Telephone Electronics Line

C.O. Operations -
No. 5 Crossbar

Construction Project:
Poor Person's Telephone

Ma Bell's garbage

Telephone Electronics Line

MAY 1975 Published Monthly VOL 2. NO 5

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Editorial

By Jack Kranyak

An interesting development awakened us here at TEL recently. On an otherwise quiet Saturday one of our writers called home to let his wife know he would be a little late. To his suprise, the call was answered by an intercept operator, who told him that number had been disconnected at customer's request. You can imagine his shock, especially since he hadn't spoken to the phone company since the day his phone had been installed. A call to the operator verified the intercept operator, but the operator could do nothing and suggested a call to repair service. Repair service declined assistance, since, as they saw it, nothing was broken. They in turn advised that the only possibility was to wait out the weekend and call the business office on Monday to get a reconnect order. After further badgering the repair operator stated flatly that there was "no way in the world" to get the phone back on during the weekend. Our correspondent inquired if Richard Nixon or perhaps Elizabeth Taylor would also find it impossible to get service on a weekend. "Yes" came the reply. After that it only took two supervising operators, the manager at the local service center and five hours to restore service.

A lesser person than our intrepid reporter might have conceded early in the game and spent the weekend without telesatisfaction, but other than musing about how it might have been, we more or less forgot about it. But not for long! Only one week later the same thing happened to our business lines here at TEL. A little thought and investigation led us to the conclusion that some unhappy reader had found out the name under which our service was listed, and using that name had called in a disconnect order. A call to our business office proved even more interesting. The business representative remembered taking the disconnect order. She said the caller, who had a noticable scottish accent, had identified herself... "Herself"? we asked! "Well, yes" said the business rep "I thought it was a little strange, but she insisted she was Jack Kranyak, so I took her order."

That situation is deplorable, but even worse were the phone company's (in this case Pacific Bell) reasons for not wanting to turn the service back on during a weekend. They argued that there was no way [unless we spoke to the business office, closed of course] they could be sure that the person requesting the reconnect was the subscriber. Their point being that if they turn on your phone when it should be off someone might make an unauthorized long-distance call, a very serious condition in their eyes. As to our contention that is was much worse to leave someone who wanted service without it, they had no reply from their world on the other side of the looking glass.

"So" you ask, "what is the point of all this?" Well, simply to help you protect yourself from the same kind of harassment. After some prodding our business office agreed to the use of a code word to authorize further orders. We could have required that a call be made to our number to verify, but then we wouldn't have been able to call the business office from another location.

TEL suggests that you set up some sort of similar system with your business office. According to the business representative this type of occurance is not all that rare today. But further, we think that a company which does most of it's business vocally should require some identifying code, such as a mother's maiden name. This would be noted when service is first ordered and checked before any information would be given out or an order taken. This is common practice at banks; we think it's time the phone company caught up. ☐

The Phone Company will go to extremes on occasions. In fact, unless you really know what to expect from them they will surprise the heck out of you with their "unpublished tariffs".

Recently, a situation was brought to my attention that up till then I had been totally unaware of, least to mention, had any concern about. It involved garbage!

The Phone Company will go as far as to prosecute anyone who rumages through their garbage and helps himself to some. Of course they have their reasons for this, and no doubt benefit from such action. But, why should they be so picky about garbage? The answer soon became clear to me; those huge metal bins are filled up with more than waste, old food and refuse...

Although it is Pacific Telephone policy to recycle paper waste products, sometimes employees do overlook this sacred operation when sorting the garbage. Thus top-secret confidential Phone Company records go to the garbage bins instead of to the paper shredders. Since it is constantly being updated with "Company Memorandums" and supplied with extensive reference material, the Phone Company must continualy dispose of the outdated materials. Some phone companies are supplied each year with the complete "System Practices" guide. This publication is an over 40 foot long library of reference material about everything to do with telephones. As the new edition arrives each year the old version of "System Practices" must also be thrown out.

I very quickly figured out where some local phone phreaks were getting their material. They crawl into the garbage bins and remove selected items that are of particular interest to them and their fellow phreaks. Such information is copied and distributed to "trusted friends".

One Phone Phreak in the Los Angeles area has salvaged the complete 1972 edition of "Bell System Practices". It is so large and was so out of order (the binders had been removed) that it took him over a year to sort it out and create enough shelving for it in his garage.

Much of this "top secret" information is so secret that most phone companies have no idea what is in their files. They have their hands full simply replacing everything each time a change in wording requires a new revision. It seems they waste more paper than they can read!

It took quite a while for a Hollywood Cal. traffic manager to figure out how all of the local phone phreaks constantly discovered the switchroom test numbers. Whenever someone wanted to use the testboard they found local phone phreaks on the lines talking to points all over the world. It got to the point where the local garbage buffs knew more about the office operations than the employees themselves. One phreak went so far as to call in and tell a switchman what his next daily assignment would be. This, however, proved too much. The switchman traced the call and one phone phreak was denied the tool of his trade.

In another rather humorous incident, a fellow phreak was rumaging through the trash bin when he heard someone aproaching. He pressed up against the side of the bin and silently waited for the goodies to come. You can imagine his suprise when the garbage from the lunchroom landed on his head.

Most people find evenings best for checking out their local telco trash piles. The only thing necessary is a flashlight and, in the case mentioned above, possibly a rain coat. A word of warning though, before

Construction Project
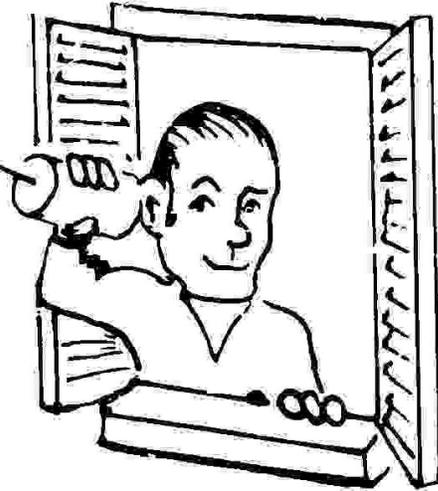
POOR PERSON'S PHONE

by A. MILLS

The telephone described in this article is not very sophisticated, but it does work. And while it is not something you might want in your living room, it is a cheap way to put a phone in the attic or basement, or wherever you might want to answer the phone.

The main part of this phone, and the hardest to make, is the handset (mouthpiece and earpiece). Rather than build this piece yourself it is best to procur it from an outside source. I wouldn't want to suggest that you go out and cut one out of a pay phone, but people have been known to do this. The metal sheathing around most pay phone cords makes that quite difficult nowadays anyway. Handsets are also available, commercially, at much less risk but slightly higher cost.

Having found a handset we move on to the construction of the phone itself. The cord from the handset contains four wires. In the case of the phone mentioned in this article the two wires coming from the earpiece are yellow and black, while those coming from the mouthpiece are green and yellow. In many phones the earpiece wires are red and black, and the mouthpiece wires are both white.

First connect the red and yellow wires together, then connect the black and yellow wires to your phone line (see diagram 1). The phone line wires will normally be red and green.

diagram 1
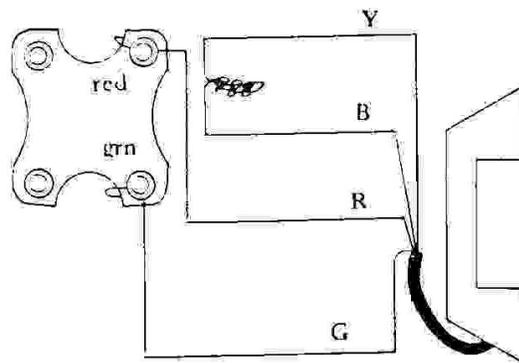
by FRED BLECHMAN

Recording telephone conversations has become very commonplace in recent years. This is due, in part, to the introduction of inexpensive battery operated tape recorders, and the availability of simple inductive recording pick-ups. However, in most states the use of this recording in public (i.e. in court or a radio broadcast) is illegal unless an audible "beep" is heard on the phone every 15 seconds. The purpose is to inform the caller that the call is being recorded. More sophisticated direct coupled recorders usually have a "beep" tone built in, but providing the tone becomes a problem when using an inductive pick-up device. The "phone beeper" described here serves this purpose conveniently and efficiently, requiring no additional wiring connections to the telephone, and only costs about $10 to build.

The "phone beeper" operates in a simple manner. The miniture speaker output of the "beeper" is placed near the telephone mouthpiece; the "beep" is therefore carried to the other end of the line with normal conversational volume. At the same time the "beep" is coupled through the

Construction Project

telephone beeper
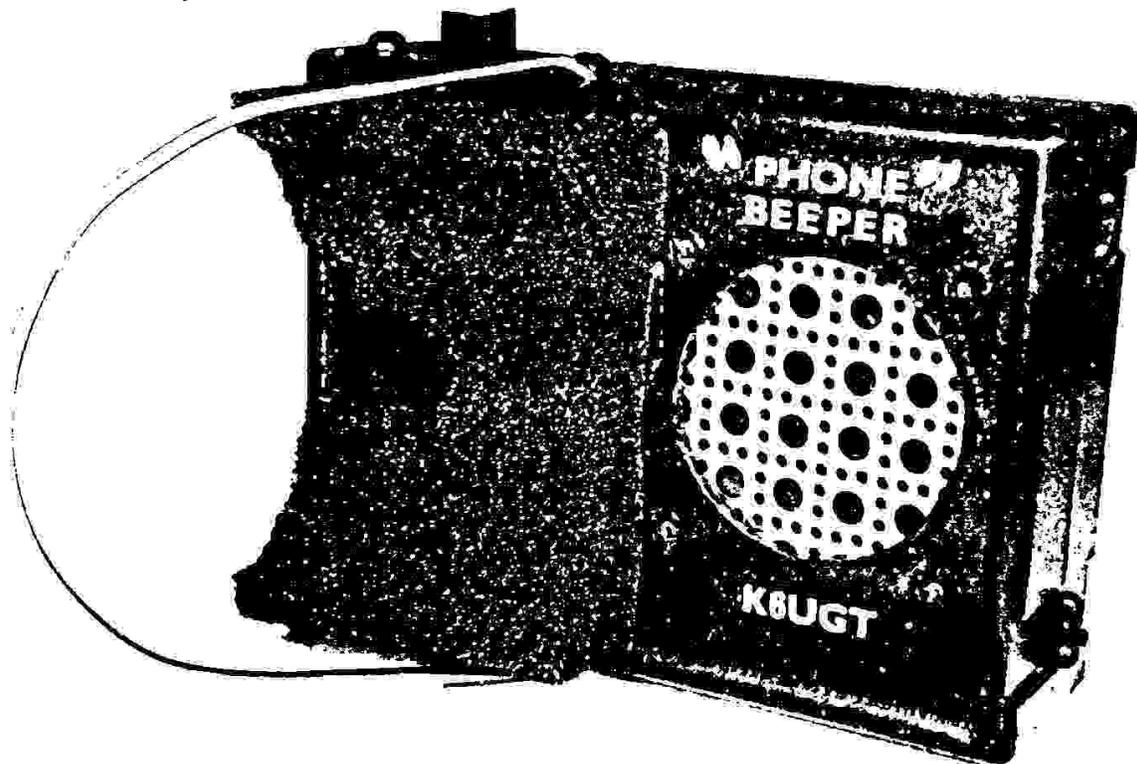
THE AUTHOR'S COMPLETED "PHONE BEEPER" This simple device could save you from a lot of legal headaches. The "beep" sound is emitted by the speaker (behind the aluminum grill) at 15 second intervals. The unit, completly portable, is held in place by a wire loop and foam cushion. The whole project can be built in one easy evening for less than $10.
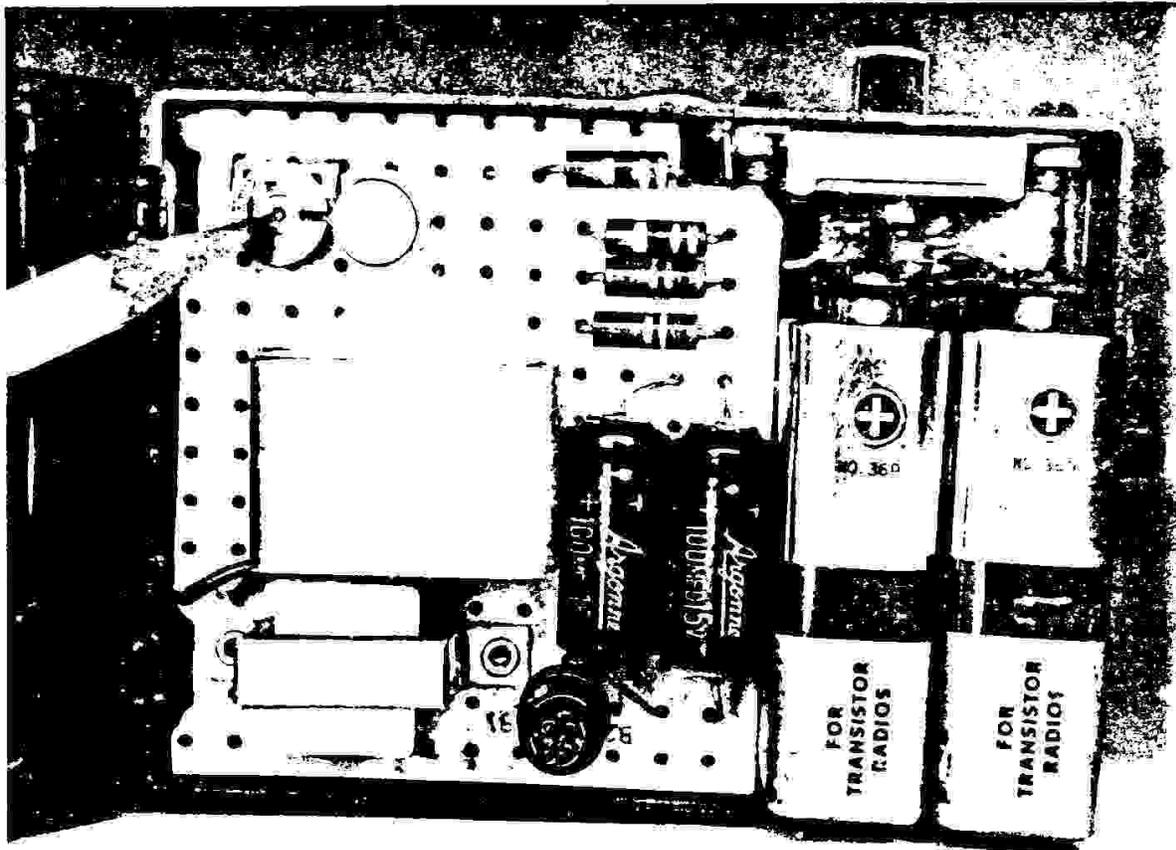
The parts layout is not critical, the author's unit was assembled in a plastic box. A sub-miniature pot allows feedback adjustment for oscillation of transistor Q2.

telephone sidetone generator, to the recording pick-up on the earpiece, and recorded at subdued volume. Furthermore, the "audible "beep" every 15 seconds, even after the phone is back on it's cradle, reminds the user to shut off the unit!

Figure 1 shows how the "phone beeper" is used. Notice that it is entirely independent physically and electrically from the recording pick-up at the earpiece. A self contained unit, the "phone beeper" contains a timing circuit, oscillator and speaker, and uses two common 9 volt transistor radio batteries for power. Built into a small box which may be held to the mouthpiece with a retaining clip made from piano wire, it does not interfere with normal telephone operation.

Figure 2 shows the schematic, and the simple circuitry used to time the "beeps". Q1 is a unijunction transistor (UJT), which is energized by the two 9 volt

batteries in series. When the switch is closed the two large value capacitors (C1 and C2) are charged through time-constant resistor R1. When the voltage at the emmiter of Q1 reaches a critical value, C1 and C2 discharge through the emitter base 1 junction of Q1, thus providing conductive bias for oscillator transistor Q2.

Feedback for oscillation is obtained through the center tapped transformer, which also couples the oscillator to the speaker. Variable resistor R2 controls the oscillation frequency. Q2 may be just about any inexpensive PNP transistor, with the adjustment of R2 compensating for differences between specific transistors. The time interval is controlled by the relationship between C1, C2 and R1 in conjunction with Q1; increase the resistance of R1 if the interval is too short, decrease if too long. If "chirp" is evident, readjust R2.

CENTRAL OFFICE OPERATIONS :

part two no. 5 crossbar

by DAVID AUTOVON

The step-by-step switching office (see TEL April '75) serves its purpose well for small closely knit groups where automatic calling is used only over short distances or for calls within one central exchange. With the advent of Direct Distance Dialing, however, equipment became more complex. At the same time, the need to switch more calls faster, without extreme expense became more apparent. It was for this purpose that Crossbar Switching was developed. There are a number of different types of crossbar switching systems. The basic crossbar systems are: No. 5 crossbar, No. 1 crossbar, and 4 A or Tandem crossbar. The type in most common use today is the No. 5 crossbar system, commonly refered to as crossbar 5. It is this version of crossbar that will be discussed in this article.

The crossbar systems get their name from the basic crossbar switch. This is an electro-mechanical inductivly operated device. It is composed of bars, called *tickler rods*, running its length, both vertically and horizontally. These are called *verticals* and *horizontals* for short. Each rod rotates aproximately 45 degrees when operated by a relay coil at its end. Each tickler rod is equiped with many protrusions, called ticklers, which push against contacts when the rod is rotated. When one vertical and one horizontal are operated, a pathway for connections is established at the point where the two rods intersect. The ability to form electrical connections in this manner forms the basis of the crossbar system. There are two sizes of crossbar 5 switches commonly used; 100 point and 200 point. The 100 point has ten verticals and the 200 point switch has 20 verticals. Each type has ten horizontals. The size of switch needed in a particular exchange is determined by the traffic volume of that exchange.

In the crossbar system equipment falls into two major catagories, *common control equipment*, and *talking path equipment*. Common control systems employ a *one at a time* method of operation. To better understand what is meant by "one at a time", consider the example of the basic single position operator controlled manual switchboard. At such a board the operator shares her time and attention over a number of calls. First she finds the calling line (indicated by a flashing light or other signal). She next determines the number to be called (usually verbally), and finally connects the two parties. After this process is completed the operator then leaves the call or "drops off the line". The operator can set up only one call at a time; when that call is completed she can go on to make another connection. Common control equipment is similarly used in the process of making the call, and also "drops off the line" after completing a connection. Equipment classified as common control includes: (1) the *originating register*, (2) the *marker*, (3) the *sender*, (4) the *incoming register*, and (5) the *number group*.

The other catagory of crossbar equipment, talking path equipment, includes the *switching frames*, the *line link frame*, and the paths (*trunks*) through which the talking circuits are established.

In the central office, each incoming telephone line is connected to a structure called the *main distributing frame* or *main frame*. As in step-by-step offices, the cables from subscribers telephones enter the building through a cable vault. The cables are then brought up to meeting point, from which the individual wires radiate. This meeting point is the main frame. The two wires from each subscriber are called a *pair*, and terminate on the vertical side of the main frame. Wires coming from the crossbar office equipment are terminated on the horizontal side. These wires connect the

battle with the phone phreaks "hots up"

European Report

(The following is reprinted from New Scientist, 3 April 1975.)

A new offensive against "phone phreaking" may have claimed its first victim last month. An alleged phone phreak had dialed a motoring organisation after a breakdown in central London, reportedly using a "lucky number" to save the change he didn't have. But, in mid call, his line was abruptly crossed by the Post Office's special phone phreak detectives. (In Britain, as in most other countries, the telephone system is owned by the state and run by the Post Office.)

The lucky number is a code which, dialed in front of a normal call will block the charging pulses from reaching the phone – or the phone bill! Interestingly, this particular code had been rigged up inside the Post Office's private London telephone system, which interconnects its numerous large London offices. But, outsiders could use this fiddle by dialing 432, the access code to Post Office headquarters, followed by the "lucky digits", 967; and then dialing the normal number, free of charge.

But the luck of the number ran out that day – for unknown to the phreaker, opposite the City [of London] callbox he used was a Post Office building. And, as he called through, the PO detectives were listening in – just 100 yards away.

This is not the first such fiddle in locations where only the internal staff could be responsible. Two years ago, the [London] Sunday Times (January 21, 1973, p 1)

reported a "Free-phone racket inside the Post Office" and alleged that up to 75 exchanges had been deliberately tampered with. One code which may have been included was very similar to the unlucky London number, using 977 rather than 967. Both these codes worked by using a unique loop-around circuit which by-passes checks in the equipment. Both must be wired by changing normal connections. Although that lucky number disappeared soon after the newspaper report, it reportedly surfaced last Autumn in its new form.

The London telephone area has reputedly now been well immunised against the phreaks, since a large trial was staged by the PO in 1973 (see "Are Telephones Addictive?" New Scientist, vol 60, p 756-760). Startlingly, it is suggested that this fiddle is a new tactic by the PO detectives, who are said to have set it up themselves. One PO engineer who works on this private network is convinced that it was established as "trap". His view is reinforced by a similar event at another black-listed free-phone exchange – Edinburgh.

There, a useful trunk circuit on code 514 which gave unrestricted access to the International Telephone System mysteriously reappeared after an absence of two years. Far from joyfully greeting an old friend, the wary phreaks probed the circuit and found that only one line had been connected up. They suspected that it might also be connected to an inquisitive Post Office ear. It is plausable that the new London fiddle may have been rigged in this way. □

May 1975

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*** BIG MOTHER IS
'ma bell' has her ear

by J. LOUIS

The Bell Telephone System monitored in random fashion millions of long-distance calls originating in six U.S. cities and secretly tape-recorded parts of at least 1,500,000 calls for analysis in New York.

The highly secretive program was designed to help combat electronic toll call frauds.

A spokesman for the American Telephone and Telegraph Co. says he doesn't think the company did anything illegal by eavesdropping on a reported 1.5 million long-distance calls between 1965 and 1970 in an effort to stop cheaters.

"We believe what we did was necessary to protect the integrity of our network and to keep people from cheating" said William Mullane about the voice recording program which recently came to light.

Mullane explained the company had been plagued by persons using an electronic blue box that bypassed AT&T billing systems and cut directly into the switching equipment, thereby completing free calls.

He would not eleborate on how the box worked.

Mullane did say that during the five year period only about 500 fraudulent calls had been discovered.

"I don't think we did anything illegal," Mullane said, explaining that the policy of intercepting pay-dodging calls has "been upheld in the courts. Such calls are illegal and since calls are our only property we have the right to intercept them."

* * *

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but only a tiny fraction of the calls listened to and recorded were ever confirmed by the company as being fraudulent.

The cities where calls were monitored were New York, Detroit, Miami, Los Angeles, St. Louis and Newark, N.J.

The monitoring program covered a six year period and is supposed to have ended in the spring of 1970, when those Bell executives involved were warned to purge their files of any reference to the program and to destroy any materials relating to it.

A source with knowledge of the internal operations of the Bell system said that Bell executives who ran the monitoring program believed the company was within its legal rights, but were afraid Bell's image might be damaged if word leaked to the public.

"From the begining they analyzed this very carefully," the source stated, "and decided that if it ever were necessary to reveal the existance of this equipment in order to prosecute a toll fraud case, they would simply decline to prosecute."

A good percentage of the tape recordings involved segments of from 30 seconds to 90 seconds from the time a call was first dialed, but in several hundred thousand instances entire conversations were recorded.

The monitoring equipment frequently misread calls as having indications of electronic toll fraud. Certain frequency components in human speech, for example, could have caused the equipment to be activated as if fraud were involved, with the result that the entire conversation might be taped, it was said.

The program was unknown to many high-ranking Bell executives even in areas where it was in effect.

More than 30,000,000 long distance calls were monitored during the first four years

WATCHING to the wall

of the program by sophisticated equipment that scanned trunk-line calls. The equipment looked for electrical indications that an attempt was being made to bypass the system's toll charge mechanism.

Of the more than 1½ million long-distance calls that were at least partly recorded during the first four years of the program, with the tapes being sent to New York for analysis, fewer than 25,000 were considered by those doing the analysis to be indicative of fraud.

Of these 25 thousand calls, only about 500, or .016%, were confirmed as fraudulent.

Initially, the program went into effect in late 1964 with six units, each capable of monitoring 100 trunk lines. Each unit could handle about five calls at any given moment. The program began with two units each in New York and Los Angeles and single units in Miami and Detroit. Early in 1967 the Detroit unit was transfered to St. Louis, remaining there untill the spring of 1970, and the supposed end of the program.

Several factors, including fear of public exposure, figured in the decision to end the program. Other factors included concern over the condition of the monitoring units and whether the whole approach was effecient and comprehensive enough.

The monitoring units used during the program were designed by Bell Laboratories to detect electronic toll cheaters, particularly those persons who utilized "blue boxes" and so-called "mutes".

(A blue box is, of course, a device intended to allow the user to place long-distance calls for free, or at greatly reduced rates. It can also access various pieces of specialized telephone equipment not intended for subscriber use. The mute is a device which enables a phone subscriber to answer long-distance calls with no charge to the caller. This device is par-

A repairman for the Bell Telephone System has brought suit against the company in Houston, Texas, charging that his constitutional rights were violated when the company sought to search his home without a search warrant for unauthorized telephone extensions.

The pending case raises large questions of public policy both for the Bell System and its customers.

At stake for "Ma" Bell and her many AT&T subsidiaries is the fate of a two year old "Tariff Enforcement Program" which, through electronic monitoring mostly at night, uncovered 155,000 unauthorized extension phones in 1974 alone. Bell System officials estimate their losses in connection fees and billing rates at close to $3 million for that number of phones.

Moreover, the sale of non-Bell phones and other unauthorized non-Bell-built equipment easily installable without company knowledge is a becoming a mushrooming business.

For customers, the case could uphold the right of any citizen to be free from the threat of a house search by the phone company without a warrant.

Bell spokespersons insist they never enter homes without permission although they claim the right to inspect their own equipment "within reasonable hours and with reasonable notice."

This interpretation is based on a decision made six years ago by the FCC which held that phone users do not have to consult the phone company—nor pay for—devices they install themselves which do not require wiring. Presumably, therefore, anything involving electrical connections is illegal.

✳ ✳ ✳

ticularly upseting to Bell, since it can be built in a matter of minutes, with as little as one resistor and two pieces of wire.)

LETTERS

Dear Sirs:

I would just like to mention that I think you made some typos that may cause some misunderstandings. On page 12 of TEL, March '75, you have listed several overseas senders wrong. I think the list should read:

Jacksonville 185
Oakland 186
Denver 187

Pittsburgh, which you omitted, should be 184.

Otherwise, a good issue, hope you catch up soon.

A. Mills
B.C., Canada

(A. Mills is right, we wern't; ED)

Dear TEL People,

On page 11 of the March issue, second column, about the middle, dial pulses are described. "Each interuption causes a capacitor to build up a small charge..." I am probably a little out of date on various dial central offices, but your description certainly doesn't fit any of the old ones, and I am really rather inclined to doubt that it fits any other dial system. Someone is rather mistaken about this, and I believe it is your author.

Sincerely,

W.W.D
Wichita, KS

(W.W.D. is of course right, it wasn't our month; ED)

In the article, "Touch-Tone— what it is, what it does" credit should have been given to David Talley and Hayden Book Company, of Rochelle Park NJ, for material used from "Basic Telephone Switching Systems", a Hayden publication.

Tel thanks Hayden books for permission to use their material, and recommends their books on the the field of telephony highly.

The April 1975 issue should have been labled Volume 2, Number 4.

COMING NEXT MONTH

OVERSEAS DIALING: SYSTEM 4

TOLL FRAUD DETECTION DEVICES

CONSTRUCTION PROJECT: TELEPHONE JOKELINE

A LETTER TO OUR READERS

Since its inception almost a year ago, TEL has been providing a service not available anywhere else. Advertised as "bringing you the secrets of your phone" TEL has tried hard to print a magazine that fills the needs of all people who have an interest in their phone and the system behind it.

As has been pointed out (TEL March '75) we didn't expect the large response to our new magazine. That initial rush simply caught us off guard. As a result we began to fall behind in production. The March issue didn't appear until late May. It was in May, however, that we moved to larger quarters and added three people to our staff in an effort to catch up.

Within two weeks after mailing the March issue we had finished the rough lay out and were ready to set the April issue. It was then that we were struck an awful blow.

After working till 2 A.M., Jack Kranyak, our Publishing Director and the brains behind TEL, was on his way home, a trip he has yet to complete. Only five blocks from our office he was involved in a serious auto accident. He lay unconcious for six weeks with severe head injuries.

Fortunately, Jack was strong and has made good progress toward recovery since regaining conciousness. He is, however, still in the hospital.

Jack's accident forced some unexpected changes on us. Two people had to be found and trained to take over the functions that Jack did by himself. Even with the extra help it still took a while to learn in a few weeks what Jack had taken years to put together.

We are now, once again, on top of it, our staff works smoothly and we expect Jack back this fall. We hope we have your understanding and your patience as we work to catch up.

In order to keep all subscriptions in order we decided not to skip months, that is why you are receiving this May issue in September. This is not a old issue! We hope that at our current pace we will be "on time" by Christmas.

Those who wish may write Jack Kranyak c/o Northridge Hospital. 18300 Roscoe Blvd., Northridge CA 91324, Room 102.

Thank you for supporting us to this point.

Sincerely,

John Reynolds

Dear Sirs,

For your info: Several step-by-step exchanges in Alabama have a good assortment of control functions and test numbers accessed by 86XX. Examples: In Birmingham 866 breaks the loop loose from the line finder and shorts the CO end for approx. 2 min. I assume this is to allow loop resistance measurements from the customer premises.

865 gives a second dial tone, when more digits are dialed the dial tone is broken and the equipment seems to be accepting the digits, but you never seem to get anywhere. 781195 is a 1KHz test tone with battery reverse every ten seconds.

The entire 681 exchange will accept Touch-Tone whether you pay extra for it or not! Odd things happen when you address this exchange from 550-XXXX.

Hope you find all this interesting,

R.C.
Birmingham, AL

Dear Phreaks,

Rochester, NY has an independent telephone company which is as bad as Ma Bell. The service is inferior even compared with other independents around the nation.

Anyway here are some codes that I have learned:

Dial 511, and a computer will read back the number you are talking from, followed by a tone.

997-XXXX gets a 1KHz tone, and if someone else in the system dials 998-XXXX the two parties will be connected. I have asked several phone company employes about this and none know what it is for.

The ring back numbers are, 981, 982 or 983 plus the last four digits of your telephone number. In Buffalo the numbers are 571, 572 or 573, I think they work the same way.

Looking forward to the next issue,

AS
Rochester, NY

poor phone

(Continued from Page 4)

(A note of caution, while phone lines are generally not dangerous to handle, they can conduct very high voltages during the ring cycle. To avoid the possibility of severe electrical shock, remove a phone from the hook to "busy out" your line and prevent ringing.)

This is about the simplest phone that one can build. However, I think that even a "poor man" would like a little more sophistication in his telephone. It would, for instance, be convenient to be able to "hang up" your phone. In order to do this, install a single-pole single-throw (SPST) switch between the yellow and red wires. While you are doing this, it would be a good idea to install a 1 K ohm resistor (see diagram 2) in series with the switch. This will give you a louder dial tone. (Smaller value resistors are fine, but any greater value stops the dial tone.)

diagram 2
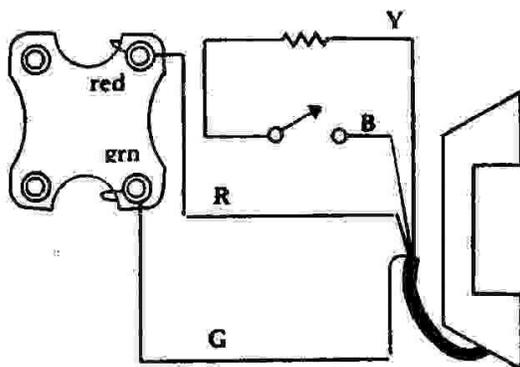
Now you can hang up and answer your phone using the switch. (By the way most early telephones had a similar switch instead of today's cradle switch.) After getting a dial tone, flick the switch *on* and *off* very quickly once. That will "dial" you a one, twice a two, etc. You should flick the switch at the rate of about ten times per second. It may sound hard at first, but practice makes perfect. Try information for starters, and work your way up to "O" operator. It is best to pause a second between digits in a number.

If you wish to know when the phone is ringing, place a 100K ohm resistor in series with a NE2 neon lamp across the telephone line (see diagram 3). The lamp will light when your phone rings.

diagram 3
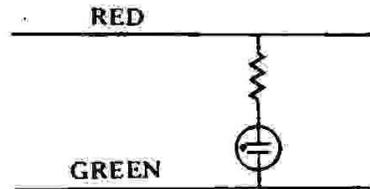
In order to make dialing a little easier, you might wish to substitute a push button switch (momentary contact, normally closed contacts) for the SPST switch. In that case, in order to "hang up" the phone, I would advise a double-pole double-throw (DPDT) switch connected to both sides of the line. To protect your phone from the possibilities of being "fried" by ring voltage it would be a good idea to connect a 1 mfd 150 volt electrolytic capacitor across the line (see diagram 4).

You can mount your finished "Poor Person's Phone" in a cigar box or similar container, or even place the whole thing in a glob of liquid plastic. To make the phone easier to use, you can add a "store bought" dial, and perhaps a simple speaker type jack and plug to make your new phone portable.

diagram 4
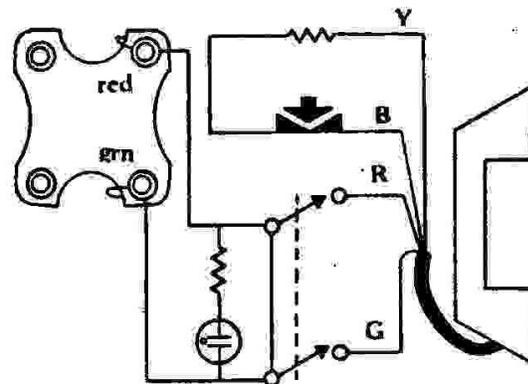
(Another Editor's Note: We would like to see photographs of your own "Poor Person's Phone" and hear about any modifications you may have added. The best ones we receive will be published in an upcoming issue of TEL.) □

A LITTLE LEXICON

(A Continuing Feature from TEL)

Blocking: The inability to interconnect two idle terminals in the switching network because one or more of the connecting links are in use for another call.

Enable pulse: Any current or voltage pulse that enables a circuit to become operative.

Interoffice trunk: Communications channel between two separate central offices.

Intraoffice trunk. Communications channel used to connect two subscribers lines in the same central office.

Loop: The two-wire circuit formed by the subscriber's telephone set, his cable pair and other conductors that connect it to the central office equipment.

Off hook: The condition that indicates a "closed" loop or the active state of a subscriber's line. This indicates that the phone is in use and has "closed" a loop with the central office.

On hook: The condition that indicates the idle state or "open" loop of a subscriber's line. Indicating that the phone is available to receive calls, an "open" loop exists between the subscriber's phone and the central office.

Talking path: The transmission path of a telephone circuit making up the tip and ring conductors, and the equipment connected to them.

Testboard: Equipment in central office used for access to subscriber lines to aid in line testing and diagnosing service breakdowns. □

sonic ranger
1000

MAGNETIC HANDSETS

Engineers at Bell Labs have designed a new type of telephone handset to accomidate users of hearing aids which have a telephone pick-up feature. The new handset produces a harmless electromagnetic field that is necessary for operation of the hearing aid. This magnetic field was once present in all handsets but was eliminated in more modern designs. The new handset is distinguished by a blue rubber grommet on the cord where it enters the handset. It is currently being tested at C&P in Baltimore and at New York Telephone.

TELEPHONES FOR THE DEAF

On May 2. 1975 what is believed to be the first transatlantic telephone call between two deaf persons. took place. The call was placed by Jack Ashley from the London Trade Center and received in Washington DC by the director of Deafness and Communicative Disorders. Department of Health Education and Welfare. They communicated with teletypwriters over normal telephone lines.

CENTRALIZED WHAT?

General Telephone of California has begun field testing of centralized answering and recording equipment. offering an alternative to customer owned or customer premises devices. The equipment was developed by General's Automatic Electric division. When the service is connected to a subcribers line the equipment automatically cuts in after a predetermined number of rings (adjustable from one to five). Features include answer and record. answer only, and variable announcement length. The customer uses his regular Touch-Tone buttons to control the unit for such functions as message record and playback. A special tone tells the customer that messages have been recorded. Remote access from any location is also provided through a special access number. ☐

DIAL-A-JOKE

"Maybe it's the telephone Daddy put in the basement that's causing the trouble."

big mother

The monitoring devices worked this way:

Once the unit locked onto a call, it would record on a temporary recorder the initial phase of each call. If it found nothing indicating electronic fraud, the temporary recording was erased and the equipment prepared to handle a new call.

But if the initial phase appeared to indicate, for example, that a blue box was being used, the equipment activated a master tape recorder that would record a segment or the entire content of the call. The master tape subsequently was sent to New York for analysis.

A Bell spokesperson stated that elaborate precautions were taken to assure that the tapes were studied by only a small group of trained security personell in New York. It was emphasized that at no time were the tapes listened to locally.

The spokesperson also pointed out that the Bell system will continue to crack down on electronic toll fraud, but that its present approach does not involve voice recordings. "We have found a better way to do it" he said in closing. □

NEW BELL BOOK

An updated revision of a book on the technical operation of the telephone industry's distance dialing network is available from American Telephone and Telegraph Company.

The revised copy of Notes on Distance Dialing, published in 1968, is to meet the requirements of the telecommunications industry for a single general information source on the basic operating principles of the network, AT&T said.

The book includes technical information required by manufacturing people. It also has material on the nationwide numbering and switching plans, plus equipment requirements and transmission considerations. New sections include material on Wide Area Telecommunications Services, Common Channel Interoffice Signaling and network management.

AT&T's Engineering and Network Services Department and Bell Labs prepared the revision with help from the USITA and the REA.

The 1975 edition can be purchased for $12.50 a copy pre-paid from Western Electric Company, Commercial Relations, P.O. Box 1579, Newark NJ, 07102.
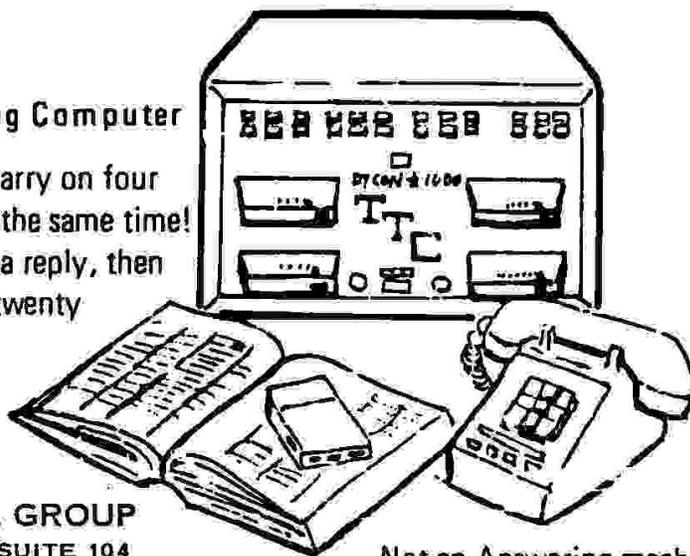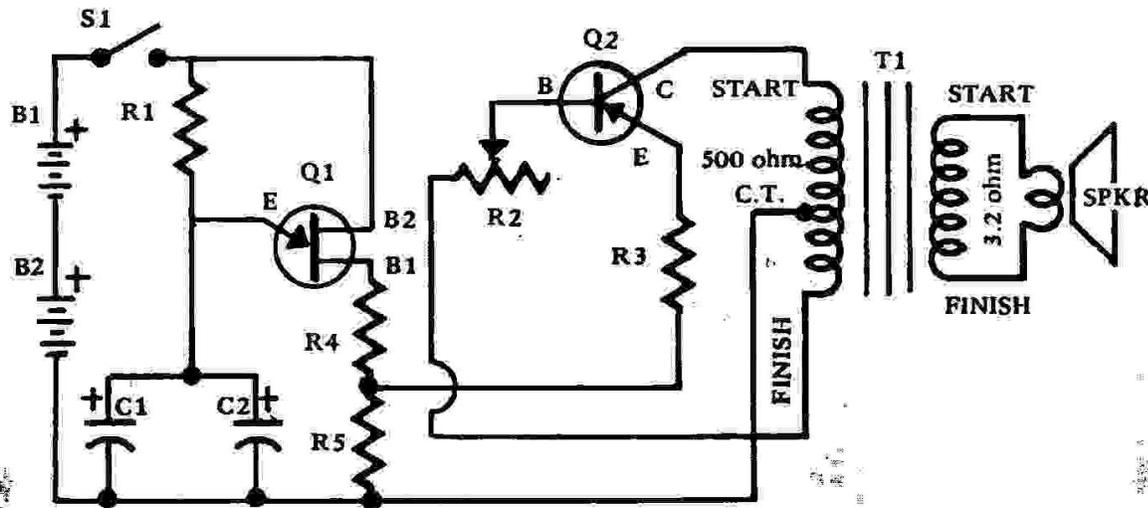
PHONE BEEPER PARTS LIST

B1, B2—9-volt transistor radio battery

C1, C2—100 mfd 15 volt electrolytic capacitor

Q1—GE 2N1671 unijunction transistor

Q2—general purpose PNP germanium transistor

R1—82K ohm ½ watt resistor

R2—50K ohm potentiometer

R3—33 ohm ½ watt resistor

R4—100 ohm ½ watt resistor

R5—27 ohm ½ watt resistor

S1—SPST slide switch

T1—subminiature output transformer

SPKR—1½" dia. speaker, 3.2 ohm

MISC: plastic box, battery clips

NOTES: (1) When S1 is turned on, first beep takes about 30 seconds. Thereafter 15 seconds. (2) Test with 10K resistor across R1 to increase beep rate. (3) Q2 will not oscillate unless T1 leads are connected as shown. If no oscillation (no beep) reverse leads and/or adjust R2.

Construction may be varied to suit the builder, and the wiring placement is not critical. The author used a perforated board with components on top and point-to-point wiring and jumpers underneath. A cutout in the board accommodates the speaker.

A simple retainer, fashioned from 1/16 diameter piano or coathanger wire, is formed to fit around the telephone mouthpiece. A piece of foam rubber may be cut out to form a cradle for the handset.

In use the first "beep" will take about 30 seconds after the unit is turned on. "Beeps" will follow regularly thereafter at aproximately 15 second intervals. Current drain should be about 2½ milliamperes, so the batteries should last over 200 hours with normal use.

If you regularly record telephone conversations of technical discussions, business transactions, long-distance calls or for any other purpose, the "phone beeper" will be a useful accessory to remind the party at the other end that they are being recorded, and may also prevent you from being charged with unlawful recording. The investment is small, the inconvenience slight and the results could be well worthwhile.□

TELEPHONE HANDSET.

RECORDING PICK-UP COIL

PHONE BEEPER

TYPICAL "BEEPER" INSTALLATION

c.o. opperations

main frame to the line link frame equipment. Jumper wires are used to connect each incoming pair to the proper points on the horizontal side. It is in this manner that a "number" is assigned. The line link frame is composed of crossbar switches, named according to their function, they are *line* switches or *junctor* switches. All calls going into or out of the office pass through the line link frame.

Subscribers' pairs are connected to the line switches through the main frame. Equipment, called *junctors* connect to the junctor switches. Permanent wires, called *line links*, connect the junctor and line switches:, this is where the name line link comes from. Subscribers having similar service (i.e. flat rate. message rate, coin, etc.) are connected to the same line link frame.

The connecting paths employed within an office. or between offices. are called trunks and are connected to another switching frame called a *trunk link frame*. The trunk link frame is also composed of crossbar switches. called trunk switches and junctor switches. Trunks and equipment called *originating registers* terminate on the trunk switches. The junctor and trunk switches are permanently wired together.

The line link frame and trunk link frame are connected together by means of *junctors*. The combination of line link frame, junctor, and trunk link frame form a chain, with the closure of crosspoints, to interconnect the subscribers line with a trunk.

When dialing is completed, the originating register locates an idle *completing marker*. This marker is sometimes known as the brain of the crossbar system; its purpose is to assist in the actual connection to the called party. The completing marker receives the complete number from the originating register and determines from the first three digits in which office the called
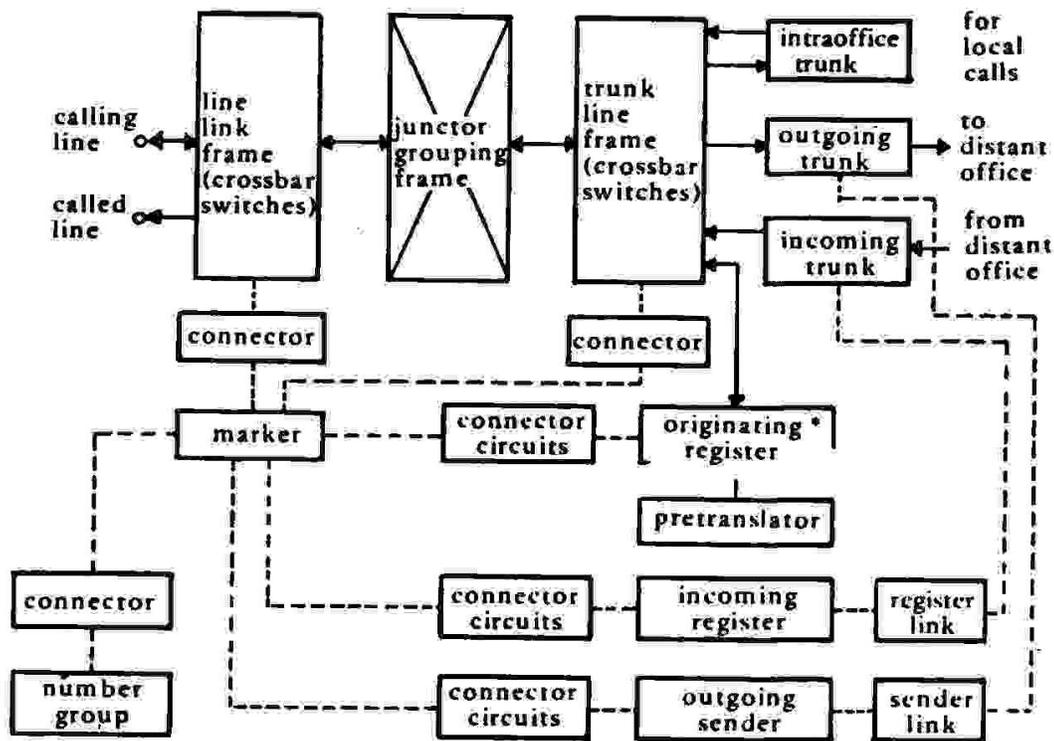
**= temporary connection for common control operations
*connected to calling subscriber line until dialing completed

BLOCK DRAWING OF No. 5 CROSSBAR SYSTEM

number is located. Next, the completing marker locates an available *outgoing sender* and gives it the last four digits of the called number. Then the completing marker locates an idle trunk on the trunk link frame, going to the desired office. The outgoing sender is now signaled to transmit the number to the distant office and the completing marker releases. The remainder of the call is handled by the distant office.

At the distant office the trunk terminates on a trunk link frame. At the time that the trunk was located by the completing marker, an *incoming register* was connected to the trunk at the distant office. This register receives the transmitted numbers and stores them, much like an outgoing register. The incoming register then finds a marker. This marker then connects to a *number group frame* to find the actual location of the called number's pair. After receiving the location, the marker tests the pair to see if it is "busy". If the pair is not "busy" the marker sets up a path from the trunk link frame through a junctor to the proper line link frame. A *ringing generator* is selected and the marker leaves the line. If the called pair tests out busy, the marker causes a busy signal to be sent to the calling party.

The main advantage of the No. 5 crossbar system lies in the fact that the common control equipment is used for only a few seconds per call. It is therfore available to set-up thousands of calls per hour. The first crossbar 5 office was built in 1947, however, it still represents the ultimate in sophistication for electromechanical switching systems. It was also, for all practical purposes, the last non-electronic system to be developed. Further articles in this series will deal with the development of the ESS or electronic switching system.

The first item of equipment used to establish a dialing connection is the *dial tone marker*. This is a rather complex device which directs the establishment of a a dialing circuit. When the subscribers handset is lifted, a *line relay* seizes an idle dial tone marker. The marker, in turn, locates the calling line on the line link frame and secures an originating register on the trunk link frame. The marker

touch-tone song of the month

OLD MAC DONALD HAD A FARM

Words and music traditional

trashing

(Continued from Page 3)

you rush out and dive into the trash heap. It is probably illegal, but no matter where you live, you certainly won't get the local policeman to hold your flashlight for you.

then closes a chain between the subscriber's pair and the trunk link frame. The dial tone marker also stores information about the class of service for the calling party and his location on the line link frame.

The originating register then returns the familiar dial tone sound to the caller, and receives and stores the digits dialed. □