U cube union operation
.ABS. cube absorb operation
$ cost sign of the given cube

Acknowledgment

The author wishes to thank prof. Chi-Fu Den of National Chiao Tung University for editing the manuscript.

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電話振鈴之改革 — 電子振鈴

An Innovative Ringing Technique in Telephone System – The Electronic Tone Ringer

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(Received November 11, 1976)

ABSTRACT — A new electronic tone ringer is presented. Basically the circuit of the new ringer can be drived by a 3.5 KHz ringing source, 3 volts in amplitude. The new ringer has the advantages over the conventional magneto bell ringer in the following respects. System reliability, flatness of frequency response, weight and cost. A prototype was built and tested with satisfactory results.

Since No 1 ESS_5 was developed a decade ago, it is of a general tendency in designing the telephone exchanger to reduce the electromechanical components and increase the semiconductor devices. For example, in No 1 ESS, the switching network and the control circuit were largely made up of electromechanical relays (1) (5). On the contrary in the latest model of the electronic switching system few electromechanical relays were employed. This change is due to the fact that the semiconductor elements such as SCR (1), CMOS (2) and Bipolar transistor (3), etc, have the advantages of either the space and cost as the crosspoint elements. On the other hand the magneto ringer requiring a 86 volts driving source. But the semiconductor devices are usually adopted at low driving voltage, therefore the typical design of a line unit circuit (4) is shown in Fig 1, where the coupling transformer T_1 and the control relay D_1 are the essential elements.

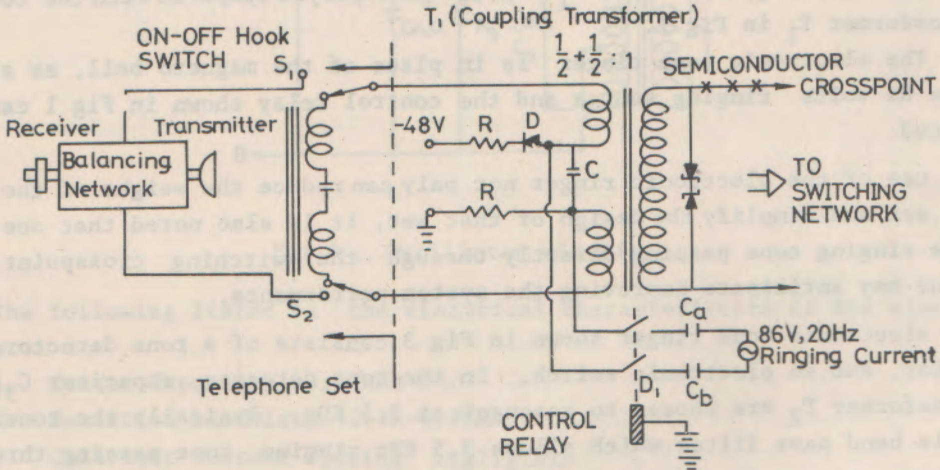

Fig. 1 Line unit circuit of the current telephone system

Apparently there are several disadvantages associated with this circuit, for example:

1. It degrades the transmission quality because the presence of the internal inductance in the coupling transformer.

2. The use of the ringing control relay D, increases the cost, space, and reduces the system reliability.

3. The 86 volts ringing current consumes more power and tends to induce noise into the system.

4. The simple magneto bell has a strict note and takes larger space and weight, and in turn increases the space and the weight of the telephone set.

In this paper a new electronic ringer designed for system performance and transmission quality is presented.

As indicated in Fig 2, a new circuit is presented, aiming to overcome those difficulties in the following respects.

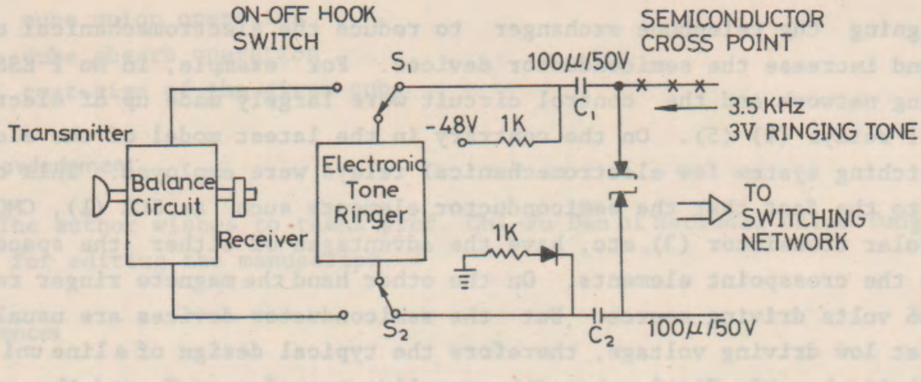

Fig 2. A newly disigned line unit

1. The coupling capacitors C_1 and C_2 are employed compared with the coupling transformer T_1 in Fig 1.

2. The electronic tone ringer is in place of the magneto bell, as a result the 86 volts ringing source and the control relay shown in Fig 1 can be eliminated.

The use of the electronic ringer not only can reduce the weight of the telephone set and simplify the design of that set, it is also noted that one can let the ringing tone passing directly through the switching crosspoint, and hence one may anticipate improving the system performance.

The electronic tone ringer shown in Fig 3 consists of a tone detector, an oscillator, and an electronic switch. In the tone detector, capacitor C_3, C_4 and transformer T_2 are chosen to resonant at 3.5 KHz. Basically the tone detector is band pass filter which allows 3.5 KHz ringing tone passing through and appears at the diode side (D_3) of the T_2. This signal then is rectified

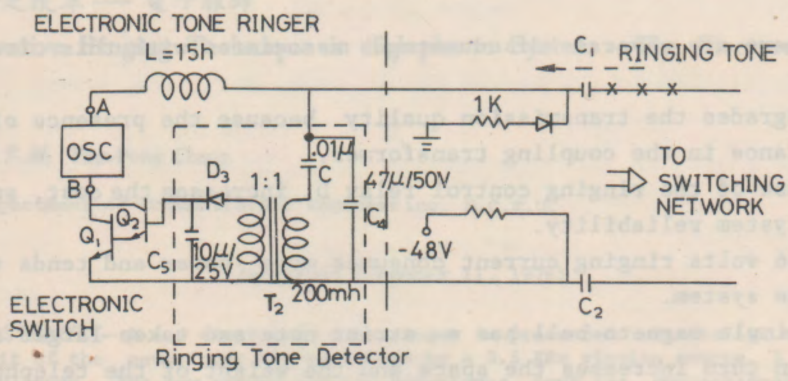

Fig 3. Electronic tone ringer circuit.

and drives the electronic switch. The electronic switch is composed of a npn darlington pair Q_1 and Q_2. wnen the electronic switch is turned on, the line circuit supply a 24 volts DC .ŋ the oscillator which generates a periodic audible ringing note. The chock L_1 blocks the AC ringing tone, Fig 4 shows the oscillation circuit. The capacitor C_6 parallel to the oscillator supply a regulated DC voltage to avoid oscillation halting.

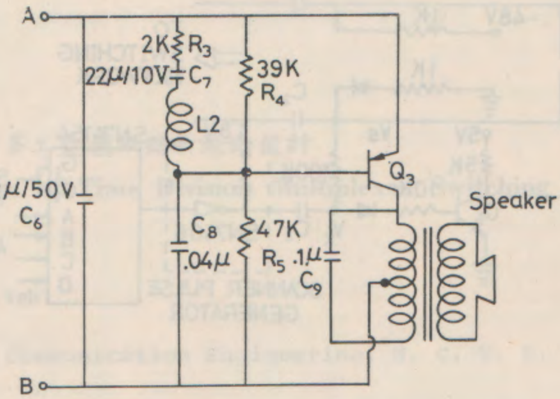

Fig 4. Oscillator circuit.

The following listed is the electrical characteristics of the electronic ringer:

1. Center frequency: 3.5 KHz
2. Detection bandwidth: 2.8K-6.8KHz
3. Ouiscient current flowing: negligible
4. Activated current flowing: 12mA
5. Suggested ringing tone: 3.5 volts (p-p)
   3.3k-4KHz

A close examination of Fig 2 to Fig 4 one may arrive at the following observations.

1. The choice of 3.5 KHz ringing current is not arbitrary since this frequency is beyond bandwidth 200-3200Hz required for high quality telephone conversation and yet is still within the designed telephone channel bandwidth of 4000 Hz.

2. It is compatible with the existing dialing system. In spite of the multi-frequency pushbutton system, the universal principle of dialing and on-off hook state change is gotton by making and breaking the 48 volts DC loop. Both dialing pulse and status change is detected in line unit by pulse interrogation method. As shown in Fig 5, when telephone set is on-hook and no ringing tone detected, V_s=0, o/p=low level. When telephone is on-hook but there is ringing tone detected V_s becomes to-12 volts, o/p still is LOW LEVEL. As the set becomes OFF-HOOK or a pulse train is dialing, V_s then drops to -21

volts. The 18 volts scanning pulse coupling from C_2 is not enough to turn on the transistor Q_5 due to the existing -21 volts V_k. Which makes the o/p=HIGH LEVEL. This status distinguishableness then supply enough information to the exchanger controller (4).

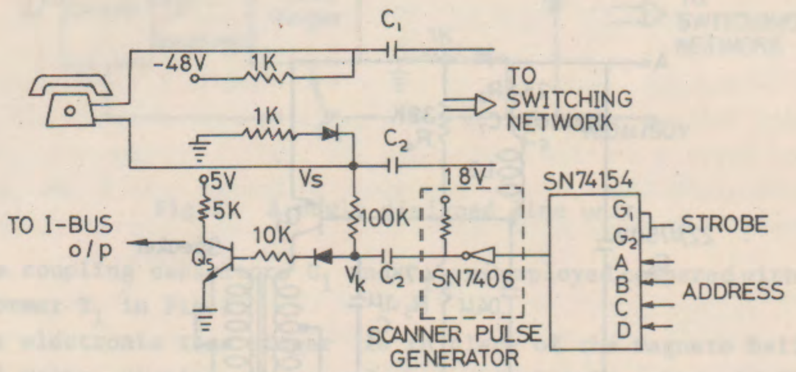

Fig 5. Line status scanning circuit.

3. The ringing note can be easily tuned. Therefore two telephones closed by can be different in ringing note. This is particular conventional for large offices.

4. With the new electronic ringer, zero quiscient power consumption yields.

5. Although the replacement of coupling transformer with coupling capacitors improves the transmission quality, but it also induces some mutual interference between adjacent lines due to the unbalance in the switching network. Yet, this interference can be minimized by careful circuit components arrangement and reducing the crosspoint turn-on resistance. (2) (3).

A new electronic ringing system is proposed and a proto-type system is fabricated and tested. This system offers many advantages over the magnetobell system, for example low power consumption, better transmission quality, simplified the design of hand set, compatible to the existing dialing system, however its ringing source differs from the existing system. This may delay the application of the new ringer in the public exchanger. But the new ringing system appears to be particularly suitable for the PBX, the private exchanger.

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平面移動排列型態分時多工交換網路新線路設計

A Noval Circuit Design of Time Division Multiplexed Switching Network of Planar Shifting Array

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(Received November 16, 1976)

ABSTRACT — A switching network using planar shifting array was first published in BSTJ by R. S. Krupp and L. A. Tomko in 1973. They proposed a time division multiplexed switching network using TSI (time slot interchanger) and PS (parallel-serial converter) as building blocks. A design having cost advantage over the foregoing-mentioned technique is presented in this paper. Standard commercially available logic circuits are utilized to realize the TSI, PS and the entire switching network. It is noticed that in the present design the PS circuit is combined into the TSI circuit of the proceeding stage, thus reduces the number of parts needed and in turn decreases the cost.

摘要——平面移動排列(planar shifting array)型分時多工交換網路(time division multiplexing switching network)是1973年R. S. Krupp及L. A. Tomko在BSTJ發表的一種分時多工交換方式。它是利用時孔交換器(time slot interchanger)與並串轉換器(parallel serial converter)來達成時空交換之目的。筆者應用該文的分時多工交換方式，用邏輯電路來設計此型交換網，並說明並串轉換器利用前級時孔交換器之電路略加擴展，即可包含並串轉換器之功用而不必另設並串轉換器。

本文分三段，第一段說明平面移動排列型分時多工交換網路之結構，第二段敘述時孔交換器之設計，第三段敘述複合式時孔交換並串轉換器之設計。

一、背景資料

本節之目的在於說明平面移動排列型分時多工交換網路之結構。蓋分時多工交換網路之最大目的，在於使脈碼調變系統(pulse code modulation，簡稱PCM)中之訊號，能夠在時域中直接交換，而無須使用複雜的空域交換網路。

平面移動排列型分時多工交換網由下列二種元件組成：

(一)時孔交換器(time slot interchanger)：其功用是將PCM中之時孔互相交換，這是一種時間位置之互換，經過時孔交換器後，各路訊號所在之時孔數，即可做一調整。例如一訊號