Advantages of Milo's Box
1. Can hold 10 10 digit numbers.
2. Each number is pulsed at the proper rate at the touch of a single key.
3. The current drain is very low. When not pulsing the battery drain is only 40 microamps. A single 9 V alkaline battery will power it for a year of on time, unlike Peter Piver's programmable box (TAP # 5 & 6) which takes two 9V batteries and pulls 24mA in standby.

Disadvantages of Milo's Box
1. The box is complex.
2. A measure of its complexity is bulkier than the usual manual box.

The enclosed schematic is of a working Milo Fonebill BB. It took one hell of a lot of study to figure it out from Milo's drawings. I'll describe how it works in 5 sections: 1. Number entry; 2. Playing back the numbers, or RUN; 3. CLEARing the Box; 4. Disadvantages of Milo's Box; 5. Advantages of Milo's Box.

1. Number entry. Assume the box has been cleared and a 1 is in all 64 bits of each register. I'll get to the reason for this later. The switch enabling the keyboard is closed. Now assume that the KP key is pressed then lines 1100 and 1700 go low. A "0" (0 is low, 1 is high) is placed on pin 15 (Data In) of IC 9 & 12 but the data is not entered yet. At the same time pin 4 of IC9A and pin 13 of IC8A go low which drives pin 11 of IC14C low. This in turn makes pin 10 of all the shift registers low through IC4A & IC16C. This puts the shift registers in data entry mode. Meanwhile charge is leaking off C5 through R14 and after about 500μs IC9 goes high and R0 goes low. This delay is to allow for changes in the keyboard switch. QD high drives pin 2 (clock input) of all the shift registers high. The data present at pin 15 of all the shift registers is now entered. R0 went low after 9μs which, through IC6A, IC17A, F, and IC21 & F turns on the output amplifier (10476) giving an audible click and lights the pulsing gate indicator LED. The LED stays lit as long as any key is depressed. Let me repeat, a 0 is entered into the 1100 and 1700 shift registers and a 1 is entered into the 700, 900, 1300, and 1500 shift registers when KP is pressed on the keyboard.

The Schmitt triggers (IC18E&F) replace the 4047 used in Milo's box. I could not get the 4047 to work in this application. Besides the 7414 Schmitt trigger is cheaper. Note also that the P gate indicator driver should be a non-inverting buffer and not an inverting buffer as Milo shows it.

The 4051 shift register, unlike other CMOS ICs, has a large clock input capacitance (pin 2) so I play safe and drive them with 5 inverting buffers rather than 1 as Milo does. The 4051 is clocked by the positive edge of the clock which does not have a high level so the clock input needs a sharply rising waveform to clock it.

2. RUN Mode. Assume that 2 ten digit numbers each with a prefix of KP and a suffix of 3 have been entered into the shift registers. Before going on I will describe the 12 data selector composed of the 2 NAND gates IC1B, C, D, and the inverting buffer IC16C. Two clock rates are used: 120Hz supplied by the oscillator IC23; 10Hz at the output (pin 3) of the divide by 128 counter (IC20). The 120Hz clock goes to one input of the data selector (pin 9, IC10A) and the 10Hz clock goes to the other input (pin 12, IC10C). The control signal appears at pin 4 of the NOR gate IC15B. When this control voltage is low then the output of the data selector (pin 4, IC15B) follows the high speed clock. When this pin is high then the output of the data selector follows the slow clock.

Now, let's press the RUN key. Immediately pin 4 of IC15B goes high and stays high for 50ms (I'll explain the reason for the 50ms later) and the output of the NOR latch composed of IC15C & D (pin 10, IC15D) goes high which sends pin 5 of IC14A low. After 50ms this turns on the clock oscillator (pin 4, IC25) and drives pin 1 of IC6A high which turns on the output amplifier and the P gate indicator.

Which clock will be used by the data selector? A total of 26 digits have been entered into the shift registers. Since there are 64 bits per shift register the data is 40 bits away from appearing at the output. The 2 NAND gates IC15B and IC14C see all "1s" at the 3 output (pin 6) of the shift registers. This through IC15D and IC15B select the high speed clock. So, at a rate of 1200Hz data is stepped through the shift registers.

3. CLEAR. When the CLEAR key is pressed pin 1 of IC15A goes high. This is one input of the NOR latch composed of IC15A and B. This drives pin 3 of IC15D low which, through IC4A and IC16B drives low pin 10 of all the shift registers. This changes the shift registers from the recirculate mode to the data entry mode. At the same time the other output of the NOR latch (pin 4, IC15B) goes high. Through IC15B this causes the data selector to select the high speed clock. The shift registers are now clocked at 1200Hz with their inputs (pin 15) all high. This load a "1" in all 64 locations of all the shift registers. Since the complement output (S) is used the shift registers are cleared. After 64 counts the EOR counter goes high (pin 5, IC19) and resets the CLEAR NOR latch. The box is now ready to accept new numbers.

After 40 clock cycles two things happen; either of which will reset the RUN latch and turn off the clock. The "End of Register" (EOR) counter (IC19) has reached a count of 64 (it also counts when the numbers are entered) placing a high level on pin 6 of IC14B. Also the KP + K0 detector composed of the 3 NAND gates IC12 & D and IC14A has detected KP at the Q output (Q not Q) output (pin 7) of the 1100 and 1700 shift registers. This places a high level at the other input (pin 5) of the NOR gate IC14B. The negative going pulse at pin 6 of the reset generator (IC23) triggers a 2ms output pulse at pin 10. This is the RUN latch, the EOR counter (IC19), the divide by 128 counter (IC20), and turns off the clock. All this happened in 81.25ms, 50ms delay before the clock turned on plus 51.25ms to shift 40 bits at 1200Hz.

But we still haven't played our numbers back. The next press of the RUN key gets the first number. KP of the first number is at the output of the 1100 & 1700 shift registers. The output of the KP + K0 detector is high making the trigger input (pin 6) of the reset generator low but this doesn't do anything. The reset generator is negative edge triggered. Let's press RUN again. Again we get the 50ms Delay before the clock turns on. The "No Data Detect" gates see data present at the shift registers so the data selector selects the low speed clock. Pin 15 of the NOR gate IC15C goes low and pin 12 of the same IC is also low because it takes 64 clock cycles before pin 4 of IC20 will go high. IC150 turns on one input of all the output NAND gates high (IC1A, B, C, D, IC2A & B). Pins 7 of shift registers IC9 and IC12 are also high so the output of NAND gates IC1C (1100) and IC2B (1700) go low which turns on the 1100 and 1700 tone generators. The output amplifiers and the P gate indicator are also on so we have 100ms of KP as per Milo's specs. KP is 100ms because of the 50ms delay before the clock starts running. This is the reason for the 50ms delay. Therefore R2 and C2 should be chosen to give a 50ms delay. The output of IC20 goes high 100ms after RUN is keyed. This turns off the tone generators and clocks the shift registers to the next number. After 50ms of silence pin 5 of IC20 goes low for 50ms and we get 50ms of tones for what over number is after KP and so on for each number until KP of the next number is reached. Then the KP + K0 detector output, which went low after KP of the first number was shifted past, again goes high triggering the reset generator which stops the clock and resets everything.

A second press of the RUN key plays the second number in the same way. After the second number is played there are 40 bits of no data so the "No Data Detect" selects the high speed clock which rapidly (31.25ms) recirculates KP of the first number to the output of the shift registers and everything stops. The box is now ready to replay the first number.

4. CLEAR. When the CLEAR key is pressed pin 1 of IC15A goes high. This is one input of the NOR latch composed of IC15A and B. This drives pin 3 of IC15D low which, through IC4A and IC16B drives low pin 10 of all the shift registers. This changes the shift registers from the recirculate mode to the data entry mode. At the same time the other output of the NOR latch (pin 4, IC15B) goes high. This through IC15B causes the data selector to select the high speed clock. The shift registers are now clocked at 1200Hz with their inputs (pin 15) all high. This loads a "1" in all 64 locations of all the shift registers. Since the complement output (S) is used the shift registers are cleared. After 64 counts the EOR counter goes high (pin 5, IC19) and resets the CLEAR NOR latch. The box is now ready to accept new numbers.

5. Advantages of Milo's Box

1. The box is complex.
2. A measure of its complexity is bulkier than the usual manual box.
3. The box can hold 5 10 digit numbers.
4. Each number is outpulsed at the proper rate at the touch of a single key.
5. The current drain is very low. When not pulsing the battery drain is only 40 microamps. A single 9 V alkaline battery will power it for a year of on time, unlike Peter Piver's programmable box (TAP # 5 & 6) which takes two 9V batteries and pulls 24mA in standby.

MAR-APR 1980 NO. 62
The Tone Generator Board

The 4017s are the oscillators and are operated at 10 times the desired output frequency. The output of each oscillator is put into a digital sine wave generator (see Don Lancaster's "CMO3 Cookbook") which gives a 10 step approximation of a sine wave at 1/10 the input frequency. Unlike a square wave whose first harmonic is the 5th at 1/3 the power of the fundamental, the first harmonic of a 10 step sine generator is the 9th at only 1/9 the power of the fundamental. Thus, if Milo's elaborate filter network is required. Just lately I've learned (of course) that square waves work as well as sine waves so the board could be simplified by operating the oscillators at the correct frequency and eliminating the digital sine wave generators.

The output amplifier (LM308) is very convenient and easy to use. Its output voltage is automatically biased at ½ the supply voltage. Its output impedance is 5 ohms to match most common speakers. It is designed for battery operation and has a low quiescent current drain.

Milo's schematic did not include it, but the voltage regulator is required. The frequency of the 4017s is somewhat voltage dependent. Do not make any component substitutions in this regulator. It is designed for CMOS circuits and has a very low power drain but can still supply quite a bit of current when necessary. When the box is outputting for instance, you can find more about this regulator in the National Semiconductor "Linear Applications, Volume 1", AN71-7 & 8.

For the buffers on the logic board do not substitute the 4009 or 4010 for the 4049 or 4050. The latter 2 can supply much more output current than the first mentioned pair.

Two tips for working with CMOS circuits. First, the inputs are static sensitive. Work on a grounded surface and ground yourself through a 1 meg resistor when handling CMOS circuits. Second, the inputs of unused devices must go somewhere, either to the positive or negative supply, or tied to a functioning input. Inputs cannot be left floating or the device may oscillate which will pull a lot of standby current. Remember that CMOS circuits theoretically draw no current when they are not switching.

I have not shown the positive and negative supply leads on the various gates on the logic board. Just remember, all the gate packages need positive and negative supplies.
The ether is truly incredible. It allows for such interesting, super-stimulating experiences that are truly out of this world. You can see the secrets of the universe revealed. As Thoreau reported, "Souces near the furthest star."}

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The use of 1063 Hz tones is in AC well control signalling. It can be used to setup touch tone phones on standard touch tone phones. This tone is 1063 Hz and can be obtained in three ways.

To generate 1063 Hz, you must use a dial-in AC well control signalling in Abudhabi (military) or automatic voice network. The buttons in the extra columns are designated: Flash Override (1644 + 697 Hz), Flash (1644 + 770 Hz), and Override (1644 + 852 Hz). To generate 1063 Hz, you must press Flash Override (1644 + 697 Hz), top to bottom. Each button switches the one below it, with flash override on top for the President in the event of a national emergency.

The other use of 1063 Hz is in AC well control signalling. It can be used to setup touch-tone phones, but are difficult to use. The main use is in the control panel at control signalling in Abudhabi (military) or automatic voice network. The buttons in the extra columns are designated: Flash Override (1644 + 697 Hz), Flash (1644 + 770 Hz), and Override (1644 + 852 Hz). To gain access to the information operator, you must press Flash Override (1644 + 697 Hz), top to bottom.

The functions now available to you through ACB are documented in ACB brail book "Notes on Distance Dialing" in the "ACB phone system" document. Just use the last digit of the code (i.e. you would be executed by pressing 2 and provide a half-tone tone). The code can be used to receive all information calls and to gain access to an information operator as usual (14305-555-121). As the call goes through, keep the priority button pressed; the operator answers, you are talking, and you will receive a dial tone with one second of voice per second.

In comparison to the ACB #50 method, the PT II method has two noteworthy advantages: First, it is less expensive because it uses the same method of making a seal rather than a method of making a seal; a passable seal can be obtained the initial outlay of cash for a large quantity of the open road was brief for Dean was irresistible. His pants were hitched a ride that took him straight back to jail. Lt. Pat Ruch of the Santa Clara police. "He just looked very disapproving."

IIlitchhiker Picks the Wrong Car
Milpitas, Calif. (AP) — The freedom of the open road was brief for escaped convict Roy Dean. He hitched a ride that took him straight back to jail.

"We're going to send questions, comments, etc. to the Magician, C/O TAP.

UPDATE ON MANUFACTURING SEALS by Agent MD

RE: TAP Issue #50.0 (May-June '78). This method of manufacturing seals for birth certificates and other official documents uses a clay called "FIMO" that is made in Germany and may be difficult to purchase locally. An acceptable substitute called "Replia-Cotta" can be purchased from American Handicrafts stores. (Stock #049-3021.) A two pound block costs five dollars, and it is a sufficient amount to make at least a hundred seals. Another way is to use a clay called "Replia-Cotta" and the price of a set of 1/2" reverse letter punches is now twice the thirty dollars quoted in TAP #50 -- $66.00! A novel and easy method of obtaining seals has been published by Ronen Press, P.O. Box 841, Fountain Valley, CA 92708, in The Paper Trip II, 1979 Edition, pages 89-89, price $14.95. (This book was formerly called The Paper Trip, and the seal section has been revised, too.)

In comparison to the TAP #50 method, the PT II method has two noteworthy advantages: First, it is less expensive because it uses the same method of making a seal rather than a method of making a seal; a passable seal can be obtained the initial outlay of cash for a large quantity of the open road was brief for Dean was irresistible. His pants were hitched a ride that took him straight back to jail. Lt. Pat Ruch of the Santa Clara police. "He just looked very disapproving."