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Total Resistance of Model 14

MODEL 14 INDEX

INTRODUCTION TO THE MODEL 19 COURSE

GENERAL

In introducing you to the Teletype Maintenance School C-1, you should know that this school is now operating its courses in package courses, affording the students with either an eight week course in the Model 14/15/19 course or an eight week course in the Model 28A/ASR. When a student is received for both courses, he first receives the Model 14/15/19 course and upon graduating from this course he immediately commences the Model 28A/ASR course the following Monday morning.

The Model 14/15/19 course is organized in three major phases of learning. (1) Orientation (2) Adjustments (3) Trouble Shooting.

The first two phases, the orientation and adjustments, are taught in steps which covers a major unit at a time, that is the orientation which teaches the nomenclature, theory of operation, both electrical and mechanical, and precautions necessary to prevent harm to the repairman and to the equipment. Then the student makes the required adjustments of the major unit where he is graded on his ability to properly adjust the unit. This sequence will be followed unit by unit until the entire machine has been taught and adjusted. When the two phases have been completed, then the student, using the same machine that he adjusted, will go into the third and final phase which is trouble shooting and completes the eight week course of instruction.

INTRODUCTION TO THE MODEL 19/15/14 COURSE

GENERAL:

The "package" courses now offered by the Teletype Maintenance School G-1 include an 8-week Model 19/15/14 course, an 8-week Model 28/ASR course and a 16-week combination of both courses. Students received for the combination course first complete the Model 19/15/14 course and following graduation commence the Model 28/ASR course the following Monday morning.

The Model 19/15/14 course is presented in three major phases of learning:

1. Orientation
2. Adjustments
3. Troubleshooting

The orientation consists of the the nomenclature, the theory of operation (mechanical and electrical),and the safety precautions necessary to prevent harm to the repairman or equipment. This is taught in steps covering one major unit at a time and the student is graded by weekly tests.

Upon completion of the orientation of a major unit the student makes the required adjustments on that major unit and is graded as to his ability to properly adjust that unit. The sequence of"orientation" and "adjust"is followed,unit by unit,until the entire machine is taught and adjusted. At that time the student, using the same machine he has adjusted, enters the Troubleshooting Phase. Here the student is required to demonstrate his knowledge of the machine by locating and repairing a minimum of 40, mechanical and electrical "troubles" introduced on the machine by the instructors. Grading for this phase is determined by the time required for the student to analyze the symptoms, locate the trouble and correctly identify the parts concerned.

In compiling this study guide, every effort has been made to follow, as closely as possible, the same order of subject matter taught in the classroom.

continued

DESCRIPTION OF MAJOR UNITS

GENERAL:

1. The Model 19 Teletype Set provide for the transmission and reception of typewritten messages over a direct wire circuit or a radio teletype (RATT) circuit. In this school we are, for teaching purposes, more concerned with direct wire circuits.

There are two main types of direct wire hook-ups:

A. SIMPLEX:

Two or more sets may be used on a single pair of wires, with any ONE of the machines sending at a time. The transmission is received by all printers in the circuit including the sender's page printer.

B. DUPLEX:

Two machines are used at each of two stations. With this type circuit both stations can transmit simultaneously. Normally, a Model 19 is used for transmitting equipment at each station with a Model 15 (RECEIVE ONLY) used for receiving. This type of circuit requires two pairs of wires.

The normal speed of the Navy Teletype circuits, using the Model 19 and 15 machines is 368 operations per minute (approximately 61 word per minute) although they are capable of 75 word per minute by changing the gear ratio of of the motor pinion and the mainshaft gear. Facilities are provided on the Model 19 for either direct keyboard or tape transmissions.

MAJOR UNITS OF THE MOD 19

1. BASE UNIT

A. The base unit is used for supporting the printer (typing) unit, motor unit, perforator transmitter unit, line relay base and to provide terminal connections for the various electrical circuits. A motor control relay is also mounted on the base for use with electrical motor stop.

2. PERFORATOR TRANSMITTER UNIT

The perforator transmitter is mounted in the base unit from the front and is fastened with two thumb screws. All electrical connections are made through slip connectors making removal of the unit convenient for maintenance personnel. The perforator transmitter operates in conjunction with associated units as follows:

A. Transmits directly from the keyboard transmitter contacts to the Line. (Keyboard)

B. Transmits directly from the keyboard transmitter contacts to the Line and simultaneously perforates a tape. (Keyboard and Tape)

C. Perforating a tape using the character counter without transmitting to the line (TAPE)

3. PRINTER UNIT

The page printer is the unit which includes the selecting and printing mechanisms for translating electrical code impulses into typewritten copy, and others that perform such functions as spacing, line feeding and carriage return. Printer units are identical in the Model 19 and Model 15 Teletype Sets.

4. TRANSMITTER DISTRIBUTOR UNIT

The transmitter distributor (TD) and its base is mounted on the table to the left of the printer unit. The TD is connected thru slip connectors to its base making it easy to remove for servicing. The TD is a motor driven device that translates the code, perforated in a tape, into electrical impulses, and transmits the impulses to receiving stations. The tape may be perforated by any of several models of teletype perforating or reperforating machines.

5. MOTOR UNIT

The Model 19 and 15 Teletypewriters are equipped with either of two types of motors.

A. SERIES GOVERNED MOTOR

The series-governed motor is equipped with the feature of being capable of operating on either AC or DC current. These motors have a governor wheel that gives the operator control of motor speed. For this reason the series governed motor is particularly desireable where line voltages are unstable.

B. SYNCHRONOUS MOTOR

The synchronous motor is an AC motor that will operate at its designed speed without being adjusted. This type of motor requires a steady line voltage.

6. TABLE (XRT-116)

The XRT-116 table is designed to handly the major units of the Mod 19 teletype equipment. It provides space on the table for the printer base unit and the TD unit. These units are connected to the table service assembly located across the rear of the table. At the lower right-hand corner in the rear of the table is a service assembly used to connect the reperforator into the system for producing tape from the circuit. On this service assembly there are also provisions made to wire in two external lines to a line switching key which enables the operator to switch to either of the external lines or to a local test position for servicing the machine without effecting the external circuits.

The table also provides a shelf for mounting a rectifier in the lower left rear of the table.

7. RECTIFIER (REC-30)

The Model REC-30 rectifier power unit is designed to provide filtered DC current suitable for the operation of teletype signal circuits and to provide the proper AC voltage for the operation of series governed motors when connected to AC sources of various voltages and frequencies. The input requirements and the output ratings are as follows:

INPUT: 95, 105, 115, 125, 210, 230 and 250 volts.
25, 40, 50 and 60 cycles, single-phase AC.

OUTPUT: 0.9 Amperes at 120 VDC. (No-load voltage not to exceed 130 V)
AC at suitable voltage for the operation of 3 series-governed motors at frequencies of 25, 40, 50 or 60 cycles.

The REC-30 power unit is designed for use in tropical climates and is furnished complete with cover, terminal panels, cords and plugs for both AC and DC input and output connections.

PROPER METHODS OF DISASSEMBLING, REASSEMBLING AND PRECAUTIONS TO BE TAKEN BY REPAIRMAN OF THE MODEL 19 TELETYPE EQUIPMENT .

1. In removing the cover unit from the Mod 19 care should be taken not to mutilate the SEND-RECEIVE-BREAK contacts. After removing the platen crank, using both hands, lift the cover straight up until it clears the printer. When replacing the cover, align the guide rails with the guide screws and carefully let it straight down.

2. TYPING UNIT:

To remove the typing unit, face the front of the unit, with the right hand grasp the flat projection on the upper portion of the right side frame. Place the left thumb over the left end of the front carriage track and the left index finger should grip the left-hand casting of the same frame. Place the three remaining fingers of the left hand under the extreme lower front corner of the casting. Lift and move carefully avoiding any undue stress that might disturb adjustments.

When replacing the typing unit on the base, hold the unit so that when the left side is resting on the base the main shaft gear will be just ready to mesh with the motor pinion gear. Make certain the typing unit is properly seated on the locating studs of the base.

The typing unit is held to the base unit by three thumb-screws. ALWAYS SECURE THE THUMB-SCREWS WHEN OPERATING THE TYPING UNIT UNDER POWER. When working on the typing unit it should be placed in one of three positions:

a. In an upright position.
b. On its back, giving access to the lower mechanism.
c. On its right side when working on the selector unit.

Any position other than the three mentioned above is apt to cause SEVERE DAMAGE TO THE MACHINE.

continued

REMOVAL OF THE TYPEBAR CARRIAGE FROM THE PRINTER UNIT

With the typing unit resting on its base (or in its up-right position on the work bench) operate the carriage return lock bar and move the carriage to the extreme right. Operate the dashpot lever, locking the carriage in this position. Holding the carriage return spring drum so the spring cannot unwind, unhook the draw strap from the carriage and hook the eyelet of the draw strap on the margin bell hammer spring post. Move the right margin adjusting screw to the rear. Operate the carriage return lock bar again and remove the carriage by sliding it off to the right.

REPLACING THE TYPEBAR CARRIAGE ON THE TYPING UNIT

Shift the platen to FIGURES position and rotate the main shaft until the printing bail is in the rear position. Then move the right margin adjusting screw arm on the carriage to the rear so it is approximately 45 degrees from vertical. Hold the carriage in the right hand and rest the front carriage support roller on the right end of the front carriage track making sure the carriage guide screw engages the slot in the carriage track. Move the carriage slowly to the left until the rear carriage support roller rests on the upper track. Operate the carriage return lock bar and move the pull bar bail to its rearmost position by pushing the right pull bar bail roller with the right thumb. Move the carriage farther to the left, making sure the bell cranks engage their respective vanes and the right front carriage support roller and guide screw properly engage the front carriage track and also that the pull bar bail plunger roller is between the printing bail blades.

continued

When the carriage has been moved far enough to the left to permit the right margin adjusting screw to clear the spacing stop lever, restore the right margin adjusting screw arm to its normal vertical position, then shift the carriage to its extreme right position and lock it into place by operating the dashpot lever. Again holding the carriage return spring drum so the spring cannot unwind, unhook the draw strap eyelet from the margin bell hammer post and hook it over its mounting post on the carriage. Operate the carriage return lock bar to permit the carriage to return to its extreme left position.

3. PERFORATOR TRANSMITTER UNIT

The perforator transmitter is mounted on two slide rails in the base unit. Plates mounted on the right and left sides of the perforator go under the rails. The perforator unit is held in place by two thumb screws.

To remove, loosen the thumb screws and slide the perforator transmitter from the base unit.

To replace, slide the unit in place slowly rotating the motor fly wheel back and forth to mesh the transmitter unit gear properly with the gear on the typing unit. Then tighten the thumb screws.

CAUTION: When mounting the transmitter unit to the base unit, be very careful not to jam the fiber gear on the transmitter unit against the steel gear on the main shaft of the typing unit.

4. TRANSMITTER DISTRIBUTOR UNIT (TD)

When removing the TD from the Model 19 table and preparing the unit for servicing, lift the front end of the TD enough to clear the Stop Post attached at the front of the slide rails and pull forward until the TD clears the Slip Connectors. Then the TD can be lifted off the base and placed on any flat surface work bench. For servicing remove the following parts: Distributor Cover, Tape Transmitter Snap Panel and the TD Base Plate.

CAUTION: DO NOT rotate the Distributor Shaft in a COUNTERCLOCKWISE direction as viewed from above as this will mutilate the Distributor Brushes. A precaution that can be taken to avoid damage to the brushes is to loosen the brush holder clamp screw and turn the brush holder until the brushes are lifted from the commutator .

5. RECTIFIER (REC-30)

The REC-30 is the recommended rectifier for use with the Model 19 Teletype Set and is located on the rear shelf of the table. All connections are made to the table service assembly by means of plugs and sockets.

CAUTION: ALWAYS THROW THE TOGGLE SWITCH TO THE OFF POSITION BEFORE OPENING THE HINGED DOOR OF THE RECTIFIER COVER. THE POTENTIAL ON THE SECONDARY OF THE TRANSFORMER IS 440 VOLTS. DO NOT MAKE ADJUSTMENTS OR CHANGE TUBES WHILE THE UNIT IS UNDER POWER.

6. LUBRICATION:

The machine is ready for lubrication after being thoroughly cleaned and the cleaning fluid has been removed from the parts. For specific points of lubrication refer to the Teletype Corp. Bulletins on adjustments and the Teletype Corp. Specifications S-5288 on lubrication. The following general instructions are extracts from these bulletins.

continued

6. LUBRICATION (CONTINUED)

Apply just the amount of lubricant sufficient for each purpose. The wiping off of excess oil or grease tends to work dirt and grit into bearing surfaces.

The Teletype Corp. specifies the use of KS 7470 oil and KS 7471 grease in lubrication procedures. These materials are generally available at teletype repair facilities but lack of these should in no way interfere with routine maintenance. Any good grade of medium cup grease and good quality SAE-10 non-paraffin base automobile crankcase oil are satisfactory substitutes. Typewriter and "3-in-1" oils do not have sufficient body for teletype requirements and should not be used.

The Teletype Corp. Instructions show three types of lubrications, oil, grease, and oil-grease-oil. The term oil-grease-oil simply means to apply oil, then grease, then oil, in that order, to a specified location or part.

The most convenient oil can to use is one having a curved three-inch spout. Grease can be applied with a toothpick, screwdriver blade or a similar instrument.

Lubricate small parts with a single drop of oil. Two or three drops are sufficient at any point. Oil cups should be filled without overflowing. One stroke of grease gun plunger should supply sufficient grease for any point. New felt washers and wicks should be saturated in oil then squeezed by hand to remove excess oil.

After lubrication the Selector Magnet Armature, the Selector Magnet Cores and the Armature front and back Stops should be cleaned by drawing a good grade of bond paper between the adjacent surface as they are held together.

DEFINITIONS OF BASIC ELECTRICAL TERMS

CURRENT - A movement of electrons thru a conductor from a NEGATIVE to a more POSITIVE source.

(a.) Current is measured in units that express the quantity of electrons that pass a given point in one second.
(b.) Six and one-third billion billions (6.24×10^{12}) of electrons make one COULOMB.
(c.) When one Coulomb of current passes a given point in one second we can say we have one AMPERE of current flowing.
(d.) The unit of current flow is the AMPERE, commonly referred to as the "AMP" and is written as "A" (i.e. 20A) and appears in formula as "I".

VOLTAGE - The force or pressure that makes current flow -ELECTROMOTIVE FORCE.

(a.) Also termed POTENTIAL DIFFERENCE (Voltage, Electromotive Force, EMF, Potential Difference all have the same meaning)
(b.) Unless you have unequal electrical pressure between two points there is no POTENTIAL DIFFERENCE or VOLTAGE between the two points.
(c.) You can not correctly say that one point in a circuit has so many VOLTS. If there is a potential difference it should be described as so much voltage at that point in respect to another point or ground.
(d.) The unit of EMF or pressure is the VOLT abbreviated as "V" and appearing in electrical formulas as "E".

CONDUCTOR - Any material that allows current to flow. The ability of a material to conduct current varies as to its composition. Copper, silver, gold are excellent conductors, while glass, wood, rubber etc are poor conductors.

RESISTANCE - is the opposition to current flow. Resistance is measured in OHMS, abbreviated and used in formulas as "R" and written as Ω (omega sign) (i.e. 30Ω).

INSULATOR - A material having a very high resistance to current flow. (Glass, porcelain, bakelite etc). There is no perfect insulator as a high enough voltage can break down any insulator known.

NOTES:

6. COMPLETE CIRCUIT

A complete path for current to flow, starting from a Negative (source) through the load and back to a Positive potential (source).

7. OPEN CIRCUIT

An open or a break in the circuit so that there is no longer a complete path for current to flow from source through the load and back to source.

8. SHORT CIRCUIT

A short cut for the current to flow through, bypassing part or all of the load, often burning out fuses, resistors, etc.

There are unintentional shorts, usually causing damage to equipment. There are also intentional shorts which we use in teletype equipment to disable certain circuits or positions of circuits.

9. SERIES CIRCUIT

A circuit with only one path for current flow, from the source through the load and back to the source. A break in any portion of a series circuit stops all current flow.

10. PARALLEL CIRCUIT

A circuit with two or more paths for current flow, from the source, through the load, and back to the source. A break in one of the paths will diable that load only and the current will continue flowing through the paths that remain intact.

11. ELECTRO-MAGNET

An electro-magnet is constructed by wrapping turns of wire around a soft iron core and passing current through the wire. The iron core will remain magnetized as long as current is flowing through the wire. When the current is stopped the iron core demagnetizes.

NOTES:

SUBJECT: BASIC ELECTRICITY & OHM'S LAW

Ohm's law explains the relationship of VOLTAGE, CURRENT and RESISTANCE in any electrical circuit. It provides mathematical formulas that help solve electrical problems. If any TWO of the electrical quantities of VOLTAGE, CURRENT or RESISTANCE are known, the THIRD or UNKNOWN quantity can be easily determined.

To understand the electrical circuits of the Model 19 Teletype, a repairman must be familiar with the way current will flow in a circuit, and with the amount of current that will flow.

A repairman must know how to check electrical circuits with a "MULTIMETER' (which is an electrical measuring instrument that can be set up to measure CURRENT FLOW, VOLTAGE or RESISTANCE). To use a multimeter, you must be able to determine or estimate how MUCH current, voltage or resistance you should have in any part of a circuit. When you apply the meter to the circuit, it will either give you a reading that is correct and what you estimated it to be (indicating that nothing is apparently wrong in that part of the circuit) or it will give you a precise clue as to exactly what is wrong with the circuit, whether it is a short, open or an excessively high or low voltage, current or resistance.

With this knowledge, a repairman can quickly locate electrical troubles, and effect rapid and intelligent repairs to any electrical circuit.

Ohm's law will be considered as it applies to circuit in the following sequence:

1. Rules that apply to ANY electrical circuit.
2. Rules that apply to SERIES circuits only.
3. Rules that apply to PARALLEL circuits only
4. Rules that apply to SERIES-PARALLEL circuits.

RULES THAT APPLY TO ANY ELECTRICAL CIRCUIT

1. In any electrical circuit, the CURRENT is DIRECTLY PROPORTIONAL TO THE VOLTAGE.
   This means: If the voltage is increased, the amount of current that flows will increase.
   If the voltage is decreased, the amount of current flows will decrease.

2. In any electrical circuit, the CURRENT is INVERSELY PROPORTIONAL TO THE RESISTANCE.
   This means: If the resistance is increased, the amount of current that flows will decrease.
   If the resistance is decreased, the amount of current that flows will increase.

SUBJECT: RULES THAT APPLY TO ANY ELECTRICAL CIRCUIT (CONT'D)

3. The voltage of a circuit is determined by the source.
   This means: A change in the RESISTANCE or CURRENT will have no effect on the voltage being supplied to the circuit. The source of voltage in a circuit, whether it is a battery, generator, or a rectifier continues to supply the voltage for which it is designed. To change this voltage, you must actually replace the generator or battery with one of a higher or lower output.

4. The resistance of a circuit is determined by it's own make-up.
   This means: Changing the voltage or the current will have no effect on the resistance of a circuit. The resistance value of a "resistor" or other electrical device is "built-in" when it was manufactured, and will not change.

APPLICATION OF THE RULES:

The first two rules explained the relationship of current, voltage and resistance. The rules can be expressed mathematically by the following formula:

$$\frac{\text{VOLTAGE}}{\text{RESISTANCE}} = \text{CURRENT}$$

Read: CURRENT IS EQUAL TO THE VOLTAGE DIVIDED BY THE RESISTANCE.

In actual practice, symbols are used in ohm's law formula instead of the full name of the electrical quantity. The symbol "I" is used for CURRENT. The symbol "E" is used for VOLTAGE. The symbol "R" is used for RESISTANCE.

$$\frac{E}{R} = I$$

Read: I equals E over R, but it still means; the current equals the voltage divided by the resistance.

If we know the voltage and the resistance of a circuit, this formula shows us how to find out how much current will flow.

Example: A circuit is being supplied with 120 volts and has a resistance of 60 ohms. How much current will flow in the circuit?

Solution:
1. Write the formula.
2. Substitute the numerical value of the voltage for "E", and the numerical value of the resistance for "R".
3. Solve the formula.

Step 1. $I = \frac{E}{R}$ Step 2. $I = \frac{120}{60}$ Step 3. $I = 2$

Answer: 2 amperes of current will flow in the circuit.

SUBJECT: RULES THAT APPLY TO ANY ELECTRICAL CIRCUIT (CONT'D)

Remembering the formula will be easy, if you learn to use Ohm's "pie".

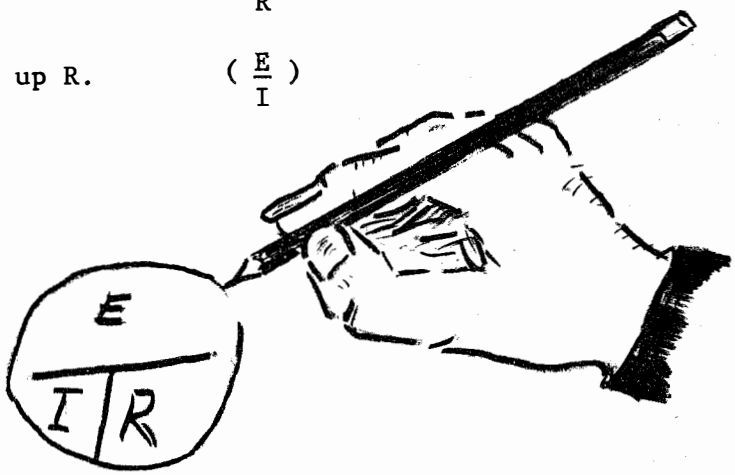
Use your finger to cover up the quantity that you are trying to find.

To find the voltage formula, cover up E. (I X R)

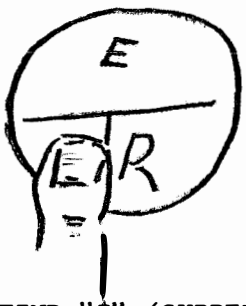
To find the current formula, cover up I. $\left(\frac{E}{R}\right)$

To find the resistance, cover up R. $\left(\frac{E}{I}\right)$

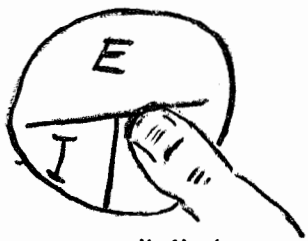
First Draw Your "PIE"
Placing the E, I & R
as shown.....



TO FIND "E" (VOLTAGE)
COVER THE "E".....



TO FIND "I" (CURRENT)
COVER THE "I"



TO FIND "R" (RESISTANCE)
COVER THE "R"

SUBJECT: RULES THAT APPLY TO ANY ELECTRICAL CIRCUIT (CONT'D)

Using the same basic formula, $I = \frac{E}{R}$, mathematicians, by using a process called "SOLVING FOR E" have provided us with two more very useful formulas:

$E = I \times R$

Read: E equals I times R, or voltage equals current times resistance.

If we know how much current is flowing in a circuit and how much resistance the circuit has, this formula shows us how to find the VOLTAGE.

EXAMPLE: A circuit is known to have 100 ohms resistance and an ammeter shows that 2 amps of current is flowing. How much voltage is the source applying?

SOLUTION:
1. Write out the formula $E = I \times R$
2. Substitute the numerical values for "I" and "R" in the formula $E = 2 \times 100$
3. Solve the formula $E = 200$

ANSWER: 200 volts of pressure is being applied by the source.

$R = \frac{E}{I}$

Read: R equals E divided by I or resistance equals voltage divided by current.

If we know how much voltage is being supplied to a circuit, and how much current is flowing in the circuit, this formula shows us how to find the TOTAL RESISTANCE of the circuit.

EXAMPLE: A circuit is powered by a 12 volt battery. An ammeter indicates 3 amps of current. How much resistance does the circuit have?

SOLUTION:
1. Write out the formula $R = \frac{E}{I}$
2. Substitute the numerical values for I and E in the formula $R = 12$ divided by 3
3. Solve the formula $R = 4$

ANSWER: The circuit has 4 ohms of resistance in it.

NOTES:

SUBJECT: RULES THAT APPLY TO THE SERIES CIRCUITS

A Series Circuit is one that offers only one path for the current to flow, from the source, through the load and back to the source. When working ohm's law problems in series circuits the following rules apply:

1. Current is the same in all parts of a series circuit. If you measure the current flow in a series circuit with an ammeter, no matter what part of the circuit you apply the meter to, it will read the same.

2. The total resistance of a series circuit, is the SUM of the individual resistances. To determine the total resistance of a series circuit, add the value of each resistance.

3. The total voltage of a series circuit, is the SUM of the individual voltage drops.

Each resistance of a circuit will "use up" some of the voltage being supplied by the source. The amount used up by each resistance is called the "voltage drop" of that resistance, or the "IR" drop. The rule implies that the total voltage being supplied by the source, must be used up in the circuit. The "total voltage drop" of a circuit must be equal to the source.

When solving for the values of any individual part of an ohms law problem for any type circuit, always use the values for the specific part of the circuit in which you are working.

APPLICATION OF THE RULES

EXAMPLE: An ammeter inserted in the signal line circuit of a teletype loop reads 60 MA. How much current will flow through the line relay at each station on the line, if the loop consists of two stations?

SOLUTION: Use rule #1 for series circuits. If 60MA is flowing in in any part of the teletype loop, the same current flows in all parts.

ANSWER: 60 MA will flow through all line relays in the loop.

NOTES

SUBJECT: RULES THAT APPLY TO THE SERIES CIRCUITS (CONT'D)

EXAMPLE: What is the total resistance of a teletype loop which consists of the following resistances. Two sets of selector magnets, each having a resistance of 210 ohms and one current resistor of 1580 ohms?

SOLUTION: Use rule #2 for a series circuit. The formula is:

$$R_t = R_1 + R_2 + R_3$$

1. Write out the above formula
2. Substitute the numerical values $R_t = 21 + 210 + 15 0$
3. Solve the formula $R_t = 200$

ANSWER: The circuit has a total of 2000 ohms resistance.

EXAMPLE: What is the voltage drop of selector magnet having 210 ohms resistance, and .0 0 Amps of current flowing?

SOLUTION: Use rule #3 for a series circuit
1. Write out the formula $E = I \times R$
2. Substitute numerical values $E = .0 \times 210$
3. Solve the formula $E = 12.6$

ANSWER: The voltage drop of the selector magnet is 12.6 volts.

EXAMPLE: What is the output voltage of a rectifier that is forcing 60 MA thru a teletype loop having a total resistance of 2000 ohms?

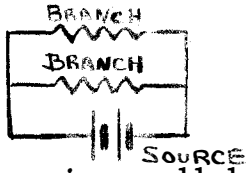
SOLUTION: Use the formula for finding voltages
1. Write out the formula $E = I \times R$
2. Substitute numerical values $E = .060 \times 20$
3. Solve the formula $E = 12$

ANSWER: The output voltage of the rectifier is 120 volts.

NOTES:

SUBJECT: RULES THAT APPLY TO PARALLEL CIRCUITS

A Parallel Circuit, is one that offers more than one path for the current to flow. A group of resistors in parallel is called a "Parallel Network" and each resistance is called a "Branch" of the parallel network. A simple parallel circuit is shown below.



When working ohms law problems in parallel circuits, the following rules apply:

1. The "total current" in a parallel network, is the sum of the individual currents in each branch. This means: If a current of 10 Amps were flowing out of a source in the diagram above, when it reaches the parallel network, the current divides and part of it will flow through each branch. If you add together the current flowing through each branch, you will come up with the total current. The formula for total current is $I_t = I_1 + I_2 + I_3$ etc.

2. The voltage is the same across all branches of a parallel network. This means: In the diagram above, the source voltage is impressed equally across the resistance of both branches. In any circuit, a parallel network will drop a certain amount of the source voltage, however, each branch will also drop this same voltage. In effect, the source voltage in the diagram will be dropped twice, once across each branch, but this is the same voltage that is dropped by the entire parallel network. Mathematically the rule reads, $E_t = E_1 + E_2 + E_3$ etc.

3. In a parallel network, the reciprocal of the total resistance is equal to the sum of the reciprocals of the individual resistances. This means: The total resistance of a parallel network is less than the resistance of the smallest branch. The reciprocal of any number is "1" divided by that number, for example, the reciprocal of 10 is 1 divided by 10, or, $\frac{1}{10}$

The formula for the total resistance is: $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$ etc...

The formula is read: 1 over R_t equals 1 over R_1 plus 1 over R_2 plus 1 over R_3 plus 1 over R_4 etc.....

In cases where the branch resistances are equal in a parallel network, the total resistance of the network is arrived at by dividing one of the resistances by the total number of branches.

NOTES:

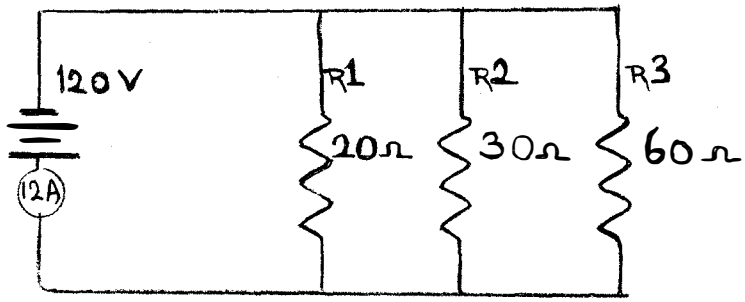
SUBJECT: RULES THAT APPLY TO PARALLEL CIRCUITS (CONT'D)

APPLICATION OF RULES FOR PARALLEL CIRCUITS.

In solving parallel circuit problems you will normally:
1. Find the total resistance of the parallel network.
2. Substitute this total resistance as a single series resistance in the circuit, in place of the parallel network.
3. Solve the problem as if it were a simple series ohm's law example.
4. You need not attempt to solve the problem in the order shown below.
5. Remember, when solving for an individual value for a specific part of a circuit, use only the values for that specific part of the circuit.

Determine the following values for the circuit shown:

Et_____
It_____
Rt_____
E1_____
E2_____
E3_____
I1_____
I2_____
I3_____



SOLUTION:

1. The total voltage must be equal to the source voltage. The parallel network will drop all of the source voltage, since it is the only resistance of the circuit. Therefore Et = 120 volts.

2. To find Rt use the reciprocal formula. You know the total resistance will be less than the smallest resistance, or less than 20 ohms.
   a. Write out the parallel resistance formula.
   b. Substitute the known values for the symbols in the formula.
   c. Solve the formula.

Step a. $\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$

Note: In order to perform the addition, find the least common denominator, (60 in this case) and change the fractions to common fractions.

Step b. $\frac{1}{Rt} = \frac{1}{20} + \frac{1}{30} + \frac{1}{60}$

Step c. $\frac{1}{Rt} = \frac{3}{60} + \frac{2}{60} + \frac{1}{60}$ or $\frac{1}{Rt} = \frac{6}{60}$

Both of the expressions $\frac{1}{Rt}$ & $\frac{6}{60}$ are reciprocals. To find the actual value instead of the reciprocal, simply invert the expression

$\frac{Rt}{1} = \frac{60}{6}$ or Rt = 10 ohms

SUBJECT: RULES THAT APPLY TO PARALLEL CIRCUITS (CONT'D)

APPLICATION OF RULES FOR PARALLEL CIRCUITS (CONT'D)

3. To find current, use the formula $I = \frac{E}{R}$ or $I = \frac{120}{10}$ or $I = 12$ amps. After we found the total resistance of the circuit we treated the problem exactly like a series problem. If necessary, redraw the circuit with one 10 ohm resistor in place of the parallel network.

4. To find the voltage across R1, simply apply the rule "voltage is the same across all branches of a parallel network". Each branch drops the same voltage as the whole network, which in this case drops the whole source voltage, 120 volts. Therefore E1 = 120 Volts.

5. Same as above E2 = 120 volts

6. Same as above E3 = 120 volts

7. To find the current through R1, we know the resistance of R1 and we know the voltage across R1. To find I1 use the formula $I1 = \frac{E1}{R1}$ or $I1 = \frac{120}{20}$ or I1 = 6 amps. Note: We use specific values for R1 exclusively.

8. To find I2, we use the same procedure as step 7:
$\frac{E2}{R2} = I2$ or $I2 = \frac{120}{30}$ or I2 = 4 amps.

9. To find I3, use the same procedure as for steps 7 and 8:
$I3 = \frac{E3}{R3}$ or $I3 = \frac{120}{60}$ or I3 = 2 amps.

Note: In step 3 we found that the total current was 12 amps flowing out of the source, and in steps 7, 8, and 9 we found I1 was 6 amps, I2 was 4 amps, and I3 was 2 amps giving a total (It) of 12 amps.

NOTES:

SUBJECT: SOLVING SERIES PARALLEL PROBLEMS

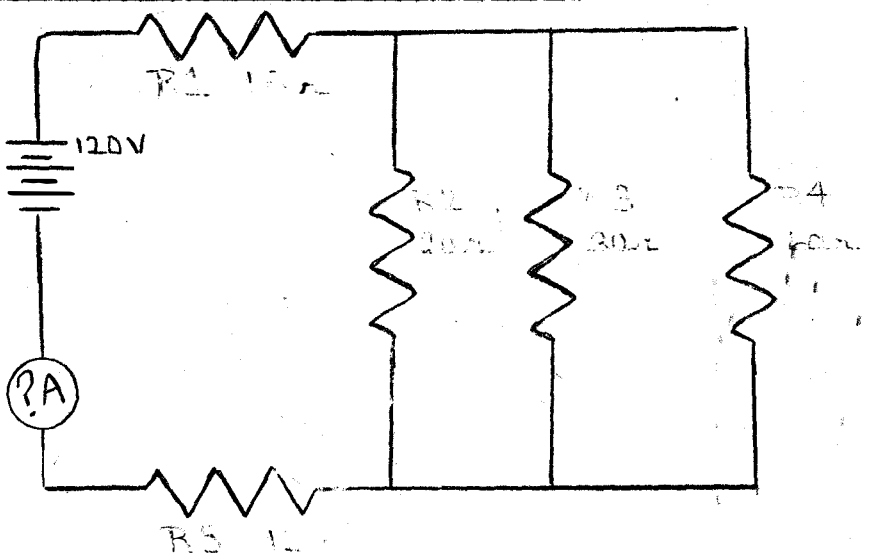
In this type of circuit, there are one or more resistors in series with a parallel network. All of the current in the line will go through the series resistors and divide in the parallel network.

In solving this type of circuit problem, no new rules of ohms law are required. The rules you already know will have to be applied in the appropriate place. Basically, it is only required that you solve the problem in a logical procedure:

1. Start with the parallel network.
2. Solve the total resistance of the network.
3. Substitute the single value arrived at for the value of the parallel network. Redraw the circuit as a series circuit.
4. Add the resistances as in a series circuit to find Rt.
5. Apply ohms law to solve the rest of the problem using:
   a. ohms law for series circuit for Et and It and Rt
   b. ohms law for parallel circuits branch voltage drops and currents.

APPLICATION OF SOLVING SERIES PARALLEL PROBLEMS

1. Et_____
2. Rt_____
3. It_____
4. E1_____
5. E2_____
6. E3_____
7. E4_____
8. E5_____
9. I1_____
10. I2_____
11. I3_____
12. I4_____
13. I5_____



SOLUTION:

1. The total voltage must be equal to the source voltage.
2. Solve for total resistance. First find the value of the parallel network.
   a. Write out the formula. $\frac{1}{Rt} = \frac{1}{R2} + \frac{1}{R3} + \frac{1}{R4}$
   b. Substitute numerical values $\frac{1}{Rt} = \frac{1}{20} + \frac{1}{30} + \frac{1}{60}$
   c. Find lowest common denominator. $\frac{1}{Rt} = \frac{3}{60} + \frac{2}{60} + \frac{1}{60}$
   d. $\frac{1}{Rt} = \frac{6}{60}$ inverted, $\frac{Rt}{1} = \frac{60}{6}$ or 10 ohms
   e. Total resistance for parallel network is 10 ohms

SUBJECT: SOLVING SERIES PARALLEL PROBLEMS (CONT'D)

APPLICATION OF SOLVING SERIES PARALLEL PROBLEMS (CONT'D)

Substitute this 10 ohms of resistance for the entire network, and you have a series circuit containing R1 of 18 ohms, the network resistance of 10 ohms and R5 of 12 ohms. The RT for the entire circuit is 40 ohms.

3. The total current is equal to the total voltage divided by the total resistance. $It = \frac{Et}{Rt}$ or $It = \frac{120}{40}$ or 3 amperes

4. Voltage drop of R1 is equal to the current through R1 times the resistance of R1. E1 = I1 X R1 or E1 = 3 X 18 or 54V

5. To find the voltage drop of R2, you know the resistance of the parallel network of which R2 is a part, is 10 ohms. Also 3 amperes of current will flow through this 10 ohms of resistance. E = I X R or E = 3 X 10 or E1 = 30 Volts Note: The voltage drop across a parallel network is also dropped across each branch of the network, therefore, since 30 Volts is dropped across the network, 30 Volts will be the IR drop of R1, R2 and R3.

6. E3...see 5 above

7. E4...see 5 above

8. Voltage drop of R5 is equal to the current through R5 times the resistance of R5. E5 = I5 X R5 or E5 = It X R5 or E5 = 3 X 12 or 36V.
Note: To check your IR drops to see if you have solved the problem correctly, add the IR drops together and they should equal the source voltage. 54 + 30 + 36 = 120

9. The total current of the circuit goes thru R1 and R5 so therefore, I1 = It or 3 amps and also I5 = It or 3 amps.

10. The current through R2 is equal to the voltage across R2 divided by the resistance of R2. $I2 = \frac{30}{20}$ or 1.5 amps.

11. See 10 above for solving for I3. $I3 = \frac{30}{30}$ or 1 amp.

12. See 10 above for solving for I4. $I4 = \frac{30}{60}$ or .5 amp.

Note: To check the current through a parallel network, add the current flow through each branch; 1.5 + 1 + .5 = 3 amps.

13. See 3 above for solving for I5.

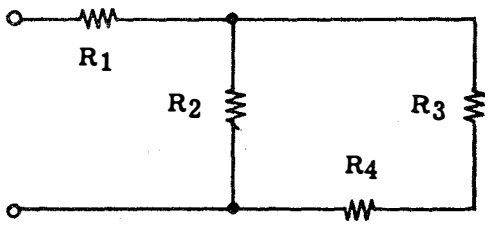
NOTES:

DIRECT CURRENT SERIES-PARALLEL CIRCUITS

Resistances in Series-Parallel

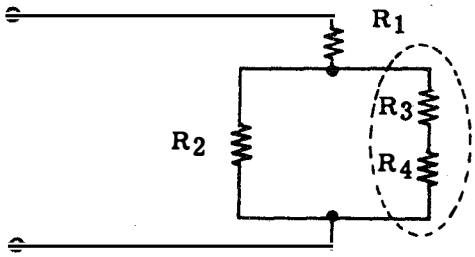
This is how you break down complex circuits to find the total resistances—

Suppose your circuit consists of four resistors—R_1, R_2, R_3 and R_4—connected as shown, and you want to find the total resistance of the circuit.



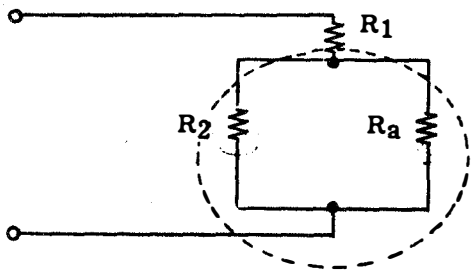
First, the circuit is redrawn and the series branch resistors R_3 and R_4 are combined by addition as an equivalent resistance R_a.

$$R_a = R_3 + R_4$$



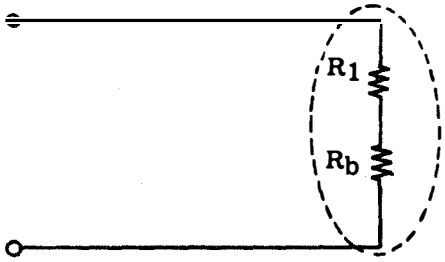
Next, the parallel combination of R_2 and R_a is combined (using the parallel resistance formula) as an equivalent resistance, R_b.

$$R_b = \frac{R_2 \times R_a}{R_2 + R_a}$$



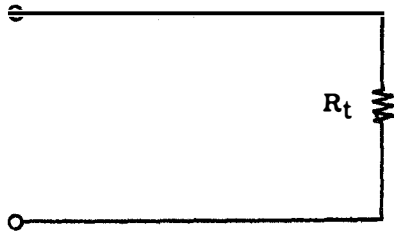
The series resistor R_1 is added to the equivalent resistance—R_b—of the parallel combination to find the total circuit resistance, R_t.

$$R_t = R_1 + R_b$$



R_t = total resistance of series-parallel circuit.

R_t = Total Resistance

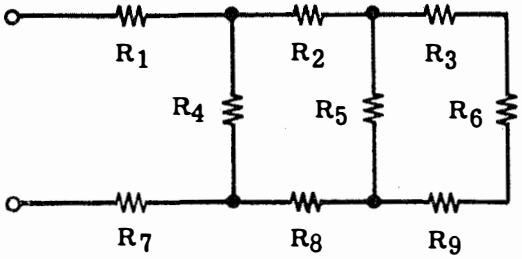


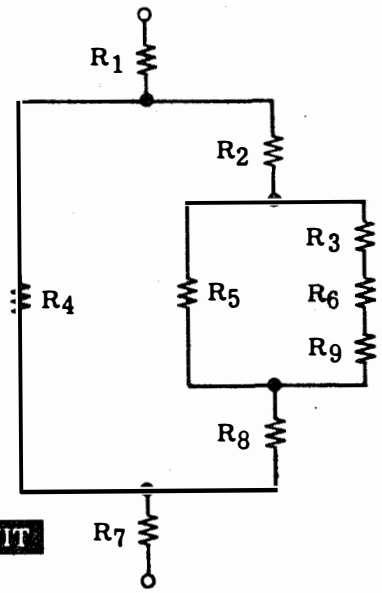
Resistances in Series-Parallel

More complicated circuits only require more steps, not any additional formulas. For example, the total resistance of a circuit consisting of nine resistors may be found as shown—

1. Redraw the circuit.

ORIGINAL CIRCUIT

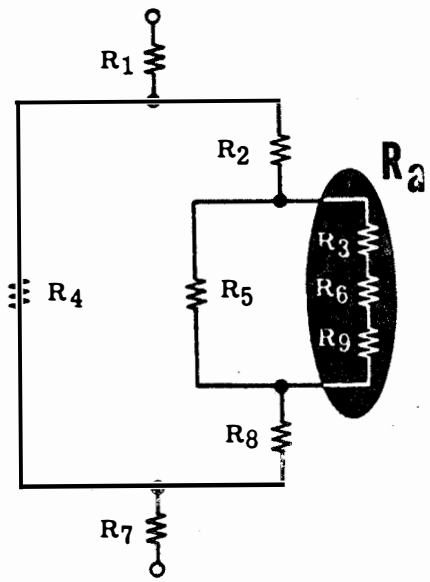




REDRAWN CIRCUIT

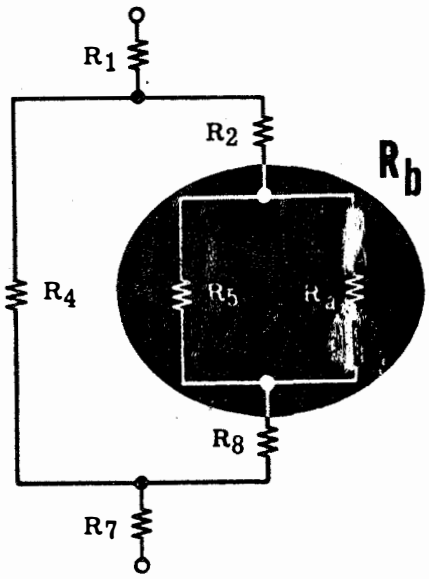
2. Combine the series branch resistors R_3, R_6 and R_9.

$$R_a = R_3 + R_6 + R_9$$



3. Combine the parallel resistances R_5 and R_a.

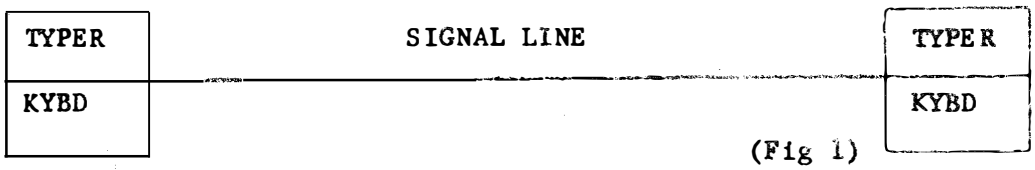
$$R_b = \frac{R_5 \times R_a}{R_5 + R_a}$$



The teletype equipment you will be studying in this course consists of a motor driven device designed for interchanging typewritten messages between two or more stations .

Each station must have a transmitting unit (Keyboard) and a receiving unit (Typing Unit). The transmitting unit converts the mechanical motion of striking a key, into electrical impulses of the five-unit code. The receiving unit transforms the electrical impulses it receives from the transmitting unit into mechanical motion to print a character, ring the signal bell, etc.

The teletype communication channel-in our case wire- carries the impulses of the five unit code from one station to the other.



(Fig 1)

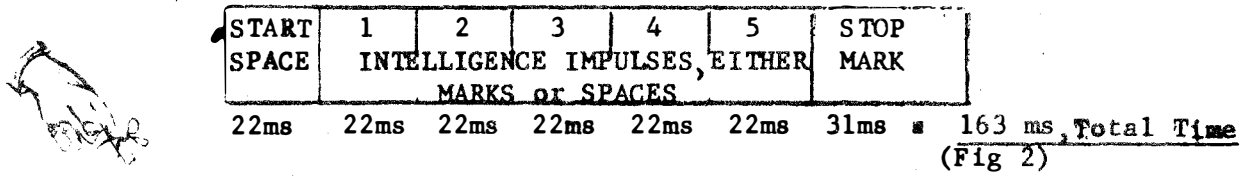
1. The TRANSMITTING UNIT changes the mechanical motion of striking the keys into the electrical impulses of the teletype code.

2. The RECEIVING UNIT changes electrical impulses back into mechanical motion to accomplish printing.

3. The SIGNAL LINE carries the electrical impulses from one station to the other.

The teletype code is an electrical code of current and no current impulses. When there is current flowing between stations it is a MARKING impulse. When no current is flowing it is a SPACING impulse. A combination of MARKING (current) and SPACING (no current) impulses carry the intelligence from one station to the other.

Each character or function is made up of seven (7) impulses. Only five (5) of these impulses carry intelligence. The other TWO impulses are used to maintain SYNCHRONIZATION between the sending and the receiv- machines. THESE TWO IMPULSES ARE CALLED THE START-STOP IMPULSES.



(Fig 2)

REMEMBER For EVERY character transmitted there will ALWAYS be a total of SEVEN impulses. They will always follow this sequence::

1. START impulse: Causes all receiving stations to be ready to receive the character that follows.(ALWAYS A SPACING IMPULSE.)
2. FIVE INTELLIGENCE impulses: A combination of MARKS and SPACES depending on the character transmitted.
3. STOP impulse: Immediately following the FIVE intelligence impulses and is ALWAYS A MARKING IMPULSE

(continued)

FIVE UNIT CODE (CONTINUED)

It will require 163 milliseconds (.163 seconds) to send any one character or function regardless of how fast the operator is typing. If he sends only one character a minute, that character will be transmitted and received by the receiving stations in 163 milliseconds. The part of the minute that the machines are not working they remain in a MARKING condition which is actually a continuation of the STOP impulse beyond its 31 milliseconds. If the operator is typing 368 operations per minute (the top limit of a 60 word per minute machine) each character still takes 163 ms, but there is no time lost between characters. In that case, immediately after the STOP impulse of 31 milliseconds a START impulse is sent for the next character. (see Fig. 2, Page 23)

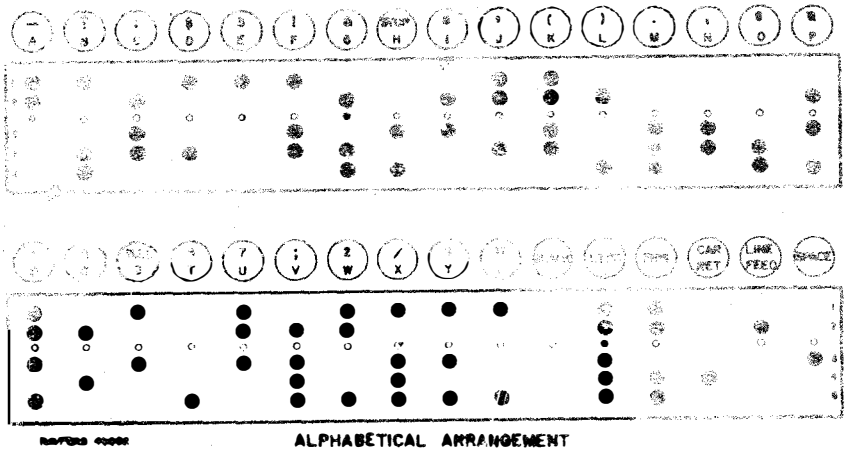
If the teletype machine was being operated one character after another, without any loss of time between characters, it would send and receive 61.3 words-per-minute. The 61.3 words-per-minute is derived as follows :

1. Each character or operation takes 163 milliseconds.
2. Operations per minute equals 60 seconds divided by 163 milliseconds (.163) or 368 operations per minute.
3. Each word is considered to be six characters or operations.
4. Words per minute would be 368 operations divided by 6 or 61.3 WPM.

The different combinations of the 5 intelligence impulses MARKING and SPACING make up the five units of the teletype code of which each character consists.(The code is illustrated below in Fig 3.) There are 32 different combinations of these marking and spacing impulses.

As with a typewriter, the teletypewriter has an upper and lower case character for each key. With the teletype in lower case, depressing the "R" key causes a capital "R" to be printed. In the upper case, the figure "4" would be printed. By using Q,W,E,R,T,Y,U,I,O and P in upper case we get the figures 1,2,3,4,5,6,7,8,9 and 0, giving us 26 letters, 10 numbers, as well as the functions of carriage return, signal bell, line feed , etc.

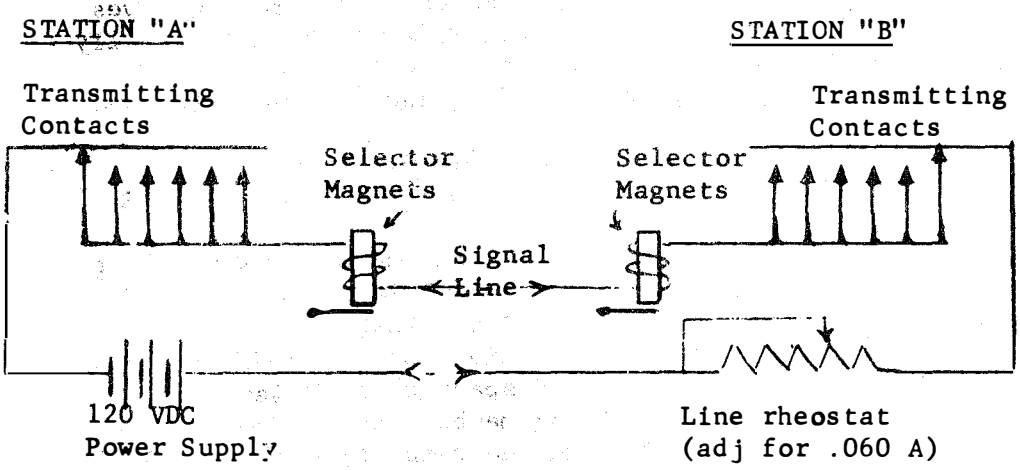
TELETYPEWRITER CODE



ALPHABETICAL ARRANGEMENT

Fig. 3.

The following diagram illustrates the method of connecting two stations together. Notice that all parts are connected in series.



POWER SUPPLY: The power supply furnishes 120 VDC to the Line Circuit. The resistance in the line is adjusted for a current flow of 60 milliamperes with a MARK on the line.

TRANSMITTING CONTACTS: The transmitting contacts make up the electrical part of the keyboard or transmitting unit. There are six pairs of contacts wired in parallel with each other. If any one pair are closed the circuit is complete and current will flow through the loop. The transmitting contacts are controlled mechanically so only one pair can be closed at once, each in turn, from the rear forward. NOTE THAT ONE PAIR (REAR) OF CONTACTS ARE USED FOR BOTH THE START AND STOP IMPULSES AND ARE CALLED THE START-STOP CONTACTS.

To begin a character, the START-STOP contacts open, the no-current impulse readies all machines to receive the intelligence following. 22 milliseconds later, the first intelligence contacts close (if a mark) or remain open (if a space). The 2nd, 3rd, 4th and 5th intelligence contacts follow in turn each remaining open or closing for 22 milliseconds. As the 5th intelligence impulse ends the START-STOP CONTACTS CLOSE AND REMAIN CLOSED UNTIL ANOTHER CHARACTER IS TRANSMITTED. THEY WILL REMAIN CLOSED AT LEAST 31 MILLISECONDS.

The STOP impulse allows the slower machines to "catch up". The START and STOP impulses together keep the machines, in the loop, in synchronization.

SELECTOR MAGNETS: The selector magnets are the heart of the receiving unit. When current flows through them they become strong magnets and attract the armature. When no current is through them, magnetism is lost and the armature falls away. It is the movement of the armature, attracted to the magnets by a MARK (CURRENT) impulse, and falling away when a SPACE (NO CURRENT) impulse is received, that set up the trains of parts to mechanically print a character.

Normal condition for the typing unit is MARKING (STOP CONTACTS CLOSED). When a START (NO CURRENT) IMPULSE is received the magnets deenergize, the armature moves away from the magnet, triggering the receiving mechanism. Then as the 5 intelligence impulses are received, the armature is either attracted or moves away for 22 milliseconds for each impulse setting up mechanical action for each impulse and on completion of the 5th impulse the character is printed. At that time, the STOP IMPULSE (CURRENT) is received, energizing the magnets, attracting the armature to them, stopping any further mechanical action of the receiving mechanism. The machine remains idle (RUNNING CLOSED) awaiting the triggering action of the next START impulse.

SUBJECT: MAIN SHAFT ASSEMBLY

GENERAL: The power to operate the MAIN SHAFT ASSEMBLY comes from a MOTOR UNIT mounted on the BASE UNIT. The motor drives the main shaft assembly which supplies power to all the mechanically operated parts. Motion for setting up the selections and for the performance of all functions is derived from cams and gears mounted on the main shaft.

The main shaft assembly is mounted in the lower center of the PRINTER UNIT and is geared thru the MAIN SHAFT FIBRE GEAR to a STEEL PINION GEAR on the MOTOR SHAFT.

The SELECTOR CAM SLEEVE is fitted over the end of the main shaft and is driven thru the medium of a FRICTION CLUTCH, formed by two pairs of steel discs each separated by a felt washer

The ~~MAIN SHAFT CAM~~ FUNCTION BAIL CAM (which provides motion for all other functions of the typing unit except selecting and spacing) is driven by a POSITIVE CLUTCH consisting of a driving member and a driven member.

The TRANSMITTING SHAFT DRIVING GEAR, near the right end of the shaft, drives the KEYBOARD TRANSMITTING CAM CYLINDER.

See following pages for the component parts and their operation.

SLEEVES ON THE MAIN SHAFT
1. Selector cam sleeve
2. Main bail cam sleeve
3. Spacing sleeve

PARTS THAT TURN ALL THE TIME
1. Main shaft gear
2. Transmitting shaft driving gear
3. Main shaft clutch driving member
4. Driving members of all friction clutches

.....POWER LAW FOR THE MODEL 19 PRINTER .....

"Power is derived from cams and gears on the main shaft and springs throughout the machine".

NOTES:

SUBJECT: DESCRIPTION AND NOMENCLATURE OF PARTS MOUNTED ON THE MAIN SHAFT OF THE MODEL 19.

REF: Teletype Bulletin 144, Page 3, Fig. 36.
Teletype Bulletin 1094, Page 3

1. SELECTOR CAM SLEEVE.
   A. Mounted on the left end of the Main Shaft between two friction clutches.
   B. Stop arm and seven (7) cams. From left to right-
      (1) stop arm
      (2) locking cam
      (3) 1st thru 5th selector cams
      (4) sixth cam

2. MAIN SHAFT LEFT BEARING.
   A. Provides for proper support and mounting of shaft to typing unit.
   B. Allows friction-free rotation of the main shaft.

3. MAIN SHAFT CLUTCH DRIVING MEMBER.
   A. Driving member of a positive action clutch
   B. Fastened to the main shaft by a tongue and groove arrangement
   C. Rotates with the main shaft
   D. Drives the main bail cam sleeve (when clutch is engaged)

4. MAIN BAIL CAM SLEEVE.
   A. Mounted on the main shaft with positive action main shaft clutch on left end and friction clutch on right end
   B. Left to right, the parts are:
      (1) main shaft clutch driven member
      (2) clutch compression spring
      (3) printing bail cam
      (4) function bail cam
   C. Clutch driven member is spline connected to the main bail cam sleeve and the friction clutch driven member is spline connected to the main bail cam sleeve
   D. Rotates only when the main shaft clutch is engaged.

5. FRICTION CLUTCH DRIVING MEMBER AND BALL BEARING ASSEMBLY.
   A. Bolted to the main shaft and rotates with the main shaft.
   B. Separates the main bail cam sleeve assembly and spacing sleeve.

6. SPACING SLEEVE.
   A. Left to right the spacing sleeve consists of:
      (1) spacing escapement ratchet
      (2) main shaft spacing gear
      (3) spacing stop sleeve, which also acts as the driven member of the friction clutch
   B. The spacing sleeve and spacing stop sleeve are spline connected and comprise the spacing sleeve assembly.

SUBJECT: DESCRIPTION AND NOMENCLATURE OF PARTS MOUNTED ON THE MAIN SHAFT OF THE MODEL 19 (CONTINUED)

7. FRICTION CLUTCH DRIVING MEMBER.
   A. Bolted to, and rotates with the main shaft.

8. TRANSMITTING SHAFT DRIVING GEAR.
   A. Bolted to, and rotates with the main shaft.

9. MAIN SHAFT RIGHT BEARING.
   A. Provides for proper support and mounting of shaft to typing unit.
   B. Allows friction-free rotation of the main shaft.

10. MAIN SHAFT GEAR.
    A. Bolted to, and rotates with the main shaft.

.....

SUBJECT: RANGE FINDER OF THE MODEL 19

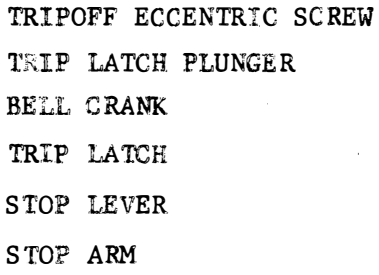
GENERAL: The range finder on the printer unit of the Model 19 is the unit that permits the electrical START-STOP IMPULSES received by the selector magnets to control the releasing and stopping of the selector cam sleeve assembly for each character received from the line circuit.

The adjustable index arm of the range finder gives the operator control, to some degree, for compensating for a biased signal. The scale of the range finder is calibrated from Ø to 12Ø to give the operator a reading of where the index arm is set.

OPERATION: (Ref: Teletype Bulletin No. 144, page 3, fig. 4)

The start impulse is a spacing impulse, allowing the armature spring to pull the armature away from the magnets. Secured to the armature is the

1. Tripoff Eccentric Screw. It depresses the
2. Trip Latch Plunger which pushes against the upper arm of the
3. Bell Crank which pushes the
4. Trip Latch out of engagement with the
5. Stop Lever. This permits the
6. Stop Arm, which is on and part of the selector cam sleeve assembly, to start rotating.



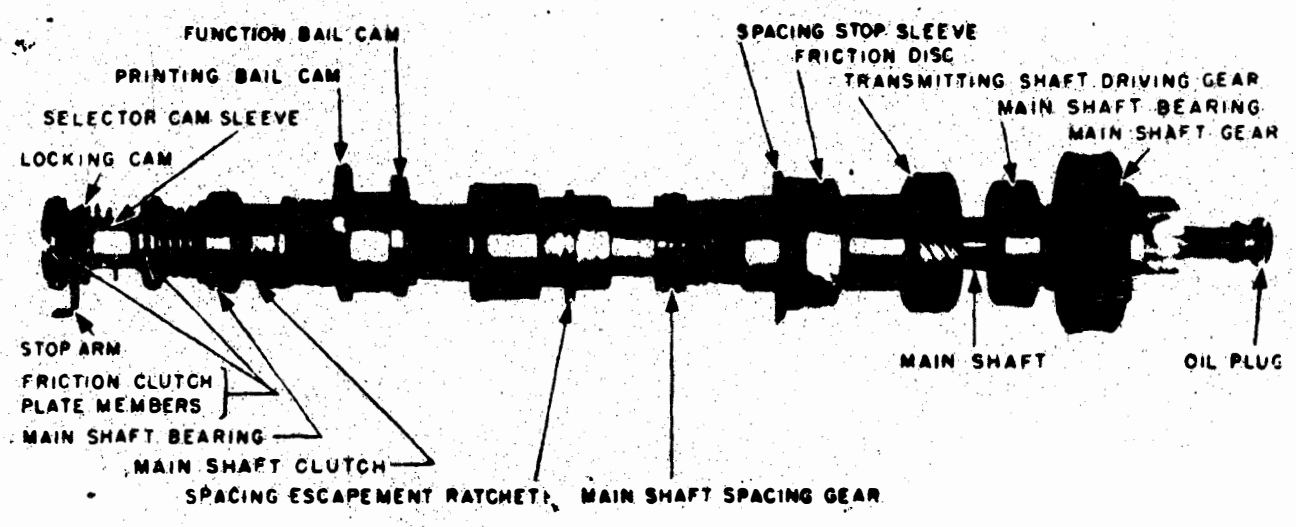


Fig. 1. [illegible]

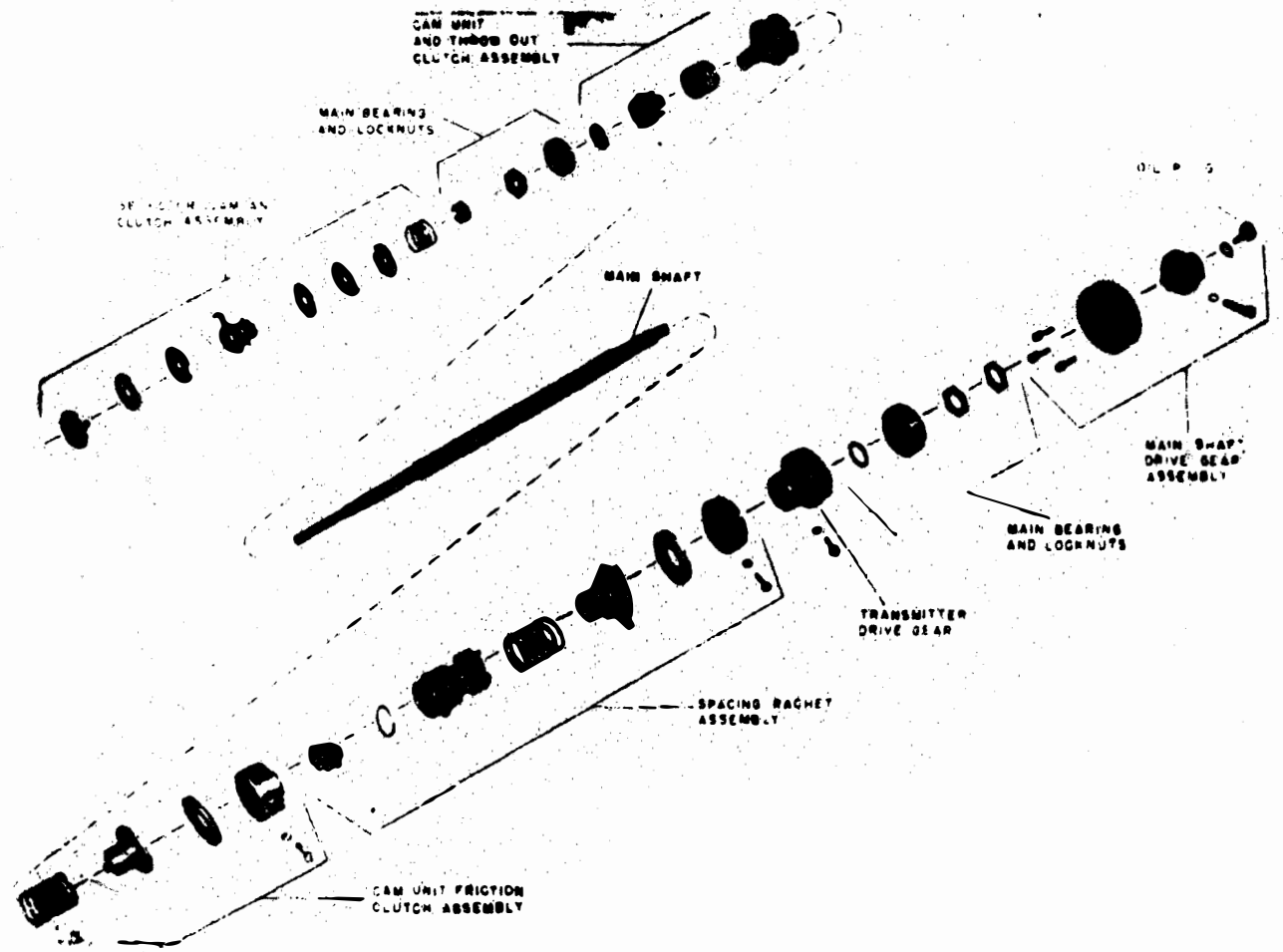


Fig. 2. MAIN SHAFT PARTS IN SEQUENCE OF REMOVAL.

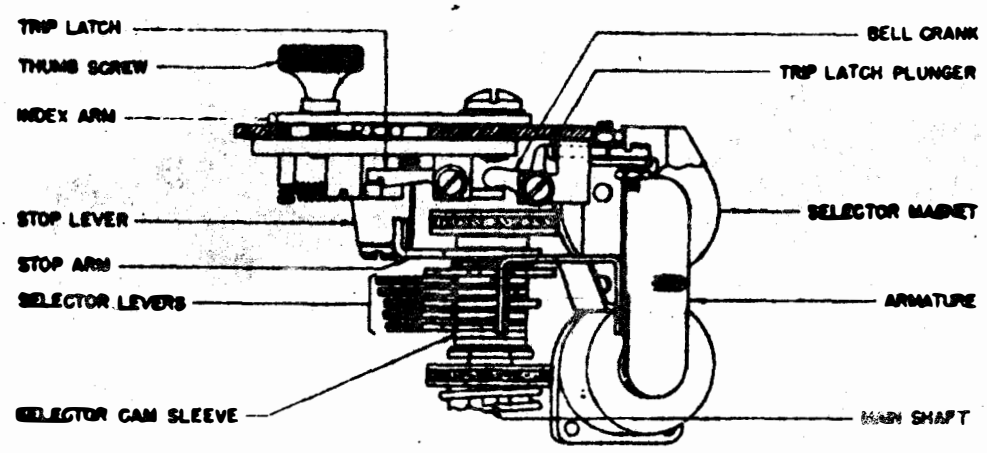


Fig. 1. CROSS-SECTION OF SELECTOR UNIT.

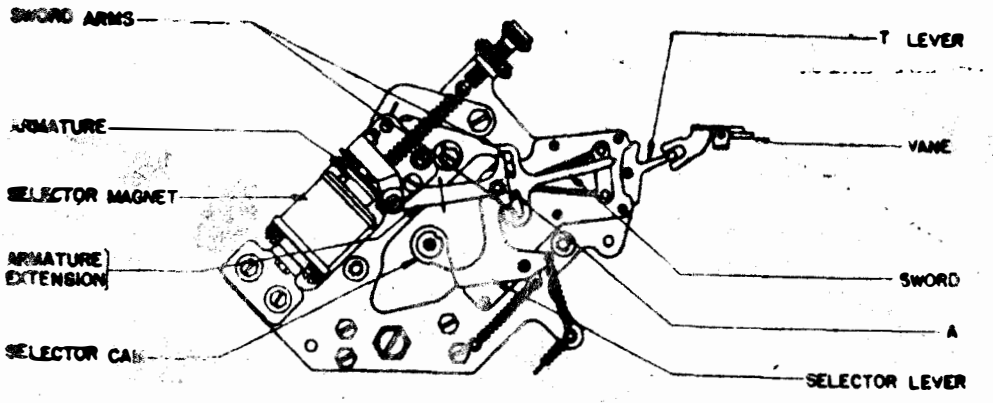


Fig. 2. SIDE VIEW OF SELECTOR UNIT.

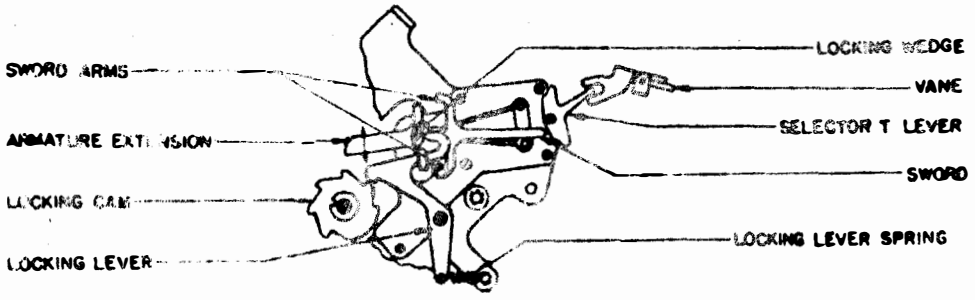


Fig. 3. LOCKING LEVER OPERATION

DESCRIPTION AND PURPOSE OF THE SELECTOR MECHANISM OF THE MODEL 19

GENERAL: The Model 19 Teletype printer may be equipped with either of the two types of selecting mechanism: A PULLING magnet selector, or a HOLDING magnet selector. Basically, the selector unit of either type performs the same function of translating the original line impulses into mechanical motion that causes the code bars to be positioned in accordance with the intelligence impulses received during the selecting cycle.

In this school the PULLING MAGNET selector is taught with the Model 19 printer The selector unit is composed of a separate train of parts from the selector cam sleeve to the vanes for each intelligence impulse. These five trains are identical with the exception of operating at different intervals as determined by the selector cam sleeve assembly. As the selector cam sleeve rotates, the staggered intelligence impulse cams operate their respective selector levers No. 1 through 5 for every revolution of the cam sleeve assembly.

SYNCHRONISM

It is apparent that for every transmitted signal of one station to be received at another station we must have precise synchronization of the sending and receiving units First, the motor units of the two stations must be of the same speed, as near as possible, but slight variations between them can be taken care of in the selector unit. Two factors make synchronization of the transmitting and receiving units possible:

1. The receiving cam sleeves are designed to rotate FASTER than the transmitting cam cylinder rotates.
2. The START and STOP impulses are employed to create pauses in the rotation of the receiving cam sleeves of sufficient duration to control this additional speed.

The reception of the START impulse starts the receiving cam sleeve revolving At that instant the sleeves are in unison with the transmitting cam cylinder. The corresponding travel of the selector cam sleeve is greater, but as the selector cam sleeve travels faster, it reaches its second position at the same time the transmitting cam cylinder reaches its second position.

As the selector cam sleeve completes its revolution BEFORE the transmitting cam cylinder, the transmitting cam cylinder sends out the STOP impulse which stops the selector cam sleeve until the START impulse is again transmitted. Usually the selector cam sleeve is one-seventh (1 7) faster than the transmitting cam cylinder and remains at rest one-seventh (1/7) of the transmission time. When the speed of the selector cam sleeve is faster (or slower) than the proper speed, the selector cam sleeve remains at rest more (or less) as the case may be.

Slight errors in the relative position of the selector cam sleeve are compensated for by the mechanism. Because the selector cam sleeve starts its revolution in unison with the transmitting cam cylinder on every operation these errors do not become any greater

ELECTOR UNIT

SUBJECT: POSITIONING OF THE SWORD TIP

REF: Teletype Bulletin 144, page 3, para 'A', fig 5 & 40

THE PURPOSE OF THE SELECTOR UNIT IS TO RECEIVE ELECTRICAL IMPULSES OF THE TELETYPE CODE AND CHANGE THEM TO MECHANICAL MOTION.

After the triggering action of the range finder train of parts has been accomplished and the selector cam sleeve is rotating, the

1. Selector Cam exerts pressure on the rear arm of the
2. Selector Lever, rotating it counter-clockwise. This motion moves the
3. Sword to the rear until one of the sword arms (either upper or lower) comes into contact with one of the arms (either upper or lower) of the
4. Armature Extension. Further movement of the selector lever to the rear will cause the
5. Sword Tip to be positioned either up (SPACE) or down (MARK).

NOTE: The upper arms of the swords and armature extension will ALWAYS engage one another and the lower arms of the swords and the armature will ALWAYS engage one another. NEVER will an upper arm of the sword engage the lower arm of the armature extension and vice versa.

SELECTOR CAM

SELECTOR LEVER

SWORD

ARMATURE EXTENSION

SWORD TIP

NOTES:

SUBJECT: LOCKING CAM TRAIN OF PARTS

REF: Teletype Bulletin No. 144, page 5, fig 5A

The

1. Locking Cam has five (5) high and five (5) low portions on it's surface. The

2. Locking Lever is held against the locking cam by the locking lever spring. During that part of each impulse when the swords are set by striking against the armature extension, at that time the peak of any selector cam is operating the corresponding selector lever, a low portion of the locking cam is opposite the locking lever. The armature will be held firmly in position by the

3. "U" Shaped Extension of the Locking Lever, engaging the

4. Locking Wedge on the armature extension. When the locking lever is riding on the high portion of the locking cam, the locking wedge and the armature will be free to move in response to the impulse being received.

Note: In the normal position (while the stop impulse is on the line), the locking lever will ride on the Long High portion of the locking cam.

LOCKING CAM

LOCKING LEVER

"U" SHAPED EXTENSION OF THE LOCKING LEVER

LOCKING WEDGE

NOTES:

SUBJECT: POSITIONING THE CODE BARS

REF: Teletype Bulletin No. 14, page 3, para "A", fig 5 & 10

After the sword tip has been positioned either up or down, the selector cam rides on part the

1. Selector Lever — and its spring rotates the selector lever clockwise to its normal stop position. This motion carries the

2. Sword — forward also and the sword tip will strike and position the

3. "T" Lever. — Mechanically coupled to the "T" lever is the corresponding

4. Vane. — As the "T" lever is positioned, the vane will also be positioned. The lower arm of the

5. Bell Crank — is mechanically coupled to the vane and the upper arm of the bell crank is also mechanically coupled to the

6. Code Bar. — Thus we see that the code bar will be positioned under the power of the selector lever spring thru the action of the above train of parts. There are five (5) of each of the above listed parts and all five trains will be positioned in their correct order, forming one (1) slot in the code bars.

SELECTOR LEVER

SWORD

"T" LEVER

VANE

BELL CRANK

CODE BAR

RY-30 RELAY

GENERAL:

A relay is a sensitive electrical device used to open and close electrical circuits. With two machines connected in a simple teletype loop, one power supply furnishes 60 MA of Direct Current for energizing the selector magnets when there is a MARK impulse. The circuit is opened for a SPACE impulse. This is satisfactory when only a few machines are connected together in a short loop. If more machines and long wires are used, the simple loop would not be satisfactory. More resistance and other characteristics of current going thru long wires and coils of the selector magnets would give sluggish action - the current could not change from 60 MA to 0 MA rapidly enough. To overcome this difficulty, a relay is used in each machine. This relay, the RY-30, is very sensitive, and a small change in the Line Current from the loop will cause it to control a strong current for the selector magnets. When relays are used, each printer must have its own power supply to furnish D.C. needed to energize its selector magnets.

PARTS OF THE RY-30 RELAY

PERMANENT MAGNET...provides the permanent magnetic field for the operation of the relay. It has pole pieces to extend the field and control the sensitivity of the relay.

ARMATURE.....a thin strip of metal pivoted at its base, extending up midway between the magnet poles. At its upper end above the magnet poles, the armature has a contact fastened to each side.

WINDINGS (COIL).....there are two windings, insulated from each other, wound on a coil form around the armature. Each winding has the same resistance, 136 ohms.

CONTACT SCREWS.....there are two contact screws. If the armature is toward the right the armature contact closes against the MARKING contact. If the armature is toward the left, the armature contact closes against the SPACING contact.

RELAY PINS.....there are eight (8) pins at the base of the relay that are connected to the different contacts and coil windings in the relay. When the relay is inserted into its mounting base, these pins make contact with their respective pin jacks, completing the various circuits.

OPERATION OF THE RY-30 RELAY

To understand the operation of the relay there are a few basic laws of magnetism which we must accept:

1. Like magnetic charges or like magnetic poles will REPEL each other.
2. Unlike magnetic charges or unlike magnetic poles will ATTRACT each other.
3. A coil with current passing through it takes on the properties of a magnet, one end being a north magnetic pole and the other end being a south magnetic pole.
4. An iron inserted inside the current carrying coil will have the properties of a bar magnet.
5. If current flowing through a coil in one direction gives the upper end of the coil the properties of a north magnetic pole, then reversing the current through the same coil gives the upper end of the coil the properties of a south magnetic pole.
6. The strength of the magnetic field, or magnetic properties of iron inserted inside a current carrying coil, will be directly proportional to the amount of current flowing through the coil.

When the relay is not energized, the armature acts just like any piece of iron which is suspended half-way between two opposite magnetic poles. It will remain between them, because the pull of non-magnetized iron is the same toward the north or south magnetic pole. But when we give the iron that is between the magnetic poles a north magnetic charge, it is going to be attracted toward the south magnetic pole of the horseshoe magnet, and repelled away from the north magnetic pole. Also, if we give the iron between the magnetic poles a south magnetic charge, the iron will be pulled to the north pole of the magnet and repelled by the south pole.

With the RY-30, the armature is just a piece of iron, but when we pass a current through one of the windings from the bottom out through the upper end of the coil, the armature becomes a bar magnet with the upper end a north magnetic pole. The armature moves over toward the south magnetic pole of the permanent magnet.

If we pass a current through this winding from the upper end and and out the bottom of the coil, the upper end of the armature becomes a south magnetic pole. It would move toward the north pole of the permanent magnet.

Since we have two windings around the armature, we can leave wires fastened to each one, and when we want the armature to move toward the south pole we put current through one winding from the bottom towards the upper end. When we want the armature to move toward the north pole we put current through the other winding from the top towards the lower end.

The two windings are called:

1. THE BIAS WINDING
2. THE LINE WINDING

The BIAS WINDING has one condition only and that is energized with 120 Volts DC at 30 Milliamps and can be considered to have a spring pressure of 30 pulling the armature towards the SPACING CONTACT SCREW.

The LINE WINDING has two conditions:

1. MARKING - energized with 120 Volts DC at 60 Milliamps and can be considered to have a spring pressure of 60 pulling the armature towards the MARKING CONTACT SCREW.
2. SPACING - ZERO CURRENT flowing or ZERO SPRING PRESSURE pulling the armature towards the MARKING CONTACT SCREW.

When a MARKING IMPULSE is on the line winding the pull of 60 (60 MA) is greater than the pull of the bias current of 30 (30 MA) so the armature will be moved against the MARKING CONTACT SCREW.

When a SPACING IMPULSE is on the line winding and there is ZERO pull of the armature towards the marking contact screw the bias winding pull of 30 (30 MA) is greater than the ZERO pull of the line winding and thus the armature is pulled toward the SPACING CONTACT SCREW.

Note: The circuits that are controlled by the ARMATURE and MARKING CONTACT SCREW and the ARMATURE and SPACING CONTACT SCREW will be covered later.

ADJUSTING THE WE-255A (RY-30) POLAR RELAY WITH A OHMETER

As very few ships or stations are equipped with the UG Test Panel or the I-193-A Test Set it is most important to learn the method of adjusting a relay with an ohmeter or continuity checker. Using the method described below and using proper care, a very accurate adjustment of the relay can be accomplished.

Before starting to adjust the relay, back off the pole pieces all the way and back off the contact screws several turns. This is so the pole pieces will have a minimum effect on the armature until the contact screws are adjusted. Clean and inspect all points that make contact on the armature and the screws. Set the meter for continuity, place alligator clips on the test prods (if available) and the relay is ready to adjust.

1. Put the test prods on Pin 1 and 4 of the relay.
2. Advance the right-hand contact screw until it touches the armature. (This will be indicated by the meter showing full scale deflection). Then back off the contact screw 1/12th turn.
3. Put test prods on Pin 1 and 5. They will remain there for the rest of the adjustment.
4. Advance left-hand contact screw until it touches the armature. (This will be indicated by a full scale deflection of the meter) Then back off the contact screw 1/12th turn.
5. Advance the right-hand pole piece until the meter shows full scale deflection. At this time the right-hand pole piece has pushed the armature until it touches the left-hand contact screw. Back off the pole piece between 1/4 and 1/2 turn.
6. Advance the left-hand pole piece until the armature has been attracted to the left-hand contact screw. This will be indicated by a full scale deflection. Then back off the left-hand pole piece until continuity if broken. (This adjustment is very critical) The relay is now adjusted. Make a visual check of the adjustment: Hold the relay on its side and see if the armature falls to a contact screw by the pull of gravity. Turn the relay over on its other side and see if the armature will fall to the other contact screw. If it does NOT, then the pole piece adjustments are incorrect and should be re-done.

After some experience you can refine the adjustments instead of remaking them. If the MARK and SPACE contacts are not equal distance from the armature when the armature is in neutral position, distortion will result. The clearance between a contact screw and the armature contact should be between .003 and .005 inches.

It is not necessary that you use an ohmeter to adjust the relay as above as any continuity check will work as well. If your ship or station has the UG Test Panel or the I-193-A Test Panel or any other later issued equipment, use the Test Equipment of your choice. The REAL check is, "DOES THE RELAY WORK IN THE TELETYPEWRITER?"

A "Tommy" should be used to make the adjustments on the relay. If none are available, you can make a good substitute out of a non-magnetic material such as heavy copper wire or brass stock. Maintenance of a relay is very little, keeping the inside clean with a soft brush or dressing down pitted contacts with a carborundum stone being careful to keep the contacts "square".

SUBJECT: COMMON DC AND RELATED CIRCUITS

GENERAL

The COMMON DC is a source of 120 Volts Direct Current furnished by the rectifier in each individual Model 19 Teletypewriter Set. Its purpose is to furnish DC to the BIAS, SELECTOR MAGNET, SHUNT CIRCUITS and others, each covered individually.

The COMMON DC from the rectifier to the table will be covered in later lessons and at this time we are concerned with the COMMON DC above the table beginning at NEGATIVE TERMINAL 25 and back to POSITIVE TERMINAL 24.

COMMON DC CIRCUITRY

Starting from:
1. NEGATIVE TERMINAL 25 (source)
2. KYBD SLIP CONNECTOR NEGATIVE 53 (for kybd control ckts)
3. NEGATIVE TERMINAL 63 (on the relay block)
   (AT THIS POINT THE COMMON DC BREAKS DOWN TO SEVERAL BRANCHES OR RELATED CIRCUITS CALLED THE BIAS, SELECTOR MAGNET AND SHUNT CIRCUITS)
4. POSITIVE TERMINAL 62 (on the relay block)
5. KYBD SLIP CONNECTOR POSITIVE 54 (for kybd control ckts)
6. POSITIVE TERMINAL 24 (source)

RELATED CIRCUITS - BIAS CIRCUIT

The BIAS CIRCUIT causes the RY-30 relay armature to be attracted against the spacing contact screw when there is a spacing impulse on the line winding of the relay. It is 120 Volts DC at 30 Milliamps and has a total resistance of 4136 ohms

BIAS CIRCUITRY

Starting from
1. NEGATIVE TERMINAL 63
2. THROUGH A 2000 OHM RESISTOR (part of a 2600 ohm resistor)
3. tied to end of an 8K ohm resistor but not through it
4. KYBD SLIP CONNECTOR NEGATIVE 51
5. POLAR NEUTRAL SWITCH CONTACTS 2 & 3 (Polar operation not taught)
6. KYBD SLIP CONNECTOR NEGATIVE 56
7. NEGATIVE PIN #2 OF RELAY
   THROUGH THE BIAS WINDING OF THE RY-30 RELAY (136 OHMS)
8. POSITIVE PIN #7 OF RELAY
9. THROUGH A 2000 OHM RESISTOR (part of a 2810 ohm resistor)
10. POSITIVE TERMINAL 62

NOTE: Self closing feature of kybd slip connector 51 and strap to kybd slip connector 56 for keyboard removal.

RELATED CIRCUITS (con't) - SELECTOR MAGNET CIRCUIT

The SELECTOR MAGNET CIRCUIT provides DC (from the common DC) through the ARMATURE and MARKING CONTACT SCREW of the RY-30 Relay to energize the SELECTOR MAGNETS to control the armature of the selector magnets. The SELECTOR MAGNET CIRCUIT is 120 Volts DC at 66 Milliamps and has a total resistance of 1810 ohms.

SELECTOR MAGNET CIRCUITRY

Starting from

1. NEGATIVE TERMINAL 63 (source)
2. THROUGH A 600 OHM RESISTOR (part of a 2600 ohm resistor)
3. NEGATIVE PIN #1 OF RELAY
   THROUGH THE ARMATURE and MARKING CONTACT SCREW OF RELAY
4. POSITIVE PIN #4 OF RELAY
5. THROUGH A 400 OHM RESISTOR
6. THROUGH A 600 OHM RESISTOR (part of a 2600 ohm resistor)
7. TERMINAL 65
8. TERMINAL 45
9. SPRING & BUTTON CONTACT # 12
   THROUGH THE SELECTOR MAGNETS (in series 105 ohms each)
10. SPRING & BUTTON CONTACT # 9
11. TERMINAL 46
12. POSITIVE TERMINAL 62 (source)

NOTES (1) WHEN THE PRINTER IS REMOVED FROM THE BASE THE LINE JACK CONNECTED ACROSS SPRING & BUTTON CONTACTS 11 & 12 COMPLETE THE SELECTOR MAGNET CIRCUIT.

(2) WHEN THE RELAY IS REMOVED THE MAGNET CLOSING JACK CONNECTED ACROSS RELAY PIN #1 & #4 COMPLETE THE SELECTOR MAGNET CIRCUIT.

SHUNT CIRCUIT

The SHUNT CIRCUIT provides a steady DC current drain from the rectifier (through the common DC) when the selector magnet circuit is deenergized. The SHUNT CIRCUIT is 120 Volts DC at 66 Milliamps and has a total resistance of 1810 ohms. The SHUNT CIRCUIT is through the ARMATURE and SPACING CONTACT SCREW of the RY-30 Relay.

SHUNT CIRCUITRY

Starting from

1. NEGATIVE TERMINAL 63 (source)
2. THROUGH A 600 OHM RESISTOR (part of 2600 ohm resistor)
3. NEGATIVE PIN #1 OF RELAY
   THROUGH THE ARMATURE and SPACING CONTACT SCREW OF RELAY
4. POSITIVE PIN #5 OF RELAY
5. THROUGH A 400 OHM RESISTOR
6. THROUGH A 810 OHM RESISTOR (part of a 2810 ohm resistor)
7. POSITIVE TERMINAL 62 (source)

NOTE: THE SOURCE VOLTAGE, CURRENT AND TOTAL RESISTANCE OF THE SHUNT CIRCUIT IS THE SAME AS THE SELECTOR MAGNET CIRCUIT.

GENERAL:

The LINE CIRCUIT carries the intelligence from the transmitting unit (transmitting contacts) to the line relay. The opening and closing of the line circuit control the line relay enabling the armature of the line relay to respond to the marking and spacing impulses. The LINE CIRCUIT has 120 Volts DC at 60 MA when a mark is on the line.

The LINE CIRCUIT has been broken down for instructional purposes to:

1. THE LINE CIRCUIT ABOVE THE TABLE

2. THE LINE CIRCUIT BELOW THE TABLE

The LINE CIRCUIT above the table has been subdivided into two distinct circuits called the:

1. THE SEND LEG OF THE LINE

2. THE RECEIVE LEG OF THE LINE

THE SEND LEG OF THE LINE - connects the keyboard transmitting contacts to the line circuit.

SRB Contacts in SEND position
1. NEGATIVE TIP BLACK PLUG
2. TERMINAL 34
3. KYBD SLIP CONNECTOR 55 .....See Note (2)
4. TRANSMITTING CONTACTS
5. KYBD SLIP CONNECTOR 54 .....See Note (2)
6. SEND-RECEIVE-BREAK CONTACT 5
7. SEND-RECEIVE-BREAK CONTACT 6
8. TERMINAL 32
9. POSITIVE SLEEVE BLACK PLUG

SRB Contacts in RECEIVE position
1. NEGATIVE TIP BLACK PLUG
2. TERMINAL 34
3. KYBD SLIP CONNECTOR 55
4. KYBD SLIP CONNECTOR 57
5. SEND-RECEIVE-BREAK CONTACT 3
6. SEND-RECEIVE-BREAK CONTACT 4 .....See Note (1)
7. SEND-RECEIVE-BREAK CONTACT 5
8. SEND-RECEIVE-BREAK CONTACT 6
9. TERMINAL 32
10. POSITIVE SLEEVE BLACK PLUG

Notes: (1) THE SEND-RECEIVE-BREAK CONTACTS 3 & 4 SHUNT THE LINE CURRENT AROUND THE TRANSMITTING CONTACTS.

(2) WHEN THE KEYBOARD IS REMOVED, THE PATH OF CURRENT IS FROM KYBD SLIP CONNECTOR 55 THROUGH A SHORTING JUMPER TO KYBD SLIP CONNECTOR 54, KEEPING THE SEND LEG OF THE LINE COMPLETE. KYBD SLIP CONNECTOR 54 HAS A SELF-CLOSING JACK.

SUBJECT: THE LINE CIRCUIT ABOVE THE TABLE (con't)

THE RECEIVE LEG OF THE LINE - to connect the RY-30 Relay to the line circuit.

1. NEGATIVE TIP RED PLUG
2. NEGATIVE TERMINAL 42
3. NEGATIVE TERMINAL 66
4. RELAY PIN JACK 6 (NEGATIVE POLARITY) .....See Note (1)
5. RELAY LINE WINDING 136 OHMS
6. RELAY PIN JACK 3 (POSITIVE POLARITY) .....See Note (1)
7. POSITIVE TERMINAL 61
8. POSITIVE TERMINAL 41
9. POSITIVE SLEEVE RED PLUG

Note: (1) WHEN THE RELAY IS REMOVED THE LINE CLOSING JACK KEEPS THE RECEIVE LEG OF THE LINE COMPLETE.

(2) THE TOTAL RESISTANCE OF THE LINE CIRCUIT ABOVE THE TABLE IS 136 OHMS. THIS IS THE TOTAL RESISTANCE OF THE RECEIVE LEG OF THE LINE. THE SEND LEG OF THE LINE HAS PRACTICALLY ZERO RESISTANCE.

(3) DEFINITIONS OF OPERATING CONDITIONS OF THE MODEL 19

NORMAL - SELECTOR CAM SLEEVE ASSEMBLY ROTATES CONTROLLED BY THE INCOMING SIGNAL.

OPEN - SELECTOR CAM SLEEVE ASSEMBLY ROTATES AT ALL TIMES UNCONTROLLED BY THE INCOMING SIGNAL.

CLOSED - SELECTOR CAM SLEEVE REMAINS STATIONARY WHILE AN INCOMING SIGNAL IS BEING RECEIVED.

* *

Wiring the RY-30 Relay 'IN' or 'OUT'..... In this school the Model 19 is equipped with RY-30 Relays. In many installations and especially aboard ship, you will find that RELAYS ARE NOT USED. Then the Line Current goes directly through the Selector Magnets to energize them for a MARK. The information below shows how you may, if occasion requires at your duty station, to wire in or wire out the relay.

WIRE IN THE RELAY: - MOVE YELLOW WIRE FROM 61 TO 62, WHITE WIRE FROM 66 to 65, UNTAPE GREEN WIRE AND CONNECT IT TO 61.

WIRE OUT THE RELAY: - DISCONNECT, AND TAPE GREEN WIRE FROM 61, MOVE YELLOW WIRE FROM 62 to 61, AND WHITE WIRE FROM 65 to 66.

BAIL MOUNTING SHAFT AND PARTS MOUNTED THEREON

GENERAL: The Bai Mounting Shaft is a shaft mounted parallel to, and above, the Main Shaft in the Model 19 Printer Unit. The Bail Mounting Shaft provides support for the various major parts mounted on it that provide mechanical linkage from the Main Shaft (Source of power) to operate all printing and function operations of the printer unit.

The assembly is mounted from the top of the printer unit, after removing the typebar carriage, and is held in place two screws securing the right bearing to the printer frame.

NOTES:

SUBJECT: BAIL MOUNTING SHAFT AND PARTS MOUNTED THEREON

REFERENCE: Teletype Bulletin No. 144 page 6, Fig 10, 12B & 18

The bail mounting shaft is a free turning shaft running parallel to and above the main shaft. IT is mounted in the typing unit casting. The following parts are mounted on it.

1. PRINTING BAIL
2. FUNCTION BAIL
3. PRINTING BAIL OPERATING ARM
4. FRONT AND REAR SPACING ESCAPEMENT PAWLS

PRINTING BAIL (parts mounted on it)

1. PRINTING BAIL BLADES
2. SPACING ESCAPEMENT PAWLS OPERATING ARM
3. FUNCTION LEVER BAIL

FUNCTION BAIL (parts mounted on it)

1. FUNCTION BAIL BLADE
2. FUNCTION BAIL ROLLER

FUNCTION LEVER BAIL (parts mounted on it)

1. BLOCKING PLATE
2. FUNCTION LEVER BAIL ROLLER

NOTES:

SUBJECT: ENGAGING THE MAIN SHAFT CLUTCH

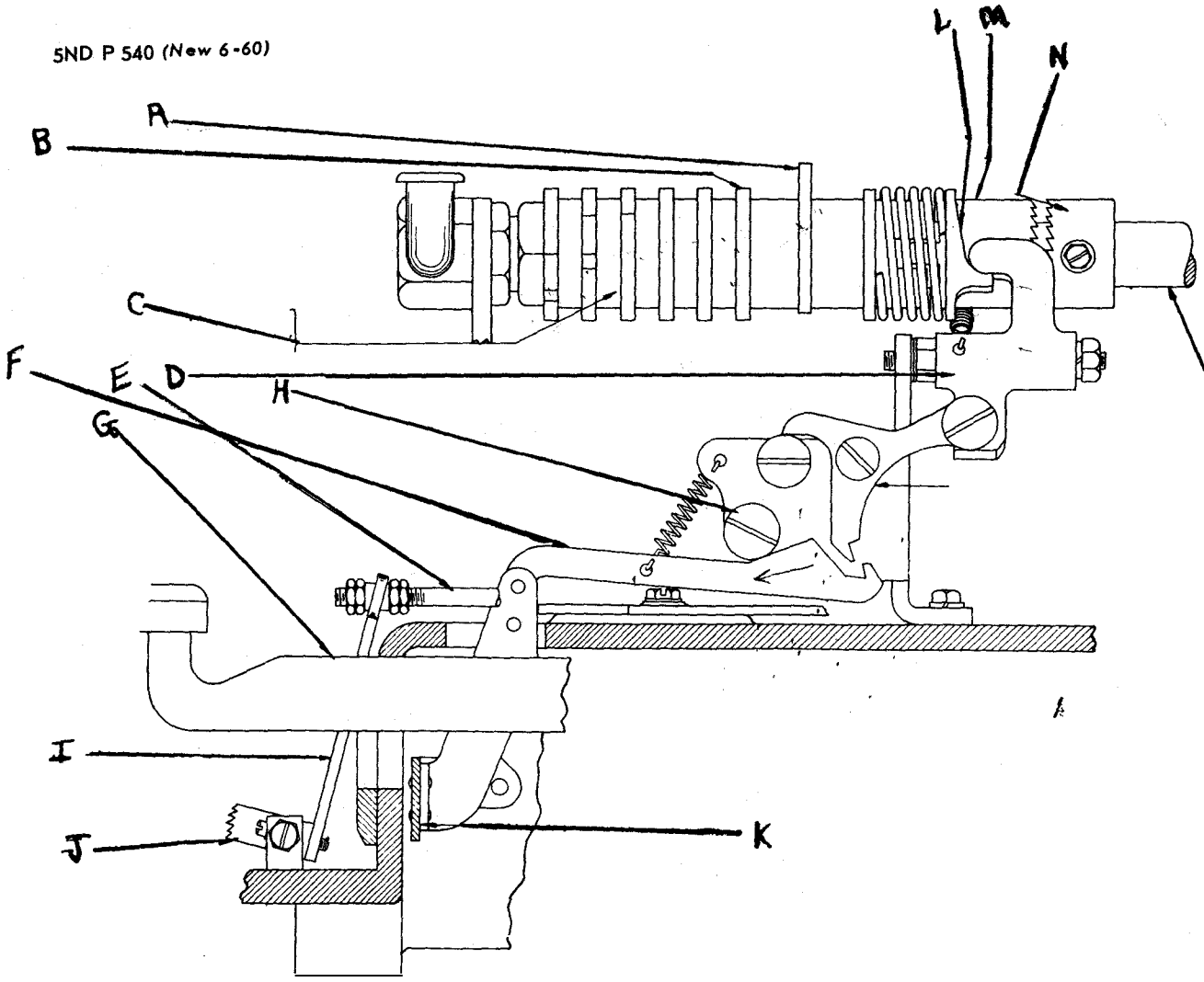
REF: Teletype Bulletin 144, page 5, Fig 9, 10 & 37

Just as # 5 sword tip is positioned, the peak of the

1. SIXTH CAM strikes the
2. CLUTCH THROWOUT ARM; bring the
3. CLUTCH STOP ARM out of engagement with the cam surface of the
4. DRIVEN CLUTCH MEMBER. This will permit the
5. COMPRESSION SPRING to move the driven clutch member into engagement with the
6. DRIVING CLUTCH MEMBER which revolves with the main shaft, thus the main bail cam sleeve will start rotating. Mounted on the main bail cam sleeve is the
7. PRINTING BAIL CAM. Riding on the printing bail cam is a roller which is mounted on the
8. PRINTING BAIL OPERATING ARM. As the roller rides to the low side of the cam, the printing bail operating arm moves away from the
9. PRINTING BAIL. This permits the printing bail to be pulled forward by the
10. PRINTING BAIL SPRING

SIXTH CAM
CLUTCH THROWOUT ARM
CLUTCH STOP ARM
DRIVEN CLUTCH MEMBER
COMPRESSION SPRING
DRIVING CLUTCH MEMBER
PRINTING BAIL CAM
PRINTING BAIL OPERATING ARM
PRINTING BAIL
PRINTING BAIL SPRING

NOTE S::::



A _____

B _____

C _____

D _____

E _____

F _____

G _____

H _____

I _____

J _____

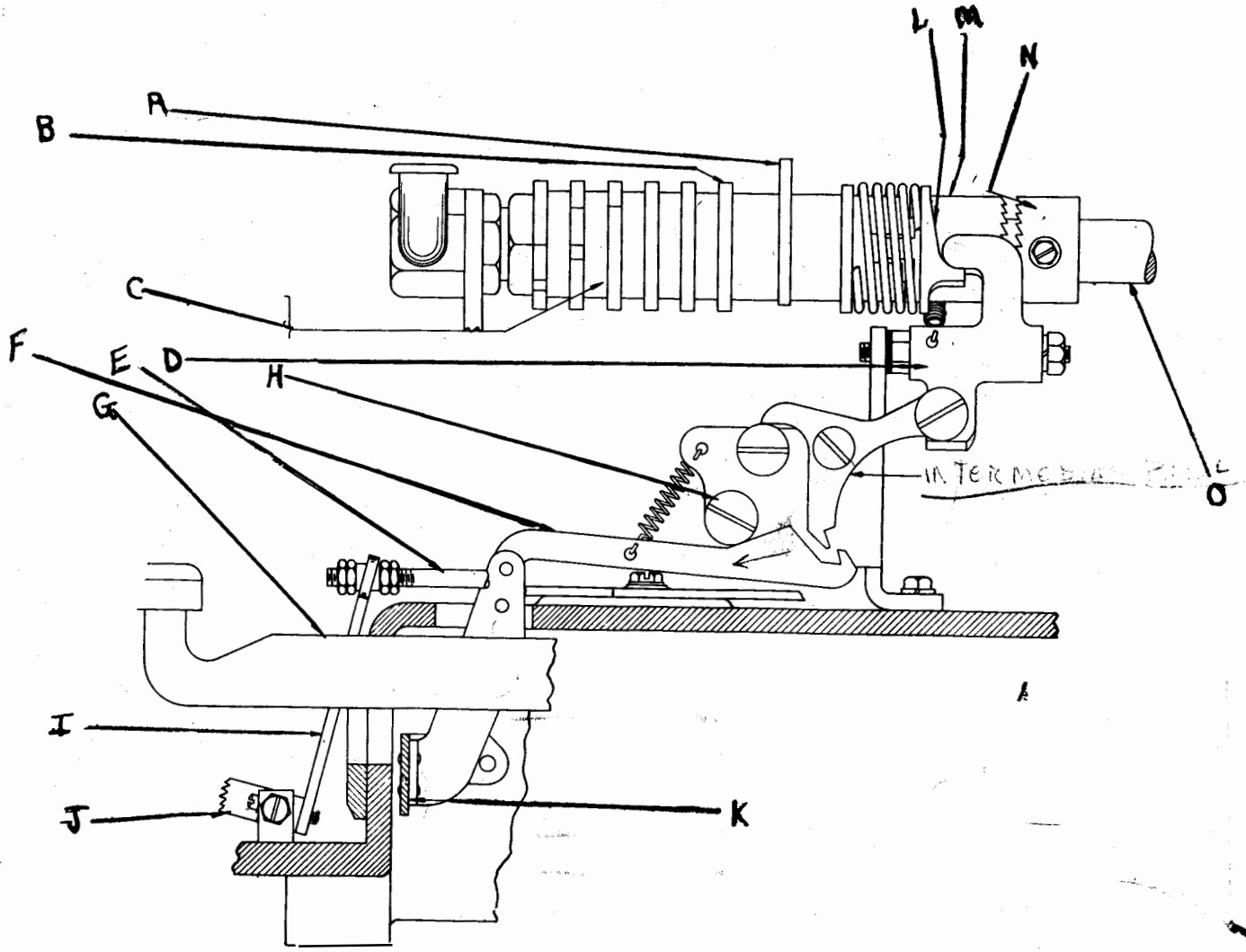
K _____

L _____

M _____

N _____

O _____



A Lock Loop CAM

B START STOP CAM

C TRANSMITTING CAM SLEEVE ASSEMBLY

D CLUTCH INBOWOUT LVR

E RPT SPACE ROD

F TRIPOFF PAWL

G KEY LVR

H TRIPOFF PAWL STOP

I EXT

J SPACE BAR ROD

K UNIVERSAL BAR

L INBOWOUT CAM

M CLUTCH DRIVEN MEMBER

N CLUTCH DRIVING MEMBER

O SHAFT

THE PRINTING OPERATION

GENERAL: The printing operation is one of the two operations of the printer unit. This operation takes place after the selector cam sleeve has rotated and the selected character has been set up in the selector unit and positioned the code bars. Then the sixth cam operates the clutch throwout lever allowing the mainshaft clutch to engage.

The actual printing is done when the type bars are thrown against the platen by a force that originates in the motor and terminates just after the the character has been printed and the mechanism has been cleared for the selection of another character. The path of this force can be traced from the motor, through the mainshaft, the printing bail, the plunger roller, the pull bar plunger, pull bar bail, and finally, to the type bar.

As the printing bail cam revolves, the roller on the printing bail operating arm moves against the low portion of the cam. The printing bail, held by the tension of its own spring, follows the upper end of the operating arm and moves the pull bar bail forward. This forward motion of the pull bar bail permits the pull bar springs to draw the pull bars against the code bars. The selected pull bar is drawn into the path created by the alignment of notches in the code bars and is moved forward when the pull bar bail engages a hook-like projection on its lower edge.

The rack and gear connection between the pull bar and the type bar causes the type bar to rotate about its pivot point and the pallet end is swung toward the platen.

As the pull bar is moved forward, the sloping surface of its lower projection strikes a stripper plate which causes the pull bar to be released from the pull bar bail shortly before the type bar reaches the platen. Momentum carries the type bar the remaining distance to the platen. As the printing bail operating arm rides to the high part of its cam the pull bars will be raised to clear the code bars and will be free to respond to a new selection.

NOTES:

OVERLAP

After the selector unit has set up the selected character and the printing bail cam starts to revolve, the printing bail starts forward, allowing the locking function lever to enter the vanes. The locking function lever holds the vanes in position while the selected character is being printed. The Selector cam sleev has started its second revolution and actually positions the selector levers and swords while the first character is being printed.

The storing up of the second character within the selector unit while the first character is being printed is called overlap. Overlap facilitates printer operation at high speeds.

The purpose of the lockirg function lever is to HOLD THE VANES IN THEIR SELECTED POSITION UNTIL THE OPERATION IS COMPLETED.

NOTES

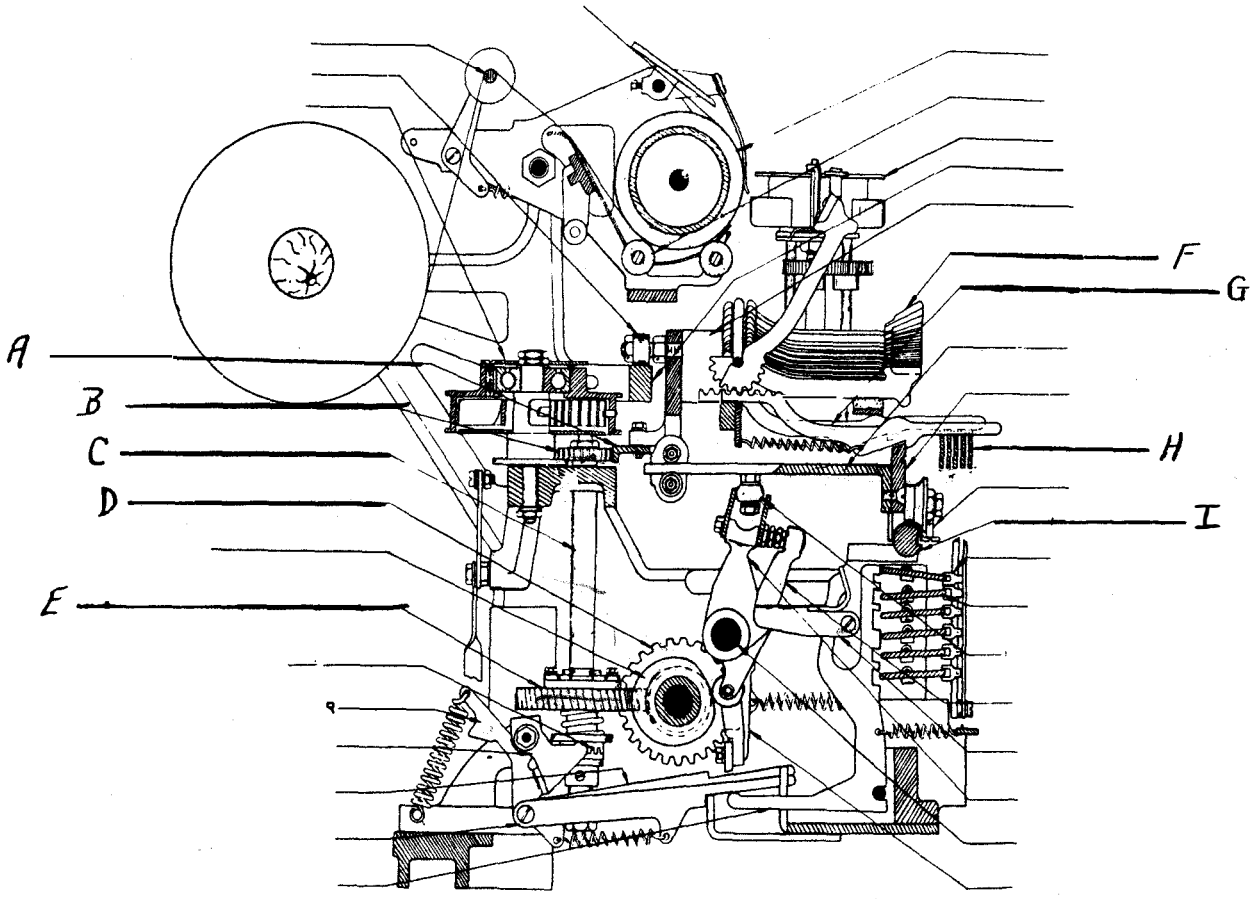
SUBJECT: PRINTING OPERATION TRAIN OF PARTS

REFERENCE: TELETYPE BULLETIN No. 144 Page 5 & 6, fig 10

PRINTING OPERATION TRAIN OF PARTS

The 1.	Printing Bail Cam	starts to revolve and the
2.	Printing Bail Operating Arm,	through the medium of a roller rides to the low side of the printing bail cam, the
3.	Printing Bail	is pulled forward by the
4.	Printing Bail Spring.	The printing bail spring pulls the printing bail and the
5.	Printing Bail Blades	forward. Since the
6.	Pull Bar Bail Plunger Roller	rides between the printing bail blades it must also come forward. The pull bar bail plunger roller is secured to the
7.	Pull Bar Bail Plunger,	which in turn is secured to the
8.	Pull Bar Bail.	The pull bar bail comes in contact with the hook like projection on the selected
9.	Pull Bar,	which is geared at the rear through a rack and gear assembly to a
10.	Type Bar.	So when the pull bar is pulled forward the typebar is moved towards the platen. When the type bar gets to within about one inch of the platen, the sloping surface of the hook projection on the pull bar strike the stripper plate and the pull bar is stripped from the pull bar bail. MOMENTUM carries the type bar the remaining distance to the platen.

PRINTING BAIL CAM
PRINTING BAIL OPERATING ARM
PRINTING BAIL
PRINTING BAIL SPRING
PRINTING BAIL BLADES
PULL BAR BAIL PLUNGER ROLLER
PULL BAR BAIL PLUNGER
PULL BAR BAIL
PULL BAR
TYPE BAR



A SPACING RACK

B SPACING GEAR

C SPACING SHAFT

D MAIN SHAFT GEAR

E SPACING SHAFT GEAR

F TYPE BAR

G PULL BAR

H CODE BARS

I FRONT CARRIAGE TRACK

SUBJECT: SPACING

REFERENCE: TELETYPE BULLETIN NO. 144, Page 6, Fig 10 and 12B

General:

Spacing is controlled by the printing bail through the medium of the spacing escapement pawl's operating arm which is mounted on the printing bail.

When the printing bail is to the rear, (it's normal position), the rear escapement pawl is engaged with a tooth on the spacing escapement ratchet. When the printing bail starts forward the lower arm of the spacing escapement pawl's operating arm begins to apply pressure to the forward arm of the rear escapement pawl. When the printing bail has traveled three quarters (3/4) of the way forward the spacing escapement pawl's operating arm has disengaged the rear spacing escapement pawl from the ratchet. Through the medium of the spacing train the type bar carriage is moved one sixth (1/6) of a space.

The spring that holds the front and rear escapement pawls against the ratchet furnishes the power to engage the front escapement pawl with the ratchet as soon as the rear escapement pawl is disengaged from the ratchet. The printing bail continues it's forward movement and a character is printed.

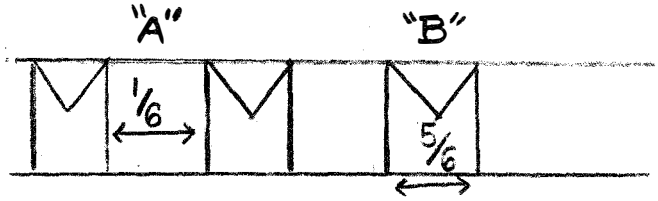
When the printing bail starts its rearward movement the spacing escapement pawl's operating arm applies pressure to the upper arm of the front escapement pawl and when the printing bail is about three quarters (3/4) of the way to the rear the front escapement pawl is disengaged from the ratchet and through the medium of the spacing train the type bar carriage is moved the remaining five-sixths of a space.

The rear escapement pawl engages the ratchet as soon as the front escapement pawl has been disengaged. The printing bail completes its travel and the machine is in a normal position.

The spacing sleeve has made one-third of a revolution for the operation and the type bar carriage has been moved one space.

NOTES

SUBJECT: SPACING ILLUSTRATION



1. When the printing bail has moved three quarters of the way FORWARD, the typebar carriage will move 1/6 of a space to the right as shown in "A" above. Then when the printing bail completes the forward stroke, the character is printed with the remaining 5/6 of a space as indicated in "B" above.

2. When the printing bail has moved three quarters of the way FORWARD, the typebar carriage will move to the right 5/6 of a space. (This is the same 5/6 of a space within which the character was printed).

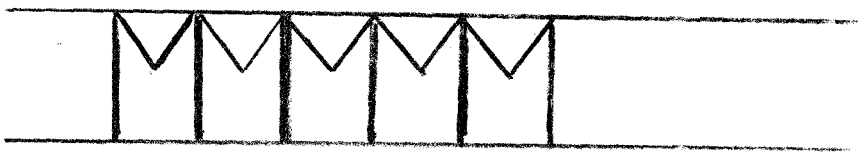
3. From the above the following can be stated;

   a. Each spacing operation is equal to 6/6 of a space.

   b. Spacing between characters is 1/6 of a space.

   c. The character itself utilizes 5/6 of a space.

4. If it were not for the 1/6 of a space the typebar carriage moves when the printing bail has completed approximately three quarters of its forward movement, a continuous string of M's would appear as shown below:



Note: The measurements of the drawings on this page are not accurate, but are used for illustrations purpose only.

SUBJECT: TRAIN OF PARTS OF SPACING OPERATION

REFERENCE: Teletype Bulletin No. 144 page 6, para. 3 Fig. 10 & 12A

TRAIN OF PARTS FOR SPACING OPERATION

1. MAIN SHAFT SPACING GEAR, which is part of the spacing sleeve meshed with the
2. SPACING SHAFT GEAR, which turns the
3. DRIVING MEMBER OF THE CARRIAGE RETURN CLUTCH which turns the
4. DRIVEN MEMBER OF THE CARRIAGE RETURN CLUTCH which is attached to the lower end of the
5. SPACING SHAFT. on the upper end of the spacing shaft is the
6. SPACING GEAR, which meshes with the
7. SPACING RACK. The spacing rack is mounted on the back of the
8. TYPE BAR CARRIAGE.

MAIN SHAFT SPACING GEAR
SPACING SHAFT GEAR
DRIVING MEMBER OF CARRIAGE RETURN CLUTCH
DRIVEN MEMBER OF CARRIAGE RETURN CLUTCH
SPACING SHAFT
SPACING GEAR
SPACING RACK
TYPE BAR CARRIAGE

NOTES:

SUBJECT: OPERATION OF THE SPACING STOP LEVER

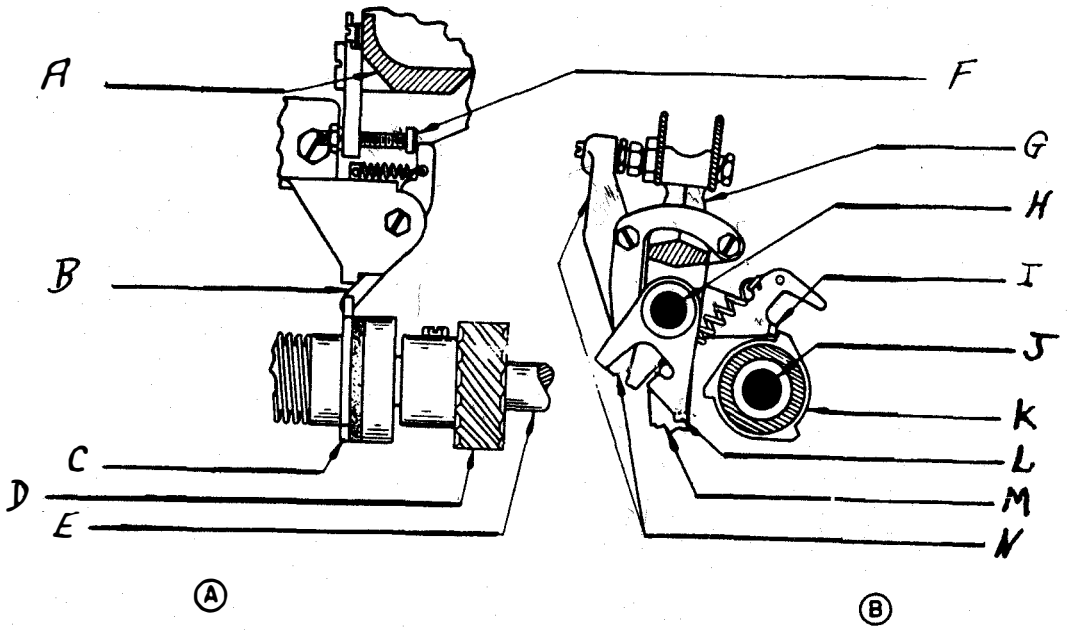
Reference: Teletype Bulletin 144, page 6, paga 3, Fig., 12A

After seventy two (72) characters have been printed, completing a full line, some method must be used to stop the movement of the typebar carriage.

When the

1. TYPE BAR CARRIAGE moves to the right margin, the
2. RIGHT MARGIN ADJUSTING SCREW comes into contact with the
3. SPACING STOP LEVER and moves the lower end of it into the path of a projection on the
4. SPACING SLEEVE. The entire spacing train is stopped and the type bar carriage stops.

TYPE BAR CARRIAGE
RIGHT MARGIN ADJUSTING SCREW
SPACING STOP LEVER
SPACING STOP SLEEVE
SPACING SLEEVE



A Type BAR CARRIAGE

B SPACING STOP LEVER

C SPACING STOP SLEEVE

D MAIN SHAFT SPACING GEAR

E MAIN SHAFT

F RIGHT MARGIN ADJUSTMENT SCREW

G PRINTING BAIL

H MAIN BAIL SHAFT

I REAR SPACING ESCAPEMENT PAWL

J MAIN SHAFT

K SPACING RATCHET

L FRONT SPACING ESCAPEMENT PAWL

M FUNCTION BAIL

N SPACING ESCAPEMENT PAWLS OPP ARM

MARGIN BELL

GENERAL: Before the type bar carriage reaches the end of its travel it rings the margin bell as a warning to the operator that the end of the line is near. The margin bell pawl on the type bar carriage depresses the margin bell cam which rotates the cam shaft which moves the bell hammer away from the bell against the tension of its spring. When the pawl slips off the end of the cam, the bell hammer spring snaps the bell hammer against the bell.

SUBJECT: MARGIN BELL

REF: Teletype bulletin 144, page 7, fig 13

THE

1. MARGIN BELL PAWL is mounted on the rear of the typebar carriage. As the typebar carriage is moved from left to right, the margin bell pawl depresses the

2. MARGIN BELL CAM which rotates the

3. MARGIN BELL CAM SHAFT which moves the

4. MARGIN BELL HAMMER away from the

5. MARGIN BELL against the tension of the

6. MARGIN BELL SPRING. As the margin bell pawl is moved beyond the margin bell cam, the margin bell cam is released and the margin bell spring pulls the margin bell hammer against the margin bell.

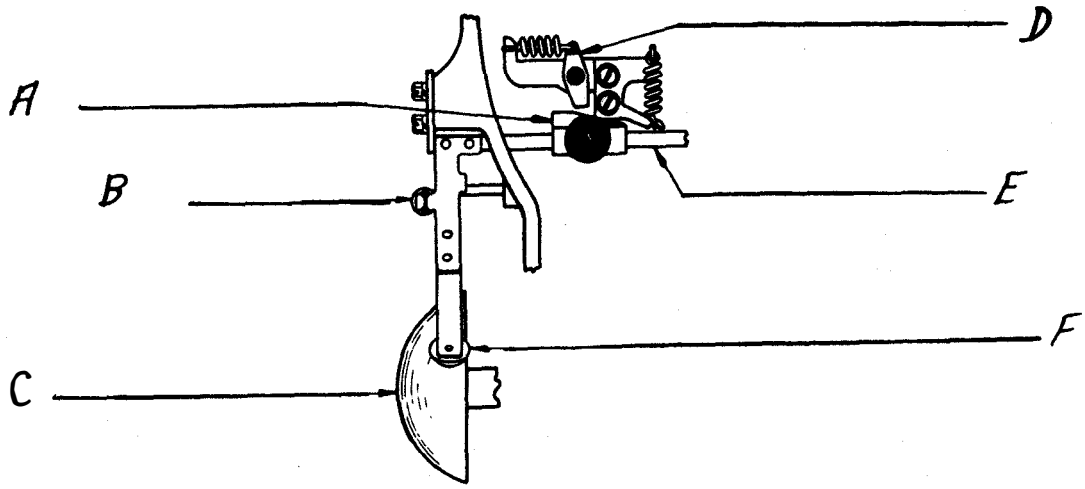
MARGIN BELL PAWL
MARGIN BELL CAM
MARGIN BELL CAM SHAFT
MARGIN BELL HAMMER
MARGIN BELL SPRING
MARGIN BELL

Note: On the return of the carriage from right to left, the margin bell pawl pivots (against the tension of its spring) as it strikes the margin bell cam. This prevents the ringing of the margin bell as the typebar carriage is returned to the left.

NOTE: The margin bell should ring just as the 66th character is printed.

- -

NOTES.....



A MARGIN BELL CAM

B MARGIN BELL HAMMER SPRING

C MARGIN BELL

D MARGIN BELL PAWL

E MARGIN BELL CAM SHAFT

F MARGIN BELL HAMMER

SUBJECT: TERMINAL BLOCKS AND ELECTRICAL CONNECTIONS

The electrical circuits of the Model 19 can be traced to 4 terminal blocks, 2 sets of spring and button contacts, 2 sets of slip connectors, and a Send-Receive-Break switch assembly

These terminal blocks are located on the base unit. The slip connectors and 2 sets of spring and button contacts permit the removal of the keyboard unit, Transmitter Distributor unit, typing unit and motor unit from the base unit without disturbing or disconnecting the wires

PHYSICAL LOCATION ON THE BASE UNIT

RELAY BLOCK
61 - 66

TYPING UNIT SPRING & BUTTON CONTACTS
9-10-11-12

MOTOR UNIT SPRING & BUTTON CONTACTS
13-14-15-16

RECEIVE BLOCK
41 - 46

SEND BLOCK
31 - 36

SEND-RECEIVE-BREAK CONTACTS
1&2, 3&4, 5&6

KEYBOARD SLIP CONNECTORS
51 - 58

POWER BLOCK
21 - 26

TERMINAL BLOCK DESCRIPTION

NAME	TERMINALS	PURPOSE
POWER or "20" block	21 thru 26	Distributes AC and DC power for all circuits except loop circuit on the base
SEND or "30" block	31 thru 36	Connect send leg of the line to the base unit
RECEIVE or "40" block	41 thru 46	Connects receive leg of the line to the base unit
RELAY or "60" block	61 thru 66	Connects relay mounting bracket to base unit (in receive leg of the line)

SLIP CONNECTORS DESCRIPTION

KEYBOARD or "50"	51 thru 58	Connects the keyboard unit to the base unit
TD	1 thru 9	Connects the TD unit to its base unit

Spring and Button Contacts Description

Name	Terminals	Purpose
Typing Unit	9-10-11-12	Connects the typing unit to the base unit
Motor Unit	13-14-15-16	Connects the motor unit to the base unit

Send-Receive-Break Contacts Description

Name	Purpose
SRB 1&2	Not used in our machines. (Used where TD lockout operation is required)
SRB 3 & 4	In the send leg of the line circuit. Wired in parallel with the keyboard transmitting contacts. Contacts are open when the SRB lever is in the upper or send position, permitting keyboard transmission. Contacts are closed when SRB lever is in the middle or receive position, this shorts out the keyboard transmitting contacts, making keyboard transmission impossible
SRB 5 & 6	In the send leg of the line circuit, but actually wired in series with the teletype loop. The contacts are closed in the upper or send and middle or recive positions of the SRB lever. Contacts are open when SRB lever is in the lower or break position. this opens or breaks the continuity of the teletype loop.

Summary Of Action Of SRB Lever & Contacts

Lever	Contacts	Condition of Machine
Send (upper) position	3 & 4 Open 5 & 6 Closed	Can SEND or Receive
Receive (middle) position	3 & 4 Closed 5 & 6 Closed	Can Receive only
Break (lower) position	3 & 4 Closed 5 & 6 Open	Teletype loop is Opened. No one on loop can sind or receive

Notes;..

SUBJECT: BLOCKS AND CONNECTIONS BELOW THE TABLE ON THE MODEL 19

REFERENCE: Wiring diagram on Page 141 of this Study Guide.

R SWITCH - Located on right hand side controls AC to the J SOCKET and therefore controls the rectifier when it is plugged into the J SOCKET.

S SWITCH - Located to the left of the R SWITCH, controls the T.D. motor and control circuit current.

LINE SWITCHING KEY - A three position switch. In the LEFT position the printer is connected into LINE ONE, CENTER position to LOCAL TEST and when in the RIGHT position connects the printer into LINE TWO.

BLOCKS, SOCKETS, PLUGS, ETC., LOCATED ON THE REAR OF THE TABLE

A BLOCK - AC terminal block. Numbered 21A through 46A.

B BLOCK - DC terminal block for DC and T.D. circuits. DC connections made on 21B to 37B. T.D. connections from 38B to 46B.

F - Convenience outlet. AC from 25A and 26A. For convenient plugging in of soldering iron, trouble light etc.

G - Fusetron holder for T.D. motor and control circuit. AC from 27A and 28A. (1.25Amp)

H - Fusetron holder for reperforator motor circuit. AC from 29A and 30A. (1.4 Amp)

J SOCKET - Used for AC INPUT to REC-30. When plugged in the socket the REC-30 can be controlled by the R switch.

K SOCKET Connects AC from 43A and 44A to the printer motor.

L SOCKET Connects DC from 29B and 31B to the printer COMMON DC circuits.

M PLUG ALL DC from the Rectifier enters the table through this plug for distribution.

LINE JACKS

The SEND and RECEIVE legs of the line may be plugged into these jacks and the printer will be in series with the line circuit of the table.

TEST JACKS

Test equipment may be inserted in the LOCAL TEST line circuit when inserted in these jacks or the printer SEND and RECEIVE legs of the line may be inserted and the machine will operate in LOCAL TEST only.

AF BLOCK

Used to furnish 60 ma D.C. to LINE ONE when required. The AF block has positive and negative terminals and when used is placed in series with the loop.

AG BLOCK

Used to furnish 60 ma D.C. to LINE TWO when required.

C BLOCK

Printer block . The printer and T.D. line circuit connections are made on this block.

D BLOCK

Reperforator block. When used, reperforator line connections made on this block.

E BLOCK

Line block. External teletype loop connects to the table on this block.

AA SWITCH

Used for a choice of AC for motors and T.D. Control Circuit either from the REC-30 or local power source.

AB PLUG

Receives AC from the rectifier. This is where controlled AC from the REC-30 comes to the table for distribution.

T SOCKET

Common DC for the reperforator comes from here.

REPERFORATOR JACKS

SEND and RECEIVE legs of the reperforator line circuit may be inserted here.

U SOCKET

AC for reperforator motor circuit.

RECTIFIER POWER PLUGS, CORDS

J PLUG - Rectifier INPUT. Connects AC from the J SOCKET of the table .

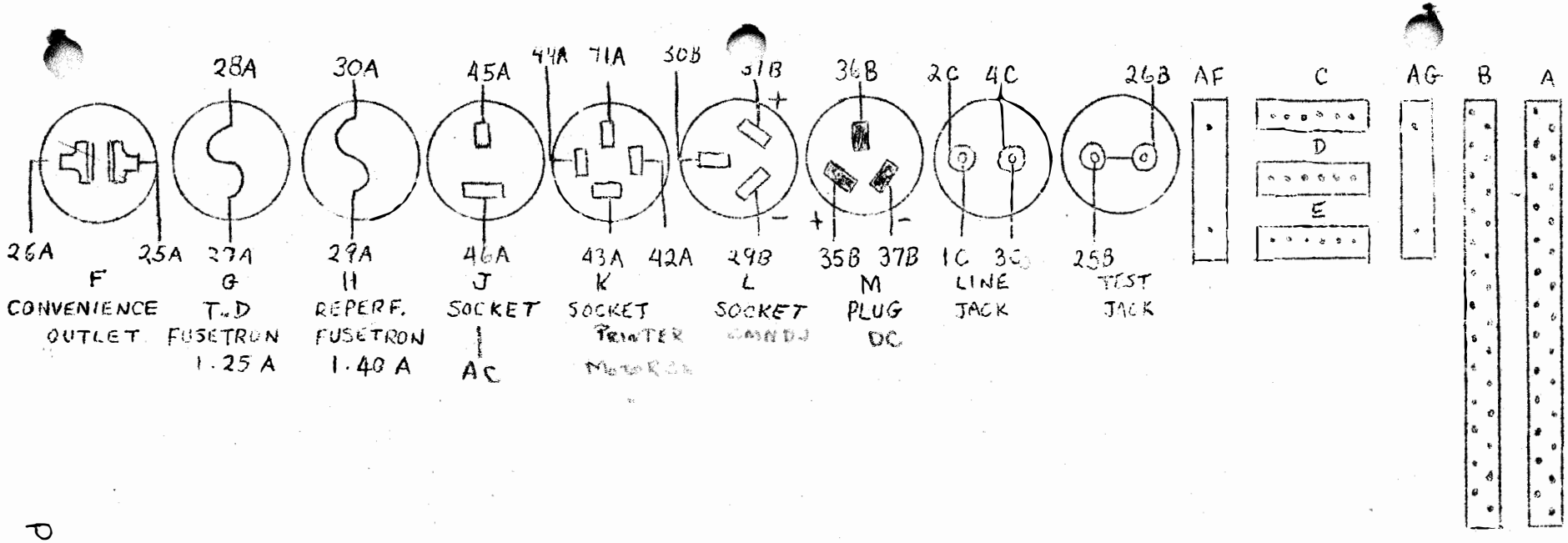
M SOCKET - Rectifier D.C. OUTPUT. Connects D.C. from the rectifier to the table.

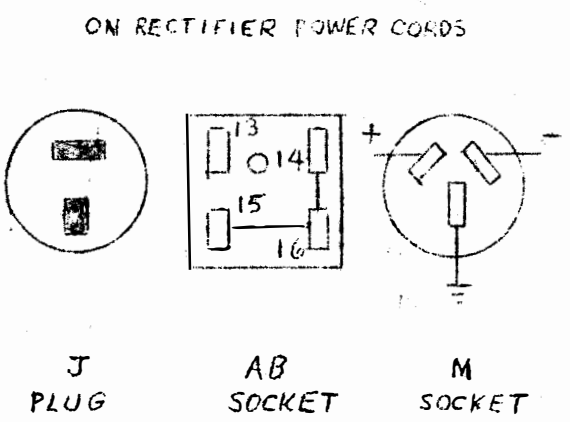
AB SOCKET- Rectifier AC OUTPUT. Connects AC from the rectifier to the table.

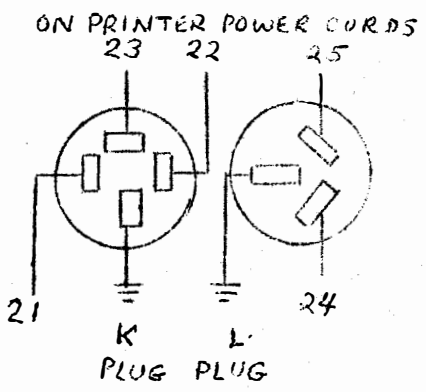
PRINTER POWER CORDS

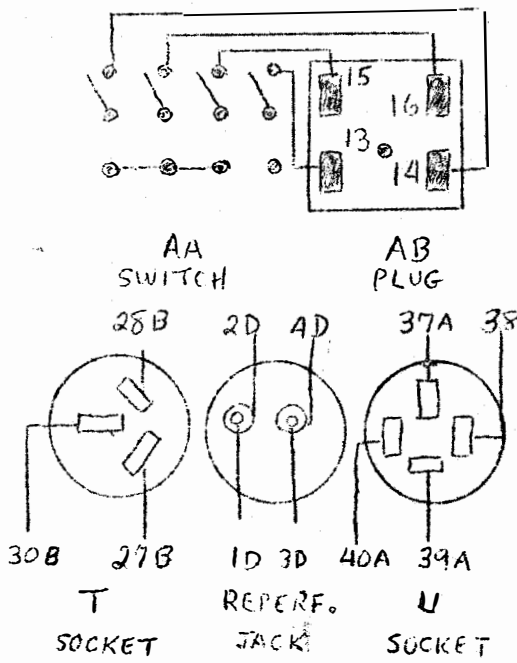
K PLUG - Connects AC to 21 and 23 on the POWER BLOCK for the printer motor from the K SOCKET on the table.

L PLUG - Connects COMMON DC from the L SOCKET to 24 and 25 on the POWER BLOCK for the printer COMMON DC.









MODEL 19 TELETYPEWRITER
REAR CONNECTIONS

Subject: Teletype Motors Unit #-7
Ref: Teletype bulletin 144, page 10, fig 41

There are three different types of motors generally used on teletype equipment.

1. DC governed motors may be used in a few instances, but rarely seen in the field.

2. AC synchronous motors will be used to a large extent when 60 cycle AC is available. The speed of this motor is kept constant as long as the 60 Cycle current remains constant. If the power supply does not keep a constant frequency, the motor speed will vary. The synchronous motor is the most satisfactory on large ships and on shore installations where constant 60 Cycle AC is available. In this school, you will see this motor on the model 14.

3. AC governed motors are the type used on our model 19 here in school. They will operate on AC of any frequency from 25 to 60 cycles . Their speed is kept constant by the use of a governor. The brushes and governor contacts in this type of motor must be checked frequently to prevent having motor trouble.

GOVERNOR ACTION

With an AC series wound motor a governor is used to maintain a speed of 2100 RPM. Without a governor the property of this type motor is to run faster until it reaches some speed above 2100RPM. If the load on the motor were heavy enough this would be a speed limiting factor, but our teletype load is not constant nor would it keep the motor slow enough.

In order to control the speed while the motor is running, when it reaches a speed of about 2105 RPM a pair of contacts open, so that the directpath of current to the motor is interrupted. The current to tun the motor will have to go through 150 ohms of resistance, which limits the current flow so that not enough will go through the motor to keep it running full speed. As soon as the motor speed is slowed down to about 2095 RPM the governor contacts close again, and there is a direct path for our current to the motor. It speed up again till it is going about 2105 RPM when the contacts open. While the motor is running the governor contacts are opening and closing many times per second. The motor will be running at an average speed of 2100 RPM, from 5RPM, faster to 5 RPM slower.

Centrifugal force which increases as the speed of rotation increases, causes the contacts to open , and an adjustable spring pulls them closed again when the speed slows down.

The governor is mounted on the back end of the motor shaft and rotates with the motor.

Connection to the governor is made at the inner and outer contact discs by brush springs with a carbon brush on them. The brushes are stationery and the discs can slide by them always making electrical contact.

Connected to the discs are contact springs which electrically connect to metal blocks inside the governor.

One block has a contact on it, while the other block has a contact arm with a contact on its end to match the contact on the first block. If these contacts are closed there is a complete circuit through the governor, or from one brush spring through the governor to the other brush spring.

An adjustable contact arm spring is inside the governor, pulling on the contact arm in a direction to hold the contacts closed.

There is a leather covered adjusting wheel protruding through the front and back side of the governor case. Turning this wheel regulated the tension of the contact arm spring.

The tighter this spring is the more centrifugal force will be required to open the contacts. Therefore the motor will have to run faster before they will open, There is a speed adjusting lever in front of the governor which can be pressed against the front protrusion of the leather covered wheel. While the motor is running, this will turn the wheel in a direction to apply more tension to the spring.

If this contact arm spring is made weaker, less centrifugal force will be required to open the contacts. The motor will run too slow.

There is a speed adjusting bracket to the rear of the governor. Pressing on this bracket while the motor is running will cause the adjusting wheel to turn in a direction to loosen the spring tension and the motor will run slower.

To adjust the motor speed of the printer and TD motors it is recommended to get an approximate speed first. After working with the equipment you will soon be able to tell if the motor is running too fast or too slow, but until you get practice, here is a very good way to check. Six (6) operations of the machine make one word and the machine operates at approximately 1 WPS. The margin bell should ring on the 66th space. Now depress the space bar until space repeat is accomplished. It should take the type bar carriage approximately 11 seconds to ring the margin bell, or 12 seconds to reach the right margin (72 charactor line).

To get an exact motor speed, the governor has a target wheel on the back with alternate black and white spots. there is a target lamp which will shine on the target wheel when it is desired to check the motor speed.

A special tunning fork which vibrates at 87.6 VPS which has a shutter on the prongs, can be used to get an exact speed. While the fork is vibrating the shutters are open only for a small fraction of a second. When the motor is running at its exact speed, if you look through the sutter, you will see what appears to be a stationary black and white spots on the target wheel. This is because you are only seeing the target wheel for a brief interval, and before the spot has a chance to turn, your vision is cut off and you will next see a later spot as being stationary. The vibrations of the tuning fork coincide with the speed of rotation of the spots of the target wheel when the speed is correct.

If the motor is running too fast, the spot will appear to be going with the rotation of the motor, and if it is running too slow, the spots will appear to be going backwards or against the rotation of the motor.

Care must be taken to have a approximate speed first or there would be no difinite spots, and you may get a harmonic with the motor going too fast or too slow by a definite amount, such as ten or twenty percent.

In this case, the spots would not appear to be their correct size.

NOTES

- -

SUBJECT: MOTOR SPEED CONTROL

REFERENCE: Teletype Bulletin No. 144 page 20.

The method of quick setting for motor speed adjustment. The following procedure is given to enable a rough setting of the motor speed adjustment when no tuning fork is available or the use of the preliminary setting for motor speed prior to checking with a tuning fork

A. Return the carriage to the extreme left margin.

B. Depress the space repeat rod and note starting time on a watch.

C. Allow the carriage to travel the entire distance to the right margin stop.

D. T ravel time should be 11 3/4 seconds, or just under 12 seconds.

Optional Setting

With the margin bell in adjustment (ringing on the 66th character and the carriage from its extreme left hand margin, it should take exactly [redacted] seconds to travel to the 66th character.

SUBJECT: PRINTER MOTOR CIRCUIT
REFERENCE: WIRING DIAGRAM PAGE 81

AC to run our printer motor comes to the power block at 21 and 23. Between 21 and 22 is the printer motor control circuit. This consists of a 1.6 fusetron for protection against an electrical short or overload. Also in the control circuit is a switch to turn the motor ON or OFF. If desired, the printer can be equipped with a pair of motor stop contacts and mechanism which can turn all machines in the loop OFF when any one of the stations sends an upper case "H" (Motor Stop) to the Line. "H" in upper case triggers a train of parts that mechanically opens all Motor Stop contacts in the loop stopping all printer motors. The Motor Stop contacts can all be closed again by any station in the loop by opening the Line momentarily with the Break key and all motors will again run.

The circuit from the typing unit to the Motor Stop contacts is completed thru Spring and Button contacts 9 and 10. In this school we have 9 and 10 shorted together thus disabling the Motor Stop contacts. If any part of the Motor Control circuit is open, the motor will not run.

Below is the circuit run of the Printer Motor Circuit with the Governor Contacts open. In this condition there is an added resistance in series with the motor that slows our motor speed.

21 - Beginning at 21 we go through the Motor Control Circuit to
22. Through 150 ohms of resistance made up of two 300 ohm resistors in parallel. Half the current goes through one resistor to 16 and the other half goes to 15, then 14 and through the other 300 ohm resistor to
16. From 16 we go through the
Field Winding,
The Brush Holder and Brush,
The Armature,
The other Brush holder and Brush
13
23

On the following page we will go through the Printer Motor Circuit with the Governor Contacts Closed. It is suggested that you use the space below to draw the circuit with the Governor Contacts open.

SUBJECT: PRINTER MOTOR CIRCUIT (CONTINUED)
REFERENCE: WIRING DIAGRAM PAGE 81.

Below we will go through the Printer Motor Circuit with the Governor Contacts CLOSED. In this condition we remove the 150 ohms resistance in series with the motor and therefore having more current the motor will gain speed.

Again we begin at	21
Go through the	Motor Control Circuit
To	22
To	14
Through the	Filter (Prevents arcing and radio interference)
Through the	Governor Fingers and Contacts, tie-point 16,
The	Field Winding, Brush holder and Brushes
Through the	Armature
	Brush holder and Brushes, Field winding
To	13
	23

It is suggested you use the space below to draw the circuit described above.

SUBJECT: AC CIRCUITS OF THE MODEL 19 TABLE

REF: Wiring diagram, page 144 of this study guide

AC first comes to the M-19 table to 21A and 22A, 21A being the "hot" side and 22A is the same potential as ground.
21A, 23A and 25A jumpered together
22A, 24A and 26A jumpered together
F outlet (convenience) is across 25A and 26A
26A jumpered to 45A
25A jumpered to 31A-33A
31A-33A through "R" switch to 32A-34A
34A jumpered to 46A
J socket across 45A and 46A
J plug through REC-30 and out the "AB" socket
AB-14,15 & 16 shorted together and is "hot" AC
AB-13 is ground potential (common return for 14, 15 & 16)
AB-13, 14, 15 & 16 to AA switch-13, 14, 15 & 16 respectively

Comming from the AA switch are three circuits which are:

1. PRINTER MOTOR
   a. AA-14 to 44A
   b. 44A to "K" socket
   c. K socket to 43A
   d. 43A to 39A
   e. 39A to AA-13

NOTE: "K" socket furnishes AC to the printer base to run the printer motor when the "K" plug is inserted (see page 82 for WD of motor)

2. REPERFORATOR MOTOR
   a. AA-16 to 29A
   b. 29A to "H" fuse holder
   c. H fuse holder to 30A
   d. 30A to 40A
   e. 40A to "U" socket
   f. U socket to 39A
   g. 39A to AA-13

NOTE: "U" socket furnishes AC to the reperforator motor if the "U" plug is inserted

3. TD MOTOR AND CONTROL CIRCUIT

A. TD motor

(1) AA-15 to 27A
(2) 27A to "G" fuse holder
(3) G fuse holder to 28A
(4) 28A to 36A
(5) 36A to S switch
(6) S switch to 35A
(7) 35A to 41B
(8) 41B to TD SC-6
(9) TD SC-5 to 42B
(10) 42B to 43A
(11) 43A to 39A
(12) 39A to AA-13

NOTE: TD slip connection (SC) 5 & 6 furnish AC to run the TD motor when the TD is inserted (see page 110 for WD of circuit)

B. TD control

(1) 41B to 39B
(2) 39B to TD SC-8
(3) TD SC-8 through STOP TAPE MAGNET to END OF TAPE CONTACTS
(4) EOT contacts to STOP TAPE SWITCH
(5) ST switch to TIGHT TAPE CONTACTS
(6) TT contacts to TD SC-7
(7) TD SC-7 thru resistor to TD SC-9
(8) TD SC-9 to 38B
(10) 38B to 42B

NOTE: See page 105 for another wiring diagram

The "AA" switch may also be thrown in a down position. then there is no connection from the center of the switch to the AB plug. A connection is made directly to AA-13 from 24A and AA-14 to 23A. AA-14, AA-15 and AA-16 are shorted together on the lower side of the AA switch. So we see we can energize the three circuits from the external AC that enters the table at 21A and 22A, without going through the REC-30, simply by switching the AA switch to the lower position.

- -

NOTES.....

TYPICAL FUNCTION

GENERAL: As previously stated, there are two types of operations that can be performed by the typing unit. The first embodies those mechanical actions directly necessary to the actual printing of a character. The second type of of operation embodies mechanical action supplementary to the printing of a character or that which alters the position of various mechanisms and is known as a function. Ten functions generally found on standard model teletype machines or can be added if desired are: BELL, BLANK, CARRIAGE RETURN, FIGURES(SHIFT), LETTERS (UNSHIFT), LINE FEED, LOCKING, MOTOR STOP , SPACE AND UNIVERSAL.

In learning a typical function, we are concerned with the operation of all parts in the printer that are common to any selected function that has a function lever. Observe the operation of the Function Bail Cam on the Main Bail Sleeve - the part of the Main Shaft assembly that turns ONLY when permitted to turn. The Function Bail and its associated blade that directly operates the selected function mechanisms - either Push Bars or Latch Bars - depending on the function, as the blade travels from the front of the machine to the rear. And the POWER for the rearward travel is ALWAYS THE FUNCTION BAIL CAM. Therefore the POWER to cause the Function Bail and its blade to be moved back to the front of the machine-its normal stop position- is ALWAYS THE FUNCTION BAIL SPRING. This occurs as the Function Bail Roller is presented with the low side of the Function Bail Cam allowing the Function Bail Spring to take over and bring the Function Bail Blade back toward the front of the machine.

Remember the Printing Bail Cam and Function Bail Cam are BOTH mounted on the Main Bail Sleeve assembly - when the sleeve rotates they both rotate. Now, in order to permit the selected function lever to move forward, the Function Lever Bail must move forward to permit the Function Levers to move against the the vanes(powered by the Function Lever Springs.)

Since ONLY the selected Function Lever will be allowed to move its front extension into the vanes, it will be the only one rotating its rear extension far enough to set its function into operation.

Here is the complete operation of a typical function:

The PRINTING BAIL MOVES FORWARD.
Th FUNCTION LEVER BAIL ROLLER MOVES DOWN OFF THE HIGH PORTION OF THE FUNCTION LEVER REAR ARMS.
THE FUNCTION LEVER SPRINGS THEN PULL THEIR RESPECTIVE LEVERS AGAINST THE VANES. THE NOTCHES IN THE FORWARD ARMS OF THE FUNCTION LEVERS PERMIT THE SELECTED FUNCTION LEVER TO MOVE FARTHER FORWARD THAN THE REMAINING FUNCTION LEVERS, ROTATING ITS REAR EXTENSION UPWARDS AND TAKING THE ASSOCIATED PUSH BAR UP INTO THE PATH OF THE FUNCTION LEVER BLADE.

After the Function Lever Bail moves forward enough to release the Function Levers,
THE FUNCTION BAIL ROLLER STARTS TO RIDE UP ON THE HIGH PART OF THE CAM, STARTING THE FUNCTION BAIL BLADE TO THE REAR.
AS IT GOES TO THE REAR THE FUNCTION BAIL BLADE WILL ENGAGE AND OPERATE ANY FUNCTION PUSH BAR IN ITS PATH.
THE FUNCTION BAIL ROLLER AGAIN RIDES DOWN TO THE LOW PORTION OF THE FUNCTION BAIL CAM AND THE FUNCTION BAIL BLADE RETURNS TO ITS FORWARD POSITION IN READINESS FOR THE NEXT FUNCTION.

****

NOTES:

When in the selected position, the BELL, CARRIAGE RETURN, FIGURES, LETTERS, LINE FEED and MOTOR STOP Function Levers will be in the path of one of the blocking extensions on the Function Lever Bail. These extensions prevent the Printing Bail from moving forward far enough to allow the Type Bar Carriage to space.

The Function Lever Bail will NOT be blocked when LOCKING, UNIVERSAL, BLANK or SPACE ("LUBS") Function Levers are selected because their operation depends upon a complete travel of the Printing Bail.

The Sixth Vane regulates the operations of BELL and MOTOR STOP functions when the platen is shifted by the LETTER (UNSHIFT) Push Bar to which the Sixth Vane is attached.

SUBJECT: NOTES ON FUNCTION LEVERS

REFERENCE: Teletype bulletin No. 144 page 8 to 10, Fig. 17

FUNCTION BAIL

The FUNCTION BAIL is one fourth ($\frac{1}{4}$) of a cycle ahead of the printing bail/ When the printing bail is half way forward, the function bail is all the way forward.

FUNCTION BAIL CAM

The normal, or stop, position of the function bail roller is just off the high and low portion of the function bail cam.

BLOCKING PLATE

The following function levers DO NOT block the blocking plate:

1. LOCKING FUNCTION LEVER
2. UNIVERSAL FUNCTION LEVER
3. BLANK FUNCTION LEVER
4. SPACE FUNCTION LEVER

FUNCTION LEVER BAIL ROLLER

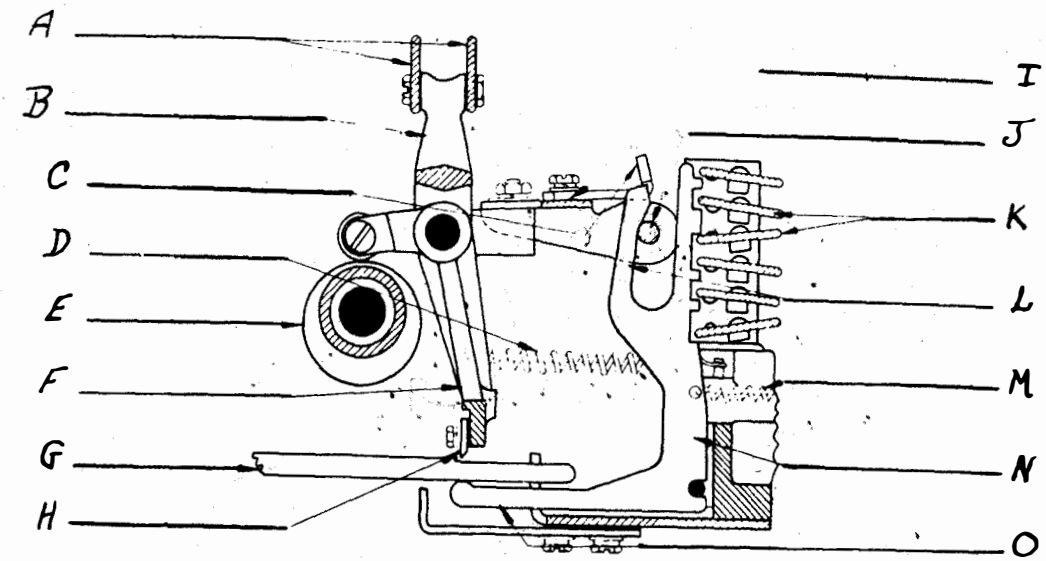
1. Rides on the high cam surface of the rear arms of the function levers, when the printing bail is in the normal position.

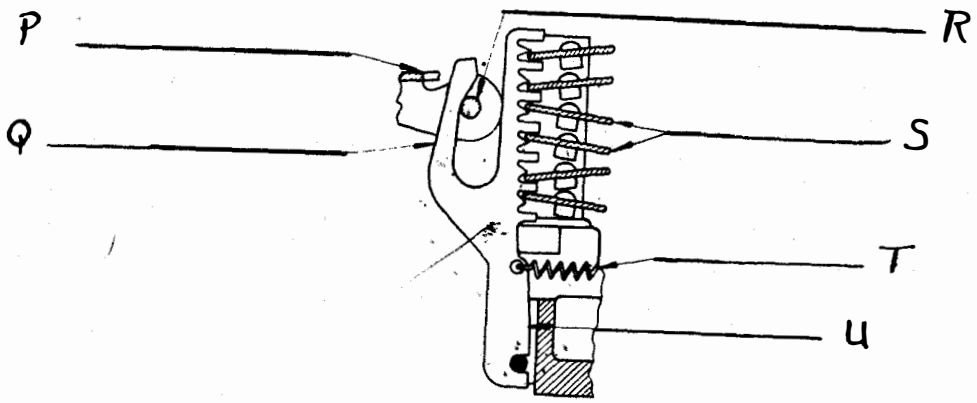
2. Allows the function levers to enter the vanes of the forward movement of the printing bail.

NON SPACE ON BLANK FUNCTION LEVER

Blocks the Blocking Plate so there will be no spacing when the blank function is selected.

NOTES:





A PRINTING BAIL BLADES

B PRINTING BAIL

C BLOCKING EXT.

D FUNCTION BAIL SPRING

E FUNCTION BAIL CAM

F FUNCTION BAIL

G SHIFT PUSH BAR

H FUNCTION BAIL BLADE

I FUNCTION LVR BAIL

J FUNCTION LVR BAIL ROLLER

K 2&3 YAINS

L 5th YAIN

m FUNCTION LVR SPRING

N FUNCTION LVR
FUNCTION LVR

O REAR EXT.
FUNCTION LVR

P BAIL
FUNCTION LVR REAR

Q ARM
FUNCTION LVR BAIL

R ROLLER

S 3&4 YAIN
LOCKING

T FUNCTION LVR SPRING
LOCKING

U FUNCTION LVR

SIGNAL BELL

GENERAL: Signal bell, being a common function of the Model 19 printer unit is used between operators to bring attention to and unattended machine at a distant station. Therefore with the proper combination of intelligence impulses sent over the line circuit we can cause the machines on a circuit to signal bell. This is accomplished first by selecting the figures combination operating the sixth vane so when the letter "S" combination is selected the printer will be set up so as to block the printing of the letter "S" thru the signal bell function lever blocking the travel of the printing bail from completing its complete travel forward, which is necessary for the printing operation. And at the same time the rear extension of the signal bell function lever causing the signal bell train of parts to trip and ring the bell as well as to reset after ringing the bell. This is accomplished in the following order. When the bell function lever is selected, its extension raises the bell latch bar from its latch. This releases the bell operating lever, its spring rotates it, and it strikes the bell hammer arm extension, which throws the bell hammer against the bell. The bell reset bar and the bell latch bar, both pivoted on the bell operating lever screw, are reset by the function bail as it returns to its rear position and the blade engages the notch on the reset bar.

SUBJECT: SIGNAL BELL FUNCTION TRAIN OF PARTS

Ref: Teletype Bulletin 144, page 10, Fig. 23

When the

1. SIGNAL BELL FUNCTION LEVER enters the vanes, the
2. SIGNAL BELL FUNCTION LEVER EXTENSION raises the
3. SIGNAL BELL LATCH BAR out of engagement which the
4. SIGNAL BELL LATCH BAR LATCH. This releases the
5. SIGNAL BELL OPERATING LEVER and it rotates, due to the tension of the
6. SIGNAL BELL OPERATING LEVER SPRING and forces the
7. SIGNAL BELL HAMMER ARM EXTENSION up and to the rear, causing the
8. SIGNAL BELL HAMMER to strike the
9. SIGNAL BELL.

SIGNAL BELL FUNCTION LEVER
SIGNAL BELL FUNCTION LEVER EXTENSION
SIGNAL BELL LATCH BAR
SIGNAL BELL LATCH BAR LATCH
SIGNAL BELL OPERATING LEVER
SIGNAL BELL OPERATING LEVER SPRING
SIGNAL BELL HAMMER ARM EXTENSION
SIGNAL BELL HAMMER
SIGNAL BELL

Notes:

SUBJECT: RESETTING THE SIGNAL BELL

REF: Teletype Bulletin No. 144 page 10, Fig 23

The---

1. FUNCTION BAIL BLADE, when moving to the rear, engages the notch on the

2. SIGNAL BELL RESET BAR. which is kept in the path of the function bail blade at all times, by the spring connecting the arms of the reset and latch bars, the

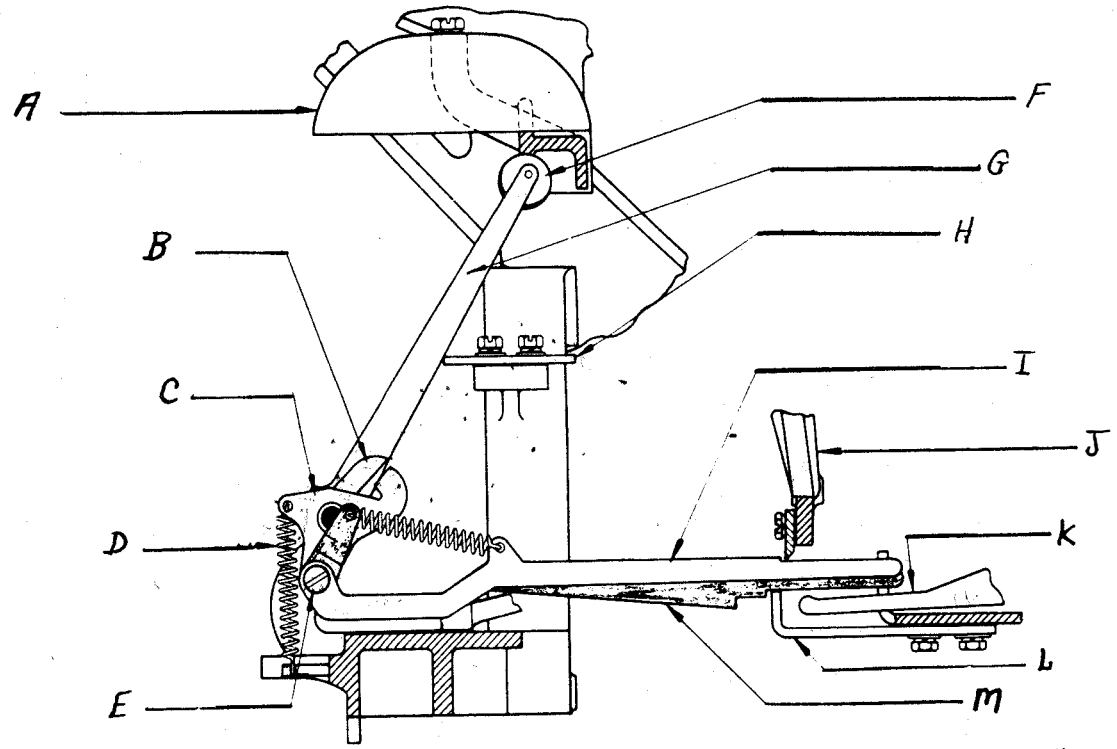
3. SIGNAL BELL LATCH BAR, being pivoted on the same screw with the reset bar, also moves to the rear and is pulled downward until the

4. SIGNAL BELL LATCH BAR LATCH, engages a notch on the signal bell latch bar.

FUNCTION BAIL BLADE
SIGNAL BELL RESET BAR
SIGNAL BELL LATCH BAR
SIGNAL BELL LATCH BAR LATCH

- -

NOTES:



A SIGNAL BELL

B SIGNAL BELL HAMMER ARM EXT.

C SIGNAL BELL OPR LVR

D S.B OPR LVR SPRING

E S.B. OPR LVR SCREW

F SIGNAL BELL HAMMER

G S.B. HAMMER ARM

H S.B HAMMER BACKSTOP

I SIG BELL RESET BAR

J FUNCTION RAIL

K S.B. FUNCTION LVR REAR EXT

L S.B. LATCH BAR LATCH

M S.B. LATCH BAR

CARRIAGE RETURN

GENERAL: Carriage return is another common function of the Model 19 printer unit which provides the sending operator with control of returning all the typebar carriages to the left margin for starting a new line of print. As in any typical function, you have a Function Lever . When you receive the correct combination of impulses for Carriage Return the Selector will set the Vanes in such a manner that when the Printing Bail is permitted to move forward the Carriage Return Function Lever will enter the Vanes. The rear arm of the Carriage Return Function Lever blocks the Printing Bail from coming all the way forward and printing is blocked. The rear extension of the CR Function Lever rotating up sets the Carriage Return train of parts into operation.

There are three steps involved in completing a Carriage Return operation :

1. The Typebar Carriage Clutch is disengaged which allows the Typebar Carriage to start moving to the left margin under the power of the Carriage Return Drum Spring.

2. Since the Carriage Return train of parts are reset during the same operation (as the Function Bail Blade moves to the rear) there is not enough time for the Typebar Carriage to complete the full travel from the right margin to the left margin, so,

3. The Carriage Return Lock mechanism is used to keep the Carriage Return Clutch disengaged until the Typebar Carriage has completed its complete travel to the left margin and releases the locking mechanism.

The complete operation is accomplished as follows: The Carriage Return Function is selected, the Function Lever Bail, moving forward, permits the Carriage Return Function Lever to enter the Vanes. This forces the Carriage Return Function Lever Rear Extension to move the Carriage Return Latch Bar upward away from its Latch. This releases the Carriage Return Operating Lever which, under spring tension, moves the Carriage Return Clutch Fork upward. This fork disengages the upper member of the Carriage Return Clutch from the Lower member. The Spacing Shaft may then turn freely in its sleeve making possible the return of the Typebar Carriage. The draw-strap of the Carriage Return Drum Spring is fastened to a post on the Typebar Carriage and it is this spring that actuates the return of the carriage.

While the Carriage Return Operating Lever is held by its spring, a series of levers move the Lock Bar until its notch engages the Lock Bar Latch. This holds the Carriage Return Clutch members disengaged and insures a complete return of the carriage. The Lock Bar may be operated manually.

(continued next page)

The speed with which the carriage returns makes it imperative to provide a dashpot to cushion the shock. The left margin adjusting screw on the carriage strikes the projecting front end of the dashpot lever and drives the plunger into the dashpot air chamber. The lower end of the lock bar latch is trapped in this action by the Dashpot Lever and the Lock Bar and the Carriage Return Clutch Fork are released. The clutch members then engage and the carriage is held in its extreme left position.

NOTES:

SUBJECT: CARRIAGE RETURN

Reference: Teletype Bulletin No. 144 page 9, Fig 20 A&B

As the carriage return combination is selected, the

1. CARRIAGE RETURN FUNCTION LEVER moves into engagement with the vanes and the

2. CARRIAGE RETURN FUNCTION LEVER EXTENSION raises the

3. CARRIAGE RETURN LATCH BAR out of engagement with the

4. CARRIAGE RETURN LATCH BAR LATCH. This action releases the

5. CARRIAGE RETURN OPERATING LEVER which is pulled down against the

6. CARRIAGE RETURN OPERATING LEVER STOP SCREW by the

7. CARRIAGE RETURN OPERATING LEVER SPRING, forcing the

8. CARRIAGE RETURN CLUTCH FORK to disengage the driving member from the driven member of the

9. CARRIAGE RETURN CLUTCH. Connected to the rear extension of the clutch fork is the

10. CARRIAGE RETURN LATCH LINK which is pulled downward when the clutch fork is moved by the operating lever causing the upper arm of the

11. BELL CRANK to rotate clockwise (as viewed from the front of the machine) and pull the lock bar to the right permitting the notch on the

12. CARRIAGE RETURN LOCK BAR to engage the

13. CARRIAGE RETURN LOCK BAR LATCH, thereby preventing engagement of the carriage return clutch member while the carriage is returning right to left.

Additional Notes (If desired)

CARRIAGE RETURN TRAIN OF PARTS

CARRIAGE RETURN FUNCTION LEVER

CARRIAGE RETURN FUNCTION LEVER EXTENSION

CARRIAGE RETURN LATCH BAR

CARRIAGE RETURN LATCH BAR LATCH

CARRIAGE RETURN OPERATING LEVER

CARRIAGE RETURN OPERATING LEVER STOP SCREW

CARRIAGE RETURN OPERATING LEVER SPRING

CARRIAGE RETURN CLUTCH FORK

CARRIAGE RETURN CLUTCH

CARRIAGE RETURN LATCH LINK

CARRIAGE RETURN BELL CRANK

CARRIAGE RETURN LOCK BAR

CARRIAGE RETURN LOCK BAR LATCH

NOTES:

SUBJECT: RESETTING OF CARRIAGE RETURN

Ref: Teletype Bulletin No. 144 page 10 fig 20B

While the type bar carriage is moving from right to left the

1. CARRIAGE RETURN RESET BAR is raised into the path of the function bail blade by the spring that connects the latch bar and the reset bar. The

2. CARRIAGE RETURN LATCH BAR is pulled down by the spring connecting the two bars until the latch bar latch engages the notch on the latch bar.

CARRIAGE RETURN RESET BAR
CARRIAGE RETURN LATCH BAR
CARRIAGE RETURN LATCH BAR LATCH

SUBJECT: TRAIN OF PARTS FOR RELEASE OF CARRIAGE RETURN

REFERENCE: Teletype Bulletin No. 144 page 9, Fig 26A

The - -

1. LEFT MARGIN ADJUSTING SCREW strikes the projecting arm of the

2. DASHPOT LEVER forcing the rear of the lever to strike the lower extension of the

3. CARRIAGE RETURN LOCK BAR LATCH disengaging it from the

4. CARRIAGE RETURN LOCK BAR, permitting the clutch members to engage through the medium of the driving clutch member compression spring.

LEFT MARGIN ADJUSTING SCREW

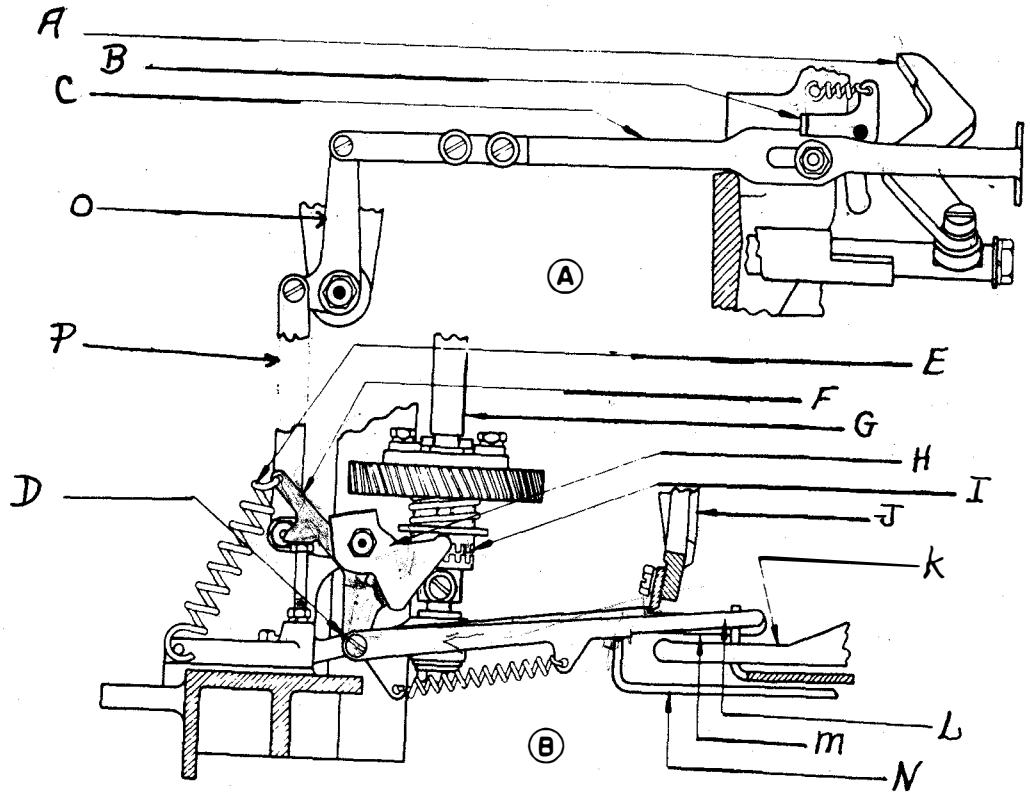
DASHPOT LEVER

CARRIAGE RETURN LOCK BAR LATCH

CARRIAGE RETURN LOCK BAR

- -

NOTES:



A DASH POT LVR

B CR LOCKBAR LATCH

C CR LOCK BAR

D FLOATING PIVOT

E CR OPERATING LVR SPRING

F CR OPERATING LVR

G SPACING SHAFT

H CR CLUTCH FORK

I CR CLUTCH

J FUNCTION BAIL

K CR FUNCTION LVR EXT

L CR LATCH BAR

M CR RESET BAR

N CR LATCH BAR LATCH

LINE FEED

GENERAL: For the Model 19 printer to cause the paper roll to rotate on the platen so as to allow continous page prin the line feed function is required. This gives the operat control of selecting and transmitting the combination of intelligence impulses to cause the selector units of all printers on the circuit to set up their vanes so that whe the line feed function lever is allowed to move forward , it will enter the vanes. This allows the rear arm to bloc the printing bail from moving all the way forward, so no printing will occur. At the same time the rear extension o the line feed function lever moves the push bar up into the path of the function bail blade and as it makes its travel to the rear the live feed train of parts are set into operation and the platen is rotated to cause the paper to be feed the number of lines which has been previously selected (either one of two lines) by the operator of the particular printer unit.

The rear extension of the line feed function lever is designed with an upper and lower extension, with the line feed push bar located between the two extensions. The upper extension will cause the push bar to be moved down out of path of the function bail blade as the printing bail moves to the rear, and keeps it there until the line feed selecti is selected again.

SUBJECT: TRAIN OF PARTS FOR LINE FEED FUNCTION

REFERENCE: Teletype Bulletin No. 144 page 10, Fig. 21

TRAIN OF PARTS OF LINE FEED FUNCTION.

As the line feed combination is selected, the

1. LINE FEED FUNCTION LEVER moves into engagement with the vanes in such a manner that during its forward motion the

2. LIND FEED FUNCTION LEVER LOWER EXTENSION is moved upward, causing

3. LINE FEED PUSH BAR to move into the path of the function bail blade. The function bail blade pushes the line feed push bar to the rear and because the push bar is connected to the

4. LINE FEED BAIL the line feed bail moves. The

5. LINE FEED VERTICAL LINK is operated by the line feed bail and in turn operates the

6. LINE FEED LEVER. Connected to the lower arm of the line feed lever is the line feed vertical link and to the top arm is connected the

7. LINE FEED PAWL which is pulled to the rear of the machine and engages a tooth on the

8. LINE FEED RATCHET. The ratchet turns the platen.

LINE FEED FUNCTION LEVER

LINE FEED FUNCTION LEVER LOWER EXTENSION

LINE FEED PUSH BAR

LINE FEED BAIL

LINE FEED VERTICAL LINK

LINE FEED LEVER

LINE FEED PAWL

LINE FEED RACHET

NOTES:

SUBJECT: RESETTING OF LINE FEED

Reference: Teletype Bulletin No. 144 page 10, Fig 21

As the

1. Line Feed Function Lever is returning to its normal position the
2. Upper Extension of the Line Feed Function Lever moves the
3. Line Feed Push Bar below the path of the
4. Function Bail Blade where it is held until line feed is again selected.

LINE FEED FUNCTION LEVER

UPPER EXTENSION OF THE LINE FEED FUNCTION LEVER

LINE FEED PUSH BAR

FUNCTION BAIL BLADE

SUBJECT: SINGLE DOUBLE LINE FEED LEVER

Reference: Teletype Bulletin No. 144 page 10, Fig 34

The

1. Single Double Line Feed Lever in its lower position allows the
2. Line Feed Pawl to skip the first and engage the second
3. Ratchet Tooth thereby rotating the
4. Platen a double line space. In its upper position it engages the first tooth and rotates the platen one space.

SINGLE DOUBLE LINE FEED LEVER

LINE FEED PAWL

PLATEN

Note: A Detent Lever on the right end of the platen holds the platen in position between line feed operations. This insures EQUAL SPACING BETWEEN LINES.

SUBJECT: PAPER STRAIGHTENER MECHANISM

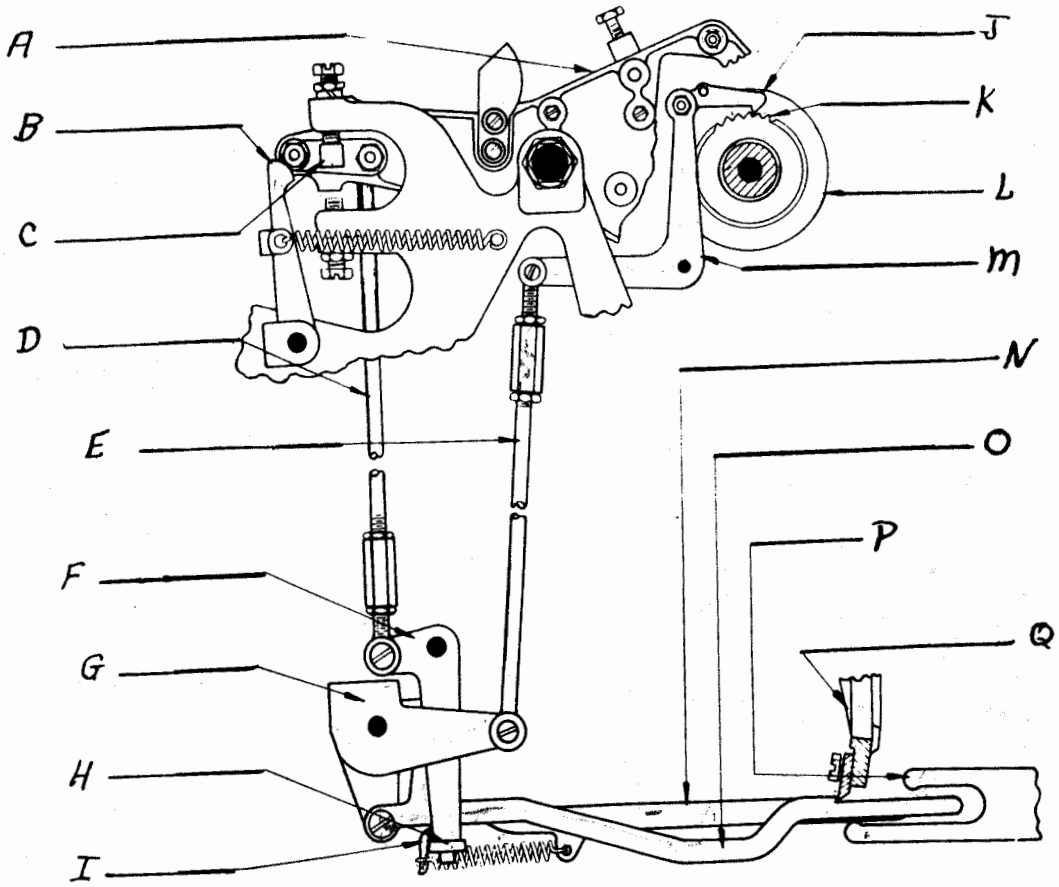
REFERENCE: TELETYPE BULLETIN 144, Page 10, Fig 10.

The Paper Straightener Rod and mechanism is to guide the paper as it unwinds from the roll and serves as a slack rod to prevent the paper from tearing during a LINE FEED operation.

If the paper starts to feed crookedly, it will start bearing against either the right or left hand collars, moving the rod to either the right or left. As a LINE FEED is performed, the paper pulls the rod down and the right or left rod extension will come down against the Rod Stop preventing further travel, while the opposite end will move all the way down, allowing that end to feed faster and thus the paper is straightened as it is fed around the platen.

STRAIGHTENER ROD
PAPER GUIDE COLLARS
STRAIGHTENER ROD EXTENSION
STRAIGHTENER ROD STOP

NOTES:



A PLATEN CASTING

B SHIFT DETENT

C SHIFT STOP POST

D SHIFT VERTICAL LINK

E LINE FEED VERTICAL LINK

F SHIFT LVR

G LINE FEED RAIL

H SHIFT LINK EXT

I SHIFT LINK

J LINE FEED PAWL

K LINE FEED RATCHET

L PLATEN ROLL

M LINE FEED LVR

N LTRS PUSH BAR

O LINE FEED PUSH BAR

P LINE FEED FUNCTION LVR

Q FUNCTION RAIL

LETTERS-FIGURES SHIFT

GENERAL: The Model 19 Printer is designed with each typebar pallet having space for a character, symbol or punctuation to be located at the top and bottom of the pallet as does the pallets on a conventional typewriter. These pallet sets are available in either communications type or weather symbol type. All machines in this school are fitted with communications type. The principle of shifting is identical in either case.

These pallets are constructed so that all 26 letters of the alphabet are in the lower case which means that as the typebar is moved towards the platen , the alphabet will be nearest the bottom of the type pallet. All figures, symbols and punctuations are located nearest the top of the pallets.

With this design we are able to shift the location of the platen in relation to the pallets so that when the platen is in its lowest position the alphabet will strike the platen and cause a printed letter to be printed on the paper. To print figures, symbols or punctuations we cause the platen to be moved up (UPPER CASE) so the characters located at the top of the pallets will strike the platen and print on our paper.

Since it is necessary to cause the platen on each printer in the circuit to shift from LETTERS to FIGURES, it is necessary to have a code combination of intelligence impulses that will cause this function to take place when selected by the sending operator.

The LETTERS-FIGURES function is the same as other functions in that when the code combination is received, the selector unit will cause the vanes to be set up. So when the printing bail moves forward the selected function lever moves into the vanes and the rear extension raises the push bar up into the path of the functic bail blade.

(continued)

The Function Bail, moving to the rear operates the train of parts to accomplish either LETTERS (UNSHIFT) or FIGURES (SHIFT) function of the platen.

The SHIFT-UNSHIFT trains of parts operate in the following order: As the FIGURES (SHIFT), and LETTERS (UNSHIFT) push bars are connected to the Shift Link the operations of both these functions are similar. The FIGURES (SHIFT) function lever, when selected, will position the push bar so it can be moved to the rear by by the Function Bail. This action causes the Shift Link to pivot - its right end moving back with the FIGURES (SHIFT) push bar. Its left end, connected to the LETTERS (UNSHIFT) push bar, moves forward. The Shift Lever, whose lower end engages the left end of the Shift Link Extension, moves the platen up to its shifted position by means of the Shift Vertical Link. The LETTERS (UNSHIFT) function reverses the foregoing procedure. The Shift Detent holds the platen assembly in the position selected.

NOTES :

SUBJECT: LETTERS AND FIGURES FUNCTION TRAIN OF PARTS

Reference: Teletype Bulletin No. 144 page 9 Fig. 18 & 21

As the figures combination is selected, the

1. Figures Function Lever moves into engagement with the vanes causing the

2. Figures Function Lever Extension to raise the

3. Figures Push Bar up into the path of the function bail blade. Then the function bail blade pushes the push bar to the rear, the

4. Right End of the Shift Link will also move, since the rear of the push bar is connected to it. Because the shift link is pivoted in the center, the right end of the shift link will move to the rear, while the left end moves toward the front of the machine. The

5. Shift Lever, which engaged in the

6. Shift Link Extension is thus moved so as to pull the

7. Shift Vertical Link down, which in turn pulls the rear of the

8. Platen Casting down and the platen up.

As the letters combination is selected, the

1. Letters Function Lever moves into engagement with the vanes causing the

2. Letters Function Lever Extension to raise the

3. Letters Push Bar up into the path of the function bail blade. Then the function bail blade pushes the push bar to the rear, the

4. Left End of the Shift Link will also move since the rear of the push bar in connected to it, Because the shift link is pivoted in the center the right end of the shift link will move towards the front of the machine and the left end will move to the rear. The

(Continued Next Page)

5. SHIFT LINK EXTENSION as part of the shift link moves to the rear and engaged with it is the

6. SHIFT LEVER. The shift lever is pivoted in the center so when the lower arm moves to the rear the upper arm moves upward, moving the

7. SHIFT VERTICAL LINK up, which in turn pushes the rear of the

8. PLATEN CASTING up, and the platen down.

FIGURES FUNCTION TRAIN	LETTERS FUNCTION TRAIN
FIGURES FUNCTION LEVER	LETTERS FUNCTION LEVER
FIGURES FUNCTION LEVER EXTENSION	LETTERS FUNCTION LEVER EXTENSION
FIGURES PUSH BAR	LETTERS PUSH BAR
RIGHT END OF SHIFT LINK	LEFT END OF SHIFT LINK
SHIFT LINK EXTENSION	SHIFT LINK EXTENSION
SHIFT LEVER	SHIFT LEVER
SHIFT VERTICAL LINK	SHIFT VERTICAL LINK
PLATEN CASTING (DOWN)	PLATEN CASTING (UP)

NOTE: The shift detent holds the platen assembly in the selected position.

SUBJECT: SIXTH VANE

Reference: Teletype Bulletin No. 144 page 8 para 5 Fig. 17 & 26

The lower end of the extension, attached to the Sixth Vane, fits into the notch in the forward end of the letters push bar. When the platen is in the figures position, the letters push bar is forward and the rear edge of the Sixth Vane is moved down. When the platen is in the letters position the rear edge of the Sixth Vane will be in its upper positon. When the letter "S" or "H" is selected and the platen is in the letters position, the signal bell and motor stop function levers will not engage the vanes because the Sixth Vane holds them out.

With the platen in the figures position the Sixth Vane will permit the signal bell and motor stop function levers to engage the vanes.

Notes:

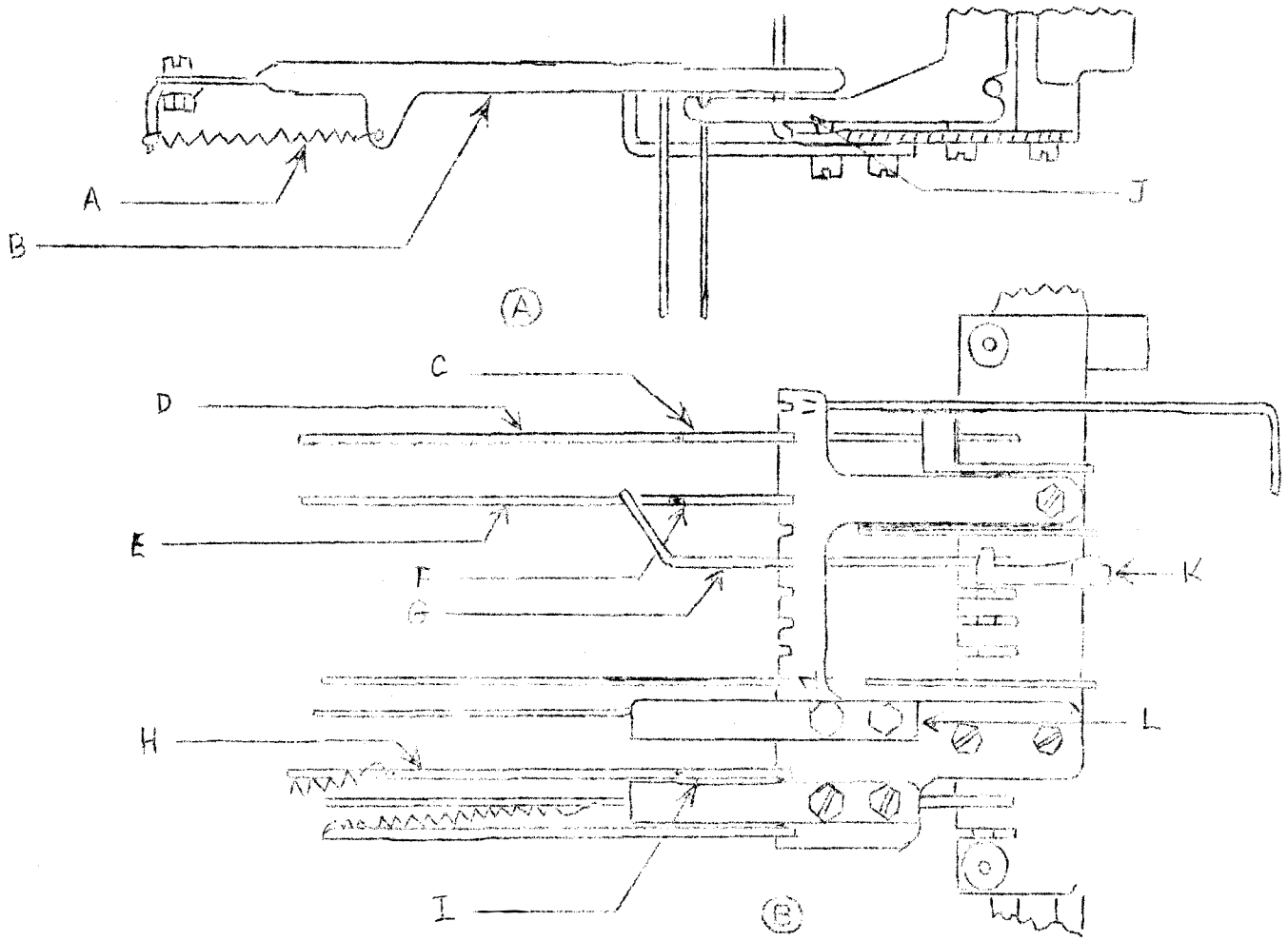
Purpose of the SIXTH VANE: To prevent the selection of Signal Bell and Motor Stop when the platen is in the letters position.

SUBJECT: UNSHIFT ON SPACE CUTOUT LEVER

REFERENCE: Teletype Bulletin No. 144 page 9, Fig. 22

If desired, the printer may be adjusted to shift the platen to the letters position on the spacing operating. This is accomplished by means of the space function lever and the unshift on space cutout lever. If the unshift on space cutout lever is moved out of engagement with the space function lever, the space function lever extension will move upward on spacing operation and raise the letters push bar into the path of the function bail blade. The platen will then be shifted to the "LETTERS" position, as previously described on page 34 and 35 of Study Guide No. 1.

Additional Notes (If desired)


A
B
J
(A)
C
D
E
F
G
K
L
H
I
(B)

KEYBOARD LOCK MECHANISM

GENERAL: The keyboard lock mechanism is a function of the Model 19 teletype which gives the sending operator control over the machines on the circuit to the extent that he can disable all keyboards on the circuit so no one will accidentally interrupt his transmission while he is sending. This is a dunction that is accomplished thru the use of the universal and blank function levers. It does not have a specific function lever as other functions that we have studied such as carriage return and signal bell. The feature of disabling the keyboards is accomplished by being able thru mechanical mechanisms to move the SEND/RECEIVE/BREAK KEY located on the base unit down to the receive position.

This operation is accomplished by the sending operator, sending two blank code combinations in succession. There are no provisions for a distant operator to reset this send receive break key back to the send position, thus it would hardly be necessary, for before the operator of the machines can transmit he will be required to reset his own machine before he can cause his keyboard to operate.

NOTE: Every operation of the printer moves the universal function lever, and its extension moves the right arm of the T lever down. This causes the top of the T lever, the pivot of the intermediate lever, and the reset lever to be moved to the right. The lower end of the intermediate lever is thus kept out of the path of the blank function lever extension.

When the blank function lever is selected by setting up an all spacing or no current combination, its extension moves downward at

about the same time as the universal function lever. However, because the spring on the blank function lever is considerably stronger than the spring on the universal function lever, the left arm of the T lever will be moved down. The upper part of the T lever, the intermediate lever pivot, and the reset lever all move to the left. The lower end of the intermediate lever then moves against the side of the blank function lever extension when this lever is in its low position. At the end of the operating cycly, when the blank function lever extension moves upward it permits the lower end of the intermediate lever to swing beneath it. If another blank selection is now made, the intermediate lever is pulled downward, the reset lever is moved against the upper contact lever which releases the upper contact lever. The spring on the upper contact lever then moves its extension against the contact springs which close the keyboard short-circuiting contacts thereby moving the send-receive-lever to its low position.

If only one blank signal is received and is followed by a space or a character, the keyboard will not be locked out.

SUBJECT: KEYBOARD LOCKOUT

Reference: Teletype Bulletin No. 144 page 12, Fig. 24 & 25

On every printing and spacing operation the

1. Universal Function Lever moves against the vanes and the

2. Universal Function Lever Front Extension moves the

3. Right Arm of the "T" Lever down. This causes the top of the "T" lever, which is the pivot point of the

4. Intermediate Lever, and the

5. Reset Lever to be moved to the right. The upper part of the intermediate lever is moved against the

6. Stop Bracket and the lower end, or "toe", of the intermediate lever will move to the right. Thus keeping out of the path of the blank function lever extension.

FIRST BLANK OPERATION

When the blank combination is selected, the

1. Blank Function lever moves into engagement with the vanes and the

2. Blank Function Lever Extension moves the

3. Left Arm of the "T" Lever down. The top of the "T" lever. Which is the pivot point of the

4. Intermediate Lever and the

5. Reset Lever will be moved to the left. The upper part of the intermediate lever is pulled against the

6. Stop Bracket by its spring and the lower end, or "toe", of the intermediate lever will be moved to the left against the side of the blank function lever extension. As the printing bail moves the function levers to the rear (normal position), the "toe" of the intermediate lever will swing beneath the blank function lever extension.

(Cont'd)

SUBJECT: KEYBOARD LOCKOUT (Continued)

SECOND BLANK OPERATION

When the blank key is depressed the second time, the

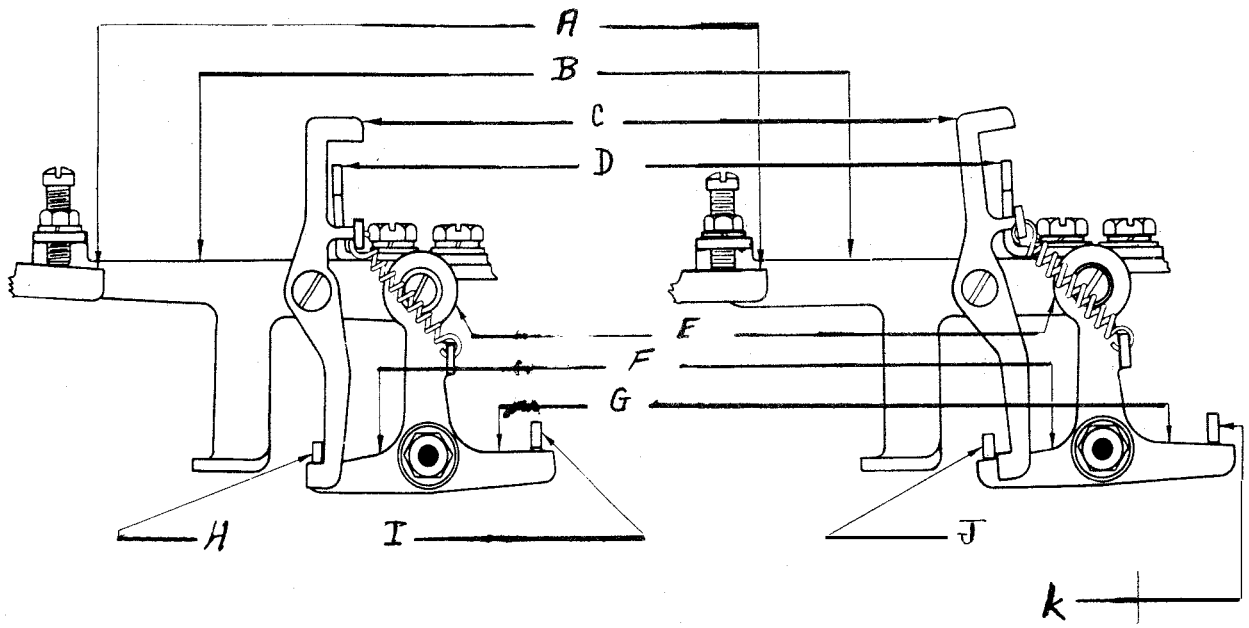
1. Blank Function Lever will enter the vanes, the
2. Blank Function Lever Extension will depress the
3. Intermediate Lever, which is now under its forward extension, and will pull down on the
4. Reset Lever, which will push the
5. Upper Contact Lever down (through the medium of the upper adjusting screw) so that the
6. SRB Contacts 3 & 4 will be allowed to close. When contacts 3 & 4 are closed the keyboard is inoperative

- -

The purpose of the KEYBOARD LOCKOUT FUNCTION? is to lock out all key boards on the circuit while you are sending a message. Each operator must put his own keyboard back in operation. In order to put the keyboard in operation again, each operator will have to place the send-receive-break key back to the send position. This will open contacts 3 and 4 each keyboard is back in the circuit again.

Notes: PAGE 117

- -



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MOTOR STOP

GENERAL: Motor Stop is a function of the Model 19 Teletype which is th same in general , as the signal bell function in that the machine must be in upper case and then the designated code combination is selected to cause the motor stop function lever to enter the vanes. Motor Stop can be accomplished by either the electrical motor stop method, or by the mechanical motor stop method. Here in the Teletype maintenance school only the mechanical motor stop will be taught, which utilizes the code combination of the letter "H". By the operator placing all the machines on his circuit in the upper case, which allows the sixth vane to be positioned properly, then transmitts the letter "H" code combination, his machine and all others in the circuit will then operate the mechanical function motor stop train of parts to cause all the printer motor circuits to open and the machines will remain in an inoperative condition until such time the circuit is needed by any operator.

For any operator to place the machines of a circuit into operation he may do so by operating the send-Receive-Break key to the break position which breaks the line circuit causing the mechanical releasing of the motor stop mechanism, allowing the motor circuit to close starting all the motors and then the circuit is ready for receiving traffic.

When the motor stop function lever is moved forward into its selected position in the vanes, its lower rear extension rasises the motor stop lever.

MOTOR STOP (Continued)

This latches the inner motor stop pawl onto the thick part of its latch on the armature extension. Simultaneously, the front extension of the motor stop function lever closes the left-hand motor contacts, and, as the rear extension of the motor stop contact lever moves up, the front extension moves down against the tension of its spring. This opens the right-hand motor stop contacts. As both pairs of contacts are wired in multiple, the motor will not stop until the motor stop function lever is restored to its normal position and the left-hand contacts open. These contacts hold the motor circuit colsed until the receiving cam sleeve comes to rest, which insures the disengagement of the main shaft clutch before the motor stops. In order to start the motors again, the line must be opened for a short interval by depressing the break lever. This moves the upper contact lever extension against the line contact insulator. The line is opened, the selector armature extension is moved downward by the armature spring, and the upper end of the motor stop lever, having moved forward a slight distance, is again stopped when its outer pawl catches the cut-away portion of the motor stop pawl latch.

When the line is closed again, the armature moves to its operated position, the outer motor stop pawl unlatches the armature extension, and the motor stop function lever returns to its normal position. The extension on the lower portion of the motor stop function lever, which has been holding the motor stop contact lever away from the right-hand motor stop contacts, will now permit the spring to move the front extension of the motor stop lever upwards, closing the motor stop

MOTOR STOP (Continued)

contacts.

It should be noted that when the motor stop function is operated, the keyboard short-circuiting contacts are closed and the keyboard transmission is locked out. To do this, the forward end of the motor stop function lever moves downward against the lower screw on the reset lever. This lever, in turn, moves the contact operating lever as described under "Send-Receive-Break Mechanism." to the received position. Immediately after the motor stop function has been set up and before the motor has stopped, should the line be accidentially opened, it would be impossible to operate the mechanical motor control. The magnet armature would be released, the selector cam cylinder would revolve beyond its stopping point, the armature locking lever might come to rest in an indent in its cam, and the armature extension could not respond to the next open line interval. The motor stop release lever is provided to prevent such a condition by making it impossible for the motor stop pawl latch to be engaged by the pawl. When the locking lever falls into an indent in its cam, its spring brings its lower extension against the stud on the release lever. This shifts the upper end of the motor stop release lever and holds its eccentric against the lower part of the outer motor stop pawl, preventing it from latching under the motor stop pawl latch. Thus the motor stop will not be permitted to function and the motor will continue to rotate.

SUBJECT: TRAIN OF PARTS FOR MOTOR STOP

Reference: Teletype Bulletin No. 144 page 13 & 14

As the motor stop combination is selected, the

1. Motor Stop Function Lever moves into engagement with the vanes causing the

2. Motor Stop Function Lever Front Extension to come down and close the

3. Left hand motor stop contacts. At the same time the motor stop function lever front extension moves the lower adjusting screw down forcing the

4. Reset Lever down locking out all keyboards on the circuit.

(B)

The - -

1. Motor Stop Function Lever enters the vanes causing the

2. Motor Stop Function Lever Rear Extension to raise the

3. Motor Stop Lever, the front extension of which raises the

4. Motor Stop Contact Lever causing its front extension to move down against the tension of its spring. This allows the

5. Right Hand Motor Stop Contacts to open. This condition will remain as long as the motor stop pawls stay latched.

(C)

1. Motor Stop Function Lever enters the vanes causing the

2. Motor Stop Function Lever Rear Extension to raise the lower

3. Motor Stop Lever, which in turn moves the

4. Inner Motor Stop Pawl so that it latches at the thick portion of the

5. Motor Stop Pawl Latch on the armature extension. Because the stop impulse is a marking impulse, the inner pawl will remain latched until such time as the circuit is broken.

NOTES: PAGE 122

SUBJECT: TRAIN OF PARTS FOR MOTOR STOP

REMEMBER: At this point the inner motor stop pawl is latched on the motor stop pawl latch, thus the right hand motor stop contacts are open, the function lever is out of the vanes thus the left hand motor stop contacts are open. Since the right and left motor stop contacts are open, the motor circuit is open and the motor will not run.

SUBJECT: MOTOR STOP RELEASE LEVER

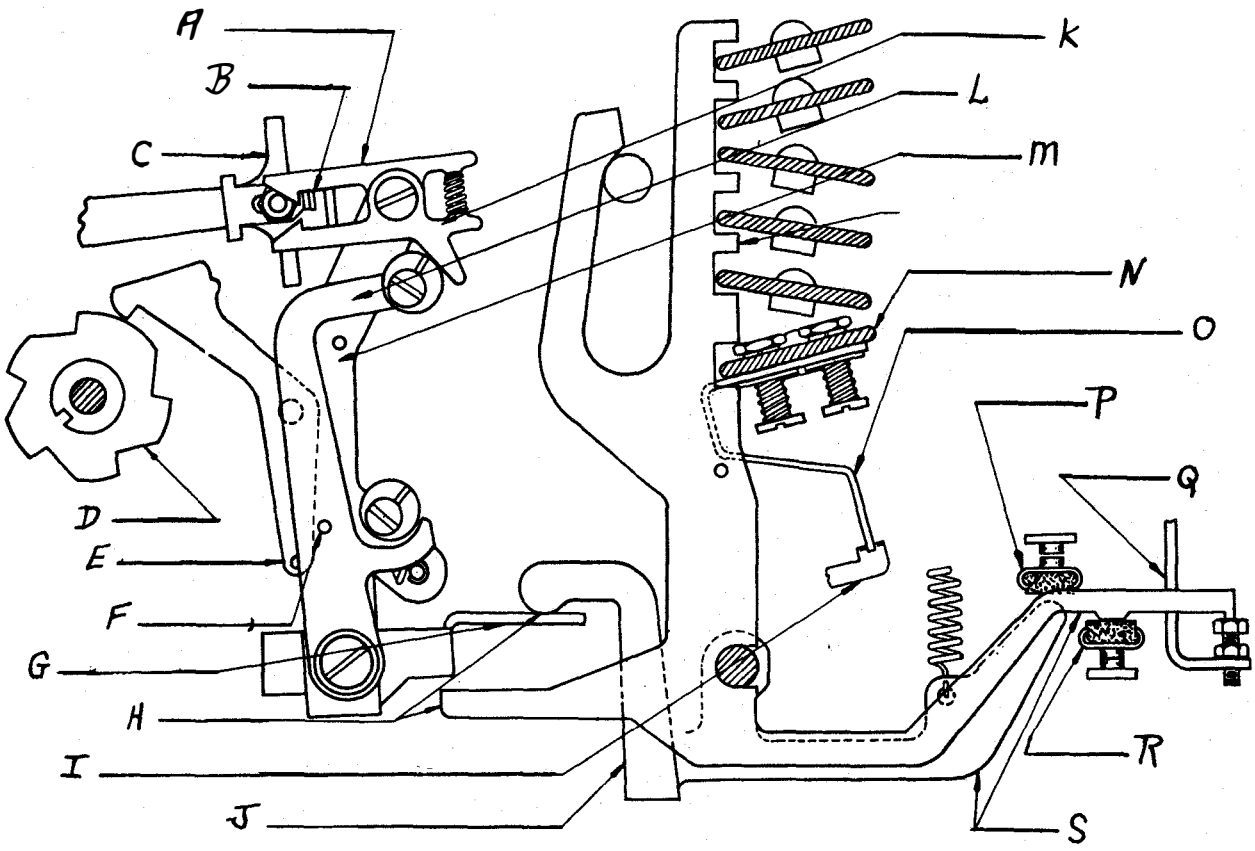
Referance: Teletype Bulletin No. 144 Page 13 and 14, Fig. 26.

MOTOR STOP RELEASE LEVER

Immediately after the motor stop function has been set up and before the motor has stopped, should the line be accidentally opened, it would be impossible to operate the mechanical motor control. The magnet armature would be released, the selector cam cylinder would revolve beyond its stopping point, the armature locking lever might come to rest in an indent in its cam, and the armature extension could not respond to the next open line interval. The motor stop release lever is provided to prevent such a condition by making impossible for the motor stop pawl latch to be engaged by the pawl, as follows:

When the - -

1. Locking Lever falls into an indent in its cam, its spring brings its lower extension against the
2. Release Lever Stud. This moves the upper end of the
3. Motor Stop RElease Lever forward, and holds its eccentric against the lower part of the
4. Outer Motor Stop Pawl, preventing it from latching the
5. Motor Stop Pawl Latch. Thus, the motor stop will not be permitted to function and the motor will continue to rotate.



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SUBJECT: REC-30 RECTIFIER POWER UNIT

GENERAL: The REC-30 is designed to provide filtered DC suitable for operation of teletype circuits and to provide proper AC voltage for series wound governed motors, when connected to AC sources of various voltages and frequencies.

INPUT 8 steps of AC input voltage:
95, 105, 115, 125, 190, 210, 230, or 250 volts.
4 steps of input frequency:
25, 40, 50 or 60 cycle, single phase.

OUTPUT: DC rated at .9 Amperes (900 MA) at 120 volts.
AC at suitable voltage to operate 3 series wound governed motors at frequencies of 25, 40, 50 or 60 cycles.
The no load voltages will not exceed 130v DC

POWER UNIT Consists essentially of the following:

1. AUTO-TRANSFORMER- takes any of the input values from 95 to 250V AC and gives correct value for AC output, for heating tube filaments and to be changed into DC.
2. PLATE TRANSFORMER - takes AC from the auto-transformer and steps it up to 400 VAC to be changed into DC by the tubes
3. RECTIFIER TUBES, grid controlled, 2 each. These are mercury vapor rectifier tubes, type 323A, connected as a full wave rectifier.
4. VOLTAGE STANDARD AND AMPLIFIER TUBE. Tthese control the grid current to rectifier tubes. Keeps the voltage up to 120 volts when there is a load on the rectifier. Prevents voltage from getting above 130 volts when there is no load.
5. DC OUTPUT FILTER - Filter the output so there is no ripple or pulses.
6. RF FILTERS.

CONTROL AND ADJUSTMENT.

1. DOUBLE POLE POWER SWITCH - a double pole ON-OFF switch which opens both wires coming to the REC-30 when turned off, eliminating any connection to all the power source.
2. INPUT FUSETRON - a 10 Amp fusetron at the lower portion of the main terminal panel. Any overload or short in the rectifier will cause it to burn out and all circuits in the rectifier will have no power.

3. PLATE TRANSFORMER FUSE - a 3 Amp fuse in the circuit going to the plate transformer from the auto-transformer. Any short or overload in the rectifying section will burn out this fuse and all DC output will be lost.
4. AC INPUT LEADS AND TAPS - to adjust for the input voltage, put the flexible lead at the left of the main terminal panel onto the tap which is marked with the voltage which is most nearly the same as your available AC.
5. FREQUENCY INPUT LEADS AND TAPS - any rectifier cannot change the frequency of the input AC. We are actually varying the AC voltage output so that is will be the correct value to run our series governed motors at the available frequency. The lower frequency requires a lower voltage to run a series wound motor.

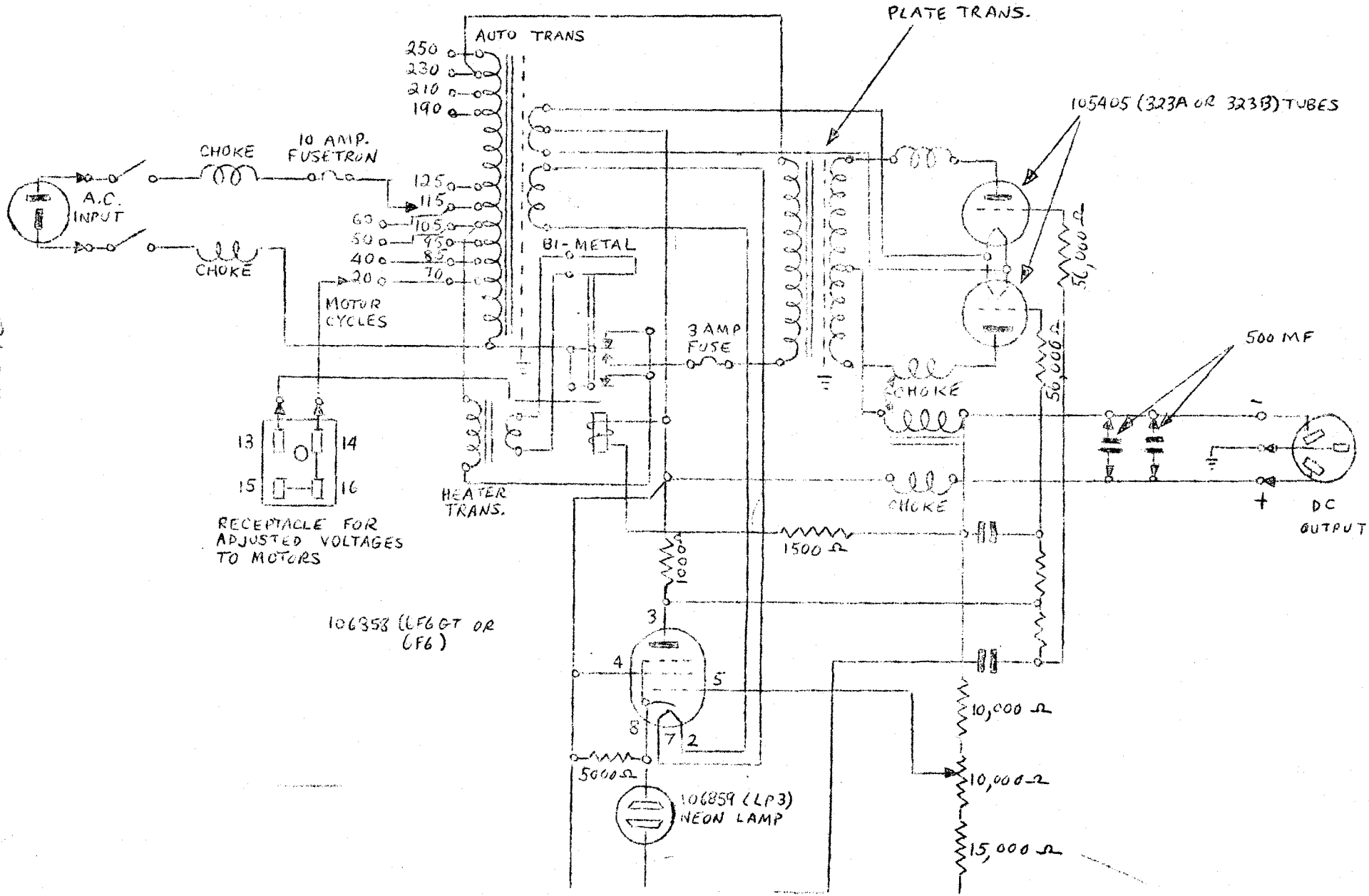
70 volts for 25 cycles
85 volts for 40 cycles
105 volts for 50 cycles
115-120 volts for 60 cycles

6. DC OUTPUT ADJUSTMENT - DC is adjusted by means of the potentiometer located between the fuses on the main terminal panel. Connect a 60 watt, 120 volt lamp in series with a suitable milliammeter across the DC output of the REC-30 and adjust the potentiometer until the meter reads 500 MA.
7. TIME DELAY RELAY (BI-METAL) -, to prevent damage to the mercury vaper rectifier tubes, it is necessary that the filament be heated at least 20 seconds before putting on the plate load. The bi-metal strips begin heating as soon as the REC-30 is turned on. After 20 to 60 seconds, they should be heated enough to bend down and complete the circuit putting the load on the plate circuit. Then DC will be available.

Also, it is desirable that you do not get AC output until after you get DC output, so the bimetal relay also controls the circuit for AC output. This bi-metal relay is controlling contacts which should close the plate circuit after the rectifier tubes are heated and then close the output AC circuit. When this happens, the circuit that heats the bi-metal strips will open.

Notes--

SCHEMATIC WIRING



GENERAL DESCRIPTION OF RANGE SPREAD.

The outboard side of the rangefinder frame is marked with a scale reading from Ø to 12Ø. On this scale rests an index arm which can be moved to any position on this scale by:

1. Loosening the thumb screw.
2. Setting the index arm.
3. Tightening the thumb screw.

On a properly adjusted machine, and when receiving a perfect (undistorted) signal, it should be possible to print perfect copy (without garbles) with the index arm moved over a full 8Ø points on the range scale. The ideal range spread is regarded as 15 to 95, although a spread of from, for example, 2Ø to 1ØØ or 1Ø to 9Ø is also acceptable, provided a full 8Ø points of range spread is obtainable.

LOSS OF RANGE

One major cause of loss of range, (a range spread of less than 8Ø points) can be traced to mechanical maladjustments, poor lubrication, or dirt, primarily in the rangefinder, selector unit or related parts of our own machine.

Another major cause of loss of range is due to (something being wrong with the incoming signal) distortion. This may be caused by:

1. The distant station may be sending out an imperfect signal.
2. The line circuit may be distorting the signal from the distant station.

GENERAL DESCRIPTION OF SIGNAL DISTORTION.

Distortion is usually defined as any change made in a signal between the time it is transmitted and the time it is received.

If a perfect signal is being transmitted to the line by the distant station, and we are not receiving a perfect signal from the line, it is obvious that the line circuit is responsible for distorting the signal. Although distortion may be present in any line, usually it increases with the length of the line. In a short line, it may be so small that we cannot detect it. In a longer line, it may be so great as to entirely prevent us from receiving a usable signal, without recourse to a LINE RELAY to regenerate an undistorted signal.

Note: It is not our purpose here to attempt a complete understanding of the may types, causes or effects of distortion. For further reference, the publication NAVSHIPS 900.031 (Advanced Base Teletype Installation and Maintenance Practices) contains an excellent discussion of the subject.

OPTIMUM SETTING FOR THE RANGEFINDER

It is obvious that the best setting for the rangefinder index arm is one that will allow the machine to print a good copy, regardless of the manner in which distortion is reducing the range spread.

This setting is called the (optimum setting) meaning: (The best average setting). It is determined as follows:

1. Find the upper and lower limits of your range.
   Example: 25 to 95
2. Add these two figures.
   Example: 25 plus 95 equals 120.
3. Devide the product by two.
   Example: 120 devided by 2 equals 60.

The Optimum setting for the index arm would be 60.

RANGEFINDER ACTION

We have already learned how the start impulse actuates the rangefinder train of parts, releasing the stop arm of the selector cam sleeve, and permitting the sleeve to make one complete revolution. At the end of this revolution, the stop arm is held by the stop lever, since the tripoff eccentric is no longer depressing the trip latch plunder, due to the reception of the stop impulse.

EFFECT OF MOVING THE RANGE FINDER INDEX ARM

Moving the range finder index arm actually changes the point at which the stop lever will catch and hold the stop arm of the selector cam sleeve, the duration of the stop impulse. When the start impulse releases the stop arm, the selector cam sleeve must travel a certain distance before the first selector cam strikes the first selector lever.

If the index arm is moved toward the Low side of the scale the stop lever will be moved to the rear, and stop the rotation of the selector cam sleeve Later, thus decreasing the distance the 1st selector cam travels before it strikes the the 1st selector lever.

In the above case, we decreased the distance and the time between the beginning of the start impulse and the positioning of the 1st sword.

Now if we move the index arm to the High side of the scale the stop lever will be moved to the front, and stop the rotation of the selector cam sleeve Sooner, thus increasing the distance the 1st selector cam travels before it strikes the 1st selector.

In this case we increased the distance and the time between the beginning of the start impulse and the positioning of the 1st sword.

SWORD POSITIONING TIME

Each sword must be positioned during its respective intelligence impulse. With a perfect signal each intelligence impulse is 22 m/s long. Due to the mechanical motion involved, it takes 4.4 m/s to position each sword.

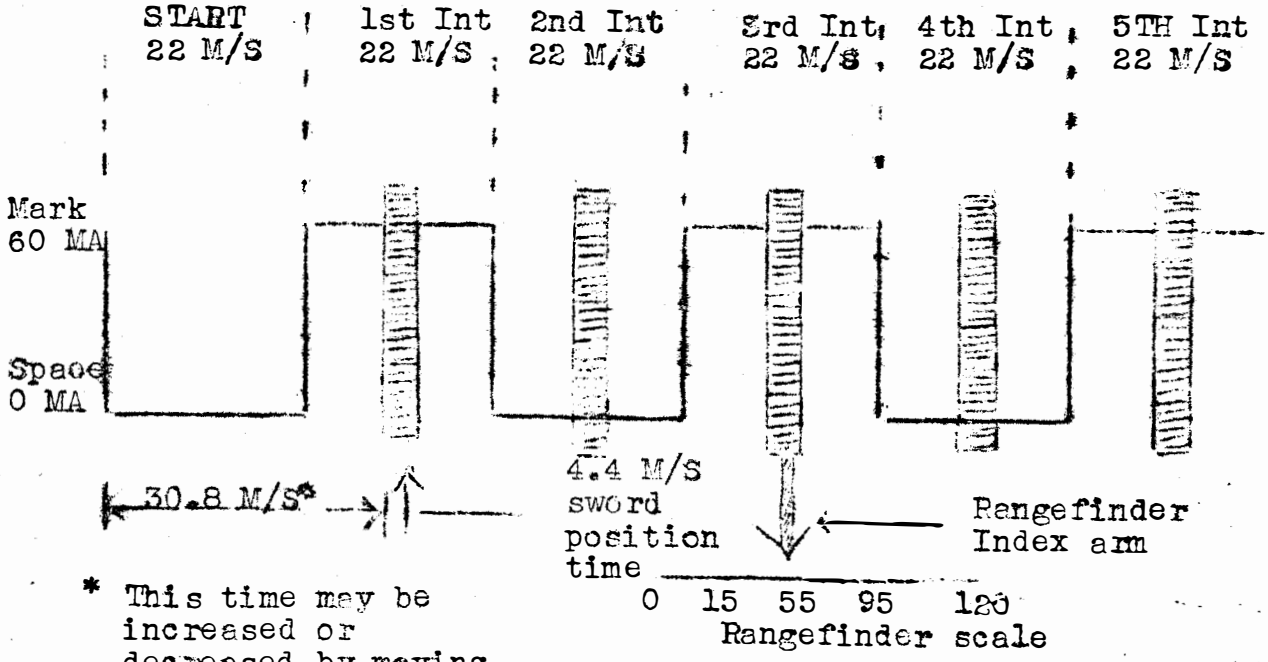
1. 22 m/s represents 100% of the available time.

2. 4.4 m/s or 20% of this time must be used to position the sword.

3. 17.6 m/s or 80% of the available time is left over.

This 80% excess available time allows us to change the positioning time of the swords by moving the rangefinder index arm. This 80% is directly convertible to the 80 points of range spread required.

Notes:



* This time may be increased or decreased by moving the rangefinder index arm.

Diagram of the letter "Y" with a perfect signal. The shaded portions represent the sword positioning time. NOTE that:

a. Each positioning time occurs in the exact center of each intelligence impulse because the rangefinder index arm is set in the exact center of the perfect range, 15 to 95.
b. In this case the first sword is positioned exactly 30.8 M/S after the beginning of the start impulse.
c. The five positioning times are always exactly 22 M/S apart due to the spacing of the selector cams on their sleeve.
d. If the index arm is moved toward the low side of the scale the swords will all be positioned earlier during their respective impulses.
e. We cannot move the index arm below 15 or above 95 on the range scale without moving each positioning time out of its allotted impulse and cause the machine to garble. HOWEVER,

WE CAN MOVE THE INDEX ARM OVER A FULL 80 POINTS OF RANGE AND STILL COPY THE INCOMING SIGNAL WITHOUT GARBLES IF THE SIGNAL IS PERFECT AND OUR MACHINE PROPERLY ADJUSTED.

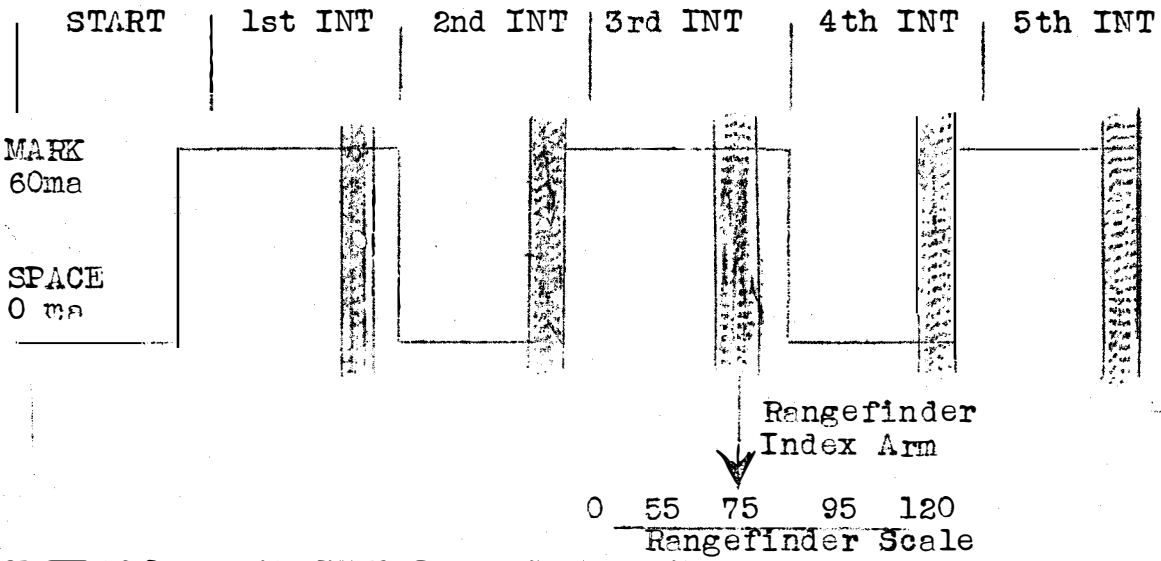
EFFECT OF BIAS DISTORTION.

If all the SPACE impulses in the above diagram were made longer by about 4.4 M?S and the MARKING impulses reduced a like amount, we would have a condition known as "SPACING BIAS" distortion. We could move our index arm below about 35 on the range scale but the machine would garble.

If all the MARK impulses in the diagram were made longer by about 4.4 M?S and the SPACE impulses reduced a like amount we have "MARKING BIAS" distortion. We could not move the arm above 75 on the rangefinder and have the machine still copy.

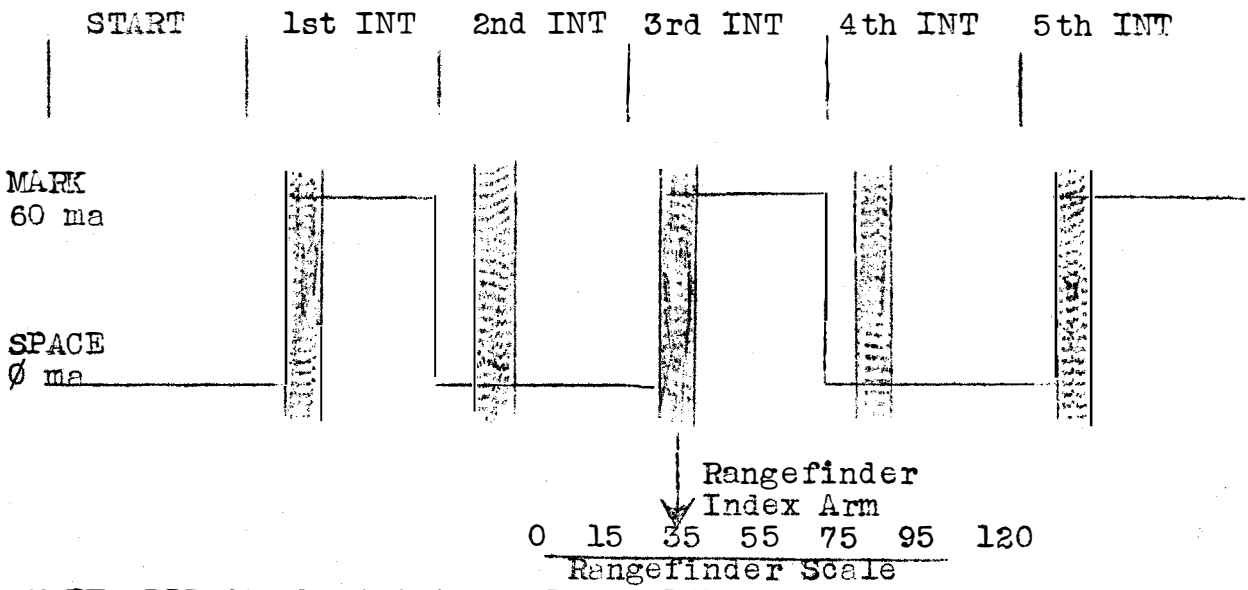
MARKING BIAS CAUSES US TO LOSE THE HIGH SIDE RANGE
SPACING BIAS CAUSES US TO LOSE THE LOW SIDE RANGE

Of our 22 M/S impulse, 20% has been lost, hence 20% distortion is present.



AN EXAMPLE OF MARKING BIAS DISTORTION

Showing 20% distortion. Notice that the machine will NOT copy above 75 on the range scale. MARKING impulses have been lengthened and SPACING impulses have been shortened.



AN EXAMPLE OF SPACING BIAS DISTORTION

Showing 20% distortion. Notice that the machine will NOT copy below 35 on the range scale. The SPACING impulses have been lengthened and the MARKING impulses have been shortened.

SOME EFFECTS OF DISTORTION

Frequently, when receiving a signal with moderate distortion, we will find that the distortion will effect the range spread in a definite manner.

For example :

1. The UPPER limit of the range may be reduced by 30 poin (Range 1[illegible] to 65)
2. The LOWER limit of the range may be reduced by 30 poin (Range 35 to 95)
3. Both ends of the range may be reduced by 15 points. (Range 30 to 80)

THE RELATIONSHIP OF 80 POINTS OF RANGE AND THE SIGNAL

When an impulse or signal is perfect, the range of the impulse is 100 percent, equalling 0 to 100 on the range finder. Since the ideal position for the selecting interval is the CENTER of the impulse, the range finder arm should be set on 50. The selecting mechanism must use 4.4 millisec or 20 percent of the impulse and since the range finder is set on 50, the 20 percent will come from the exact center o the impulse and leave a total of 80 percent, 40 percent on each side. Therefore the range finder can be moved 40 poin each way without receiving a wrong impulse, resulting in a range of 10 to 90 (50 minus 40, 50 plus 40) or 80 points.

To measure net effect of all kinds of systematic distortion, position of received signals, the range finder arm is first moved in one direction until errors appear in the copy and then moved back slowly until these errors are eliminated. Similarly, the rangefinder arm is moved to the maximum distance in the opposite direction. These two scal readings then give the operating margin of signals under te On perfect signals the margin would be from 10 to 90, 80 po but with either MARKING or SPACING bias this margin would n be so great. With MARKING bias the HIGH part of the range would be affected, and when SPACING bia is present, the LOW part would be affected.

NOTES::

RIBBON FEED

REF: Teletype Bulletin NO. 144 Pg. 7, Fig. 14

General: The ribbon feeding operation in the model 19 teletype is for the purpose of causing the ribbon to be continuously move in front of the type pallets, which causes the printed copy to be printed legible. Ribbon feed is acccomplished on the rearward travel of the printing bail.

RIBBON FEED TRAIN OF PARTS

The ---

1. Nothced Extension of the Pull Bar Bail Plunger has one end of
2. Ribbon Feed Lever engaged in its slot. The other end of the ribbon feed lever is attached to the casting of the type bar carriage. Connected in the middle of the ribbon feed lever is the
3. Ribbon Feed Pawl, which, on the forward motion of the printing bail, rides over and engages a tooth on the
4. Ribbon Feed Ratchet. When on the rearward movement of the printing bail, the pawl advances the ribbon feed ratchet one tooth as it turns. Mounted on the same shaft as the ratchet is the
5. Ribbon Feed Ratchet Gear, which will also turn. It is meshed with and turns the
6. Ribbon Feed Shaft Gear, which is mounted on the
7. Ribbon Feed Shaft. Mounted on it are the
8. Ribbon Feed Shaft Bevel Gears that mesh with the
9. Vertical Ribbon Feed Shaft Bevel Gear. These cause the
10. Vertical RibbonFeed Shaft to rotate. This shaft rotates the
11. Vertical Ribbon Feed Shaft Spur Gear. These mesh with the
12. Ribbon Spool Shaft Spur Gear causing the

(RIBBON FEED CON'T)

13. RIBBON SPOOL SHAFT to rotate. Mounted on the spool shaft is the

14. RIBBON SPOOL which will also rotate. This action advances the ribbon.

RIBBON FEED TRAIN OF PARTS

NOTCHED EXTENSION OF THE PULL BAR BAIL PLUNGER

RIBBON FEED LEVER

RIBBON FEED PAWL

RIBBON FEED RATCHET

RIBBON FEED RATCHET GEAR

RIBBON FEED SHAFT GEAR

RIBBON FEED SHAFT

RIBBON FEED SHAFT BEVEL GEAR

VERTICAL RIBBON FEED SHAFT BEVEL GEAR

VERTICAL RIBBON FEED SHAFT

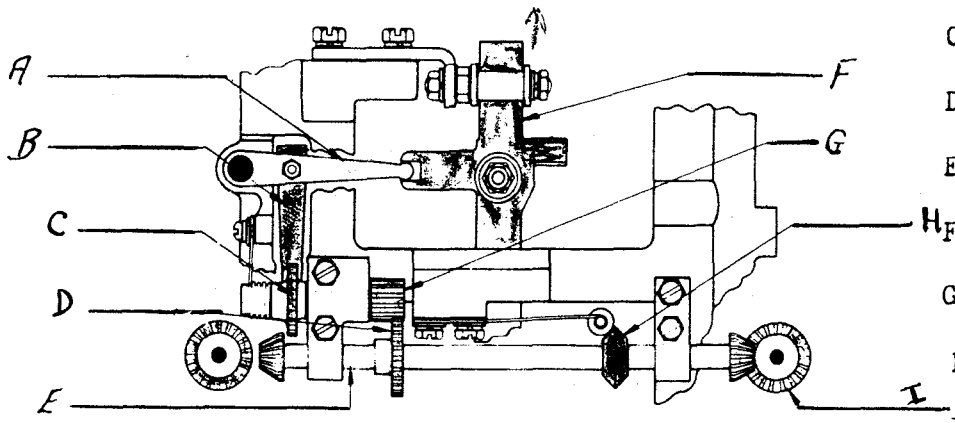
VERTICAL RIBBON FEED SHAFT SPUR GEAR

RIBBON SPOOL SHAFT SPUR GEAR

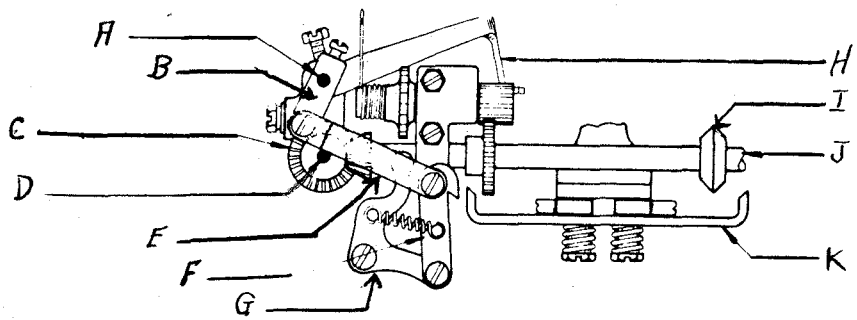
RIBBON SPOOL SHAFT

RIBBON SPOOL

Notes:



A ribbon feed lever
B ribbon feed pawl
C ribbon feed ratchet
D ribbon feed shaft gear
E ribbon feed shaft
F PULL BAR BALL PLUNGER
G ribbon feed ratchet gear
H ribbon feed shaft detent
I vertical ribbon feed shaft bevel gear



A ribbon reverse shaft
B ribbon reverse shaft link
C vertical ribbon feed shaft bevel gear
D vertical ribbon feed shaft
E ribbon reverse pawl link
F ribbon reverse pawl
G ribbon reverse lever

H ribbon revers arm
I ribbon feed shaft detent
J ribbon feed shaft
K ribbon reverse rail

SUBJECT: RIBBON REVERSE TRAIN OF PARTS

Reference: Teletype bulletin No. 144 page 7, Fig 15

RIBBON REVERSE TRAIN OF PARTS.

The eyelet in the ribbon engages the ---

1. Ribbon Reverse Arm, which is secured to and turns the
2. Ribbon Reverse Shaft. Secured to the bottom of this shaft is
3. Ribbon Reverse Shaft Link, which actuates the
4. Ribbon Reverse Pawl Link, which moves the
5. Ribbon Reverse Pawl, into the path of the
6. Ribbon reverse Bail, On the rearward motion of the ribbon reverse bail it engages the ribbon reverse pawl and pulls it to the rear which in turn causes the
7. Ribbon Reverse Lever, to move the ribbon feed shaft bevel gear into engagement with the opposite vertic ribbon feed shaft bevel gear.

R-E-M-E-M-B-E-R-, The ribbon feed shaft is held to the right or left by the ribbon feed shaft detent and roller.

RIBBON REVERSE ARM

RIBBON REVERSE SHAFT

RIBBON REVERSE SHAFT LINK

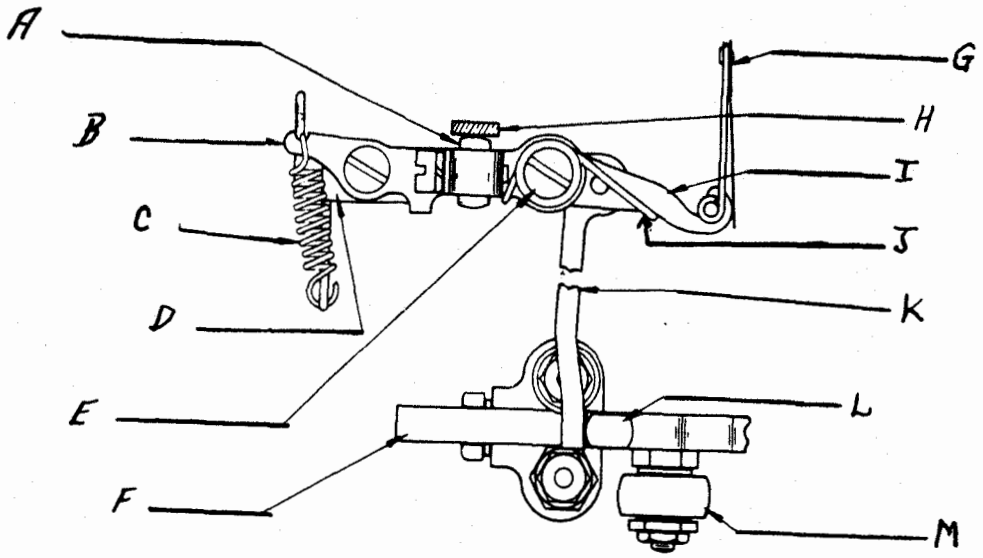
RIBBON REVERSE PAWL LINK

RIBBON REVERSE PAWL

RIBBON REVERSE BAIL

RIBBON REVERSE LEVER

Notes:



A RIBBON SHIFT LVR ROLLER

B RIBBON SHIFT LVR

C RIBBON SHIFT SPRING

D RIBBON SHIFT LVR BRACKET

E SHOULDER SCREW

F PULL BAR BAIL BUMPER

G RIBBON CARRIER

H RIBBON SHIFT LVR ROLLER BAR

I RIBBON OSCILLATOR

J RIBBON OSCILLATOR SPIRAL SPRING

K RIBBON OSCILLATOR EXT

L LEFT SIDE PULL BAR BAIL BUMPER

M PULL BAR BAIL BUMPER ROLLER

SUBJECT: RIBBON OSCILLATOR TRAIN OF PARTS

Reference: Teletype Bulletin No 144 Pg. 7, Fig 16

RIBBON OSCILLATOR TRAIN OF PARTS.

The - -

1. Pull Bar Bail Plunger Left Arm, on it's rearward movement strikes the

2. Ribbon Oscillator Extension, which in turn pulls the

3. Ribbon Oscillator, down against the tension of the

4. Ribbon Oscillator Spiral Spring, Connected to the ribbon oscillator is the

5. Ribbon Carrier, which pulls the ribbon below the line of print.

PULL BAR BAIL PLUNGER LEFT ARM

RIBBON OSCILLATOR EXTENSION

RIBBON OSCILLATOR

RIBBON OSCILLATOR SPIRAL SPRING

RIBBON CARRIER

P-U-R-P-O-S-E of the ribbon oscillator is to move the ribbon below the line of print when the machine is in its normal position.

SUBJECT: RIBBON LOCKOUT

Reference: Teletype Bulletin No. 144 page 7, Fig. 11

Tje Ribbon Lockout Bar is manually operated. When the ribbon lockout bar is moved to the left, the ribbon lockout bar extension rides over the ribbon oscillator extension, holding it down. This prevents the ribbon oscillator spiral spring from raising the ribbon carrier during the forward motion of the printing bail. The purpose of the ribbon lockout is to make it possible to cut stencils on your printer.

Note: Because the ribbon shift lever spring holds the ribbon shift lever roller against the slide bar on the platen assembly, the ribbon is moved up when the platen shifts to the figures position.

JOB SHEET NO. 1

SUBJECT: ADJUSTMENTS
REF: TELETYPE BULLETIN NO. 138B

THE TYPEBAR CARRIAGE INTRODUCTORY ADJUSTMENT

1. PLUNGER GUIDE ROLLER BRACKET
   Page 1-4, Para 3 and 5, Fig 2 _____

2. PLUNGER ROLLER ECCENTRIC MOUNTING STUD
   PAge 1-4, Para 6, Fig 2 _____

3. PULL BAR GUIDE
   Page 1-4, Para 9, Fig 5 _____

4. CODE BAR BELL CRANKS
   Page 1-28, Para 153, Fig 62 _____

Adjustments 1 through 4 are familiarizing adjustments to acquaint the student with the proper use of tools and guages, and to read and interpret directions from the manual.

5. REMOVE AND DISASSEMBLE MAIN SHAFT.
   CAUTION: DO NOT wash parts in solvent that have felt washers or wicks inside .

6. REASSEMBLE MAIN SHAFT
   Teletype Bulletin No. 144,Page 3,Fig 36

7. INSTALL AND ADJUST MAIN SHAFT
   Page 1-9, Para 39

8. MAIN SHAFT CLUTCH THROWOUT LEVER
   Page 1-9, Para 40, Fig 20

9. SPACING SHAFT LOWER BEARING BRACKET
   Page 1-10, Para 43, Fig 22

10. PRINTING BAIL ADJUSTMENT
    Page 1-10, Para 45, Fig 23

11. FUNCTION LEVER BAIL
    Page 1-10, Para 46, Fig 24 and 25

12. BLOCKING PLATE
    Page 1-10, Para 47, Fig 24

13. SIXTH VANE
    Page 1-11, Para 50, Fig 25

14. SELECTOR VANES
    Page 1-12, Para 51, Fig 25

15. PRINTING BAIL SPRING TENSION
    Page 1-12, Para 53, Fig 28

JOB SHEET NO.3

TYPEBAR CARRIAGE FINAL-RIBBON FEED, RIBBON REVERSE.

16. RIBBON FEED SHAFT BEARING PLATES
Page 1-5, Para 10, Fig 6 & 7

* 17. RIBBON FEED SHAFT DETENT SPRING
Page 1-5, Para 11, Fig 6

18. VERTICAL RIBBON FEED SHAFTS
Page 1-5, Para 13, Fig 7

19. RIBBON SPOOL BRACKETS
Page 1-5, Para 15, Fig 7

20. RIBBON SPOOL SHAFT SPUR GEARS
Page 1-5, Para 15, Fig 8

21. VERTICAL RIBBON FEED SHAFT SPUR GEARS
Page 1-5, Para 16, Fig 8

* 22. RIBBON SPOOL CUPS
Page 1-6, Para 17, Fig 9

23. VERTICAL RIBBON FEED SHAFT SPRING TENSION
Page 1-6, Para 18, Fig 9

24. RIBBON REVERSE SHAFT COLLARS
Page 1-6, Para 21, Fig 10

25. RIBBON REVERSE SHAFTS
Page 1-6, Para 20, Fig 10

26. RIBBON REVERSE SHAFT LINKS
Page 1-6, Para 22, Fig 11

27. RIBBON REVERSE ARM BACKSTOP
Page 1-7, Para 23, Fig 10

28. TYPEBAR BACKSTOP
Page 1-7, Fig 12A

29. RIBBON SHIFT LEVER BRACKET
Page 1-8, Para 29, Figs 13 & 14

30. RIGHT PULL BAR SPRING BRACKET
Page 8, Para 35, Fig 18

* 31. LEFT PULL BAR SPRING BRACKET
Page 9, Para 35, Fig 18

32. CARRIAGE SUPPORT & PULL BAR BAIL PLUNGER ROLLER.
Page 9, Para 38, Fig 22

33. CARRIAGE GUIDE SCREWS
Page 28, Para 152, Fig 23

34. SPACING RACK
Page 28, Para 154, Fig 63

35. RIBBON OSCILLATOR LEVER
Page 31, Para 170, Fig 67

NOTE: ADJUSTMENTS INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED (IF NECESSARY) BY THE INSTRUCTOR AND/OR STUDENT AS TIME PERMITS.

JOB SHEET NO. 4

SHIFT/UNSHIFT MECHANISM

* 36. PLATEN UNIT PILOT SCREWS
Page 19,Para 90,Fig 49 & 52

37. PLATEN SHIFT/UNSHIFT STOP POST
Page 19,Para 91, Fig 50

38. UNSHIFT STOP SCREW
Page 20, Para 92, Fig 50

39. SHIFT STOP SCREW
Page 20, Para 93, Fig 50

40. FUNCTION BAIL BLADE
Page 20, Para 97, Fig 52

*41. UNSHIFT ON SPACE CUTOUT LEVER
Page 21, Para 98, Fig 97 & 98

42. SHIFT(FIGURES)AND UNSHIFT(LETTERS)
Page 1-21, Para 99, Fig 50 & 51

43. SHIFT/UNSHIFT DETENT
Page 21, Para 101, Fig 50

NOTE: ADJUSTMENT INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED BY THE INSTRUCTOR AND/OR STUDENT (IF NECESSARY) AS TIME PERMITS.

JOB SHEET NO. 5

LINE FEED MECHANISM

* 44. PLATEN SHAFT
Page 1-22 Para 105

* 45. PLATEN FRICTION ASSEMBLY
Page 42, Para 231, Fig 93

* 46. SINGLE/DOUBLE LINE FEED DETENT
Page 1-22, Para 106, Fig 50

47. LINE FEED DETENT LEVER
Page 1-22, Para 108, Fig 50 & 53

48. LINE FEED CHECK SCREW
Page 23, Para 113, Fig 53

49. LINE FEED LINK TURNBUCKLE
Page 1-22, Para 109, Fig 50

50. LINE FEED CHECK POST STOP SCREW
Page 1-23, Para 114, Fig 53

51. LINE FEED CHECK LEVER
Page 23, Para 115, Fig 50 & 53

* 52. PRESSURE ROLLER RELEASE CAMS
Page 23, Para 118, Fig 53

* 53. PRESSURE ROLLER TENSION SPRING
Page 1-24, Para 119, Fig 55

NOTE: ADJUSTMENTS INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED (IF NECESSARY) BY THE INSTRUCTOR AND/OR STUDENT AS TIME PERMITS.

JOB SHEET NO. 6

SIGNAL BELL, CARRIAGE RETURN AND SPACING

54. SPACING ESCAPEMENT PAWL OPERATING ARM
Page 1-25,Para 128, Fig 57

* 55. SIGNAL BELL LATCH BAR LATCH SHIMS
Page 1-25, Para 133, Fig 29A

* 56. SIGNAL BELL LATCH BAR LATCH
Page 1-25, Para 134, Fig 59A

* 57. SIGNAL BELL HAMMER BACKSTOP
Page 1-25, Para 135, Fig 59A

58. CARRIAGE RETURN LATCH BAR LATCH SHIMS
Page 1-26,Para 139, Fig 59A & 60

59. CARRIAGE RETURN LATCH BAR LATCH
Page 1-26, Para 140, Fig 60B

60. CARRIAGE RETURN LOCK BAR LATCH ECCENTRIC SCREW
Page 26, Para 143, Fig 60A

61. CARRIAGE RETURN LOCK BAR
Page 1-26, Para 143, Fig 60A

62. CARRIAGE RETURN OPERATING LEVER STOP SCREW
Page 1-27, Para 144, Fig 60B

63. SPACING STOP LEVER BRACKET
Page 1-27, Para 150, Fig 61

64. CARRIAGE RETURN SPRING DRUM
Page 1-28, Para 157, Fig (none)

65. LEFT AND RIGHT MARGIN ADJUSTING SCREWS
Page 1-31,Para 168 & 169,Fig60B and 61

66. MARGIN BELL
Page 1-32,Para 173,Fig 58

67. DASHPOT VENT SCREW
Page 1-33,Para 176,Fig 60

JOB SHEET NO.7

THE SELECTOR UNIT

PRELIMINARY: 1. REMOVE SEPARATOR PLATES. PLACE ALL PARTS ON WORK BENCH IN EXACT ORDER OF REMOVAL. PROCEED AS FOLLOWS :

a. Remove the five nuts and lock washers holding the plates assembly.
b. Remove the top separator plate. Note that it is different in shape than the others.
c. Remove the armature locking lever and its spring.
d. Remove second separator plate.
e. Remove selector lever spring, sword, "T" lever and selector lever.
f. Continue disassembly, removing all plates, swords, "T" levers, springs -

2. CLEANING, LUBRICATION AND REASSEMBLY.

a. Draw pan of Agitene from shop.
b. Draw rags from container in room.
c. Clean all parts removed above. Spread a fine film of oil on all parts and wipe off excess.
d. Check all parts for undue wear and tear while cleaning.
e. Reassemble the unit in exactly the reverse order of removal.
f. Call Instructor for throwout on the following adjustments.

68. STOP LEVER ECCENTRIC SCREW
Page 1-14,Para 63, Fig 36.

_____

69. MAGNET BRACKET
Page 1-15,Para 69, Fig 33

_____

70. SELECTOR MAGNET COIL
Page 1-15, Para 68, Fig 33

_____

71. SELECTOR ARMATURE BRACKET AND LINK
Page 1-13,Para 58, Figs 31,32 & 33

_____

72. SELECTOR ARMATURE
Page 1-12, Para 57 ,Fig 31

_____

73. ARMATURE STOPS
Page 1-14, Para 60, Fig 34

74. AMATURE TRIP OFF ECCENTRIC SCREW
Page 1-15, Para 67, Fig 39

75. ARMATURE LOCKING WEDGE
Page 1-17, Para 75, Fig 43

It is required that the student obtain 80 points of range, anywhere on the range scale, using the BD-100 "TD" or the mobile "DTS".

Students obtaining 80 points or over will proceed on to the next adjustment without having each of the selector unit adjustments checked by the Instructor.

When the student is certain he has 80 points of range he should place his name on the board for a check. If the Instructor determines he has 80 points or more it is indicated that all selector unit adjustments are within tolerance.

If unable to obtain 80 points of range after refinir all selector unit adjustments call the Instructor.

JOB SHEET NO. 8

MOTOR STOP AND KEYBOARD LOCKOUT MECHANISM

76. ARMATURE LOCKING WEDGE (MOTOR STOP PAWL LATCH)
PAGE 1-14, PARA 61, FIG 97 _____

77. MOTOR STOP LEVER BRACKET
PAGE 1-43, PARA 240, FIG 97 _____

78. MOTOR STOP LEVER ECCENTRIC
PAGE 1-43, PARA 241, FIG 97 _____

79. MOTOR STOP PAWL BACKSTOP
PAGE 1-44, PARA 243, FIG 97 _____

80. MOTOR STOP LEVER BACKSTOP SCREW
PAGE 1-44, PARA 242, FIG 97 _____

81. MOTOR STOP RELEASE LEVER ECCENTRIC
PAGE 1-44, PARA 244, FIG 97 _____

82. MOTOR STOP LEVER SPRING TENSION
PAGE 1-44, PARA 246, FIG 97 _____

83. STOP LEVER PLATE
PAGE 1-37, PARA 206, FIG 83B _____

84. BREAK LEVER ADJUSTING PLATE
PAGE 1-37, PARA 207, FIG 83B _____

85. SEND RECEIVE "T" LEVER FRICTION WASHER
PAGE 1-29, PARA 160, FIG 65A _____

86. SEND RECEIVE MECHANISM PLATE
PAGE 1-29, PARA 163, FIG 66 _____

87. INTERMEDIATE LEVER STOP BRACKET
PAGE 1-30, PARA 164, FIG 65A-66 _____

88. SEND RECEIVE RESET LEVER UPPER ADJUSTING PLATE (SCREW)
PAGE 1-31, PARA 167, FIG 65B _____

89. RESET LEVER LOWER ADJUSTING SCREW
PAGE 1-45, PARA 251, FIG 99 _____

90. RESET LEVER DOWNSTOP SCREW
PAGE 1-45, PARA 252, FIG 99A-99B _____

MODEL 19 KEYBOARD TRANSMITTING UNIT

GENERAL: The keyboard of the Model 19 Perforator Transmitter is the TRANSMITTING UNIT which permits manual operation of the Mod. 19 teletypewriter.

PURPOSE: THE KEYBOARD CHANGES MECHANICAL MOTION INTO ELECTRICAL IMPULSES OF THE FIVE UNIT TELETYPE CODE.

Pressing down on any key causes mechanical action to take place that opens and closes six pairs of electrical contacts in various patterns. This causes the teletype loop to be either OPENED (SPACE) with NO current on the line, or CLOSED (MARK) with current on the line.

SOURCE OF MECHANICAL POWER: Mechanical power for the operation of the Model 19 is derived FROM CAMS AND GEARS ON THE MAINSHAFT ONLY ,AND SPRINGS THROUGHOUT THE MACHINE.

The main shaft is mounted on the typing unit. On its right end is a large fiber gear (Main shaft gear) which meshes with a metal gear (Motor pinion gear) on the motor shaft. The transmitting shaft is driven by the transmitting shafts DRIVEN gear which is mounted on the rear end of the transmitting shaft. The transmitting shaft DRIVEN gear is driven by the transmitting shaft DRIVING gear which is mounted on the main shaft. Thus we can trace the the train of parts for rotation of the transmitting shaft as follows :

MOTOR PINION GEAR
MAIN SHAFT GEAR
MAIN SHAFT
TRANSMITTING SHAFT DRIVING GEAR
TRANSMITTING SHAFT DRIVEN GEAR
TRANSMITTING SHAFT

In the Model 19 we will frequently discuss the source of POWER. As the motor pinion gear actually starts it all off, it seems the logical place to go, BUT IT IS NOT. For each operation in the machine, there is a cam or gear on the main shaft that furnishes power, or a spring some where in the machine that assists in the operation. Therefore, in tracing the source of power, we will go back only as far as the main shaft and we will ALWAYS be guided by the following rule. Memorize it and learn to apply it!

IN THE MODEL 19 ALL POWER IS DERIVED FROM CAMS AND GEARS ON THE MAIN SHAFT ONLY, AND SPRINGS THROUGHOUT THE MACHINE.

NOTE: The motor rotates at 2100 RPM
The main shaft rotates at 420 RPM
The transmitting shaft rotates at 368 RPM

KEYBOARD TRANSMITTING SHAFT

The transmitting shaft rotates all the time the motor is running. In all our discussions of the machine, we will assume that the motor is running, as that is the normal condition of the machine.

The transmitting shaft has mounted on it, the TRANSMITTING CAM SLEEVE, and the TRANSMITTING SHAFT CLUTCH (a positive action clutch) and the TRANSMITTING SHAFT DRIVEN GEAR (fibre). The transmitting cam sleeve rotates only when the transmitting shaft clutch is engaged.

The TRANSMITTING CAM SLEEVE HAS 7 cams on it. From rear to front they are the :

LOCK LOOP CAM
START STOP CAM
1st thru 5th TRANSMITTING CAM

The TRANSMITTING SHAFT CLUTCH consists of a DRIVING member which is bolted to the TRANSMITTING SHAFT, and a DRIVEN member which is connected by a spline and compression spring to the TRANSMITTING CAM SLEEVE assembly. The spline is used so the DRIVING and DRIVEN members of the clutch may be engaged and disengaged without having to move the cam sleeve assembly, only the clutch driven member.

Normally between operations, the transmitting shaft clutch is disengaged and the transmitting cam sleeve does not turn. Whenever a key is depressed, the transmitting shaft clutch is engaged and the cam sleeve makes one complete revolution, at the end of which the clutch becomes disengaged again. (The cluton action will be explained later).

The purpose of the LOCK LOOP CAM will be explained late

The START-STOP CAM governs the transmission of the START and STOP impulses.

The FIVE TRANSMITTING (OR INTELLIGENCE) CAMS govern the transmission of the five unit teletype code, the operation of which will be covered in the KEY to CONTACTS train of parts.

NOTES:

SUBJECT: TRANSMITTING SHAFT ASSEMBLY

Reference: Teletype Bulletin 166, Page 3, Para 2, Fig 6 & 14

1. The TRANSMITTING SHAFT rotates ALL the time.

2. The TRANSMITTING CAM SLEEVE rotates ONLY when the TRANSMITTING SHAFT CLUTCH is engaged.

3. There are EIGHT (8) cams on the TRANSMITTING SHAFT. From the REAR to the FRONT, they are:

   a. THROWOUT CAM
      (Used to cam the DRIVEN member from the DRIVING clutch member)

   b. LOCK LOOP CAM
      (Used to lift the LOCK LOOP up ...this will be explained later)

   c. START-STOP CAM
      (Governs the START and STOP impulses of the Teletype code (Baudot Code).

   d. 1st thru 5th TRANSMITTING CAMS (or Intelligence Cams)
      (Used to govern the TRANSMITTING CONTACTS)

Additional Notes (If desired)

KEY TO THROWOUT CAM, TRAIN OF PARTS.

REF: Teletype Bulletin 166, Page 3, Para 2, Fig 6.

PURPOSE OF THE KEYBOARD: TO CHANGE MECHANICAL MOTION INTO ELECTRICAL IMPULSES OF THE FIVE UNIT CODE.

Depress a

1. KEY, the key moves the

2. KEY LEVER. The keylever moves the

3. UNIVERSAL BAR down. Attached to the right end of the Universal Bar is the

4. TRIP-OFF PAWL which is pulled towards the front of the machine and in doing so rotates the

5. INTERMEDIATE PAWL clockwise. Mounted on the rear arm of the Intermediate Pawl is an eccentric screw which will move the lower arm of the

6. CLUTCH THROW-OUT LEVER, rotating it CLOCKWISE, thus disengaging the Clutch Throwou Lever from the

7. THROWOUT CAM, which is physically part of the clutch driven member. As the Clutch Throwout Lever is disengaged from the Throwout Cam, the Clutch Compression Spring forces the Driven member into the Driving member, thus starting the Transmitting Cam Sleeve to rotating.

KEY
KEYLEVER
UNIVERSAL BAR
TRIP-OFF PAWL
INTERMEDIATE PAWL
THROWOUT CAM
****

NOTES:

SPACE BAR to the THROWOUT CAM, TRAIN OF PARTS.

REF: Teletype Bulletin 166, Page 3, Para 4.
Teletype Bulletin 144, Page 3

NOTE: THE KEYBOARD HAS A SPACE KEYLEVER THAT OPERATES LIKE ANY OTHER KEYLEVER FOR THE TRANSMISSION OF A SINGLE SPACE.

Depress the -

1. SPACE BAR, which will move the
2. SPACE BAR LOOP, down. The Space Bar Loop upper extensi is attached to and operates the
3. SPACE REPEAT ROD to the FRONT of the machine and in doing so the Space Repeat Rod strikes the
4. INTERMEDIATE PAWL rotating it CLOCKWISE, which in turn will rotate the
5. CLUTCH THROWOUT LEVER clockwise thus disengaging it from the
6. THROWOUT CAM, allowing the clutch compression spring to force the DRIVEN member into engagemer with the DRIVING member and thereby rotating the Transmitting Cam Sleeve. The Transmitting Cam Sleeve will continue to rotate until the Space Bar is released and returns to its normal position by the action of the Space Keylever Srping.

SPACE BAR
SPACE BAR LOOP
SPACE REPEAT ROD
INTERMEDIATE PAWL
CLUTCH THROWOUT LEVER
THROWOUT CAM

NOTES:

KEY TO TRANSMITTING CONTACTS, Train of Parts

Ref: Teletype Bulletin No. 166, page 2, 3, Fig 5

Depress the

1. KEY which moves the

2. KEY LEVER which moves the

3. SELECTOR BARS. There are FIVE pairs of Selector Bars directly underneath the keylevers. The front selector bar of each pair rests on the LEFT arm of the "Y" levers. The rear selector bar of each pair rests on the RIGHT arm of the "Y" levers. If the FRONT selector bar goes down, the "Y" lever lower arm move toward the RIGHT. If the rear selector bar goes down, the "Y" lever lower arm moves toward the LEFT. When the FRONT selector bar moves DOWN a SPACING impulse is being transmitted. When the REAR selector bar moves DOWN, a MARKING impulse is being transmitted.

The selector bars move the

4. "Y" LEVERS, the "Y" levers lower arms are secured together with

5. "Y" LEVER CONNECTING LINKS. Secured to the "Y" lever connecting links are the

6. LOCKING LEVER FORKS.. Riding in the forks are the

7. LOCKING LEVERS which control the

8. CONTACT LEVERS which control the

9. TRANSMITTING CONTACTS.

KEY
KEYLEVER
SELECTOR BARS
"Y" LEVERS
"Y" LEVER CONNECTING LINKS
LOCKING LEVER FORKS
LOCKING LEVERS
CONTACT LEVERS
TRANSMITTING CONTACTS

- -

OPERATION OF THE LOCK LOOP

Once the locking levers have been positioned, they must not change this position until the character or operation set up on them has been completely transmitted

If the levers were shifted during transmission of a selected operation, that operation would be garbled.

The action of the lock loop prevents depressing another key until the previously selected operation has been completed.

Normally, the LOCK LOOP ROLLER rests on the HIGH side of the LOCK LOOP CAM.

When the Transmitting Cam Sleeve starts to rotate, the LOCK LOOP ROLLER rides down to the LOW side of the LOCK LOOP CAM.

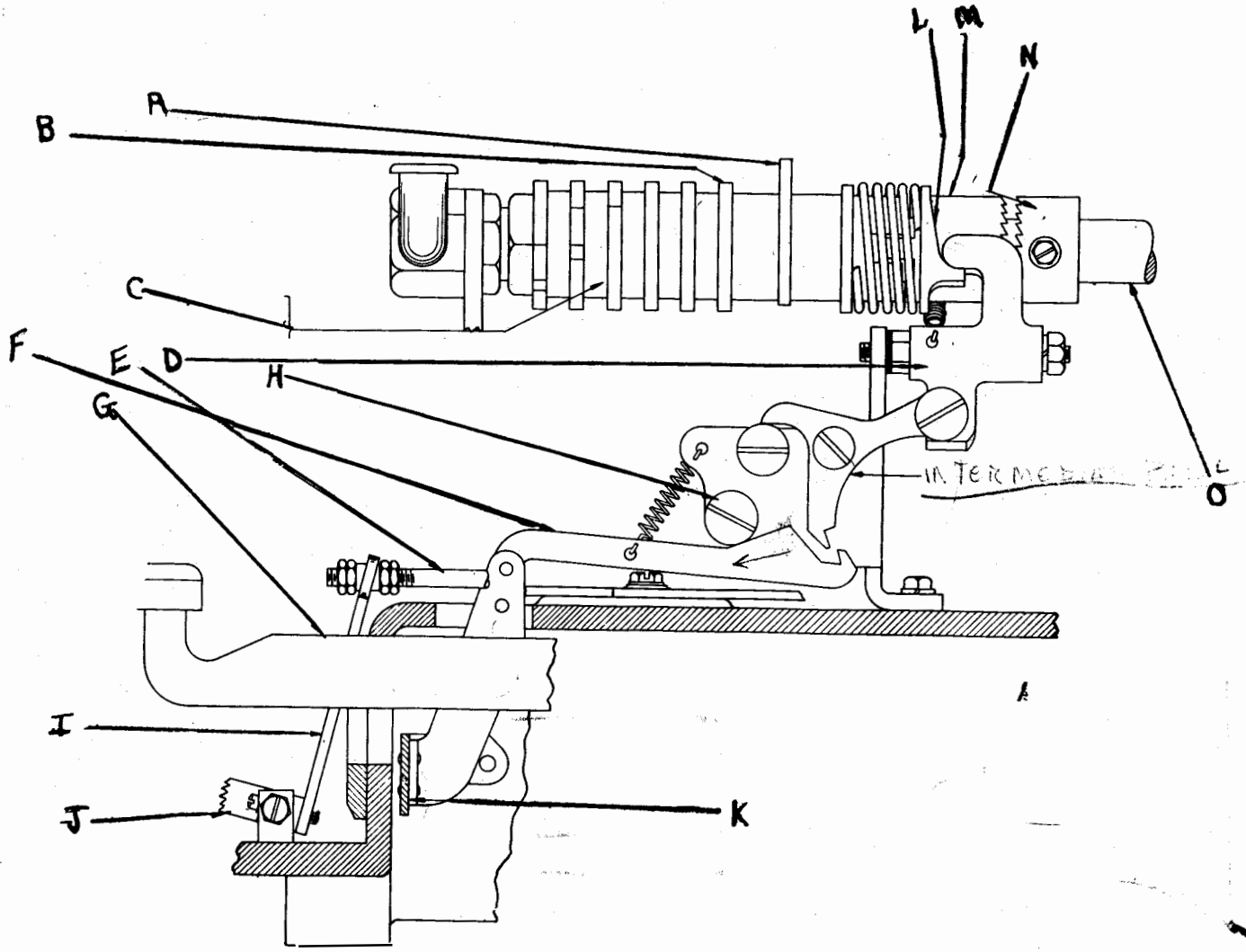
This allows the LOCK LOOP to drop down and the LOCK LOOP BLADE locks the LOCKING LEVERS.

If the operator tries to depress another key at this point, he is prevented from doing so, since the locking levers are prevented from changing to another position by the lock loop blade.

When the selected operation is completely transmitted and the transmitting cam sleeve comes to a stop, the lock loop roller is again resting on the HIGH side of the lock loop cam. The lock loop has been moved up and the lock loop blade releases the locking levers so that they may be positioned for the next operation.

LOCK LOOP CAM
LOCK LOOP ROLLER
LOCK LOOP
LOCK LOOP BLADE
LOCKING LEVERS

NOTES:



A Lock Loop CAM

B START STOP CAM

C TRANSMITTING CAM SLEEVE ASSEMBLY

D CLUTCH INBOWOUT LVR

E RPT SPACE ROD

F TRIPOFF PAWL

G KEY LVR

H TRIPOFF PAWL STOP

I EXT

J SPACE BAR ROD

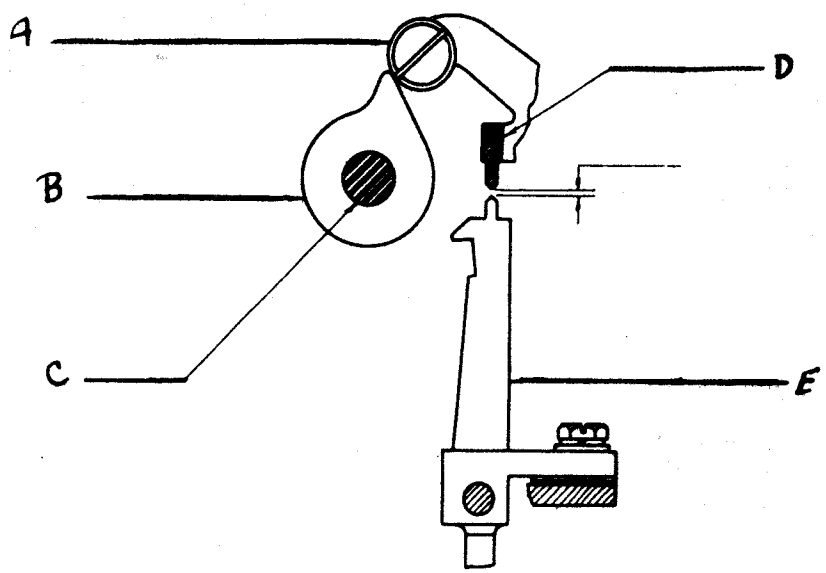
K UNIVERSAL BAR

L INBOWOUT CAM

M CLUTCH DRIVEN MEMBER

N CLUTCH DRIVING MEMBER

O SHAFT



A Locking Lever Roller

B Lock Lock Cam

C Track Guide

D Lock Loop BLADE

E Lock Rod Link

PERFORATOR MECHANISM

GENERAL:

The perforator unit of the Model 19 is attached to the left side of the keyboard casting. This mechanism consists essentially of a set of punches for perforating the tape, a punch magnet and armature lever for operating the punches, a set of selector fingers, selector levers and "Y" lever connecting link extensions, used in selecting the punches and a tape feeding mechanism. The perforating mechanism which punches the holes in the tape if the impulse if MARKING, or leaves the tape unpunched if the impulse is SPACING, consists of a mechanical train of parts which sets up six fingers beneath the six punches which are under the tape. An armature and a pair of punch magnets are beneath the fingers. After the fingers are positioned so the proper punches will be pushed through the tape to correspond with the code combination the punch magnets will be energized, operating the armature, raising the fingers UP, pushing the punches through the tape for each MARKING impulse.

At this time we are concerned with HOW and WHEN the punch magnets will be energized.

We have already traced out the line circuit through the keyboard, tracing its path through 55, 54 and 57 slip connector and the transmitting contacts. Our bias circuit when through 51 and 56 slip connectors and the polar neutral key. Our common DC path for bias, magnet and shunt circuits make contact at 53 and 52 slip connectors, but we only used them as check points. Now we will see how the DC from 53 and 52 slip connectors will be used in the perforator unit.

KEYBOARD OPERATING LEVER

The keyboard operating lever is a manually operated, three position lever located on the right side of the keyboard unit. The selection of any one of three methods of operation may be made by placing this operating lever in the desired position.

A. OPERATING LEVER IN UPPER OR "KEYBOARD" POSITION - direct keyboard transmission to the line with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set which is 60 WPM here in school.

B. OPERATING LEVER IN MIDDLE OR "KEYBOARD AND TAPE" POSITION - simultaneous direct keyboard transmission to the line and perforating of tape with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set which is 60 WPM.

C. OPERATING LEVER IN LOWER OR "TAPE" POSITION - perforation of tape only, with the associated printer either receiving messages from a distant station, or monitoring the message perforated in the tape as it is being transmitted to the line by a transmitter distributor.

KEYBOARD CONTROL CONTACTS

The keyboard control contacts are mounted on the right rear corner of the keyboard casting. There are FIVE contac numbered 1 thru 5, from the top down. These contacts are controlled by the keyboard control operating lever.

CAM PULSING CONTACTS

The cam pulsing contacts are mounted on a bracket above the transmitting cam sleeve. There are two pairs of cam pulsing contacts, wired in parallel, the rear one above number 4 intelligence cam and the front one above number 5 intelligence cam. When the indent of the cam is at the top of the shaft, the cam pulsing contacts above it is allowed to close.

PUNCH CONTACTS

The punch contacts are mounted on the perforator mechanis These two contacts will close every time a key is depressed, and open every time a key is released.

KEYBOARD CONTROL OPERATING LEVER IN KEYBOARD & TAPE POSITION

1. Keyboard control contacts 4 and 5 closed
2. Keyboard control contacts 1,2 and 3 open
3. Punch magnets are energized thru the cam pulsing contac
   a. As a key is depressed, setting up the locking levers, and the fingers under the punches, the cam sleeve assembly begins rotating.
   b. As the START impulse is sent, the rear cam pulsing contacts close.
   c. As the first selecting impulse is sent, the front cam pulsing contacts close, just before the rear ones open.
   d. For the second and succeeding impulses the cam pulsin contacts will be open until another character is selected.
   e. The first 44 M/S of time to send a character to the line as the transmitting cam sleeve is rotating, find the cam pulsing contacts closed.
4. This is the way our electrical circuit is completed to energize the punch magnets when we have the operating lever in KEYBOARD AND TAPE position: From #53 slip connector, thru a wire to the pair of punch magnets hooked inseries, thru TWO 200 ohm resistors, hooked in parallel with each other, to keyboard control contact #3 (tie point) thru the cam pulsing contacts, thru the filter unit, to keyboard control contacts #4, thru the keyboard control contacts #5 and back to slip connector #52.

5. The character will be perforated, before the character has been completely transmitted to the line. The fingers will always be under the punches before the selector cam sleeve begins rotating, so that when the punch magnets are energized by closing of the first cam pulsing contact, the punches are pushed up thru the tape. The two cam pulsing contacts in parallel are a safety feature. This assures that the magnets will be energized. If one pair were dirty or bent, the other pair of contacts would be closed for a long enough period of time to insure perforation.

KEYBOARD CONTROL OPERATING LEVER IN TAPE POSITION

1. All keyboard control contacts are closed, 4 & 5 together, 1, 2 and 3 together.
2. Direct keyboard transmission is prevented mechanically. The transmitting cam sleeve assembly is prevented from rotating.
   a. Although keyboard contacts 4 & 5 remain closed, as in keyboard and tape position, no current can flow through them, as the cam pulsing contacts are held mechanically open, by preventing the transmitting cam sleeve from rotating.
3. Operation of any key mechanically closes the punch contacts each time the key is pushed down, and the punch contacts open every time the key is released.
   a. Even though the cam sleeve is prevented from rotating, the selector fingers are set up under the punches so that the tape may be perforated any time the punch magnets are energized.
4. This is the way our electrical circuit is completed to energize the punch magnets when we have the operating lever in TAPE position:--
   53 slip connector, thru a wire to the punch megnets, through a wire to the two 200 ohm resistors in parallel with each other, to keyboard control contact #2, through contact 2 to keyboard control contact #1, through a wire to the punch contacts, through the punch contacts and a filter unit to 52 slip connector.

From the above you can see that we have two separate paths for the current to take in order to energize the punch magnets. In the KEYBOARD/TAPE position, we do not use the punch contacts at all. They close each time a key is depressed, but since the keyboard control contacts 1, 2 and 3 are open, the path through the punch contact circuit is broken and no current can flow through the contacts.

In keyboard/tape position, the keyboard control contacts 4 & 5 are closed, therefore, every time the transmitting cam sleeve rotates, and the cam pulsing contacts close, current will flow thru the punch magnet circuit, energizing the magnets and punching the tape.
Now, as the cam pulsing contacts will only close once, with each rotation of the cam sleeve, we are thereby limited to the speed of the machine when punching tape in keyboard/tape to 368 OPM or 60 WPM.

In tape position, we allow the keyboard control contacts 4 & 5 to close, but no current can flow thru them as we've cammed out the trip-off pawl and space repeat rod, preventing the cam sleeve from rotating and prevent the cam pulsing contacts from closing.
Therefore, we complete the circuit for the punch magnets thru the keyboard control contacts 1 & 2 and the punch contacts. As the punch contacts will close very time a key is depressed, no matter how fast or how slow the operator is typing, we see we are not limited as to how fast tape can be cut in the tape position. Only the operators typing speed will be the speed governing factor when cutting tape in the "TAPE" position.
One more point, the punch contacts are so adjusted that the selector fingers are always positioned under the punches by the time the punch contacts close.

FILTER CIRCUITS

There is a filter unit on every contact in the teletype machine. Here in the school, several of them have been removed to allow access to portions of the machine, otherwise unavailable.
The purpose of a filter unit is to supress sparking when contacts open or close, thereby preventing radio interference in equipment located in close proximity to the teletype equipment.
There is a filter unit between the punch contacts and slip connector 52.
Also between the keyboard control contact #5 and the cam pulsing contacts.
There is a filter unit with a surge resistor in the punch magnet circuit, across the two 200 ohm resistors and slip connector 52.

There filters effectively filter the radio interference that would ordinarily occur by the opening and closing of the cam pulsing, punch and counter control contacts.

SUBJECT: PERFORATOR OPERATION

REF: Teletype Bulletin 166, pages 3 & 4, fig 3, 47 & 48

The magnet armature is mounted on a centrally pivoted armature lever. When the magnet is energized, the right end of the armature lever moves down, the left end moves up, carrying with it the left end of the selector fingers.

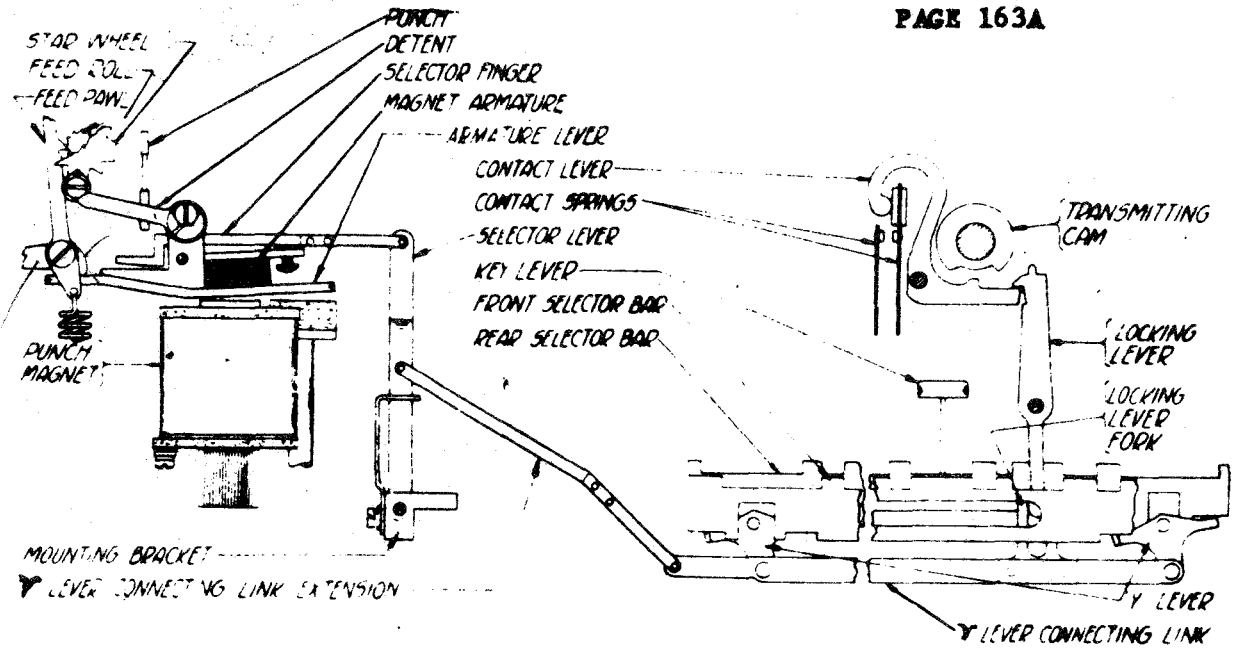
Selector fingers respond the same as the lower end of the locking levers when any key is depressed. Any selector finger that is positioned to the right will raise up also, but it will not be under its punch, therefore no hole will be punched in the tape. Any selector finger that is positioned to the left will raise up, moving its associated punch up through the tape above it.

The feed punch selector lever and finger does not move out from under the feed punch, therefore the feed punch selector finger is always raised up and the feed hole will be punched in the tape on every operation of the perforator.

Depress any

1. KEY and the associated
2. KEYLEVER moves downward against the
3. PUNCH CONTACT OPERATING BAR which rotates the
4. "Y" LEVER clockwise, moving the
5. "Y" LEVER CONNECTING LINK to the left, moving the
6. ADJUSTABLE LINK to the left, moving the
7. PUNCH CONTACT OPERATING LEVER to the left, applying tension to the
8. RETRACTING SPRING allowing the
9. PUNCH CONTACTS to close, under their own spring tension, energizing the
10. PUNCH MAGNETS.

KEY
KEYLEVER
PUNCH CONTACT OPERATING BAR
"Y" LEVER
"Y" LEVER CONNECTING LINK
ADJUSTABLE LINK
PUNCH CONTACT OPERATING LEVER
RETRACTING SPRING
PUNCH CONTACTS
PUNCH MAGNET


STAR WHEEL
FEED ROLL
FEED PAWL
PUNCH
DETENT
SELECTOR FINGER
MAGNET ARMATURE
ARMATURE LEVER
CONTACT LEVER
CONTACT SPRINGS
SELECTOR LEVER
KEY LEVER
FRONT SELECTOR BAR
REAR SELECTOR BAR
TRANSMITTING CAM
LOCKING LEVER
LOCKING LEVER FORK
PUNCH MAGNET
MOUNTING BRACKET
Y LEVER
Y LEVER CONNECTING LINK

SUBJECT: PERFORATOR OPERATING

REF: Teletype bulletin 166, pages 3 & 4 fig 3, 47 & 4

Depress any

1. KEY and the assocaited
2. KEYLEVER moves downward against the
3. SELECTOR BARS which rotate their associated
4. "Y" LEVERS clockwise for a mark. Atuached to the bot is the
5. "Y" LEVERS CONNECTING LINKS (6) which will be position to the left, moving the
6. "Y" LEVER CONNECTING LINK EXTENSIONS to the left, positioning it ass ociated
7. SELECTOR LEVERS (6) to the left, moving the
8. PUNCH SELECTOR FINGERS (6) to the left under the
9. PUNCH PINS (6) and when the punch magnets energize, a hole will be punched in the tape.

If any Y lever rotates counterclockwise, the associated pu selector finger will be moved to the right, moving it out under the punch pin, and no hole will be punched in the ta

There are 5 "Y" LEVER CONNECTING LINK EXTENSIONS, plus 1 the operating bar, making a total of six (6).

KEY
KEYLEVER
SELECTOR BARS
"Y" LEVERS
"Y" LEVER CONNECTING LINKS
"Y" LEVER CONNECTING LINK EXTENSIONS
SELECTOR LEVERS
PUNCH SELECTOR FINGERS
PUNCH PINS

- -

NOTES:.....

PSU
SUBJECT: PERFORATOR OPERATION

REF: Teletype bulletin 166, pages 3 & 4 fig 5, 47 & 4

The left end of the

1. ARMATURE LEVER raises up when the punch magnet energiz
The

2. FEED PAWL is lifted up by the armature lever by liftin

3. FEED PAWL LEVER applying tension to the

4. FEED PAWL SPRING As the feed pawl is raised up, it
engages the next tooth of the

5. FEED ROLL When the punch magnet de-energizes, the feed
pawl spring pulls the feed pawl down, advanci
the feed roll one character space. The

6. TAPE TENSION LEVER holds the tape aginst the feed roll,
keeping the feed holes in the tape
meshed with the

7. TAPE FEED PINS of the feed roll. The

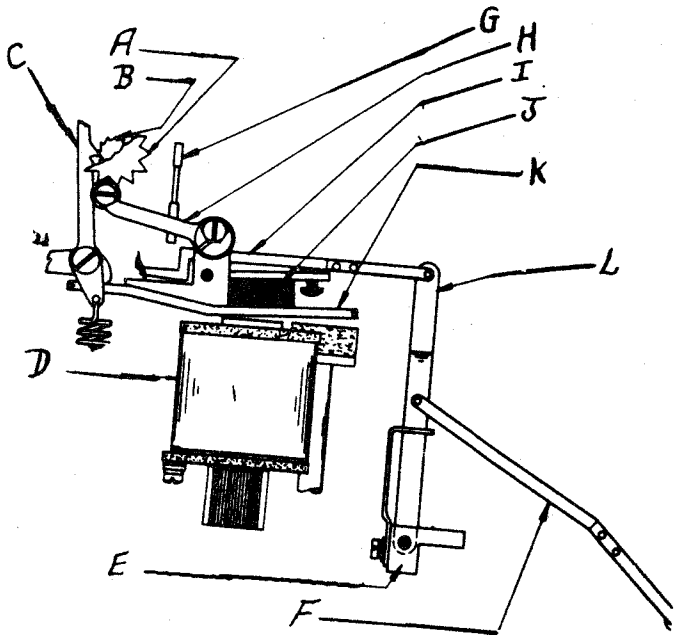
8. STAR WHEEL and the

9. STAR WHEEL DETENT insures equal spacing of the tape
perforations.

ARMATURE LEVER
FEED PAWL
FEED PAWL LEVER
FEED PAWL SPRING
FEED ROLL
TAPE TENSION LEVER
TAPE FEED PINS
STAR WHEEL
STAR WHEEL DETENT

- -

NOTES: ....



A _____

B _____

C _____

D _____

E _____

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G _____

H _____

I _____

J _____

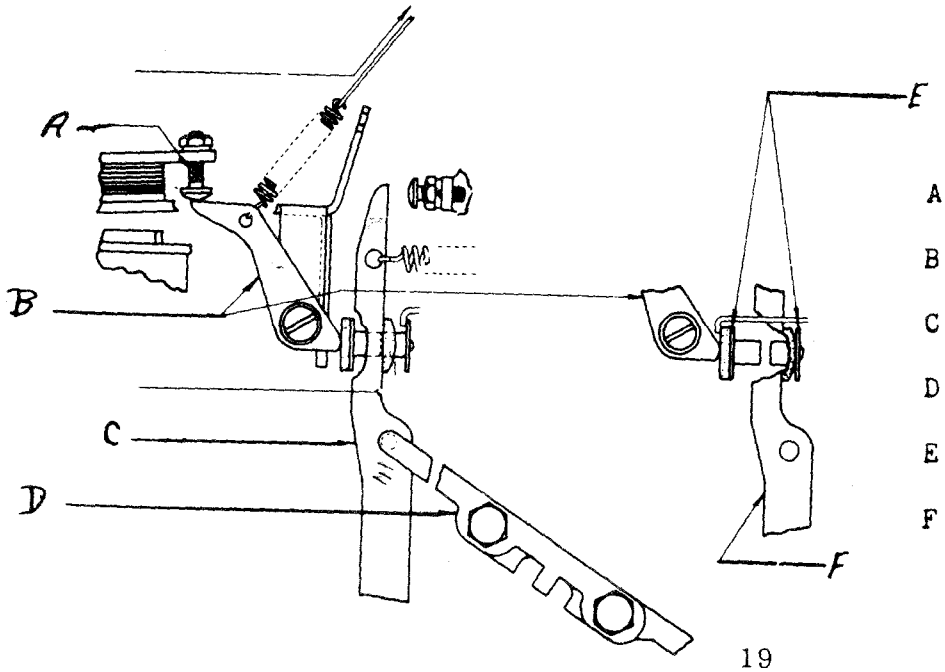
K _____

L _____

SUBJECT : ANTI-CHATTER MECHANISM
REFERENCE: TELETYPE BULLETIN 166, Page 5, Fig 47.

The Anti-Chatter mechanism is used to insure complete perforation of the tape when the Punch Contacts are closed, by holding the contacts tightly together allowing no sparking or vibration.

Attached to the Punch Magnet Armature is the "Anti-Chatter Lever Adjusting Screw" which, as the magnets become energized pushes downward on the Anti-Chatter Lever rotating it counter-clockwise. The top of the lever will move against the Left Punch Contact and will hold it tightly in position thus preventing any sparking and"chattering" of the magnets from the rapid "making" and "breaking" of the circuit.



A _____

B _____

C _____

D _____

E _____

F _____

COUNTER CONTROL MECHANISM

Teletype bulletin 166, page 5, fig 51 & 52.

The counter and release magnts in the character counter are controled by the counter control contacts, mounted on the upper left hand portion of the keyboard casting. Counter control contacts #1 & #2 control the counter magnets. When the Gigures, Letters or Line Feed keylever is depressed contacts #1 & #2 will be opened, disabling the counter magnets.
Counter control contacts #2 & #3 control the release magnets. When the Carriage Return keylever is depressed, contact #2 will be moved away from #1 and make contact with #3, opening the circuit to the counter magnets and allowing the release magnets to energize.
The normal condition of the counter control contacts is #1 & #2 closed, #2 & #3 open, allowing the counter magnets to energize and disabling the release magnets.

NON COUNTING OPERATION

When the Figures, Letters or Line Feed

1. KEYLEVER is depressed, the top of the
2. CAM LEVER moves to the right, moving the bottom to the left (clockwise) and moving the
3. CROSS BAR and the
4. FIBER EXTENSION to the left. This fiber extension is mounted between contacts #1 & #2. Therefore, as the fiber extension move left, it opens the counting magnet circuit by pulling the
5. COUNTER CONTROL CONTACT #1 away from
6. COUNTER CONTROL CONTACT #2 preventing current flow thr the counter magnet when eit Letters, Figures or Line Fe keys are depressed.

KEYLEVER
CAM LEVER
CROSS BAR
FIBER EXTENSION
COUNTER CONTROL CONTACT #1
COUNTER CONTROL CONTACT #2

- -

NOTES: ....

SUBJECT: COUNTER CONTROL MECHANISM

REF: Teletype bulletin 166, page 5, fig 51 & 52

When the

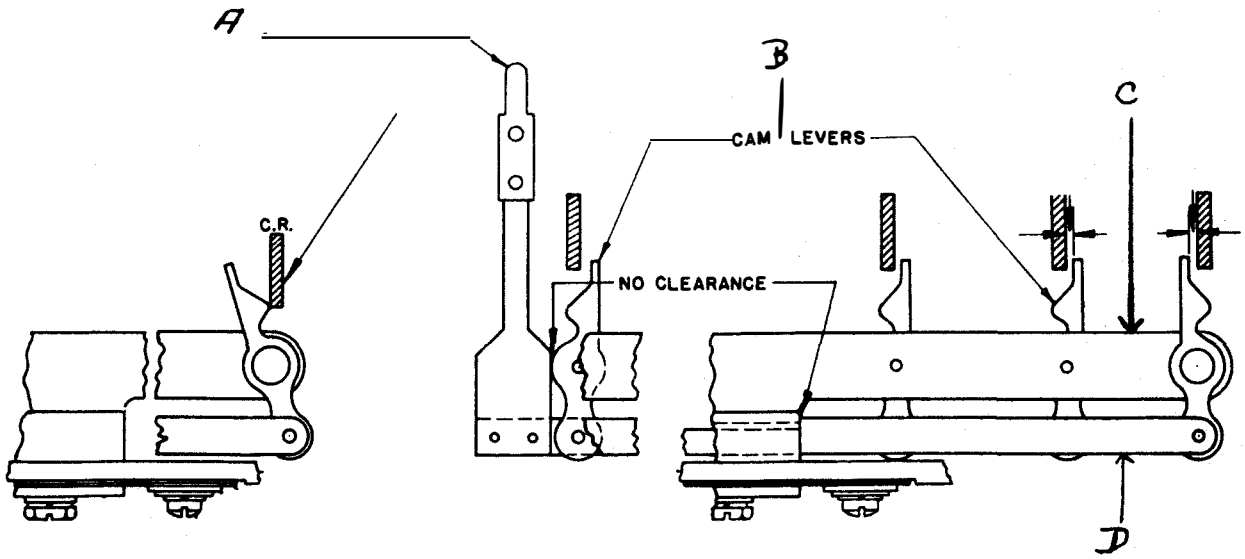
1. CARRIAGE RETURN KEY is depressed, the
2. CARRIAGE RETURN KEY LEVER moves down, riding against th
3. CARRIAGE RETURN CAM LEVER moving the top of it to the l and the bottom of it to the right (clockwise) moving the
4. CROSS BAR to the right, which in turn moves the
5. FIBER EXTENSION to the right, moving
6. COUNTER CONTROL CONTACT #2 away from #1 and against
7. COUNTER CONTROL CONTACT #3 there by allowing current to flow thru the release magnet circuit.

NOTE: The forward cross bar is operated by the CARRIAGE RETURN KEYLEVER and the rear CROSS BAR is operated by the Figures, Letters or Line Feed key levers

CARRIAGE RETURN KEY
CARRIAGE RETURN KEY LEVER
CARRIAGE RETURN CAM LEVER
CROSS BAR
FIBER EXTENSION
COUNTER CONTROL CONTACT #2
COUNTER CONTROL CONTACT #3

- -

NOTES: ....



A _____

B _____

C _____

D _____

s
SUBJECT: ADVANCING THE CHARACTER COUNTER

REF: Teletype bulletin 166, pages 5 & 6, fig 11.

The

1. COUNTER MAGNET becomes energized, pulling the
2. COUNTER MAGNET ARMATURE against the core. Attached to the counter magnet armature is
3. FEED PAWL BRACKET. Mounted on the feed pawl bracket is
4. FEED PAWL which is advanced forward on a tooth arround
5. RATCHET. When the counter magnet is de-energized, the
6. FEED PAWL SPRING pulls the feed pawl back, rotating the ratchet one tooth and pulling the armature away from the magnet. The ratchet is attached to the
7. RATCHET SHAFT which has on its other end an
8. INDICATOR which shows by a number on the
9. DIAL how many spaces you have used. As the feed pawl h advanced the ratchet one tooth, the
10. LATCH PAWL engages a tooth on the ratchet and holds the ratchet in its advanced position so that the feed pawl can again be operated and engage another tooth.

COUNTER MAGNET
COUNTER MAGNET ARMATURE
FEED PAWL BRACKET
FEED PAWL
RATCHET
FEED PAWL SPRING
RATCHET SHAFT
INDICATOR
DIAL
LATCH PAWL

- -

NOTES: ....

SUBJECT: RELEASING THE CHARACTER COUNTER

REF: Teletype bulletin 166, page 6

When the

1. RELEASE MAGNET becomes energized, it pulls the

2. RELEASE MAGNET ARMATURE against the magnet core. Attac to the armature is the

3. RELEASE LEVER. As the release lever is moved by the armature, it disengages both the

4. FEED PAWL and the

5. LATCH PAWL from the

6. RATCHET, releasing the ratchet and allowing the

7. RATCHET SPRING to return the counter to zero. The

8. RELEASE LATCH holds the release lever in its operated position, holding the feed pawl and latch pawl out of engagement with the ratchet until the next time the

9. COUNTER MAGNET becomes energized. Then the

10. FEED PAWL EXTENSION disengages the release latch from t release lever, allowing the feed pa and latch pawl to re-engae the ratc

NOTE: When the ratchet returns to zero, it operates a pistc in the dashpot cylinder, which cushions the shock of the counter returning to zero and prevents the counte from bounding.

RELEASE MAGNET
RELEASE MAGNET ARMATURE
RELEASE LEVER
FEED PAWL
LATCH
RATCHET
RATCHET SPRING
RELEASE LATCH
COUNTER MAGNET
FEED PAWL EXTENSION

- -

NOTES: ....

SUBJECT: LIGHTING THE SIGNAL LAMP

REF: Teletype bulletin 166, page 6

The

1. RATCHET SHAFT has a

2. CAM attached to it with a set screw. As the shaft rote the cam will rotate and ride against the

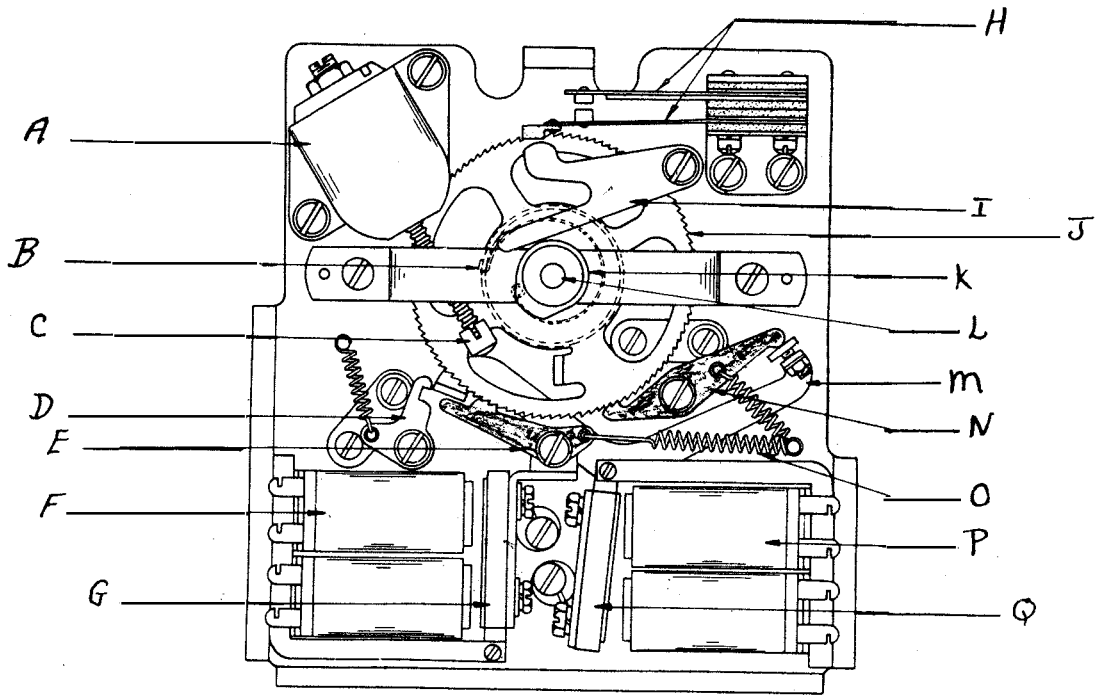
3. CONTACT LEVER, which will close the

4. SIGNAL LAMP OPERATING CONTACTS on the 65th character perforated in the tape, completing the circuit and lighting the signal lamp.

RATCHET SHAFT
CAM
CONTACT LVER
SIGNAL LAMP OPERATING CONTACTS

- -

NOTES: ....



A _____

B _____

C _____

D _____

E _____

F _____

G _____

H _____

I _____

J _____

K _____

L _____

M _____

N _____

O _____

P _____

Q _____

SUBJECT: ELECTRICAL CIRCUITS OF THE MOD 15 PERFORATOR.

REF: Teletype bulletin 166, page 5 & 6.

KEYBOARD CONTROL OPERATING LEVER IN THE TAPE POSITION

ADVANCING THE COUNTER INDICATOR

1. Slip connector 53
2. Counter magnets (2 of 500 ohms each, total 1000 ohms)
3. Counter control contact #1 (left)
4. Counter control contact #2 (center)
5. Keyboard control contact #3
6. Keyboard control contact #2
7. Keyboard control contact #1
8. Punch contacts
9. Slip connector 52

NOTE: Punch, CCC 1 & 2, KCC 1, 2 & 3 must close to energize counter magnets

RETURNING THE INDICATOR TO ZERO

1. Slip connector 53
2. Release magnets (2 of 500 ohms each, total 1000 ohms)
3. Counter control contact #3 (right)
4. Counter control contact #2 (center)
5. Keyboard control contact #3
6. Keyboard control contact #2
7. Keyboard control contact #1
8. Punch contacts
9. Slip connector 52

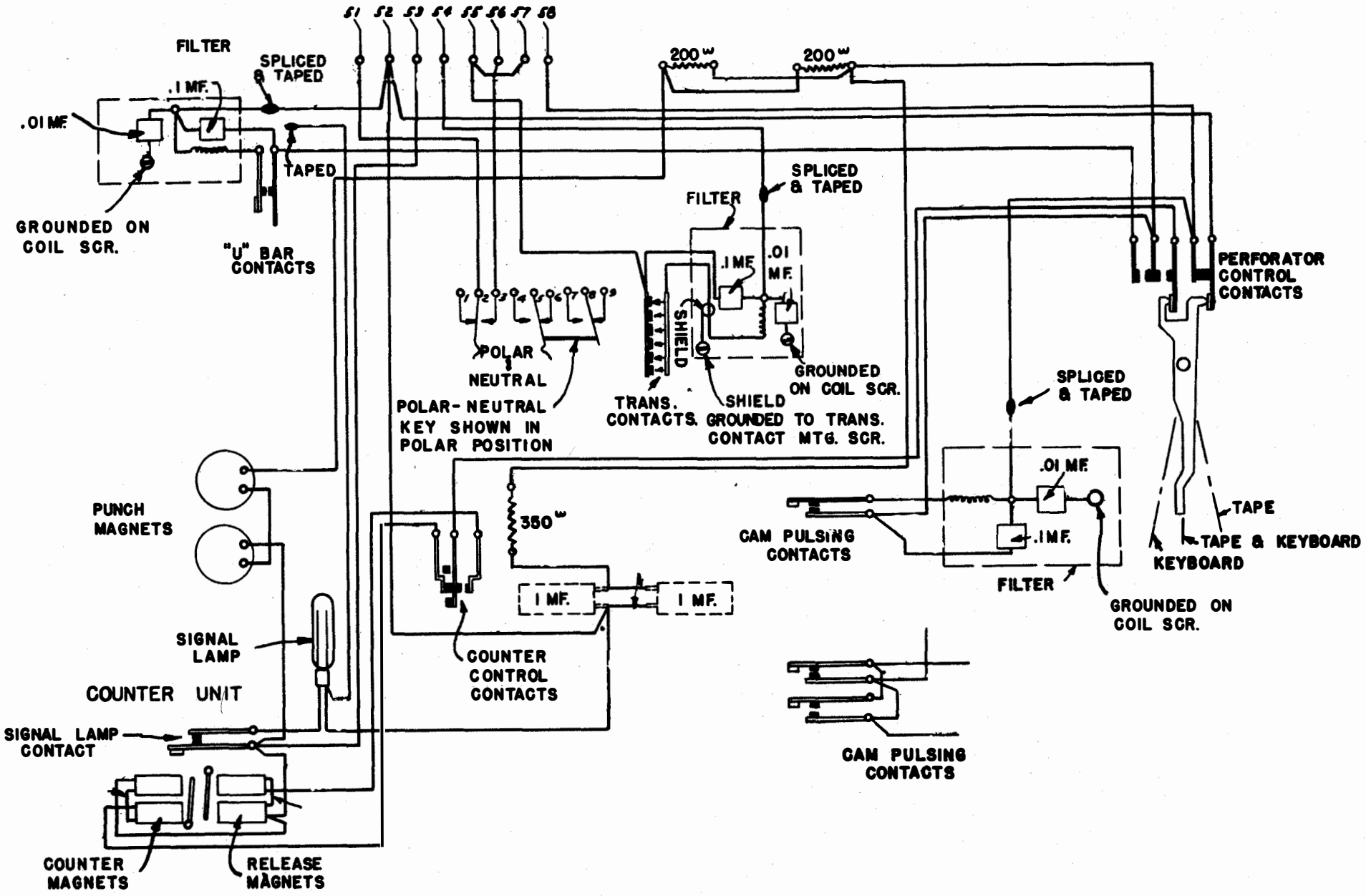
NOTE: Punch, CCC 2 & 3, KCC 1, 2 & 3 must close to energized the release magnets

LIGHTING THE SIGNAL LAMP

The signal lamp contacts are operated mechanically, so that they will close when the indicator has reached a predetermined position, usually 65 characters on Navy machines. When these contacts close, the red signal lamp is lighted.

1. Slip connector 53
2. Signal lamp contacts
3. Signal lamp
4. Slip connector 52

The signal lamp is wired directly between slip connectors 52 and 53. They cannot be de-energizing unless you return the counter to zero by energizing the release magnet.



ACTUAL WIRING - 15 TYPE PERFORATOR TRANSMITTER

(CHARACTER COUNTER UNIT MOUNTED ON PUNCH ASSEMBLY TO THE LEFT OF KEYBOARD)

JOB SHEET NO. 9 Ref: Teletype Bulletin B166

91. TRANSMITTING SHAFT BEARING BRACKET.
Page 8, Fig 14 R

92. SELECTOR BAR ASSEMBLE BRACKET.
Page 10, Fig 5 and 6 R

93. LOCKING LEVER BRACKET POSITION.
Page 10, Fig 15 R

94. CLUTCH THROWOUT LEVER.
Page 10, Fig 16 R

95. LOCK LOOP ROLLER.
Page 10 & 11, Fig 18 R

96. KEYBOARD CONTROL OPERATING LEVER BRACKET.
Page 11, Fig 16 R

97. UNIVERSAL BAR BRACKET.
Page 11, Fig 16. Part 1, 2, & 3 R

98. INTERMEDIATE PAWL ECCENTRIC
Page 11, Fig 19 R

99 CLUTCH THROWOUT LEVER ECCENTRIC.
Page 12, Fig 21 R

100. TRIP OFF PAWL ECCENTRIC.
Page 12, Fig 20 R

101. REPEAT SPACE ROD BRACKET.
Page 13, Fig 24, Part A R

102. REPEAT SPACE ROD.
Page 13, Fig 26 R

103. REPEAT SPACE ROD CUTOUT.
Page 14, Fig 28, Part A & B

104. KEYBOARD CONTROL OPERATING LEVER DETENT BRACKET. Page 16, Fig 27

105. UNIVERSAL BAR CUTOUT LEVER.
Page 16, Fig 34

JOB SHEET NO. 10 Ref: Teletype Bulletin B166

106. TAPE TENSION LVER SPRING TENSION
Page 18, Fig 37 _____

107. HAND ROLL DETENT ADJUSTMENT.
Page 18 & 25, Fig 40 _____

108. FEED ROLL DETENT SPRING TENSION.
Page 18, Fig 40, Part A _____

109. SLECTOR LEVER BRACKET
Page 19, Fig 41 _____

110. ARMATURE LEVER LEFT AND RIGHT STOP SCREWS.
Page 20, Fig 41 & 42 _____

111. SELECTOR FINGER RETAINER.
Page 20, Fig 41, Part A _____

112. PUNCH CONTACT BRACKET.
Page 21, Fig 47 & 49 _____

113. ANTI-CHATTER MECHANISM.
Page 22, Fig 47 & 46, Part A&B _____

114. PUNCH CONTACT OPERATING LEVER LINK.
Page 22, Fig 44 & 47 _____

115. PUNCH CONTACT LEVER BACKSTOP
Page 23, Fig 46 _____

116. FEED PAWL ECCENTRIC.
Page 23, Fig 41 _____

117. FEED PAWL THROWOUT BRACKET.
Page 24, Fig 41 _____

118. FEED PAWL GUIDE.
Page 24, Fig 41 & 43 _____

119. PUNCH Magnet.
Page 24, Fig 41 _____

120. TAPE STRIPPER PLATE.
Page 25, Fig (none) _____

121. TAPE KNIFE.
Page 25, Fig (none) _____

122. COUNTER CONTROL CONTACT OPERATING MECHANISM.
Page 25, Fig 51 _____

123. FEED PAWL BRACKET.
Page 27, Fig 54 _____

124. RELEASE MAGNET ARMATURE ECCENTRIC STOP.
Page 28, Fig 55 _____

125. CHECK LATCH PAWL BRACKET.
Page 28, Fig 56 _____

126. RELEASE LEVER EXTENSION ADJUSTING SCREW.
Page 28, Fig 54 _____

127. COUNTING MAGNET ARMATURE ECCENTRIC STOP.
Page 28, Fig 57 _____

128. RELEASE LATCH BRACKET.
Page 28, Fig 58 _____

129. DASHPOT POSITION
Page 29, Fig 47 _____

130. COUNTER INDICATOR ARM
Adjust as indicated by instructor. _____

131. CONTACT CAM
Page 30 _____

SUBJECT: TRANSMITTER DISTRIBUTOR

REF: Teletype bulletin 141, pages 1 thru 4

TAPE SENSING OPERATION.

Each contact tongue is controlled by the presence or absence of a perforation in the tape above it's respective sensing pin. If, when the sensing pin is moving up, it encounters a perforation in the tape, the contact lever will rotate a sufficient distance to allow the contact tongue to make contact with it's marking contact screw.
In the absence of a perforation, the tape will limit the upward travel of the sensing pin which will prevent the contact lever from rotating far enough to allow the contact tongue to leave the spacing contact screw.

As the operating cam releases the operating lever, the

1. CONTACT LEVER SPRINGS are allowed to rotate the
2. CONTACT LEVERS in a counter-clockwise direction, moving the
3. SENSING PINS up against, or thru the tape, and the
4. CONTACT TONGUES down toward the marking contact screws.

As the

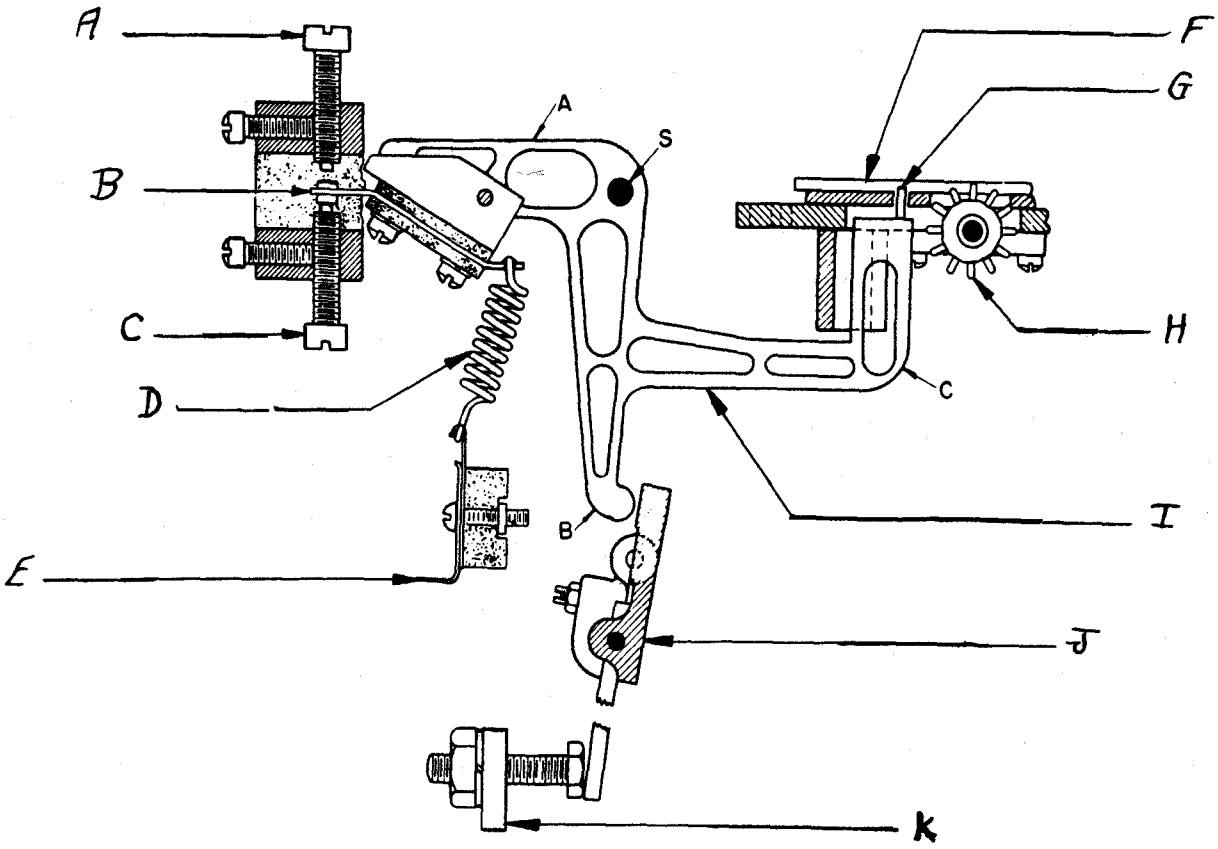
1. OPERATING CAM nears the end of it's revolution, it will operate the
2. OPERATING LEVER, which will in turn rotate the
3. CONTACT LEVER BAIL counter-clockwise, causing the
4. CONTACT LEVERS to rotate clockwise, pulling the sensing pins down, and moving the contact tongues up against the spacing contact screws.

CONTACT LEVER SPRINGS
CONTACT LEVERS
SENSING PINS
CONTACT TONGUES

OPERATING CAM
OPERATING LEVER
CONTACT LEVER BAIL
CONTACT LEVERS

- -

NOTES:....



A _____

B _____

C _____

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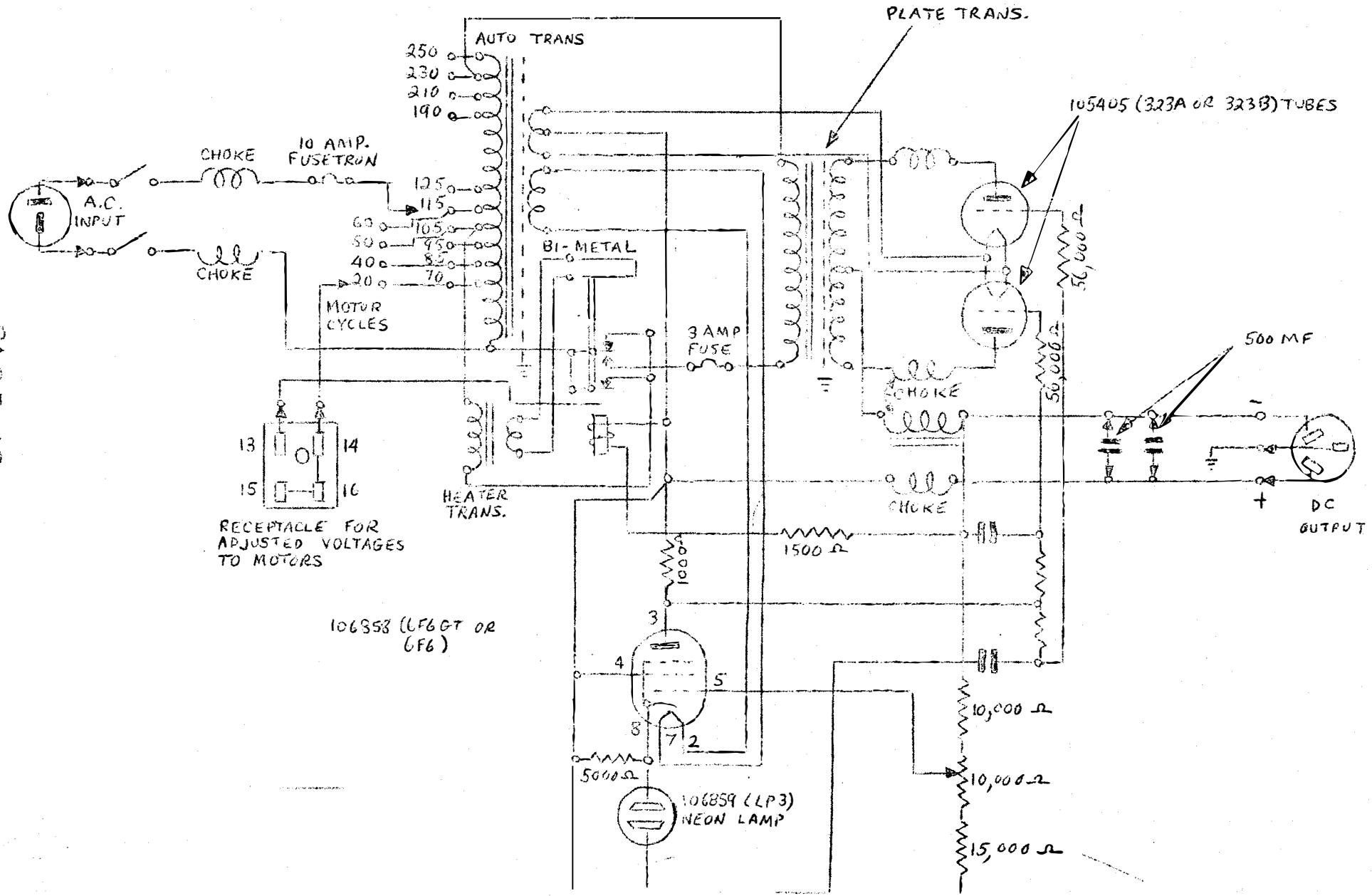
H _____

I _____

J _____

K _____

SCHEMATIC WIRING



GENERAL DESCRIPTION OF RANGE SPREAD.

The outboard side of the rangefinder frame is marked with a scale reading from Ø to 12Ø. On this scale rests an index arm which can be moved to any position on this scale by:

1. Loosening the thumb screw.
2. Setting the index arm.
3. Tightening the thumb screw.

On a properly adjusted machine, and when receiving a perfect (undistorted) signal, it should be possible to print perfect copy (without garbles) with the index arm moved over a full 8Ø points on the range scale. The ideal range spread is regarded as 15 to 95, although a spread of from, for example, 2Ø to 1ØØ or 1Ø to 9Ø is also acceptable, provided a full 8Ø points of range spread is obtainable.

LOSS OF RANGE

One major cause of loss of range, (a range spread of less than 8Ø points) can be traced to mechanical maladjustments, poor lubrication, or dirt, primarily in the rangefinder, selector unit or related parts of our own machine.

Another major cause of loss of range is due to (something being wrong with the incoming signal) distortion. This may be caused by:

1. The distant station may be sending out an imperfect signal.
2. The line circuit may be distorting the signal from the distant station.

GENERAL DESCRIPTION OF SIGNAL DISTORTION.

Distortion is usually defined as any change made in a signal between the time it is transmitted and the time it is received.

If a perfect signal is being transmitted to the line by the distant station, and we are not receiving a perfect signal from the line, it is obvious that the line circuit is responsible for distorting the signal. Although distortion may be present in any line, usually it increases with the length of the line. In a short line, it may be so small that we cannot detect it. In a longer line, it may be so great as to entirely prevent us from receiving a usable signal, without recourse to a LINE RELAY to regenerate an undistorted signal.

Note: It is not our purpose here to attempt a complete understanding of the may types, causes or effects of distortion. For further reference, the publication NAVSHIPS 900.031 (Advanced Base Teletype Installation and Maintenance Practices) contains an excellent discussion of the subject.

OPTIMUM SETTING FOR THE RANGEFINDER

It is obvious that the best setting for the rangefinder index arm is one that will allow the machine to print a good copy, regardless of the manner in which distortion is reducing the range spread.

This setting is called the (optimum setting) meaning: (The best average setting). It is determined as follows:

1. Find the upper and lower limits of your range.
   Example: 25 to 95
2. Add these two figures.
   Example: 25 plus 95 equals 120.
3. Devide the product by two.
   Example: 120 devided by 2 equals 60.

The Optimum setting for the index arm would be 60.

RANGEFINDER ACTION

We have already learned how the start impulse actuates the rangefinder train of parts, releasing the stop arm of the selector cam sleeve, and permitting the sleeve to make one complete revolution. At the end of this revolution, the stop arm is held by the stop lever, since the tripoff eccentric is no longer depressing the trip latch plunder, due to the reception of the stop impulse.

EFFECT OF MOVING THE RANGE FINDER INDEX ARM

Moving the range finder index arm actually changes the point at which the stop lever will catch and hold the stop arm of the selector cam sleeve, the duration of the stop impulse. When the start impulse releases the stop arm, the selector cam sleeve must travel a certain distance before the first selector cam strikes the first selector lever.

If the index arm is moved toward the Low side of the scale the stop lever will be moved to the rear, and stop the rotation of the selector cam sleeve Later, thus decreasing the distance the 1st selector cam travels before it strikes the the 1st selector lever.

In the above case, we decreased the distance and the time between the beginning of the start impulse and the positioning of the 1st sword.

Now if we move the index arm to the High side of the scale the stop lever will be moved to the front, and stop the rotation of the selector cam sleeve Sooner, thus increasing the distance the 1st selector cam travels before it strikes the 1st selector.

In this case we increased the distance and the time between the beginning of the start impulse and the positioning of the 1st sword.

SWORD POSITIONING TIME

Each sword must be positioned during its respective intelligence impulse. With a perfect signal each intelligence impulse is 22 m/s long. Due to the mechanical motion involved, it takes 4.4 m/s to position each sword.

1. 22 m/s represents 100% of the available time.

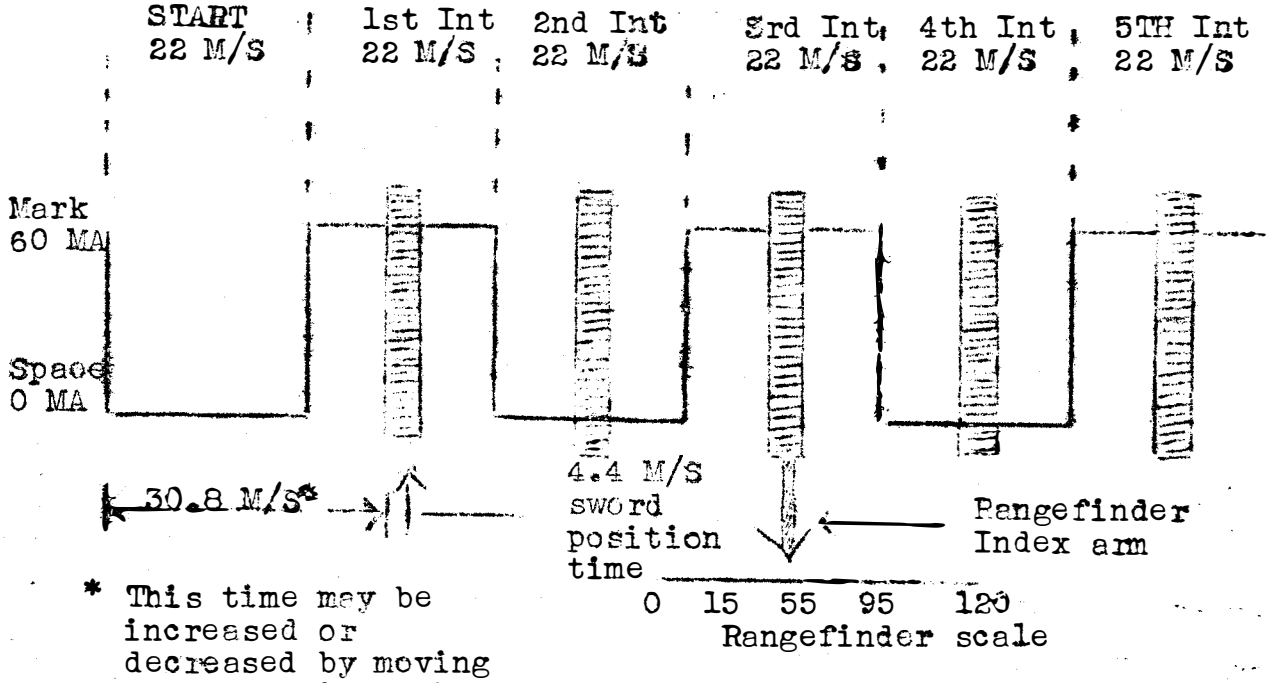
2. 4.4 m/s or 20% of this time must be used to position the sword.

3. 17.6 m/s or 80% of the available time is left over.

This 80% excess available time allows us to change the positioning time of the swords by moving the rangefinder index arm. This 80% is directly convertible to the 80 points of range spread required.

- -

Notes:



* This time may be increased or decreased by moving the rangefinder index arm.

Diagram of the letter "Y" with a perfect signal. The shaded portions represent the sword positioning time. NOTE that:

a. Each positioning time occurs in the exact center of each intelligence impulse because the rangefinder index arm is set in the exact center of the perfect range, 15 to 95.
b. In this case the first sword is positioned exactly 30.8 M/S after the beginning of the start impulse.
c. The five positioning times are always exactly 22 M/S apart due to the spacing of the selector cams on their sleeve.
d. If the index arm is moved toward the low side of the scale the swords will all be positioned earlier during their respective impulses.
e. We cannot move the index arm below 15 or above 95 on the range scale without moving each positioning time out of its allotted impulse and cause the machine to garble. HOWEVER,

WE CAN MOVE THE INDEX ARM OVER A FULL 80 POINTS OF RANGE AND STILL COPY THE INCOMING SIGNAL WITHOUT GARBLES IF THE SIGNAL IS PERFECT AND OUR MACHINE PROPERLY ADJUSTED.

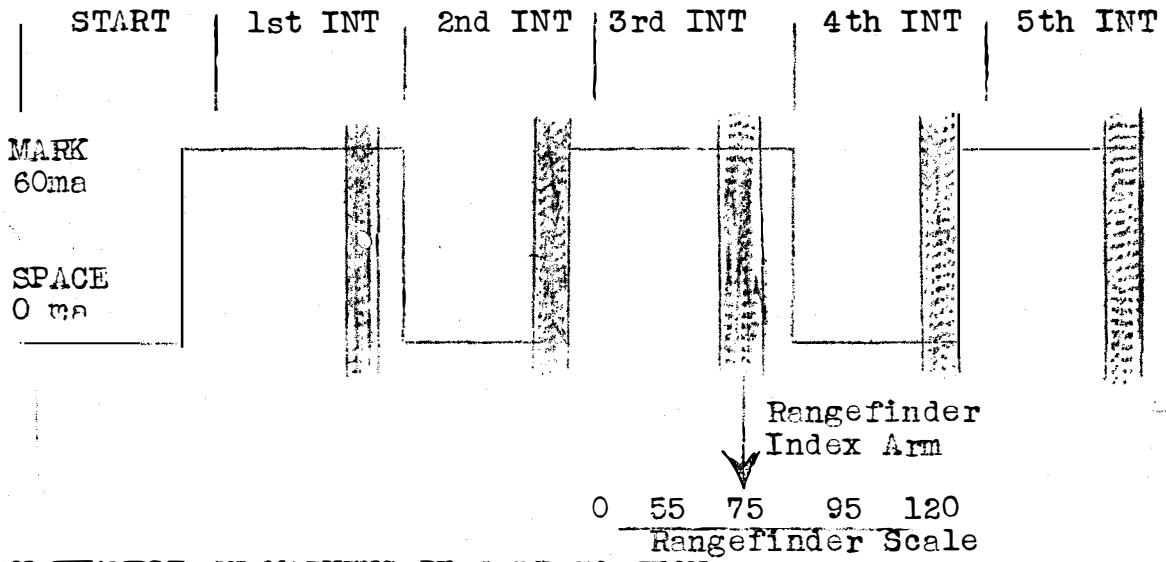
EFFECT OF BIAS DISTORTION.

If all the SPACE impulses in the above diagram were made longer by about 4.4 M?S and the MARKING impulses reduced a like amount, we would have a condition known as "SPACING BIAS" distortion. We could move our index arm below about 35 on the range scale but the machine would garble.

If all the MARK impulses in the diagram were made longer by about 4.4 M?S and the SPACE impulses reduced a like amount we have "MARKING BIAS" distortion. We could not move the arm above 75 on the rangefinder and have the machine still copy.

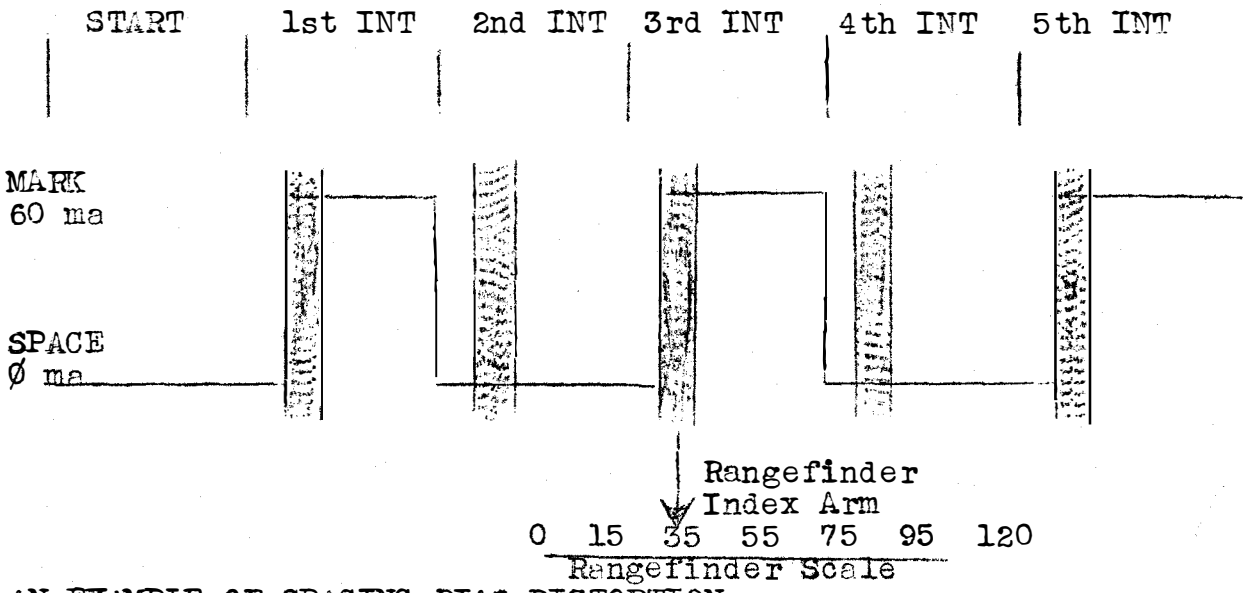
MARKING BIAS CAUSES US TO LOSE THE HIGH SIDE RANGE
SPACING BIAS CAUSES US TO LOSE THE LOW SIDE RANGE

Of our 22 M/S impulse, 20% has been lost, hence 20% distortion is present.



AN EXAMPLE OF MARKING BIAS DISTORTION

Showing 20% distortion. Notice that the machine will NOT copy above 75 on the range scale. MARKING impulses have been lengthened and SPACING impulses have been shortened.



AN EXAMPLE OF SPACING BIAS DISTORTION

Showing 20% distortion. Notice that the machine will NOT copy below 35 on the range scale. The SPACING impulses have been lengthened and the MARKING impulses have been shortened.

SOME EFFECTS OF DISTORTION

Frequently, when receiving a signal with moderate distortion, we will find that the distortion will effect the range spread in a definite manner,

For example :

1. The UPPER limit of the range may be reduced by 30 poin (Range 1[illegible] to 65)
2. The LOWER limit of the range may be reduced by 30 poin (Range 35 to 95)
3. Both ends of the range may be reduced by 15 points. (Range 30 to 80)

THE RELATIONSHIP OF 80 POINTS OF RANGE AND THE SIGNAL

When an impulse or signal is perfect, the range of the impulse is 100 percent, equalling 0 to 100 on the range finder. Since the ideal position for the selecting interval is the CENTER of the impulse, the range finder arm should be set on 50. The selecting mechanism must use 4.4 millisec or 20 percent of the impulse and since the range finder is set on 50, the 20 percent will come from the exact center o the impulse and leave a total of 80 percent, 40 percent on each side. Therefore the range finder can be moved 40 poin each way without receiving a wrong impulse, resulting in a range of 10 to 90 (50 minus 40, 50 plus 40) or 80 points.

To measure net effect of all kinds of systematic distortion, position of received signals, the range finder arm is first moved in one direction until errors appear in the copy and then moved back slowly until these errors are eliminated. Similarly, the rangefinder arm is moved to the maximum distance in the opposite direction. These two scal readings then give the operating margin of signals under te On perfect signals the margin would be from 10 to 90, 80 po but with either MARKING or SPACING bias this margin would n be so great. With MARKING bias the HIGH part of the range would be affected, and when SPACING bia is present, the LOW part would be affected.

NOTES::

RIBBON FEED

REF: Telet ype Bulletin NO. 144 Pg. 7, Fig. 14

General: The ribbon feeding operation in the model 19 teletype is for the purpose of causing the ribbon to be continuously move in front of the type pallets, which causes the printed copy to be printed legible. Ribbon feed is acccomplished on the rearward travel of the printing bail.

RIBBON FEED TRAIN OF PARTS

The ---

1. Nothced Extension of the Pull Bar Bail Plunger has one end of
2. Ribbon Feed Lever engaged in its slot. The other end of the ribbon feed lever is attached to the casting of the type bar carriage. Connected in the middle of the ribbon feed lever is the
3. Ribbon Feed Pawl, which, on the forward motion of the printing bail, rides over and engages a tooth on the
4. Ribbon Feed Ratchet. T hen on the rearward movement of the printing bail, the pawl advances the ribbon feed ratchet one tooth as it turns. Mounted on the same shaft as the ratchet is the
5. Ribb on F eed Ratchet G ear, which will also turn. It is meshed with and turns the
6. Ribbon Feed Shaft Gear, which is mounted on the
7. Ribbon Feed Shaft. Mounted on it are the
8. Ribbon Feed Shaft Bevel G ears that mesh with the
9. Vertical Ribbon Feed Shaft Bevel Gear. These cause the
10. Vertical RibbonFeed Shaft to rotate. This shaft rotates the
11. Vertical Ribbon Feed Shaft Spur Gear. These mesh with t he
12. Ribbon Spool Shaft Spur Gear causing the

(RIBBON FEED CON'T)

13. RIBBON SPOOL SHAFT to rotate. Mounted on the spool shaft is the

14. RIBBON SPOOL which will also rotate. This action advances the ribbon.

RIBBON FEED TRAIN OF PARTS

NOTCHED EXTENSION OF THE PULL BAR BAIL PLUNGER

RIBBON FEED LEVER

RIBBON FEED PAWL

RIBBON FEED RATCHET

RIBBON FEED RATCHET GEAR

RIBBON FEED SHAFT GEAR

RIBBON FEED SHAFT

RIBBON FEED SHAFT BEVEL GEAR

VERTICAL RIBBON FEED SHAFT BEVEL GEAR

VERTICAL RIBBON FEED SHAFT

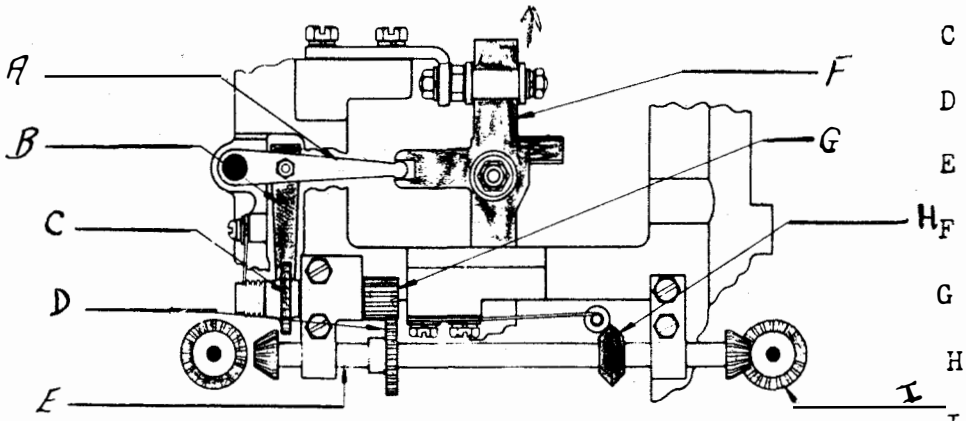
VERTICAL RIBBON FEED SHAFT SPUR GEAR

RIBBON SPOOL SHAFT SPUR GEAR

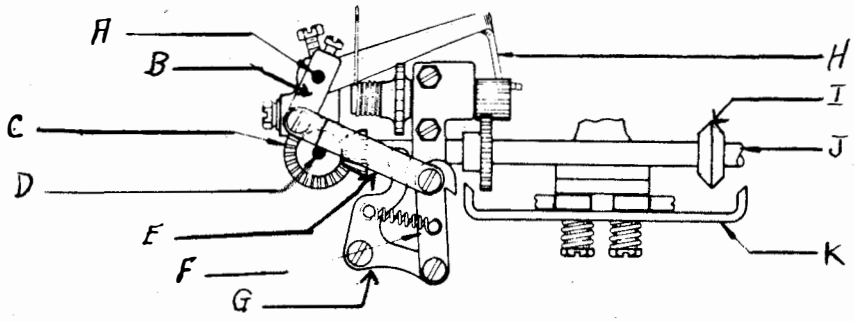
RIBBON SPOOL SHAFT

RIBBON SPOOL

Notes:

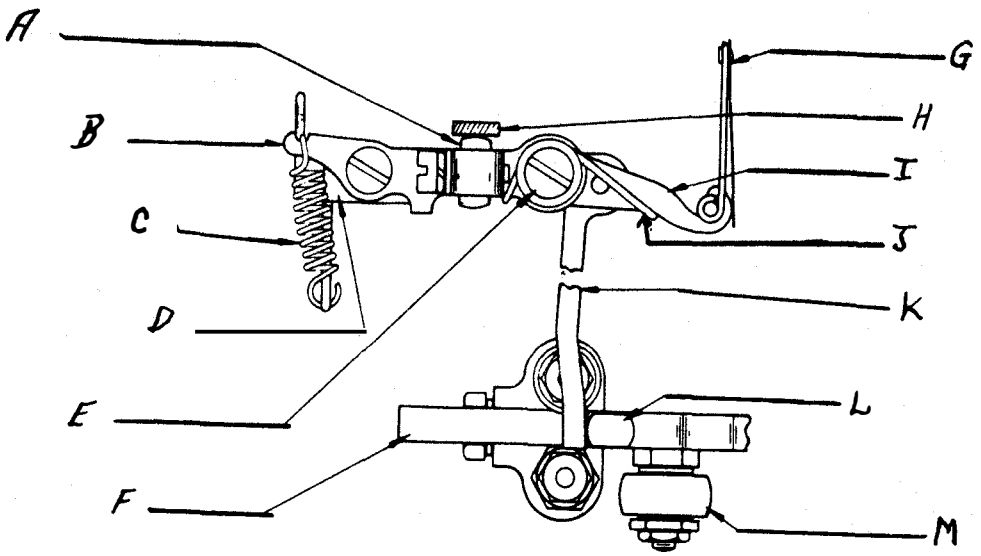


A ribbon feed lever
B ribbon feed guard
C ribbon feed ratchet
D ribbon feed shaft gear
E ribbon feed shaft
F PULLBAR BALL PLUNGER
G ribbon feed ratchet gear
H ribbon feed shaft det. t
I vertical ribbon feed shaft bevel gear



A ribbon reverse shaft
B ribbon reverse shaft link
C vertical ribbon feed shaft bevel gear
D vertical ribbon feed shaft
E ribbon reverse pawl link
F ribbon reverse pawl
G ribbon reverse lever

H ribbon revers arm
I ribbon feed shaft lever
J ribbon feed shaft
K ribbon reverse bail



A RIBBON SHIFT LVR ROLLER

B RIBBON SHIFT LVR

C RIBBON SHIFT SPRING

D RIBBON SHIFT LVR BRACKET

E SHOULDER SCREW

F PULL BAR BALL PLUNGER

G RIBBON CARRIER

H RIBBON SHIFT LVR ROLLER BAR

I RIBBON OSCILLATOR

J RIBBON OSCILLATOR SPIRAL SPRING

K RIBBON OSCILLATOR EXT

L LEFT HAND PULL BAR BALL PLUNGER

M PULL BAR BALL PLUNGER ROLLER

JOB SHEET NO. 1

SUBJECT: ADJUSTMENTS
REF: TELETYPE BULLETIN NO. 138B

THE TYPEBAR CARRIAGE INTRODUCTORY ADJUSTMENT

1. PLUNGER GUIDE ROLLER BRACKET
   Page 1-4, Para 3 and 5, Fig 2 _____

2. PLUNGER ROLLER ECCENTRIC MOUNTING STUD
   PAge 1-4, Para 6, Fig 2 _____

3. PULL BAR GUIDE
   Page 1-4, Para 9, Fig 5 _____

4. CODE BAR BELL CRANKS
   Page 1-28, Para 153, Fig 62 _____

Adjustments 1 through 4 are familiarizing adjustments to acquaint the student with the proper use of tools and guages, and to read and interpret directions from the manual.

JOB SHEET NO. 2

5. REMOVE AND DISASSEMBLE MAIN SHAFT.
   CAUTION: DO NOT wash parts in solvent that have felt washers or wicks inside .

6. REASSEMBLE MAIN SHAFT
   Teletype Bulletin No. 144,Page 3,Fig 36

7. INSTALL AND ADJUST MAIN SHAFT
   Page 1-9, Para 39

8. MAIN SHAFT CLUTCH THROWOUT LEVER
   Page 1-9, Para 40, Fig 20

9. SPACING SHAFT LOWER BEARING BRACKET
   Page 1-10, Para 43, Fig 22

10. PRINTING BAIL ADJUSTMENT
    Page 1-10, Para 45, Fig 23

11. FUNCTION LEVER BAIL
    Page 1-10, Para 46, Fig 24 and 25

12. BLOCKING PLATE
    Page 1-10, Para 47, Fig 24

13. SIXTH VANE
    Page 1-11, Para 50, Fig 25

14. SELECTOR VANES
    Page 1-12, Para 51, Fig 25

15. PRINTING BAIL SPRING TENSION
    Page 1-12, Para 53, Fig 28

JOB SHEET NO.3

TYPEBAR CARRIAGE FINAL-RIBBON FEED, RIBBON REVERSE.

16. RIBBON FEED SHAFT BEARING PLATES
Page 1-5, Para 10, Fig 6 & 7

* 17. RIBBON FEED SHAFT DETENT SPRING
Page 1-5, Para 11, Fig 6

18. VERTICAL RIBBON FEED SHAFTS
Page 1-5, Para 13, Fig 7

19. RIBBON SPOOL BRACKETS
Page 1-5, Para 15, Fig 7

20. RIBBON SPOOL SHAFT SPUR GEARS
Page 1-5, Para 15, Fig 8

21. VERTICAL RIBBON FEED SHAFT SPUR GEARS
Page 1-5, Para 16, Fig 8

* 22. RIBBON SPOOL CUPS
Page 1-6, Para 17, Fig 9

23. VERTICAL RIBBON FEED SHAFT SPRING TENSION
Page 1-6, Para 18, Fig 9

24. RIBBON REVERSE SHAFT COLLARS
Page 1-6, Para 21, Fig 10

25. RIBBON REVERSE SHAFTS
Page 1-6, Para 20, Fig 10

26. RIBBON REVERSE SHAFT LINKS
Page 1-6, Para 22, Fig 11

27. RIBBON REVERSE ARM BACKSTOP
Page 1-7, Para 23, Fig 10

28. TYPEBAR BACKSTOP
Page 1-7, Fig 12A

29. RIBBON SHIFT LEVER BRACKET
Page 1-8, Para 29, Figs 13 & 14

30. RIGHT PULL BAR SPRING BRACKET
Page 8, Para 35, Fig 18

* 31. LEFT PULL BAR SPRING BRACKET
Page 9, Para 35, Fig 18

32. CARRIAGE SUPPORT & PULL BAR BAIL PLUNGER ROLLER.
Page 9, Para 38, Fig 22

33. CARRIAGE GUIDE SCREWS
Page 28, Para 152, Fig 23

34. SPACING RACK
Page 28, Para 154, Fig 63

35. RIBBON OSCILLATOR LEVER
Page 31, Para 170, Fig 67

NOTE: ADJUSTMENTS INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED (IF NECESSARY) BY THE INSTRUCTOR AND/OR STUDENT AS TIME PERMITS.

JOB SHEET NO. 4

SHIFT/UNSHIFT MECHANISM

* 36. PLATEN UNIT PILOT SCREWS
Page 19,Para 90,Fig 49 & 52

37. PLATEN SHIFT/UNSHIFT STOP POST
Page 19,Para 91, Fig 50

38. UNSHIFT STOP SCREW
Page 20, Para 92, Fig 50

39. SHIFT STOP SCREW
Page 20, Para 93, Fig 50

40. FUNCTION BAIL BLADE
Page 20, Para 97, Fig 52

*41. UNSHIFT ON SPACE CUTOUT LEVER
Page 21, Para 98, Fig 97 & 98

42. SHIFT(FIGURES)AND UNSHIFT(LETTERS)
Page 1-21, Para 99, Fig 50 & 51

43. SHIFT/UNSHIFT DETENT
Page 21, Para 101, Fig 50

NOTE: ADJUSTMENT INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED BY THE INSTRUCTOR AND/OR STUDENT (IF NECESSARY) AS TIME PERMITS.

JOB SHEET NO. 5

LINE FEED MECHANISM

* 44. PLATEN SHAFT
Page 1-22 Para 105

* 45. PLATEN FRICTION ASSEMBLY
Page 42, Para 231, Fig 93

* 46. SINGLE/DOUBLE LINE FEED DETENT
Page 1-22, Para 106, Fig 50

47. LINE FEED DETENT LEVER
Page 1-22, Para 108, Fig 50 & 53

48. LINE FEED CHECK SCREW
Page 23, Para 113, Fig 53

49. LINE FEED LINK TURNBUCKLE
Page 1-22, Para 109, Fig 50

50. LINE FEED CHECK POST STOP SCREW
Page 1-23, Para 114, Fig 53

51. LINE FEED CHECK LEVER
Page 23, Para 115, Fig 50 & 53

* 52. PRESSURE ROLLER RELEASE CAMS
Page 23, Para 118, Fig 53

* 53. PRESSURE ROLLER TENSION SPRING
Page 1-24, Para 119, Fig 55

NOTE: ADJUSTMENTS INDICATED BY * ARE NOT REQUIRED FOR GRADES BUT WILL BE ACCOMPLISHED (IF NECESSARY) BY THE INSTRUCTOR AND/OR STUDENT AS TIME PERMITS.

JOB SHEET NO. 6

SIGNAL BELL, CARRIAGE RETURN AND SPACING

54. SPACING ESCAPEMENT PAWL OPERATING ARM
Page 1-25,Para 128, Fig 57

* 55. SIGNAL BELL LATCH BAR LATCH SHIMS
Page 1-25, Para 133, Fig 29A

* 56. SIGNAL BELL LATCH BAR LATCH
Page 1-25, Para 134, Fig 59A

* 57. SIGNAL BELL HAMMER BACKSTOP
Page 1-25, Para 135, Fig 59A

58. CARRIAGE RETURN LATCH BAR LATCH SHIMS
Page 1-26,Para 139, Fig 59A & 60

59. CARRIAGE RETURN LATCH BAR LATCH
Page 1-26, Para 140, Fig 60B

60. CARRIAGE RETURN LOCK BAR LATCH ECCENTRIC SCREW
Page 26, Para 143, Fig 60A

61. CARRIAGE RETURN LOCK BAR
Page 1-26, Para 143, Fig 60A

62. CARRIAGE RETURN OPERATING LEVER STOP SCREW
Page 1-27, Para 144, Fig 60B

63. SPACING STOP LEVER BRACKET
Page 1-27, Para 150, Fig 61

64. CARRIAGE RETURN SPRING DRUM
Page 1-28, Para 157, Fig (none)

65. LEFT AND RIGHT MARGIN ADJUSTING SCREWS
Page 1-31,Para 168 & 169,Fig60B and 61

66. MARGIN BELL
Page 1-32,Para 173,Fig 58

67. DASHPOT VENT SCREW
Page 1-33,Para 176,Fig 60

JOB SHEET NO.7

THE SELECTOR UNIT

PRELIMINARY: 1. REMOVE SEPARATOR PLATES. PLACE ALL PARTS ON WORK BENCH IN EXACT ORDER OF REMOVAL. PROCEED AS FOLLOWS :

a. Remove the five nuts and lock washers holding the plates assembly.
b. Remove the top separator plate. Note that it is different in shape than the others.
c. Remove the armature locking lever and its spring.
d. Remove second separator plate.
e. Remove selector lever spring, sword, "T" lever and selector lever.
f. Continue disassembly, removing all plates, swords, "T" levers, springs -

2. CLEANING, LUBRICATION AND REASSEMBLY.

a. Draw pan of Agitene from shop.
b. Draw rags from container in room.
c. Clean all parts removed above. Spread a fine film of oil on all parts and wipe off excess.
d. Check all parts for undue wear and tear while cleaning.
e. Reassemble the unit in exactly the reverse order of removal.
f. Call Instructor for throwout on the following adjustments.

68. STOP LEVER ECCENTRIC SCREW
Page 1-14, Para 63, Fig 36.

_____

69. MAGNET BRACKET
Page 1-15, Para 69, Fig 33

_____

70. SELECTOR MAGNET COIL
Page 1-15, Para 68, Fig 33

_____

71. SELECTOR ARMATURE BRACKET AND LINK
Page 1-13, Para 58, Figs 31, 32 & 33

_____

72. SELECTOR ARMATURE
Page 1-12, Para 57 , Fig 31

_____

73. ARMATURE STOPS
Page 1-14, Para 60, Fig 34

_____

74. AMATURE TRIP OFF ECCENTRIC SCREW
Page 1-15, Para 67, Fig 39

_____

75. ARMATURE LOCKING WEDGE
Page 1-17, Para 75, Fig 43

_____

It is required that the student obtain 80 points of range, anywhere on the range scale, using the BD-100 "TD" or the mobile "DTS".

Students obtaining 80 points or over will proceed on to the next adjustment without having each of the selector unit adjustments checked by the Instructor.

When the student is certain he has 80 points of range he should place his name on the board for a check. If the Instructor determines he has 80 points or more it is indicated that all selector unit adjustments are within tolerance.

If unable to obtain 80 points of range after refinir all selector unit adjustments call the Instructor.

JOB SHEET NO. 8

MOTOR STOP AND KEYBOARD LOCKOUT MECHANISM

76. ARMATURE LOCKING WEDGE (MOTOR STOP PAWL LATCH)
PAGE 1-14, PARA 61, FIG 97 _____

77. MOTOR STOP LEVER BRACKET
PAGE 1-43, PARA 240, FIG 97 _____

78. MOTOR STOP LEVER ECCENTRIC
PAGE 1-43, PARA 241, FIG 97 _____

79. MOTOR STOP PAWL BACKSTOP
PAGE 1-44, PARA 243, FIG 97 _____

80. MOTOR STOP LEVER BACKSTOP SCREW
PAGE 1-44, PARA 242, FIG 97 _____

81. MOTOR STOP RELEASE LEVER ECCENTRIC
PAGE 1-44, PARA 244, FIG 97 _____

82. MOTOR STOP LEVER SPRING TENSION
PAGE 1-44, PARA 246, FIG 97 _____

83. STOP LEVER PLATE
PAGE 1-37, PARA 206, FIG 83B _____

84. BREAK LEVER ADJUSTING PLATE
PAGE 1-37, PARA 207, FIG 83B _____

85. SEND RECEIVE "T" LEVER FRICTION WASHER
PAGE 1-29, PARA 160, FIG 65A _____

86. SEND RECEIVE MECHANISM PLATE
PAGE 1-29, PARA 163, FIG 66 _____

87. INTERMEDIATE LEVER STOP BRACKET
PAGE 1-30, PARA 164, FIG 65A-66 _____

88. SEND RECEIVE RESET LEVER UPPER ADJUSTING PLATE (SCREW)
PAGE 1-31, PARA 167, FIG 65B _____

89. RESET LEVER LOWER ADJUSTING SCREW
PAGE 1-45, PARA 251, FIG 99 _____

90. RESET LEVER DOWNSTOP SCREW
PAGE 1-45, PARA 252, FIG 99A-99B _____

MODEL 19 KEYBOARD TRANSMITTING UNIT

GENERAL: The keyboard of the Model 19 Perforator Transmitter is the TRANSMITTING UNIT which permits manual operation of the Mod. 19 teletypewriter.

PURPOSE: THE KEYBOARD CHANGES MECHANICAL MOTION INTO ELECTRICAL IMPULSES OF THE FIVE UNIT TELETYPE CODE.

Pressing down on any key causes mechanical action to take place that opens and closes six pairs of electrical contacts in various patterns. This causes the teletype loop to be either OPENED (SPACE) with NO current on the line, or CLOSED (MARK) with current on the line.

SOURCE OF MECHANICAL POWER: Mechanical power for the operation of the Model 19 is derived FROM CAMS AND GEARS ON THE MAINSHAFT ONLY ,AND SPRINGS THROUGHOUT THE MACHINE.

The main shaft is mounted on the typing unit. On its right end is a large fiber gear (Main shaft gear) which meshes with a metal gear (Motor pinion gear) on the motor shaft. The transmitting shaft is driven by the transmitting shafs DRIVEN gear which is mounted on the rear end of the transmitting shaft. The transmitting shaft DRIVEN gear is driven by the transmitting shaft DRIVING gear which is mounted on the main shaft. Thus we can trace the the train of parts for rotation of the transmitting shaft as follows :

MOTOR PINION GEAR
MAIN SHAFT GEAR
MAIN SHAFT
TRANSMITTING SHAFT DRIVING GEAR
TRANSMITTING SHAFT DRIVEN GEAR
TRANSMITTING SHAFT

In the Model 19 we will frequently discuss the source of POWER. As the motor pinion gear actually starts it all off, it seems the logical place to go, BUT IT IS NOT. For each operation in the machine, there is a cam or gear on the main shaft that furnishes power, or a spring some where in the machine that assists in the operation. Therefore, in tracing the source of power, we will go back only as far as the main shaft and we will ALWAYS be guided by the following rule. Memorize it and learn to apply it!

IN THE MODEL 19 ALL POWER IS DERIVED FROM CAMS AND GEARS ON THE MAIN SHAFT ONLY, AND SPRINGS THROUGHOUT THE MACHINE.

NOTE: The motor rotates at 2100 RPM
The main shaft rotates at 420 RPM
The transmitting shaft rotates at 368 RPM

KEYBOARD TRANSMITTING SHAFT

The transmitting shaft rotates all the time the motor is running. In all our discussions of the mchine, we wil assume that the motor is running, as that is the normal condition of the mchine.

The transmitting shaft has mounted on it, the TRANSMITTING CAM SLEEVE, and the TRANSMITTING SHAFT CLUTCH (a positive action clutch) and the TRANSMITTING SHAFT DRIVEN GEAR (fibre). The transmitting cam sleeve rotates only when the transmitting shaft clutch is engaged.

The TRANSMITTING CAM SLEEVE HAS 7 cams on it. From rear to front they are the :

LOCK LOOP CAM
START STOP CAM
1st thru 5th TRANSMITTING CAM

The TRANSMITTING SHAFT CLUTCH consists of a DRIVING member which is bolted to the TRANSMITTING SHAFT, and a DRIVEN member which is connected by a spline and compression spring to the TRANSMITTING CAM SLEEVE assembly. The spline is used so the DRIVING and DRIVEN members of the clutch may be engaged and disengaged without having to move the cam sleeve assembly, only the clutch driven member.

Normally between operations, the transmitting shaft clutch is disengaged and the transmitting cam sleeve does not turn. Whenever a key is depressed, the transmitting shaft clutch is engaged and the cam sleeve makes one complete revolution, at the end of which the clutch becomes disengaged again. (The cluton action will be explained later).

The purpose of the LOCK LOOP CAM will be explained late

The START-STOP CAM governs the transmission of the START and STOP impulses.

The FIVE TRANSMITTING (OR INTELLIGENCE) CAMS govern the transmission of the five unit teletype code, the operation of which will be covered in the KEY to CONTACTS train of parts.

NOTES:

SUBJECT: LINE CIRCUIT OF THE TD

REF: Teletype bulletin 141

In the normal stopped position, all of the contact tongues are positioned up against the spacing contact screws and the distributor brushes are at rest on the scribe mark approximate in the center of the stop segment. As the main shaft begins its rotation, the brushes will begin rotating toward the start segment. Before the brushes reach the start segment, all of the contact tongues will be positioned according to the perforations in the tape. As the brushes continue their rotation, they will ride onto the start segment. The start segment is no wired into the circuit, so as long as the brushes remain on the start segment (22 M/S), the line circuit will be broken giving the start impulse. The brushes then continue to rotate across t impulse contact segments (1 thru 5), so that the circuit will b complete if the contact tongue is against the marking contact screw, and open if the contact tongue is against the spacing contact screw. This will give us a combination of marking and spacing impulses corresponding to the position of the contact tongues. After the #5 impulse has been transmitted, the brushe return to their normal stopped position on the stop segment. The stop segment is wired directly to the marking block complet the circuit for the stop impulse.

PATH OF LINE CIRCUIT THRU TD WITH BRUSH ON STOP SEGMENT

1. #2 slip connector
2. Inner collector ring
3. Stop segment
4. Marking block
5. #3 slip connector

There is a wire lead going directly to the marking block from the stop segment, so we will always have a marking impulse on the line when the brushes are riding on the stop segment, regardless of the position of the contact tongues.

PATH OF LINE CIRCUIT THRU TD BRUSH ON START SEGMENT

1. #2 slip connector
2. Inner collector ring
3. Start segment

This is the point in the circuit that is open giving us the start impulse (22 M/S spacing). The lead from the start segment is taped and makes no connection to the spacing block.

* *

NOTES:....

PATH OF LINE CIRCUIT THRU T.D. WITH BRUSH ON #1 SEGMENT(MARKI

This is the electrical path when the contact tongue is against the marking contact screw.

1. #2 Slip connector
2. Inner collector ring
3. #1 Segment
4. Contact tongue
5. Marking contact screw
6. #3 Slip connector

PATH OF LINE CIRCUIT THRU T.D. WITH BRUSH ON #1 SEGMENT(SPACINC

This is the electrical path when the contact tongue is against the spacing contact screw.

1. #2 Slip connector
2. Inner connector ring
3. #1 Segment
4. Contact tongue
5. Spacing contact screw.

At this point, the circuit is open, since there is no lead going away from the spacing contacts.
Each of the remaining four impulse segments will be crossed by the brushes and the line circuit will be marking each time the tongue is on the marking block, and spacing each time the tongue is on the spacing block.
Here again we must observe an exact time element. The start impulse is exactly 22 m/s spacing, which is the time ti takes for the brush to pass across the start segment. Each impulse segment will be crossed in order, each being 22 m/s the stop segment will take 31 m/s or more, if it was the last character to be transmitted the brush will remain on the stop segment and we get a continuous mark.

NOTE: All five contact tongues are on the space block while the brushes are on the stop segment.

All five contact tongues are set for the combination before the brush rides onto the start segment.

The contact tongues remain in position until the brushes travel around the segments and come to the stop segment.

All contact tongues move to the spacing block just as the brushes ride onto the stop segment.

SUBJECT: T.D. CONTROL CIRCUIT

REF: Teletype bulletin 141

GENERAL:

The circuit which energized or de-energizes the tape stop magnet is call the TD control circuit. This circuit is normally operated on AC, but, when AC is not available, it can be operated by DC.

The TD control circuit has three control points in series. All three points must be closed or the tape stop magnet cannot be energized.

PATH OF TD CONTROL CIRCUIT

1. #9 Slip connector
2. 525 ohm tapped resistor (center tap 350 ohms)
    a. For AC operation, 175 ohm section is used
    b. For DC operation, entire 525 ohms is used
3. #7 Slip connector
    a. Used to make connection to SRB 1 & 2 for TD lockout. (not wired in our machines)
4. Tight tape contacts
5. Tape stop switch
6. End of tape contacts
7. Tape stop magnet
8. #8 Slip connector

- -

NOTES:....

SUBJECT: CONTROL POINTS OF TD CONTROL CIRCUIT

REF: Teletype Bulletin 141
Wiring diagram, page 103 of this study guide

If any of the below control points are open, no current will flow thru the stop tape magnets, therefore, the stop arm spring will hold the stop arm against the stop cam lug and the main shaft will not rotate

1. END OF TAPE CONTACTS

   a. Mounted under tape guide
   b. Operated by a steel pin that sticks up thru the tape guide.

2. STOP TAPE SWITCH

   a. Toggle switch, on-off
   b. Mounted on from of TD
      (1) On position completes circuit through switch
      (2) Off position opens TD control circuit

TIGHT TAPE CONTACTS (AUTOMATIC STOP MECHANISM)

   a. Mounted on right, center of TD
   b. Operated by steel rod that runs for and aft

SUBJECT: TRANSMITTER DISTRIBUTOR MOTOR

Ref: Teletype Bulletin 141

The motor used with the T.D. is basically the same as the printer motor. It runs at 2100 RPM and is governor controlled. Power comes to the T.D. motor through slip connectors 5 & 6. The switch and fusetron are located under the table and not in the T.D.

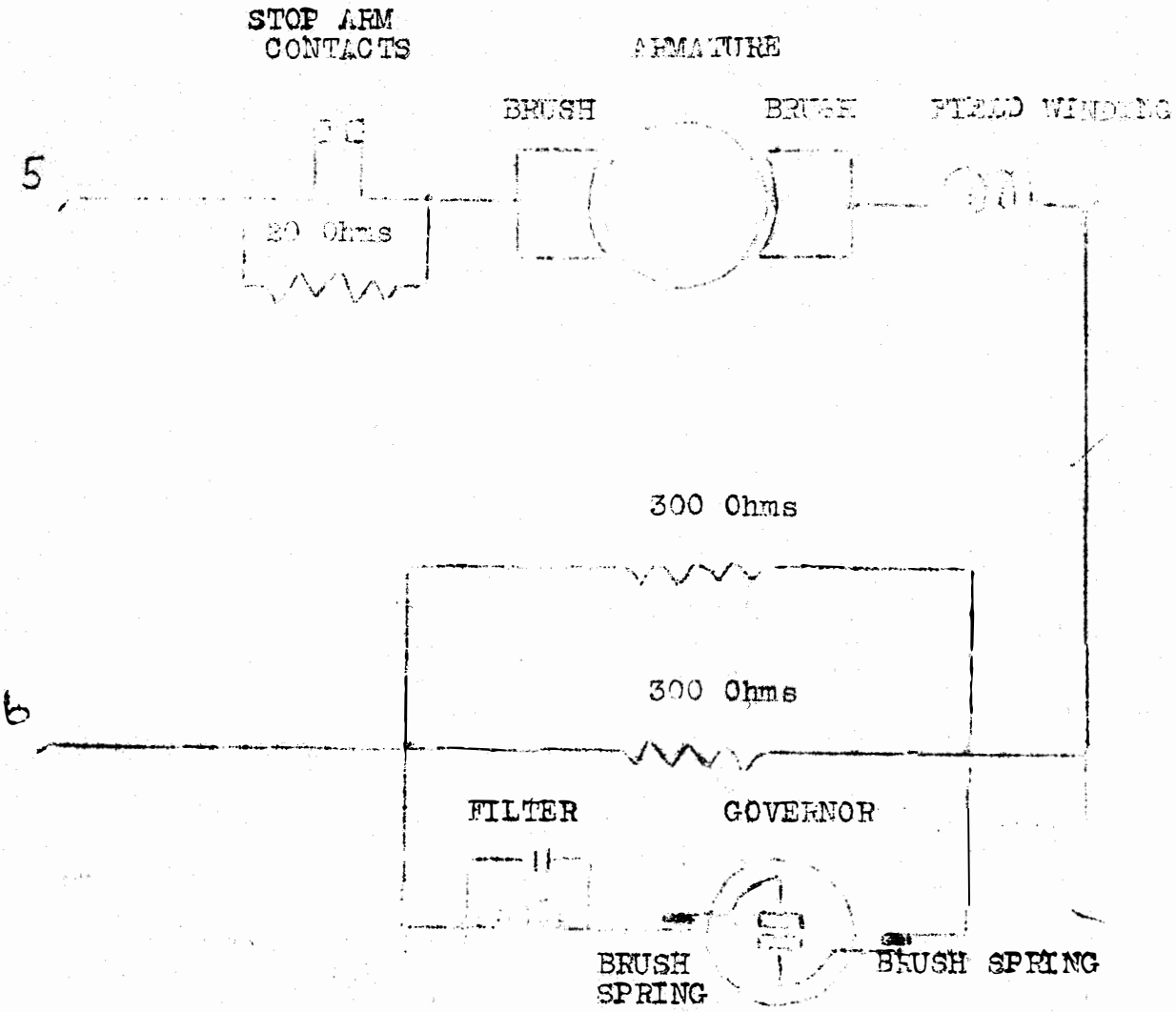
Added to the T.D. motor circuit, and in series with the circuit there is a 20 ohm resistor with a pair of stop arm contacts in parallel with the resistor. With the contacts closed, this adds no resistance, but with the contacts open, 20 ohms of resistance is added to the motor circuit.

When the main shaft of the T.D. is free to turn and you are transmitting from tape, the mechanical load of the motor is light, but when the main shaft is prevented from turning, and the clutch must slip, the mechanical load is heavy. Mechanical arrangement insures that while the main shaft is held stationary (heavy load), the stop arm contacts will be closed, shorting out the 20 ohms. When the main shaft can turn (light load), the stop arm contacts open, inserting the 20 ohms of resistance which limits the current flow thru the motor circuit.

This is the electrical path of the T.D. motor circuit:

1. #6 slip connector
2. 150 ohms (if governor contacts are open) or thru governor contacts
3. field winding
4. brush and brush holder
5. armature
6. brush and brush holder
7. stop arm contacts (if main shaft is held stationary) or through 20 ohms (if main shaft is turning)
8. #5 slip connector.

Speed of the motor is controlled by the governor action. The 20 ohm resistor gives the effect of an electrical load to replace the mechanical load of the slipping of the main shaft clutch. The T.D. motor does not have the adjusting bracket necessary to slow down the motor but does have the lever to speed the motor up.



SWITCH AND FUSETRON ARE IN TABLE, BETWEEN A.C. SOURCE AND SLIP CONNECTORS 5 and 6

A.C. SERIES WOUND MOTOR

T.D. MOTOR CIRCUIT

132. MAINSHAFT
Page 5, Figure 10

133. MOTOR POSITION
Page 5, Figure 3

134. MAIN SHAFT CLUTCH TORQUE
Page 13, Figure 12

135. TAPE FEED PAWL SPRING TENSION
Page 7, Figure 15

136. TAPE GUIDE
Page 7, Figure 17

137. DETENT BRACKET
Page 8, Figure 17

138. TAPE RETAINING LID PLATE
Page 8, Figure 19

139. FEED LEVER ADJUSTING SCREW
Paged 9, Figure 20

140. OPERATING LEVER ADJUSTING SCREW
Page 9, Figure 22

141. FEED LEVER UPSTOP
Page 9, Figure 21

142. LOWER CONTACT SCREW
Page 9, Figure 23

143. UPPER CONTACT SCREW
Page 10, Figure 23

144. CONTACT LEVER SPRING TENSION
Page 10, Figure 23

145. FEED LEVER SPRING TENSION
Page 10, Figure 23

146. TIGHT TAPE STOP (AUTO STOP MECHANISM)
Page 10, Figure 24

147. END-OF-TAPE STOP CONTACT PIN GUIDE
Page 14, Figure 30

148. STOP ARM CONTACT GAP
Page 17, Figure 34B

*149. TAPE GUIDE WIRE
Page 14, figure 24A _____

150. DISTRIBUTOR CARBON BRUSH
Page 12, figure 27 _____

151. OPERATING CAM
Page 13, figure 27 _____

JOB SHEET 13

SUBJECT: MODEL 14 ADJUSTMENTS

REF: Teletype bulletin 165B

152. Remove and disassemble MAIN SHAFT.....
As directed by instructor

153. Reassemble MAIN SHAFT.....
As directed by instructor

154. MAIN SHAFT.....
Page 2-1

155. MAIN SHAFT CLUTCH THROWOUT LEVER .....
Page 2-1

- -

NOTES:....

JOB SHEET 14

SUBJECT: MODEL 14 ADJUSTMENTS
REF: Teletype bulletin 165B

156. SELECTOR CLUTCH ✓.....
Page 2-17

157. ARMATURE PIVOT SCREWS PA.....
Page 2-4

158. SELECTOR MAGNETS PA.....
Page 2-4

159. SELECTOR ARM PIVOT SCREW PA.....
Page 2-4

160. SELECTOR ARM BRACKET PA.....
Page 2-5

161. LOCKING WEDGE PA.....
Page 2-6

162. SELECTOR ARM STOP DETENT PA.....
Page 2-5

163. SELECTOR MAGNET BRACKET POSITION PA.....
Page 2-6

164. SELECTOR ARM OPERATING SCREW .....PA.....
Page 2-6

165. SELECTOR MAGNET BRACKET PA.....
Page 2-6, Re-check #164 after making 165.

166. ARMATURE LEVER SPRING TENSION PA.....
Page 2-6

167. STOP LEVER ECCENTRIC SCREW PA.....
Page 2-7

168. TRIP-OFF SCREW PA.....
Page 2-7

FINAL REQUIREMENTS .....

A. Range 25 to 105.

B. Machine runs closed at 110 plus or minus 3 points.

- -

NOTES:....

JOB SHEET 15

SUBJECT: MODEL 14 ADJUSTMENTS
REF: Teletype bulletin 165B

169. MAIN BAIL GUIDES PA.....
Page 2-8

170. PULL BAR GUIDE PAM
Page 2-9

171. MAIN BAIL ADJUSTING SCREW PA.....
Page 2-9

172. CODE BAR PULL CRANK PAM
Page 2-13

173. VERTICAL LEVER PIVOT SCREW PA.....
Page 2-14

172. MAIN BAIL ADJUSTING SCREW (FINAL) PA
Page 2-14

173. PUNCH SELECTOR FINGER BACK STOP PA
Page 2-14

174. PUNCH BAIL BEARING PA.....
Page 2-12

175. PUNCH BAIL FRONT PIVOT BEARING PA...
Page 2-12

176. PUNCH BAIL LINK PA.....
Page 2-14

177. PUNCH BAIL UPSTOP SCREW PA.....
Page 2-14

178. FEED ROLL BEARING PA.....
Page 2-13

179. TAPE TENSION LEVER SPRING TENSION PA.....
Page 2-15

180. FEED ROLL DETENT FINAL.....
Page 2-15

181. FEED PAWL ECCENTRIC .....
Page 2-15

- -

NOTES:....

JOB SHEET 16

SUBJECT: MODEL 14 ADJUSTMENTS
REF: Teletype bulletin 165B

182. SHIFT BELL CRANK GUIDE .....
Page 2-16

183. SHIFT ROCKER .....
Page 2-16

184. MAIN BAIL SPRING TENSION .....
Page 2-17

185. PULL BAR LOCKOUT LEVER .....
Page 3-4

186. BELL HAMMER POST .....
Page 3-5

187. BELL HAMMER ECCENTRIC SCREW .....
Page 3-5

188. SIGNAL BELL .....
Page 3-5

189. RIBBON SPOOL SHAFT BEVEL GEARS .....
Page 2-10

190. RIBBON SPOOL SHAFT BRACKET .....
Page 2-10

191. RIBBON REVERSE ARM SHAFTS .....
Page 2-10

192. RIBBON REVERSE PAWL LINK .....
Page 2-11

193. RIBBON CHECK PAWL .....
Page 2-12

194. RIBBON FEED PAWL .....
Page 2-12

195. RIBBON GUIDE .....
Page 2-16

- -

NOTES: ....

TELETYPE MAINTENANCE SCHOOL

MODEL 14 STUDY GUIDE
ELECTRICAL
&
MECHANICAL

Table of Contents

SUBJECT: MODEL 14 TELETYPEWRITER - GENERAL INFORMATION

REF: Teletype Bulletin 172, page 1 & 2.

The Model 14 typing reperforator is a motor driven mechanism for receiving messages over wires and recording the messages in both code perforations and typewritten characters on the same tape. Receiving units of this kind are particularly adaptable for use at message distribution centers because the perforated tape may be used to retransmit the message to one or more stations by means of another unit known as a transmitter-distributor, thus eliminatingthe necessity for manual transmittion by direct keyboard or manual preparation of tape. The typewritten characters on the tape facilitate identification and distribution of the message tape at the message center.

The typing reperforator utilizes standard perforator tape 11/16" wide. A method of tape perforating known as CHADLESS perforating is employed to permit perforation of the tape in the same space that is occupied by the typewritten characters. The punching, or chads, are not completely served from the tape but remain attached to it at their leading edges so as to form lids over the holes. The legibility of the typewritten character is not impaired by this type of perforating because the perforating does not eliminate any portion of the tape.

Typing and printing occure simultaneously, but due to the fact that the platen is to the right of the perforator die block, characters are typed to the right of their respective perforations . The separation between the typewritten characters and its associated perforation is six (6) character spaces. This separation must be taken into account when tearing message tapes from the unit for re-transmission. When the tape is to be used for transmittion by means of a transmitter-distributor, the end of the tape should include all the typewritten characters in the message, and the first typewritten characters in the message must be preceded by at least six sets of code perforations in order to transmit the entire message.

- -

NOTES:

SUBJECT: ELECTRICAL INFORMATION OF THE MODEL 14 TELETYPEWRITTER

REF: Teletype bulletin 172, TM-11-2223

GENERAL

Due to the various field changes that have been made in the Model 14 it is impossible to put down in a few words a true picture of the electrical circuits. A good breakdown of all circuits can be found in TM-11-2223, para 108, under the heading of circuit analysis. This paragraph refers to figures which will show the various ways that the circuits are used in a Model 14 depending upon the flexability of the equipment that is desired.

LINE CIRCUIT COMPONENTS

The Model 14 must obtain its AC and DC from an external source. The DC input is from the Model 19 table, entering in at spring and button contact #12, to the series-parallel switch (right for series, left for parallel), to the selector magnets, (92 ohms each, a total of 184 ohms), and back to battery through spring and button contact #11.

AC CIRCUIT COMPONENTS

The AC distribution is made to 21, 22 and 23 on the terminal board located under the base plate. The AC motor switch is between 21 and 22. Further circuit distribution is made through spring and button contacts 13 and 16 (13 & 15 HOT).

Information on the start winding, running winding, cutout switch method of coil winding can be found in TM-11-353 which is an old issue or refer to an electrical shop for re-winding of load starting.

NOTE: For information on AC/DC see TM-11-2223, fig 314

NOTES:

SUBJECT: MAJOR UNITS OF THE MODEL 14

REF: Teletype bulletin 172.

1. Base

2. Typing reperforator unit.

3. Motor unit.

4. Cover.

REMOVING THE COVER

1. As no control levers extend through the front of the cover, the cover is easily replaced by holding directly over the typing reperforator and lowering straight down.

REMOVING THE TYPING REPERFORATOR UNIT FROM BASE

1. Remove the two knurled thumbscrews and lift typing reperforator unit from the two locating pins in right front and left rear corners of the base plate. Some machines do not have these thumbscrews, but anytime you are moving, handling, or operating in rough weather it is a very good idea to have these thumbscrews mounted to protect the machine from falling from the base unit.

REPLACING THE TYPING REPERFORATOR UNIT ON BASE

1. Place right hole in unit over right locating pin. Swing reperforator unit clockwise against elecfrical spring and button contacts until left hand locating pin is allowed to enter its associated hole in left side reperforator unit. Replace thumbcrews.

2. Always rotate motor by hand to ascertain there is no bind in the machine.

ROTATION OF MOTOR BY HAND IS A MUST AFTER EVERY ADJUSTMENT OR CONNECTION OF TYPING REPERFORATOR UNIT TO THE BASE.

- -

NOTES:

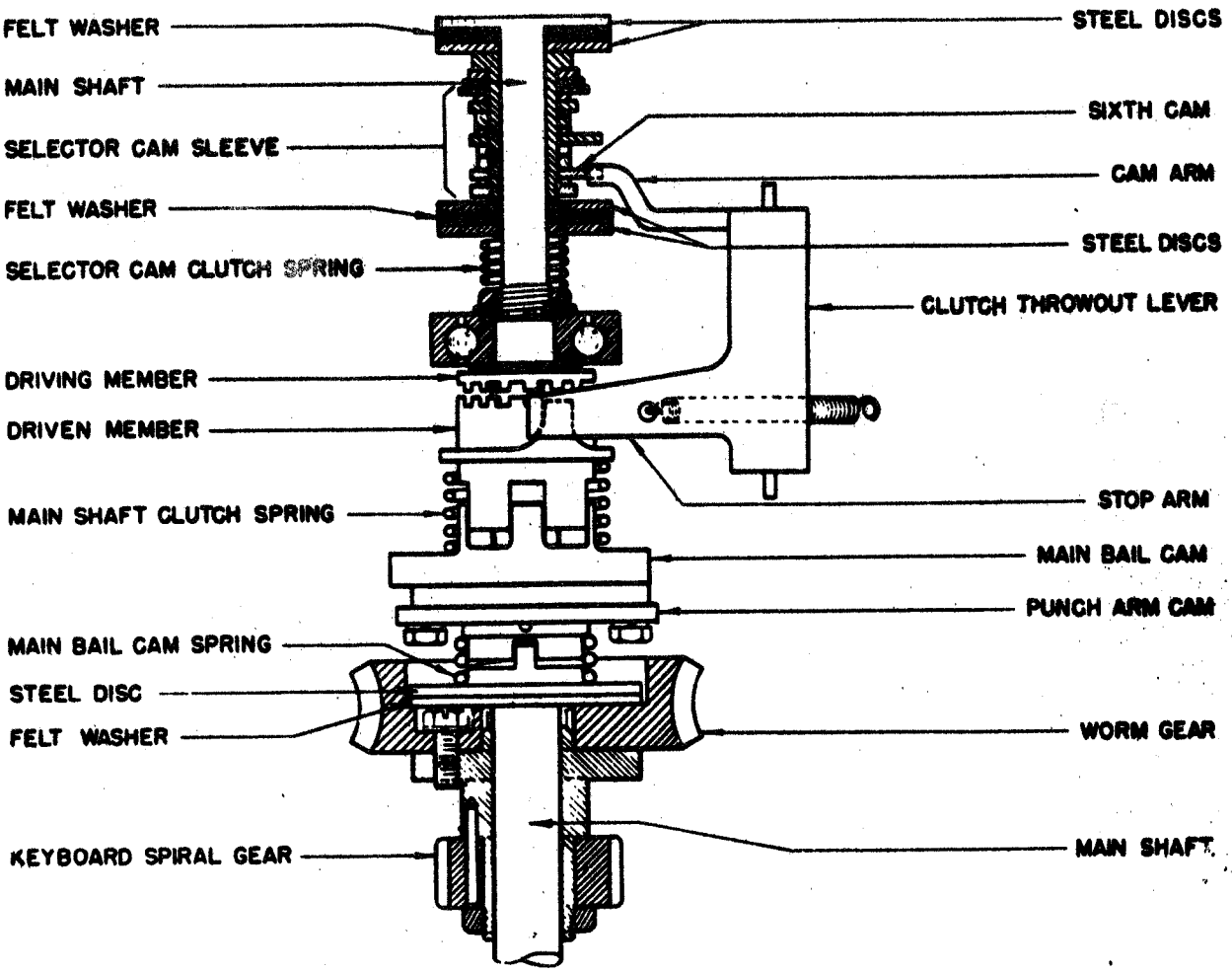

FELT WASHER
MAIN SHAFT
SELECTOR CAM SLEEVE
FELT WASHER
SELECTOR CAM CLUTCH SPRING
DRIVING MEMBER
DRIVEN MEMBER
MAIN SHAFT CLUTCH SPRING
MAIN BAIL CAM SPRING
STEEL DISC
FELT WASHER
KEYBOARD SPIRAL GEAR
STEEL DISCS
SIXTH CAM
CAM ARM
STEEL DISCS
CLUTCH THROWOUT LEVER
STOP ARM
MAIN BAIL CAM
PUNCH ARM CAM
WORM GEAR
MAIN SHAFT

FIGURE 13

SUBJECT: MAIN SHAFT

REF: Teletype bulletin 172, page 4, fig 13

PARTS THAT ROTATE ALL THE TIME

1. Main shaft gear.
2. Driving member of the main shaft clutch.
3. Driving members of friction type clutch selector cam sleeve.

SLEEVE ON THE MAIN SHAFT

1. Selector cam sleeve assembly.
2. Main bail cam, punch arm cam, and driven member of the main shaft clutch.

Note: Power for the operation of this machine originate from cams and gears on the main shaft and springs throughout the machine.

NOTES:

SUBJECT: SELECTOR UNIT

REF: Teletype bulletin 172, page 5, para B, fig 17 & 18.

There are five (5) parts common to both the marking and spacing train of parts.

Riding the

ARMATURE CAM is the point

ARMATURE LEVER. This in turn is fastened to the

ARMATURE Which is forced against the

SELECTOR MAGNETS For every impulse (except the start impulse) of every charactor. The position of the armature lever determines also the position of the

SELECTOR ARM.

ARMATURE CAM
ARMATURE LEVER
ARMATURE
SELECTOR MAGNETS
SELECTOR ARM

NOTES:

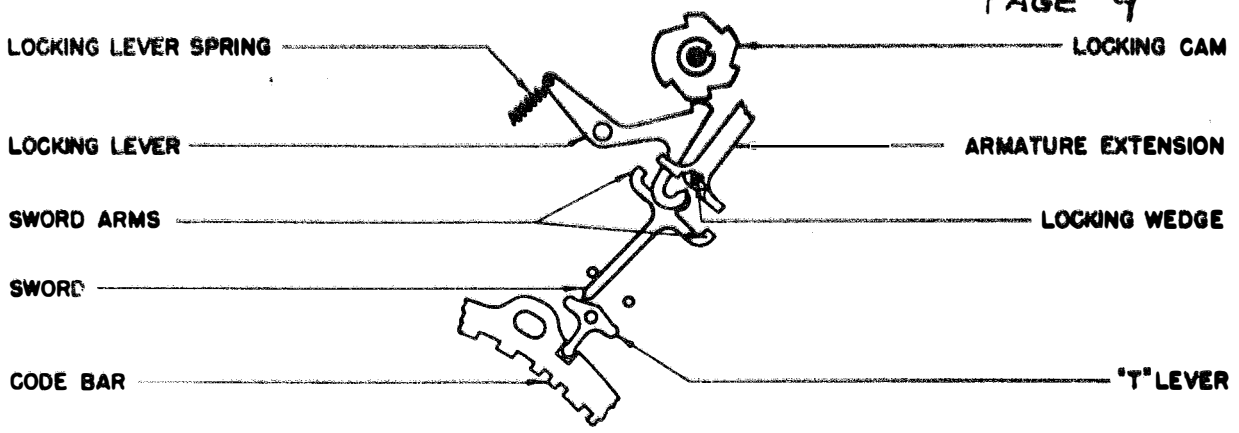


FIGURE 16

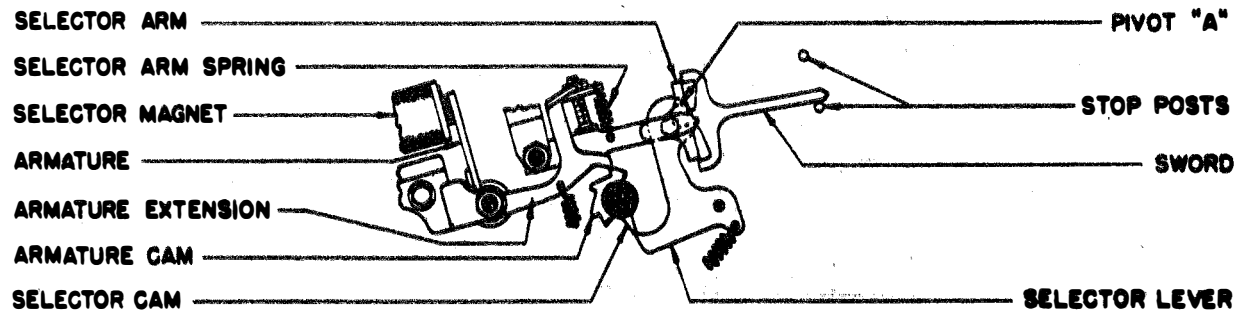
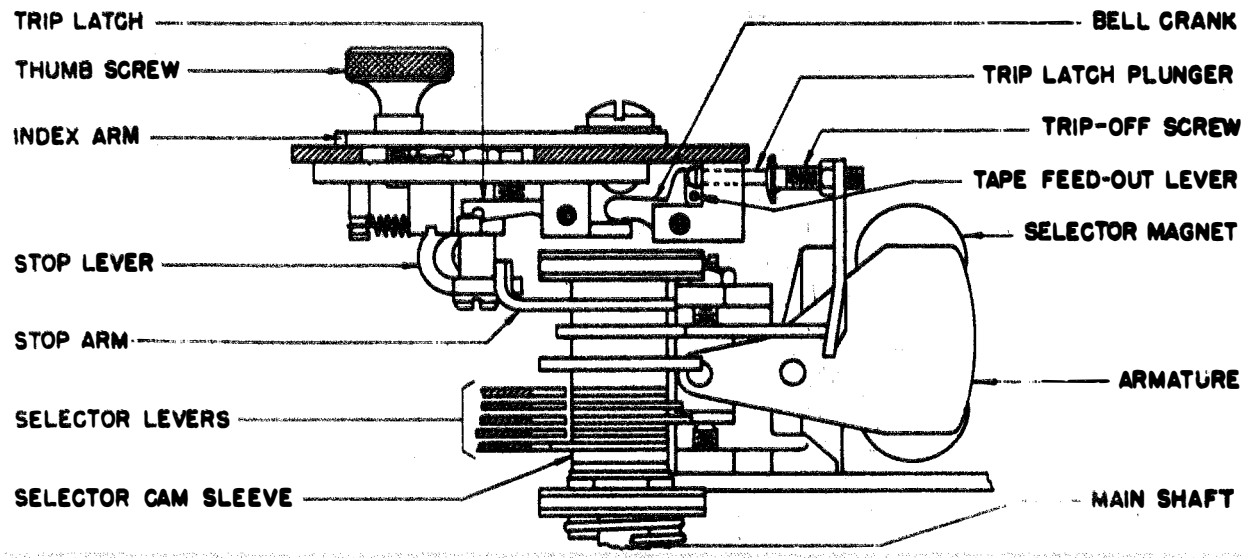


FIGURE 17



SUBJECT: SELECTOR UNIT

REF: Teletype bulletin 172, page 5, para B, fir 17 & 18

For a marking impulse the

ARMATURE CAM forces the

ARMATURE LEVER to the RIGHT which places the

ARMATURE . against the

SELECTOR MAGNETS where it is held by magnetic attraction.
This movement places tension of the

SELECTOR ARM SPRING which pulls the

SELECTOR ARM to the right into the path of the right arm of the

SWORD, causing the point of the sword to move to the left.
As the sword is forced forward by the selector
lever spring, it strikes the left arm of the

"T" LEVER causing its point and the associated

CODE BAR to move to the RIGHT FOR A MARK.

ARMATURE CAM
ARMATURE LEVER
ARMATURE
SELECTOR MAGNETS
SELECTOR ARM SPRING
SELECTOR ARM
SWORD
"T" LEVER
CODE BAR

- -

NOTES:

SUBJECT: SELECTOR UNIT

REF: Teletype bulletin 172, page 5, para B, fig 17 & 18

For a spacing impulse the

ARMATURE CAM forces the

ARMATURE LEVER to the right which places the

ARMATURE against the

SELECTOR MAGNETS and also puts tension on the

ARMATURE SPRING. As the armature cam passes the point of the armature lever, this spring pulls the armature lever to the left which causes the

SELECTOR ARM OPERATING SCREW to ride against the

SELECTOR ARM, moving it to the left into the path of the left arm of the selected

SWORD causing the point of the sword to move to the right. As the sword is forced forward by the selector lever spring, it strikes the right arm of the

"T" LEVER causing its point and the associated

CODE BAR to move LEFT FOR A SPACE.

ARMATURE CAM
ARMATURE LIVER
ARMATURE
SELECTOR MAGNETS
ARMATURE SPRING
SELECTOR ARM OPERATING SCREW
SELECTOR ARM
SWORDS
"T" LEVER
CODE BAR

NOTES:

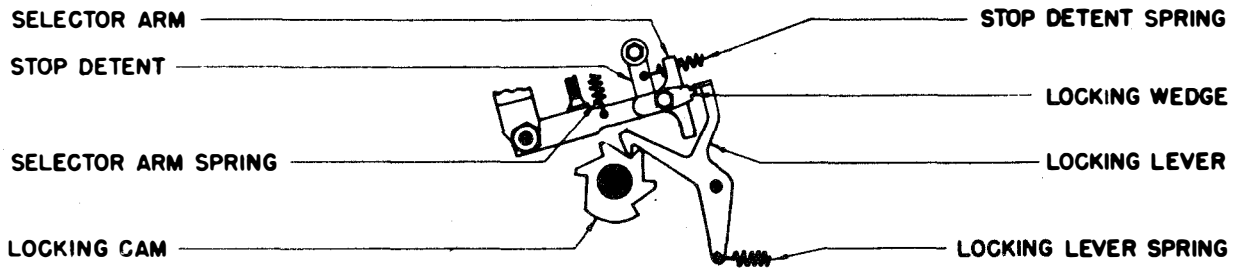


FIGURE 19

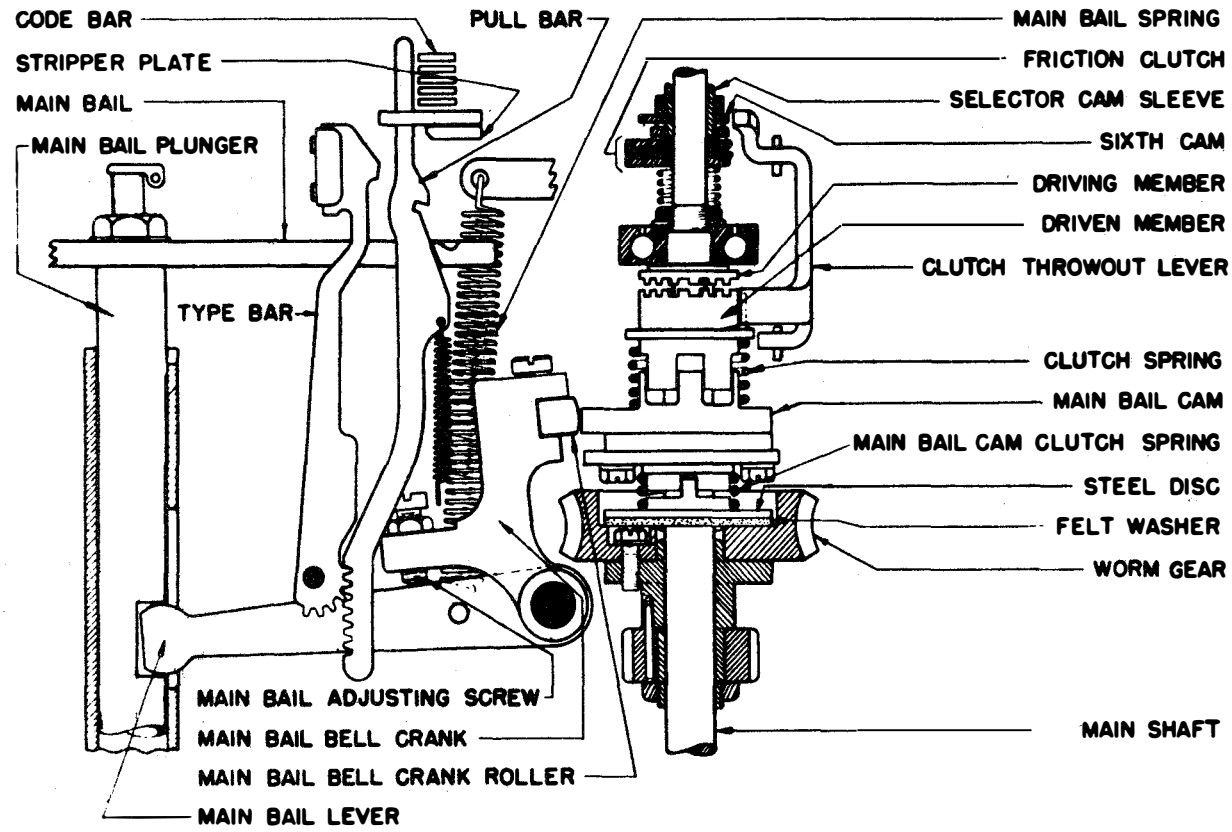


FIGURE 20

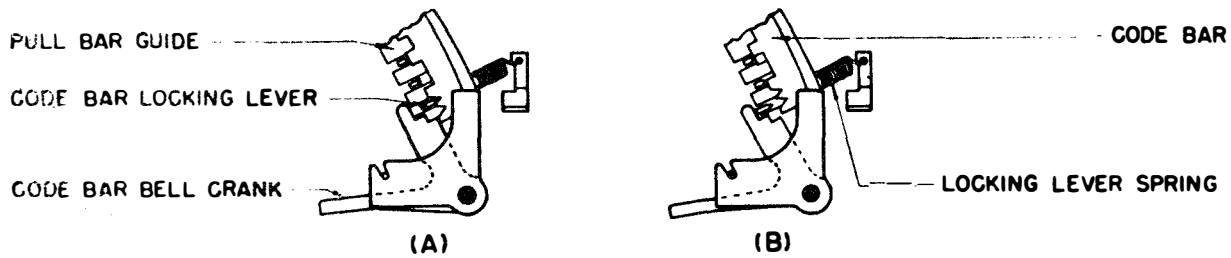


FIGURE 21

SUBJECT : PRINTING
REFERENCE : Teletype Bulletin 172, Page 6, Fig 20

When the Main Shaft Clutch Driven Member becomes engaged and starts to turn, the

MAIN BAIL SPRING pulls the

MAIN BAIL LEVER up, which moves the

MAIN BAIL PLUNGER up, on top of which is mounted the

MAIN BAIL, This engages the selected

PULL BAR Which is geared at the bottom to a

TYPE BAR. When the PULL BAR is pulled up by the MAIN BAIL the TYPE BAR moves toward the PLATEN. When the TYPE BAR is within approximately one inch of the PLATEN, the sloping surface of the hooked projection on the PULL BAR strikes the stripper plate, and the PULL BAR is stripped from the MAIN BAIL . Momentum carries the TYPE BAR the remaining distance.

MAIN BAIL SPRING
MAIN BAIL LEVER
MAIN BAIL PLUNGER
MAIN BAIL
PULL BAR
TYPE BAR

PULL BARS ON THE MODEL 14

RIGHT SIDE toward the center
- Code Bar Locking Lever
- Figures Pull Bar
- Blank Pull Bar
- Line Feed Pull Bar
- Carriage Return Pull Bar

LEFT SIDE toward the center
- Unshift On Space Pull Bar
- Letters Pull Bar
- Signal Bell Pull Bar
- "S" Pull Bar

The FIRST THREE Pull Bars on either side are NOT stripped by the stripper plate. This allows a more definite action on these Pull Bars.

SUBJECT: SELECTION FOR PUNCHING

REFERENCE: Teletype Bulletin 172, Page 6, Last Paragraph

Selection for printing occurs early during the upward travel of the Main Bail. Selection for punching is accomplished by means of a train of parts that starts with the action of the right end of the Code Bars on the Code Bar Bell Cranks. This train imparts motion down to the Selector Fingers in the Punch Bail. Whether or not a hole will be punched in the tape, depends on the position of these Selector Fingers.

1. When the Selector Fingers are moved to the extreme LEFT, they are positioned for a SPACE. (NO PERFORATION)

2. When the Selector Fingers are moved slightly LEFT, they are positioned for a MARK. (PERFORATION OCCURS)

3. When the Selector Fingers are to the extreme RIGHT, they are in their normal STOP position.

POSITIONING THE CODE BAR BELL CRANKS

The Code Bar Bell Cranks are operated in a CLOCKWISE direction when they are positioned for a MARK OR A SPACE. They are moved in a COUNTER-CLOCKWISE direction when they are returned to their normal stop position.

1. When the Code Bars are to the RIGHT (MARKING), they limit the CLOCKWISE rotation of the Code Bar Bell Cranks, allowing only a slight CLOCKWISE rotation until the rear are of the Bell Crank is blocked by the RIGHT FRONT END of the Code Bars.

2. When the Code Bars are to the LEFT (SPACING), they allow an additional CLOCKWISE rotation of the Code Bar Bell Cranks, permitting continued rotation until the FIRST STEP ON THE REAR ARM OF THE BELL CRANK IS BLOCKED by the RIGHT FRONT END OF THE CODE BARS.

NOTES:

SUBJECT: SELECTION FOR PUNCHING

REF: Teletype bulletin 172, page 6, last paragraph

The train is the same whether positioning for a mark or a space.

As the main bail starts its upward movement, the

CODE BAR LOCKING LEVER enters the code bars, allowing the

CODE BAR BELL CRANKS to rotate clockwise, allowing the

VERTICAL LEVERS to rotate clockwise, (viewed from the right), allowing the
VERTICAL LEVER BELL CRANKS to rotate counter-clockwise, (viewed from the right), allowing the
PUNCH BELL CRANKS to rotate clockwise (viewed from the front), from the power of the
PUNCH BELL CRANK SPRINGS. This movement will cause the

SELECTOR FINGERS to move to the left, positioning either for a mark of a space.

NOTE: The punch bell crank springs are extending power in TWO directions in this train of parts.

CODE BAR LOCKING LEVER
CODE BAR BELL CRANKS
VERTICAL LEVERS
VERTICAL LEVER BELL CRANKS
PUNCH BELL CRANKS
PUNCH BELL CRANK SPRINGS
SELECTOR FINGERS

Train of parts to return the SELECTOR FINGERS to their normal stop position. (resetting)

CODE BAR LOCKING LEVER
CODE BAR BELL CRANKS (counter-clockwise)
VERTICAL LEVERS (counter-clockwise)
VERTICAL LEVER BELL CRANKS (clockwise)
PUNCH BELL CRANKS (counter-clockwise)
SELECTOR FINGERS

NOTE: Degree of movement of the code bar bell cranks is determined by the position of the code bars

POWER to position the selector fingers: PUNCH BELL CRANK SPRINGS
POWER to reset the SELECTOR FINGERS: MAIN BAILCAM

- -

NOTES:

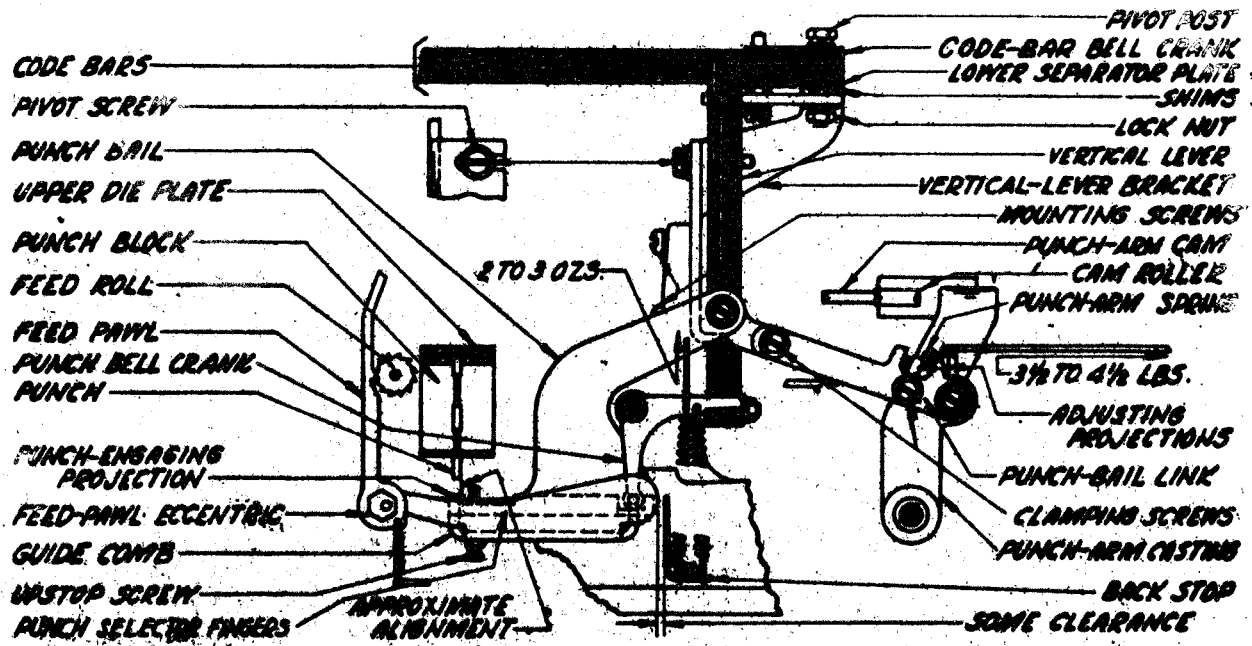


FIGURE 43

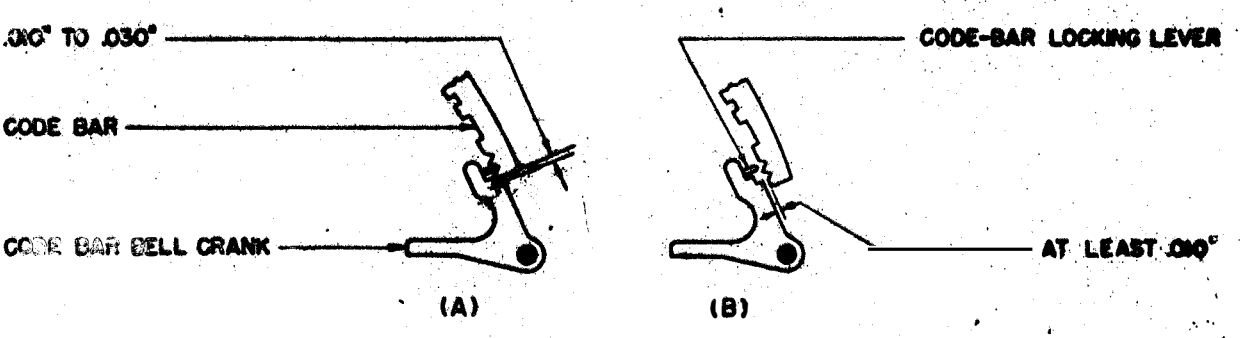
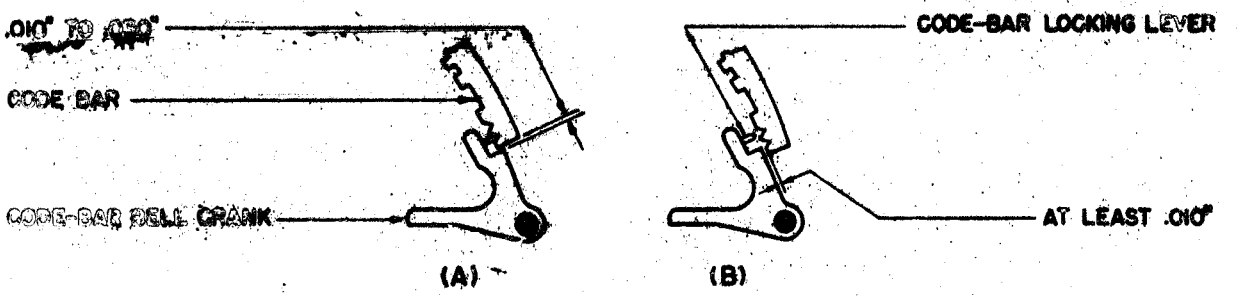


FIGURE 44



SUBJECT: PUNCHING

REF: Teletype bulletin 172, page 6, bottom paragraph

Punching is accomplished when the punch arm roller moves from the LOW to the HIGH side of the

PUNCH ARM CAM, the roller moves the

PUNCH ARM CASTING, to the right. Attached to the casting is the

PUNCH BAIL LINK, which in turn moves the upper right end of the

PUNCH BAIL, to the right and down. This causes the punch bail to rotate clockwise moving the

PUNCH SELECTOR FINGERS, up. The punch selector fingers contact and move the

PUNCH PINS up forcing them to perforate the tape.

PUNCH ARM CAM
PUNCH ARM CAM ROLLER
PUNCH ARM CASTING
PUNCH BAIL LINK
PUNCH BAIL
PUNCH SELECTOR FINGERS
PUNCH PINS

- -

NOTES:

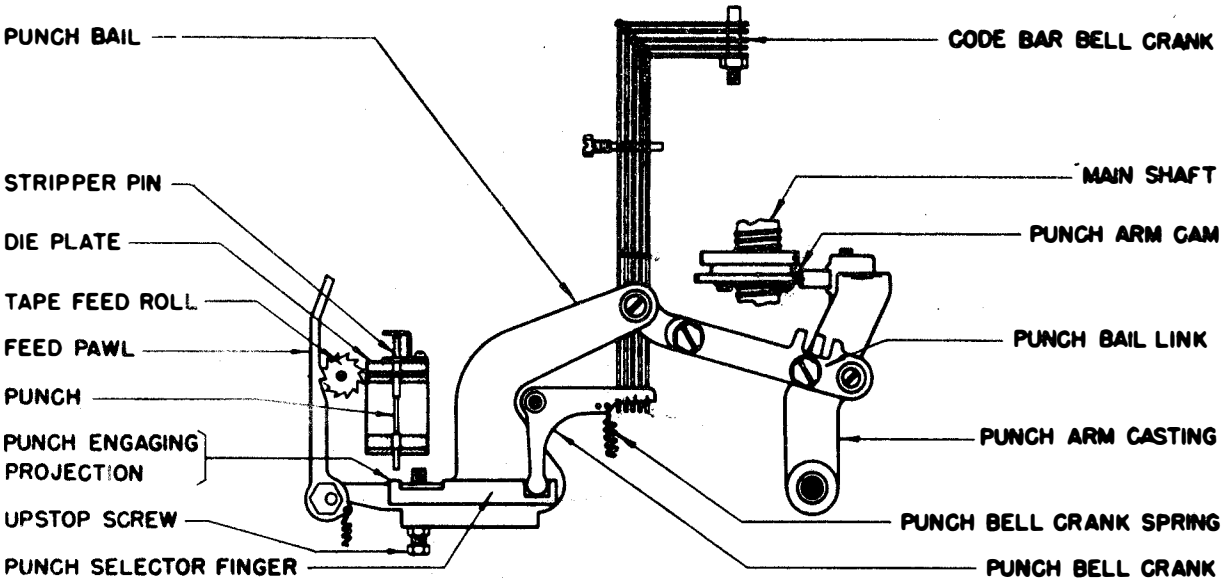


FIGURE 22

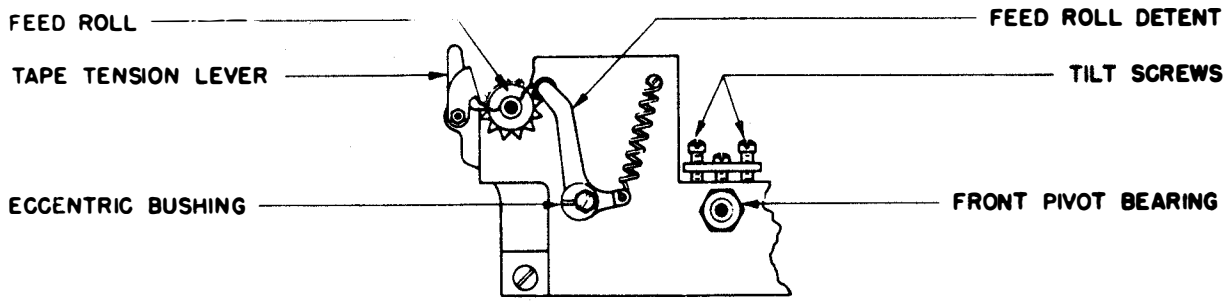


FIGURE 23

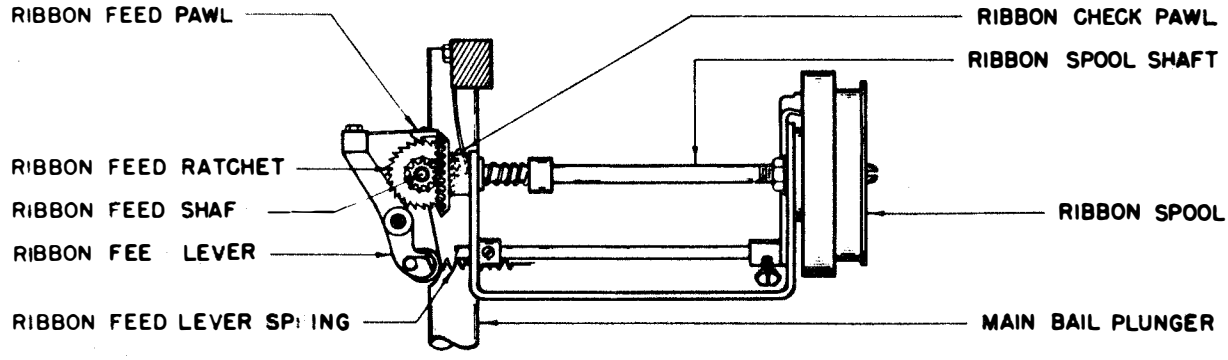


FIGURE 24

SUBJECT: TAPE SPACING

REF: Teletype bulletin 172, page 7.

Tape spacing takes place after tape perforation is accomplished. However spacing is set-up during tape perforation. Tension is applied to the punch arm casting spring when the punch arm casting moves to the right during perforation. The punch bail has the tape feed pawl connected to its left end and when the punch bail rotates clockwise to perforate it also moves the tape feed pawl up so that it overtravels a tooth on the tape feed roll. After perforation occures the high side of the punch arm cam moves away from the punch arm cam roller.

THIS ALLOWS THE

PUNCH ARM CASTING SPRING to contract moving the

PUNCH ARM CASTING to the left. This forces the

PUNCH BAIL LINK to the left, rotating the

PUNCH BAIL counter-clockwise pulling down on the

FEED PAWL which rotates the

FEED ROLL One tooth. This causes the tape to advance one space to the left. Simultaneously with this action the detent lever roller rides over a tooth on the star wheel to insure even spacing of the feed hole perforations.

PUNCH ARM CASTING SPRING
PUNCH ARM CASTING
PUNCH BAIL LINK
PUNCH BAIL
FEED PAWL
FEED PAWL SPRING
FEED ROLL

NOTE: Since the tape feed pawl spring must hold the feed pawl is position to overtravel a tooth on the feed roll, the spring must be included in the tape spacing train of parts.

- -

NOTES:

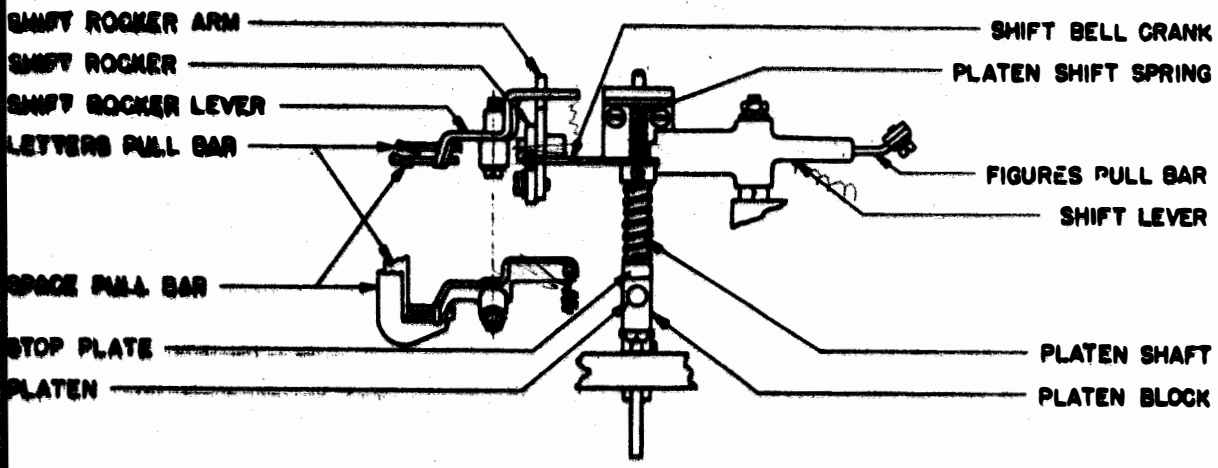

SHIFT ROCKER ARM
SHIFT ROCKER
SHIFT ROCKER LEVER
LETTERS PULL BAR
SPACE PULL BAR
STOP PLATE
PLATEN
SHIFT BELL CRANK
PLATEN SHIFT SPRING
FIGURES PULL BAR
SHIFT LEVER
PLATEN SHAFT
PLATEN BLOCK

FIGURE 27

SUBJECT: SHIFT

REF: Teletype bulletin 172, page 8.

To shift from letters to figures position the

MAIN BAIL in the upward movement picks up and moves the selected

FIGURES PULL BAR up. At the lower end of the figures pull bar is the figures pull bar toe which engages and rotates the

SHIFT LEVER counter-clockwise. This rotation of the shift lever moves the left end of the shift lever clear of the lower extension of the shift bell crank. The

PLATEN SHIFT SPRING then expands and provides the power to move the

PLATEN SHAFT forward. Riding in the platen shaft is the

PLATEN which is carried **FORWARD** into the figures position. Printing takes place on the front side of the tape.

MAIN BAIL
FIGURES PULL BAR
SHIFT LEVER
PLATEN SHIFT SPRING
PLATEN SHAFT
PLATEN

NOTES:

SUBJECT: UNSHIFT

REF: Teletype bulletin 172, page 8.

To unshift from figures to letters position, the

MAIN BAIL in its upward movement picks up and moves the selected

LETTERS PULL BAR up. At the lower end of the letters pull bar is a toe which engages and rotates the

SHIFT ROCKER LEVER clockwise. The right end of the shift rocker lever moves the

SHIFT ROCKER ARM rear extension down causing the

SHIFT ROCKER to rotate toward the rear. A notch in the top of the shift rocker moves the left arm of the

SHIFT BELL CRANK to the rear. The shift bell crank is fastened to the

PLATEN SHAFT and pulls it to the rear. Mounted on the platen shaft is a block which carries the

PLATEN The platen shaft and platen moves to the rear against the tension of the platen shift spring and printing will appear on the rear half of the tape.

NOTE: When the shift bell crank has been moved to the extreme rear position, it is held there by the shoulder on the shift lever

MAIN BAIL
LETTERS PULL BAR
SHIFT ROCKER LEVER
SHIFT ROCKER ARM
SHIFT ROCKER
SHIT BELL CRANK
PLATEN SHAFT
PLATEN

NOTES:

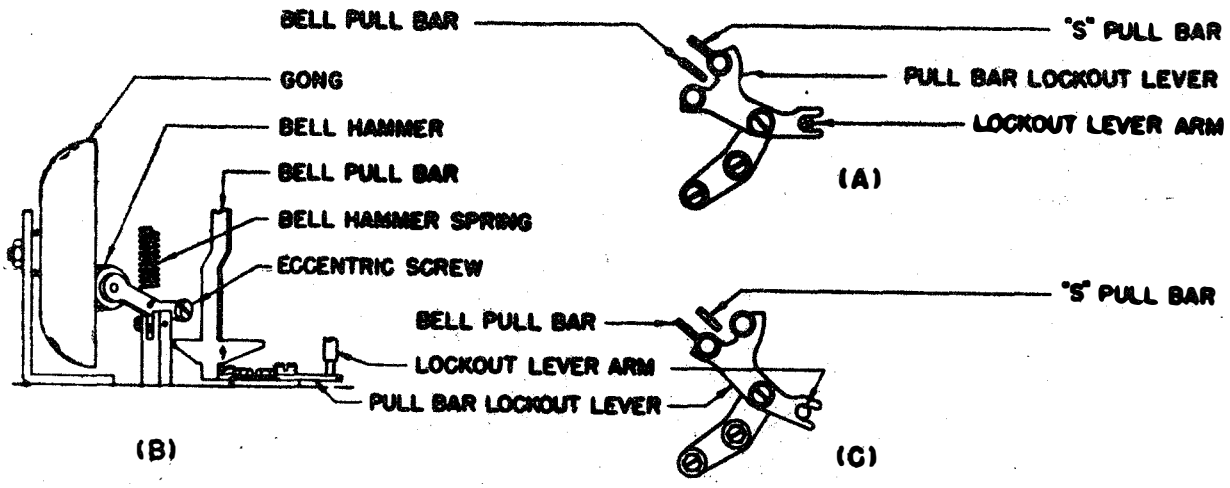

BELL PULL BAR
"S" PULL BAR
PULL BAR LOCKOUT LEVER
LOCKOUT LEVER ARM
(A)
GONG
BELL HAMMER
BELL PULL BAR
BELL HAMMER SPRING
ECCENTRIC SCREW
(B)
"S" PULL BAR
BELL PULL BAR
LOCKOUT LEVER ARM
PULL BAR LOCKOUT LEVER
(C)

FIGURE 28

SUBJECT: SIGNAL BELL

REF: Teletype bulletin 172, page 8.

Some units of the Model 14 are designed to ring the signal bell when in the figures position and the letter "S" (1-3--) is selected.

When in the figures position, the pull bar lockout lever are (which is a lower extension of the shift rocker), is to the rear and rotates the pull bar lockout lever counter-clockwise. This moves the rear pull bar lockout lever roller into engagement with the "S" pull bar and cams the bottom of the pull bar toward the rear, preventing the "S" pull bar from entering the code bars, thereby preventing "S" from printing in the figures position.

As the

MAIN BAIL moves up, it picks up the selected

BELL PULL BAR and moves it up. On the lower end of the bell pull bar is a toe extending toward the rear which engages the

BELL HAMMER ECCENTRIC SCREW and moves it up and carries with it the

BELL HAMMER ringing the

SIGNAL BELL.

MAIN BAIL
BELL PULL BAR
BELL HAMMER ECCENTRIC SCREW
BELL HAMMER
SIGNAL BELL

- -

NOTES:

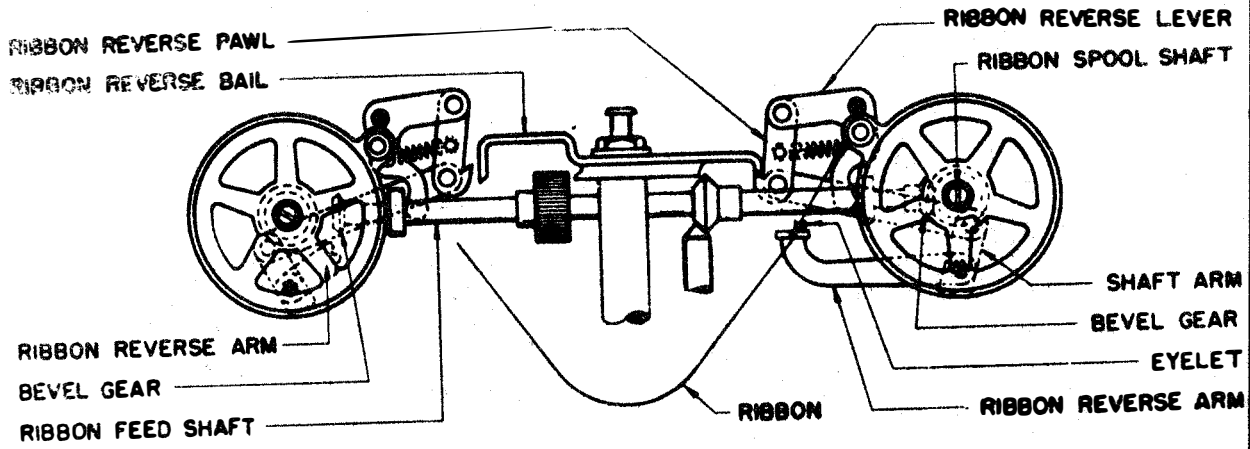

RIBBON REVERSE PAWL
RIBBON REVERSE BAIL
RIBBON REVERSE ARM
BEVEL GEAR
RIBBON FEED SHAFT
RIBBON REVERSE LEVER
RIBBON SPOOL SHAFT
SHAFT ARM
BEVEL GEAR
EYELET
RIBBON
RIBBON REVERSE ARM

FIGURE 26

SUBJECT: RIBBON FEED

REF: Teletype bulletin 172, page 7.

During the downward movement of the

MAIN BAIL PLUNGER the

RIBBON FEED LEVER ROLLER moves from the low to the high side of the cam surface moving the lower end of the

RIBBON FEED LEVER toward the rear. The upper end of the ribbon feed lever is forced to move forward and this moves the

RIBBON FEED PAWL forward, which engages a tooth on the

RIBBON FEED RATCHET and rotates it forward, The

RIBBON FEED SHAFT runs through the center of the ratchet and turns with the ratchet. Mounted on each end of the ribbon feed shaft are

RIBBON FEED SHAFT BEVEL GEARS which in turn mesh with

RIBBON SPOOL SHAFT BEVEL GEARS. These rotate a

RIBBON SPOOL SHAFT which in turn moves either the right of left

RIBBON SPOOL. Only one of the ribbon spool shafts rotate at a time.

MAIN BAIL PLUNGER
RIBBON FEED LEVER ROLLER
RIBBON FEED LEVER
RIBBON FEED PAWL
RIBBON FEED RATCHET
RIBBON FEED SHAFT
RIBBON FEED SHAFT BEVEL GEAR
RIBBON SPOOL SHAFT BEVEL GEAR
RIBBON SPOOL SHAFT
RIBBON SPOOL

- -

NOTES:

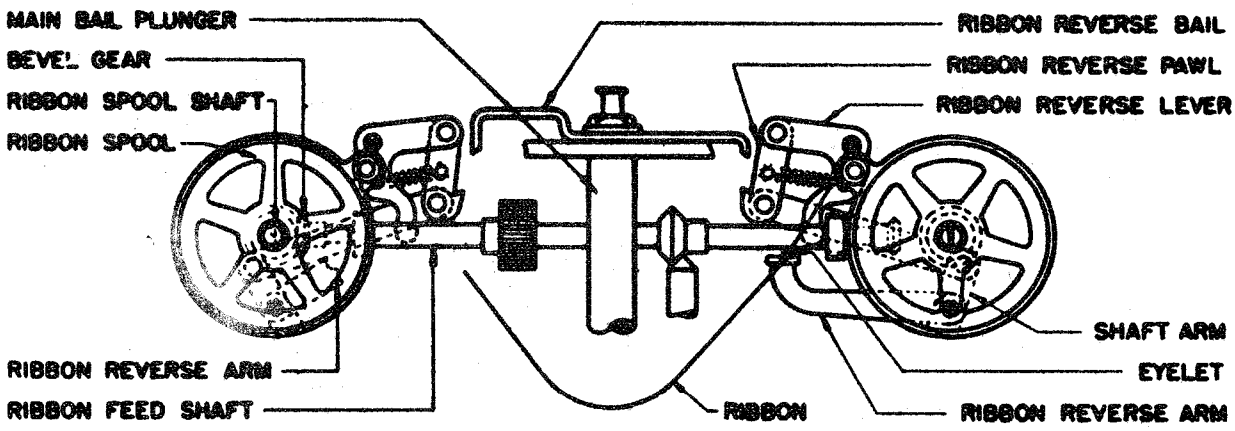

MAIN BAIL PLUNGER
BEVEL GEAR
RIBBON SPOOL SHAFT
RIBBON SPOOL
RIBBON REVERSE ARM
RIBBON FEED SHAFT
RIBBON REVERSE BAIL
RIBBON REVERSE PAWL
RIBBON REVERSE LEVER
SHAFT ARM
EYELET
RIBBON
RIBBON REVERSE ARM

FIGURE 25

SUBJECT: RIBBON REVERSE

REF: Teletype bulletin 172, page 8.

Ribbon reverse action stems from two directions. In one, the

RIBBON EYELET catches the slot of the

RIBBON REVERSE ARM and moves it down. This moves the

RIBBON REVERSE ARM SHAFT. Connected to the rear of the ribbon reversearm shaft is the

RIBBON REVERSE SHAFT ARM. The movement of the ribbon reverse shaft arm is transfered to the

RIBBON REVERSE PAWL LINK which in turn moves the

RIBBON REVERSE PAWL causing it to move into the path of the

RIBBON REVERSE BAIL.

RIBBON EYELET
RIBBON REVERSE ARM
RIBBON REVERSE ARM SHAFT
RIBBON REVERSE SHAFT ARM
RIBBON REVERSE PAWL LINK
RIBBON REVERSE PAWL
RIBBON REVERSE BAIL

The other movement starts with the

RIBBON REVERSE BAIL moving down engages the

RIBBON REVERSE PAWL, which moves the

RIBBON REVERSE LEVER which shifts the

RIBBON FEED SHAFT to the opposite position causing one

BEVEL GEAR to engage and the other to dis-engage. This reverses the ribbon feeding.

RIBBON REVERSE BAIL
RIBBON REVERSE PAWL
RIBBON REVERSE LEVER
RIBBON FEED SHAFT
BEVEL GEAR

- -

NOTES:

SUBJECT: TELETYPE PANEL TT-23/SG

ref: NavShips 91103
Wiring diagram, page 170 of this study guide
Wiring diagram, page 171 of this study guide

The teletype panel TT-23/SG is intended for general shipboard use to facilitate the interconnection and transfere of teletype equipment with various radio adaptors such as frequency shift keyers, converters, tone modulation terminal equipment, etc.

The panel has the following characteristics.
a. There are six channels, each comprising a looping circuit of two looping jacks, one set jack, a rheostat for adjusting line current and toggle switch for selecting either local or external source of line current.

b. There is a meter and a rotary selector switch for measuring line current in any channel.

c. There are six miscellaneous jacks to which may be connected any teletype equipment not regularly assigned to a channel.

d. There is a connection block mounted inside the cabinet to which all teletype equipment, radio adapters and local current connections are terminated.

Basic circuit design

a. The teletype panel TT-23/SG contains six"loopi g" circuits. The word looping is intended to indicate the manner in which the jacks are connected in series with the teletype equipment and radio adapters thus forming a complete loop as shown in the basic looping circuit diargam (page 170

b. The looping jacks on the front panel are the standard type 49560 phone jacks. With the jumper connection as shown the tip and sleeve springs are shorted thru the spring contacts thus providing circuit continuity thru each jack. Insertion of a patchcord plug in either jack opens up the spring contacts and allows another equipment to be connected in the series circuit.

The set jack incorporates a double pole-double throw switch. When no plug is inserted in the jack, it functions the same as the looping jacks, however, by inserting a plug in the set jack, the sleeve and tip of the plug are connected to terminals 3 and 4 (series) respectively of the connection block to which a teletype may also be connected. In addition, the looping circuit is simultaneously completed maintaining loop continuity thru the radio adaptor and looping jacks. The switching action of the set jack is shown on set jack diagrams (page 171).

c. It may now be clearly seen that if it is desired to transfere a teletype from one channel to any other channel, all that is required is to patch the teletype equipment from its corresponding set jack to one of the two looping jacks in the channel to be used. If it is preferred that the teletype wired in this channel should not operate, simply insert a dummy plug (supplied with the panel) in the set jack.

d. Any teletype connected to terminals 5 and 6 (series) of the connection block may be patched from the miscellaneous jack to a looping jack of any desired channel.

e. Also included in each looping channel is a battery selector switch by which either local or external line current can be selected, a rheostat for adjusting line currentm and a meter shunt resistor. Provisions are made to connect a local source of 120V DC across terminals 7 and 9 (series). These connections are parallel across the corresponding terminals of each channel by means of the selector toggle switch. It should be noted that this local current is not supplied.

f. The meter and meter selector switch are provided for the purpose of measuring the line current in each channel. By having identical meter shunt resistors in each channel, the meter may be switched to any channel without interupting the teletype signal.

g. Another desirable feature of the teletype panel TT-23/SG is the provision for testing teletype equipment. In those instances where signal distortion test equipment is available it may be permanently connected into one channel similarly to that of a frequency shift converter or keyer. Any teletypewriter termination in this patch panel or an adjecent panel may be patched into this test circuit.

- -

NOTES:.....

INSTALLATION
The teletype panel TT-23/SG is designed for fastening to bulkheads by means of the 1/4 inch mounting holes in the back of the cabinet. Cable entry holes may be made on the top and the upper 8 inches of both sides.

Connection of Cables.

a. All cables coming into the panel are terminated on the terminal block. All teletype equipment desired to be in a looping circuit should be connected to the 3 and 4 (series) lugs. Other miscellaneous teletype equipment may be connected to the 5 and 6 (series) lugs.

b. All radio adapters, such as frequency shift keyers, converters and tone modulated terminal equipment should be connected to the 1 and 2 (series) lugs except FSA and KY-32-GRT.

c. Careful consideration should be given to which teletype equipment are connected with the various looping circuits. If the most used combinations of radio adaptors and teletype equipment can be determained, and then be connected accordingly, considerable patching can be eliminated during operation.

d. The local source of line current, 120V DC should be connected to terminals 7 and 9 (series) which are parallel across the panel for each channel. A 1000 ohm fixed resistor is inserted in a leg of each toggle switch to serve to limit line current to a maximum of approximately 100 Ma. The local line current supplied to the panel should be routed thru a power distribution panel to provide for on-off control.

e. The lugs on the terminal block of the patch panel TT-23/SG are numbered from 10 to 69. The first digit indicates to which channel the lug belongs. The second digit indicates a particular terminal in that channel. Terminal lug numbers 10,20,30,40,50 and 60 are spares, one spare terminal for each channel. Lug terminal 44 could indicate that it belongs to channel number four and is the positive terminal four, where a teletype would normally be conntcted. Terminal 61 would indicate that the lug belongs to channel six and is the negative terminal number one, where a radio adaptor would normally be connected.

- -

OPERATION

Method of Use.

a. Turn all line current rheostats counter-clockwise to allow passage of minimum current.

b. Turn on local line current supply at distribution panel (green indicator light on teletype panel on).

c. If desired teletype equipment is wired in the same looping channel as the radio adaptor being used, no patchcor is required.

d. If the radio adaptor supplies its own line current, flic toggle of battery selector switch down to "EXT" current position. If not supplied, flick switch to "LOCAL" current position.

e. Turn meter selector switch to desired channel and adjust corresponding line current to 60 MA.

f. If the desired teletype is not wired in the same looping channel as the radio adaptor being used, insert one end of a moulded patchcord (supplied with panel) in the proper set jack and the other end in either one of the two looping jac in the desired channel. The teletype originally in this channel may be made inoperative by inserting a dummy plug in the set jack, or it may be patched to the looping jacks of another channel in the same manner as described above.

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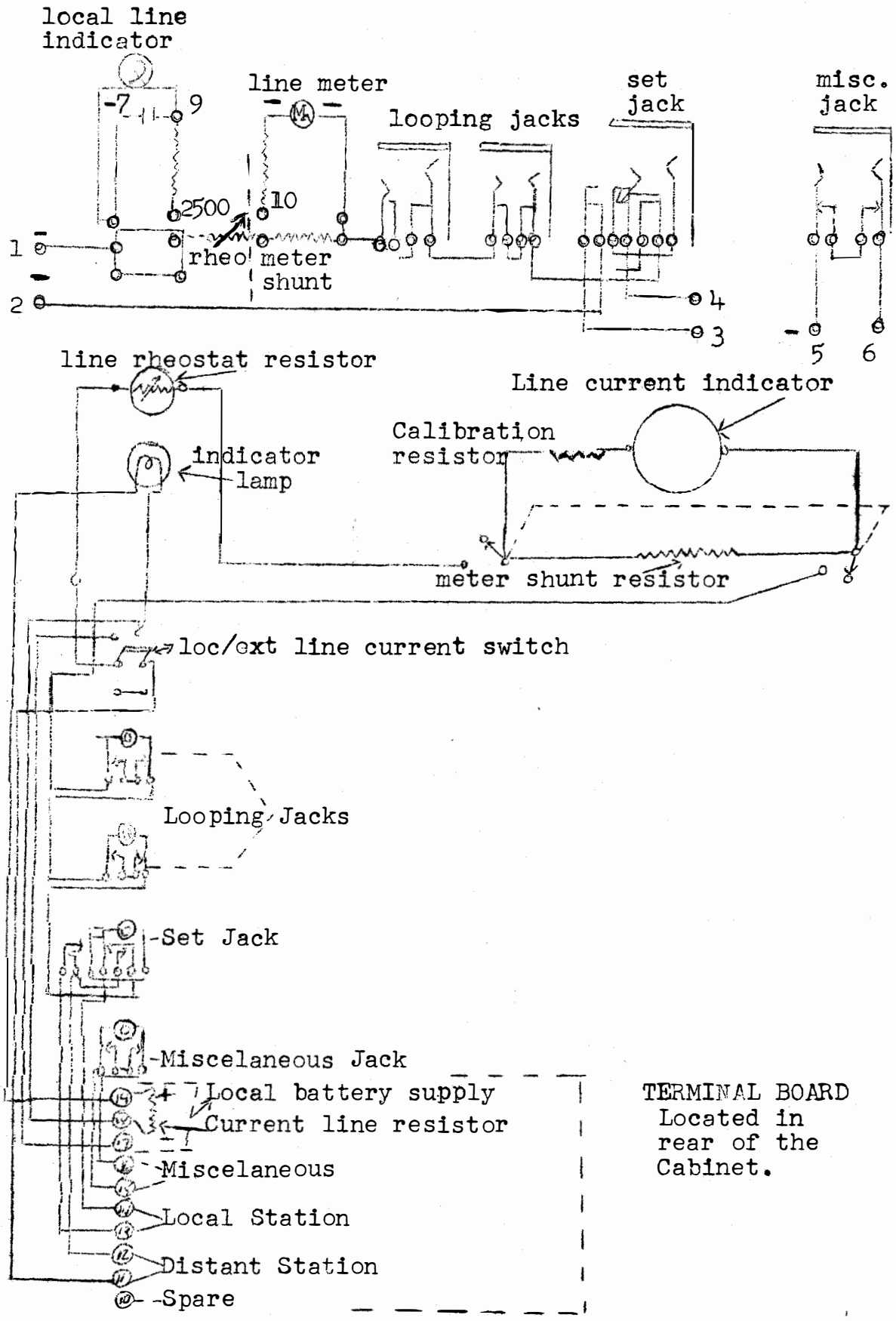
NOTES:.....


local line indicator
line meter
set jack
misc. jack
looping jacks
-7
9
2500
10
1
2
rheo
meter shunt
4
3
5
6
line rheostat resistor
Line current indicator
Calibration resistor
indicator lamp
meter shunt resistor
loc/ext line current switch
Looping Jacks
Set Jack
Miscelaneous Jack
Local battery supply
Current line resistor
Miscelaneous
Local Station
Distant Station
Spare
TERMINAL BOARD
Located in rear of the Cabinet.

SUBJECT: LINE HOOK-UPS OF TELETYPEWRITERS

Three factors must be present in a teletype loop in order to have a correct connection between teletypewriters.

POWER

We must have only one source of direct current in a teletype loop. Loop current cannot be supplied by more than one station in a loop at the same time.

SERIES

All teletypewriters in a loop must be hooked up in series.

POLARITY

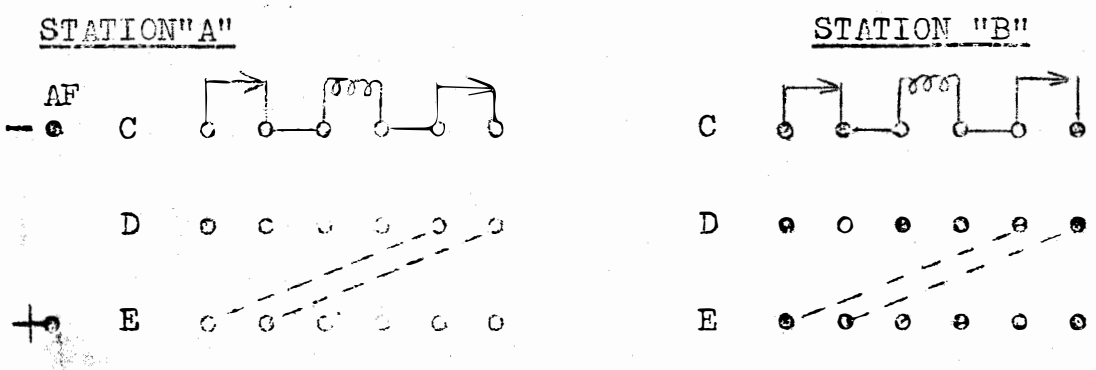
Polarity must be observed throughout the loop. Current must enter each machine at the negative terminal.

NOTES: _____

HOOK UPS

No1

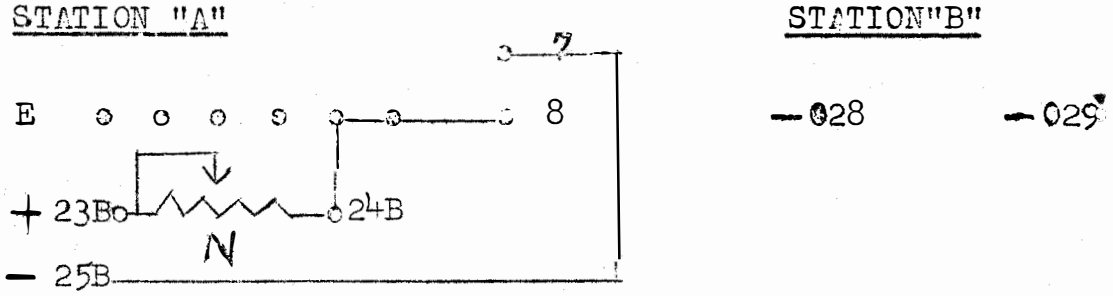
A. Two model 19's connected in simplex.
B. Both 19's in line one.
C. Station "A" to furnish line current.
NOTE: Unless otherwise directed you are to use the "AF"block when furnishing line current for line 1 and the "AG" block when furnishing line current for line 2.



1. Jumper negative side of the AF block to E1 at Station "A".
2. Jumper E2 at Station "A" to E1 at Station "B".
3. Jumper E2 at Station "B" to positive side of AF at Station.
4. Jumper E5 to E6 at both stations.

No2

A. Model 19 and Model 14 connected in simplex.
B. Model 19 furnish line current.
C. Use Local Test Line.

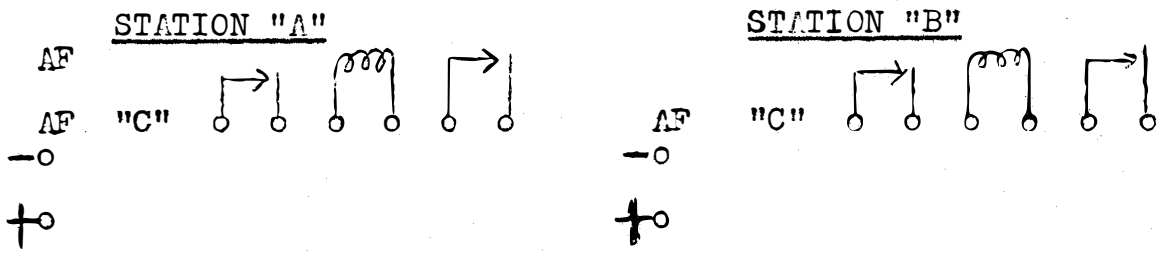


1. Remove jumper between E5 and E6.
2. Jumper E6 at Station A negative "8 at Station B.
3. Jumper E5 to Positive 29 at Station B.

HOOK UPS

No.3

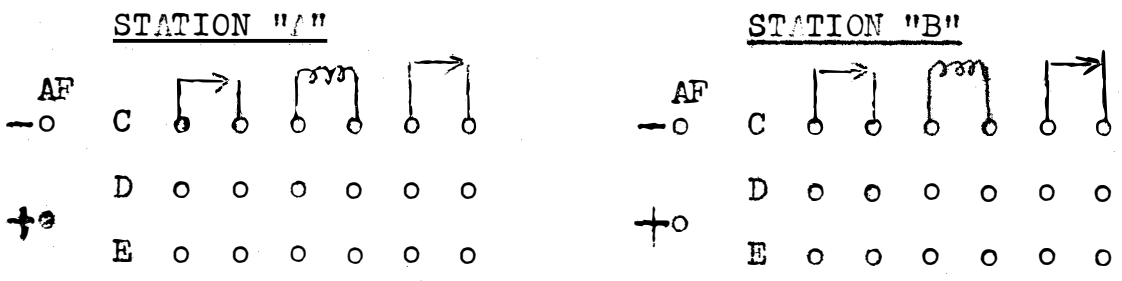
A. Two model 19's connected in duplex.
B. Transmitting station to furnish line current for his loop.
C. Do Not use the "D" and "E" blocks in this hook-up.



1. Jumper Negative AF to C1 at Station "A".
2. Jumper C2 to C5 at Station "A".
3. Jumper C6 at Station A to C3 at Station B.
4. Jumper C4 at Station B to Positive AF at Station A.
5. Jumper Negative AF to C1 at Station B.
6. Jumper C2 to C5 at Station B.
7. Jumper C6 at Station B to C3 at Station A.
8. Jumper C4 at Station A to Positive AF at Station B.

NO. 4

A. Two Model 19's connected in duplex.
B. Transmitting station to furnish line current for his loop.
C. Use D and E Blocks as possible.



1. Jumper Negative AF to E1 Station A.
2. Jumper D5 to C1 Station A.
3. Jumper C2 to C5 Station A.
4. Jumper C6 to D6 Station A.
5. Jumper Negative AF to C1 Station B.
6. Jumper C2 to C5 Station B.
7. Jumper C6 Station B to C3 Station A.
8. Jumper C4 Station A to Positive AF Station B.
9. Jumper Positive AF Station A to E2 Station B.
10. Jumper E2 Station A to E1 Station B.
11. Jumper D5 to C3 Station B.
12. Jumper D6 to C4 Station B.

2 up

SUBJECT: FINDING THE SYMPTOM

In the field when you are called to repair a machine, usually you will be told what the trouble symptoms are, but in order to become a good repairman and become completely familiar with trouble shooting the equipment, here in school you will be given troubles to look for without having been told the symptoms.

The follwoing is a systematic check list of steps to be taken in searching for a symptom. There are many different systems that could be used to locate the trouble symptoms and if you already have your own system it is fine to use it, but if you do not have a good system that you are completely accustomed to , we recommend the follwoing one. If you do have your own, see if there are any points that would help you. we beleive that by completing this check list carefully, all troubles (except rarely intermittent ones) will have given a noticeable symptom.

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.MMM
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK 1 2 3 4 5 6 7 8 9

The above test tape shows all the letters of the alphabet, plus all the numerals and is 73 characters long. The 73rd letter should pile up on the 72nd one. We suggest you have a tape similar to this one prepared to use before you start trouble shooting.

NOTES:

ISOLATING TROUBLES

1. Malfunction of one train of parts only
   a. Start with source of power and check through train.

2. Malfunction of more than one train of parts
   a. Check all parts common to trains that are malfunctioning.

3. Machine runs closed
   a. Manually depress selector armature extension
      (1) if machine runs open, the trouble is electrical
      (2) if machine runs closed, the trouble is mechanical

4. Machine runs open.
   a. Manually depress selector armature against magnet cores
      (1) if machine runs open trouble is mechanical
      (2) if machine runs closed, trouble is electrical, then
         (a) remove keyboard and transmitter-distributor
         (b) move LSK to test and line 2
         (c) remove relay and open MCJ and LCJ and take current reading on line, bias, magnet and shunt circuits

      After determining what circuit or circuits are malfunctioning make point to point voltage checks to locate the trouble.

5. Electrical trouble, AC - determine whether the trouble is above or below the table by taking voltage readings at appropriate 20, 30, or 40 blocks or at the TD slip connectors. If source voltage is read where the AC first comes above the table, then the trouble will be above the table and continue voltage checks until you have found the trouble.

6. Electrical trouble, DC - determine whether the trouble is above or below by taking reading at 24 & 25. If source voltage is read at this point, the trouble is above the table and continue reading voltages until you have located the trouble. If no voltage is read at this point the trouble is below the table, continue voltage checks going below the table until the trouble has been located. Check common or local DC below the table in the same manner prescribed above starting at 35B and 37B.