HARDWARE FOR VOICE CONFERENCING

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HARDWARE FOR VOICE CONFERENCING

The goal of the project was to design for the Institute For the Future a system for telephone conferencing via computer control. The system was to have up to 32 participants able to switch onto one of 8 conference lines at any time. It was assumed that each participant also had a terminal connected to a central computer which controlled the state of the conference. The participant was either in the talk or monitor mode on a conference line.

The system consists of 3 subsystems, the receive state control, the telephone line control, and the send state control. To the computer, the whole system is viewed as a terminal. Because of long lead times experienced in acquiring parts, much of the system was designed using small scale integration. The parts count could be reduced through the use of medium scale integration. The send state control and the automatic telephone answering have not been thoroughly been debugged, but it is believed few modifications need to be made. All physical layouts assume a 6 1/2 by 4 1/2 inch, 32 connector vector board.

The receive state control receives two characters, the first being the state in which the line is to be and the second character the telephone line affected. The sequence of the steps are:

1.) The leading edge of the start bit turns on the start flip flop which allows the rest of the system to see the clock.

2.) The clock is divided by 32. In the middle of the bit timing, the bit is sampled onto the shift register.

3.) After the time for 9 bits has been counted, if the first bit of the last character received is a one, the address is decoded and a pulse is sent to the proper line board, which then switches to the proper state. The state of the device is communicated through pins T12-T16. To address lines 17-32, the address undecoded is sent to another board using board pins T3-T7. Board pin T11 sends the strobe for the time to sample the address lines.

4.) After all of the above occurs, one clock time, the divide by 32 flip flops are cleared, the start stop flip flop is turned off, andthe count 9 flip flops are cleared.

The code for the address character is:

Bit 1 0

Bit 2 2^0

Bit 3 2^1

Bit 4 2^2

Bit 5 2^3

Bit 6 2^4

Bit 8 not used

The code for the state character is:

Bit 1	1	
Bit 2	2^0	Party Line Number
Bit 3	2^1	Party Line Number
Bit 4	2^2	Party Line Number
Bit 5	ENABLE	
Bit 6	0 is monitor mode,	1 is talk mode
Bit 8	not used	

For both characters, bit 7 is used to start sending state of system. The state of the system sent by the transmit subsystem tells whether or not a line has been accuated by the automatic telephone answering unit. The board connections are:

1	+5. Volts
2	GND
3-7	Undecoded Line Address
9	Send System State
10	TTY Input Line
11	Change State Pulse
12-16	Party Line State Change
17-32	Telephone Address Lines

The telephone line control consists of one board as described per telephone line. Because not all of the parts were ever received, an actual layout is not presented, nor

is the automatic answering system. It is assumed that a line could not be answered unless the line was enabled and that a line would be hung up be disenabling the line. The one of eight switch is a LM3705 analog switch, the talk-monitor switch is a Siliconix DG172CJ, and the amplifiers are LM307Ds. The transformer is a UTC SO-1 with a 200/50 ohm primary connected to the network and a 250k/62.5k ohm secondary connected to the telephone line board. The values of the capacitors and resistors are critical because of impedence considerations. Capacitor C3 is especially critical. The specifications are:

R1	1.0 Mohms
R2	100 Kohms
R3	91 Kohms
R4	2.4 Kohms
R5	2.4 Kohms
R6	1.0 Mohm pot
C1	12. mfd.
C2	2.7 mfd.
C3	.082 mfd.
C4	.68 mfd.

The board connectors are:

1	+5. Volts

2	GND
3	+15. Volts
4	-15. Volts
5	Talk or Monitor
6	Party Line Enable
7	2^0 Party Line
8	2^1 Party Line
9	2^2 Party Line
10	Addressed Change State Pulse
12	Telephone Line White Wire
13	Telephone Line Black Wire
14	Telephone Line Red Wire
15	Telephone Line Green Wire

The send state control is initialized by a 1 in the seventh bit of a received character. This is send board pin T9. Initially a start pulse turns on the start flip flop which allows the clock to be run through a ripple counter. At the initial time, the states of 16 telephone conference lines are parallel shifted into a shift register. The state of a telephone line tells whether the automatic answering mechanism has been accuated by someone calling in onto a particular line. Then the start bit and eight state bits

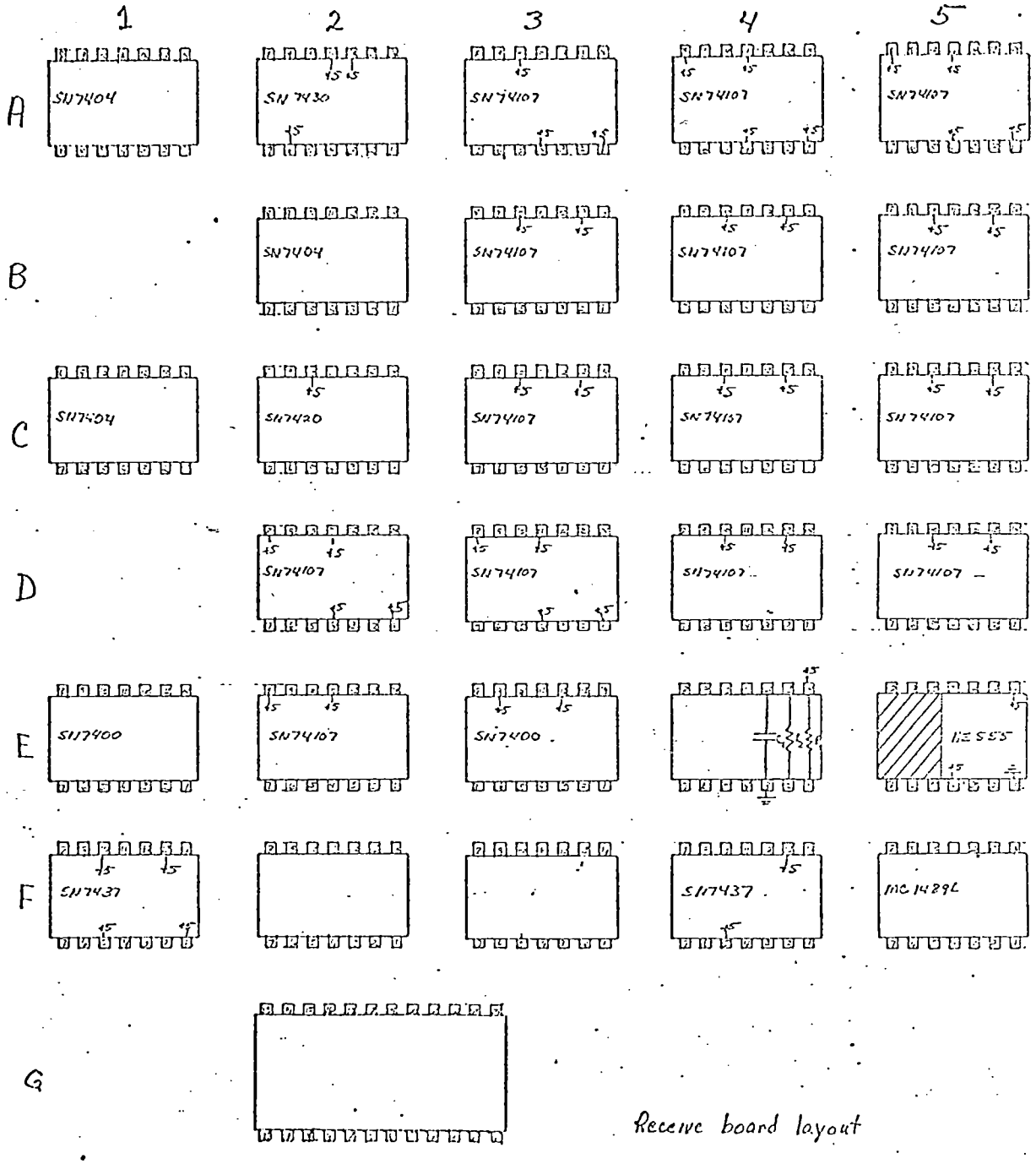
are sent out followed by a wait of five bit times and then the next character is sent. As it is presently arranged, the same telephone conferencing lines are again sampled and the information broadcast again. The transmit state subsystem then turns off until the next start strobe is received. It is planned that this plan is expandable to 32 lines by a signal at board pin T5. This pin signals when the first two characters have been sent. With the addition of more boards, the input to pins T17-T32 could be changed at this time. The board connectors are

1	5. Volts
2	GND
3	+15. Volts
4	-15. Volts
5	End of sending first two characters.
6	TTY transmit line
17-32	telephone line states

The clock chip on this board and the receive board is a NE555. For 110 baud lines, the RC constant requires

R1	1.3kohms
R2	2490 ohms
C1	.0656 mfd.

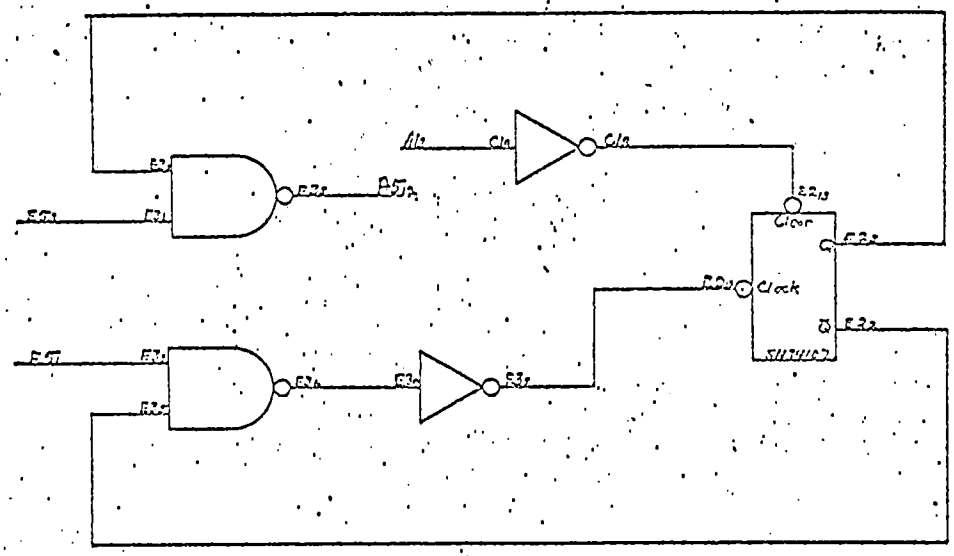
All components have 1% tolerances.



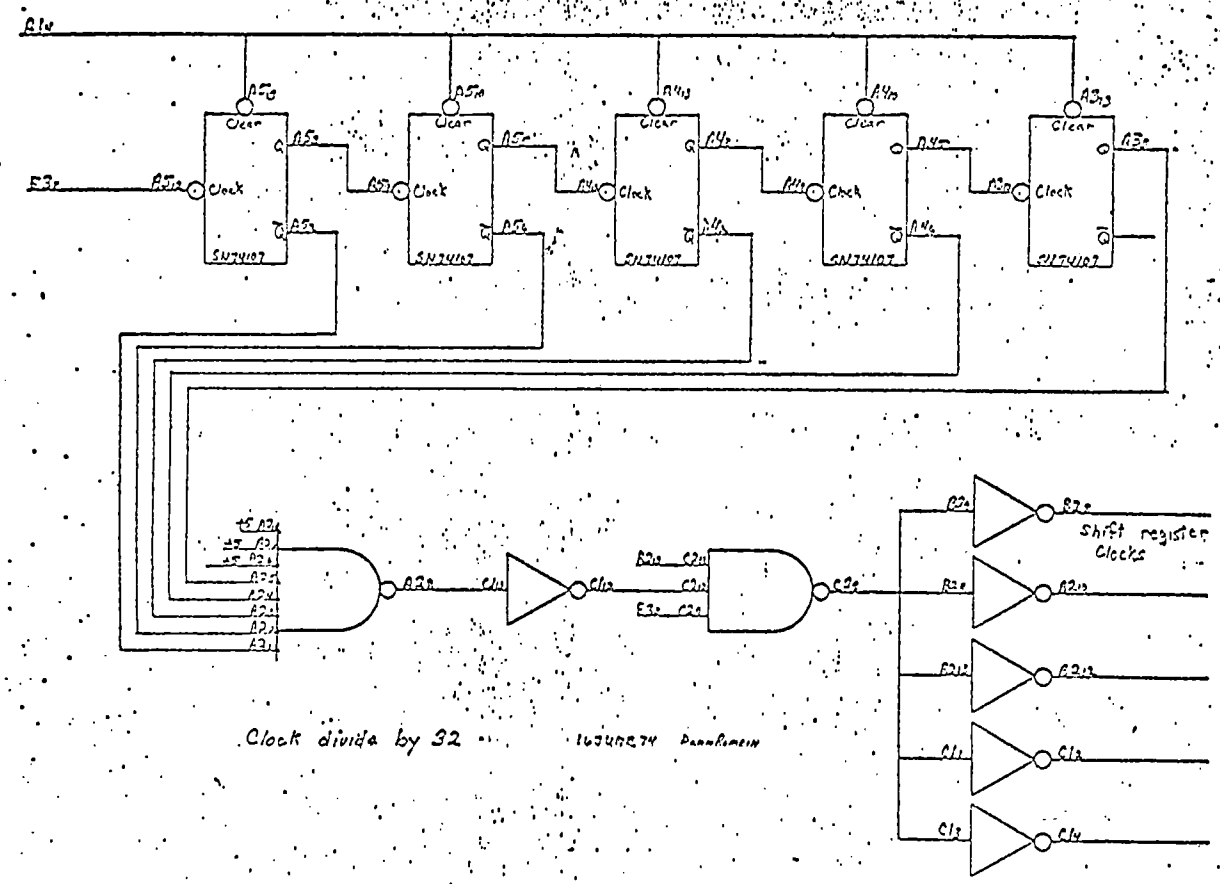
Receive board layout

32 terminal board

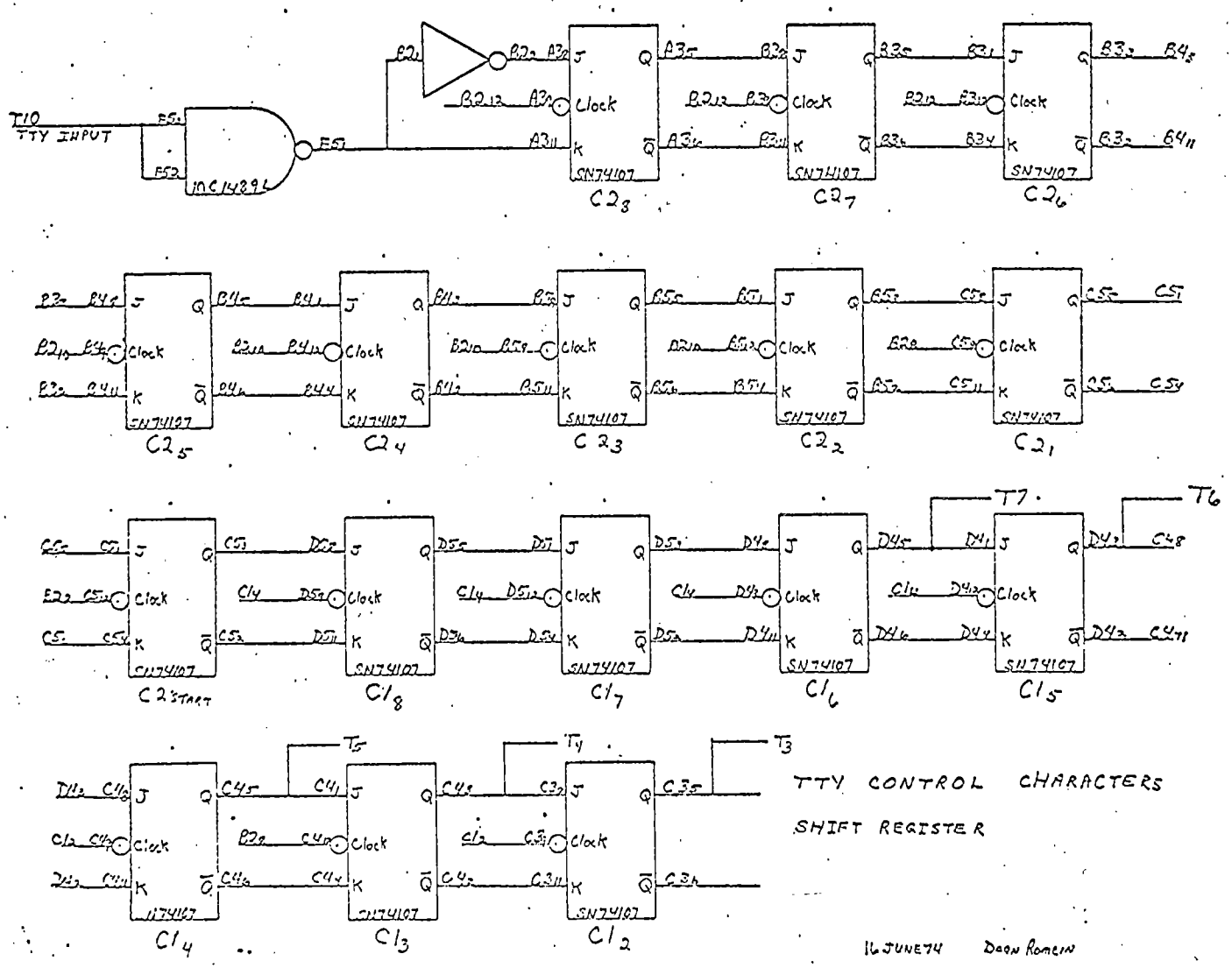
16 JUNE 74 Don Lancaster



Start Stop Flip Flop



Clock divide by 32


T10
TTY INPUT
MC14572
SN74107
C2 8
C2 7
C2 6
C2 5
C2 4
C2 3
C2 2
C2 1
C2 START
C1 8
C1 7
C1 6
C1 5
C1 4
C1 3
C1 2
T7
T6
T5
T4
T3
TTY CONTROL CHARACTERS
SHIFT REGISTER
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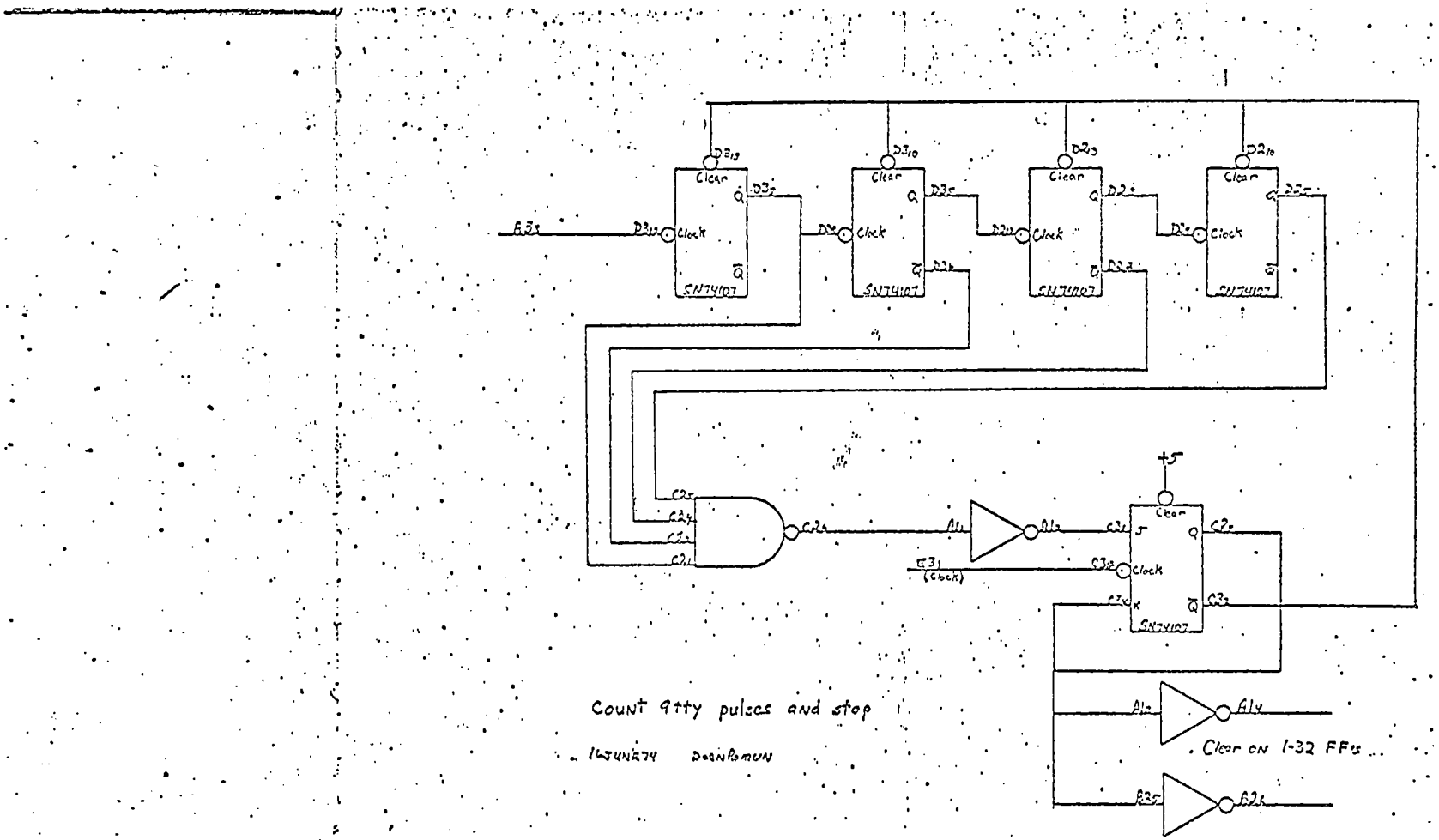
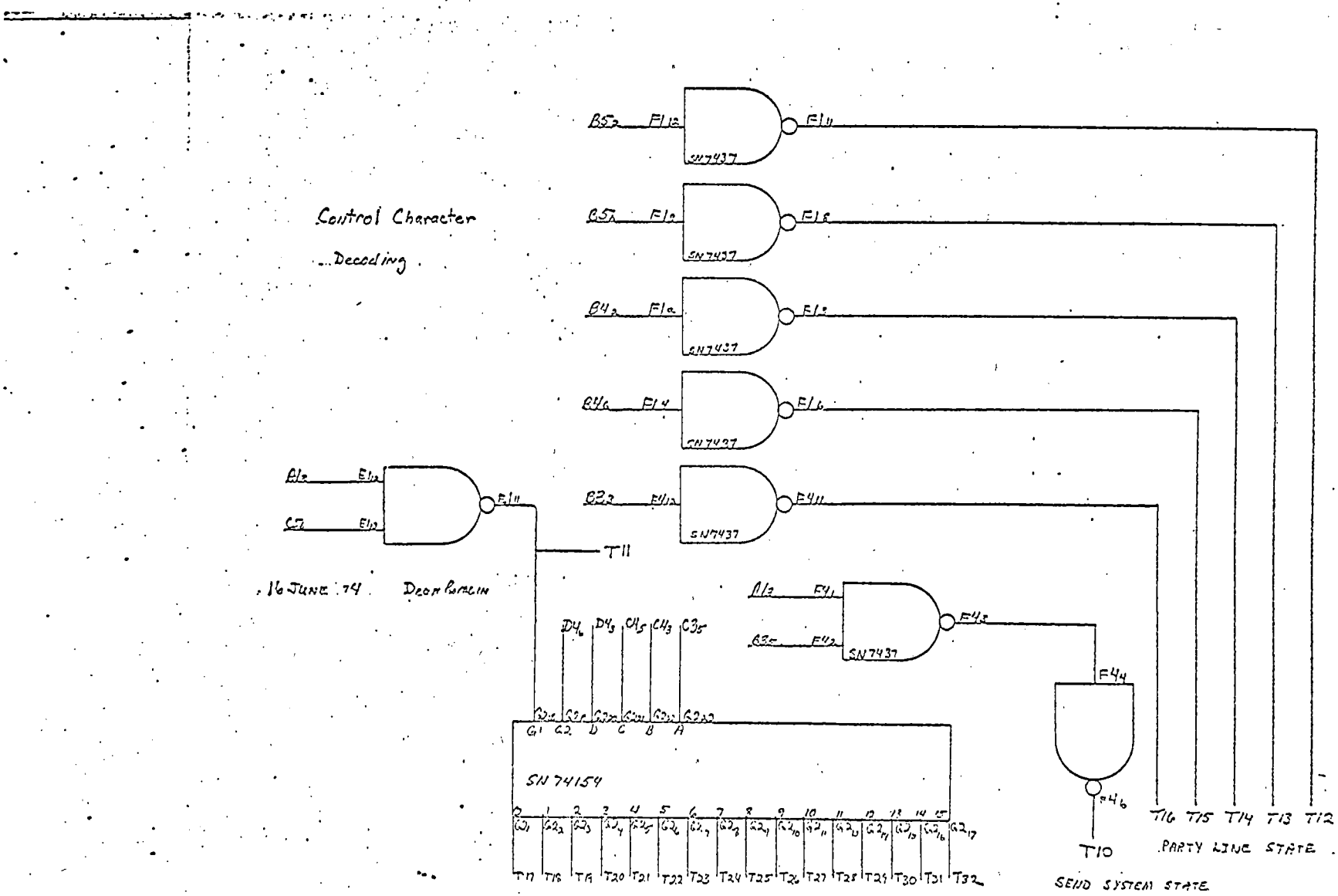

Clear
Clock
SN74107
+5
Count qtty pulses and stop
Clear on 1-32 FFs


Control Character
...Decoding.
B5₂
F1₁₂
F1₁₁
SN7437
B5₁
F1₉
F1₈
B4₂
F1₆
F1₅
B4₁
F1₄
F1₃
B2₂
F4₁₂
F4₁₁
B1₂
E1₁₂
C7
E1₁₃
F1₁₁
T11
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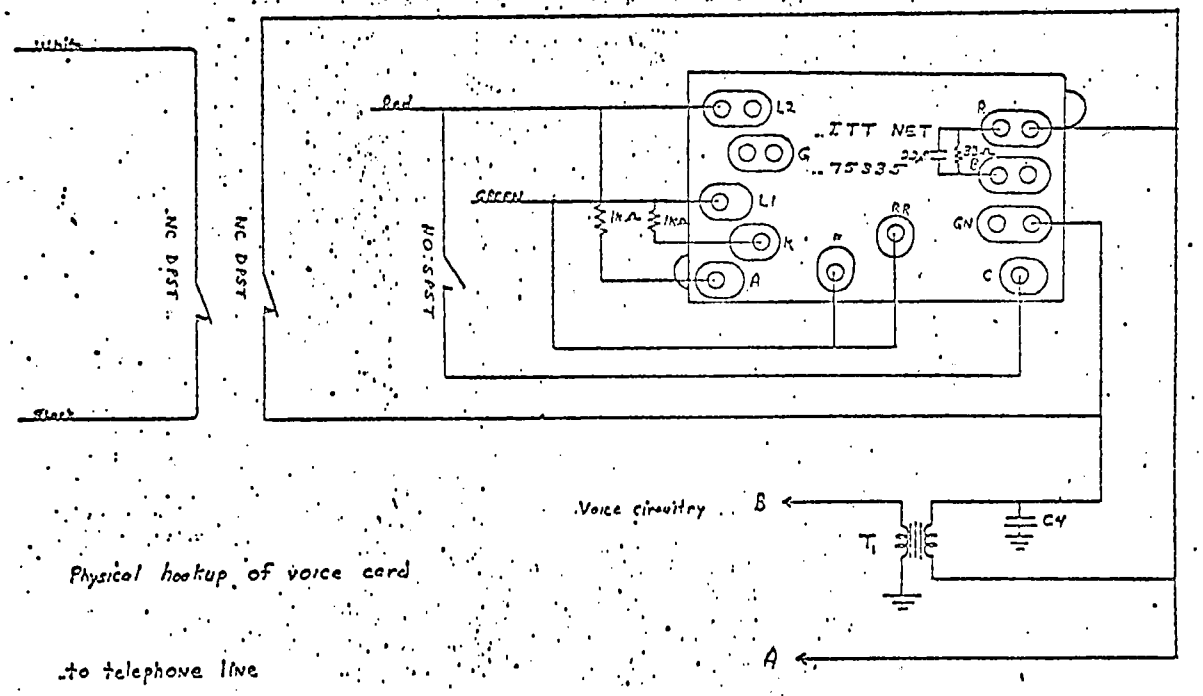
A1₂
F4₁
B3₂
F4₂
F4₃
F4₄
F4₆
T10
SEND SYSTEM STATE
T16 T15 T14 T13 T12
PARTY LINE STATE
D4₆ D4₅ C4₅ C4₃ C3₅
G1 G2 D C B A
SN74154
T17 T18 T19 T20 T21 T22 T23 T24 T25 T26 T27 T28 T29 T30 T31 T32
Telephone Address lines



Physical hookup of voice card

to telephone line

Ring detection done on Red-Green lines.

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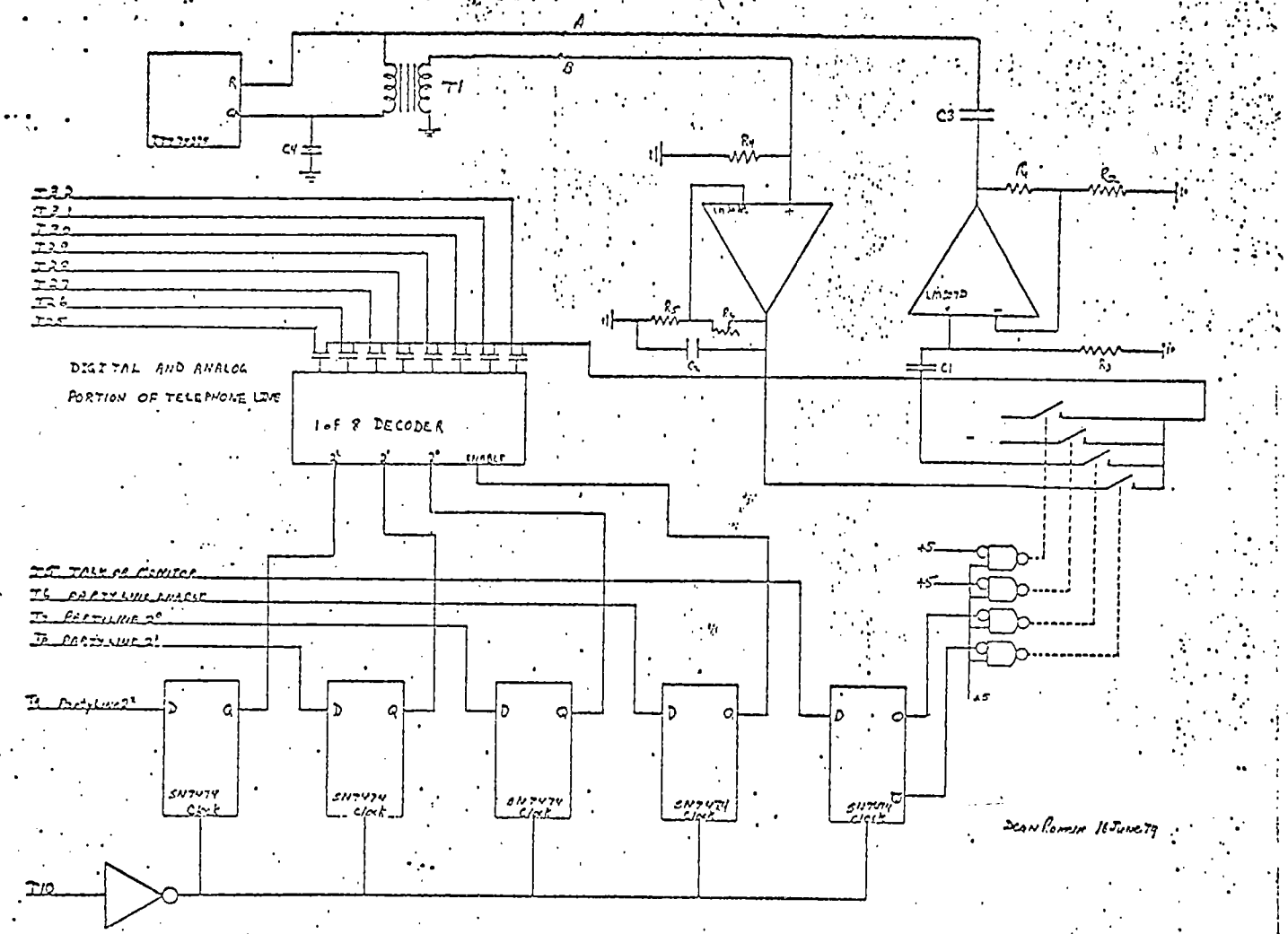
A
B
T1
C4
C3
R4
R5
R6
R7
R8
C2
C1
R3
LM324
DIGITAL AND ANALOG
PORTION OF TELEPHONE LINE
1 of 8 DECODER
ENABLE
TO TALK TO MONITOR
TO PARTY LINE SHARE
TO PARTYLINE 2
TO PARTYLINE 1
+5
SN7474
CLOCK
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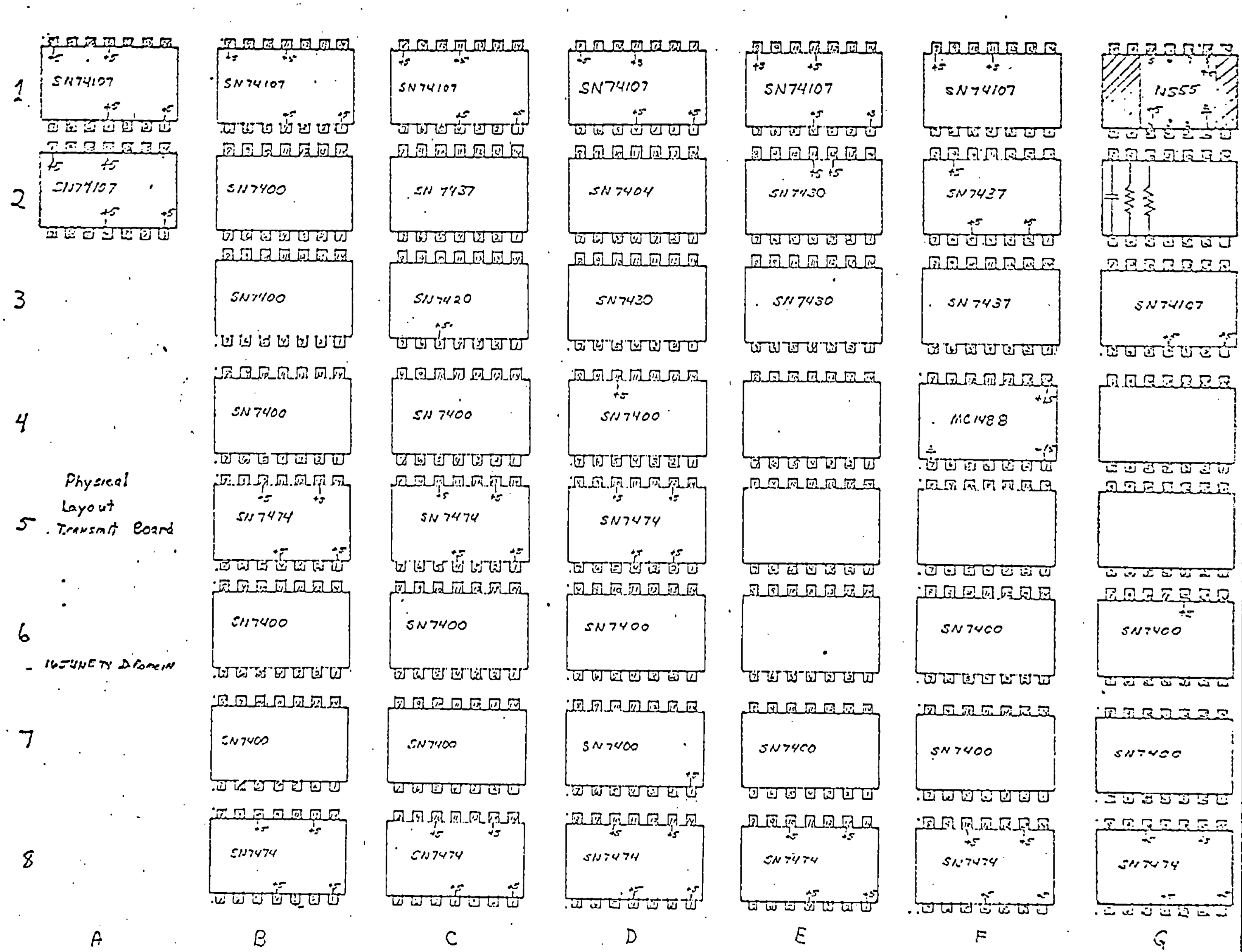
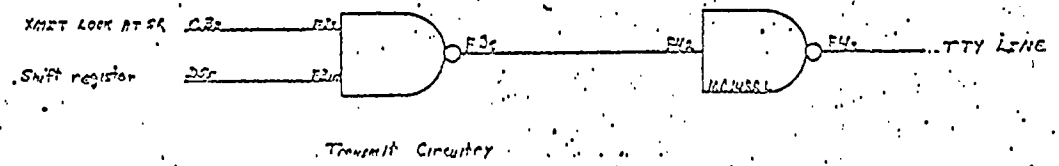
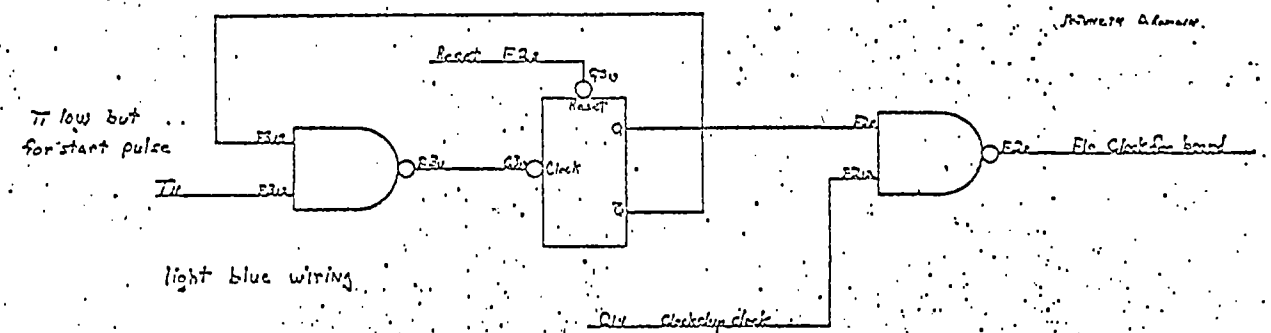
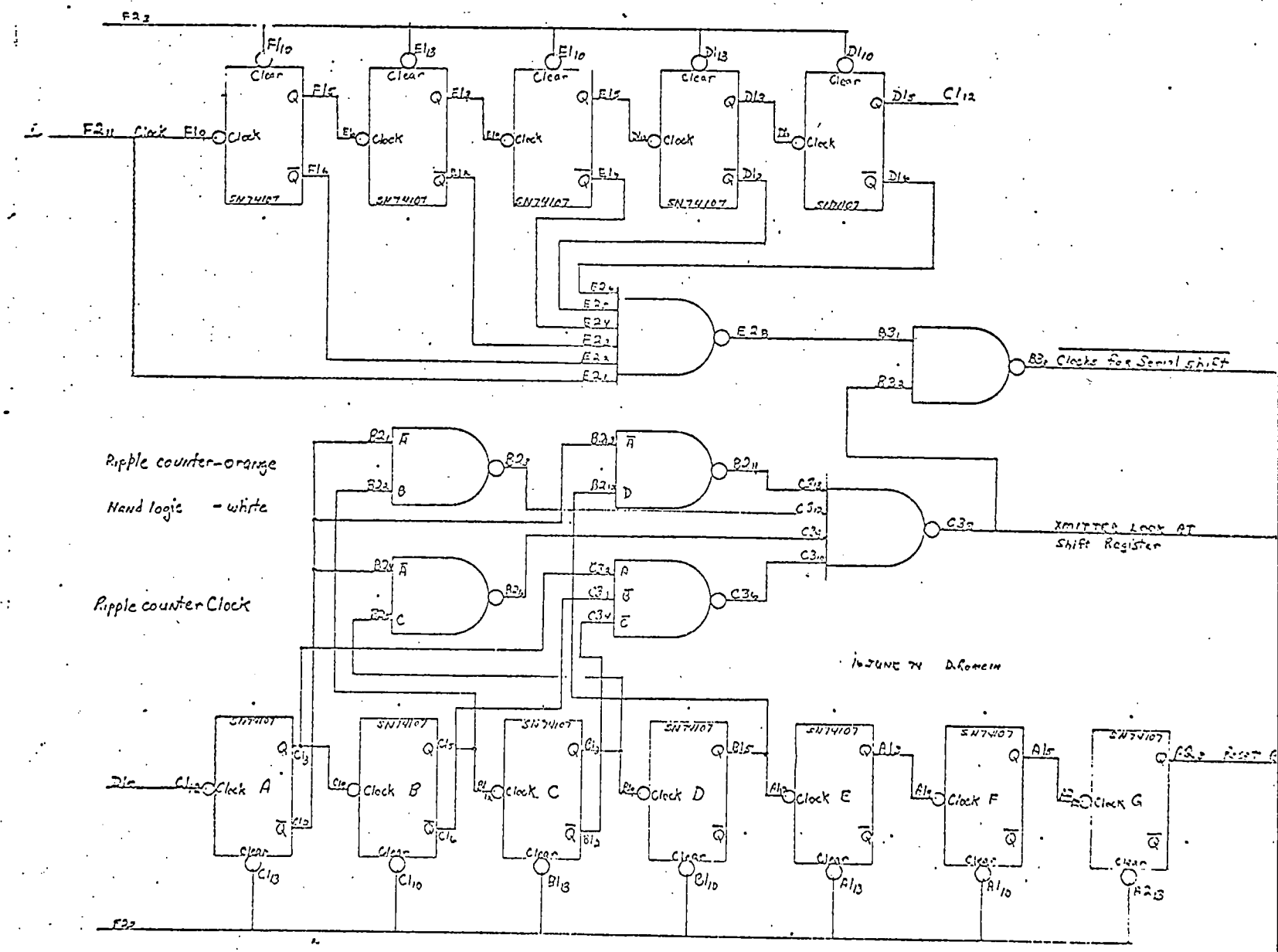

Physical
Layout
Transmit Board
1
2
3
4
5
6
7
8
A
B
C
D
E
F
G
SN74107
SN74107
SN7400
SN7437
SN7404
SN7430
SN7437
SN7420
SN7430
MC1488
SN7474
SN7400
N555
+5

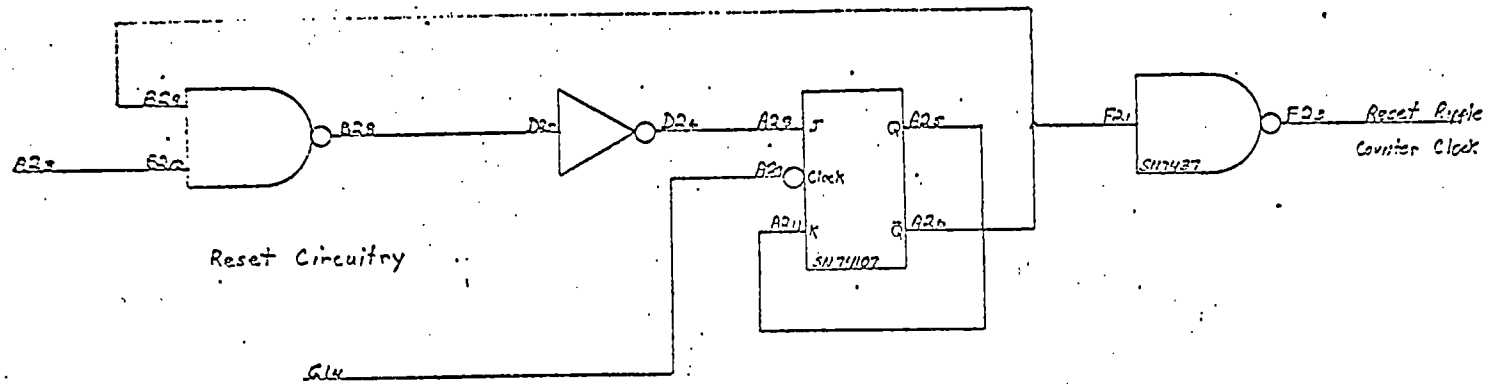


Transmit Circuitry



Start chip


Ripple counter-orange
Nand logic - white
Ripple counter Clock
XMITTER LOOK AT Shift Register
SN74107
Clear
Clock A
Clock B
Clock C
Clock D
Clock E
Clock F
Clock G



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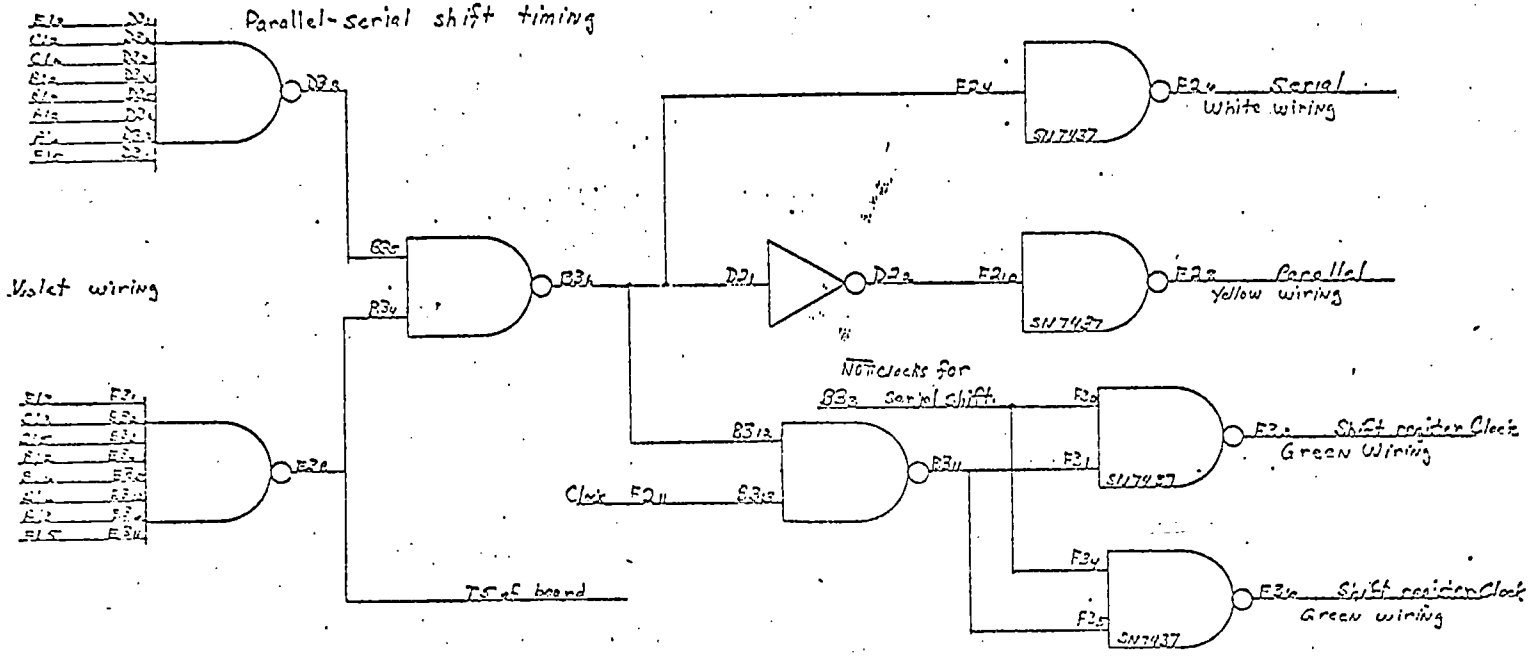
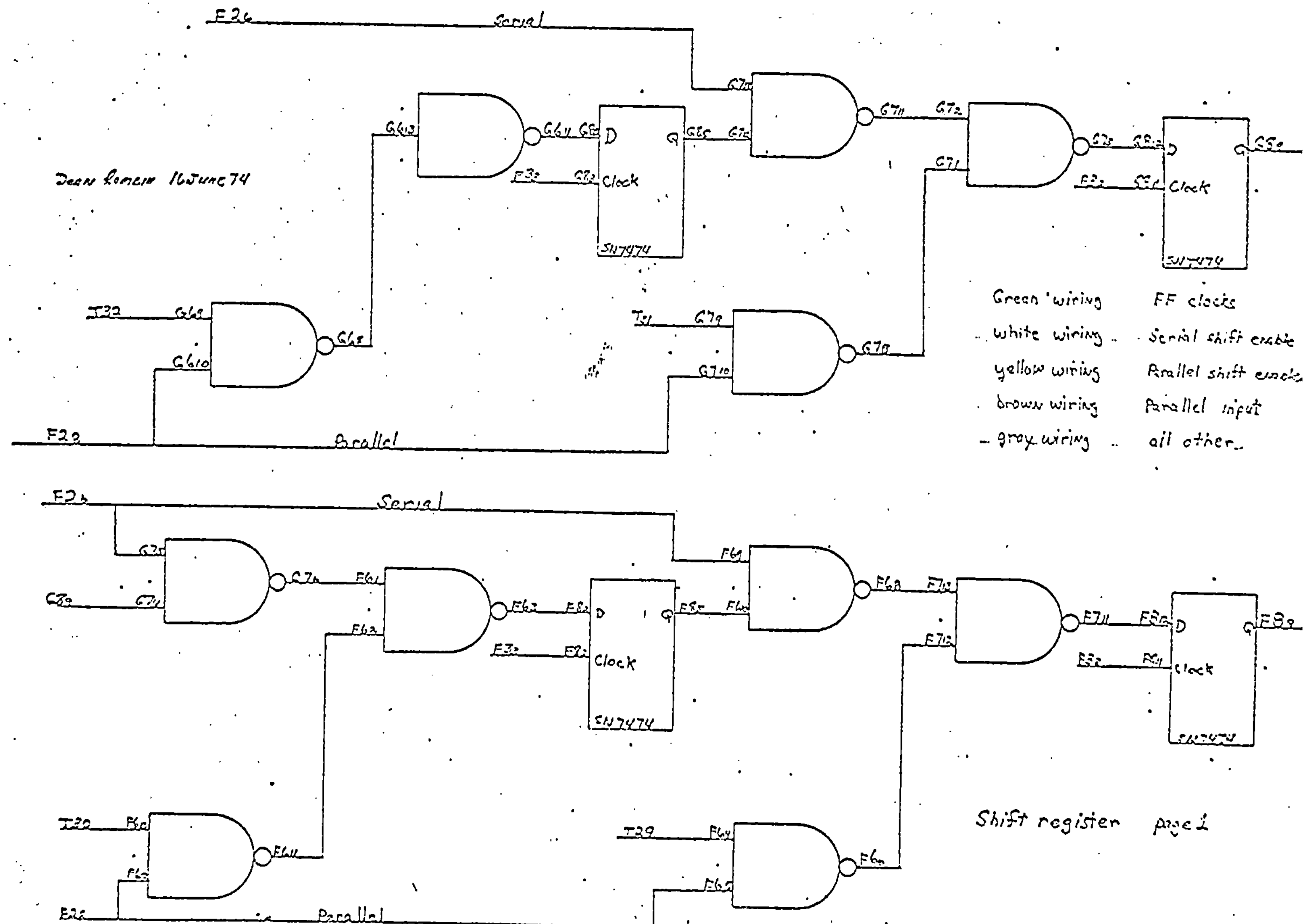
Parallel-serial shift timing

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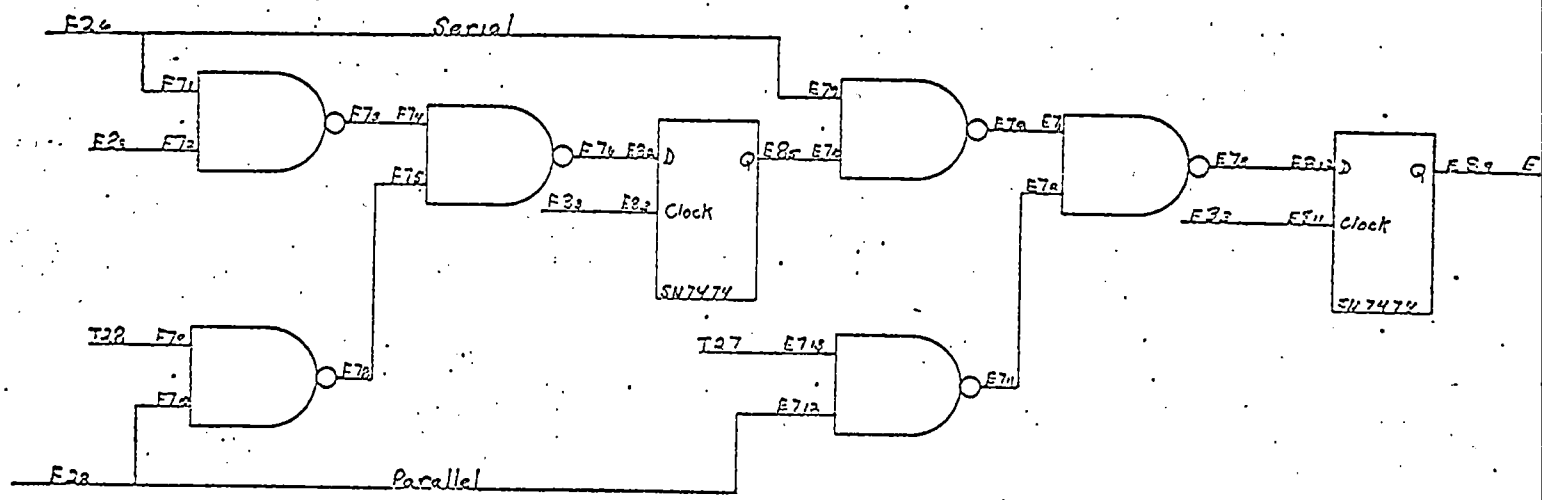
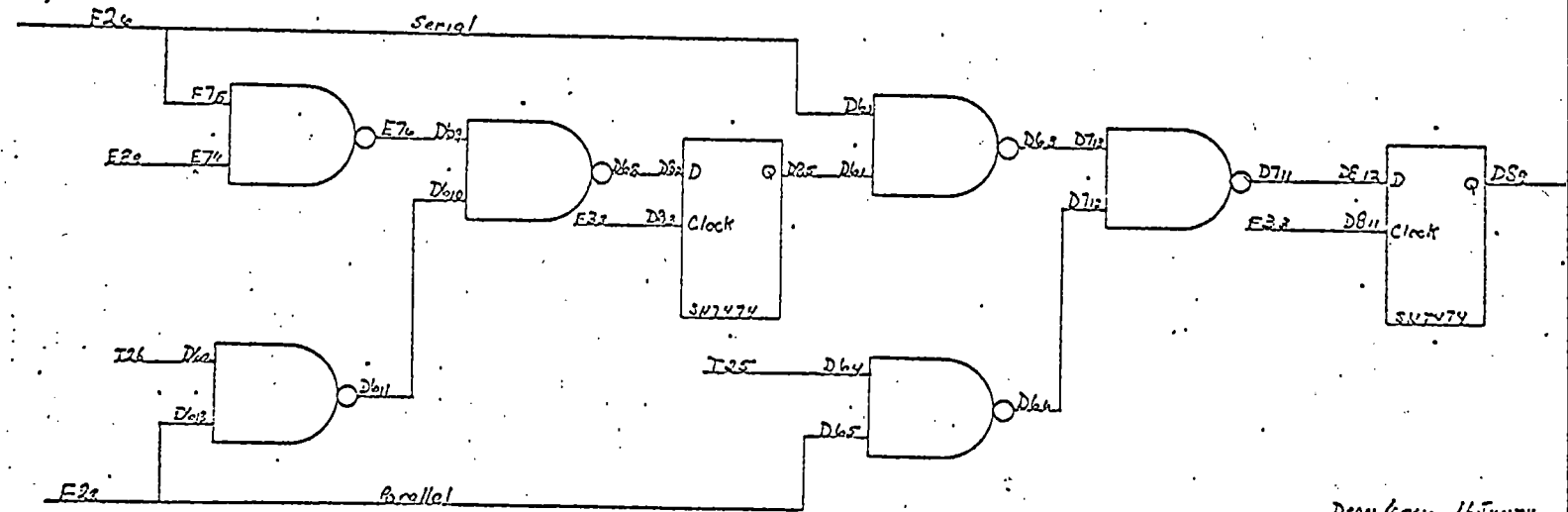
Serial
Parallel
D
Q
Clock
SN7474
Green wiring FF clocks
white wiring Serial shift enable
yellow wiring Parallel shift enable
brown wiring Parallel input
gray wiring all other
Shift register page 1



Page 2 shift register



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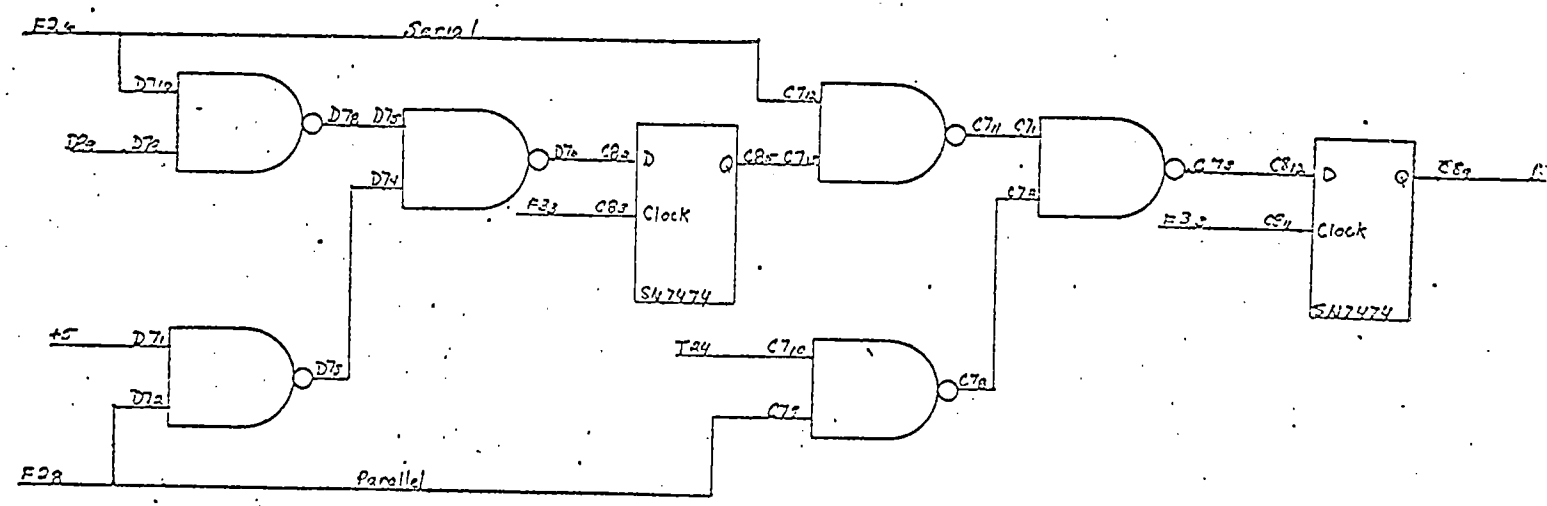
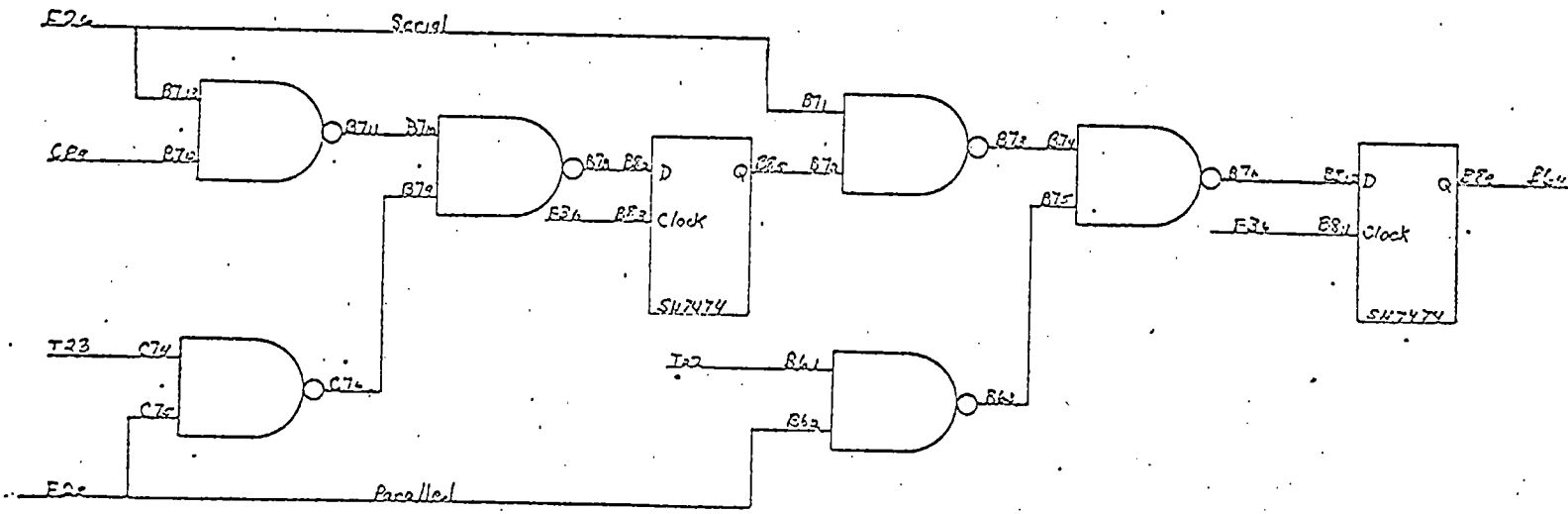


-Shift register Page 3



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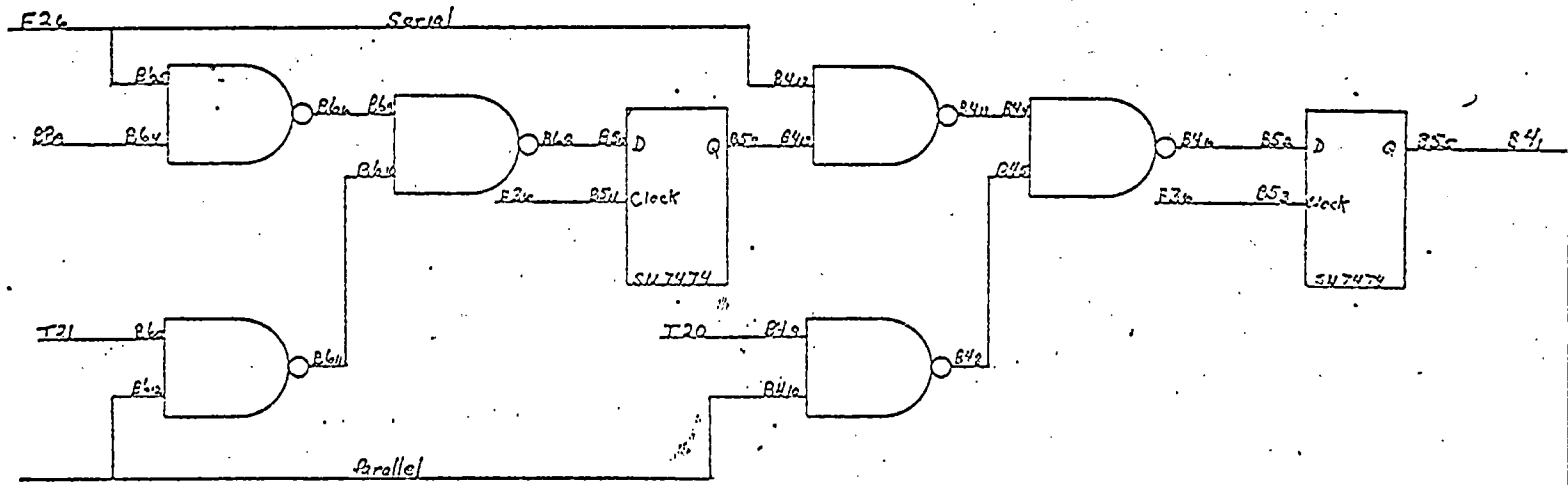
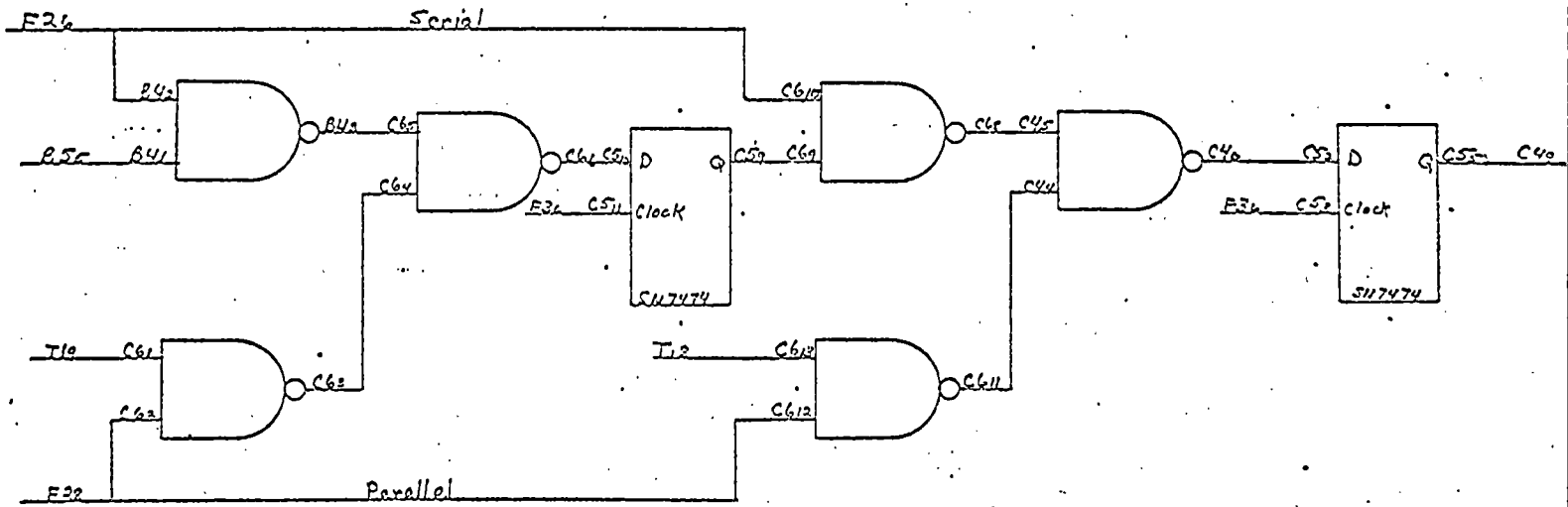


. SHIFT Register Page 4



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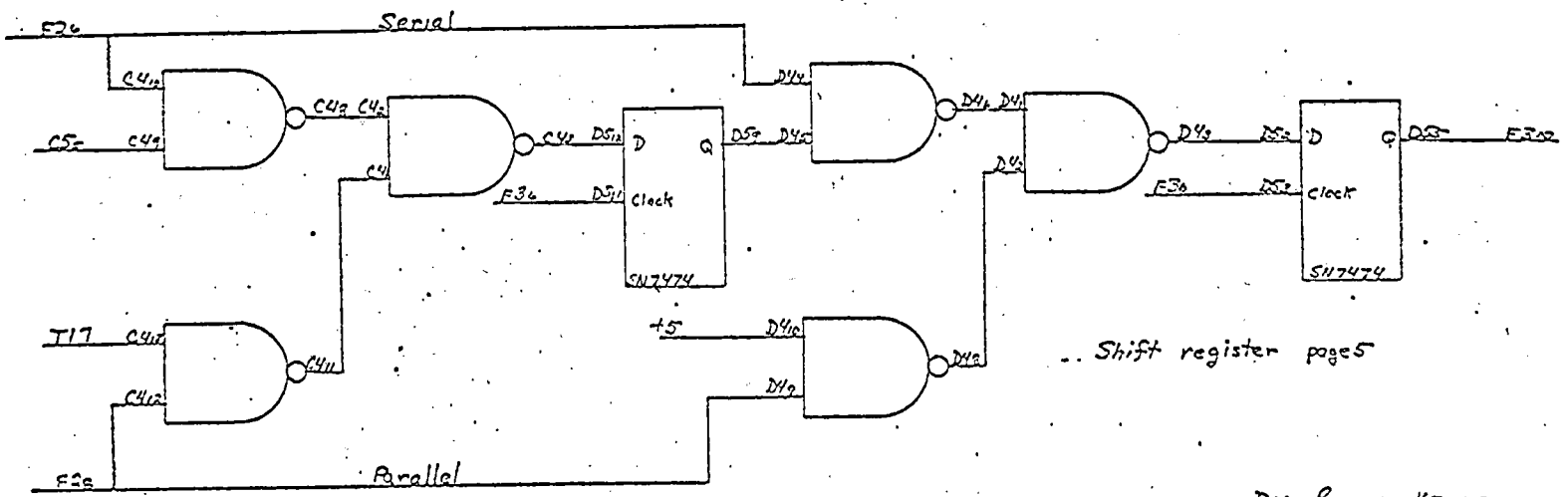

.. Shift register page 5

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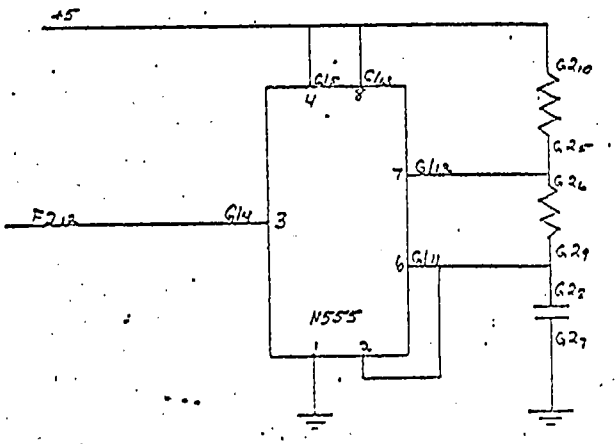

.. Clock circuitry