

## TBC-Zero Circuit Technology

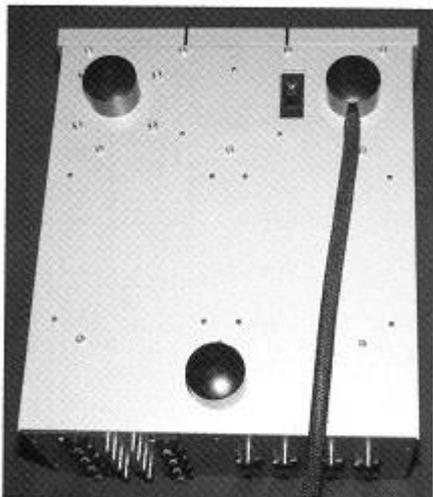
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[Photo 2] Front appearance of the preamplifier TBC-Zero released in 2005 (the price at the time of release is 1.7 million yen excluding tax). The knob has a volume on the right and an input selector on the left. In the centre are four input sources and muting indicators lined up in a row



[Photo 3] Rear panel of TBC-Zero. The right column are the 4 input terminals, the left are the 2 outputs. The XLR terminal is hot at Pin 2 and is connected in parallel with the adjacent RCA terminal.



[Photo 4] The bottom of TBC-Zero. The limbs with a spherical bottom are black-painted brass, with two in front. The power cable emerges out from the right front foot through an 8mm aluminium bottom plate, and next to it is a circuit breaker that has a power switch.

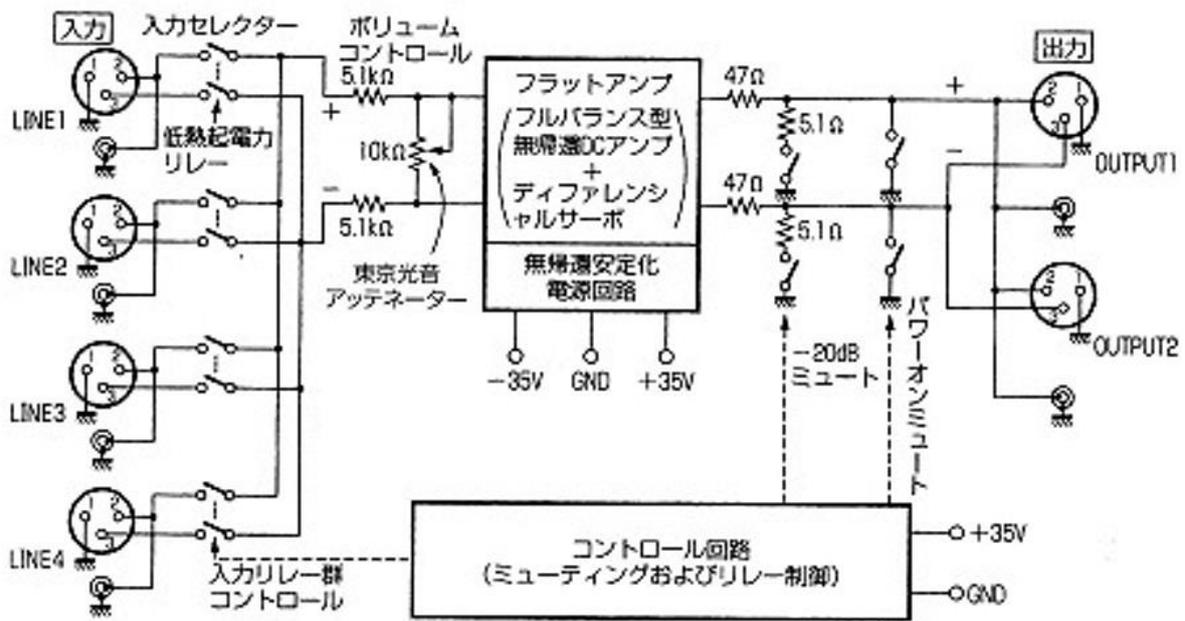


Fig. 4 TBC-Zero signal system block diagram

... Since it is a parallel connection, one can use either one. And when using the RCA input, insert the attached shorting plug (XLR plug that connects the 3rd and 1st pin) into the adjacent XLR terminal and ground the 3rd pin. For signal switching, a relay with a low thermo-noise of  $3 \mu\text{V}$  or less and excellent contact reliability for microcurrent circuit is used.

Volume control is by means of inserting a series resistor with fixed resistance in the hot and cold signal lines, and then inserting a variable resistance in the form of shunting the hot and cold. The series resistance is  $5.1\text{k}\Omega$  metal-film with a 1% deviation. A  $10\text{k}\Omega$  Nikkohm P-type attenuator has been adopted for the shunt resistor. Therefore, the input impedance varies from  $10\text{k}\Omega$  (at the minimum volume) to  $20\text{k}\Omega$  (at the maximum volume), and a minimum insertion loss of about  $6\text{dB}$ , depending on the volume position.

A  $47\Omega$  series resistor is inserted in the output circuit. The muting circuit is of the shunt type with no contacts intervening in the signal path. The power-on-mute, which operates automatically when the power is turned on / off, grounds the output directly with a relay. Pressing the mute button grounds the output by  $-20\text{dB}$  via a  $5.1\Omega$  resistor.

Since TBC-Zero is a complete DC amplifier with DC servo, it uses a differential servo that applies a servo so that the difference between the signal and the input signal, which has been reduced to  $1 / \text{gain}$  of the amplifier, is zero. The basic circuit is shown in Fig. 5. But since this unit is a full-balanced amplifier with a balanced configuration from input to output, the DC servo circuit shown in Fig. 6 is used in reality. This is an example of the initial model. In the model and its successor TBC-Zero / EX, a trimmer is used that fine-tunes so that the signal returned from the output is  $1 / \text{gain}$  of the amplifier. It has been relocated to the output side of the first stage amplifier.

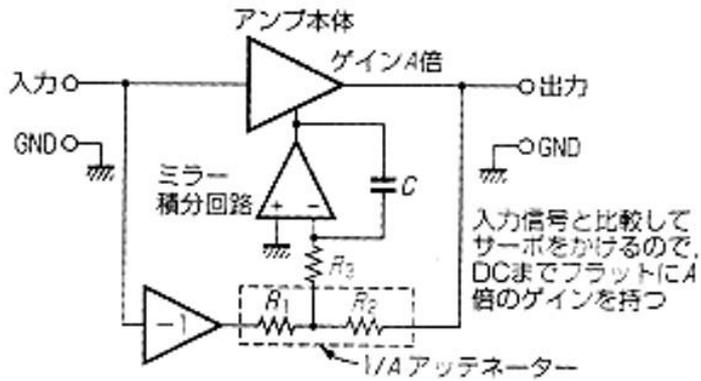


Fig. 5 Differential amplifier theory

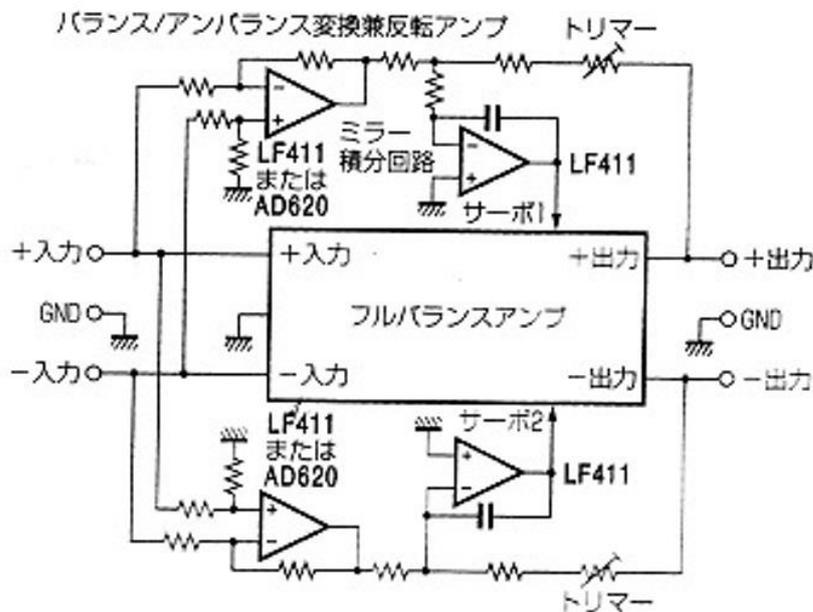


Fig. 6 TBC-Zero DC Servo Circuit

The FET amplifier with balance input and balance output is a combination of a two-stage voltage amplification circuit and a two-stage Darlington power amplification circuit, and has the configuration shown in Fig. 7. The circuit has a vertically symmetrical push-pull configuration, and the transistors within in the dotted lines are thermally coupled. The signal of the differential servo is, for sonic quality reasons, returned to the second stage emitter instead of the first stage.

In this amplifier circuit, the amplifier element is used in the region with good linearity. In order to make it less susceptible to electrostatic induction, a high power-supply voltage of  $\pm 23V$  is applied. A generous amount of current is passed through each stage. The aim is that the impedance is lowered as much as possible. Like the power amplifier TBP-Zero introduced in the previous issue, the first stage is a vertically symmetrical push-up with no current limiting effect.

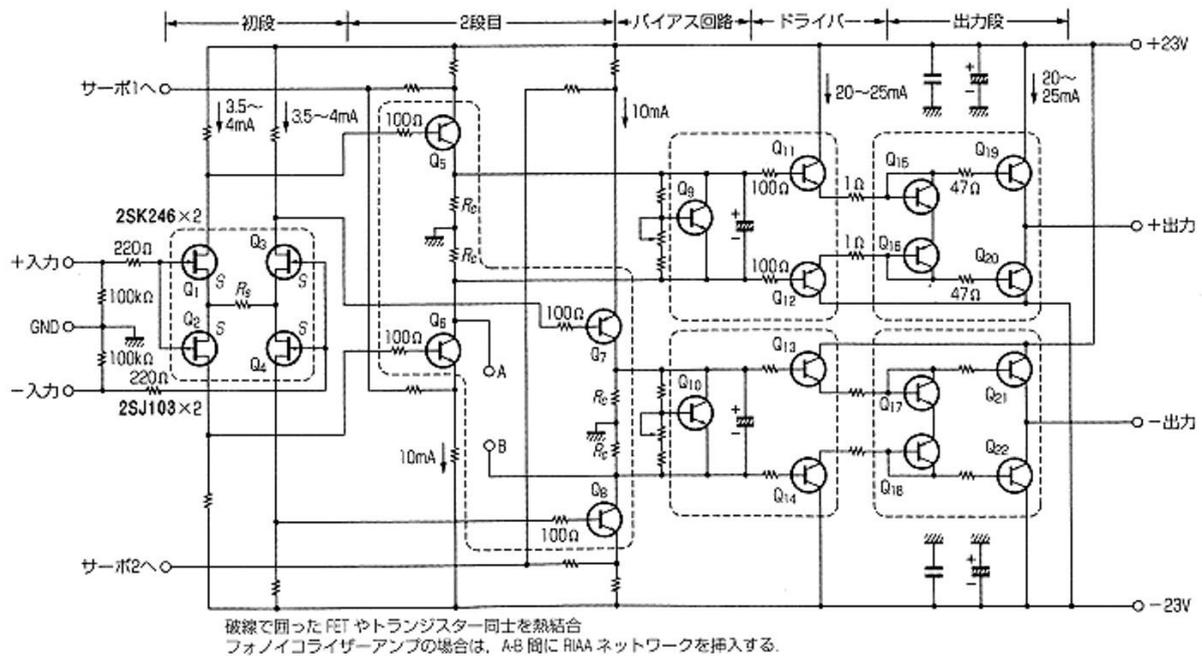
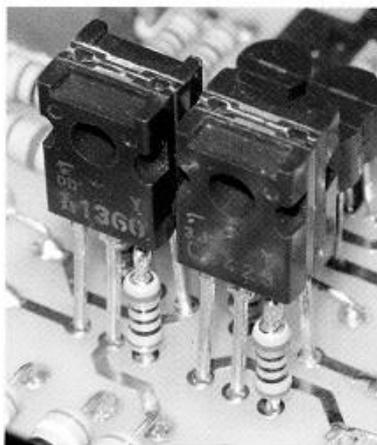


Fig. 7 TBC-Zero Amplifier Circuit

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[Photo 9] Three-dimensional wiring of the base resistance for degeneration of the second-stage transistors. In order to reduce the inductance and improve the high frequency stability, cut the transistor lead leaving about 2 mm from the root here.

[Photo 10] Rear panel of TBC-Zero/EX released in 2011 (Silver type is 296 million yen without tax, black type in photo is 3.48 million yen). The big difference from TBC-Zero is that the input terminal group of RCA's has been abolished. And it comes with 2 RCA / XLR conversion plugs.



[Photo 11] 2007 Released. Output stage resistance-less, complete DC non-feedback, phono EQ amplifier TEQ-Zero appearance. Adopting the same housing as TBC-Zero.



[Photo 12] TEQ-Zero's rear panel. Same as TBC-Zero except that the ground terminal is added. The right column is the 4 input terminals of the system. The left is the output of the system. The XLR terminals can be connected in parallel with the adjacent RCA terminals.

.... the power transformer is a large Japanese EI core with low magnetic flux density, the L&R channels have separate windings on the secondary, and Nihon Inter 10A Schottky diodes FCH10A15 & FRH10A15 are used for rectification. 15000  $\mu$ F of the KMH type from Nippon Chemi-Con are used for the smoothing capacitors. The regulated power supply circuit, mounted on the independent amplifier boards, is a non-feedback type and has the configuration shown in Fig. 9.

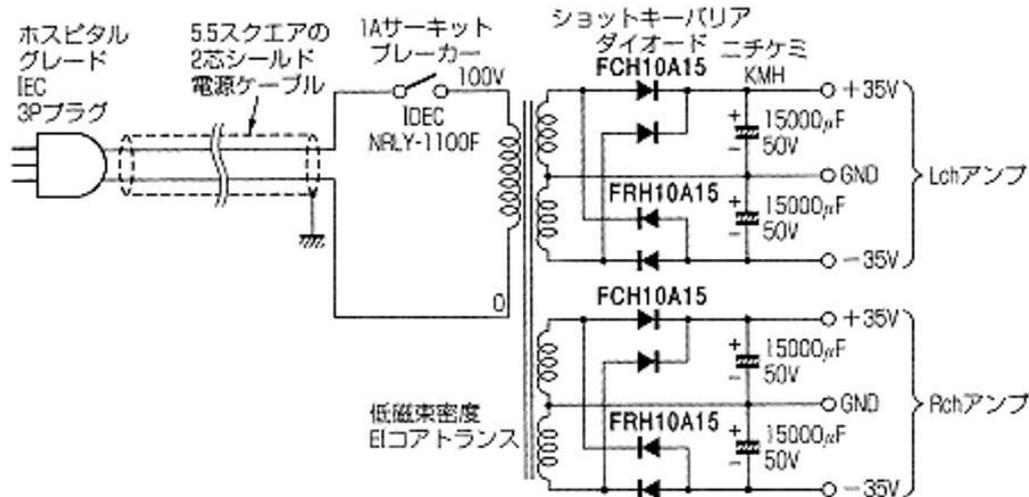


Fig. 8 TBC-Zero Power Supply Circuit

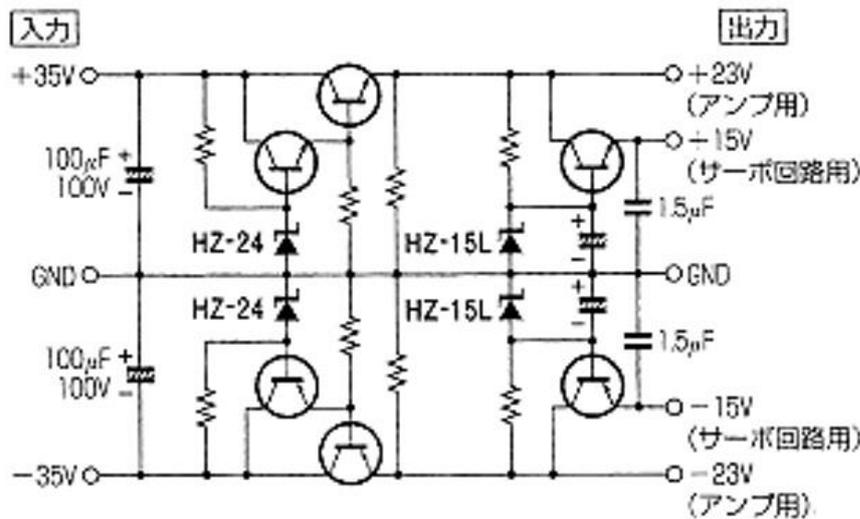


Fig. 9 TBC-Zero Regulator Circuit

The inside of this machine has the structure shown in Photo 5-17. The housing is a non-magnetic aluminium alloy drawing. The front panel is 13 mm. The rear panel / top plate / side plate / bottom plate are 8mm aluminium alloy, with 6mm internal partitions in a 3-box configuration, the power supply is at the front, and the amplifier is in the centre. And the input circuits are in the rear. Like in the power amplifier, the smoothing capacitors of the power supply circuit is physically stabilised against vibration and the vibrations damps out quickly. It is a mounting method that hangs from the board.

Photo 8 is the amplifier board of the TBC-Zero earlier model. What is noteworthy in this board is the three-dimensional wiring structure of the second-stage base resistor shown in Photo 9 at the transistor base to prevent oscillation. A low resistance is inserted. The difference is that the smaller the inductance from the base of the transistor to this resistance, the better.

The main points that have been changed in TBC-Zero/EX are that the RCA input terminal has been abolished, and the plate thickness of the housing has been increased. It has a lower structure that is

less likely to vibrate. And the attenuator for volume control and the regulated power supply circuit have been changed. The circuit around the amplifier have also been optimized.

The attenuator is made by Tokyo Nikkohm, and the attenuator step is 1.5dB. It was changed to a custom-made resistor parallel type that involves only one resistor. For the stabilised power supply, as shown in Fig. 11, the reference voltage of the power supply circuit for the amplifier is 24V Zener. It has been changed from a diode to a possible regulator TL431, and the noise has been reduced.

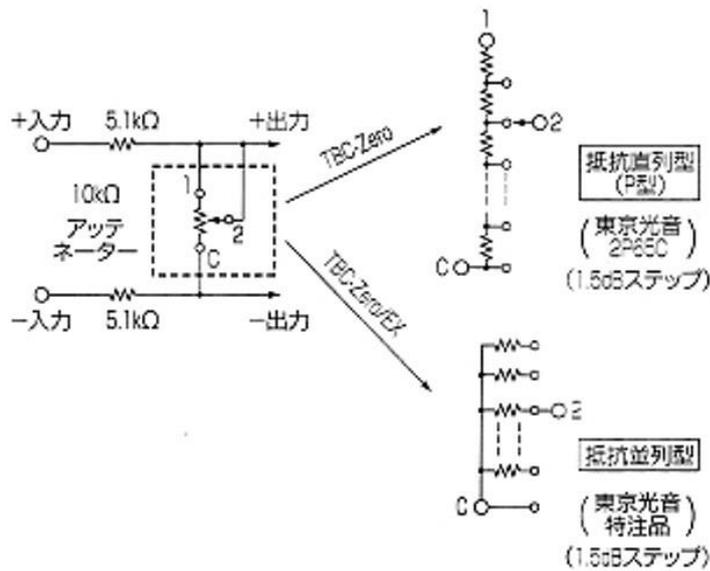


Fig. 10 Comparison of attenuator of TBC-Zero and TBC-Zero/EX

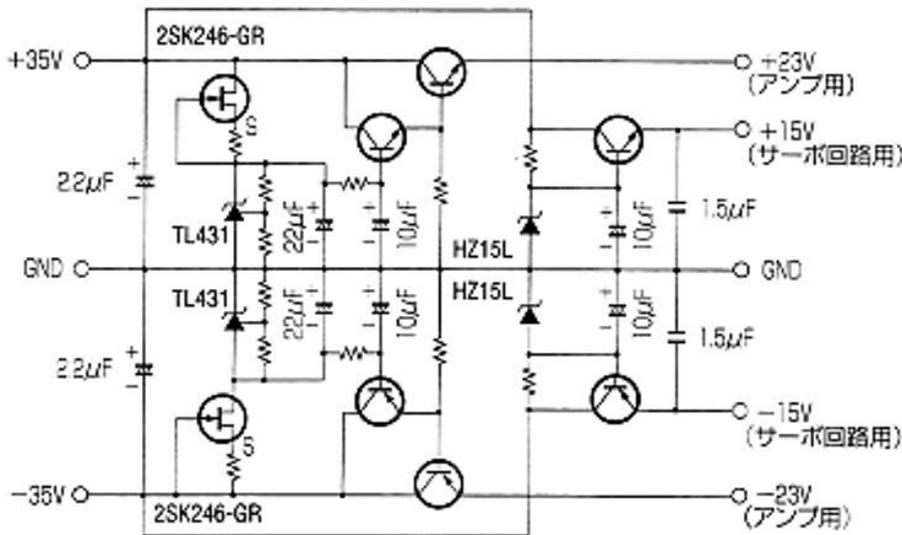


Fig. 11 Stabilised power supply circuit of TBC-Zero-EX

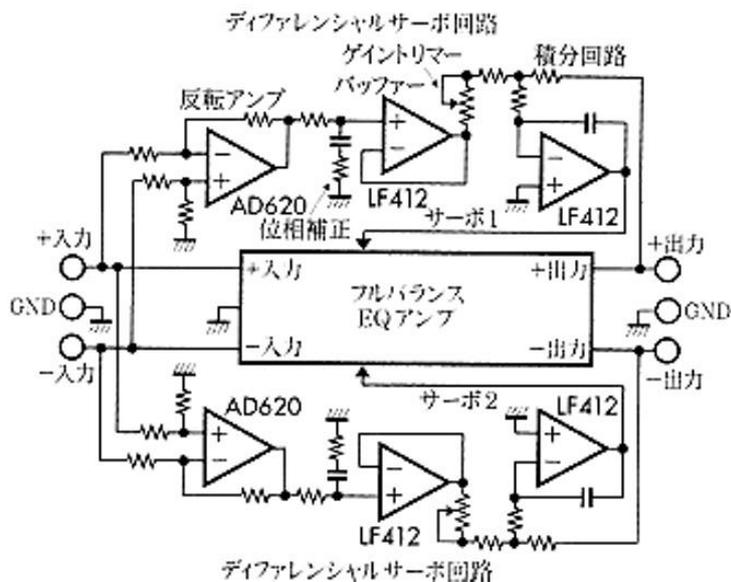


Fig. 12 TEQ-Zero DC servo circuit

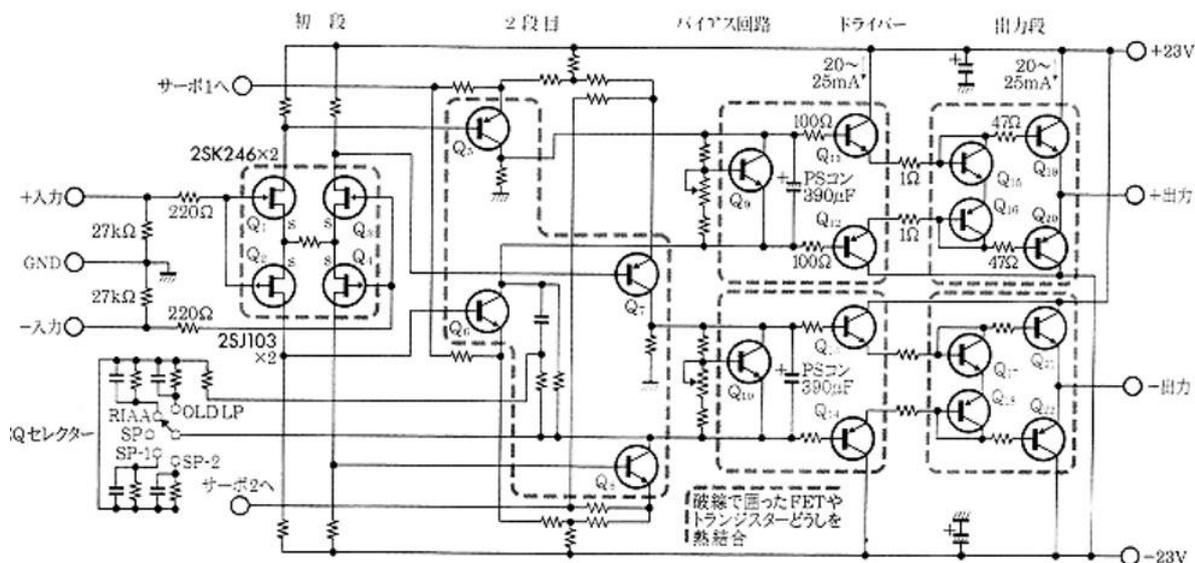


Fig. 13 TEQ-Zero fully balanced amplifier

### Full DC phono EQ amplifier -- TEQ-Zero

TBGQ Zero, released in 2007, is MM-dedicated, output stage-less, complete DC, full-balanced, non-feedback phono EQ amplifier, and its appearance is as shown in photos 11 and 12. The preamplifier TBC-Zero is used. Therefore, the appearance is very similar, and the amplifier knob has been changed to the EQ selector knob. It is equipped with 2 series RCA and XLR. The hot RCA input can be connected to the 2nd pin of the XLR input. It is the same as TBC-Zero in that it grounds the cold input.

Balanced inputs are provided. Because the hot and cold signals of the MM / MC cartridge are separated from the ground and independent. Connect to the amplifier from the 5P output terminal of the tone arm with the stereo balance cable with the 5P plug. This is because it is more advantageous in terms of sound quality to ground the cold side on the input side of the amplifier. Moreover, in the case of balanced connection, the ground is also connected together. There is no need to connect the ground wire separately. And balanced connection in order to make the best use of the advantages of, this unit which is a fully balanced EQ amplifier with balanced input and balanced output.

TBQ-Zero is a complete DC non-feedback phono EQ amplifier with a differential servo, and the signal level handled is lower than that of the preamplifier. Since the gain of the amplifier is high, the DC servo is .....