentially, what is required is a magnet-line current amplifier.

While the magnet current is high, it is a fortunate fact that the driving voltage can be low. Hence we can design a very simple selector-magnet driver circuit, using commonly available parts. All that is needed is a 12-volt, 1-ampere centertapped transformer, a pair of silicon diodes, a 2000-mF, 12 volt capacitor, and a RCA-40022 germanium power transistor. Further we shall require a 10-ohm, 12-watt resistor, for series current limitation. Figure 15-69 shows the circuit diagram of the entire selector magnet driver.

Delivering 600 mA on Mark, the power supply provides 7 volts. The 10-ohm series current-limiting resistor appears to be about right, working into the 1.4-ohm selector coils, so there results a full 80-point range (from 20 to 100) on the teletypewriter.

As a matter of fact, a 6-volt centertapped transformer was tried, resulting in 4 volts DC. This voltage was found too low, as it raised the low end of the range, resulting in a span of only about 60 or 65 points, instead of the desirable 80 points. This is a consequence of the damping effect of a too-low series resistance value on the teleprinter magnet coils.




NOTES: Phone plug input is polarized negative on tip with respect to ring positive. Since the circuit is left floating, polarity can be reversed if necessary.

Or, wire the input wires to the usual points (45 and 46) on the 15-19 base strip. Observe input polarity.

Mount these parts on a suitable board which can then be fastened on the rear surface of the Model 15-19 base. Power is obtained from off the motor terminals, under the base. Wire the magnet line wires direct to the selector magnet coils, to minimize lead resistance.

The transistor need not be heatsinked. Can design a printed circuit to hold all parts, or else mount on a piece of wood, using tie points as needed.

Fig. 15-69

SELECTOR MAGNET DRIVER FOR W-U 1.4-ohm SELECTORS

The 1K resistor and .1 mF capacitor form a spike limiting network, in order to protect the transistor insofar as inductive surges are concerned.

As far as the Telex machine is concerned, its gears will have to be changed in order to adapt it to 60-wpm operation. Use 74912 and 74913 gears, obtainable from Teletype Corp., or from any one of the numerous amateur RTTY sources.

PARTS LIST

| | | |
|---|---|---|
| 1- | Transformer, 12.6 VAC, 1 AMP (CALRAD) | $2.79 |
| 2- | Diodes, 100 PIV, 1 AMP (SARKES or IR) | 1.10 |
| 1- | 2000 mF, 12V Capacitor (SPRAGUE, etc) | 2.10 |
| 1- | Transistor, Type 40022 (RCA) | .75 |
| 1- | 10-ohm, 12-watt Resistor (OHMITE) | .74 |
| 1- | 1,000-ohm, 1/2 watt resistor | .10 |
| 1- | 27-ohm, 1/2-watt resistor | .10 |
| 1- | .1 mF, 100-V capacitor | .20 |

Prices given are approximate only; judicious shopping should result in much lower costs. All parts are common type; for instance the transistor could be any germanium power type, rated at about 10 watts, as used in automobile radios. Look at the blister packs as found in Radio Shack or similar electronic emporium.

## N. MISCELLANY - MODEL 15

This section will serve to round up some odds and ends lying around the M15 story. For instance, lubricants should be applied to various other unmarked parts on the machine; this will be left to the judgement of the serviceman. Apply a thin film of grease to the vanes, for instance; also a thin film to the rear track supporting the carriage. Also, some grease inside the two blades of the printing bail (Fig. 15-32).

### Adjusting the Typing Impressions on Paper...

Fig. 15-70 shows how one may vary the typing impression on paper, from light to heavy. On the right side of the typing unit, there is a screw, held by a lock nut. The latter nut is loosened first, then the screw is turned clockwise to get a heavier impression, counter-clockwise to get a lighter impression. In general, though, the impressions should not be too heavy, in interest of keeping platen rubber life as long as possible, not to mention wear on the typing pallets. You will very likely need a new ribbon or a re-inked ribbon if your printing becomes faint.

### New Window Glass for M15 Teletype Cover...

In the event that the window glass is cracked, a new piece can be obtained from various places handling Teletype parts. Or, a new piece can be ordered made at a local glass shop. Be sure to take the old window to the shop for an exact measurement. Specify SAFETY glass (laminated), 1/8-inch thick. Line the left and right

edges with black plastic tape, then trim it off with a razor blade after installation has been made.

Painting and Preparing the M15 Cover and Table...

You can paint the cover any color you like. A restful color is beige - a sort of light tan. Use enamel paint, obtainable anywhere. Be sure to wash the surfaces with naptha and wipe well, before applying paint. A rubber kneeling pad can serve to cushion the underside of the M15 base, to make the installation less noisy to nearby hearing people.

A Special Note on Gears...

When remounting the typing unit on the base of the M15, be sure to turn the motor fan wheel by hand back and forth just a tiny bit to make sure that the gears mesh. This includes not only the motor pinion and fiber gear but also the two other gears working into the keyboard. This will prevent damage to gears as the typing unit is being fastened down with the thumb screws.

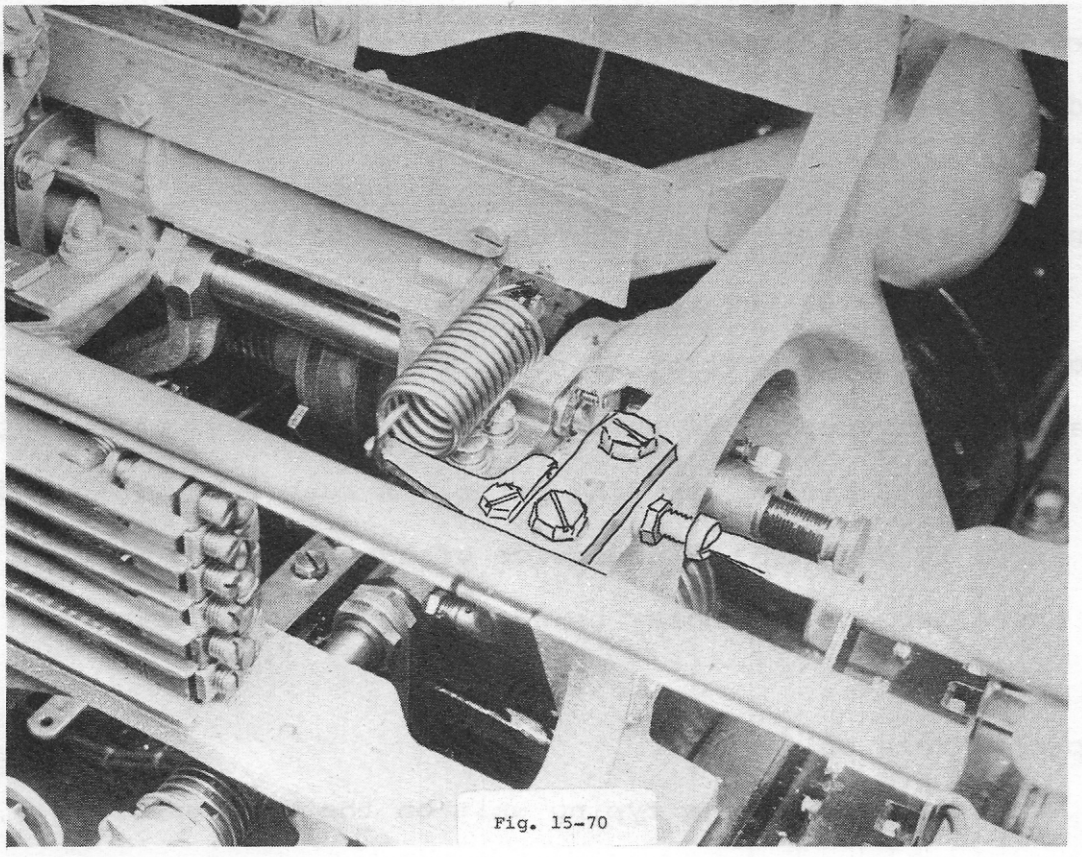


Fig. 15-70