THE WESTERN UNION TELEGRAPH COMPANY
ENGINEERING DEPARTMENT

SPECIFICATIONS
4681-A
May 25, 1939.
Superseding
Section 3 of
Specifications
263-C

SPECIFICATIONS FOR THE OPERATION AND ADJUSTMENT OF MULTIPLEX TAPE TRANSMITTER 1-A

SPECIFICATIONS REFERRED TO:

263 The Multiplex Printing Telegraph System. (These specifications supersede Section 3 of Specifications 263-C and Supplements #18, #49 and Appendices #13 and #15.)

DRAWINGS INCLUDED:

22341-B-1	Transmitter 1-A.
22342-B-1	Stop Latch Mechanism.
22344-B-1	Wiring Diagram.
22346-C-1	Jockey Spring Adjustment.
22349-B-1	Contact Springs Adjustment.
48673-A-1	Feed Wheel Adjustment Tool.

GENERAL

1. The Multiplex Tape Transmitter 1-A is an electrically-operated device for setting up five-unit code combinations of positive and negative impulses for transmission to the line. It comprises essentially the equivalent of five polechanger keys which are selectively controlled by perforations in a previously prepared paper tape.

2. This transmitter consists of five contact tongues connected mechanically to five pins or selecting rods. Each tongue moves between two contact points, one of which is connected to a marking battery bus bar, the other to a spacing battery bus bar. Normally all pins tend to move upward by the force of a spring and consequently to move their linked tongues to the marking contact. When, however, a perforated tape is fed along the top of the transmitter and over the selecting pins, only those pins which are directly opposite a perforation in the tape can continue their upward travel through the perforation. Therefore, only these can move their tongues to the marking contact, the other pins, being held by the web of the tape, cause their tongues to remain on the spacing contact.

3. The prepared tape passes over the pins from right to left and is fed forward one character at a time (1/10 of an inch). The feeding of the tape is effected by means of a small star-wheel, the teeth of which engage in the feed holes of the tape. The selecting pins and star-wheel are operated by an electro-magnet which is energized by a local battery impulse, once for each character. This magnet attracts its armature, which in turn withdraws the pins from the perforations in the tape and moves the five tongues to the spacing contacts and at the same time, just as the pins have cleared the perforation, feeds the tape forward one character combination. When the armature is released the five pins move upward, by means of a spring on each pin, against the perforated tape. The pins in line with the perforations in the paper tape will pass through, causing their corresponding tongues to move against the marking contacts, while those pins which are stopped by the web of the tape hold their tongues against the spacing contacts. A combination of positive and negative polarities is thereby set up on the corresponding contact tongues. After these different polarities are transmitted, the electromagnet of the transmitter is again energized and the operation described is repeated for the next character.

4. In the following description reference is made to Drawing 22341 which shows the transmitter stripped of all but essential parts, and connected to the segments of a multiplex distributor. The rings of the distributor, for simplicity, are shown developed or rolled out.

5. The five tongues of the transmitter are electrically connected to five consecutive segments on the sending ring. They are mechanically mounted on pivoted support levers in such a manner that the tongues may be brought into contact with either the marking or spacing contacts by a slight rotation of the support levers. The free end of the support levers is held against a step on the selecting pins

by the support lever springs. The lower end of the selecting pins rests on the spring levers; the upper end protrudes through holes in the tape guide. (Tape guide not shown). Through the action of the selecting pin bar springs the pins are normally forced upward, thus rotating the support levers until the tongues touch the marking contacts. This limits the upward motion of the selecting pins.

6. A plate is so mounted on the magnet armature that it will engage steps on the selecting pins and pull them down whenever the magnet is energized. The armature also operates the feed pawl through the pivoted feed rocker and sliding bar. This feed pawl engages a ten toothed ratchet wheel forming part of the feed wheel shaft. Each operation of the magnet therefore causes the feed wheel to be rotated through an angle of 36 degrees. This advances the tape one-tenth of an inch, which is the distance between two consecutive feed holes. A spring, not shown in the drawing, holds the armature away from the pole pieces when the magnet is not energized.

7. Keeping in mind this description of the parts of the instrument, the operation of the transmitter during one revolution of the distributor brushes will now be considered. It is assumed that the letter "A" combination, in which perforations are provided for the first and second pins only, is directly over the pins of the transmitter.

8. When the brushes, moving from left to right, reach the point where the sending brushes are making contact between sending segment 1 and the solid ring, an impulse is sent to the line. Since in the letter A there is a perforation directly above the first pin this selecting pin has moved up, thus moving the tongue controlled by lever 1 to the left-hand contact. The line impulse sent out is therefore marking battery. When the brush reaches the second sending segment the battery is not reversed, for the second pin has also moved up through the perforation above it in the tape and has moved its tongue to the marking contact. When the brush passes to the third segment, however, the battery is reversed, for there is no perforation above the third pin, hence the third tongue is held in contact with the right-hand contact, which is connected to the spacing battery. The fourth and fifth segments also send out spacing battery in the same manner as the third.

9. The local brushes next come in contact with segments 6-7-8, which are strapped together to provide an impulse of sufficient duration to properly operate the magnet. This magnet is energized. The armature plate engages the steps on the selecting pins and draws them away from the paper tape. When they are out of the way the feed pawl rotates the feed wheel shaft, thus advancing the tape one feed hole. When the brush finally leaves segment 8 the magnet is deenergized, thus permitting the feed pawl to drop back to its normal position. The selecting pins are also released by the armature plate so that those pins which are directly under perforations in the tape, in its new position, may move up, thus moving their tongues to the marking contact as described. The transmitter is now ready to send out the new combination on the next revolution of the brushes.

10. To provide a convenient means of stopping the transmitter with the tongues on the spacing contacts, a manually-controlled locking device is provided. This consists of an extension on the armature which is provided with a small hook so arranged that it may be engaged by a latch controlled by a lever extending outside the transmitter cover.

11. When this lever is in the position shown at the top on Drawing 22342, the latch is thrown to the right, away from the hook on the end of the armature extension. If, however, the lever be thrown to the position shown at the bottom of Drawing 22342, the spring pulls the latch into engagement with the hook and prevents further upward motion of the extension, and the armature therefore remains locked in its operated position.

12. A switch is also provided in the base of the transmitter by means of which the circuit through the operating magnet may be opened. This switch is shown in the transmitter circuit diagram, Drawing 22344.

ADJUSTMENTS

13. GENERAL. Before adjusting, the apparatus shall be thoroughly cleaned, examined for mechanical or electrical defects, and a thin film of oil applied to all bearing surfaces.

14. FEED WHEEL POSITION. The horizontal distance from the center of the feed wheel pins to the center of the selecting pins shall be .287 inch. This can be checked with Tool #161 by placing it so that the hole indicated at "A" on Drawing 48673 fits over the feed wheel pin and the five

selecting pins extend upward into the five adjacent holes. These pins should be centrally located within these holes in order to obtain the specified adjustment. To increase the distance, loosen the lower adjustment screw, Drawing 22346 on the jockey lever and tighten the upper one; to decrease the distance, loosen the upper and tighten the lower screw. The position of the pins in relation to the holes of this tool also shows whether any pins are bent or otherwise out of alignment.

15. JOCKEY ROLLER SPRING. The tension of the jockey roller spring shall be 3 1/2 ounces measured as indicated on Drawing 22346.

16. SLIDING BAR LOWER ADJUSTING NUTS. With the operating magnet energized, adjust the lower nut on the slide bar until the feed wheel will just return to its normal position, after having been rotated backward as far as possible by hand. This adjustment should be checked for each of the ten teeth and must be very carefully made. The lock nut must be carefully tightened; otherwise it will interfere with the selecting pin adjustment.

17. SLIDING BAR UPPER ADJUSTING NUTS. With the operating magnet energized, adjust the upper nuts so that there is a clearance of .015 inch between the upper nut and the slide bearing.

18. FEED ROCKER. With the operating magnet de-energized, turn in the feed rocker stop screw until the feed pawl fails to clear a ratchet wheel tooth. Slowly back off the stop screw until the feed pawl barely clears any ratchet wheel tooth, then back off an additional 1/4 turn. This will insure the feed pawl clearing the tip of any ratchet wheel tooth by .006 inch.

19. ARMATURE ADJUSTING PLATE. Adjust the armature adjusting plate until the highest selecting pin is .006 inch above the surface of the guide plate, when the feed wheel begins to move.

20. SPACING CONTACTS. With the magnet armature still released, insert a piece of blank tape under the latch and back off all contact screws. Now advance each spacing contact screw (right side) until it touches its tongue. The moment of contact should be definitely determined by using a pair of test lamps between the spacing bus bar and the transmitter clip corresponding to the particular tongue under test. Finally, to insure firm contact, each spacing contact screw should be given a three-quarter additional turn.

21. MARKING CONTACTS. Adjust the marking contact (left side) so that there is a gap of .006 inch between the contact screws and their tongues.

22. ARMATURE BACK STOP. With the transmitter operating from the test table distributor and without tape, advance the armature back stop screw until a marking contact just fails to properly make. The printer or other receiving unit can be used to indicate this condition. Then back the armature back stop screw an additional 1/2 turn and tighten the lock nut. The armature retractile spring should have sufficient tension to properly hold the armature against its back stop.

23. TONGUE PRESSURE AGAINST THE SPACING CONTACTS. Remove transmitter from its sub-base and lock the transmitter by means of the stop latch. Remove the top plates and clamp spring adjusting Tool #9240-A in the position shown on Drawing 22349. Adjust the thumb screws until the slot in the bottom of the contact tongue arm will engage any transmitter tongue without resting upon it or binding it in any way. Tighten the mounting screws and lock nuts of the tool and put the contact arm on one of the tongues. Put the weight on the latch side. Adjust the spring adjusting plate so that the weight, when depressed and slowly released, will just rise and allow the complete return of the tongue to its spacing contact. This method of adjustment compensates for slight frictional errors in the transmitter and in the adjusting tool. The same procedure should be carried out for each of the other tongues.

24. TONGUE PRESSURE AGAINST THE MARKING CONTACTS. Unlatch the magnet armature and swing the weight arm, (leaving the weight clamped as before) over to the left-hand position. Adjust the marking spring adjusting nuts so that the weight, when depressed and slowly released, will just rise and allow the complete return of the tongue to its marking contact. It will be evident that the nearest approach to this adjustment will be within 1/4 turn of the adjusting lock nuts. The same procedure should be carried out for each tongue. It should be borne in mind that the marking springs should not be allowed to touch or rub against each other. The same applies to the bond wires which carry main line potentials from the tongues.

25. MANUAL STOP LATCH. The latch of the manual stop and start mechanism is arranged to hook

over the extension on the armature when the magnet is energized. The upper edge of the slot in the latch shall be adjusted to pass over the upturned end of the extension with a clearance of about .005 inch. This adjustment shall be made by bending the armature extension. If it is found that the feed wheel still has a tendency to turn over, the extension must be given a slight upward bend near the armature, followed by a downward bend at the end. The upturned end of the extension should never be ground off, as this may permit the pins to come up at the wrong time.

26. TAPE GUIDE. The tape guide shall be so located that the tape passes through without pressure on either edge. The width of the narrow end of Tool 161 (Drawing 48673) is such that it may be used to determine the position of the guide which can be moved forward or backward slightly, when necessary.

27. FINAL TEST. After adjusting a transmitter it should meet the following requirements:

An "RY" tape should not become perforated by being run through the transmitter eight times. The performance of the transmitter should be perfect on at least three pages of tests containing "RY" and "William Jex quickly caught five dozen Republicans 1234567890," at a speed of at least 5 words per minute faster than the operating circuit on which it is to be used. The operation of the manual start-stop mechanism should also be tested at this time. When the marking and spacing bus bars are short circuited, nothing but "LETTERS" should be indicated by the printer when a test slip is run through the transmitter. This "short circuit" test is necessary to determine whether the tongues are making contact on the spacing bus bar as well as the marking bus bar. The short circuit which may be made with the tweezers puts the same polarity on both the marking and spacing bus bars. Ordinarily, on the test table the spacing bus bar receives no current at all. As a final test the transmitter should be placed under observation on a working channel.

28. SPECIAL INSTRUCTIONS FOR ADJUSTING TRANSMITTERS PROVIDED WITH TUNGSTEN CARBIDE CONTACTS. On certain transmitters, the transmitter bus bar contacts #663 and the tongues #643 have been replaced by tungsten carbide bus bar contacts #663-B and tongues #643-B to minimize the effect of excessive sparking. For such transmitters, the same adjustment procedure as just outlined is to be followed, except as noted in the following paragraphs.

29. Before adjusting the tongue pressure against the spacing contacts, the spacing bus bar should be removed, and in order to apply Tool #9240-A, one leg of the contact tongue arm of the tool, #9243, must be filed off. The remaining leg is positioned to engage the tongue so as to move it to the left.

30. After this adjustment has been made, the spacing bus bar is to be replaced, and the .006 inch gap, obtained when adjusting the marking contacts, is to be checked.

31. Finally, remove the marking bus bar and set the leg of the modified Tool #9240-A so as to engage the other face of the transmitter tongue. After adjusting the tongue pressure against the marking contacts, replace the bus bar and again check the .006 inch gap.

32. A special fibre gauge, Multiplex Tool #10085, is to be used for adjusting the contact gap of transmitters equipped with tungsten carbide contacts. Metallic gauges should not be used.

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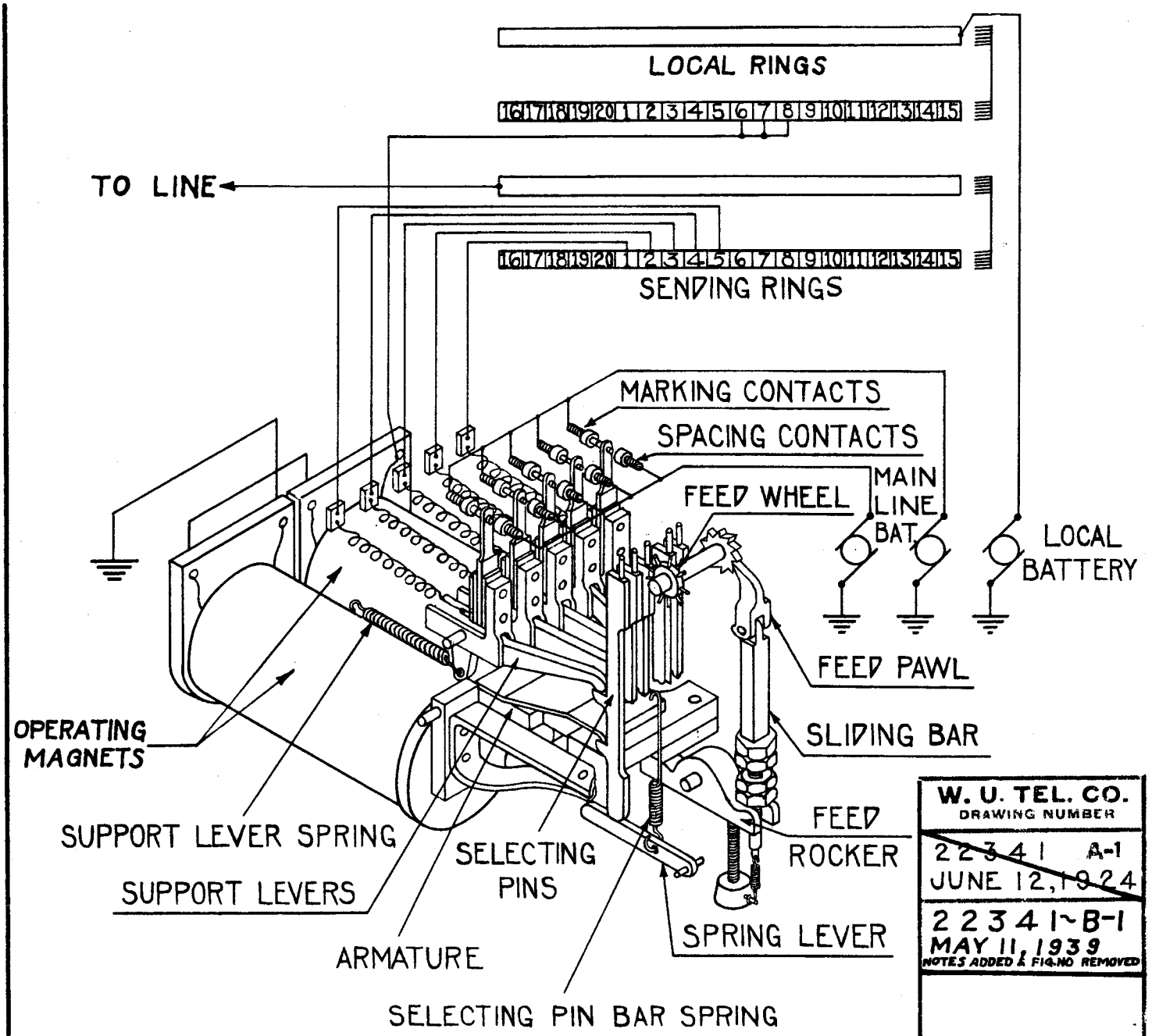
BINDING SPACE

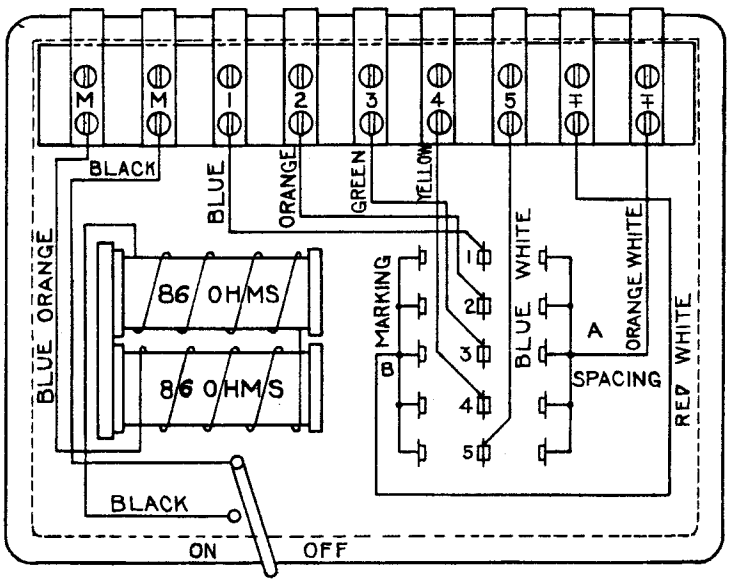


W. U. TEL. CO. DRAWING NUMBER
22341 A-1 JUNE 12, 1924
22341-B-1 MAY 11, 1939 NOTES ADDED & FIG. NO REMOVED

MULTIPLEX SYSTEM TRANSMITTER I-A

DRAWN	W. J. R.
TRACED	W. J. R.
CHECKED	
ENGR'D	
APPROVED	

BINDING SPACE



W. U. TEL. CO. DRAWING NUMBER
~~22344~~ A-1 JUNE 12, 1924
22344-B-1 MAY 11, 1939 86Ω MAGNETS WERE 80Ω
MULTIPLEX SYSTEM TRANSMITTER 1-A WIRING DIAGRAM
DRAWN W.J.R. TRACED W.J.R. CHECKED ENGR'D APPROVED