



Caution

To prevent a damaged or burned-out meter or rectifier observe the following precautions.

- (1) Always have test-leads in series with current under test.
- (2) Always adjust the meter with the zero ohm adjust control as specified in the manual when measuring resistance, capacitance, etc.
- (3) Before making resistance and capacitance measurements ensure that no voltage exist across the resistance or capacitance under test. Failure to observe this precaution may result in a damaged instrument.
- (4) Connect test-leads to plus and minus terminal of the meter unless otherwise specified.
- (5) When in doubt of an AC or DC voltage, begin the test with the highest range and work down.
- (6) When measuring, turn the polar reversing switch completely to the left (white dot), unless otherwise specified.

The polar reversing switch has three poles, the left (white dot) is normal polar position, the right (black dot) is the reversing polar position, and the center is neutral position when carrying or no using, keep the reversing switch at neutral position.

Accessories (included with FN multimeter).

- (1) Standard test-leads.
- (2) IG probe (non-interference)
- (3) High voltage probe. (1400 VDC/3500 VAC)
- (4) High voltage probe (28 KV)
- (5) RF head probe.
- (6) Leather case.

Hansen FN

The model "FN" is a new member of the Hansen family of fine instruments. With its extreme wide voltage ranges, high sensitivity, and accuracy; it is most suitable for transistor and color television engineers. The polar reversing switch and germanium diode of the model "FN" enable the measurement of resistances, DC/AC voltages, and RF frequencies to be accomplished more easily and quickly than the conventional meters.

Since the model "FN" has the polar reversing switch, the reversal of test leads for DC readings is not necessary. Another feature of the "FN" is the tri-color printed scales. Whenever the selector switch indicates a certain range or type of measurement, the reading will be taken from the colored scale corresponding to the color indicated by the selector switch range. Note that when the selector switch is in the ohms range. (indicated by the green x10, x1K, x0.1) the reading is taken from the ohms scale, also printed in green. This is true for all phases in selecting ranges and scales. The AC is in red, DC in black, etc.

Ranges

DC Volts : 0~0.28, 1, 4, 7, 35, 140, 350, 700 volt
(20,000 ohms/Volt AC)

AC Volts : 0~1, 4, 7, 35, 140, 350, 700 volts.
(5,000 ohms/Volt AC)

High volts : 0~1,400 7,000, 28,000V(1.4~28KV) DC
0~3,500, 28,000V (3.5~28KV) AC.

DC milliamperes : 0.7, 140mA.

DC microamperes : 0~50 μ A (Fist division = 1 μ A)

RF Volts : 0~14 volt RMS, 0~40 volt P-P.

DB : -20~+59.

Ohms : 0~5,000, 500K, 50Megohm.

Microfarads : 0~0.03, 0.6.

Henries : 0~5H, 500H.

Non-interference DC volts : 0~28, 140, 700, 1,400volt.

Non-interference DC amperes (where RF is presented).

Tube Emission. Gm checker, etc.

Instruction

1) AC Volts (5,000 ohms per volt)

Set selector switch to AC volt range desired. Measure AC volts by standard method.

When selector is at 35, 140, 350 or 700 volt position, use AC red scale for reading. If selector is at 7 volt AC position, use red "7 volt only" scale. If selector is at 1.4 volt AC, use green "1.4 volt only" scale.

2) DC Volts (20,000 ohms per volt)

Set selector switch to DC volt range desired. Measure DC volts by standard method. For reading, use DC black scale.

3) High Voltage See Fig. 1 and 2

i) When measuring high voltage, use 28 KV "high voltage" probe and refer to the following chart.

Chart 1

Range	DC 28,000	DC 7,000	AC 28,000
Connect red alligator clip to	black-tip(—)	red-tip (+)	red-tip (+)
Selector position	700 V DC	140 V DC	700 V AC
Caution			Peak voltage limit is 32 KV

When measuring high voltage in this manner, connect black alligator clip of high voltage probe to chassis (ground).

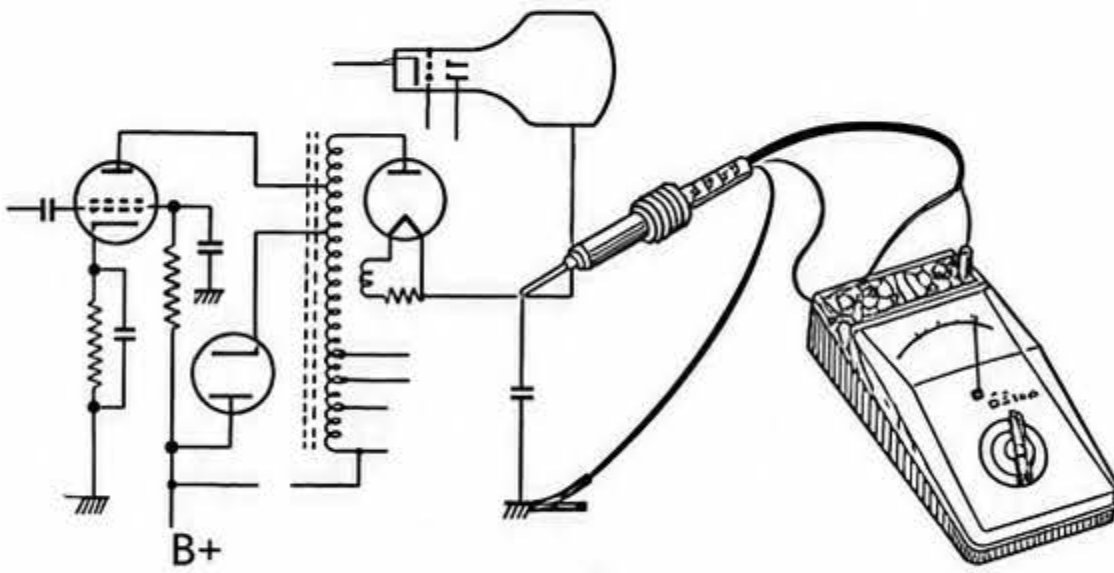


Fig. 1

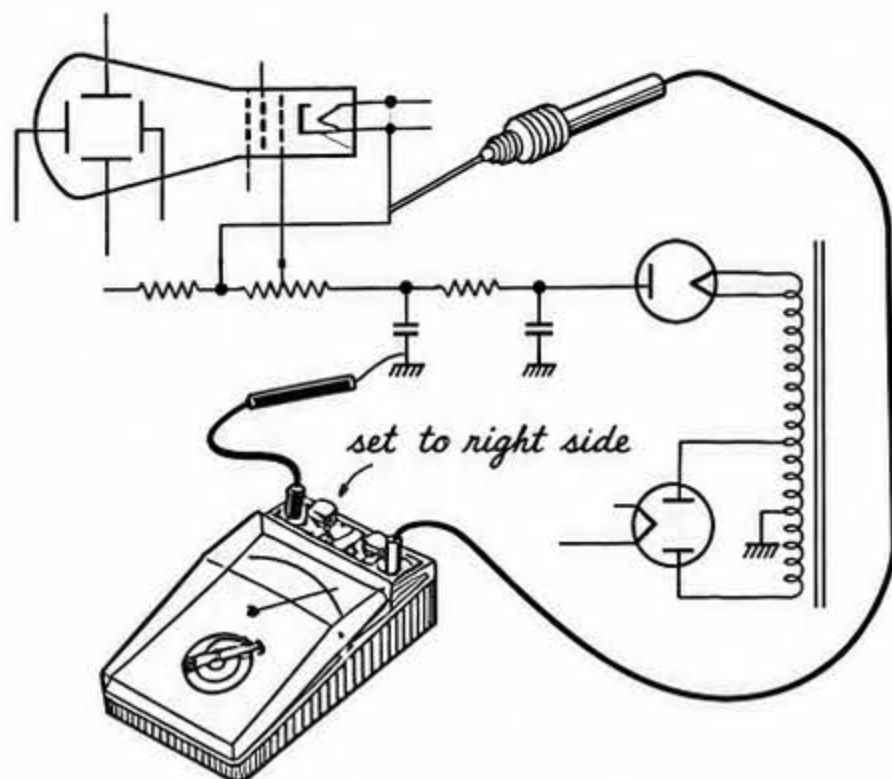


Fig. 2

- ii) Set selector to AC or DC 700 volt range, and connect high voltage probe (1400 VDC/3500VAC) to plus terminal; and the ranges are expanded to 3500 volts AC or 1400 volts DC.

When using this method, connect minus lead to chassis (ground).

4) RF Voltage

The FN multimeter has a built-in germanium diode. So the multimeter can be used as RF Volt meter like a VTVM.

Set selector to DC 140 Volt position marked RF., Connect RF head probe to RF terminal and minus lead to minus terminal. Place RF head probe where RF is presented. And minus lead to chassis (ground).

5) Decibels

Connect standard leads to DB and minus terminals, Set selector to DB range desired. The DB is read by the black scale from minus 15 to plus 59 DB. If selector is at AC 1.4 Volt position, use the 1.4 Volt only DB scale.

6) Non-interference DC Volts

By using the IG probe, transmitter DC plate voltage, oscillator DC voltage (including TV sweep amplifier grid or plate voltage), and DC voltage can be measured where RF is presented. Use of this multimeter will not interfere with circuits, even when RF is presented.

For selecting position and connecting terminals, etc., refer to the following chart.

Chart 2

Range	28 V	140 V	700 V	1400 V
Probe	IG	IG	1400VDC/ 3500VAC	1400VDC/ 3500VAC
Tip connect	Gray to + Brown to DB	Brown to + Gray to DB	+ terminal	+ terminal
Selector position	1.4 VDC	7 VDC	1.4 VDC	700 VDC

7) Resistance

Select ohm range desired. Short test leads and adjust zero-ohm control for a zero-ohm reading. Measure resistance by standard method.

8) Very high resistance

In order to measure high resistance value, switch selector to Meg $\Omega \times 0.1$, connect brown tip of IG probe to plus and gray tip to DB terminals, use 150~300 volt DC source.

Then the multimeter will be meg-ohm $\times 1$, and up to 500 meg-ohms can be measured by direct reading.

9) DC Current

Switch selector to current ranges desired. Connect test leads in series with current source to be measured. Three DC current ranges are available from 50 microamperes at full scale to 140 milliamperes full scale. For microampere reading, use microampere red scale. The 50 microampere selector position is 0.28 DC volt position.

10) For measuring grid current See Fig. 4

Connect one test lead to minus terminal and gray tip of IG probe to the plus terminal and the brown tip to DB terminal. Set selector to 1.4 volt DC where it marked IG.

Place IG probe on grid negative side of grid bias resistor and plus lead to plus side of bias resistor. Consult chart for grid current value when full scale reading is obtained. By using this method, grid current of receiver's local oscillator and transmitted stage by tuning can be accomplished. Also, the grid current value in milliampere can be obtained.

Chart 3

Resistance valve (KΩ)	200	100	80	70	56	40
Fuli scale (mA)	0.14	0.28	0.35	0.4	0.5	0.7

28	20	14	10	8	7	5.6	4
1.0	1.4	2.0	2.8	3.5	4	5	7

If the resistor value is not illustrated in the chart

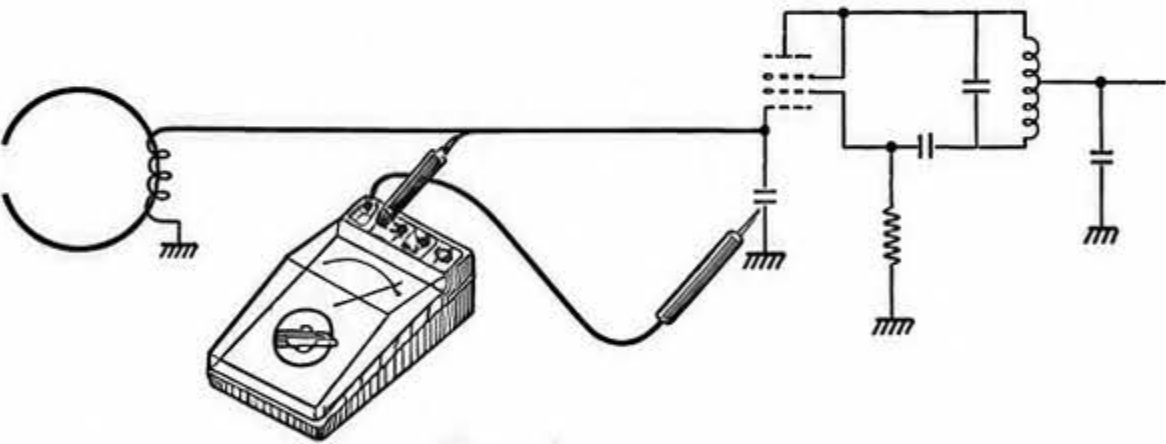


Fig. 3

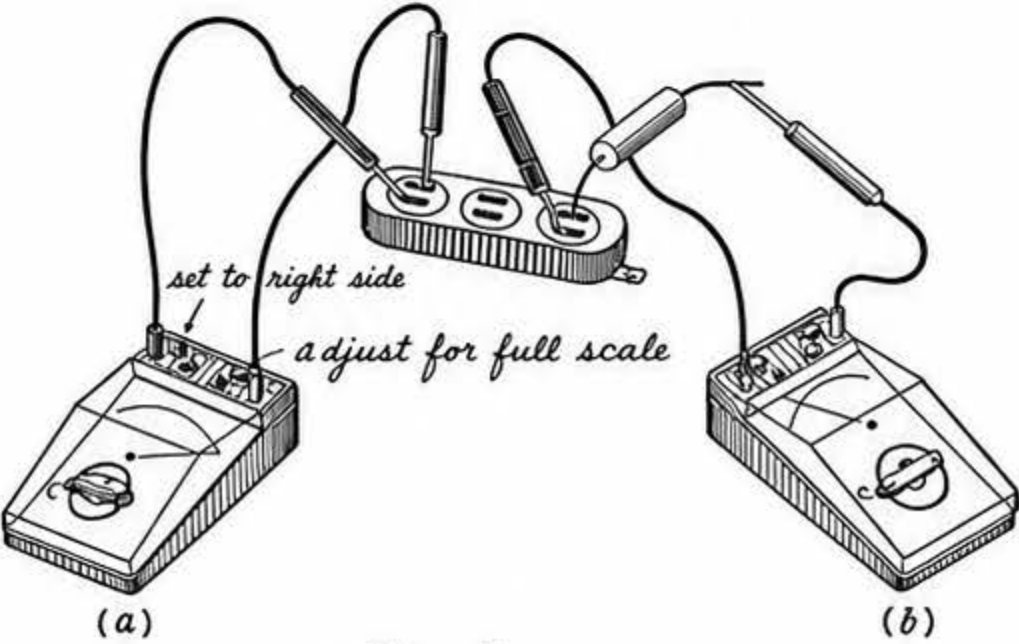


Fig. 5

3 within 20 K ohm, the full scale reading is required using the followig equation. Full scale (mA)=28/Resistance (K Ω).

If the resistor value is larger than chart 3, exchange the tip connection, set selector to DC 7 volt range and refer to chart 4.

Chart4

Resistance value (K Ω)	1000	700	500	400	350
Full scale (mA)	0.14	0.2	0.28	0.35	0.4

280	200	140	100	70	50	40	35	28	20	14	10
0.5	0.7	1.0	1.4	2	2.8	3.5	4	5	7	10	14

If the resistor value is not illustrated in the chart 4, within 1 megohm, the full scale reading is required using the following equation.

Full scale (mA)=140/Resistance (K Ω)

11) Capacitance See Fig. 5

Set selector to 140 volt AC range marked C and change the polar reversing switch to right side (marked with black point), connect the test leads to the plus and minus terminals.

Obtain 90 to 250 volt AC, 50~60c/s, source. Adjust zero ohm control for full scale. Connect capacitance to be measured in series with plus or minus lead, connect leads with capacitance to the AC line.

The capacitance reading will be directed.

12) Large capacitance

To measure large capacitance., set selector to 7 volt

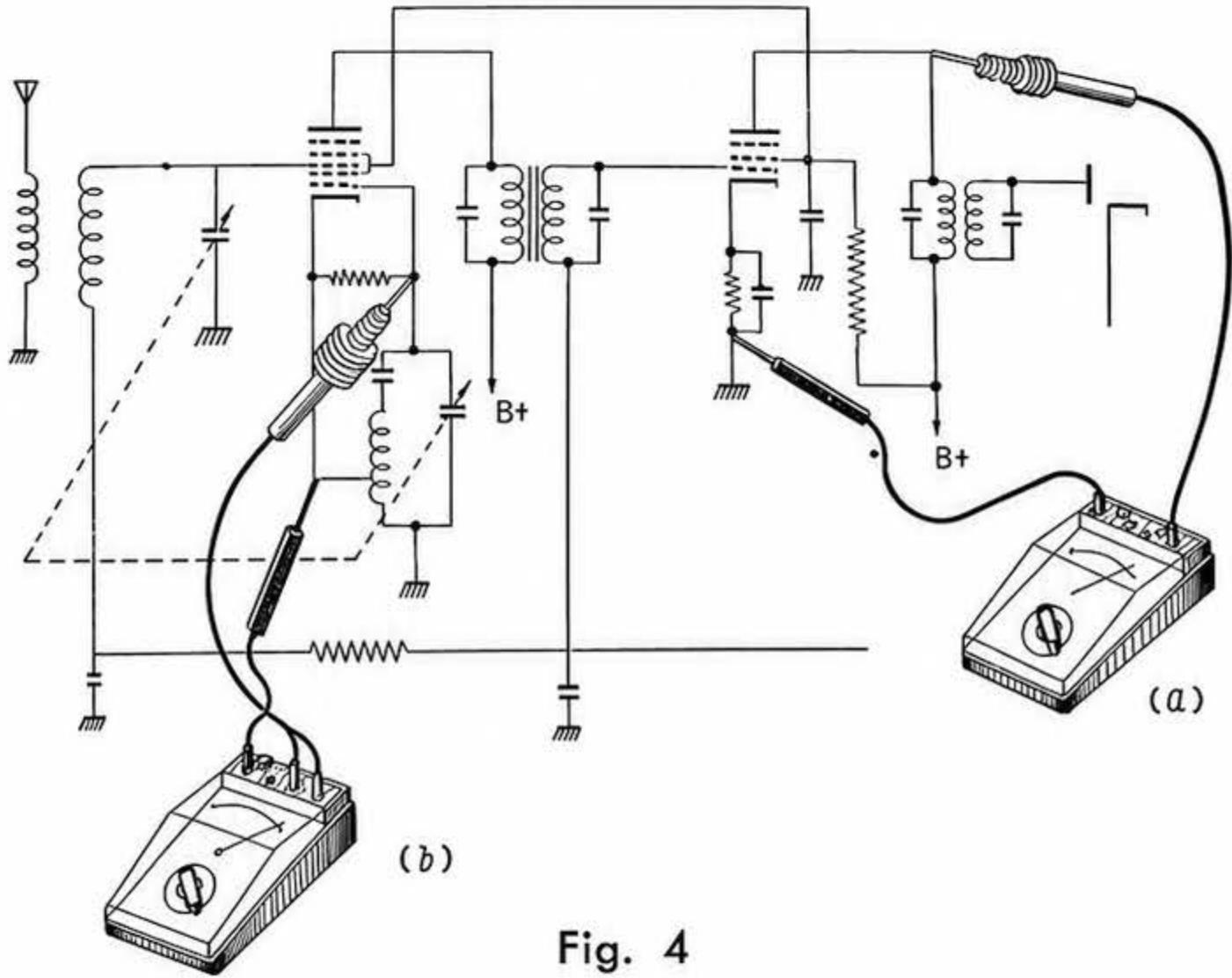


Fig. 4

AC range marked C $\times$ 20, and the polar reversing switch to black point. Obtain 5~6.3 or 12 volt AC, 50~60c/s, source. Measure capacitance as per method in the above paragraph. Then the scale reading will be reduced 20 times.

To measure larger than the above capacitance. Connect the three 1 K ohm resistors in parallel across the plus and minus terminals of the multimeter.

Set to C $\times$ 20 range, measure as per above method. It will be C $\times$ 2000 range up to 60 μ F can be measured.

13) Inductance

Inductance will be measured as per method for C $\times$ 20 or C $\times$ 2000.

The C $\times$ 20 range is used as L $\times$ 1 range, and the C $\times$ 2000 is L $\times$ 0.01.

Refer to the following figure 6 for inductance reading, it is illustrated as L $\times$ 1 range.

When using L $\times$ 0.01 range the inductance reading will be reduced to 1/100.

14) Tube-Emission See Fig. 7

Place selector in ohm $\times$ 1K position. Short test leads and adjust for zero ohm. Remove B plus from the tube and plus lead to cathode. If grid leak or bias resistor it lower than 30,000 ohms, disconnect the resistor from the grid. If over 30,000 ohms, it is not necessary to disconnect. Refer to the following chart 5 for testing.

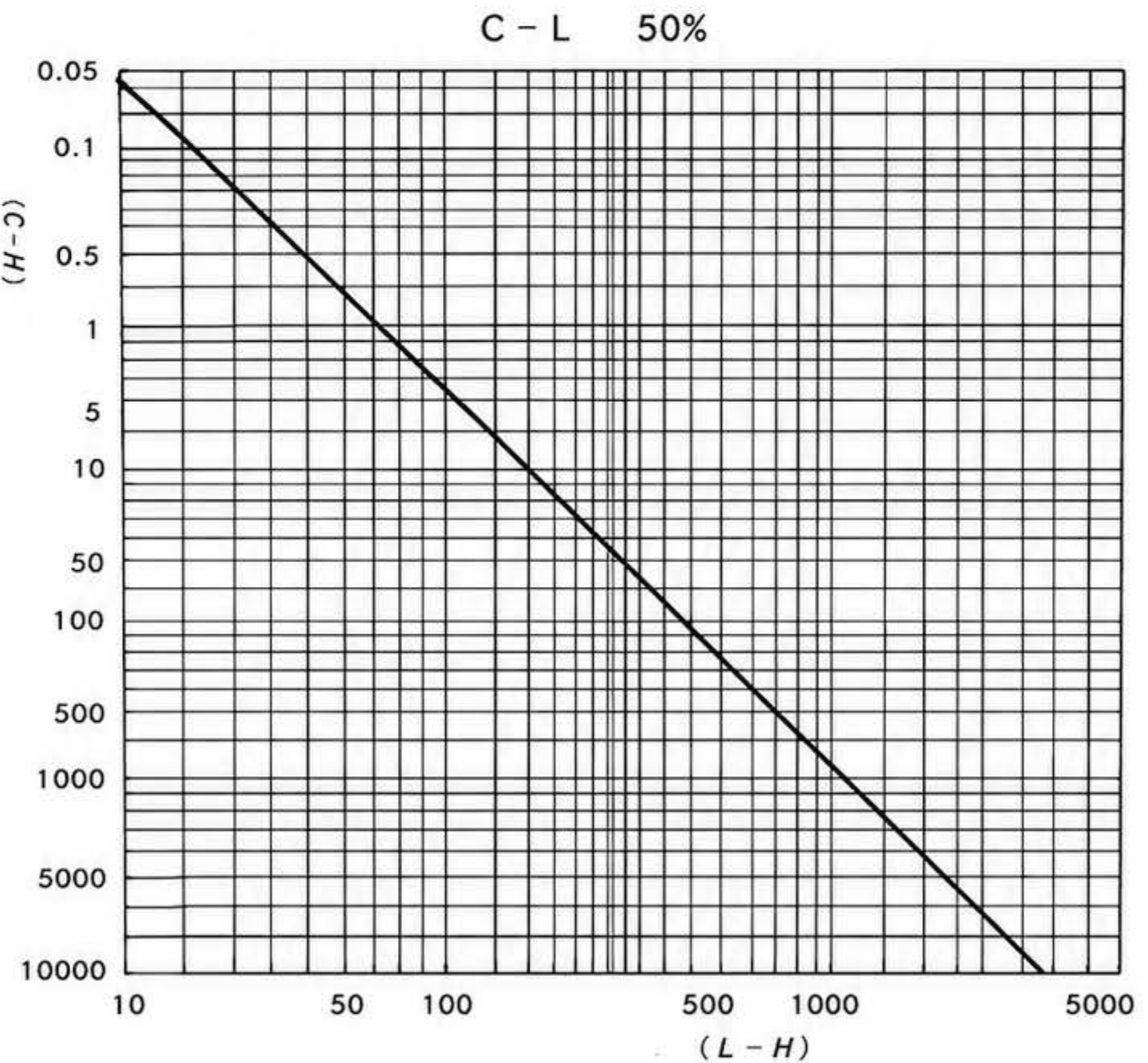


Fig. 6 (A)

Note. Use DC black scale (full scale 140). The small figure 2 in the chart denotes diode section, 5 denotes pentode section.

Chart 5

Reading for Good tubes	Tubes
130~cale over	6J4, 35Z5, 6AU4, 12GK17
125~cale over	6AG7, 6AX4, 6CL6, 6W4
120~cale over	6AC7, 6AG5, 12AT7, 6U8 ₃
115~cale over	2C51, 6AK5, 6AS6, 6AL5, 6BQ7A, 6SD7, 6UB ₅ 12BH7A, 5Z4, 6CB6
105~cale over	5MK9, 6BA6, 6BE6, 6BG6, 6SH7, 6SG7, 6J6, 6SA7, 6WC5, 80HK, 807, KT66, 6AU6,
100~130	6AQ5, 6BQ5, 6CU6, 6L6, 6V6, 2A3, 6GB6
90~120	6J5, 6SN7, 6SL7, 6X4, 6X5, 12F, 12AU7, 12AX7, 5Z3 6BD6, 5U4G
75~110	6C5, 6C6, 6D6, 6F6, 6H6, 6SC7, 6SJ7, 6SQ7 _{3i} , 6SK7, 6SR7 ₃ , 42, 76 80 6ZDH3A ₃ , 6AT ₃ 6AV ₃ , 6T8 ₃
60~100	6AR5, 6ZP1, 6E5, PICTURE TUBES
25~70	6AT6 ₂ , 6AV6 ₂ , 6SQ7 ₂ , 6SR7 ₂ , 6ZDH3A ₂ , 3S4 3Q4, 3V4, 6TB ₂
20~55	1L4, 1R5, 1T4, 1U4
12~40	1S5 ₂₋₅ 6BN6, 1U5 ₂₋₅

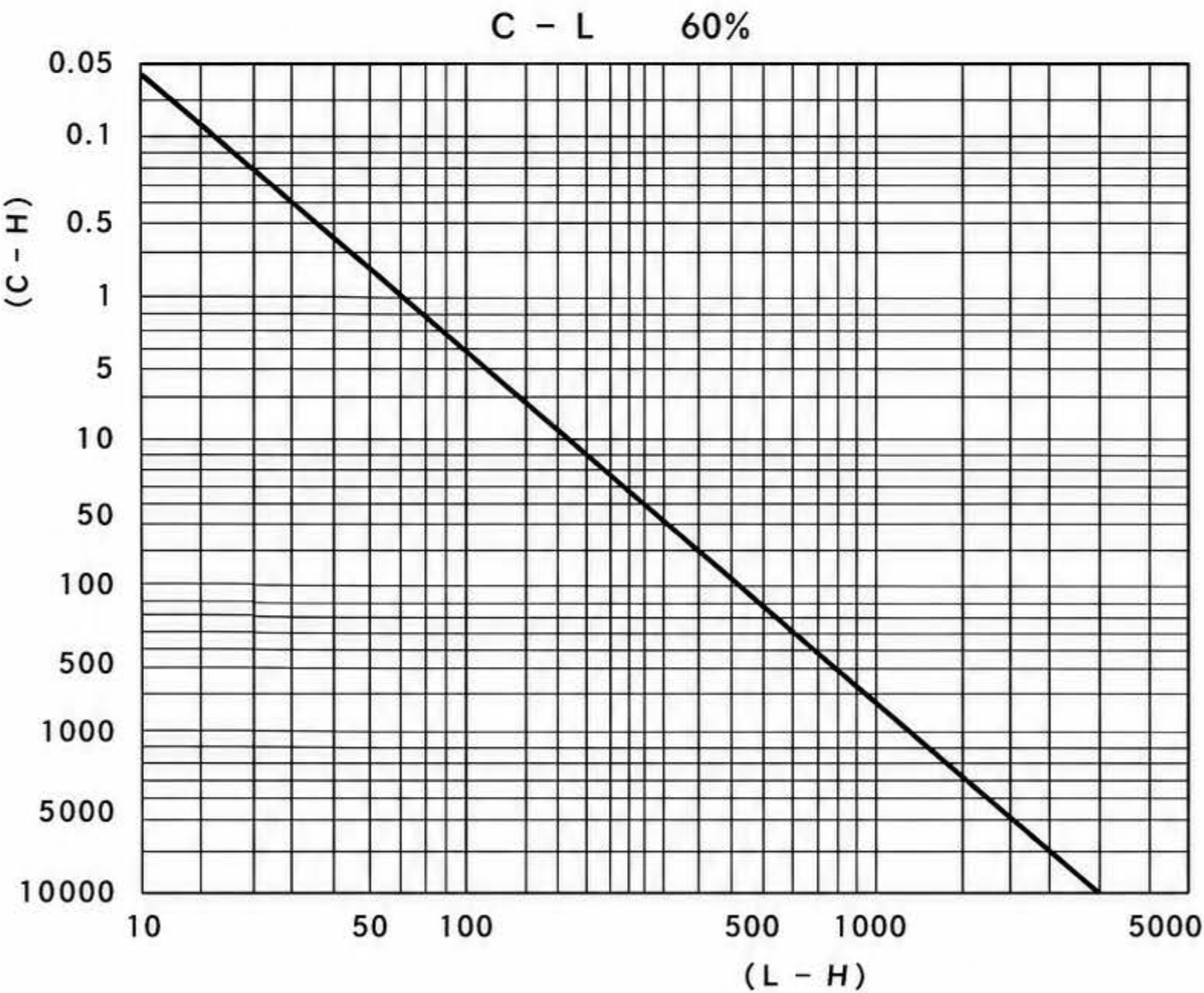


Fig. 6 (B)

15) Tubes-Gm See Fig. 8

Set selector to CX20 where the AC 7 volt position is marked, and the reversing switch to right side. Connect a 300Ω resistor across the test leads and connect the DB and minus terminal.

Place test leads to 5 or 6.3 volt AC (it is necessary to predetermine which voltage is suitable), 50~60/s, source. Adjust zero ohm control to full scale. Send AC voltage, dividing it between a 1-Megohm resistor and a 250-K ohm resistor (which are connected as shown in the illustration), to the grid of the tube. Place leads to both ends of tube plate load. However, if plate load impedance is very low in audio frequency, e.g., IFT, RF coil, etc., ... connect test leads in series with plate loads. Then, Gm 14,000 micro ohms will be obtained by direct reading red AC 7 volt full scale.

16) Transistor test

Set selector switch to ohm X1K range, connect test leads to the plus and minus terminals of the multimeter. Short the leads and adjust the zero ohm control for zero ohm reading. Place minus lead to the base leads of the transistor under test and plus lead to the emitter lead of same transistor, note the ohm scale reading and then reverse the reversing switch and note this reading. If one reading shows less than 1 kilo-ohm and the other reading shows 1 megohm or more, the test result is so far considered good. As the final check-up, repeat the following test : Place minus test lead to the base lead and plus lead to the collector lead of the transistor under test, and note the ohm scale reading. Again, change the reversing switch and note the ohm scale reading. If one reading shows less than 2 kilo ohms and the other reading shows 1 megohm or more, the transistor is satisfactory.

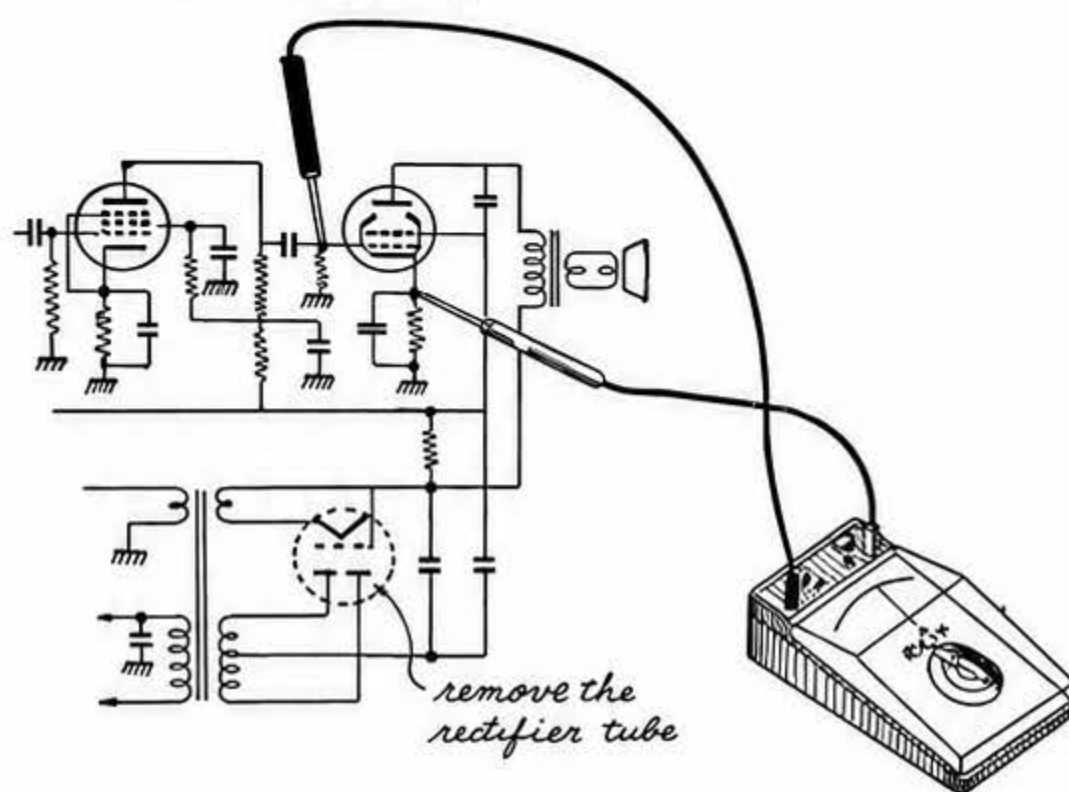


Fig. 7

Note : The above test is equivalent to that of the emission of the vacuum tubes. Difference between readings can be smaller for power transistors to be satisfactory.

17) Photo electric tube

Switch selector to meg $\Omega \times 0.1$. Short test leads and adjust zero ohm control for zero reading. Connect leads to photo electric tube. Place photo electric tube in front of electric light. Meter deflection should be noted on R scale.

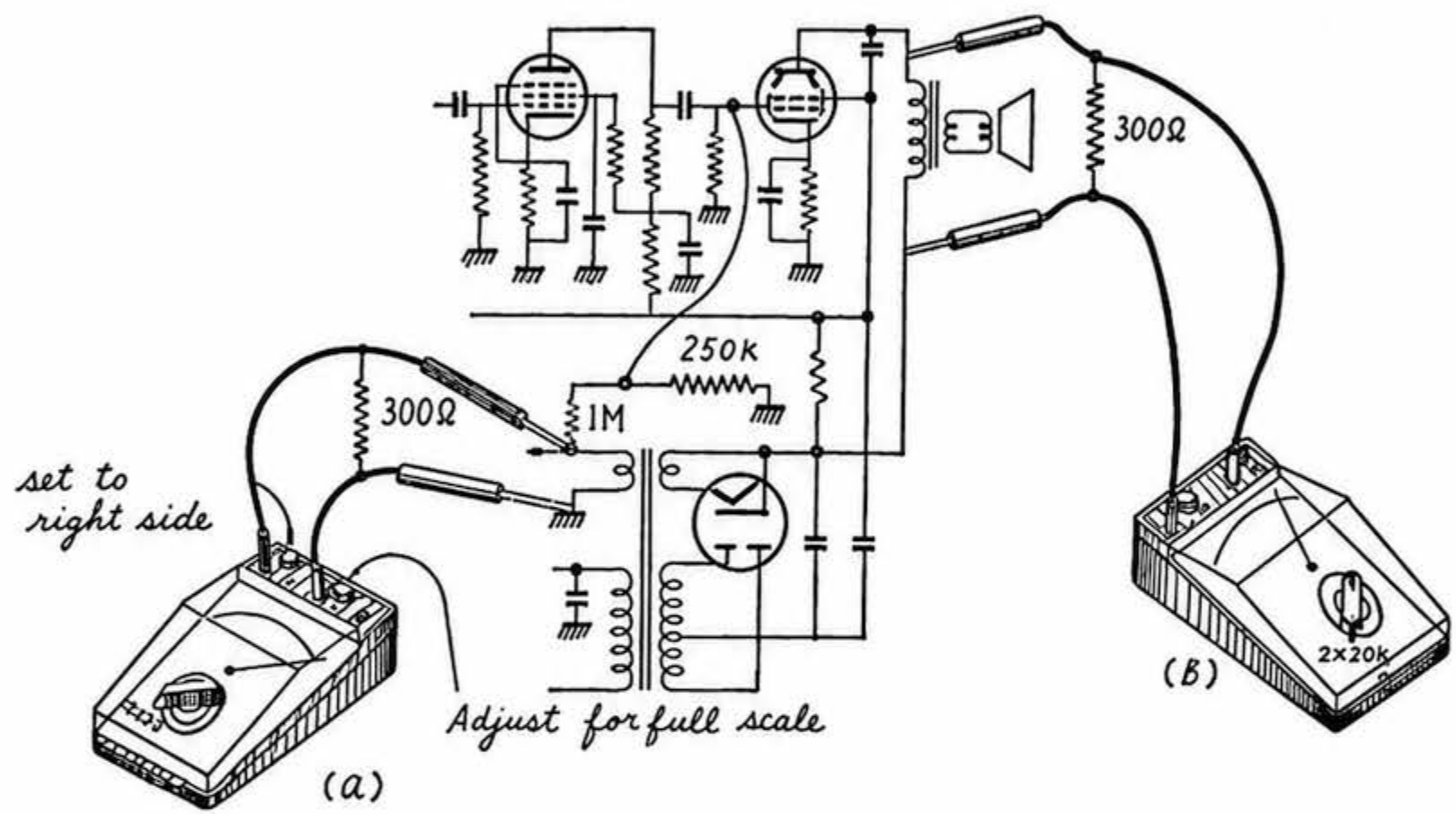
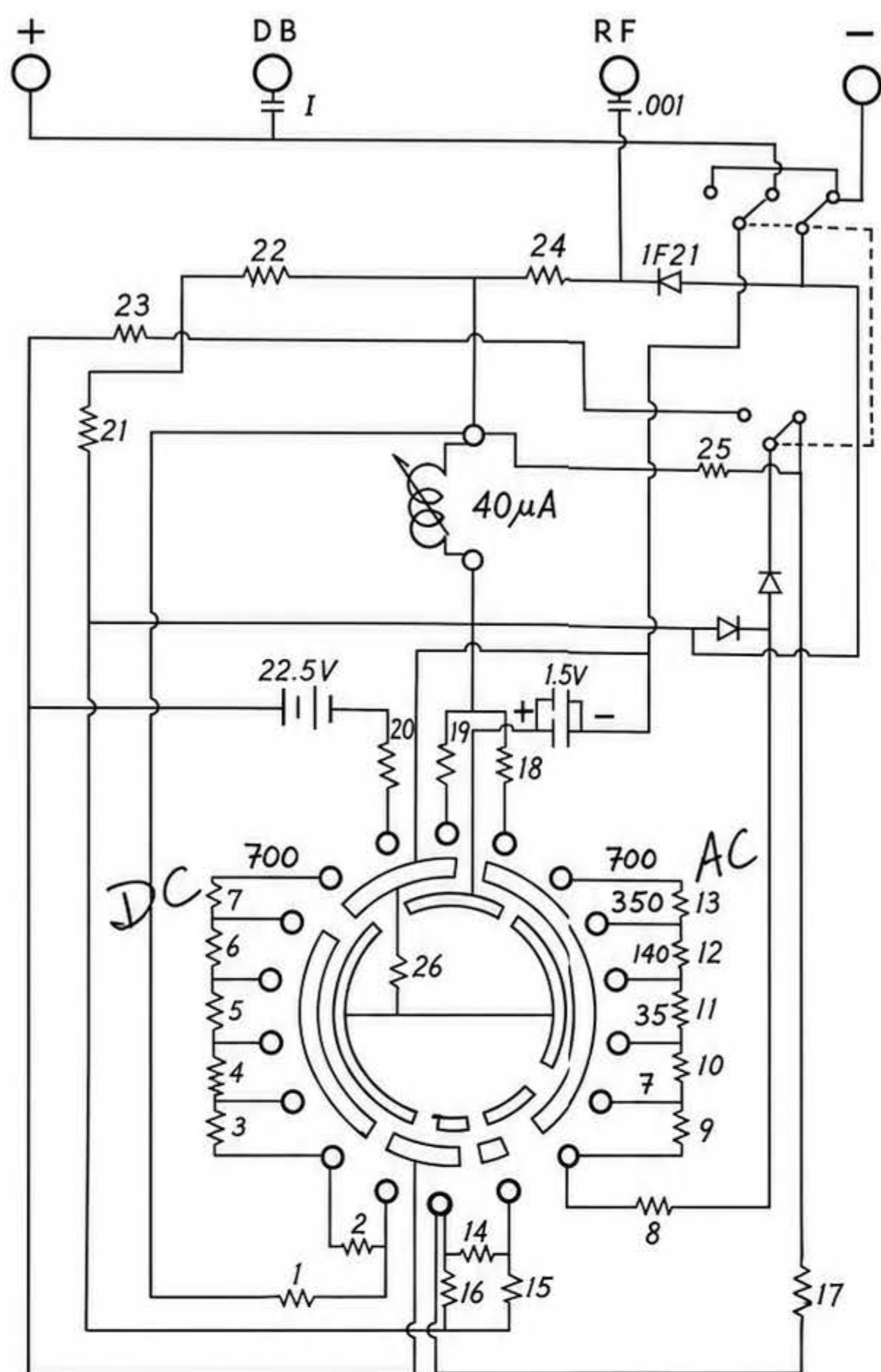


Fig. 8



1. 2.9 K
2. 22.4 K
3. 112 K
4. 560 K
5. 2.1 M
6. 4.2 M
7. 7 M
8. 4 K
9. 27 K
10. 140 K
11. 525 K
12. 1.05 M
13. 1.75 M
14. 67.8Ω
15. 3.57Ω
16. 643Ω
17. 5 K
18. 29.5Ω
19. 3.5 K
20. 278 K
21. 4 K
22. 10 K, VR
23. 20 K
24. 395 K
25. 3.6 K
26. 1 K



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