Junior Model 8T

A MANUAL SHOWING HOW TO USE THE INSTRUMENT TO MEASURE SOUND FREQUENCIES

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SECTION I

INTRODUCTION

1. The Stroboconn Junior is an electronic device for rapid and accurate *visual* comparison of sound frequencies with semitone intervals of the Equally Tempered musical scale based upon the American Standard "A" of 440 cycles per second.

2. The range of the Stroboconn Junior encompasses 84 semitones, from C-1 (first-octave "C" at lower end of piano keyboard) to B-7 (seventh-octave "B" at upper end of piano keyboard), essentially the entire range of the piano. Expressed in frequencies, this range is from 32.703 to 3,951.1 cycles per second. No comparison tones are used and no mathematical computations or reductions are necessary.

SECTION II

GENERAL DESCRIPTION

1. The complete Stroboconn Junior is made up of one encased Scanning Unit, one desk-type microphone with shielded cable, and a suitable a-c power cord. (*See Figure 1.*)

2. A list of valuable and convenient accessories will be found listed in Section VII, Paragraph 1, of this Handbook.

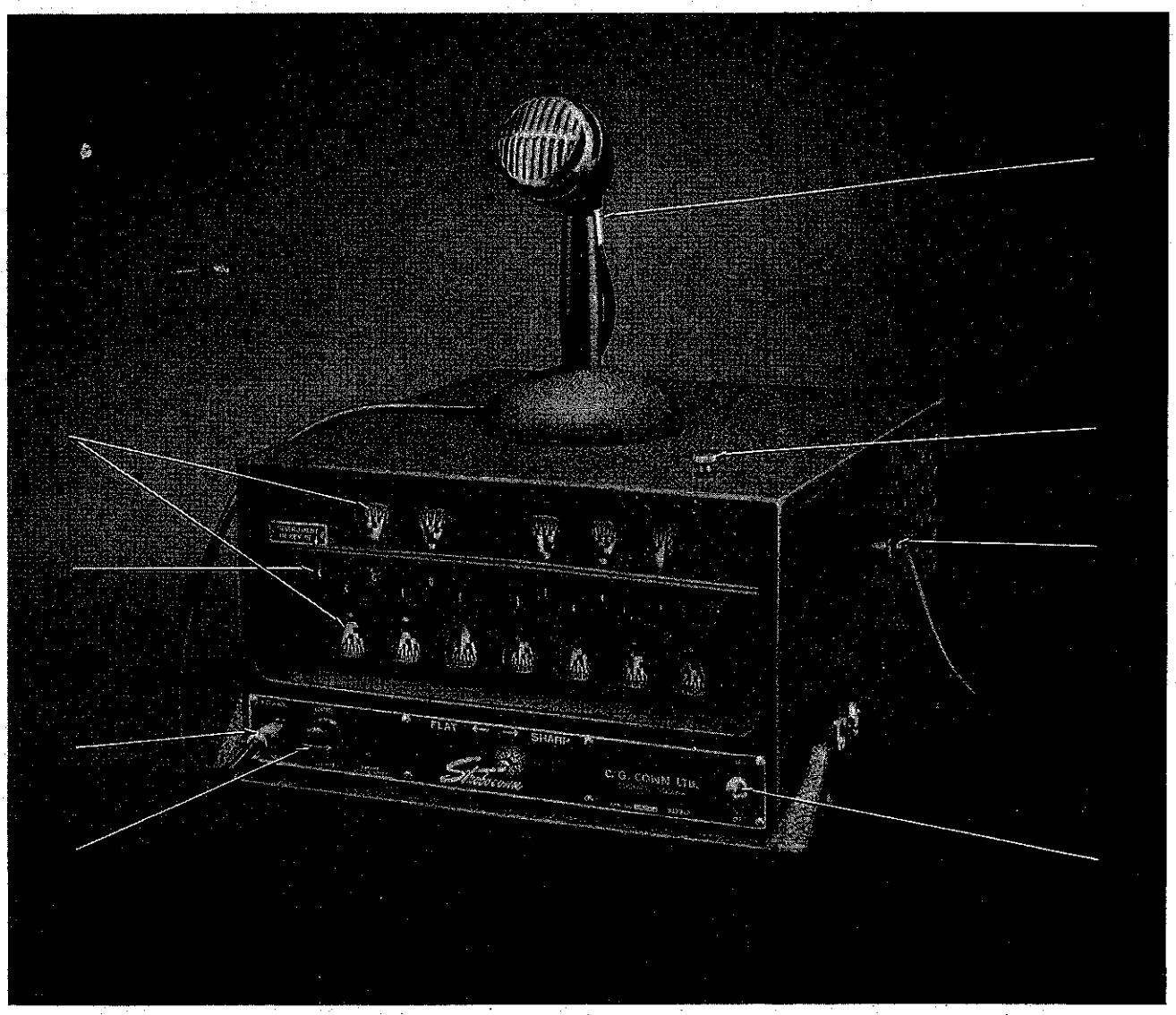


Figure 1—The Complete Stroboconn Junior, Model 8T.

1. Microphone
2. Transposition Knob
3. A-c Power Cable
4. Power Switch
5. Volume Control
6. Microphone Connection
7. Key Signature Window
8. Scanning Windows

SECTION III
DETAILED DESCRIPTION

1. SCANNING UNIT.

a. As may be seen from the illustration in Figure 1, the Scanning Unit of the Stroboconn Junior has in its front side twelve windows occupying positions corresponding to the white and black keys of the piano in an octave from C to B. The twelve notes of the chromatic octave are thus represented. Sound picked up by the microphone causes whirling stroboscopic disks in these windows to become illuminated by a neon tube whose rate of flashing corresponds exactly to the frequency of the tone sounded.

b. On each of the whirling disks there are seven stroboscopic pattern bands, each representing a particular musical note as it occurs in one of seven octaves. Thus 7 x 12, or 84, musical notes may be measured.

c. Because the Stroboconn Junior is completely non-selective in its measurement of musical notes, or any other sound within its range, several pattern bands may appear simultaneously if the tone or sound is complex in nature. A pure tone, such as produced by a flute, will cause only one pattern band of black "spokes" to appear for each note sounded. A violin tone, which has many overtones of different frequencies, will cause several pattern bands to appear in various windows. (*See Figure 2.*)

d. The Stroboconn Junior also will measure each of any number of notes sounded at one time. The summation and difference frequencies, resulting when two or more notes are sounded simultaneously, will be indicated by faint grayish patterns. (*See Figure 3.*)

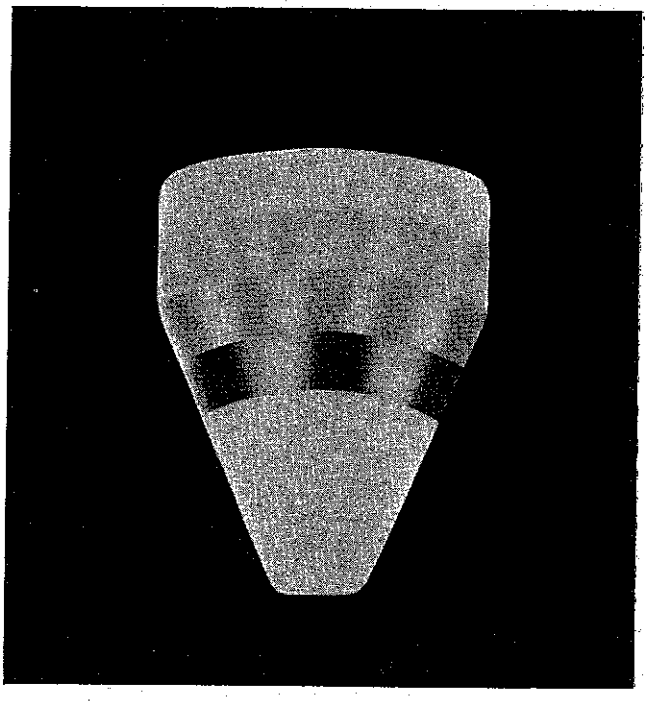
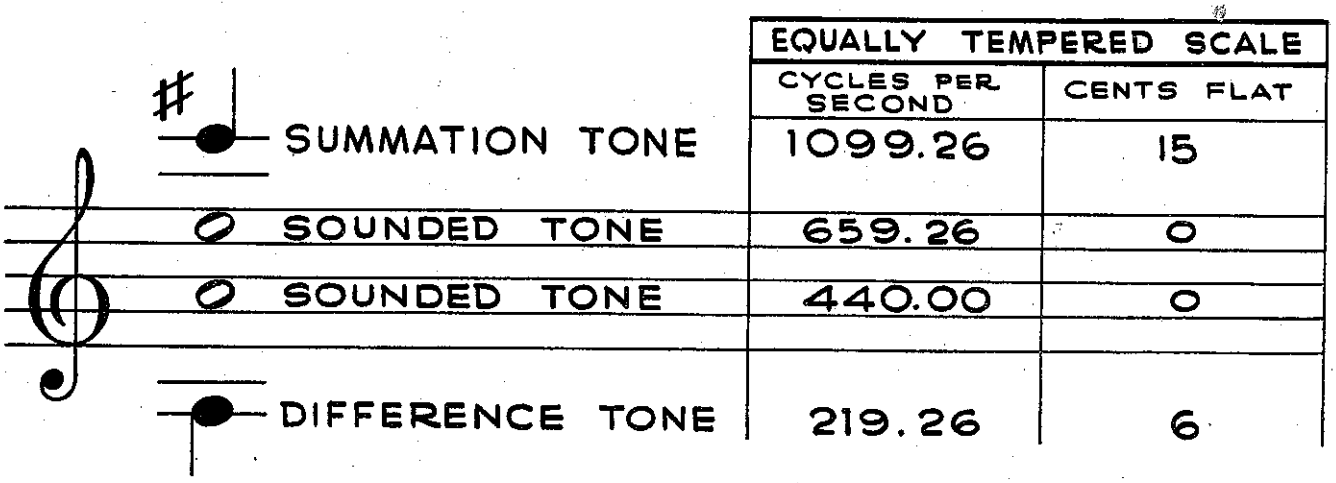


Figure 2—Close-up of Scanning Window.

Illustration shows band pattern of a tone whose fundamental is in the 4th octave and whose overtones are indicated by faint patterns in the 5th and 6th octave bands.



	EQUALLY TEMPERED SCALE	
	CYCLES PER SECOND	CENTS FLAT
SUMMATION TONE	1099.26	15
SOUNDED TONE	659.26	0
SOUNDED TONE	440.00	0
DIFFERENCE TONE	219.26	6

Figure 3—Example of Summation and Difference Tones.

e. The fundamental of any one tone, if unknown, may be located by looking for the black-spoked band that appears nearest the apex in any of the twelve wedge-shaped windows of the Scanning Unit. (*See Figure 2.*) If the fundamental of the tone is known, such procedure is unnecessary, as each of the twelve windows is labeled as to the note it represents and measures. These window markings can be changed, however, to correspond to the key of the instrument whose tones are being tested. This is accomplished by use of the transposing knob on top the Scanning Unit. At the extreme left of the twelve window labels is a small opening wherein the key signature is displayed. (*See 7, figure 1.*) By lifting the transposition knob to different positions the Stroboconn Junior windows can be labeled to read correctly in the keys

of C, D♭, E♭, F and B♭, the commonly used key signatures. Thus when the Stroboconn Junior is set to read in the key of F, for instance, C appears as a label for the window which is marked F when the Stroboconn is set to read in the key of C.

f. By observation of the Scanning Unit a sounded tone may instantly be discovered to be in tune, sharp or flat. No mathematical computations are necessary. If the black-spoked pattern in the window representing this tone appears to stand still when the tone is sounded, the note is known to be in tune to within 1/100th of a semitone. (See Section V, Paragraph 3, *c* and *d.*)

NOTE

Accuracy of the Stroboconn Junior depends upon adherence of the a-c power supply to a frequency of 60 cycles per second, since this frequency is used to control the synchronous motor which drives the stroboscopic disks. Extensive surveys show that in most localities any deviation from 60 cycles is so slight as to be negligible in measuring musical performance. If accuracy of the Stroboconn Junior is in doubt, a check of the power supply's frequency should be made.

If the pattern drifts to the operator's right, the tone is sharper than standard. If the pattern drifts to the operator's left, the tone is flatter than standard. Indication of relative sharpness or flatness is also immediately discernible from the speed of drift, which increases both directions from standard.

2. MICROPHONE.

The Stroboconn Junior microphone is a quality, crystal microphone of the high impedence type. It is supplied with desk-type stand and connecting cable with plug.

3. POWER CABLE.

The Stroboconn Junior power cable is a conventional a-c appliance type.

SECTION IV

PREPARATION FOR USE

1. Unlatch cover of Scanning Unit and lift off. Remove cables and microphone from compartment in case cover.

CAUTION

Do not cover or obstruct ventilating grills of the Scanning Unit. Overheating will cause damage to the instrument.

2. Attach microphone and power cables as shown in Figure 1.

CAUTION

The Stroboconn Junior is designed to operate *only* on a power source supplying 105-120 volts of 60 cycle alternating electrical current. Connection to improper power source may cause damage to the instrument.

3. Lift motor switch to POWER position. Turn volume control to MAX. position. After a warm-up period of about 45 seconds, sounds reaching the microphone should cause the stroboscopic disks to become illuminated for the duration of the sound. The Stroboconn Junior is now ready to operate.

SECTION V

OPERATION

1. PRINCIPLES OF OPERATION.

a. The method of measurement employed in the Stroboconn Junior is stroboscopic in nature. A familiar example of the stroboscopic phenomena is one often seen in motion pictures where a wagon wheel appears to stand still or move backward while the vehicle is moving forward. Movie film is projected at the rate of 24 pictures per second, and because the eye is unable to resolve each picture at this rate of speed a continuous motion is seen. However, when the spokes of a wagon wheel in a motion picture are revolving at such speed that 24 spokes per second pass any given point, the eye no longer sees motion but an apparently motionless wheel. If slightly less than 24 spokes per second pass any given point, the wheel appears to rotate slowly backward. Similarly, slightly more than 24 spokes per second will cause an apparent slow forward rotation. A wheel in motion appears stationary only when the rate at which the pictures are projected exactly equals the product of the number of spokes multiplied by the number of wheel revolutions per second.

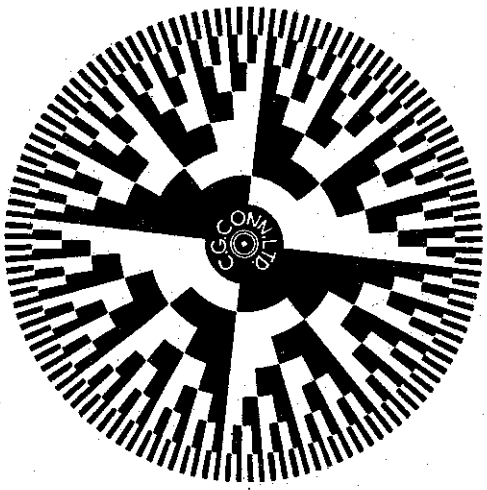


Figure 4—Stroboconn Scanning Disk.

b. In the Stroboconn Junior a neon discharge tube is made to flash in accordance with the pulsations (frequency) of the sound reaching the microphone. The light from this tube is used to illuminate a series of twelve rotating disks which have been imprinted with a pattern such as seen in Figure 4, consisting of seven rings of alternate light and dark segments that correspond roughly to the spokes of a wagon wheel. Each ring, progressing radially from the center, has exactly twice the number of segments as the preceding one, just as musical notes double their frequencies in progressing to successively higher octaves.

c. As an example of how the Stroboconn Junior operates, the 16-segment ring of the Stroboconn Junior "A" (Key of C) disk appears stationary when rotating at a speed of 27.5 revolutions per second and illuminated by light flashes (picture images) occurring at the rate of 440 per second . . . 16 x 27.5 = 440.

d. A sound having a frequency of 438 cycles per second would make the Stroboconn Junior 16-segment "A" ring pattern appear to rotate slowly to the left, and a sound slightly higher in pitch than 440 cycles would cause the pattern on this disk to appear to rotate slowly to the right. In this manner the Stroboconn Junior indicates directly and instantly whether a sounded tone is flatter or sharper than standard.

e. All twelve Stroboconn Junior disks are geared together and are driven by a common power source. Each disk will measure one note throughout a range of seven octaves (the number of segmented bands on each) and, thus, twelve disks will measure a complete chromatic octave through a range of seven octaves.

f. Because the frequency ratio of successive semitones in the Equally Tempered scale is the 12th root of 2, it is impossible to gear the Stroboconn Junior disks together in such a way as to achieve absolutely perfect intervals. By using the two gear ratios 89/84 and 107/101, however, an exceeding close approximation to true equal temperament is possible. The maximum error is about 25 times smaller than any error that can be detected by the keenest human ear. So, for all musical purposes, this error in semitone intervals is of no consequence.

2. OPERATING INSTRUCTIONS.

a. General Instructions.

(1) When the Stroboconn Junior is prepared for use as directed in Section IV, proceed as directed in the paragraph containing applicable technique. (Paragraphs *b, c* and *d* hereunder.)

(2) The Stroboconn Junior microphone is a very sensitive instrument which will pick up sound from quite a distance. It is usually desirable, however, to place this microphone near the source of the sound to be tested and to reduce the volume control on the Scanning Unit to some point below maximum, where a clear pattern can be observed but where unwanted sounds and extraneous noises are not picked up by the microphone. No damage will be caused by excessive sound intensity. However, clearer patterns will result if the procedure above is followed and full volume is used only when needed.

b. Musical Instrument Testing.

(1) *Mallet Played Instruments.*

The xylophone, marimba, vibraphone, glockenspiel, etc., are best tested and tuned by placing the microphone as near the bar being sounded as possible. Any vibrato mechanism should be turned off and the resonator butterfly valves should be turned so that the tube is as open as possible.

(2) *Bowed String Instruments.*

The microphone should be placed as near the instrument as possible. Intonation of both tones of a double-stopped combination may be tested at the same time.

(3) *Plucked String Instruments.*

The microphone should be placed as near the instrument as possible. In testing harps the microphone should be placed near the strings. All the notes in a chordal combination may be tested at one time.

(4) *Cup Mouthpiece Instruments.*

Since intensity of sound from most cup mouthpiece instruments is high, improvement may sometimes be made in the Stroboconn Junior pattern if the microphone control is turned down considerably or the microphone is moved some distance from the instrument.

(5) *Keyed Wind Instruments.*

The same technique is used as is employed in testing cup mouthpiece instruments.

(6) *Tuning Forks and Bars.*

Place the microphone near to and parallel to the flat side of the vibrating part.

c. Testing Vocal Tones.

The vocalist should stand 12 to 14 inches from the microphone. Since some voices are particularly full of strong overtones, faster readings are obtained when the fundamental of the tone sung is known to the operator.

d. Testing Electronic Musical Instruments.

The microphone may be placed near the speaker of the instrument, or impulses may be fed directly into the Stroboconn Junior's microphone connection from the electronic instrument's loudspeaker connections, dispensing with use of the microphone entirely.

3. TIPS TO THE OPERATOR.

a. Changes in temperature have a great effect on musical instruments—wind instruments become sharp with an increase in temperature and string instruments become flat. Bells and other instruments using solid vibrating material (xylophone, marimba, ordinary tuning fork, etc.) likewise become flat with a rise in temperature. Most instruments are made to perform with best intonation at a temperature of 72 degrees Fahrenheit under conditions of 50% relative humidity. Tunable wind instruments, however, are manufactured with a scale that is acceptable within a range of 23 degrees Fahrenheit either way from this standard.

NOTE

Accuracy of the Stroboconn Junior depends upon adherence of the a-c power supply to a frequency of 60 cycles per second, since this frequency is used to control the synchronous motor which drives the stroboscopic disks. Extensive surveys show that in most localities any deviation from 60 cycles is so slight as to be negligible in measuring musical performance. If accuracy of the Stroboconn Junior is in doubt, a check of the power supply's frequency should be made.

b. Musical instruments are built to have correct intonation with reference to the tuning note. As a general practice, always check an instrument's tuning note first. Some musicians, however, have a tendency to sound the tuning note unnaturally. Any error due to this tendency may be reduced by measuring other tones within the range of the instrument, or a series of tones, to determine the average tuning. The intonation of a musical passage is also sometimes used to check intonation. In making such a measurement it is useful if the Stroboconn Junior observer is familiar with the passage being played. He can then locate and measure the tones more rapidly.

c. Since some variation is allowable in actual musical performance, a student should not be discouraged if he cannot make each pattern of the Stroboconn Junior stand perfectly still. Because of the instrument's extreme sensitivity, differences in pitch smaller than those discernible by ear often will cause some motion in the band pattern. Vibrato will cause the pattern to rock back and forth.

d. Many excellent musicians feel that strict adherence to the Equally Tempered scale does not permit the fullest measure of artistic musical performance. It has been found that while the Equally Tempered scale is not strictly adhered to, neither is the Just nor Pythagorean scale consistently used. The Equally Tempered scale, with its flexibility and wide acceptance, is therefore justified as the best reference from which to measure the deviations of actual performance.

e. Struck strings, bars and bells may produce inharmonic overtones. The Stroboconn Junior makes it possible to compare frequencies of these overtones even in the presence of strong fundamentals. If further discrimination is required, however, an adjustable filter can be used in connection with the Stroboconn Junior.

NOTE

The fundamental tone (if unknown) may be located by looking for the black-spoked band that appears nearest the apex in any one of the twelve wedge-shaped viewing windows.

SECTION VI

INSPECTION, LUBRICATION, MAINTENANCE

1. INSPECTION.

a. The Stroboconn Junior is strongly but simply made. It needs no inspection before operating.

2. LUBRICATION.

a. Where the Stroboconn Junior is used steadily 8 hours or more a day, oil in the Scanning Unit gear box should be replenished about every six months. Access to the gear box may be had by removing the unit's cover as described in Paragraph 5, *a,* this Section. No oil should be visible when the gear box plug (2, *figure 5*) is removed, as it is held by absorption in the felt lining of the reservoir. One-half ounce is sufficient for six months of operation under the above mentioned conditions. Pour oil into reservoir with motor running.

CAUTION

Only special Stroboconn gear box lubricating oil should be used. Any other oil may cause damage to the instrument. See list of accessories in Section VII, Paragraph 1.

b. The synchronous motor in the Scanning Unit should be oiled at the same time the gear box is lubricated. (*See 1, figure 5.*) Any good lightweight motor oil may be used, but the motor oil listed under "Accessories" in Section VII, Paragraph 1, is recommended.

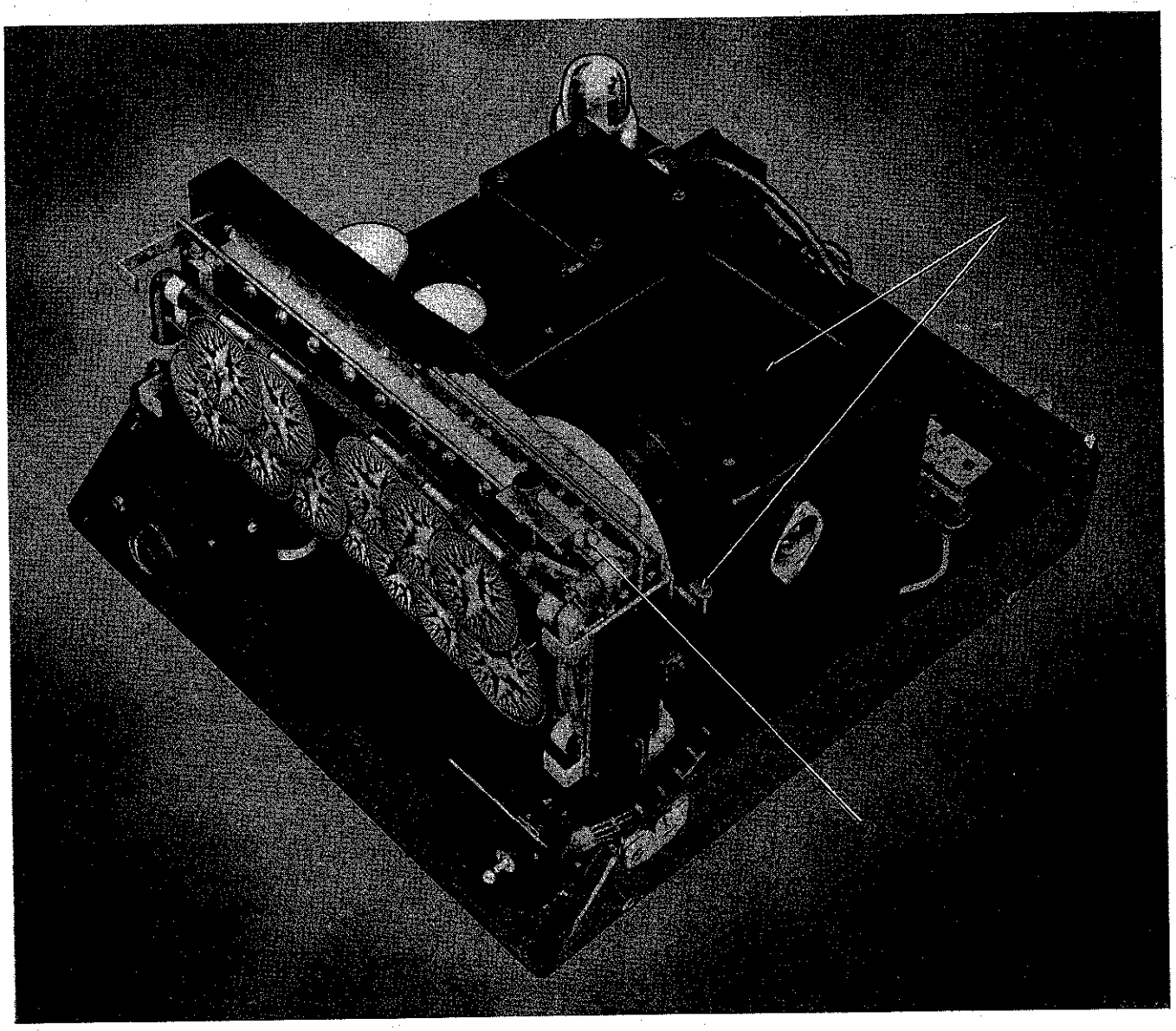


Figure 5—Stroboconn Junior With Cover and Mask Off.

1. Oil Cups for Motor
2. Gear Case Oil Plug

3. MAINTENANCE.

a. Precautions.

(1) The Stroboconn Junior is *not* intended for use under extremes of temperature or under conditions of extreme humidity, and it is *not* fungi-proofed.

(2) It should be remembered that the Stroboconn Junior is an electronic instrument and should, therefore, be reasonably protected from jars, bumps and excessive vibration.

(3) The microphone should be protected from jars, and should not be blown into when testing. Also, it must be protected from long exposure to direct sunlight or any source of heat which will cause it to attain a temperature above 120 degrees Fahrenheit.

(4) The grills of the Stroboconn Junior unit should not be covered when the instrument is in operation. Excessive heat will cause damage to the instrument.

b. Electronic Tube Replacement.

The Stroboconn Junior's circuits are not critical as to electronic tube replacement, but only a tube whose number exactly corresponds with the number stamped on the chassis beside the tube socket should be used.

c. Fuse Replacement.

If failure of an electronic tube or other circuit component has caused one of the Stroboconn Junior fuses to "blow," it should be replaced with one of exactly the same rating, as shown by the number stamped between the fuse clips. Otherwise, serious damage to the instrument may result.

d. Neon Tube Replacement.

The flashing neon tube used to illuminate the whirling disks of the Scanning Unit may be replaced by removing the four securing clamps and unsoldering wire leads of the lamp from the terminal board, after removing the unit's cover as directed in Paragraph 5, *a*, this Section.

4. CALIBRATION CHECK.

A simple spot check of the Stroboconn Junior's accuracy may be made by comparison with the A-440 signal broadcast by the Bureau of Standards radio station WWV in Washington, D. C. This signal is broadcast about 4 minutes out of every 5, on 5 and 10 megacycles. The signal may be fed from loudspeaker to microphone, or directly into the microphone input jack of the Stroboconn Junior. The Bureau of Standards signal should cause the scale-of-C, fourth-ring A pattern to stand still.

NOTE

Accuracy of the Stroboconn Junior depends almost entirely upon adherence of the a-c power supply to a frequency of 60 cycles per second, since this frequency is used to control the synchronous motor which drives the stroboscopic disks. Extensive surveys show that in most localities any deviation from 60 cycles is so slight as to be negligible in measuring musical performance. If accuracy of the Stroboconn Junior is in doubt, a check of the power supply's frequency should be made. Also, the Bureau of Standards signal may vary momentarily as much as 1% at points remote from Washington. A steady pattern drift of one spoke per second indicates a frequency deviation of 1 cycle per second (at 440 cycles) or a frequency deviation in the 60 cycle supply of only about 1/25th of a semitone.

5. CIRCUIT CHECK.

a. Preparation. (*See Figure 1.*)

First remove screws in cover, the volume control knob (5), and the transposition knob (2), which unscrews. Lift up back of cover while holding front side down. Then lift straight up.

b. Amplifier.

(1) Connect a-c power cable and lift Power Switch to POWER position. Allow 45 seconds for warm-up and then remove shield cap from 6J7 input tube and touch grid cap with finger. U-shaped neon tube should light. If this checks all right, look for short circuit in the microphone circuit or defective contact at input jack. Measure resistance at the microphone plug. A dynamic microphone should have a continuity resistance of several hundred ohms; a crystal microphone should be an open circuit. Next, measure resistance between grid clip and ground. This should be 3 megohms with the volume control at MAX. and about 30 ohms or less at OFF.

(2) If U-shaped neon tube does not light when grid cap is touched, check electronic tubes.

WARNING

Shut off a-c power. High voltage may cause bodily injury if power is on when next step is performed.

Pull out neon tube cable plug and measure resistance between its center prong and shell. This should be an open circuit at low voltages. Next, measure resistance between center terminal of plug socket and ground. This should be approximately 44,000 ohms.

(3) Should the above fail to reveal the source of trouble, take chassis from case by removing nuts at corners. Connect a-c power and measure voltages indicated on schematic diagram (*Figure 6*). Compare results with voltages listed. Any unusual discrepancy should be investigated. Disconnect a-c power and measure resistances and capacitances of components as given on the schematic diagram. Check for accidental grounds and inspect all wiring and all soldered connections. Next, connect a-c power and measure gain. With an input of 1.5 millivolts at 440 cps applied to the grid of the 6J7 tube (115v. line voltage), the U-shaped neon tube should glow steadily.

c. Gear Box.

Connect a-c power, lift Power Switch to POWER position. After running for 15 minutes, listen to sound produced. A high-pitched whine indicates insufficient oil, while a rattling sound may indicate worn bearings and gears. Unscrew oil plug (*2, figure 5*) and add not more than ½ ounce of Stroboconn Junior gear box lubricating oil while motor is running. (See Paragraph 2, *a*, this Section.) The oil should be completely absorbed by the felt reservoir lining in a few minutes. If, after oiling, the gear box is still noisy, the complete Scanning Unit should be returned to the factory for repair.

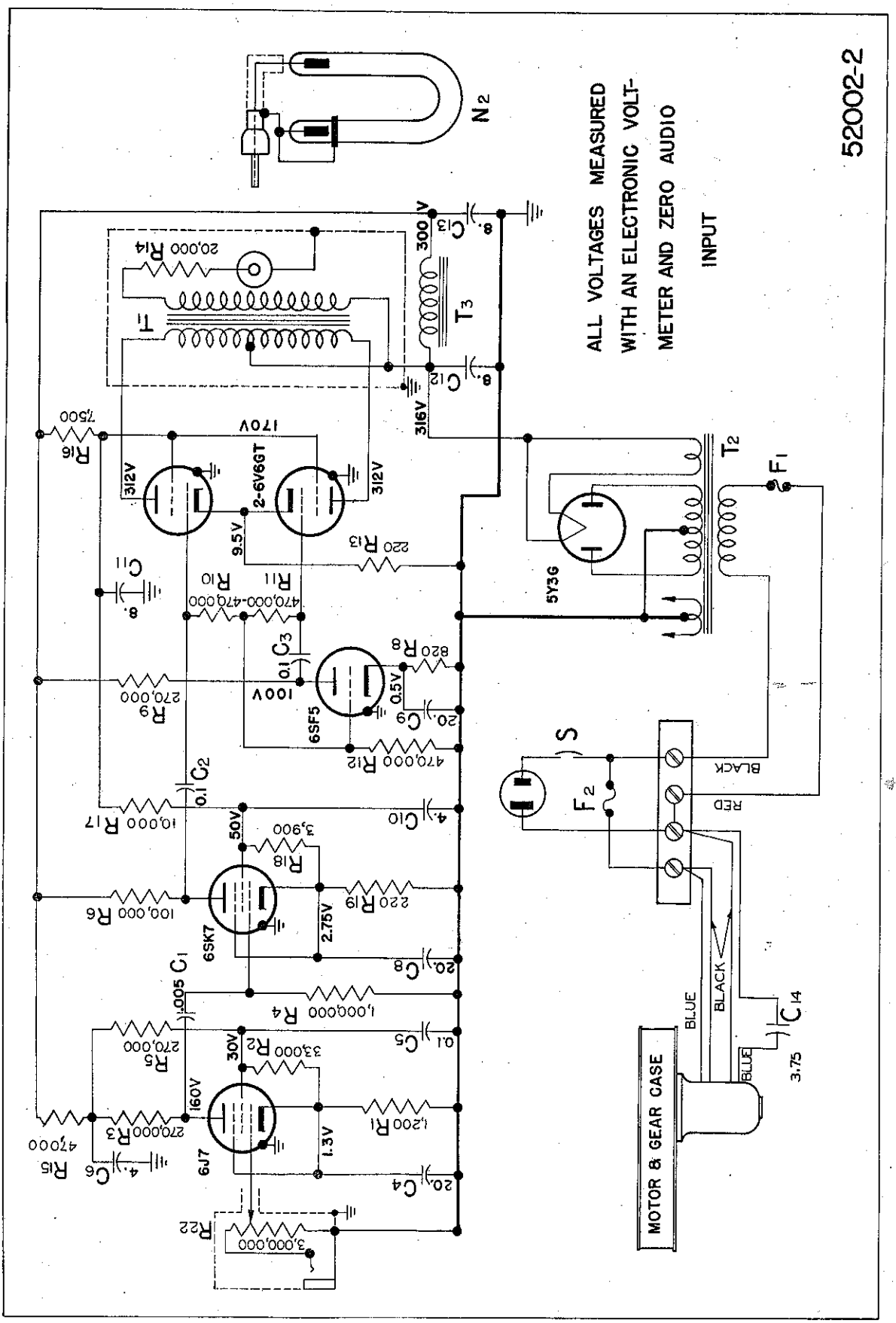


Figure 6—Schematic Diagram of Stroboconn Junior.

SECTION VII

ACCESSORIES AND REPLACEMENT PARTS

1. ACCESSORIES.

a. Table with wheels. Convenient for moving instrument to different locations. Table has heavy Keratol-covered top, nickel plated tubular steel frame, rubber wheels equipped with brakes. Can be completely disassembled in few minutes to fit in case formed by table top and lid. No. 50624.

b. Waterproof mackintosh zipper cover for Stroboconn Junior. No. 48532.

c. Crystal microphone with 12-foot cable and plug connection. No. 45280.

d. Contact microphone equipped with attachments for use in piano tuning. 10-foot cable and plug connection. No. 50754.

e. Extension cable for microphone, complete with connections. No. 48522. 20 and 50-foot lengths. No. 48523.

f. Floor stand for microphone. Adjustable from 36 inches to 76 inches in height. Chrome plated stem, heavy black finish base. No. 50640.

g. Switch box for alternative connection of six separate microphones. Useful for testing different sections of band and orchestra or for checking various studios from central location. No. 48524.

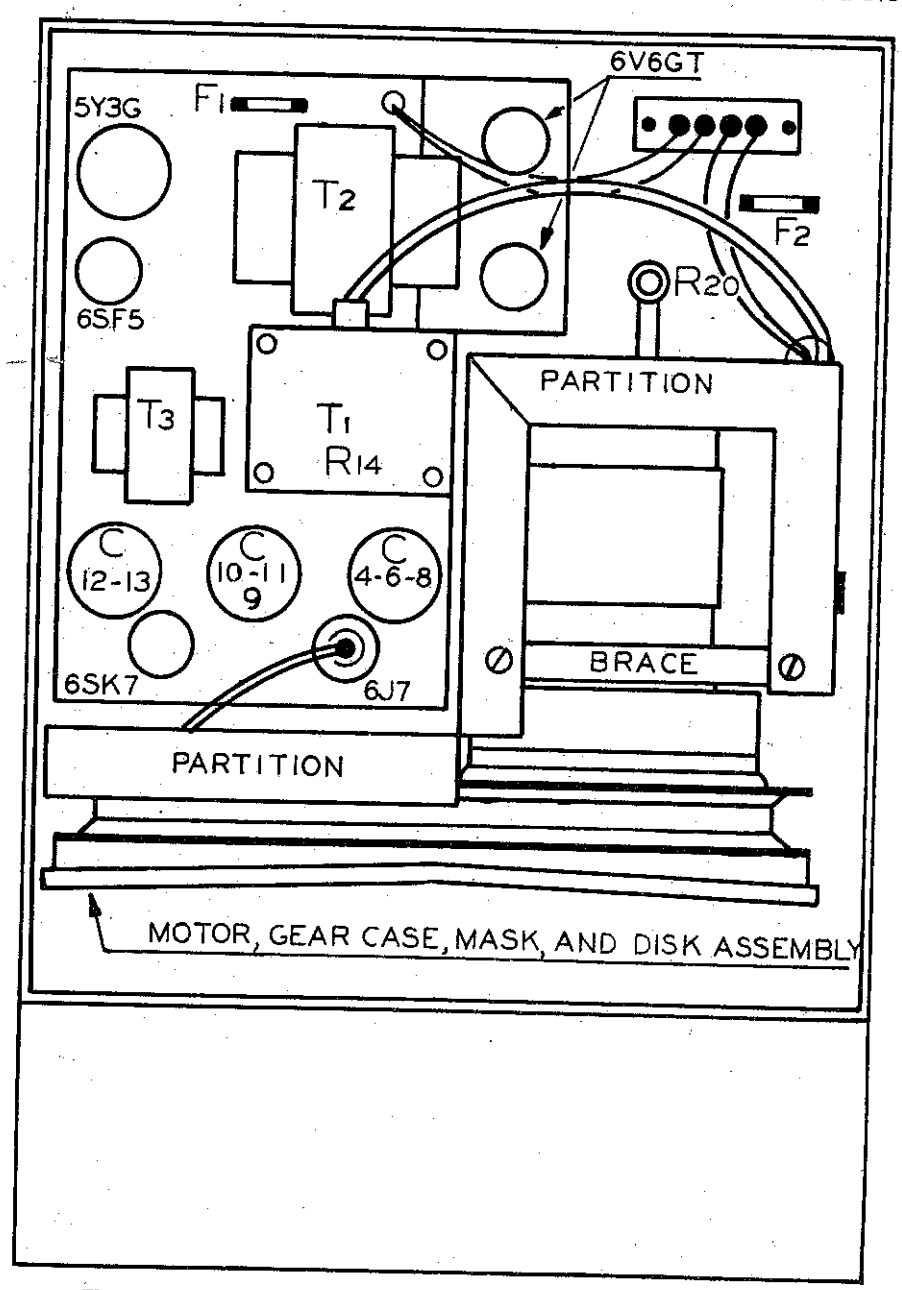


Figure 7—Simplified Schematic Top View of Stroboconn Junior.

b. Stroboconn Oil.

(1) Oil for Tuning Unit motor. 1-ounce bottle. No. 48525.

(2) Oil for Tuning Unit gear box. 1-ounce bottle. No. 48526.

i. Connivar Tuning Bars. Made of special metal that is almost entirely unaffected by temperature changes. All bars have patented suspension mounting, which permit extraordinarily clear and sustained tones, and come equipped with resonator and mallet. Bars listed are more popular tunings. Others can be furnished on special order.

(1) A-440, single bar. No. 26718.

(2) B♭-466.2, single bar. No. 26721.

(3) Set of 4 bars, A-440, A-435, A-445, A-880, mounted on one resonator base, complete with mallet. No. 50792.

(4) Set of 8 bars, A major scale, A-440 to A-880, tuned to Equally Tempered scale, mounted on one resonator base; complete with mallet. No. 50954.

(5) Set of 8 bars, same as above except tuned to the Just scale. Valuable in comparing differences between the two scales. No. 50952.

(6) Set of 8 bars, same as above except tuned to the Pythagorean scale. No. 50955.

j. "A Table Relating Frequency to Cents," by R. W. Young, gives frequencies for each 1/100th part of a semitone, auxiliary tables, and other valuable information.

2. REPLACEMENT PARTS.

a. Scanning Unit.

R1, Resistor, 1,200 ohm, 1 sw—#43547
R2, Resistor, 33,000 ohm, 1 w—#43646
R3, Resistor, 270,000 ohm, 1 w—#43648
R4, Resistor, 1,000,000 ohm, ½ w—#50891
R5, Resistor, 270,000 ohm, 1 w—#43648
R6, Resistor, 100,000 ohm, 1 w—#43640
R8, Resistor, 820 ohm, 1 w—#43545
R9, Resistor, 270,000 ohm, 1 w—#43648
R10, Resistor, 470,000 ohm, ½ w—#45228
R11, Resistor, 470,000 ohm, ½w—#45228
R12, Resistor, 470,000 ohm, ½ w—#45228
R13, Resistor, 220 ohm, 2 w—#48439
R14, Resistor, 20,000 ohm, 10 w—#50897
R15, Resistor, 47,000 ohm, 1 w—#43847
R16, Resistor, 7,500 ohm, 10 w—#50899
R17, Resistor, 10,000 ohm, 10 w—#50894
R18, Resistor, 3,900 ohm, 1 w—#44182
R19, Resistor, 220 ohm, 1 w—#43543
R22, Volume Control, 3,000,000 ohm—#50270
C1, Capacitor, 0.005 mf, 500 v Mica—## #50912
C2, Capacitor, 0.1 mf, 400 v Paper—#50822
C3, Capacitor, 0.1 mf, 400 v Paper—#50822
C4, C6, C8, Capacitor, 20 mf 25 wv, 4 mf 450 wv, 20 mf 25 wv Electrolytic—#52022
C5, Capacitor, 0.1 mf, 400 v Paper—#50822
C9, C10, C11, Capacitor, 20 mf 25 wv, 4-8 mf, 450 wv Electrolytic—#52021
C12, C13, Capacitor, 8-8 mf 500 wv Electrolytic—#52023
N2, Lamp, Tubular Neon with Coating—#50265
S1, Switch, SPST Toggle—#50908
F1, Fuse, 2.0 Ampere—#50901
F2, Fuse, 1.0 Ampere—#48446
J, Jack, Microphone, Single Circuit—#55053
T1, Transformer, Output—#52016
T2, Transformer, Power—#52004
T3, Reactor, Filter—#52005