

TELEPHONE INSTRUMENT DIALS

(NOTE: THE "TEL-TOUCH" DIAL IS COVERED IN SECTION 228.)

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1 GENERAL DESCRIPTION

1.1 Each of the various types of dials consists of a rigid metal base on which are mounted the numeral ring, finger plate and number card assembly, finger stop and dust cover protected gear train and contact spring assemblies.

1.2 The dials can be supplied with either of two types of numeral ring marking; type D with numerals only and type G with letters as well as numerals - Metropolitan type dial. Standard type dials have the characters marked outside the finger plate to provide greater legibility, with a marker spot located centrally under each finger plate hole. Compact type dials have the characters marked below each finger plate hole.

1.3 The dial units are designed to provide a series, dependent upon the digit dialed, of uniform impulses at a speed of ten or twenty, dependent upon the type of dial, impulses per second. An auxiliary set of contacts is arranged to operate whenever the finger plate is moved from the rest position.

1.4 As the finger plate is rotated from the rest position, to wind up the main spring, an actuator pin is moved away from the off-normal springs so that the contacts actuate. At the same time the pulse spring locking cam is moved away from the impulse springs to prevent impulsing by allowing both springs to move as a unit against the surface of the pulsing cam. The helical spring clutch rides freely on the governor shaft during this dial wind-up and prevents the governor from causing resistance to the forward rotation of the finger plate.

1.5 When the finger plate is released the dial is driven to the normal position by the tension of the main spring. The spring clutch engages the governor to maintain a uniform speed of return and the

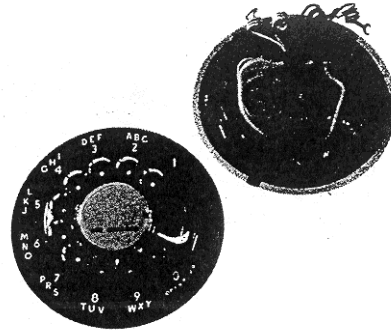


Fig. 1-1 TYPICAL DIAL

locking cam moves into engagement with the impulse springs to permit the impulse cam to cause the springs to break contact for each unit of the dialed digit. As the mechanism reaches the rest position the actuator pin causes the off-normal springs to break contact just after the impulse springs close to complete the last impulse.

1.6 The dials are designed for mounting in a U-shaped bracket to which they are clamped by means of two screws fitted laterally behind the numeral ring. The number card can easily be changed after removal of the lucite finger plate - disassembly of the unit is not necessary.

2 ASSOCIATED PUBLICATIONS

2.1 Specific details of each type of dial are given in individual sub-sections in this section of the manual, each indexed by the type number of the dial to which it applies. The information given in this sub-section is of a general nature and applies to all the telephone dials.

2.2 The types of dial used with each type of telephone are noted in the sub-section in which the instrument is described.

2.3 The full code number for each type of dial is given in the title of the individual descriptive sub-section. The color code (sub-section 111.) must be inserted in place of the two dashes, where applicable, and the type of numeral ring code (see individual dial sub-section) must be inserted in place of the single dash inside the brackets in order to complete the code number for each type of assembly.

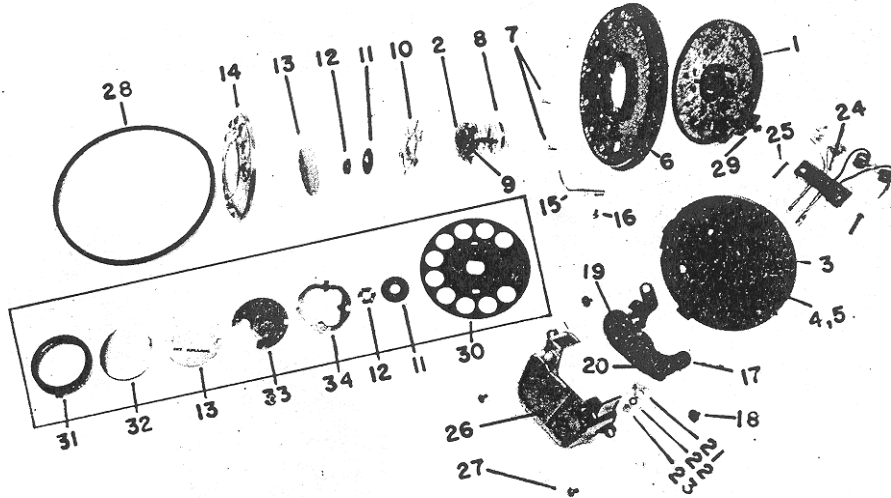


Fig. 3-1 COMPONENT PARTS - EXPLODED VIEW (19-TYPE DIAL)

Rotate finger plate fully clockwise. Insert opened paper clip into tab release hole to depress tab by 1/8". Rotate finger plate slightly more clockwise and lift from spider spring.

Place finger plate squarely over spider spring with "0" finger hole directly over "9" character marking on numeral ring. Turn finger plate in an anti-clockwise direction until tab latches in notch.

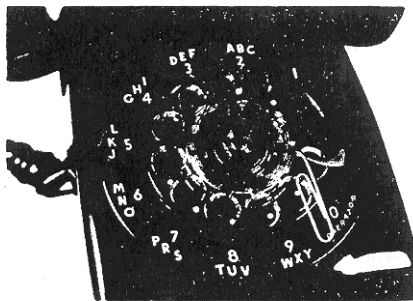


Fig. 3-2 REMOVING LUCITE FINGER PLATE

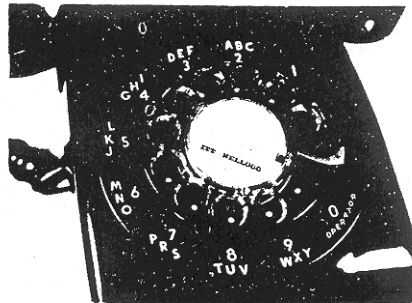


Fig. 3-3 REPLACING LUCITE FINGER PLATE

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3 DISASSEMBLY AND ASSEMBLY (19-TYPE DIAL)

3.1 Dials should be disassembled and assembled only when necessary for maintenance purposes. The procedures given in the following paragraphs, which apply specifically to the types 19 and 28 units, should be followed. The exploded view of Fig. 3-1 shows the component parts of the type 19 dial.

3.2 DISASSEMBLY

- a: Remove the screws (27) and dust cover (26).
- b: Remove the screws (25) and spring assembly (24).
- c: Loosen but do not remove the nut (5) holding the main gear assembly (3).
- d: Remove the screws (18) and gear train assembly (17).
- e: Remove the finger plate (14), see Fig. 3-2.
- f: Remove the special hex. nut (12), the spring washer (11) and the spider spring (10).
- g: Pull the cam casting (9) forward and unwind the main spring (8), then lift out the cam casting and main spring.
- h: Remove the nut (5), the washer (4), the main gear assembly (3) and the main shaft (2).
- i: Remove the screw (16) and the finger stop (15).
- j: Remove the screws (7) and the numeral ring (6).
- k: Remove the gasket (28) from the finger plate.

NOTE: Disassembly of the spring washer (20), cam (21), washer (22) and impulse cam (23) of the types 19 and 28 dials should be avoided where possible. If these parts must be disassembled refer to paragraph 3.3f, below.

3.3 ASSEMBLY

- a: Locate the numeral ring (6) on the base (1) and fix with the screws (7).
- b: Insert the finger stop (15) through the slot in the finger plate and fix with screw (16).
- c: Insert the main shaft (2) from the front of the base then mount the main gear (3) using the washer (4) and nut (5). DO NOT TIGHTEN THE NUT AT THIS STAGE.

d: Insert the formed tip of the main spring (8) into the hole in the cam casting (9) and fit the first coil of the spring over the lugs on the casting. The second coil of the spring must lie inside the lips of the two lugs.

e: With the shunt spring actuator pin on the main gear (5) held midway between the figures 8 and 9 on the numeral ring place the spring and cam casting over the main shaft from the front of the base. Locate the angled tip of the spring in its slot then rotate the cam casting two full turns clockwise, to tension the main spring, and press the cam casting over the flattened portion of the main shaft. Now fit the spider spring (10), with the small tab pointing midway between positions 9 and 0 on the numeral ring and the flanges of the center hole towards the cam casting. Add the spring washer (11) and nut (12) then tighten.

f: Replace the gear train assembly (17), turning the gears so that the impulse cam (23) takes up the position shown in the descriptive sub-section for the particular dial, then tighten with screws (18).

g: Tighten the nut (5), which was previously left loose, to hold the main gear securely.

h: Place the spring assembly (24) in position, locating the ends of the springs correctly against the actuating cams (see individual descriptive sub-section), and secure with screws (25).

i: Fit the number card (13), if required, in the finger plate (14), matching the notch in the card with the tab inside the recess of the finger plate, then replace the finger plate, see Fig. 3-3.

j: Lubricate the dial, if necessary, section 4.

k: Adjust the dial as detailed in section 5.

l: Mount the dust cover (26) with screws (27).

m: Replace the gasket (28) over the rim of the numeral ring.

4 LUBRICATION

4.1 It is essential that the dial mechanism is lubricated correctly so that smooth, trouble-free performance will be obtained.

4.2 Clean all existing lubricant and collected dirt from the mechanism with a good quality, non-filming commercial solvent, using a small brush with firm bristles. Disassemble the mechanism as necessary for this operation. IT IS VERY IMPORTANT THAT THE INTERNAL PARTS OF THE GOVERNOR MECHANISM ARE FREE FROM LUBRICANT AND DIRT.

4.3 A fine camel hair brush is recommended for applying lubricant. Use a high quality lubricant such as ITTK Dial Lubricant 79946. Apply sparingly to both bearings of each gear shaft, the main shaft and the clutch spring. Apply a very light film to the teeth of each gear. Operate the dial several times to spread the lubricant then check the gear train adjustment and speed, see section 5. AVOID EXCESSIVE LUBRICATION AS IT TENDS TO COLLECT DIRT AND CAN CREEP INTO THE GOVERNOR DRUM.

5 TEST AND ADJUSTMENT

5.1 First check the individual sub-section, in which the specific dial is described, for details of any special tests or adjustments. Then proceed as outlined below.

5.2 Tests and readjustments of dials should be carried out in the order given in the following paragraphs. It will be necessary to remove the dust cover to obtain access to the moving parts of the assembly.

5.3 PRELIMINARY CHECKS

Check for end play in the main shaft, maximum .010", and all gear train shafts, maximum .015". Excessive end play in the main shaft may be caused by a loose end nut and in the gear train shafts may be caused by loose assembly screws. Check all gears for worn teeth. Badly worn parts must be replaced before adjusting the dial.

5.4 GEAR TRAIN

Slowly rotate the finger plate in both the wind and unwind directions and check for binding and gear train noise. If readjustment is required slightly loosen the two gear train mounting screws and slide the assembly to adjust the mesh of the drive pinion with the main gear. The mounting holes in the gear train baseplate are made oversize to permit this adjustment which must be made to obtain minimum gear train noise without binding. Tighten the mounting screws securely and recheck.

5.5 DIAL SPEED

Check the speed of the dial on a reliable pulse speed tester. If the speed falls outside the range given under the TEST heading in the individual descriptive sub-section, readjust it to be within the range given under the heading of READJUST. The speed is controlled by the end-to-end tension of the governor spring; reducing the inward tension of the spring causes the speed to be reduced and increasing the inward tension causes the speed to be increased. Adjust the spring tension by curving or flattening the spring at the center of the loop, using a pair of tweezers with flat jaws. Be sure that the loop of the spring is kept approximately parallel with the governor housing and has a clearance of about 1/64" from all other parts of the governor mechanism, except for the tips of the spring connecting to the weights.

5.6 CONTACT SPRINGS

Each of the springs must be approximately straight and the bar contacts of mating springs must make approximately on center. Bend the springs at the base to obtain the specified tension and position adjustments. Refer to the individual descriptive sub-section for the specific values of spring tension and contact clearance.

5.6.1 Shunt Springs

With the dial at normal each make spring must be straight, have the correct minimum contact separation from its mating lever spring and be approximately perpendicular to the mounting block. With the dial rotated from the normal position each lever spring must provide the required contact pressure against its make spring. With the dial at normal each break spring must provide the correct contact pressure against its mating lever spring. With the dial rotated from the normal position each break spring must have the correct minimum contact separation from its mating lever spring.

5.6.2 Pulsing Springs

During the return motion of the dial the pulsing contacts must have the correct minimum contact separation on each pulse. With the contacts fully parted the lever spring must bear against the pulsing cam with the correct pressure, measured at the tip of the spring. Rotate the dial FROM the normal position until the lever spring rests against the low part of the cam. In this condition the break spring must provide the correct contact pressure against the lever spring, measured at the tip of the break spring. Note that there must be a slight clearance between the tip of the break spring and the trigger locking cam with the dial at normal.

5.7 PULSE RATIO

Check the break period of the dial pulses on a reliable pulse ratio tester. If the pulse ratio is outside the range given under the TEST heading in the individual descriptive sub-section, readjust it to be within the range given under the heading of READJUST. The adjustment is effected by slight bending of the tab of the pulsing lever spring at a point just behind the pulsing cam. Bending the tab away from the cam increases the break time and bending it towards the cam reduces the break time. Refer also to the last sentence of paragraph 5.6.2.

TYPE 24(-)450 DIAL

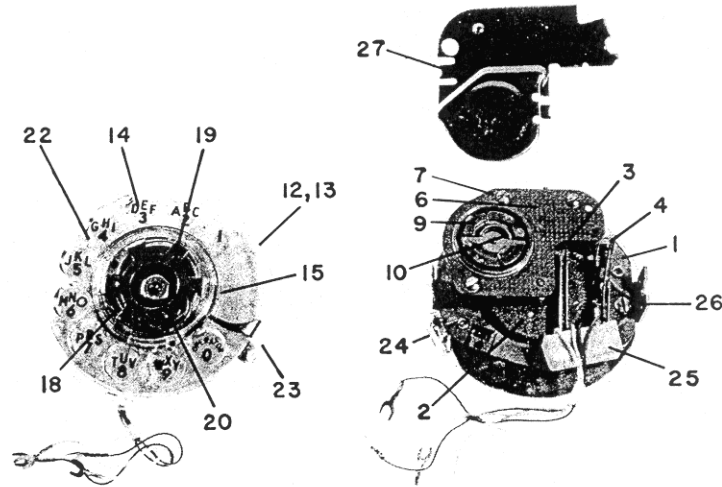
The type 24 dial is the standard pulsing device used on all 700 series compact desk telephone instruments. It is designed for service on any type of automatic switching system requiring dial impulses at a speed of 10 impulses per second nominal, and a pulse ratio with a break of 61.5 percent of the pulse duration.

A single, normally closed pen, off-normal contact is fitted to the normally closed pulsing mechanism. Each contact spring is provided with a connection lead. A small lamp may be set behind the 3" diameter translucent number plate to provide diffused dial illumination or night light service. A lucite finger plate is provided.

(Manufacture Discontinued-Superseded by Type 33)

Table 1 REPLACEABLE PARTS

Item	Description	Number	Qty	Item	Description	Number	Qty
1	Gear Train and Bracket Assembly c/w items 2 thru 10	190218	1	15	Retainer Ring	190214	1
2	Main Gear Assembly	190205-1	1	16	Bushing	190255	1
3	Intermediate Gear Assembly	190222	1	17	Spring and Spider Assembly comprising items 18 and 19	190235	1
4	Cam Assembly	190241	1	18	Spring (Main)	190258	1
5	Clutch Assembly	190234	1	19	Spider (Spring) Assembly	190238	1
6	Governor Drum and Plate Assy.	190243	1	20	Hex. Nut	77007-2	1
7	Fil. Hd. Mach. Screw	68293	3	21	Number Card	75415	1
8	Washer	75478	1	22	Finger Plate	79284	1
9	Weight and Drive Bar Assembly	190257	1	23	Finger Stop	190209	1
10	Spring	75461	1	24	Special Screw	190262-2	1
11	Positioning Ring	86387	1	25	Spring Assembly	190255	1
12	Ring	190213	1	26	Bind. Hd. Mach. Screw	75576-2	1
13	Reflector Ring	190203	1	27	Cover	190201	1
14a	Numeral Ring (Type C)	190204	1	28	Gasket	190261	1
b	Numeral Ring (Type D)	190367	1	29	Bind. Hd. Mach. Screw	75392-2	2



a) Front View

b) Rear View

Fig. 1 IDENTIFICATION OF DIAL PARTS

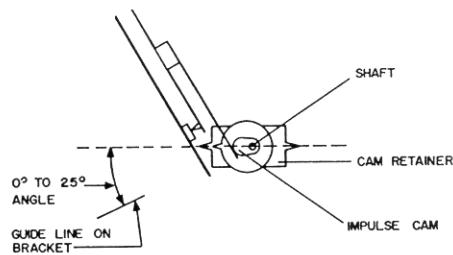


Fig. 2 POSITION OF PULSING CAM

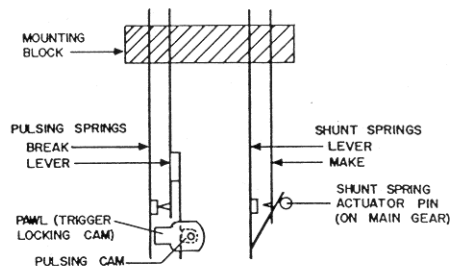


Fig. 3 CONTACT ARRANGEMENT

SPECIFIC TEST AND ADJUSTMENT DATA

Refer to sub-section M2A-DLS/GEN for complete test and adjustment data.

Impulse Cam

The correct rotary position of the impulse cam is shown in Fig. 2. The cam is positioned by loosening the three gear train mounting screws, so that the cam shaft may be rotated without the rest of the gears, then aligning the arrow end of the cam retainer as indicated. The gears are then remeshed and the mounting screws tightened.

Spring Assembly Position

The correct position of the spring assembly with respect to the pulsing cam, pawl and shunt spring actuator pin is shown in Fig. 3.

Pawl

The force required to rotate the pawl, applied to the tip of the pawl and radial to the cam shaft, must not be less than 1/2 gram. With a force of 5 grams, applied at the same point, the pawl must not rotate during dial rundown. Any pawl not meeting these requirements must be replaced.

Dial Speed

Test; 9.0 to 11.0 pulses/second.
 Readjust; 9.5 to 10.5 pulses/second.

Spring Pressures

Shunt lever spring to make spring; 20 grams min.
 Pulsing lever spring against cam; 12±7 grams.
 Pulsing break spring to lever spring, with pawl away and cam in low position; 30±7 grams.

Spring Clearances

Between the contacts of the open shunt springs; .015" min.
 Between the contacts of the open pulsing springs; .010" min.
 Note that there must be a slight clearance between the tip of the pulsing break spring and the tip of the pawl with the dial at normal.

Pulse Ratio

	Percent Make.	Percent Break.
Test;	38.5±4	61.5±4
Readjust;	38.5±2	61.5±2

SPECIFIC DISASSEMBLY AND ASSEMBLY DATA

The disassembly and assembly procedures given in sub-section M2A-DLS/GEN apply only generally to the type 24 dial. The major differences for this dial are outlined below.

- The dust cover is clipped to the dial frame.
- The gear train is not a separate sub-assembly but is built up on the dial base and held by the rear plate and three screws.
- The spider spring is shaped so that a separate cam casting is not necessary. The main spring is hooked over the three tabs on the rim of the spider spring then the spider spring is rotated, to tension the main spring, and pressed over the flattened end of the main shaft. See Fig. 4; also paragraphs 3.3d and e of sub-section M2A-DLS/GEN.
- A positioning ring is fitted in the center of the reflector ring in order to locate the numeral ring correctly. The location of the positioning ring is indicated in Fig. 4.

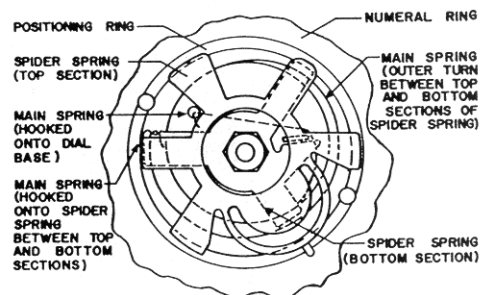


Fig. 4 MAIN SPRING, SPIDER SPRING AND POSITIONING RING LOCATION

TYPE 19--(-)450 DIAL

The type 19 dial is the standard pulsing device used on the 500 and 554 series telephone instruments. It is designed for service on any type of automatic switching system requiring dial impulses at a speed of 10 impulses per second, nominal, and a ratio with a break period of 60 to 70 or the pulse duration. A single, no (Manufacture Discontinued-Superseded by Type 30)

normal contact provided in addition to the normal contact pulsing contacts. Each contact is provided with a flexible connection lead. The 4.1/4" diameter numeral ring is available in colors to match the various telephone housings. A lucite finger plate is provided. Tropicalization treatment can be applied, if specified.

Table 1 REPLACEABLE PARTS

Item	Description	Number	Qty	Item	Description	Number	Qty
1	Base Assembly	75485	1	18	Bind. Hd. Mach. Screw	75576-2	2
2	Main Shaft	75460	1	19	Governor Spring	75461	1
3	Main Gear Assembly	75475	1	20	Spring Washer	75454	1
4	Washer	60629	1	21	Cam (Trigger Locking)	75452	1
5	Hex. Nut	63986	1	22	Washer	75453	1
6	Numeral Ring	75482-Ø	1	23	Impulse Cam	75451	1
7	Special Screw	75468	2	24	Spring Assembly	75437	1
8	Main Spring	75466	1	25	Rd. Hd. Mach. Screw	75436-2	2
9	Cam Casting	75449	1	26	Dust Cover	75438	1
10	Spider Spring	79285	1	27	Bind. Hd. Mach. Screw	75576-2	2
11	Spring Washer	75467	1	28	Gasket	75474-2	1
12	Special Hex. Nut	75469	1	29	Bind. Hd. Mach. Screw	75487-2	2
13	Number Card	75415	1	30	Finger Plate (Metal)	75465	*1
14	Finger Plate	79284	1	31	Retaining Ring	75412	*1
15	Finger Stop	75480-2	1	32	Protector	75413	*1
16	Special Screw	75481	1	33	Retaining Disc	75416	*1
17	Gear Train Assembly	75479	1	34	Retaining Spring	75417	*1
				35	Finger Stop	75480	*1

Ø Replace by color code suffix, from series 1-16 for type G or from series 21-36 for type D numeral ring, to complete part number.

* These parts used in place of items 10, 14 and 15 when the black metal finger plate is fitted. To convert to plastic finger plate, order 11000()79 kit.

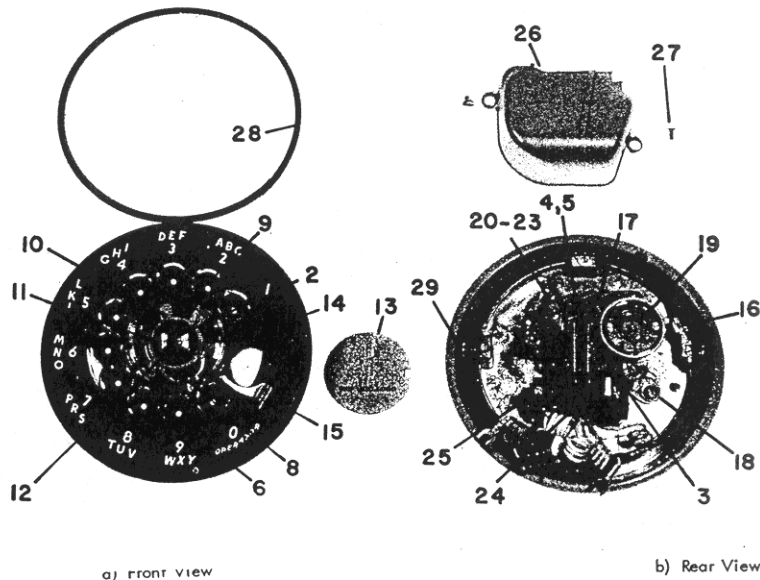


Fig. 1 IDENTIFICATION OF DIAL PARTS

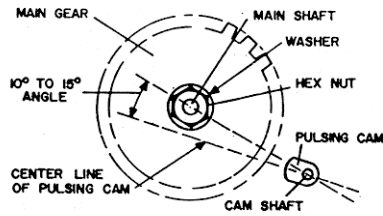


Fig. 2 POSITION OF PULSING CAM

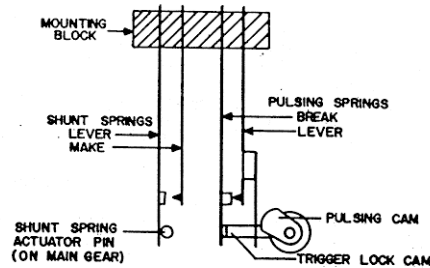


Fig. 3 CONTACT ARRANGEMENT

SPECIFIC TEST AND ADJUSTMENT DATA

Refer to sub-section M2A-DLS/GEN for complete test and adjustment procedure.

Impulse Cam

The impulse cam is push fitted to the splined cam shaft. The correct rotary position is shown in Fig. 2. The cam may be positioned either by removing it from the shaft and replacing it in the correct position or by loosening the gear train mounting screws so that the gears may be turned, to obtain correct alignment of the cam, and then remeshed with the main gear. The latter method is recommended except when the cam has been removed for other purposes.

Spring Assembly Position

The correct position of the spring assembly with respect to the pulsing cam, trigger locking cam and shunt spring actuator pin is shown in Fig. 3.

Dial Speed

Test: 9.0 to 11.0 pulses/second.
Readjust: 9.5 to 10.5 pulses/second.

Spring Pressures

Shunt lever spring to make spring; 20 grams min.
Pulsing lever spring against cam; 12 ± 7 grams.
Pulsing break spring to lever spring, with trigger locking cam away and cam in low posn. 30 ± 7 grams.

Spring Clearances

Between the contacts of the open shunt springs; .015" min.
Between the contacts of the open pulsing springs; .010" min.

Note that there must be a slight clearance between the tip of the pulsing break spring and the tip of the trigger locking cam with the dial at normal.

Between the edge of the cam riding tip of the pulsing lever spring and the top surface of the trigger locking cam there must be a minimum clearance of .006" during rotation of the dial.

Pulse Ratio

	Percent Make.	Percent Break.
Test:	38.5 ± 4	61.5 ± 4
Readjust:	38.5 ± 2	61.5 ± 2

ALTERNATIVE FINGER PLATE ASSEMBLIES

Two earlier types of finger plates, differing from the standard lucite type, have been produced. These are described below.

Metal Finger Plate

This type is only available in black for fitting to black telephones. The component parts are shown in the exploded view on the type 19 dial in sub-section M2A-DLS/GEN and are listed in the parts list of this sub-section.

The retaining ring (31) is removed by prying up at the top edge with a knife or small screwdriver. The retaining disc (33), number card (13) and protector (32) may be removed from the retaining ring after taking out the retaining spring (34) by squeezing the two inner tabs together. The finger plate (30) is removed after taking off nut (12) and spring washer (11). Reassembly is a reversal of the above processes; the tab at the bottom of the retaining ring being

placed in the lower slot of the finger plate and the tab at the top snapped into the upper slot. NOTE: A different shape of finger stop (35) is used with the metal finger plate. It differs from that used with the lucite finger plate only in the angle between the top and side arms. It may be adapted for use with the lucite finger plate by slightly bending up the top arm until it is parallel with the top of the lucite finger plate.

Lucite Finger Plate

This differs from the current type of lucite finger plate only by the fact that a separate protector (32) was used in front of the number card and a retaining spring (not listed) was fitted behind the number card. The spring is removed or replaced by turning it slightly to move its tabs in the guide slots in the finger plate recess.

TYPE 28--(-)450 DIAL

The type 28 dial is a special pulsing device for use on speakerphone types of telephone instruments. It is designed for service on any type of automatic switching system requiring dial impulses at a speed of 10 impulses per second, nominal, and a pulse ratio with a break period of 60 to 70 percent of the pulse duration. Two, normally open, off-normal contacts are provided in addition to the normally closed pulsing contacts. Each contact

spring is provided by Type 35. The 4.1/4" numeral ring is available in colors in the various telephone housings. A 1" finger plate is provided. Tropicalization treatment can be applied, if specified.

The type 28 dial is identical in most respects to the type 19 dial and many of the parts of the two assemblies are interchangeable.

Fig. 1 IDENTIFICATION OF DIAL PARTS

Item	Description	Number	Qty	Item	Description	Number	Qty
1	Base Assembly	75485	1	18	Bind. Hd. Mach. Screw	75576-2	2
2	Main Shaft	75460	1	19	Governor Spring	75461	1
3	Main Gear Assembly	75475-2	1	20	Spring Washer	75454	1
4	Washer	84768-2	1	21	Cam (Trigger Locking)	75452	1
5	Hex. Nut	84767-2	1	22	Washer	75453	1
6	Numeral Ring	75482-Ø	1	23	Impulse Cam	75451	1
7	Special Screw	75468	2	24	Spring Assembly	84766-1	1
8	Main Spring	75466	1	25	Rd. Hd. Mach. Screw	69378	2
9	Cam Casting	75449	1	26	Dust Cover	75438	1
10	Spider Spring	79285	1	27	Bind. Hd. Mach. Screw	75576-2	2
11	Spring Washer	75467	1	28	Gasket	75474-2	1
12	Special Hex. Nut	75469	1	29	Bind. Hd. Mach. Screw	75487-2	2
13	Number Card	75415	1				
14	Finger Plate	79284	1				
15	Finger Stop	75480-2	1				
16	Special Screw	75481	1				
17	Gear Train Assembly	75479	1				

Ø Replace by color code suffix, from series 1-16 for type G or from series 21-36 for type D numeral ring, to complete part number.

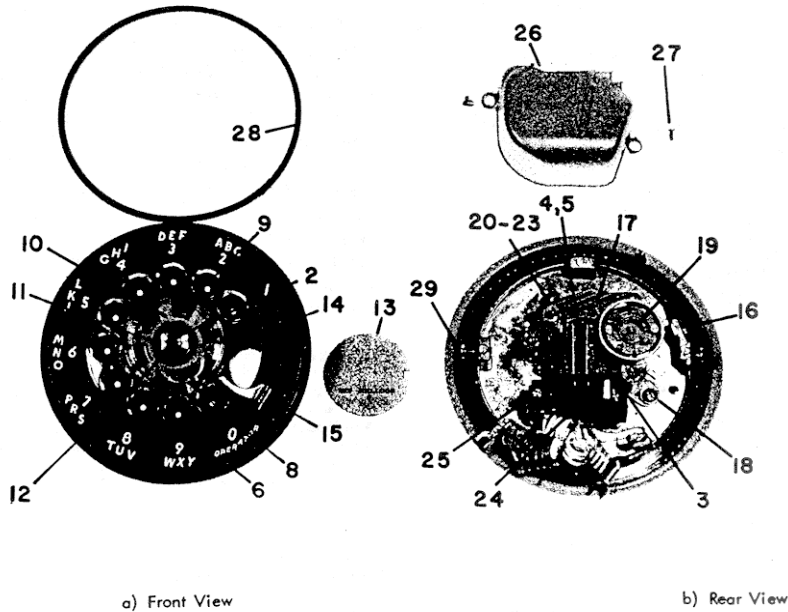


Table 1 REPLACEABLE PARTS

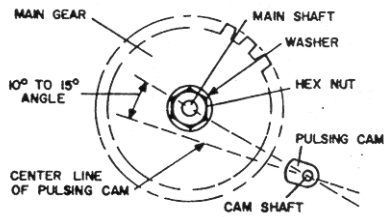


Fig. 2 POSITION OF PULSING CAM

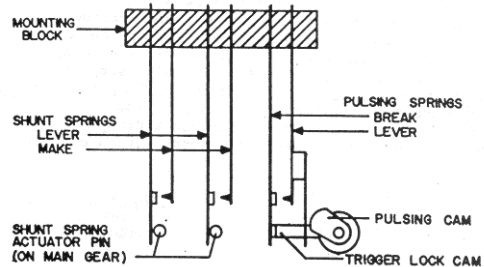


Fig. 3 CONTACT ARRANGEMENT

SPECIFIC TEST AND ADJUSTMENT DATA

Refer to sub-section M2A-DLS/GEN for complete test and adjustment procedure.

Impulse Cam

The impulse cam is press fitted to the splined cam shaft. The correct rotary position is shown in Fig. 2. The cam may be positioned either by removing it from the shaft and replacing it in the correct position or by loosening the gear train mounting screws so that the gears may be turned, to obtain correct alignment of the cam, and then remeshed with the main gear. The latter method is recommended except when the cam has been removed for other purposes.

Spring Assembly Position

The correct position of the spring assembly with respect to the pulsing cam, trigger locking cam and shunt spring actuator pin is shown in Fig. 3.

Dial Speed

Test; 9.0 to 11.0 pulses/second.
 Readjust; 9.5 to 10.5 pulses/second.

Spring Pressures

Each shunt lever spring to its mating make spring; 20 grams min.
 Pulsing lever spring against cam; 12±7 grams.
 Pulsing break spring to lever spring, with trigger locking cam away and cam in low posn. 30±7 grams.

Spring Clearances

Between the contacts of the open shunt springs; .015" min.
 Between the contacts of the open pulsing springs; .010" min.

Note that there must be a slight clearance between the tip of the pulsing break spring and the tip of the trigger locking cam with the dial at normal.

Between the edge of the cam riding tip of the pulsing lever spring and the top surface of the trigger locking cam there must be a minimum clearance of .006" during rotation of the dial.

Pulse Ratio

	Percent Make.	Percent Break.
Test;	38.5±4	61.5±4
Readjust;	38.5±2	61.5±2

ROTARY DIALS, NUMBER 30 SERIES
(Numbers 30, 33, 35 and 38)

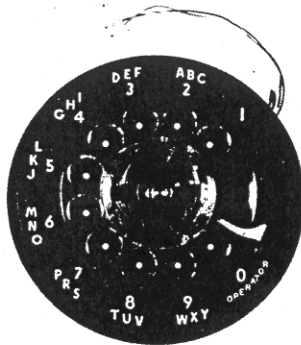


Figure 1A. Rotary Dial, Numbers 30 and 35

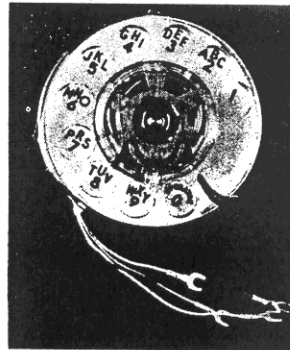


Figure 1B. Rotary Dial, Numbers 33 and 38

1. SCOPE

Section 227 covers general information, ordering information, replaceable parts lists, description, repair, lubrication and adjustment of the 30 series of rotary dials.

2. GENERAL

The 30-series of rotary dials includes four basic models of similar construction and characteristics, numbers 30, 33, 35 and 38. Each model is available with a regular type numeral ring, (numerals only), coded "D" or a metropolitan type numeral ring, (letters and numerals), coded "G". Dials with expanded numeral rings, (30 and 35), are available in eleven colors, (see table I). The 33 and 38 dials have a reflector ring under the numeral ring. Each dial consists of a rigid metal bracket on which are mounted the gear train, contact spring assembly, numeral ring, mainspring and spider assembly, finger plate and miscellaneous parts. The gear train is protected by a plastic dust cover which snaps into place.

3. OPERATION

The mechanism is actuated by the clear plastic finger plate which, when wound up and released, causes a pair of pulsing contacts to interrupt the telephone line current once for each unit of the dialed digit, (i.e., once for 1, twice for 2, etc.). Telephone switching equipment is operated in accordance with the number of impulses received. The dials are adjusted to 10 impulses per second, nominal and a pulse ratio with a break period of 61.5% of the pulse duration.

4. IDENTIFICATION

An identifying code is stamped in ink on the back of the mounting bracket. See tables I and II for explanation of each code.

5. DESCRIPTION

5.1 Number 30

The number 30 rotary dial is designed for use with K-500 and similar type telephones. It has one set of off-normal contacts which close to short circuit the telephone receiver during dial windup and release. It replaces the type 19 dial.

5.2 Number 33

The number 33 dial is designed for use with K-700 series and similar type telephones having a 3-inch diameter opening in the telephone housing. It has one set of off-normal contacts which close to short circuit the telephone receiver during dial windup and release. Replaces type 24 dial.

5.3 Number 35

Same as number 30 dial, but has an additional set of off-normal contacts which close to short circuit the loudspeaker associated with hands-free telephones during dial windup and release. Replaces number 28 dial.

5.4 Number 38

Same as number 33 dial, but has an additional set of off-normal contacts which close to short circuit the loudspeaker associated with hands-free telephones during dial windup and release. Replaces number 24 (R).

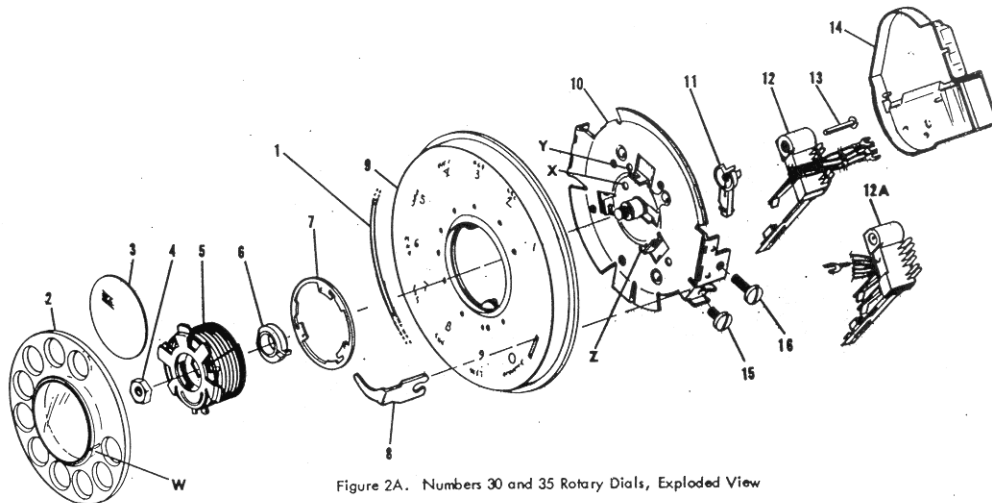


Figure 2A. Numbers 30 and 35 Rotary Dials, Exploded View

FIGURE INDEX NO.	NO.	PART NUMBER	NAME, Description part under which they are indented)	QUANTITY USED ON:			
				30D	30G	35D	35G
TABLE I. ORDERING INFORMATION AND REPLACEABLE PARTS LIST, No. 30 and 35 DIALS							
		30**(D)450	DIAL ASSEMBLY, Regular Style, (Numerals Only)	X	-	-	-
		30**(G)450	DIAL ASSEMBLY, Metro Style, (Letters and Numerals)	-	X	-	-
		35**(D)450	DIAL ASSEMBLY, Regular Style, (Numerals Only)-(Hands Free Use)	-	-	X	-
		35**(G)450	DIAL ASSEMBLY, Metro Style, (Letters and Numerals)-(Hands Free Use)	-	-	-	X
2A	1	75474-1	. GASKET, Dial; for black phones	X	X	X	X
	1	75474-2	. GASKET, Dial; for colored phones	X	X	X	X
	2	79284-1	. FINGERPLATE	1	1	1	1
	3	75415-1	. CARD, Number	1	1	1	1
	4	64433	. NUT, Hex	1	1	1	1
	5	88438-1	. SPRING AND SPIDER ASSEMBLY	1	1	1	1
		88439-1	. . SPIDER	1	1	1	1
		190258-1	. . SPRING, Main	1	1	1	1
	6	88416-1	. BUSHING	1	1	1	1
	7	88418-1	. RING, Retaining	1	1	1	1
	8	88417-1	. FINGER STOP	1	1	1	1
	9	88403- ##	. RING, Numeral, Regular Style, (Numerals only)	1	-	1	-
	9	88403- **	. RING, Numeral, Metro Style, (Letters and Numerals)	-	1	-	1
	10	88421-1	. GEAR TRAIN AND BRACKET ASSEMBLY	1	1	1	1
	11	88400-1	. ACTUATOR	1	1	1	1
	12	88419-1	. CONTACT SPRING ASSEMBLY	1	1	-	-
12A	88419-2	. CONTACT SPRING ASSEMBLY	-	-	1	1	
13	75576-8	. SCREW	1	1	1	1	
14	88402-1	. COVER, Dust	1	1	1	1	
15	190262-2	. SCREW, Finger Stop	1	1	1	1	
16	75487-2	. SCREW, Mounting	2	2	2	2	
	** ##	COLOR CODES					
		CODE	COLOR	CODE	COLOR		
		** ##		** ##			
		00 21	BLACK	12 32	AQUA BLUE		
		02 22	RED	13 33	LIGHT BEIGE		
		04 24	YELLOW	14 34	LIGHT GRAY		
		05 25	GREEN	15 35	WHITE		
		09 29	IVORY	16 36	SEA GREEN		
		11 31	ROSE PINK				

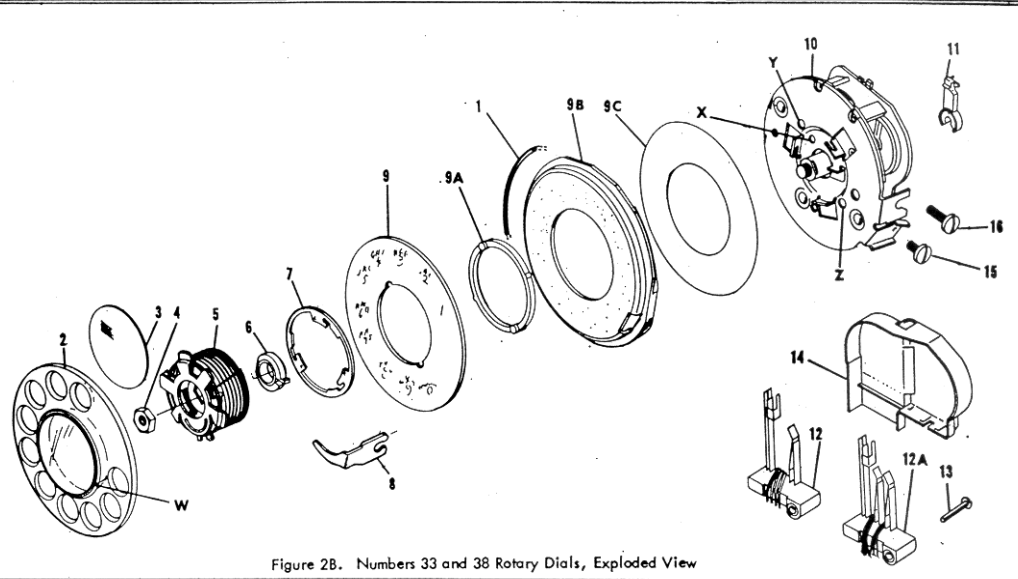


Figure 2B. Numbers 33 and 38 Rotary Dials, Exploded View

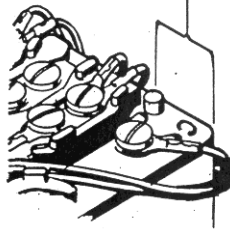
FIGURE INDEX NO.	NO.	PART NUMBER	NAME, Description (Indented items are included in the part under which they are indented)	QUANTITY USED ON:			
TABLE II. ORDERING INFORMATION AND REPLACEABLE PARTS LIST, NUMBER 33 AND 38 DIALS				33(D) 450	33(G) 450	38(D) 450	38(G) 450
		33(D)450	DIAL ASSEMBLY, Regular Style, (Numerals Only)	X	-	-	-
		33(G)450	DIAL ASSEMBLY, Metro Style, (Letters and Numerals)	-	X	-	-
		38(D)450	DIAL ASSEMBLY, Regular Style, Hands Free	-	-	X	-
		38(G)450	DIAL ASSEMBLY, Metro Style, Hands Free	-	-	-	X
2B	1	190261-1	. GASKET, Dial	1	1	1	1
	2	79284-1	. FINGERPLATE	1	1	1	1
	3	75415-1	. CARD, Number	1	1	1	1
	4	64433	. NUT, Hex	1	1	1	1
	5	190235-1	. SPRING AND SPIDER ASSEMBLY	1	1	1	1
		190238-1	. SPIDER	1	1	1	1
		190258-1	. SPRING, Main	1	1	1	1
	6	88416-1	. BUSHING	1	1	1	1
	7	88418-1	. RING, Retaining	1	1	1	1
	8	190209-1	. FINGER STOP	1	1	1	1
	9	190367-1	. RING, Numeral, Regular Style (Numerals only)	1	-	1	-
	9	190204-1	. RING, Numeral, Metro Style (Letters and Numerals)	-	1	-	1
	9A	86387-1	. RING, Positioning	1	1	1	1
	9B	190203-1	. RING, Reflector	1	1	1	1
9C	190213-1	. RING, White Plastic	1	1	1	1	
10	88881-1	. GEAR TRAIN AND BRACKET ASSEMBLY	1	1	1	1	
11	88400-1	. ACTUATOR	1	1	1	1	
12	88419-1	. CONTACT SPRING ASSEMBLY	1	1	-	-	
12A	88419-2	. CONTACT SPRING ASSEMBLY, Hands Free	-	-	1	1	
13	75576-8	. SCREW	1	1	1	1	
14	88402-1	. COVER, Dust	1	1	1	1	
15	190262-2	. SCREW, Finger Stop	1	1	1	1	
16	75392-2	. SCREW, Dial Mounting	2	2	2	2	

6. INSTALLATION AND REMOVAL OF DIAL

- (a) Refer to section of manual in chapter three which covers the specific telephone and remove the telephone housing.
- (b) Loosen the two dial mounting screws and remove old dial from the mounting brackets.
- (c) Disconnect leads of old dial one at a time and connect leads of new dial (same color)
(Or remove old dial entirely and refer to appropriate circuit schematic to connect new dial.)
- (d) Place dial in mounting brackets and tighten the mounting screws. Be sure the punched bosses seat in the mating holes at each mounting bracket.
- (e) Install the telephone housing.

CAUTION

No wires across edge of network terminal board in this area.



When replacing a number 19 dial with a number 30 dial in a 500 type wall phone, be sure to dress wiring at "C" terminal of the network as shown at left.
Any wiring crossing the terminal board in this area might be grounded by the rear plate of the number 30 dial.

Figure 3. Recommended method of dressing wiring at "C" terminal of network on 500 type wall phones.

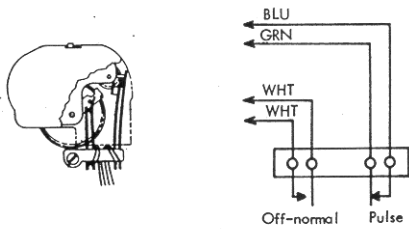


Figure 4A. Contact and lead arrangement, Type 30 and 33 dials

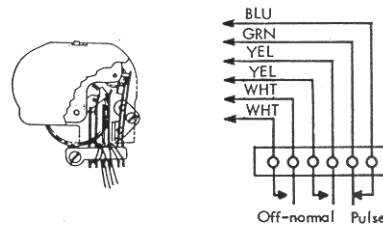


Figure 4B. Contact and lead arrangement, Type 35 and 38 dials

7. CLEANING AND LUBRICATION"

- (a) **CLEANING**
Use a dry brush or compressed air and remove dust. Be sure compressed air is not contaminated with oil. Solvents are not recommended as they may damage the nylatron bearings.
 - (b) **LUBRICATION**
Any time the dial is cleaned or adjusted, apply a light film of lubricant to the teeth of the main gear. Use a small brush and ITT K 79946-2 Dial Lubricant or equivalent. Operate the dial a few times to distribute the lubricant, then wipe off excess with a clean lint-free cloth.
- Lubricate Nylatron bearings with ITT K 79946-3 Dial Lubricant, W.E. KS 19589-L1 or equivalent.

CAUTION

Do not allow lubricant to enter the governor drum, as dial speed will be affected.

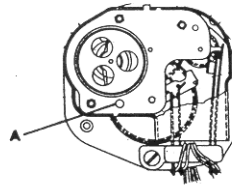


Figure 5. Alignment of parts for assembly.

(Align hole in main gear with hole "A" in the rear plate of dial.)

8. DISASSEMBLY

8.1 FINGER PLATE

(a) REMOVAL (FIGURE 2)

- (1) Rotate finger plate clockwise as far as it will go. Hold there gently.
- (2) Insert the straightened end of a paper clip or similar tool in the hole "W" which is now about 1/4 inch to the left of the tip of the finger stop (8).
- (3) Press down on the paper clip to spring the tab of the spider, (5, figure 2), and rotate the finger plate clockwise to release. Work finger plate off of spider and from under the finger stop.

(b) INSTALLATION

- (1) Be sure number card is in place and position the finger plate gently under the finger stop and over the spider.
- (2) Position the finger plate so that the "O" or "OPERATOR" finger hole is at position "9". Let the finger plate drop into position over the spider and rotate finger plate counter-clockwise until it clicks into place.

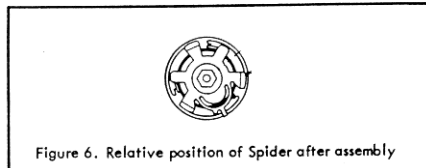


Figure 6. Relative position of Spider after assembly

8.2 SPRING AND SPIDER ASSEMBLY (5) AND BUSHING (6).

(a) REMOVAL

- (1) Remove finger plate as directed in previous step.
- (2) While holding the spider firmly, use a suitable tool and remove the hex nut, (4, figure 2). Work the spring out of the ring (7) and bracket (10).
- (3) Lift out bushing (6).
- (4) Remove spring from spider if necessary.

(b) INSTALLATION

- (1) Install the bushing (6) with the protruding end of the inner bushing toward the bracket (10) and so the slot fits over the tab of the bracket.
- (2) Rotate the main gear until the round hole lines up with hole "A" in figure 5.
- (3) Place the hooked end of the spring in hole "X", figure 2. Rotate the spider clockwise two complete turns then seat it on the flattened shoulder of the mainshaft.
- (4) Install the hex nut and tighten to 20 inch-pounds torque minimum while holding the spider to prevent unwinding.

NOTE:

The spring has a larger diameter when free than when wound up. Usually it will be found that some coils of the spring lie outside of one of the three locking tabs on the mounting bracket. Use a smooth tool, such as a screwdriver, and work the coils back inside the locking tab.

8.3 FINGER STOP

- (a) Removal, Loosen screw (15) and slide finger stop out.
- (b) Installation, slide finger stop into position and tighten screw. Bend if necessary to clear finger plate.

8.4 NUMERAL RING GROUP

NOTE

The numeral ring can be removed without removing the spring and spider assembly. However it will be much simpler if the spring and spider assembly are removed first.

(a) REMOVAL

- (1) Rotate the retaining ring (7) counter-clockwise to clear the locking slots of the mounting bracket.
- (2) Lift off retaining ring and numeral ring.
- (3) Types 33 and 38 only: Lift off the reflector ring (9B), positioning ring (9A) and white plastic ring (9C).

(b) INSTALLATION

- (1) Types 33 and 38 only: Place the positioning ring on the bracket so the larger studs fit into holes "Y" and "Z". Place reflector ring around positioning ring.
- (2) Install the numeral ring. On dials 30 and 35, seat the two studs of the numeral ring in holes "Y" and "Z" of the bracket. On dials 33 and 38, position the numeral ring so the circular cutouts seat around the studs of the positioning ring.
- (3) Place the retaining ring on the numeral ring so the locking tabs of the retaining ring point toward the locking slots of the mounting bracket. Rotate the retaining ring clockwise until it tightens securely.

8.5 CONTACT SPRING ASSEMBLY

(a) REMOVAL

Remove attaching screw (13) and remove contact spring assembly.

(b) INSTALLATION

- (1) Dress leads around and under the plastic base of the spring assembly. Install the spring assembly so the locating studs seat in the two holes provided in the base. Secure the assembly with screw (13).

NOTE

Be sure leads do not interfere with the contact springs nor with the main gear teeth.

The inner stud of the actuator (11) must rest against the lever spring of the off-normal (shunt) switch and the contacts must be open. (See table 3). (This applies only if mainspring and spider are in place so that tension is applied to the actuator.)

The tab at the end of the pulsing lever spring must rest on the surface of the impulse cam

Refer to figure 4 for illustration of assembly.

8.6 ACTUATOR

- (a) REMOVAL
 (1) Remove contact spring assembly (12 or 12A)
 (2) Grasp the actuator and pull. The actuator will spring off the mainshaft.
 (b) INSTALLATION
 (1) Slip the actuator on the mainshaft, with flat side to surface of maingear, and rotate counterclockwise to the stop on the maingear (See figure 5).
 (2) Install contact spring assembly

8.7 GEAR TRAIN ASSEMBLY

The Gear Train Assembly is a staked unit, and repair is not recommended. Replace the Gear Train and Bracket Assembly, (item 10 on figure 2A and 2B), as a unit.

9. TEST AND ADJUSTMENT (Figure 4)

NOTE
Adjustment of the 30 Series Rotary Dials is limited to dial speed adjustment and adjustment of contact springs.

9.1 DIAL SPEED ADJUSTMENT

Check dial speed on a reliable pulse speed tester. Maximum tolerance is 9.0 to 11.0 pulse per second. If necessary, adjust to 9.5 to 10.5 pulses per second.

Dial speed is controlled by the end-to-end tension of the governor spring. Adjust the spring tension by curving to increase speed or flattening to decrease speed. Use a pair of tweezers with flat jaws and curve or flatten the spring at the center of the loop. After adjustment, the loop of the spring must be approximately parallel with the bottom of the governor housing and should have a clearance of about 1/64" from all other parts of the governor mechanism, except for the tips of the spring connecting to the weights.

9.2 CONTACT SPRINGS

Each of the springs must be approximately straight and the contacts must make approximately on center. Bend the springs at the base to obtain the specified tension and position adjustments.

- (a) OFF-NORMAL, (SHUNT), SPRINGS (Table III)
 With the dial at normal each make spring must be straight, have the correct minimum contact separation from its mating lever spring and be approximately perpendicular to the mounting block. With the dial rotated from the normal position each lever spring must provide the required contact pressure against its make spring.
 (b) PULSING SPRINGS (Table III)
 During the return motion of the dial the pulsing contacts must have the correct minimum contact separation (See Table III) on each pulse. With the contacts fully parted the lever spring must bear against the pulsing cam with the correct pressure, measured at the tip of the spring. Rotate the dial FROM the normal position until the lever spring rests against the low part of the cam. In this condition the break spring must provide the correct contact pressure against the lever spring, measured at the tip of the break spring. Note that there must be a slight clearance between the tip of the break spring and the trigger locking cam with the dial at normal.

9.3 PULSE RATIO (Table III)

Check the break period of the dial pulses on a reliable pulse ratio tester. If the pulse ratio is outside the range given under the test heading in Table III, readjust it to be within the range given under the heading of READJUST. The adjustment is effected by slight bending of the tab of the pulsing lever spring at the point just below the pulsing cam. Bending the tab away from the cam increases the break time and bending it towards the cam reduces the break time. Refer also to the last sentence of paragraph 9.2(b).

TABLE III. ADJUSTMENT DATA

Dial Speed		
Test:	9.0 to 11.0 pulses/second.	
Readjust:	9.5 to 10.5 pulses/second.	
Spring Pressures		
Shunt lever spring to make spring; 20 grams min.		
Pulsing lever spring against cam; 12 + 7 grams.		
Pulsing break spring to lever spring, with pawl away and cam in low position; 30 + 7 grams.		
Spring Clearances		
Between the contacts of the open shunt springs; .015" min.		
Between the contacts of the open pulsing springs; .010" min.		
Note that there must be a slight clearance between the tip of the pulsing break spring and the tip of the pawl with the dial at normal.		
Pulse Ratio		
	Percent Make	Percent Break
Test:	38.5+4	61.5+4
Readjust:	38.5±2	61.5±2

TYPE 10A DIAL

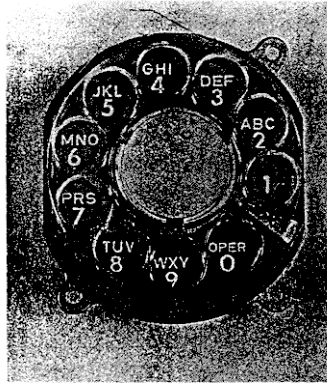


Figure 1. Type 10A Dial

1. GENERAL

Designed for use in dial-in-handset telephones. Overall diameter is approximately 2-3/4", fingerplate diameter is 2-3/8".

The moveable fingerstop moves clockwise approximately two hole spaces at the beginning of each dial windup until it contacts a fixed stop.

Off-normal contacts are not provided.

2. OPERATION

The mechanism is actuated by the clear plastic fingerplate which, when wound up and released, causes a pair of pulsing contacts to interrupt the line current once for each unit of the dialed digit. Telephone switching equipment is operated in accordance with the number of impulses received. The dials are adjusted to 10 impulses per second, nominal, and a pulse ratio with a break period of 61.5% of the pulse duration.

3. IDENTIFICATION

An identifying code and date of manufacture are stamped in ink on the back of the baseplate.

4. CLEANING AND LUBRICATION

(a) CLEANING. Use a dry brush or compressed air to remove dust. Do not use a solvent, as the bearings might be damaged. Be sure compressed air is not contaminated with oil or water.

(b) LUBRICATION. Any time dial is repaired, use a No. 4 artist's round sable brush and lubricate all bearing points lightly with ITT - 79946-3 Dial Lubricant, or W. E. KS 19589-L2 lubricant or equivalent.

CAUTION

Do not allow lubricant to enter the governor drum, as dial speed will be affected.

5. DISASSEMBLY AND REASSEMBLY

(a) CONTACT SPRING. Remove clip (17) and dust cover (18). Remove screw (13) washer (14) and contact spring (15). Assemble in reverse order of disassembly.

(b) FINGERPLATE AND NUMERAL RING GROUPS. Insert point of release tool in hole "A" and pry cover (1) out. Slide E-Ring (3) from groove in mainshaft and lift off washer (4), fingerplate (5) and fingerstop (6). Rotate retainer ring (9) counterclockwise until its tabs are free of slots in base. Lift off retainer ring, numeral ring (10) and background card (11). NOTE: If spring assembly (15) has been removed, be careful not to lose nut (18). Assemble in reverse order of disassembly.

NOTE

Removal of items 7 and 8 is not recommended.

6. TEST AND ADJUSTMENT

NOTE: Adjustments are limited to dial speed, contact spring pressure and clearances, and percent make.

6.1 DIAL SPEED ADJUSTMENT

Dial speed is controlled by the end-to-end tension of the governor spring. Adjust the spring tension by curving to increase speed or flattening to decrease speed. After adjustment, the loop of the spring must be approximately parallel with the dial base plate and have a clearance of about 1/64" from all parts of the governor mechanism except for the tips of the springs connecting to the weights.

6.2 CONTACT SPRING PRESSURE AND CLEARANCES.

Contacts must make approximately on center. Bend the springs at the base to obtain the specified spring pressure and clearance adjustments. Measure spring pressures at tips of springs.

(a) DIAL IN NORMAL POSITION

- (1) Clearance between the trigger-locking cam and the tip of the break spring should be approximately .006 inch.
- (2) Pressure of the break spring to lever spring must be 22 to 30 grams.

(b) DIAL ROTATED FROM NORMAL POSITION

- (1) Clearance between open spring contacts must be .010" minimum.
- (2) Pressure of lever spring against cam with contacts open, 2 to 10 grams.

6.3 DIAL PULSE RATIO

Adjustment for pulse ratio is made by slightly bending the tab of the lever spring which rides upon the impulse cam. Bending the tab away from the cam increases the break period. Bending the tab toward the cam decreases the break period.

The break period should be 61.5 + 4%;

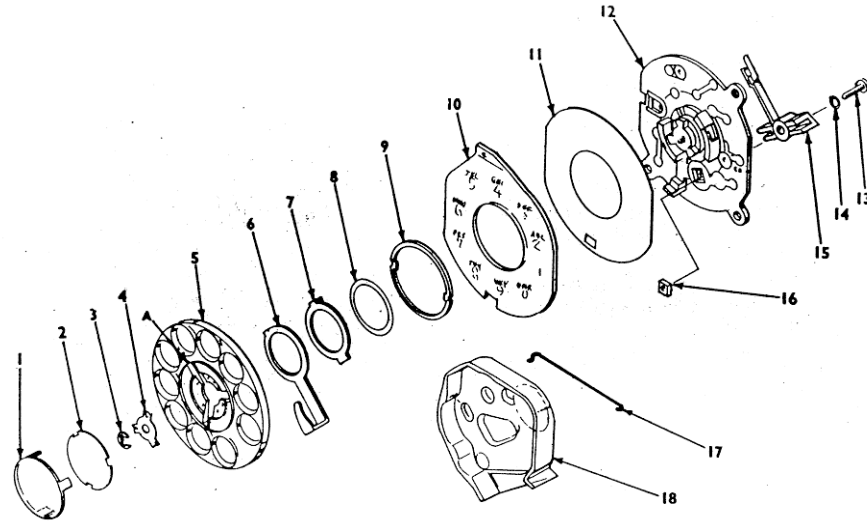


Figure 2. Type 10A Dial, Exploded View

FIGURE NO.	INDEX NO.	PART NUMBER	NAME, Description part under which they are indented)	QUANTITY USED ON:					
				10A					
				G					
TABLE I. REPLACEABLE PARTS LIST, TYPE 10A ROTARY DIAL									
2	1	10A(G)450	Dial Assembly, Metro (95991-1)	X					
	2	180314 -101	Cover, Fingerplate	1					
	3	180308 -***	Insert, Fingerplate Cover	1					
	4	181027 -101	E-Ring	1					
	5	181028 -101	Spider Washer	1					
	6	180313-101	Fingerplate	1					
	7	181029 -101	Fingerstop, Moveable	1					
	8	181033 -101	Washer, Stop	1					
	9	181034 -101	Washer, Wave	1					
	10	181030 -101	Ring, Retainer	1					
	11	181031 -101	Ring, Numeral, Metro	1					
	12	181032 -101	Card, Background	1					
	13	181039 -101	Mechanism, Dial	1					
	14	181036 -101	Screw	1					
	15	181037 -101	Washer	1					
	16	181035 -101	Contact Spring Assembly	1					
	17	181038 -101	Nut	1					
	18	180316-101	Clip, Spring; Dust Cover	1					
		180315-101	Cover, Dust	1					
		***	SUBSTITUTE COLOR CODE						

"TEL-TOUCH" PUSHBUTTON DIALS, No. 27, 32, and 36

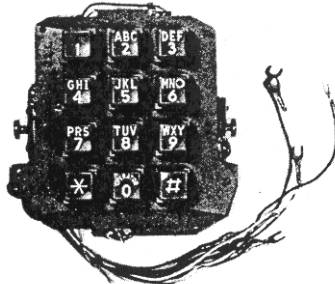


Figure 1A. "TEL-TOUCH" Pushbutton Dial, Front View

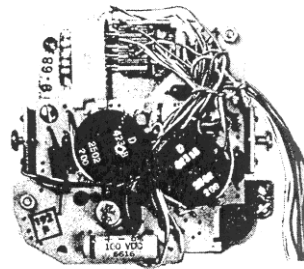


Figure 1B. "TEL-TOUCH" Pushbutton Dial, Rear View

1. IDENTIFICATION

The "TEL-TOUCH" pushbutton dials have been manufactured in three basic models, numbers 27, 32, and 36.

NUMBER 27

The number 27 Dial is a 10-pushbutton unit which has been superseded by number 32 12-pushbutton dial.

NUMBER 32

The number 32 Dial is a 12-pushbutton unit and is the standard dial used in ITT "TEL-TOUCH" telephones. Ten of the buttons are numbered 1 through 9 and 0. The remaining two buttons have symbols * and #.

NUMBER 36

Similar to number 32, but designed for use with hands free equipment.

2. PURPOSE OF THE "TEL-TOUCH" DIAL

The pushbuttons numbered 1 through 0 are used by the subscriber to "dial" the desired number. (The central office must be equipped to accept the signals.) The additional two buttons are used for specific applications which are beyond the scope of this publication.

3. DESCRIPTION AND OPERATION

The "TEL-TOUCH" dial consists chiefly of two major sub-assemblies; the Pushbutton Assembly (1, figure 2) and the tone generating Circuit Board Assembly (35). An Insulator (30) is assembled between the two sub-assemblies.

3.1 CIRCUIT BOARD ASSEMBLY (35, Figure 2)

The Circuit Board Assembly includes two tuning coils and two capacitors. The tuning coils have several taps - each tap representing a tuned circuit when it is connected to its associated capacitor. Leads from the coil-taps and from the capacitors are soldered to individual contact springs mounted on the Pushbutton Assembly (1).

3.2 PUSHBUTTON ASSEMBLY (1, Figure 2)

The Pushbutton Assembly consists of the Cover Plate (2); Pushbuttons (3); four Horizontal (Row) Cranks (4 and 5); three Vertical (Column) Cranks (6 and 7); ten Pushbutton Return Springs (8); the Frame (9); the Actuator Slide (10); the Mounting Plate-Assembly (11); and the Spring Switch Assembly (28).

Four groups of spring contacts are mounted on the Mounting Plate (24) to make up the Mounting Plate Assembly (11). The tuned circuits of the Circuit Board Assembly are connected to individual contact springs of the sets.

The Spring Switch Assembly (28) is mounted on the rear side of the Mounting Plate and its springs mesh with the teeth of the actuator slide (10).

Depressing a Pushbutton rotates one of the Horizontal Cranks and one of the Vertical Cranks. In the early part of the downstroke, each crank operates a specific spring contact to connect a tuning capacitor to a specific coil tap. (In brief, each crank represents a specific frequency.) Later in the downstroke, the horizontal crank contacts and moves the slide (10) which operates a common switch (28). The Vertical (column) Cranks operate switches connected to the high band coil, and the horizontal (row) cranks operate switches connected to the low band coil. (See figure 3.)

The common switch (Spring Assembly; item 28) performs the following functions:

- (1) Attenuates the side tone in the telephone receiver to a comfortable level.
- (2) Applies power to transistor.
- (3) Opens the transmitter circuit.
- (4) Initiates the signal.
- (5) Attenuates the sidetone in the speaker in "hands free" application. (36 Dial)

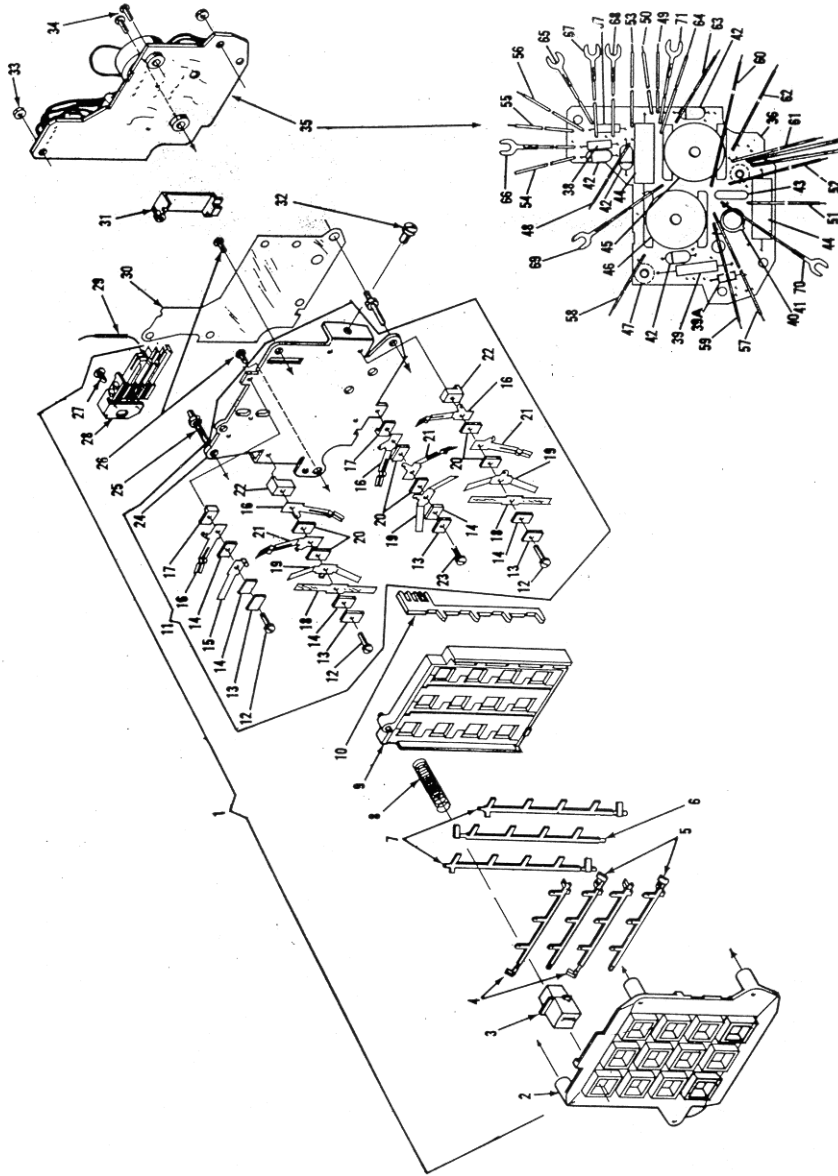
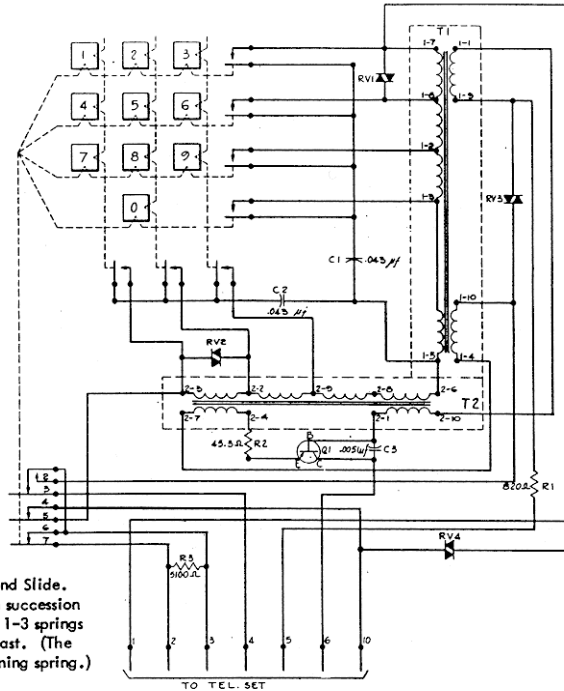


Figure 2. "TEL-TOUCH" Pushbutton Dial, Exploded View, (No. 27, 32, and 36)

FIGURE INDEX		NAME, Description		QUANTITY USED ON					
NO.	NO.	PART NUMBER	NAME, Description	27D	27G	32D	32G	36D	36G
TABLE I. REPLACEABLE PARTS LIST, "TEL-TOUCH" (PUSHBUTTON) DIAL									
		27(D)450	DIAL ASSEMBLY, "TEL-TOUCH" 10-Pushbutton, Regular Style (Obsolete)X	-	-	-	-	-	-
		27(G)450	DIAL ASSEMBLY, "TEL-TOUCH" 10-Pushbutton, Metro Style (Obsolete)	-	X	-	-	-	-
		32(D)450	DIAL ASSEMBLY, "TEL-TOUCH" 12-Pushbutton, Regular Style	-	-	X	-	-	-
		32(G)450	DIAL ASSEMBLY, "TEL-TOUCH" 12-Pushbutton, Metro Style	-	-	-	X	-	-
		36(D)450	DIAL ASSEMBLY, "TEL-TOUCH" 12-Pushbutton, Regular Style, Handsfree	-	-	-	-	X	-
		36(G)450	DIAL ASSEMBLY, "TEL-TOUCH" 12-Pushbutton, Metro Style, Handsfree	-	-	-	-	-	X
1		86134-1	PUSHBUTTON ASSEMBLY, 10-Button Metro	-	1	-	-	-	-
1		86134-2	PUSHBUTTON ASSEMBLY, 10-Button Regular	1	-	-	-	-	-
1		86134-3	PUSHBUTTON ASSEMBLY, 12-Button Metro	-	-	-	1	-	-
1		86134-4	PUSHBUTTON ASSEMBLY, 12-Button Regular	-	-	1	-	-	-
1		86134-5	PUSHBUTTON ASSEMBLY, 12-Button Metro	-	-	-	-	-	1
1		86134-6	PUSHBUTTON ASSEMBLY, 12-Button Regular	-	-	-	-	1	-
2		86101-1	PLATE, Pushbutton Cover (10-button)	1	1	-	-	-	-
2		86101-4	PLATE, Pushbutton Cover (12-button)	-	-	1	1	1	1
3		181452-101	BUTTON, Push #1 (Metropolitan) (Was 86100-1)	-	1	-	1	-	1
		181452-102	BUTTON, Push #2, ABC (Was 86100-2)	-	1	-	1	-	1
		181452-103	BUTTON, Push #3, DEF (Was 86100-3)	-	1	-	1	-	1
		181452-104	BUTTON, Push #4, GHI (Was 86100-4)	-	1	-	1	-	1
		181452-105	BUTTON, Push #5, JKL (Was 86100-5)	-	1	-	1	-	1
		181452-106	BUTTON, Push #6, MNO (Was 86100-6)	-	1	-	1	-	1
		181452-107	BUTTON, Push #7, PRS (Was 86100-7)	-	1	-	1	-	1
		181452-108	BUTTON, Push #8, TUV (Was 86100-8)	-	1	-	1	-	1
		181452-109	BUTTON, Push #9, WXY (Was 86100-9)	-	1	-	1	-	1
		181452-110	BUTTON, Push #0, OPERATOR (Was 86100-10)	-	1	-	1	-	1
		181452-111	BUTTON, Push #1 (Regular) (Was 86100-11)	1	-	1	-	1	-
		181452-112	BUTTON, Push #2 (Was 86100-12)	1	-	1	-	1	-
		181452-113	BUTTON, Push #3 (Was 86100-13)	1	-	1	-	1	-
		181452-114	BUTTON, Push #4 (Was 86100-14)	1	-	1	-	1	-
		181452-115	BUTTON, Push #5 (Was 86100-15)	1	-	1	-	1	-
		181452-116	BUTTON, Push #6 (Was 86100-16)	1	-	1	-	1	-
		181452-117	BUTTON, Push #7 (Was 86100-17)	1	-	1	-	1	-
		181452-118	BUTTON, Push #8 (Was 86100-18)	1	-	1	-	1	-
		181452-119	BUTTON, Push #9 (Was 86100-19)	1	-	1	-	1	-
		181452-120	BUTTON, Push #10 (Was 86100-20)	1	-	1	-	1	-
		181452-131	BUTTON, Push # (Was 86100-31)	-	-	1	1	1	1
		181452-132	BUTTON, Push # (Was 86100-32)	-	-	1	1	1	1
4		86108-1	CRANK, Horizontal (1 and 3 from top)	2	2	2	2	2	2
5		86109-1	CRANK, Horizontal (2 and 4 from top)	2	2	2	2	2	2
6		86110-1	CRANK, Vertical (Center Position)	1	1	1	1	1	1
7		86111-1	CRANK, Vertical (Side Positions)	2	2	2	2	2	2
8		86112-1	SPRING, Push Button	10	10	10	10	10	10
9		86102-1	FRAME, Push Button	1	1	1	1	1	1
10		86113-1	SLIDE	1	1	1	1	1	1
11		86107-1	MOUNTING PLATE ASSEMBLY	1	1	1	1	1	1
12		86135-4	SCREW	3	3	3	3	3	3
13		86119-1	PLATE, Clamp	4	4	4	4	4	4
14		86121-2	INSULATOR, 1/32-inch thick	5	5	5	5	5	5
15		86118-1	SPRING	1	1	1	1	1	1
16		86115-2	SPRING	4	4	4	4	4	4
17		86116-1	SPACER	2	2	2	2	2	2
18		180026	INSULATOR	2	2	2	2	2	2
19		86114-1	SPRING	3	3	3	3	3	3
20		86121-1	INSULATOR, 1/64-inch thick	6	6	6	6	6	6
21		86115-1	SPRING	3	3	3	3	3	3
22		86116-2	SPACER	2	2	2	2	2	2
23		86135-2	SCREW	1	1	1	1	1	1
24		86105-2	PLATE, Mounting	1	1	1	1	1	1
25		86149-1	SCREW, Special	2	2	2	2	2	2
26		76787-2	SCREW, Self-Tapping	2	2	2	2	2	2
NOTE: Parts Breakdown of Push button Assembly (Item 1) is continued on next page.									

FIGURE NO.	INDEX NO.	PART NUMBER	NAME, Description (Indented items are included in the part under which they are indented)	QUANTITY USED ON:					
				27D 450	27G 450	32D	32G	36D	36G
TABLE I. REPLACEABLE PARTS LIST, "TEL-TOUCH" (PUSH BUTTON) DIAL				27D 450	27G 450	32D	32G	36D	36G
			PUSHBUTTON ASSEMBLY, (Item 1), continued (Consists of items 2 through 28)						
	27	71660	SCREW (Spring Assembly Attaching)	1	1	1	1	1	1
	28	86133-1	SPRING ASSEMBLY (Includes following 12 parts)	1	1	1	1	-	-
		86135-6	SCREW	2	2	2	2	-	-
		86130-1	BUSHING (ORDER OF ASSEMBLY IS SHOWN IN PARENTHESES FOR FOLLOWING PARTS)	2	2	2	2	-	-
		86132-1	BRACKET, Spring Assembly (1)	1	1	1	1	-	-
		86131-2	INSULATOR, 3/64-inch thick (2)	1	1	1	1	-	-
		86131-1	INSULATOR, 1/32-inch thick (3, 5, 7, 8, 10, 11, 13, 15, 16, 18, 20, 21, 22)	13	13	13	13	-	-
		86129-1	SPRING, (4)	1	1	1	1	-	-
		86128-1	SPRING, (6)	1	1	1	1	-	-
		86127-1	SPRING, (8)	1	1	1	1	-	-
		86126-1	SPRING, (12, 17)	2	2	2	2	-	-
		86124-1	SPRING, (14, 19)	2	2	2	2	-	-
		86117-1	SPRING, (23)	1	1	1	1	-	-
		86120-1	NUT PLATE, (24)	1	1	1	1	-	-
	28	88891-1	SPRING ASSEMBLY (Includes following parts)	-	-	-	-	1	1
		86135-8	SCREW	-	-	-	-	2	2
		86130-2	BUSHING (Order of Assembly is shown in parentheses for following parts)	-	-	-	-	2	2
		86132-1	BRACKET, Spring Assembly (1)	-	-	-	-	1	1
		86131-2	INSULATOR, 3/64-inch thick, (2, 32)	-	-	-	-	2	2
		86131-1	INSULATOR, 1/32-inch thick, (3, 5, 7, 9, 10, 11, 13, 15, 16, 18, 20, 21, 23, 25, 26, 28, 29)	-	-	-	-	17	17
		86129-1	SPRING, (4)	-	-	-	-	1	1
		86128-1	SPRING, (6, 30)	-	-	-	-	2	2
		86127-1	SPRING, (8)	-	-	-	-	1	1
		86126-1	SPRING, (12, 17, 22)	-	-	-	-	3	3
		86124-1	SPRING, (14, 19, 24)	-	-	-	-	3	3
		88892-1	SPRING (27)	-	-	-	-	1	1
		88893-1	SPRING, (31)	-	-	-	-	1	1
		86120-1	NUT PLATE, (33)	-	-	-	-	1	1
	29	190106-85	WIRE (White-Blue-Green)	1	1	-	-	-	-
	29	190106-351	WIRE (White- Yellow- Violet)	-	-	-	-	1	1
	30	86106-1	INSULATOR, Circuit Board to Mounting Plate	1	1	1	1	1	1
	31	86104-1	COVER, Spring Assembly	1	1	1	1	1	1
	32	180219	SCREW, Dial Mounting	2	2	2	2	2	2
	33	86150-1	LOCKNUT, (Goes on Item 25)	2	2	2	2	2	2
	34	79485-2	SCREW, Circuit Board to Mounting Plate	2	2	2	2	2	2
	35	86140-1	CIRCUIT BOARD ASSEMBLY, Tone Generator	1	1	-	-	-	-
	35	180142-1	CIRCUIT BOARD ASSEMBLY, Tone Generator	-	-	1	1	-	-
	35	89561-1	CIRCUIT BOARD ASSEMBLY, Tone Generator	-	-	-	-	1	1
	36	86141-1	BOARD, Printed circuit	1	1	1	1	1	1
	37	62948-20	RESISTOR, (R3) 5,100 Ohm	1	1	1	1	1	1
	38	62948-29	RESISTOR (R1) 820 Ohm	1	1	1	1	1	1
	39	95535-18	RESISTOR (R2) 45.3 Ohm	1	1	1	1	1	1
	39A	62948-93	RESISTOR (R4) 33,000 Ohm	-	-	-	-	1	1
	40	95830-1	TRANSISTOR	1	1	1	1	1	1
	41	95749-1	SPACER, Transistor	1	1	1	1	1	1
	42	95853-1	VARIATOR	4	4	4	4	4	4
	43	95854-1	CAPACITOR	1	1	1	1	1	1
	44	95862-1	CAPACITOR	2	2	2	2	2	2
	45	86125-1	TRANSFORMER (T1)	1	1	1	1	1	1
	46	86125-2	TRANSFORMER (T2)	1	1	1	1	1	1
	47	86148-1	SPACER	2	2	2	2	2	2



Dotted lines represent Cranks and Slide.
 Springs 6-7 break first, then in succession the 1-2 springs make, then the 1-3 springs break. The 4-5 springs break last. (The 8 spring, not shown, is a stiffening spring.)

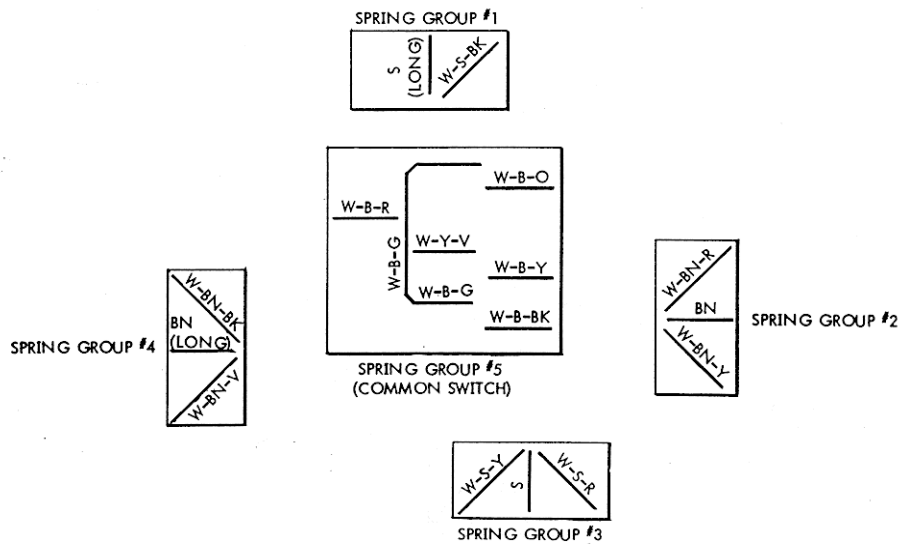
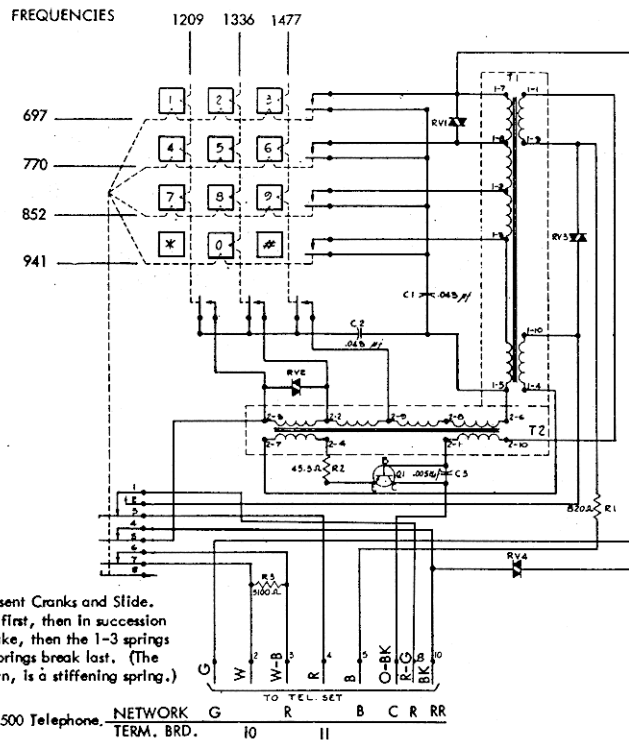


Figure 3A. Dial circuit and wiring diagram, No. 27 dial.



Dotted lines represent Cranks and Slide.
Springs 6-7 break first, then in succession the 1-2 springs make, then the 1-3 springs break. The 4-5 springs break last. (The 8 spring, not shown, is a stiffening spring.)

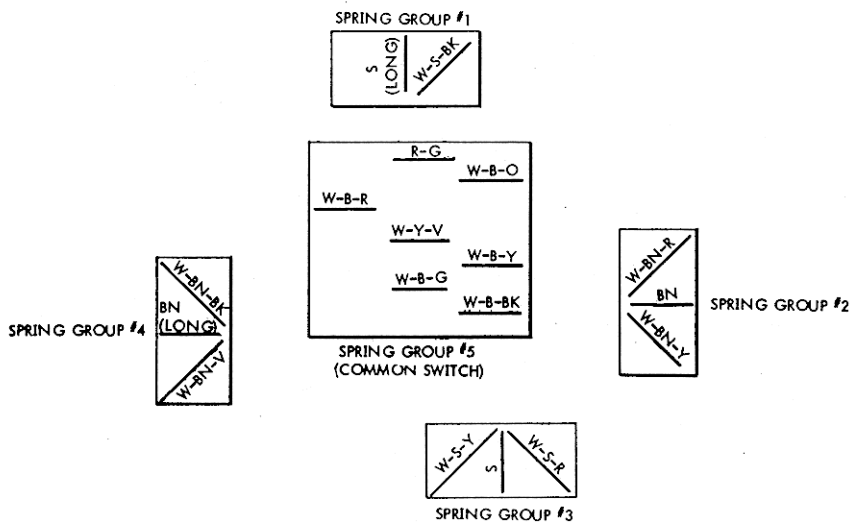
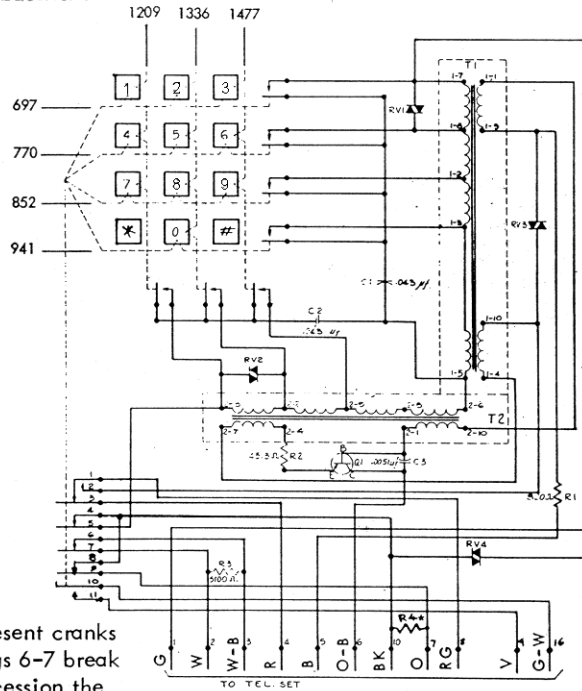


Figure 38. Dial circuit and wiring diagram, No. 32 dial.

FREQUENCIES



Dotted lines represent cranks and slide. Springs 6-7 break first, then in succession the 1-2, 10-11 springs make and then the 1-3, 8-9 springs break. The 4-5 springs break last.

*33,000 ohm

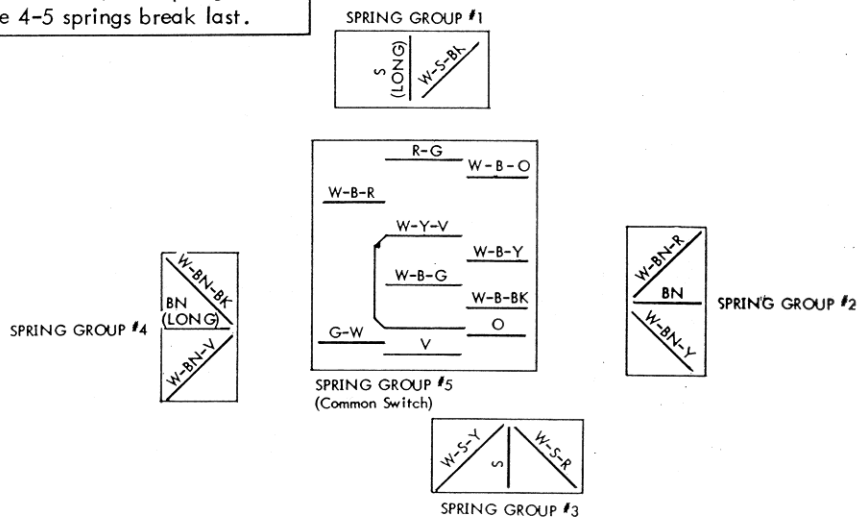


Figure 3C. Dial circuit and wiring diagram, No 36 dial.

4. DISASSEMBLY AND REASSEMBLY

4.1 PUSHBUTTON PARTS

a. DISASSEMBLY OF PUSHBUTTON PARTS

- (1) Place dial face down in a fixture, (See figure 4).
- (2) Rotate the Spring Cover (31) clockwise until it clears the Circuit Board (35). Lift upward to remove it from the screw threads if desired.
- (3) Remove the two locknuts (35) and the two screws (34) that secure the Circuit Board to the Mounting Plate (24).
- (4) Remove the two screws (26) and the two stud-type screws (25) that secure the Mounting Plate to the Cover Plate (2). Lift off the Circuit Board and Mounting Plate group.
- (5) Lift off the Actuator Slide (10) and Pushbutton Frame (9).
- (6) Remove Cranks and Pushbuttons as required.

b. ASSEMBLY OF PUSHBUTTON PARTS

- (1) Place the Cover Plate (2) face down on the fixture shown in figure 4.
- (2) Place Pushbuttons in proper holes in Cover Plate.
- (3) Place the Horizontal (Row) Cranks in position in the Cover Plate. The arm which contacts the Actuator Slide (10) must be toward the assembler's left and must point upward. The round sections of each crank must ride in appropriate slots.
- (4) Place the Vertical (Column) Cranks in position.
The arms of the cranks point toward the assembler's left and ride on the flanges of the push-buttons.

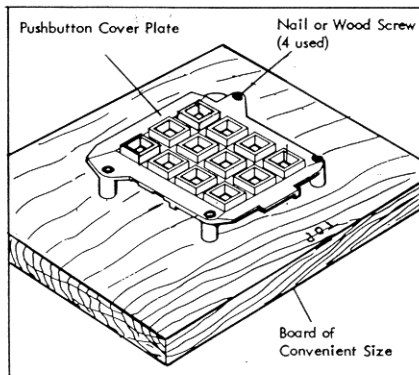


Figure 4. Holding fixture

- (5) Place the Pushbutton Frame (9) over the assembled parts, so the dowel of the Frame inserts into the dowel hole of the Cover Plate.
- (6) Place the Spring (8) in position, one in each pushbutton.
- (7) Place the Slide (10) in the Frame so the arms on the front side mesh below the arms of the four vertical (row) cranks.
- (8) Position the Mounting Plate and Circuit Board group over the assembled parts. Note that the teeth of the Actuator Slide mesh properly with the springs of the Spring Assembly (28). The top tooth goes above the top long flat spring. Each successive tooth goes above the subsequent long flat spring. The fourth tooth engages the stiffener spring of the Spring Assembly.
- (9) Secure the Mounting Plate Assembly to the Cover Plate with screws (25 and 26).
- (10) Secure the Circuit Board Assembly with the two nuts (33) and screws (34).
- (11) Install the Spring Cover (31) by pressing it down on the threads of the screw (12). Rotate counterclockwise until it engages the Circuit Board.

4.2 REPLACEMENT OF CIRCUIT BOARD ASSEMBLY

a. REMOVAL OF CIRCUIT BOARD ASSEMBLY

- (1) Remove the waxed twine from the wire and pull kinks out of wire.
- (2) Remove the two nuts (33) and the two screws (34) that secure the Circuit Board to the Mounting Plate.
- (3) Rotate the Spring Cover (31) until it clears the Circuit Board.
- (4) Use a soldering iron and de-solder the leads of the Circuit Board from the spring contacts on the Mounting Plate.

b. INSTALLATION OF CIRCUIT BOARD ASSEMBLY.

- (1) Place Circuit Board in position on the Mounting Plate and secure with the two nuts (33) and screws (34).
- (2) Refer to figure 3 and solder leads to the Spring Contacts on the Mounting Plate.
- (3) Pull the wiring together and bind with twine. (Figure 1A)
- (4) Pull the wires equipped with terminals to the top right hand corner (as viewed from rear of dial) and bind with twine.

5. REPLACEMENT OF COMPONENTS ON CIRCUIT BOARD (With Circuit Board Assembly Removed)

5.1 TRANSFORMERS

a. REMOVAL OF TRANSFORMERS

- (1) Remove Circuit Board Assembly as directed in paragraph 4.2.
- (2) Locate the solder joints associated with the transformer to be removed. Using a soldering iron, apply heat and pressure directly into the joints, pushing the Transformer terminals out of the Circuit Board.

b. INSTALLATION OF TRANSFORMERS

- (1) Place the Transformer in position with the terminals extending through the appropriate holes in the Circuit Board.
- (2) Hold the Transformer in position and apply solder as required.

5.2 CAPACITORS, RESISTORS, VARISTORS

a. REMOVAL OF CAPACITORS, RESISTORS AND VARISTORS

- (1) Use side cutters and clip leads of unit to be replaced.
- (2) Apply hot soldering iron to associated solder joint on printed side of Circuit Board. When solder is melted away, rap the Circuit Board lightly; the part of lead wire in solder joint will fall out.

b. INSTALLATION OF CAPACITORS, RESISTORS AND VARISTORS

- (1) Insert leads into appropriate holes in Circuit Board and bend leads down closely to hold unit in place.
- (2) Solder unit in place and clip excess length from leads.

6. INSPECTION TEST AND ADJUSTMENT

6.1 VISUAL INSPECTION

Inspect to be sure all nuts and screws are properly tightened. During assembly, be sure all plated parts have a good finish. Check all solder joints to be sure they are intact.

6.2 TEMPERATURE REQUIREMENTS

Dials must be stored in a room at 75°F for at least four hours immediately to testing so they will stabilize at 75° F.

6.3 MECHANICAL REQUIREMENTS

- a. Down travel of button shall be between .012" to .018" before the slide switch motion will start. Minimum of 0.015" pre-travel of the slide-switch motion is required, before any sequence of switching occurs. Slide switch travel in sliding motion is to be between .080" to .110".
- b. The contact springs of the dial shall be so adjusted that no contact shall be made during the initial .014" travel of button. Signalling shall start when a force of 150 to 275 grams is applied to any of the buttons. Cranks shall not touch one another when a button is depressed with any side-way pressure applied to the button.
- c. Contact Spring Adjustment
 - (1) All contact spring adjustment shall be made at the base of the springs. The alignment of the contact springs shall be such as to mate all springs approximately on center.
 - (2) The contact spring separation shall in no case be less than 0.012"
 - (3) Contact pressure of the adjusted springs in the operated position shall be a minimum of 15 grams.

6.4 TEST CIRCUIT DESCRIPTION

- a. The normal circuitry of the K-2500 type telephone, less dial, with a selected network having average characteristics and with seven Rapid Test Clips, or equivalent, so as to provide ready access to the test circuit.
- b. A mechanical arrangement for holding the dial such that the dial may be rotated to provide ready access to the threaded cores.
- c. A battery feed circuit consisting of a 48VDC power supply, a WE Co. 94E repeat coil or equivalent, a 1000 ohm - 3 watt wirewound resistor, a 2500 ohm - 2 watt wirewound potentiometer, a 2MF capacitor and a SPST switch "S1".
- d. A 47 ohm ± 5% one watt resistor to replace the transmitter, a 150 ohm ± 5% 1/2 watt resistor to replace the receiver and a 900 ohm ± 1% load resistor.
- e. A 0-50 DC milliammeter, accuracy at 20 MA to be within 1%.
- f. A Ballantine 310A voltmeter or equivalent; a frequency counter; a Tektronix Model RM 561 oscilloscope or equivalent.

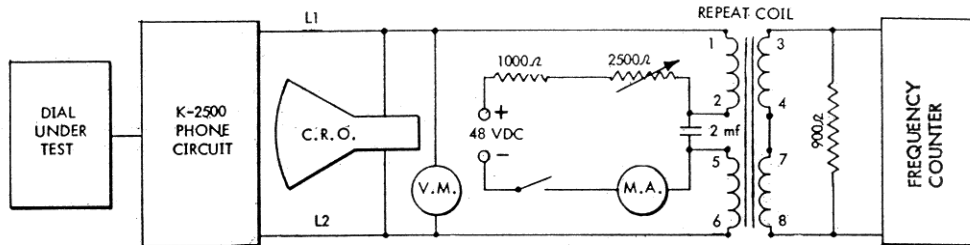


Figure 5. Test Circuit Schematic

6.5. TEST AND ADJUSTMENT

- a. The oscillator circuit generates two frequencies when any one button of the dial is depressed, however, it will generate only one frequency when any two buttons in one row or one column are depressed. Adjustments, frequency measurements, and signal amplitude measurements are made on the basis of one frequency being generated at a time.
- b. Insert dial in test fixture.
- c. Close switch S1 and adjust line current to 20 MA.
- d. After dial has been connected to circuit for 30 seconds, depress buttons 4 and 5 simultaneously and adjust threaded core of transformer assembly 86125-1 to obtain a reading of 770 Hz. Release buttons 4 and 5, then depress buttons 8 and 0 simultaneously and adjust transformer 86125-2 to obtain a reading of 1336 Hz.
- e. Observe readings for each of the frequencies available. Readings must be within 1.5% of nominal frequencies shown.

f. Dual Frequency Output Test

- (1) The dual frequency output shall be observed at the L1-L2 terminals using a Tektronix Model RM 561 oscilloscope or equivalent.
- (2) Depress each button in turn and, while button is depressed, tilt each button side-way through an arc of 360 degrees using a rubber-tipped pencil or the index finger. Both frequencies should be present at all times a button is depressed.

g. Rise Time

- (1) Rise time is defined as being that time from the opening of the common switch contact that initiates oscillator action to the time at which the oscillator signal reaches maximum amplitude.
- (2) Rise time shall be observed at the L1-L2 terminals of the test set using a Tektronix Model RM 561 oscilloscope or equivalent and shall not exceed 15 milli-seconds.
- (3) Rise time shall be observed during tests as outlined 6.5. e.

h. Parasitic Suppression

- (1) A parasitic oscillation is herein defined as an undesired high frequency signal superimposed on the desired signal.
- (2) Parasitic suppression shall be observed at the L1-L2 terminals of the test set using a Tektronix Model RM 561 oscilloscope or equivalent.
- (3) Observation of parasitic suppression shall be made during tests as outlined in 6.5. e.
- (4) There shall be no evidence of parasitic oscillations. An open .0051 MF feedback capacitor will cause parasitic oscillations.

i. Voltage Breakdown

CAUTION
To prevent possibility of breakdown of .043 mf capacitors, this test should be made with no: 1 button depressed.

TEST STANDARDS

NOTE: Single frequencies are obtained by depressing two buttons in the same row for low frequencies or two buttons in the same column for high frequencies. Readings should be within 1.5% of the nominal readings shown

ROW	NOMINAL FREQUENCY	COLUMN	NOMINAL FREQUENCY
1, 2, 3	697 Hz	1, 4, 7, *	1209 Hz
4, 5, 6	770 Hz	2, 5, 8, 0	1336 Hz
7, 8, 9	852 Hz	3, 6, 9, #	1477 Hz
*, 0, #	941 Hz		

Completed dials shall withstand the application of 500 volts RMS 60 CPS from each of the seven lugged dial leads to the dial mounting frame. Voltage shall be increased from zero to 500 volts in a period of not less than one second, maintained for thirty seconds and decreased to zero in a period of not less than one second.