

# DOBRADOR DE FREQUÊNCIAS PARA GUITARRAS



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## INTRODUCTION

You, as a guitarist, already feeling that wish, always that frustrating need, when executing that hot part of a solo, when reaching the last frets of the first and thinnest string, continue, continue always and always, higher, more, further, yet?

It's hard to need to return from the physical limit of a guitar when the mind listens and asks us for a whole step up, a new scream, a hypertreble that realizes in the executants and listeners' body, that chill of satisfaction, conclusion, that only the great musical parts provide.

Feeling the case in the flesh, since the time that I carried a guitar, I searched for an electronic gadget that allowed me the

accomplishment of the so waited for dream, without modifying the (inside electrical parts of the) guitar.

I had already heard about frequency doublers, "octavers", but never heard good things about them. I confess that, with all my experience, I never saw or (actually) heard them. Schematics neither: never seen one. Maybe, for these things, the gadget that I built was a success? I have already seen and built frequency dividers. But, doublers, that give us an octave up, never did anything extraordinary.

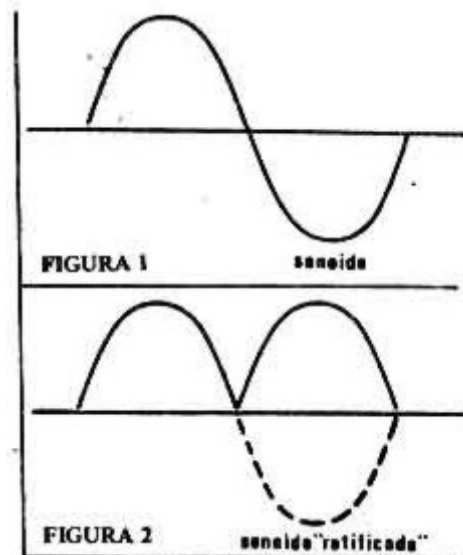
The musician, pro or not, can use this effect, because it does the thing it was designed to do and has some extra capabilities beyond the octave effect.

## HISTORY

The first idea to get a frequency doubler, or octaver, was to rectify the sine wave (**Figure 1**) with a transformer and a diode pair. The transformer could be substituted for a pair of transistors, with their collectors out-of-phase. Wiring a diode to each collector and both the diodes themselves, I would get the output wave of **Figure 2**.

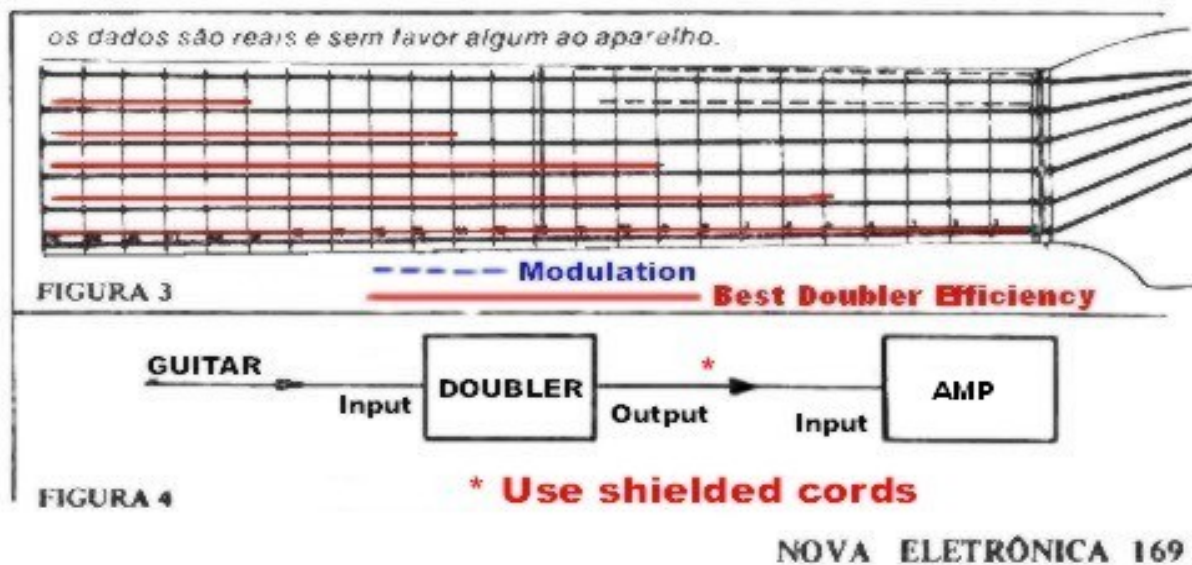
The remaining would be to adjusted to the gain, input and output level, impedance, bypass, volume control, and more things, to get a versatile gadget. But it wasn't too simple. With the diode pair connected, the output didn't sounded like it was in a higher octave, but just sounded richer in harmonics.

The reason was evident when I watched the guitar waveform and the output waveform. The guitar waveform wasn't sine, but a sine fundamental, with a floating 2nd harmonic. This latter cuts and adds harmonics that, when they become symmetrical, the octave sound can be heard, but when they become asymmetrical, the octave could not be heard.



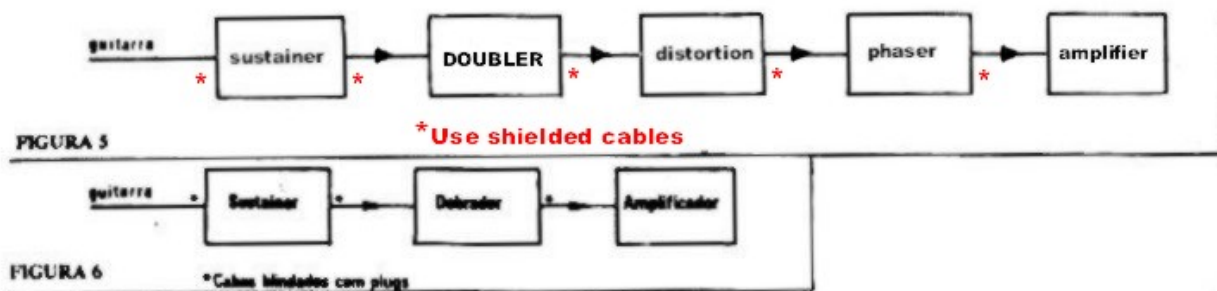
The solution was to use a low-pass filter with a steep cut of 18dB/octave, between the doubler transistors pair and the preamp. This filter "cleans" the harmonics of the last octave of the guitar, turning the waveform of this octave to sine, and the result was surprisingly great - playing in the Hi-E string, the octave was clean, warm and with sustain.

The effect was reduced when we played lower frequencies. But this isn't a bad thing. The need for the higher octave is only in the Hi-E string(range), the frequency limits of the guitar. Exactly when the distorters are bad, the octave is great - in the higher notes.



## OTHER EFFECTS - DISTORTION

The Octaver sound is never as pure as the clean guitar sound, but can be near when you use low gain. When you adjust the Distortion pot, the octave became cleaner to hear, and the sound becomes more distorted. The point between too much distortion and where the cleaner octave is heard needs to be found. This is discussed more below.



The IMAGE 5 shows how to connect it correctly.

## APPLICATION

The Octaver can be used alone or with another effect, creating a kind of synth. The results of the Octaver using, at least, the Sustainer with it, are much better than the Octaver alone.

## RING MODULATOR

The Octaver isn't a Ring Modulator(or Balanced Modulator), but can sound very similar. Play a low string and jam using the higher strings. The sound of the higher strings will be modulated by the lower string sound, creating a great effect.

## BYPASS

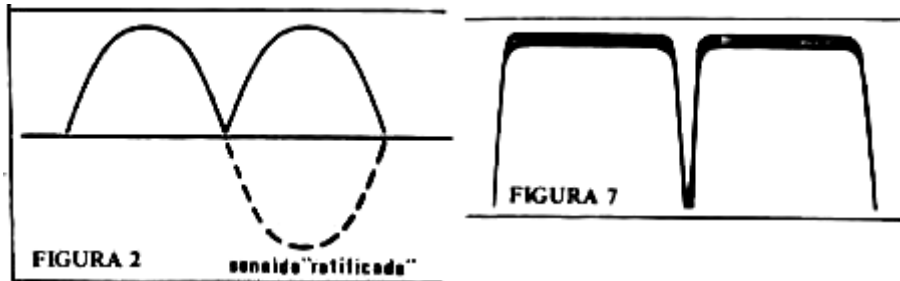
The circuit uses a (true)bypass switch, S1, where you can choose between the clean sound or the Octavier sound.

## VOLUME

The P3 pot controls the output volume of the circuit.

## DISTORTION

The P1 pot controls the gain AND the output level of the preamp in the Octaver, turning the waveform from one with less distortion (**IMAGE 2**) into a waveform with more distortion (**IMAGE 7**).



## POWER SUPPLY

The circuit, when used as a gadget(stompbox), not as a synth module, can be powered with **TWO** 9V batteries, connected as shown in **IMAGE 8**. Be careful when you connect J1 and J2 jacks to B1 and B2 batteries! This connection was responsible for the biggest part of troubles of the Sustainer builds.

J1 and J2 have two functions.

The first one is to connect the cables to the octaver circuit, and the second purpose is to connect a pole of each battery to ground.

## BUILDING

The build of the Octaver is very simple. The parts have their codes (R1, R2, etc.) identified in the layout in **IMAGE 10**. Take care with diodes and transistors, which can't handle overheating, but don't make the mistake of cold solder connections. The offboard wires are shown in **IMAGE 8**.

Finish all the connections, recheck everything at least twice before boxing it.

Box the circuit, put the knobs on the pots, but don't close the box.

Test it again, then, finally, close the box.

## TESTING

### Without any test gadgets(equipment)

**C**onnect the guitar to the input jack (J1) and the amp to the output jack (J2).

**T**urn on the amp, with low volume and with the eq adjusted like you use to play.

**T**urn all the guitar pots to maximum and turn on only the neck pickup.

**A**adjust the octaver volume pot to about half and the distortion pot to a little bit after the half, between the half and maximum travel.

**U**se the S1 bypass switch, readjusting the volume pot until the output volume is the same as the clean guitar volume. It's better to ask for somebody help. When somebody plays the low e string at the 12th fret, slowly turn the trimpot (P2) until you find the "sweet spot".

**N**ow adjust the distortion pot until you find the spot between a sustained octave and excessive distortion. Don't do the test using the low strings, because you won't get any change if you turn the trimpot.

### With test gadgets(equipment)

**C**onnect a sine generator with 500Hz frequency to the J1 jack.

**A**adjust the generator output to 50mV.

**C**onnect an oscilloscope to the circuit output.

**T**urn the octaver off to see in the oscilloscope that the sine wave that is going thru the switch S1.

**T**urn on the circuit(S1) and adjust the distortion pot until you get a output wave form like **IMAGES 14A, 14B or 14C;**  
**not like 14D**, when you get excessive distortion.

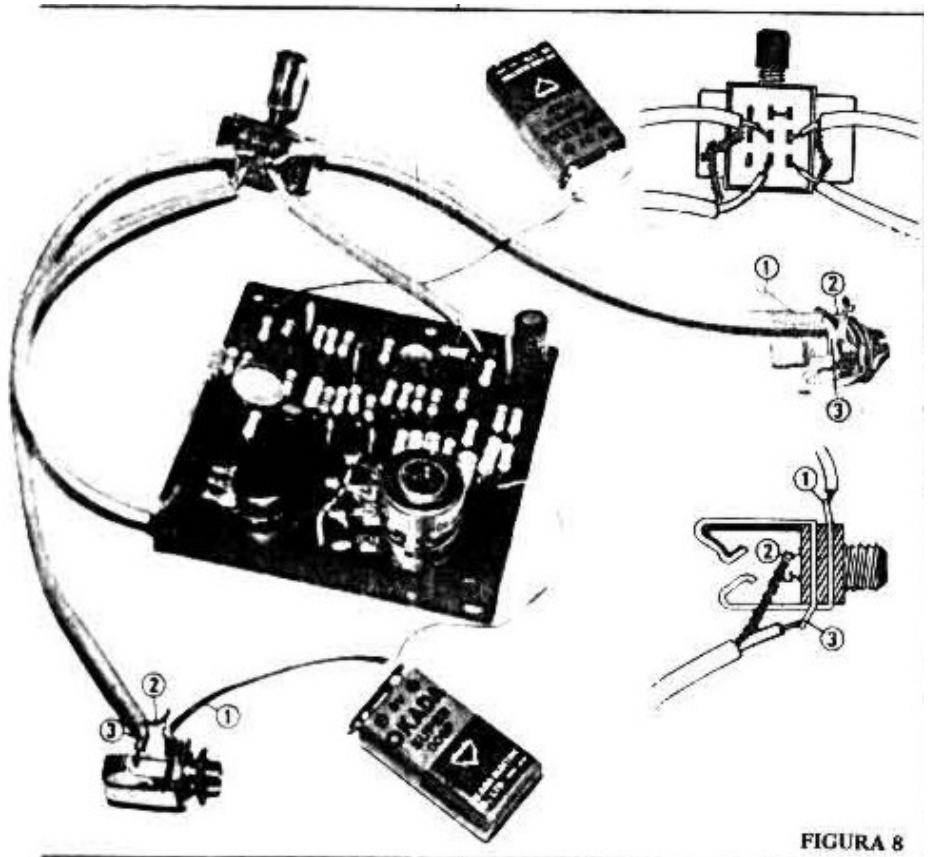


FIGURA 8

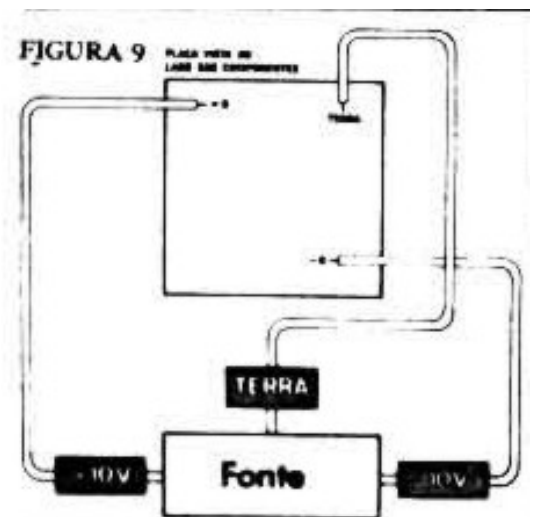
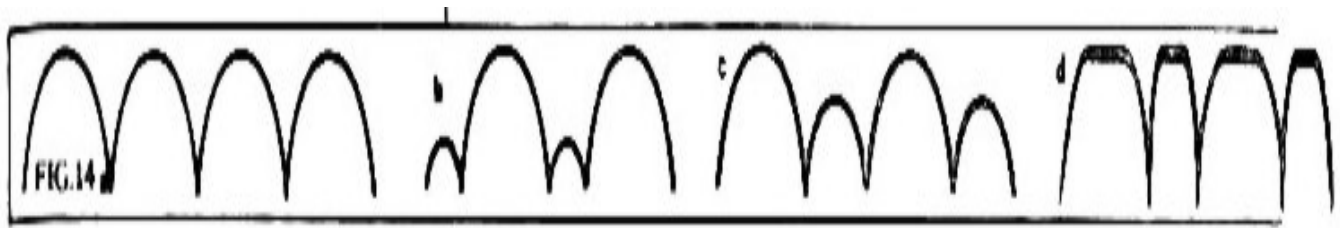


FIGURA 9



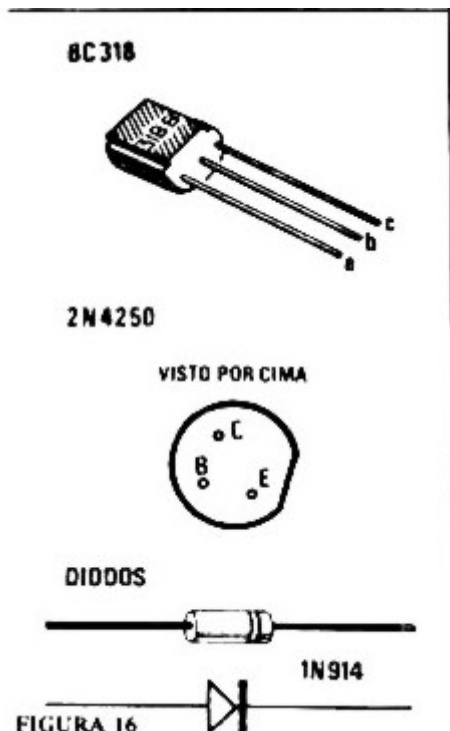
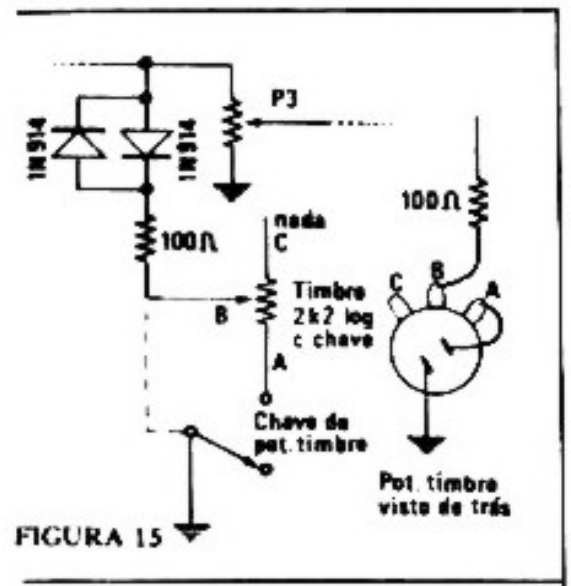
Adjust the trimpot(P2) to get the wave as symmetrical as possible, like in **IMAGE 14A**.

If you don't get rounded waves, it's because the generator signal is too strong, readjust/reduce the output level of the generator. When you get symmetrical wave, P2 is adjusted. Test if the signal stays symmetrical with volume changes. Now connect the circuit to a guitar and a amp to do the sound test.

If you need to adjust P2 again, reconnect the circuit to the generator and the oscilloscope to see if the waveform is still symmetrical.

### **Circuit MOD - TIMBRE POT(tone control)**

The Timbre pot mod modifies the waveform of the circuit. The result is not very positive if you want to make the octave more audible, because it reduces the harmonics; but you will have less distortion and maximum purity. When you turn the Timbre pot, you get a fuzz sound. The Timbre pot mod schematic can be seen in **IMAGE 15**. Image15: lug C connected to nothing, and in the switch is something similar to Timbre pot switch. In the other image, is wired in Back of the pot.





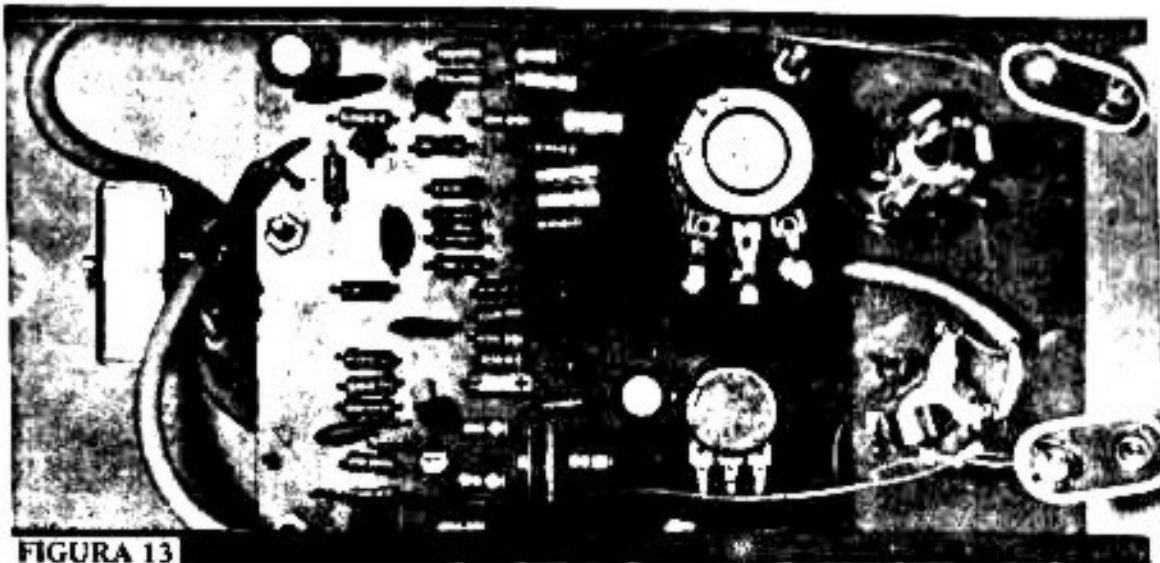
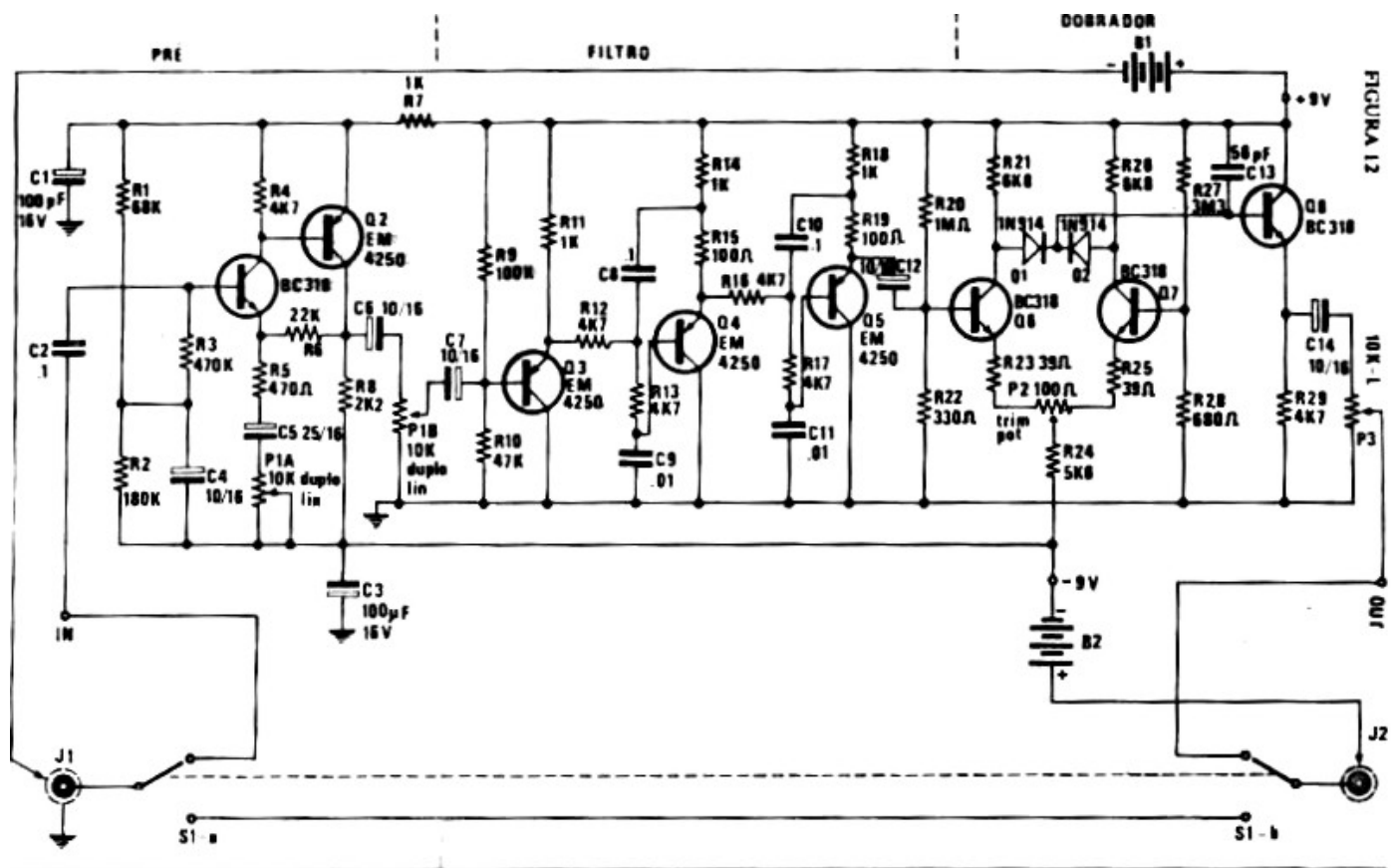
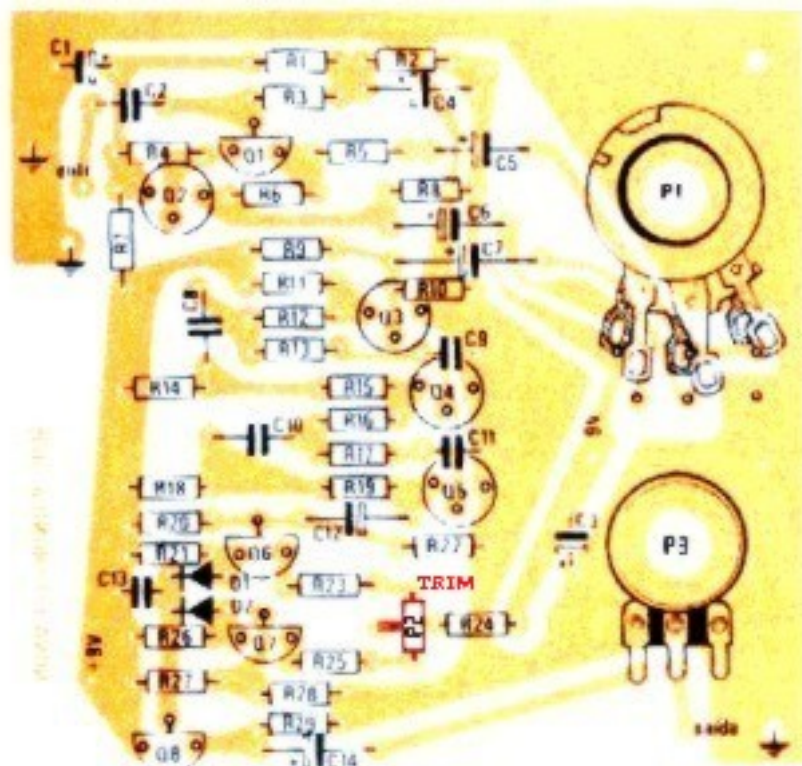


FIGURA 13





NOVA ELECTRONICA 3005

# LISTA DE COMPONENTES

R1 — 58 K  
 R2 — 180 K  
 R3 — 470 K  
 R4 — 4,7 K  
 R5 — 470  $\Omega$   
 R6 — 22 K  
 R7 — 1 K  
 R8 — 2,2 K  
 R9 — 100 K  
 R10 — 47 K  
 R11 — 1 K  
 R12 — 4,7 K  
 R13 — 4,7 K  
 R14 — 1 K  
 R15 100  $\Omega$   
 R16 — 4,7 K  
 R17 — 4,7 K  
 R18 — 1 K  
 R19 — 100  $\Omega$   
 R20 — 1 M  
  
 R21 — 6,8 K  
 R22 — 330  $\Omega$   
 R23 — 39  $\Omega$   
 R24 — 5,6 K  
 R25 — 39  $\Omega$   
 R26 — 6,8 K  
 R27 — 3,3 M  $\Omega$   
 R28 — 680  $\Omega$   
 R29 — 4,7 K  
 R30 — 100  $\Omega$  (tone mod)  
 P1 — Potenciômetro 10 K  
       duplo linear 1/4 W  
 P2 — Trimpot 100  $\Omega$   
 P3 — Potenciômetro 10 K linear  
 P4 — 2K2 LOR (tone mod)  
 C1 — 100  $\mu$ F x 16 V  
 C2 — .1  $\mu$ F  
 C3 — 100  $\mu$ F x 16 V  
 C4 — 10  $\mu$ F x 16 V  
 C5 — 25  $\mu$ F x 16 V

C6 — 10  $\mu$ F x 16 V  
 C7 — 10  $\mu$ F x 16 V  
 C8 — .1  $\mu$ F  
 C9 — .01  $\mu$ F  
 C10 .1  $\mu$ F  
 C11 — .01  $\mu$ F  
 C12 — 10  $\mu$ F x 16 V  
 C13 — 56 pF  
 C14 — 10  $\mu$ F x 16 V

Q1 — BC318  
 Q2 — EM 4250  
 Q3 — EM 4250  
 Q4 — EM 4250  
 Q5 — EM 4250  
 Q6 — BC 318  
 Q7 — BC 318  
 Q8 — BC 318

D1 — IN 914  
 D2 — IN 914  
 D3 —  
 D4 —  
 B1 — Bateria 9 V  
 B2 — Bateria 9 V

J1 — Jack Stéreo  
 J2 — Jack Stéreo

S1 — Chave inversora bipolar

Vários  
 1 — Placa 3035  
 1 — Caixa  
 2 — Knobs  
 4 — Espaçadores  
 4 — Parafusos com porca  
 4 — Pés  
 2 — Conectores Bateria 9 V  
 1 — Pedaco de espuma  
 1/2 m fio blindado  
 Solda