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FORTRESS FUN-DING

TAP
Room 603
147 W. 42 St.
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NO. 66

INTRODUCTION

A modern Coin Telephone set must provide new features that will become telephone industry standards as coin telephone services are upgraded by Operating Companies[1]. Among these are a high quality, reliable, electronic coin value signalling system and a variable initial rate coin totalizing circuit. A new electronic tone generating circuit has replaced the mechanical gong system of signalling coin values in pay phones. The signalling circuit produces the coded audible tone signals which have been adopted by most North American telephone operating companies to signal coin denominations from a coin telephone to a toll operator. In addition, it provides coin value pulses which are counted by a Variable Initial Rate (VIR) totalizing circuit.

The coin signalling circuit, developed for new single-slot coin telephones, eliminates the bulky mechanical gongs, making room for a new fraud resistant coin chute. It improves the quality of coin signalling as heard by the operator by providing a consistent sound which varies less in level with the normal variations in line length between the telephone set and the switching office. Signalling security is improved by muting the telephone handset receiver during the time that the tones are on the line.

The totalizing circuit illustrates the flexibility gained by using electronics in coin sets. It will allow the operating company to select the desired initial rate for local calls and to alter the rate in 5¢ amounts by a very simple field modification. If the set is used with a switching office which provides a free emergency calling service, the output of the totalizing circuit may be used to control an electronic switch which is interrogated by the switching office. With such a system, the coin set is operative without coin deposit but the switching office will deny service to all but free calls unless the initial rate is deposited.

SELECTION OF TECHNOLOGY

The coin signalling problem has been approached in the past with a combination of electromechanical and bipolar technologies. However, problems arise with reliability, power supply, and the need to switch the telephone line between the signalling circuit and the telephone voice circuit. Thus, important design objectives for the new coin circuit were to operate on the power available from the telephone line and to be directly connected in parallel with the voice circuit of the telephone set. Complementary MOS technology was chosen for the coin signalling circuit because of its low power consumption, excellent noise immunity, and wide supply voltage and temperature tolerance. It is ideally suited to the Coin Telephone Set application which demands high performance in each of these characteristics. The major part of the system, all the digital logic functions and three linear amplifiers for the tone oscillator, are fabricated on two integrated circuits using metal gate CMOS technology. Discrete devices are provided for circuit reset and power handling situations such as relay driving, and transient and polarity protection.

CIRCUIT DESCRIPTION

When the telephone handset is lifted, a line switch contact applies central office battery to the circuit via the Ring and Tip leads (Fig. 1). A power supply and protection circuit increases the available supply voltage by approximately 1.8V dc to maintain the minimum 3V dc requirement of the circuit, corrects line voltage polarity, and protects the circuit against transients on the line. An external reset circuit provides an enabling input to the coin signalling and VIR IC's after a 300msec delay. The same circuit gives an immediate disabling input after any break in the power supply which disables the circuit during operations such as dial pulsing and coin collect/refund. Coin inputs appear as contact closures on three different input leads, one for each of the 5, 10 and 25¢ denominations. The CMOS microcircuit translates these into coded tone bursts for transmission to the central office (Fig. 2). Digital signals are also provided at the start and finish of each cycle to operate a receiver muring latching reed relay. The oscillator feeds a driver transistor T1 which is normally biased off to present a high impedance to the line. R1 controls the magnitude of the transmitted tone. The totalizer circuit receives from the coin signalling circuit a pulse for every 5¢ increment of deposited coinage. It totalizes the amount and when the preset Initial Rate is reached, actuates a relay. This relay may be used to enable the dial or in sets with free emergency calling capability, to activate an electronic switch. The initial rate may be varied from 5¢ to 40¢ in 5¢ increments.

To improve the line balance ground isolation is provided. This circuit senses the presence of loop current and opens the ground path during the talking period.

CMOS TONE OSCILLATOR

The gateable CMOS sine wave oscillator used in the coin signalling circuit utilizes three CMOS inverters (A_1,A_2,A_3 in Fig. 3) in the following way. Inverter A_2 is connected as a Colpitts type oscillator with the frequency determining elements being inductor L_1 and the two capacitors C_1 and C_2 connected in series. Feedback of correct phase and magnitude is applied to the gate of A_2 by providing an ac ground at the node of C_1 and C_2. The ac ground is provided by connecting the input and output of A_1 together. R_1 provides stabilization of the output resistance of A_2 to control frequency drift. Limiting diodes D_1,D_2 and thermistor R_{T1} stabilize the oscillator output voltage with regard to temperature and supply voltage variations. Power for A_1 and A_2 is provided via series n-type devices which are switched by logic level "B" (Fig. 2). The sine wave is present throughout the signalling cycle. Tone bursts are created by gating the oscillator output into A_3 using the coin value code pulses generated by the logic. This method of gating a constant sine wave was chosen to achieve a fast rise time for the output tone burst. To have turned the oscillator on and off would have required a considerable number of off chip components to achieve an acceptably fast rise time. With this technique, the only "off chip" components are gain and frequency controlling elements.

Fig. 4 shows the level of tone bursts measured at a 900ohm termination at the C.O. for different temperatures and line lengths.

CONCLUSION

The concept of the new coin signalling and totalizing circuit involves the use of a micropower technology with a capability for implementing linear as well as digital functions, a tolerance for a wide range of power supply voltages and very high noise immunity both on inputs and the power supply. With a technology having these features, the system can be placed directly in parallel with the telephone speech network without causing transmission loss, without changing the equalization characteristics of the speech network, and without going to the added expense of a local power supply.

Systems for improving the security of Coin Telephone signalling and for providing automated long distance calling (DDD) are under investigation. While the details of such systems are not settled, it is clear that they will require much more digital processing at the coin station. Improved signalling between switching office and coin set as well as expanded totalizing and storage functions can be achieved with technology and design methods based on those that have proven successful in the present coin signalling and totalizing circuits.

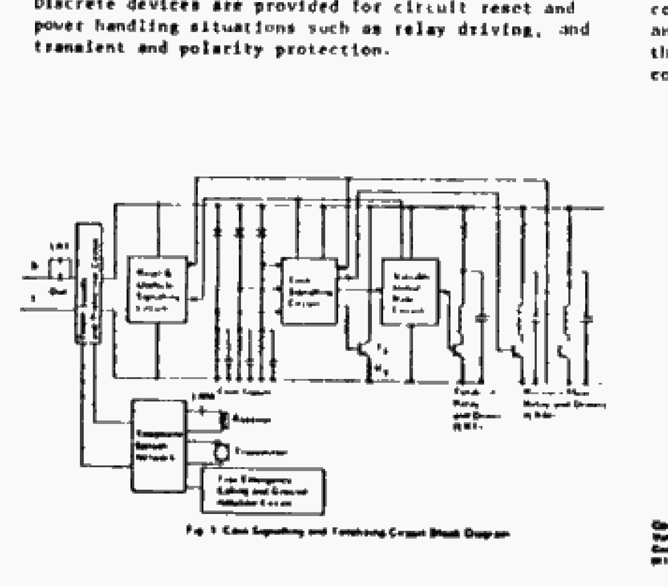


Fig. 1 Coin Signalling and Totalizing Circuit Block Diagram

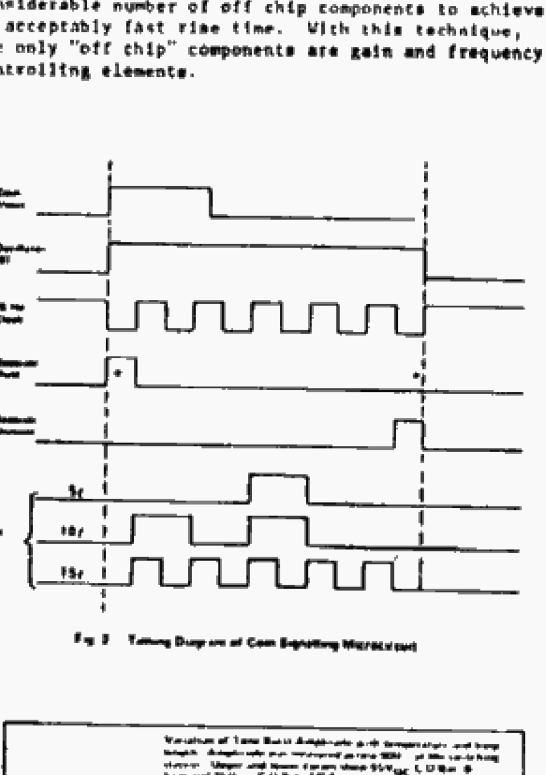


Fig. 2 Timing Diagram of Coin Signalling Microcircuit

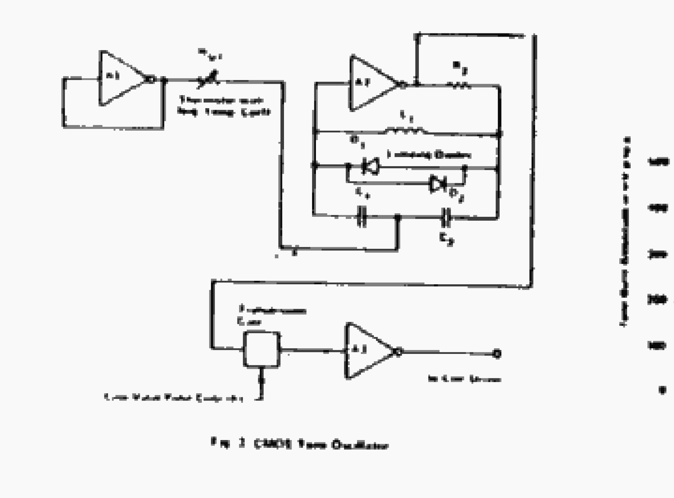


Fig. 3 CMOS Tone Oscillator

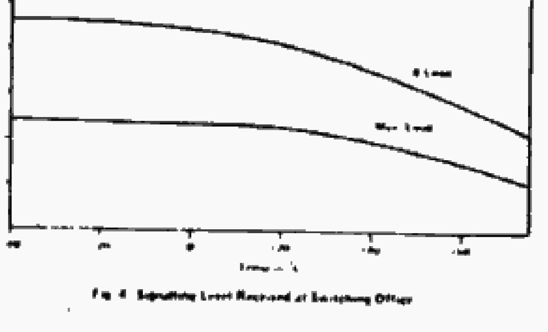


Fig. 4 Signalling Level Received at Switching Office

LETTERS FROM READERS

On Long Island if you dial 958 you get a computer with a voice which announces the number from which you are calling. I have been told that if there is a tap on the line the voice doesn't say anything so it's one way of checking a line for a tap-- I don't know if this is a fact and, if so, it is because of some condition on the line which prevents the computer from uttering anything or if the phone co programs the computer not to respond to 958 calls which come from numbers they have taps on-- or what happens if it isn't a MA Bell approved tap. I also don't know if 958 produces any response from fones outside of my own area-- but in Long Island it does produce a response. I've been to people's homes where they have an unlisted phone and have thoughtfully removed the number from the phone so their casual guests can't get it-- ol' 958 has come through every time!

Free magazines? Easy! Next time you go to a doctor or dentist's office, sort through the mags in his waiting room. See any you like? Pull off the address sticker on the front cover, attach it to the change of address coupon in the magazine, and send it back to the publisher. In a few weeks you'll be getting the magazine (hopefully at your P.O. box). Sometimes it takes the better part of the year before Doc realizes what happened and then gets it straightened out!

Good luck!

Super Grinch

Producing Short-Run Printed Circuit Boards

Because of the widespread demand for printed circuits as ... with integrated circuitry, technicians should be capable of producing ... of printed circuit boards for prototype work.

Printed circuit board fabrication in the school laboratory has frequently been limited to the act of pasting decals directly onto copper clad boards and ... the boards in an etchant solution such as ammonium persulphate or ferric chloride in order to remove the excess copper. The student has therefore been limited to the production of one board at a time and must begin again from scratch in order to make any changes. In addition, because of the undercutting along the edges of the tape, the quality of the printed circuit boards developed by this direct technique leaves a great deal to be desired.

One way of overcoming these problems is to use a photographic process in which ultraviolet light, shown through a photonegative of the tape layup, exposes an ultraviolet light sensitized chemical on the copper clad board. Then the board is bathed in the etchant.

A Low-Cost Variation

The major objection to the photographic technique has been the expense associated with the camera equipment it requires. At The College of Staten Island we employ a low cost system for the production of short runs of printed circuit boards, using a variation on the standard photographic technique. This technique eliminates both the expensive photographic equipment and the problems involved in direct layup of paste-ons onto the copper clad board. Further, the technique allows students to design and fabricate their own printed circuit boards, yet also permits limited quantity production runs.

Our technique uses no camera. Instead, we expose 3M Company photo-reversing film to ultraviolet light shown through the original art tape layup on mylar. The result is a reversal of the artwork that can be used in turn as the negative for the production of printed circuit boards. Here is a list of the materials and equipment we use in this process.

Materials
Kodak Photo Resist (K.P.R.) Type 3
Kodak Ortho Resist developer
Kodak Ortho Resist thinner
Copper etchant (ammonium persulphate or ferric chloride)
3M Scotchcal photo reversing film
Copper-clad boards
Mylar sheets
Printed circuit drafting aids (Bishop, Kepro or equal)
3M Scotchcal developer and pads

Equipment
Ultraviolet source
Vacuum frame, or 12 by 12 glass plates
Spray etcher (Any heated holding tank can be used to etch the copper-clad board. In some cases a small glass tray that holds the etchants and is agitated by hand can be used. A small fish tank is just fine.)

Making the Negative

1. The procedure for manufacturing the negative is quite simple. Start out with a schematic diagram of the project circuit. The first task is to convert the schematic to a printed circuit board format, taking into consideration such factors as the size of the components, the sockets, and the power dissipation. The primary draft of the printed circuit board layout is a pencil drawing which will be used as a guide for laying out the tape on clear acetate. Drafting aids for printed circuit board layouts are readily available today in all sizes and forms. With the use of these aids, the students can lay out a professional looking board with a minimum of effort.

2. Place the final tape layup over a sheet of Scotchcal reversing film, clamp the two together into a vacuum frame, and expose both to ultraviolet light. Experiments will best determine the amount of exposure time and the distance from the source, although the specification sheets for correct exposure time supplied with the Scotchcal reversing film, can serve as a reference. The Scotchcal reversing film is then developed using Scotchcal developer and rubbing pads. Rub off the unexposed coating that the Scotchcal developer has softened.

Making the Printed Circuit

1. Once the photonegative has been manufactured, degrease the printed circuit board. The entire board should be cleaned free of all dirt and skin oil. Steel wool is fine for this purpose.

2. Wash the printed circuit board in warm water, and place it in an oven to dry.

3. Apply K.P.R. Type 3 to the board. The board should be at ambient temperature before resist is applied.

4. Place the printed circuit board in an oven for approximately 15 minutes in order to dry the photo resist.

5. Lay the photo negative on top of the photo-sensitized printed circuit board. Then place the combination in a vacuum frame where the board will be exposed. The ultraviolet light used to expose the board will polymerize the photo lacquer where it passes through the negative.

6. Next, place the board in a developing solution to wash off the unexposed lacquer.

7. Wash the board in 70°F water to remove the developing solution and nonhardened lacquer.

8. The layout can now be seen on the printed circuit board. Check it for any errors.

9. Etch the printed circuit board. (Note that the finished printed circuit board at this point has polymerized lacquer over the copper conductors. It will have to be removed.)

Conclusion

When using the methods described above to produce printed circuit boards, the cost of the materials is low, the quality of the finished board is excellent, and the student who completes a board gains a feeling of personal satisfaction and accomplishment because of the professional quality of the board. We have found that students take more care and exhibit greater interest in projects when printed circuit boards are used. Consequently they learn more of the techniques of electronic fabrication.

Energy 'theft' targeted

Public Utilities Commissioner Edward H. Hynes, pointing to literature mailed to New Jersey residents outlining meter tampering methods, has asked Attorney General John J. Degnan to begin prosecuting energy theft through meter tampering.

In a memo to the attorney general, Hynes also asked for action against any groups or individuals who urge or advise such theft.

"It is the estimate of the board's staff and the utilities that energy theft in this state totals $15 million to $20 million per year. That is energy used and therefore energy that must be paid for. Unfortunately, it is a cost that is borne by a utility's law-abiding customers," Hynes said.

Haynes said anyone convicted of tampering with a meter with intent to defraud is subject to punishment of up to six months in jail and a fine of $1,000 plus restitution.

"This is a growing problem, and strong affirmative action must be taken. We must eradicate the notion that meter theft pays," the commissioner said.

He said tampering with a meter is "extremely dangerous" because it could result in electrocution of the person tampering with the live wires, a serious electrical fire or, in the case of gas pipes, a gas leak or explosion.

PARIS — The telephone company has squelched a do-it-yourself electronic dating service for French lonelyhearts, stamping out what it called "unofficial exploitation of the telephone system."

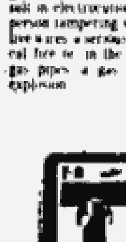
A whining sound has been installed on a telephone circuit that gives the exact time every 10 seconds. The whine prevents hundreds of people from shouting their names and phone numbers to each other in the silence between each recorded announcement.

According to officials of Postes et Telecommunications, the state-run post office and telephone company, subscribers calling for the right time often would hear a babble of voices on the line. What they heard went something like this:

"It is 23 hours, 12 minutes and 30 seconds ... hello out there, this is Francois, I'm lonely ... any feminine voices on the line? ... It is 23 hours, 12 minutes and 40 seconds ... Veronique here, Francois, call me at 206 91 03 ... it is 23 hours and 13 minutes ... Got it. Hang up Veronique, I'm dialing you now ... it is 23 hours, 13 minutes and 20 seconds ..."

The clandestine dial-a-date network became so well known in Paris that the French refer to it simply as "Le Reseau" — "The Network." Such networks have operated since the dawn of the telephone age in France, but none was more popular than "L'Horloge Parlante" — "The Speaking Clock."

One hundred callers were able to dial The Speaking Clock simultaneously, and sometimes the network would draw up to a dozen people into group discussions.



* Mabellephobe is said to be a coined word used to describe anyone who dislikes the telephone company. A man recently was sentenced to serve from six months to a year in a Roaring Springs, Pa., jail for making 1126 obscene phone calls, all to telephone company employees. He must have been a mabellephobe.

THE ELECTRIC PHONE BOOK

A Directory of 144 Computerized Bulletin Board Systems

A computerized bulletin board works just like an ordinary bulletin board system except that instead of paper and thumbtacks it uses a terminal, a computer, and the dial-up telephone network. It's a place to leave messages for everyone or for some particular person who, you know, browses the bulletin board occasionally.

The list below was developed from several sources including the Peripheral People in Mercer Island, Washington and the People's Message System in Santee, California. It is being maintained by PCC's PCNET project, our effort to bring computers and telecommunications into the hands of everyone. While this is the most complete listing we have as of this writing, we would appreciate additions and corrections. Send them to PCNET, PCC, P.O. Box E, Menlo Park, CA 94025 or leave them on the PCNET/PCC Bulletin Board System for Dave Caulkins, (415) 948-1474.

All the bulletin board systems listed here can be accessed by telephone using a 300-baud ASCII terminal and a Bell 103 modem. Most use carriage-return as a speed recognition character, after which they are self-teaching. All are free to anyone who calls, unlike the Arpanet which is restricted, and The Source and MicroNet which cost money. The list has been sorted by area code; consult your local telephone directory for geographical correspondence.

We are compiling a mailing list of people interested in computers and telecommunication. If you would like to be on it, send us a note at the address above. If you are interested in PAN, PCNET's computer mail system for the PET, send us a stamped, self-addressed envelope and we'll send you back information.

(201) 457-0893	(213) 795-3788	(314) 838-7784	(604) 687-2640	(714) 730-1206
(201) 835-7228	(213) 799-1632	(316) 746-2078	(607) 754-5571	(714) 739-0711
(201) 874-6033	(213) 799-6514	(319) 353-6528	(609) 983-5970	(714) 751-1422
(201) 891-7441	(213) 826-0325	(319) 557-9618	(612) 929-8966	(714) 772-8868
(201) 948-1074	(213) 828-3400	(404) 394-4220	(614) 272-2759	(714) 898-1984
(202) 337-4694	(213) 843-5390	(404) 733-3461	(614) 649-7097	(714) 962-2929
(205) 945-1489	(214) 288-4859	(404) 790-8614	(615) 254-9193	(801) 753-6800
(206) 244-5438	(214) 634-2668	(404) 939-1520	(617) 354-4682	(803) 270-5372
(206) 482-5134	(214) 634-2775	(404) 939-8429	(617) 431-1699	(803) 270-5392
(206) 524-0203	(214) 641-8759	(404) 953-0723	(617) 649-7097	(803) 279-5392
(206) 723-3282	(216) 745-7855	(405) 528-0009	(617) 864-3819	(803) 771-0922
(206) 937-0444	(305) 566-0805	(408) 241-1956	(617) 897-0346	(805) 484-9904
(209) 638-6392	(305) 689-3234	(408) 263-0248	(617) 963-8310	(813) 223-7688
(212) 448-6576	(305) 772-4444	(415) 348-2139	(702) 873-9491	(816) 861-7040
(213) 276-4276	(305) 821-7401	(415) 348-2396	(703) 281-2125	(816) 931-3135
(213) 316-5706	(305) 989-9647	(415) 493-7691	(703) 734-1387	(817) 855-3916
(213) 329-3715	(312) 255-6489	(415) 661-0705	(703) 750-0930	(817) 855-3918
(213) 340-0135	(312) 269-8083	(415) 792-8406	(703) 893-9474	(817) 923-0009
(213) 349-5728	(312) 337-6631	(415) 948-1474	(703) 978-2561	(901) 276-8196
(213) 360-6332	(312) 420-7995	(417) 862-7052	(713) 693-8000	(901) 362-2222
(213) 394-1505	(312) 528-7141	(451) 948-1474	(713) 977-7019	(901) 761-4743
(213) 395-1592	(312) 622-9609	(502) 245-8288	(714) 449-5689	(904) 243-1257
(213) 394-5905	(312) 767-0202	(503) 646-5510	(714) 463-0461	(904) 243-6565
(213) 424-3506	(312) 964-7768	(512) 657-0779	(714) 526-3687	(913) 764-1520
(213) 426-4718	(313) 288-0335	(513) 874-2203	(714) 537-7913	(913) 782-5115
(213) 459-3177	(313) 465-9531	(516) 938-9043	(714) 545-0961	(915) 584-5393
(213) 566-8035	(313) 477-4471	(602) 866-0258	(714) 571-3550	
(213) 657-8803	(313) 484-0732	(602) 866-0258	(714) 582-9557	
(213) 675-8803	(313) 569-2063	(602) 955-1486	(714) 582-9957	
(213) 787-4004		(602) 957-4428		

Nick's Easy Guide to CCITT Signalling Systems

The CCITT has set standards for signalling systems in use throughout the world. Almost all have provisions for our beloved MF tones so don't worry. You might like to try experimenting with some of these archaic systems. This information is from the 1975 CCITT Orange Book.

CCITT #1. This is an old international system using 500/20 hz signalling. The 500 hz was interrupted at 20 hz to send one-way line & register signals. Still used in Mozambique.

CCITT #2. A proposed international system that didn't catch on. It uses 600/750 hz in a single frequency signalling system. Seems to be British because it's used in South Africa, New Zealand, and Austrailia.

CCITT #3. One of the early in-band signalling systems. It used 2280 hz for both line & register signals. Nearly all terminal European traffic is sent with this system. Notice the French influence where this system is used: France, Austria, Jamaica, Poland, Thailand, and Hungary.

CCITT #4. Another early in-band system, this one using 2040 and 2400 hz for end-to-end transmission of line and register signals. Widely used for international traffic in Europe and suitable for both terminal and transit traffic. Said to have slow set-up for satellite links and cannot be used on TASI-equipped systems. Used in Italy, Argentina, Kenya, Syria, and Uganda.

CCITT #5. This is our favorite in-band system. It uses 2400 and 2600 for link-by-link transmission of line signals and a 2-of-6 code for the transmission of register signals. The 2-of-6 code uses 6 frequencies (700, 900, 1100, 1300, 1500, & 1700) in a scheme that I'm sure all of you are familiar with.
Used for TASI-equipped submarine cables and suitable for both terminal and transit traffic. This is the current world standard and nearly every other system can interact with this one.

CCITT #5 bis. This is very similar to #5 except a gaurd and TASI-looking frequency of 1850 hz is used for transmission of line signals.

CCITT #6. This seems to be the wave of the future. I'm sure you have read about it so I won't try to explain. This is an out-of-band signalling system that is strictly digital. The connection is made and the billing is started before you get control of the line. Here lies the great challenge of the 80's. Get the details in VOL VI.2 of the Orange Book.

CCITT R1. This is Regional System 1. AT&T heads up this movement and you can easily see the similarities between this system and CCITT #5. In fact about the only difference is that R1 does not have 2400 hz signalling and cannot be used with TASI-equipped systems. This statement indicates a possible connection between 2400 hz and TASI. What does 2400 hz do anyway? I can't find any reference to it in my literature.

CCITT R2. Naturally enough, this is Regional System 2. It operates like R1 and #5 because it uses a 2-of-6 code for register signals. However this system offers independent forward and backward signalling. Also it uses 3825 hz for transmission of line signals instead of the familiar 2600 hz. Of course 3825 is out-of-band so this is not easy to beat. The frequencies are as follows: forward- 1380, 1500, 1620, 1740, 1860, & 1980. backward- 1140, 1020, 900, 780, 660, & 540.
Notice that the spacing between frequencies is 120 hz while the spacing between frequencies on CCITT #5 is 200 hz. This system seems to be compatable with the military AUTOVON system. I have written a seperate article speculating on the AUTOVON signalling system which I'm submitting at the same time.

Nick Haflinger

	900	1100	1300	1500	1700
700	1	2 CC	4	7	11 ST3P RB
900		3	5	8	12 STP
1100			6	9	KP CR KP1
1300				0	? ST2P KP2
1500					ST

"The six frequencies provide 15 possible 2-frequency combinations. Ten combinations are used for the digits 0 to 9 inclusive and one each for signals indicating the beginning (kp) and end (st) of pulsing. the remaining three combinations are used for special signals."
-from 'Notes on Distance Dialing' (sec 5 p33)

This refers to signaling system R1, which is shown as the left-hand code in the above chart. The 3 extra combinations are 11, 12, and ?. I suspect this unknown code ... codes are shown on the right-hand side. I ... guess that 1300-1700 is code KP in light of the above data.

SPECIAL SIGNAL SUBSETS
CCITT #5
11 - inward operator
12 - delay operator
KP1 - terminal call
KP2 - transit call
? - extra signal (probably KP)

2. Coin Control Signals (details in TAP #54)
CC - coin collect
CR - coin return
RB - ring back

3. TSPS (Traffic Service Position System)
It is necessary to identify the trunk type in TSPS.
ST - 1 + digits (coin station)
STP - 0 + digits (coin station)
ST2P - 1 + digits (noncoin)
ST3P - 0 + digits (noncoin)

USE OF FREQUENCIES IN SELECTED SIGNALLING SYSTEMS

FREQUENCY	R1/#5	ARMY		R2-fwd	R2-back	USAF
500			N/A			
540					X	
660					X	
700	X					
780					X	
900	X				X	
1020	X				X	X
1100	X					
1140					X	X
1260						X
1300	X					X
1380				X		X
1500	X			X		X
1620				X		X
1700	X					
1740				X		X
1860				X		X
1900		X				
1980				X		X
2100		X				
2220			N/A			
2300		X				
2340			N/A			
2460			N/A			
2500		X				
2580			N/A			
2700		X				
2820			N/A			
2900		X				

Frequencies in 120 hz increments from 540 hz. and in 200 hz increments from 500 hz. Frequencies marked N/A fit in sequence but have no known use.

"I have an idea for our age of computerization. If computers ever get too powerful, we can organize them into committees. That'll do them in."
— Julie Andrews

'Your Access Code Tom, Input Your Access Code!!'

CARRIER CONTROLLED COIN CONTROL

Since the normal DC coin control signals cannot be used on TOUCH-TONE exchanges, Bell has come up with two other methods of coin control. The first of these is known as MULTIPLE WINK COIN CONTROL (MWCC).

This system was designed for TSPS and it provides the operator with some measure of control. MWCC uses multiple on-hook signals of 70-130 milliseconds. Table I shows the waveform of these signals. Take special note of the OPERATOR ATTACHED and OPERATOR RELEASED signals. (Kilgore Trout in TAP#37 asked about this)

The OPERATOR ATTACHED signal is used to disable the keyset on the pay phone. Likewise, the OPERATOR RELEASED signal is used to enable the keyset. Someone with a recent model payphone could trace the internal action of these signals.

The on-hook winks should have a duration of 70-130 ms and should be 100-150 ms apart when sent (75-185 ms received).

The second method is known as INBAND COIN CONTROL (ICC). This refers to the audible tones used for control. We know these as MF tones.

The important bit to remember is that the pay phone will NOT accept ICC MF tones until it has been prepared by an on-hook wink. This is the same as the OPERATOR RELEASED signal metioned above. The MF tone should start about 60 ms after the wink ends, and the tone should last 900 ms. The wink, from start to finish, should last about 350 ms.

One application of this information would be to design a special mute that gives the calling party their coins back. It may also be possible to OPERATOR ATTACH a pay station and prevent the operator from regaining control.

TABLE I.

# WINKS	FUNCTION	WAVEFORM	TONES
1	operator released	[waveform]	
*	operator attached	[waveform]	
3	coin collect		700 + 1100
4	coin return		1100 + 1700
5	ring back		700 + 1700

MORE on AUTOVON

I really enjoyed Ted Vail's discussion of AUTOVON (TAP 60) and it started the old synapses firing again. I think the answer has been right in front of us all the time. Let's start with some basic facts about AUTOVON and MaBELL.
1) AUTOVON uses BELL's long distance lines.
2) It follows that AUTOVON signaling must be compatable.
3) All CCITT analog signaling systems used in America are '2-of-6' codes with 6 evenly spaced frequencies as a base.
4) The military doesn't have the ability to create their own system.

It looks like the 'USAF 412L' matrix is just like the BELL Touch Tone matrix. These are both 2-of-8 codes and as far as I know they can only used to transmit digits to the central office. Lets compare the two matrices side by side. Note that the BELL frequencies are metricaly spaced while the AUTOVON frequencies are evenly spaced.

	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Bell Touch Tone

	1620	1740	1860	1980
1020	1	2	3	FO
1140	4	5	6	F
1260	7	8	9	I
1380		0		P

AUTOVON Touch Tone

AUTOVON doesn't use * and #, and the A,B,C,D has been replaced with FO,F,I,P. These letters designate which priority class you request for your call. FO is FLASH OVERIDE, F is FLASH, I is IMMEDIATE, and P is PRIORITY. P is the lowest priority class and FO is the highest class available. Don't try to use it.

The 'priority request' is first handled on the calling end to see if the desired class is available. If not a caller is bumped off and the higher priority takes his line. Once an outgoing line is captured the called number is translated into 'MF' tones and processed. One of the digits in this 12-digit number is the IDENTIFICATION DIGIT, which Bell uses to distinguish pay phones, home phones, and hotel phones. I believe AUTOVON uses this digit to carry priority information to the called party.

The article raised some questions in my mind so I refered to my references and found some interesting data in the CCITT Orange Book. AUTOVON has many points of similarity with BELL signaling system R2. R2 uses 2 sets of 6 frequencies (two 2-of-6 codes) for independent forward and backward signaling. These frequencies are listed below and the reader can construct a matrix for study if desired.

Forward: 1380, 1500, 1620, 1740, 1860, and 1980.
Backward: 1140, 1020, 900, 780, 660, and 540.

Some of these frequencies (1020, 1140, 1380, 1620, 1740 and 1860) are used in the AUTOVON Touch Tone. One other frequency is used in the AUTOVON TT, and it should come as no surprise that 1260 is this frequency. Notice that all R2 frequencies are spaced 120 hz apart and 1260 is between the forward and backward frequencies. Also note that the AUTOVON frequencies are bounded by 900-1500 hz and 1500-2100 hz. Refer to the table at the end of this article.

This brings up the possibility that AUTOVON is only a special case of R2. If this is true then we have problems because R2 does not use in-band line controls. R2 uses 3825 hz out-of-band control for line signals and as a TASI-locking frequency.

Of course we know the military and they couldn't come up with this systen by themselves. It's possible that the 412L system is only used for touch tone and the frequencies were chosen for convienence.

This seems likely because the Army TA341 system seems to fit in with the R1/#5 system quite well. It also seems compatable with the international signaling systems where AF 412L is not.

Let's draw out the BELL matrix and the Army TA341 matrix for comparison. Take the BELL matrix and add 1200 hz to every frequency.

	900	1100	1300	1500	1700
700	1	2	4	7	11
900		3	5	8	12
1100			6	9	KP
1300				0	KP2
1500					ST

Bell MF tones

	2100	2300	2500	2700	2900
1900	4	8	0	3	?
2100		1	7	9	?
2300			2	6	?
2500				5	?
2700					?

AUTOVON MF tones

Well, need I say more? The only thing missing is the order of KP, ST, etc in the AUTOVON system. I suspect they will be the same as BELL. Both matrices represent a 2-of-6 code. Since Bell long distance lines are used in the AUTOVON system, it seems reasonable that AUTOVON would use a compatable signaling system.

It is possible that AUTOVON MF tones are converted to BELL MF tones before being placed on the long distance network. Another possibility is that Bell has special equipment to 'subtract' 1200 hz from each signalling tone. Surely someone can find out and let me know.

Write me in care of TAP
Nick Haflinger

Readers with scanners might wish to tune their attention to the following frequencies which are used by Ma Bell's maintenance crews:

Primarily used in rural and suburban areas-
Base & Mobiles: 35.16 151.985 MHz
Mobiles only: 43.16 158.34 MHz
Primarily used in metropolitan areas:
451.30 451.325 451.35 451.40 451.45 451.50
In some heavily populated areas the following frequencies may secondarily be used when all other frequencies are assigned:
451.175 451.225 451.275 451.375 451.425
451.475 451.525 451.575 451.625 451.675
462.475 462.525
Additionally, the following frequencies are available in selected metro areas as noted:
Boston MA 471.3125 to 471.3875 MHz
Los Angeles CA 473.3125 471.4125 507.3125 507.4125 MHz
New York NY 472.9625 472.9875 478.9625 478.9875 MHz
Mobile telephone operators are most often found operating on: 152.51 152.54 152.57 152.60 152.63 152.66 152.69 152.72 152.75 152.78-- there are also other frequencies used between 454.375 and 454.65. Not all frequencies used in all areas. Ship-to-shore phone calls most often heard ont 161.80 161.85 161.90 161.95 162.00 161.825 161.875 161.925 161.975. A listing of mobile operator & ship-to-shore frequencies used at specific locations is called TELE-COMM and is available for $3.95, ppd, from CRB Research. Box 56, Commack NY 11725.

Postal breakthroughs

WASHINGTON — While many people have complained about a first-class stamp going up from 13 cents to 15 cents, the U.S. Postal Service is very proud of it.

I talked to one of the men who developed the 15-cent stamp and he considers it one of the greatest breakthroughs in mail delivery since the invention of the zip code.

"For years we've dreamed of a 15-cent stamp, but it is one thing to have the concept and another to make it a reality. Ever since the people upstairs said they wanted it, we have been working day and night to develop one according to their needs."

"What specifically did they want?"

"They said they wanted a stamp lighter in weight so we could get more letters on an airplane. At the same time it had to take a beating from hail and snow and sleet. The stamp also had to be flexible enough to bend when it was bought in rolls instead of sheets. And the most important requirement was that it could not be used again when the post office failed to cancel it."

"How did you solve the last problem?"

"That was the most difficult," he said. "The post office has been losing between $10 million and $20 million a year because when people got a letter with a stamp that was not canceled they steamed it off and used it again. This is a federal crime, but very few federal attorneys will prosecute.

"They say it is too difficult to find a jury that will convict someone for recycling a postage stamp. So the people upstairs told us we had to come up with a stamp that couldn't be used twice. It wasn't an easy assignment. The first thing we developed was a glue with an explosive base. When a person tried to pry off an uncanceled stamp from a letter, the stamp would blow his hand off. We thought we had the solution, but the Occupational Safety and Health Administration raised objections so we had to go back to the drawing board."

"That was tough luck," I said, "because it would have done away with the crime."

"Then we came up with a blue dye. If you tried to get the stamp off the envelope you would be covered from head to foot with this indelible dye, and then our postal inspectors would be able to make a foolproof arrest."

"The people upstairs didn't go for that?"

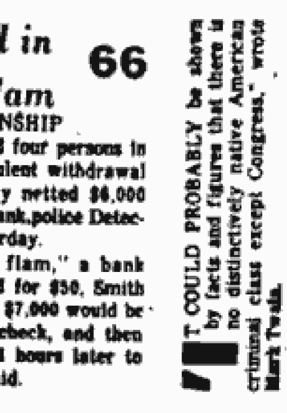
"They did, but the postal workers kept getting the dye all over their clothes and wanted the service to pay for new uniforms."

"What was the answer?"

"A secret glue which makes it impossible to steam the stamp off. It self-destructs if anyone tampers with it after it has been stuck on an envelope. It's the biggest breakthrough since the invention of air mail."

"Will the new 15-cent stamp speed up the delivery of mail?"

"I should hope so. With less weight and more stable corners, our new 15-cent stamp could break the record from New York to Washington by 45 minutes. A first-class letter can now get to any place within 500 miles in less than four days."



"Blessed are the young, for they shall inherit the national debt." — Herbert Hoover.

Locksmiths pick away at Caan's 'Thief'

HOLLYWOOD — James Caan's next movie, "Thief," is not due out until February, but already it has gotten its first review.

The Professional Locksmiths Coordinating Council of California and assorted safe manufacturers do not like the movie. Too graphic, they say.

This time the issues are not sex, violence or four-letter words but graphic depiction of safecracking.

"We believe the information this movie could provide to the criminal element would be used by them to deprive the general public of their property and possessions, and create a feeling of insecurity and anger amongst those victims against whom such information may be used," Kenneth R. Lussier Sr., chairman of the Professional Locksmiths Coordinating Council of California, wrote the producers of the film in a letter dated June 30.

* * *

"We do not believe that the general public has the need to know how to drill open a safe or otherwise gain entry into prohibited areas in which an individual, human or corporate, secures his possessions," Lussier continued.

In a telephone interview, "Thief" director Michael Mann agreed the film is graphic — it does show sophisticated ways to pick open a safe.

"But criminalogically," Mann said, "the letter is inaccurate. You might know how to drill a safe after seeing the movie, but you'd also have to have 15 years of experience to put the methods shown into operation."

Mann and Caan do not have that kind of experience, so they hired someone who did. The technical adviser on the film, Mann said, had worked as a burglar for more than a decade.

Four arrested in $6,000 flim-flam

READINGTON TOWNSHIP — Authorities have arrested four persons in connection with a fraudulent withdrawal scheme that temporarily netted $6,000 from Citizens National Bank, police Detective Dan Smith said yesterday.

In the alleged "flim flam," a bank account would be opened for $50, Smith said. The next day, about $7,000 would be deposited with a phony check, and then someone would return 24 hours later to withdraw $6,000, Smith said.

IT COULD PROBABLY be shown by facts and figures that there is no distinctively native American criminal class except Congress," wrote Mark Twain.

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