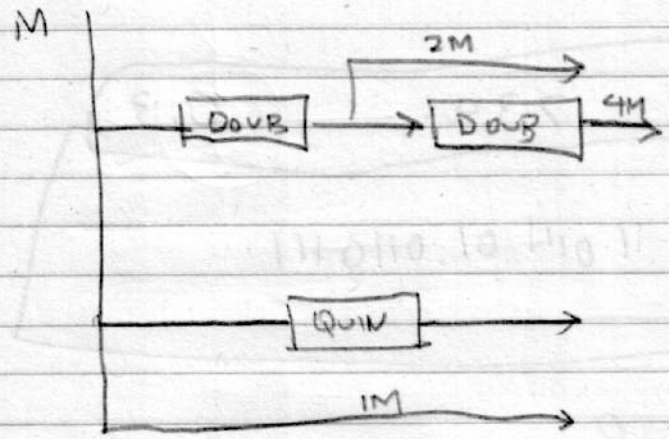
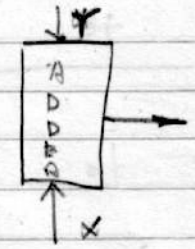
Dick Richards

8/9

		x	y
0000	0	—	—
0001	1	1M	—
0010	2	—	2M
0011	3	1M	2M
0100	4	4M	—
0101	5	5M	—
0110	6	4M	2M
0111	7	5M	2M
1000	8	4M	4M
1001	9	5M	4M

702 Multiplication





$$1M_x = R_1 \overline{R_4}\,\overline{R_8}$$

$$4M_x = (R_4 + R_8)\,\overline{R_1}$$

$$5M_x = (R_4 + R_8)\,R_1$$

$$2M_y = R_2$$

$$4M_y = R_8$$

DIVISION IS TOUGH

Decimal to Binary

243		.413	
121	1	.826	.0
60	11	1).652	.01
30	011	1).304	.011
15	0011	.608	.0110
7	10011	1).216	.01101
3	110011	.432	.011010
1	1110011	.864	.0110100
0	11110011	1).728	.011010011

Convert to Binary 7391 , 0.3

Convert to Decimal 11 0111 01.0110111

Tape

Sorting... Look for sequences

sort

63	23	06
23	51	17
51	63	
06	03	
17	07	
92	22	
03	32	
22	41	
07	73	
41		
32		
73		
09		
10		

06	23
17	51
92	63
09	03
10	07
	22
	32
	41
	73

7391	
3695	1
1842	11
921	011
460	1011
230	01011
115	001011
57	1001011
28	11001011
14	011001011
7	0011001011
3	10011001011
1	110011001011
0	1110011001011

0.3	.0100110011 0011
.6	
1.2	
.4	
.8	1101110.0110111
1.6	
1.2	1.25
4	4.125
8	8.03125
1.6	16.015625
1.2	64.0078125
.4	128
.8	221.4296875

DESIGN SWITCHING MATRIX FOR CONVERSION
FROM PUNCH CARD CODE TO DATA SEARCHING

Symbol	Card Code	D.S. Code
A	12,1	12,1
B	12,2	12,2
C	12,3	12,3
D	12,4	12,4
E	12,5	12,5
F	12,6	12,6
G	12,7	12,7
H	12,8	12,8
I	12,9	12,9
J	11,1	11,1
K	11,2	11,2
L	11,3	11,3
M	11,4	11,4
N	11,5	11,5
O	11,6	11,6
P	11,7	11,7
Q	11,8	11,8
R	11,9	11,9
/	0,1	0,1
S	0,2	0,2
T	0,3	0,3
U	0,4	0,4
V	0,5	0,5
W	0,6	0,6
X	0,7	0,7
Y	0,8	0,8
Z	0,9	0,9
0	0	12,11
1	1	2,3
2	2	3,5
3	3	1,4
4	4	1,7
5	5	1,2
6	6	1,9
7	7	3,4
8	8	3,9
9	9	3,6
#	3,8	3,8
@	4,8	4,8
-	11	8,9
&	12	1,3
,	0,3,8	2,4
$	11,3,8	7,8
.	12,3,8	12,0
%	0,4,8	5,7
*	11,4,8	5,8
¤	12,4,8	11,0

12 ¢ $\boxed{\text{X or}}$ (1-9) straight transmission

11 ¢ $\boxed{\text{X OR}}$ (1-9) straight

0 ¢ $\boxed{\text{X or}}$ (1-9) straight

$\boxed{3\ ¢ + 3 \text{ broad X (or)} + \boxed{\text{X OR}}\ 1\text{-}9 + 12\ ¢}$

12 ~~X~~

Now needed

$\overline{12}$ $\overline{11}$ $\overline{0}$ $\overline{8}$

$\overline{12 + 11 + 0 + 8}$

$\overline{12+11+0}$ ε 1 no

ε 2

ε 3 ¢ $\overline{8}$

ε 4 ¢ $\overline{8}$

ε 5

ε 6

ε 7

ε 8 ε $\overline{3+4}$

ε 9

ε 0

$\overline{\boxed{\text{X or}}\ (1\text{-}9)}$ ε 12 ε $\overline{8}$

ε 11 ε $\overline{8}$

ε 0 ε $\overline{8}$

(3+8) + 0

(3+8) + 11

(3+8) + 12

(4+8) + 0

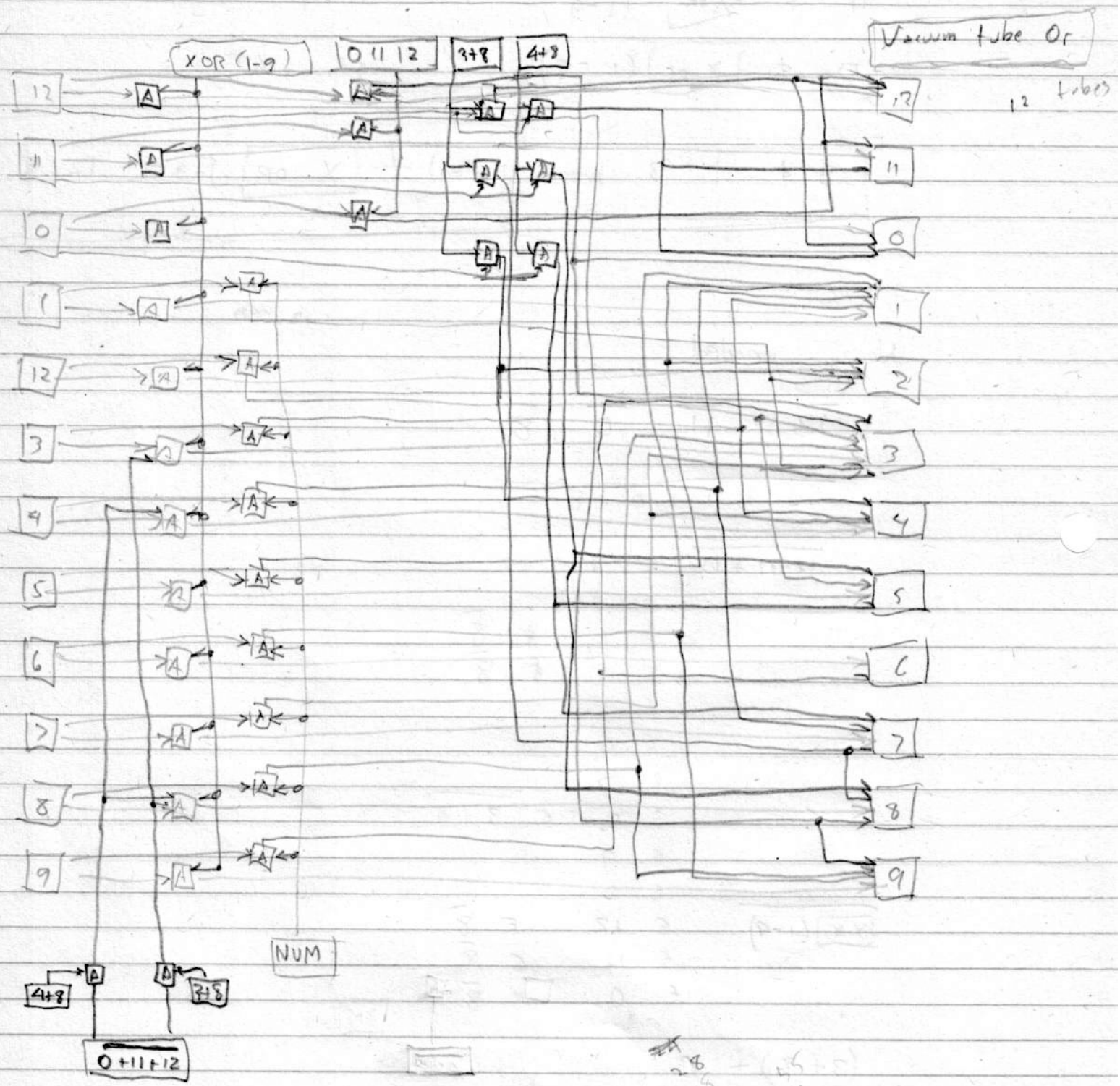
(4+8) + 11

(4+8) + 12

$\boxed{0\ 11\ 12} = \overline{(1+2+3,\ldots,+9)}$

$\boxed{\text{NUM}} = \left[\overline{8(3+4)}\right]\left[\overline{0+11+12}\right]$

$\boxed{\text{X OR } (1-9)} = \overline{(1+2+3+4,\ldots,+9)}\left[\overline{8(3+4)}\right]$



NUM becomes

1	3,3
2	3,5
3	1,4
4	1,7
5	1,2
6	1,9
7	3,4
8	3,7
9	3,6

M = 1+2+3+4+5+6+7+8+9

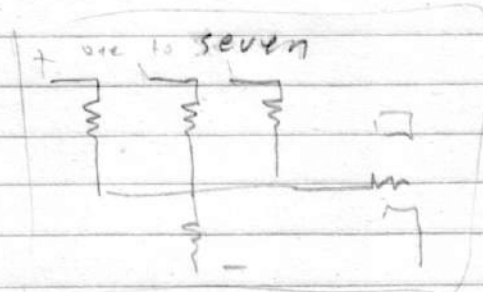
vacuum tube or circuit & VT inverter

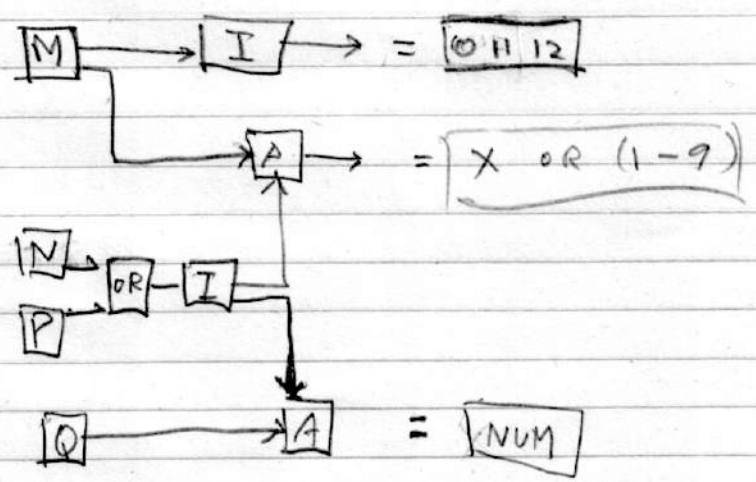
N = 3+8

P = 4+8

Q = $\overline{0+11+12}$

VT or inverter



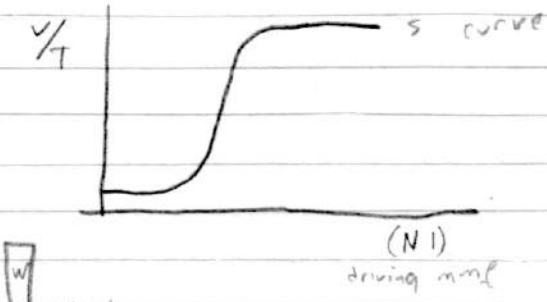


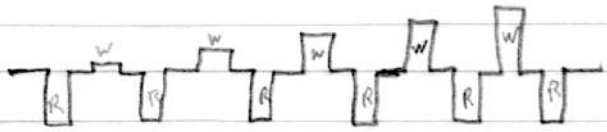
55
14
69

69 diodes
2 VT inverters
14 VT or circuit

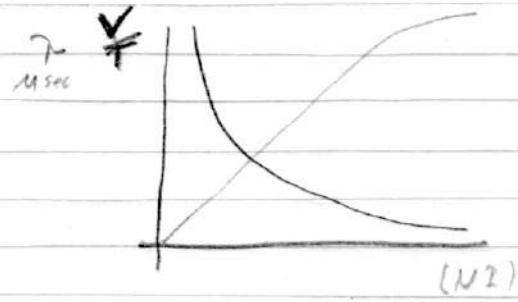
Core Logic.....

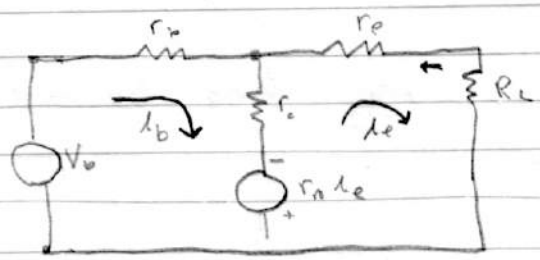
Core Power Gate

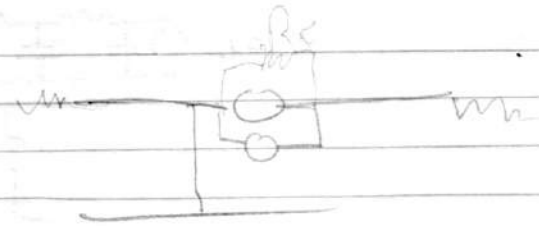




Switching time curve





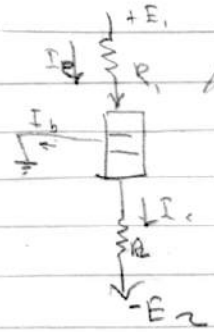


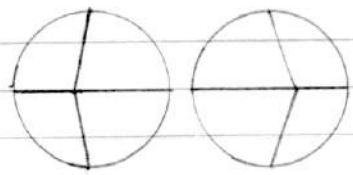
$$i_e(r_c + r_e + R_L) - i_b r_c - r_m i_e = 0$$

$$\frac{i_e}{i_b} = \frac{r_c}{r_c + r_e + R_L - r_m} \doteq \frac{r_c}{r_c - r_m} = \frac{1}{1 - \frac{r_m}{r_c}} = \frac{1}{1 - \alpha}$$

$$\alpha = \frac{r_m}{r_c}$$

$$V_{eb} = 0$$



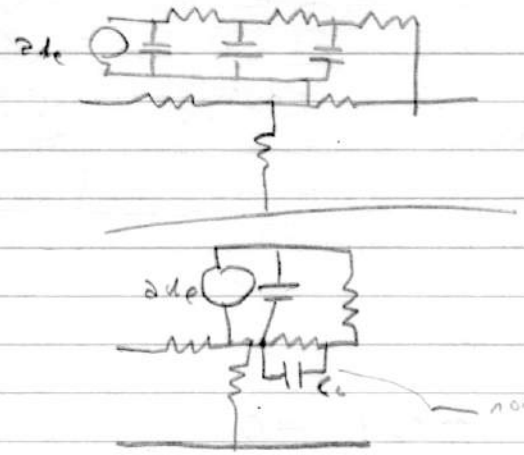


Find I_c in terms of I_{co} & parameters of the circuit

$$I_c = I_{co} + \alpha I_e$$

$$I_c = \frac{I_{co}(R_1 + R_2)}{R_1 + (1-\alpha)R_2} + \frac{E_1 \alpha}{R_1 + (1-\alpha)R_2}$$

$$S = \frac{R_1 + R_2}{R_1 + 1 - \alpha R_2}$$



high freq equivalent circuit

good to just below f_{co}

non linear approach

Transistorized 604 —— looks very good....

Lou Blenderman — Magnetic Recording

Advantages

1. Large amount of storage in small space
   Drum - 800 bits/in²
   Tape - 2800 bits/in²
2. Permanent type of storge (retained on power failure)
3. Regeneration not necessary
4. Read out without alteration of stored information
5. Old data easily replaced by new
6. Either serial or parallel storage

Tape - Large volume for input & output

Drum - Fairly large storage with reasonably rapid access.

$\phi = \frac{NI}{R}$ $\qquad e = n\frac{d\phi}{dt}$

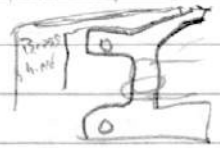
Tape spec

Width	½"		
Tape speed	75 "/sec		
Bit density	701	100	bits/in
	702	200	bits/in
Track width	0.032"		
Track pitch	0.070"		
No. of tracks	7.		

NORD 1400 in/sec 4 tracks 500 bits/in

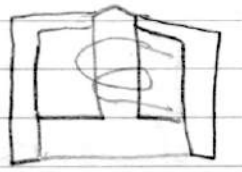
930 turns of #42 wire

laminations .0002 thick 85-90% iron plastic bonded



mu-metal

Wafer Stack . finish half head
assemble wedge with 0.5 mil beryl-copper

701  erase head .... restore to magnetic zero

DC erase with two gaps
all seven erased↑ one saturates, the other restores.....

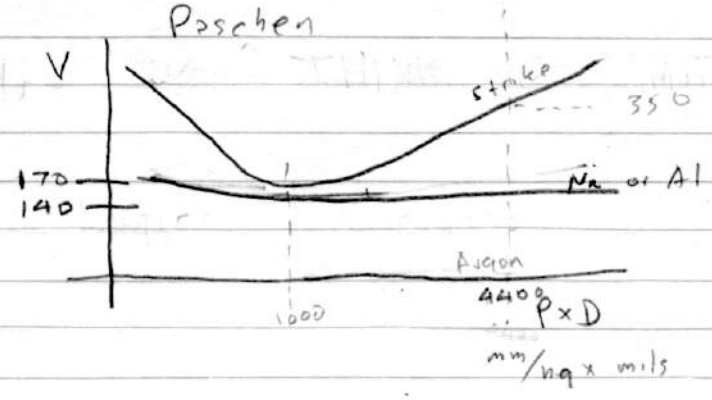
702 single gap erase head 1/8" from recording head on opposite side of tape... recording heads must be reset. Erase saturates

Tape drives .... magnetic clutch

Drum Spec

	701	702	650
Drum Diam	13	10.7	4
Bit density	50	60	48
surface speed	2000	2090	2500
RPM	2929	3730	12500
track spacing	16/in	20/in	20/in
Length	5	12.5	16
head	round	flat	flat
Access time	20 ms	8 ms	2.4 ms
Information Bits	147,456	420,000	123,000

Discrete pulse type of writing .. a single bit can be altered ... Timing Track used


Paschen
V
strike
350
170
140
Na or Al
Argon
1000
4400
P x D
mm/hg x mils

John (Emilos) →

Wayne Kalenich - Librarian
B Brown

Pok 2 - 3110 Ext 4 or 3

Wally Brooks — IBM Reports

Mr Wolf MGR IBM Dept of Educ'n

100

F. Dill

1

1 Input
2 Output
3 Storage
4 Arithmetic & Logical Unit
5 Control

2

Factor storage is storage used for storing numbers used in computation. It can be read into by the reading brushes or the calculator. It cannot be read out directly to the punch.

General storage is the same as factor storage except that it can be read out to the punch. It cannot punch and read-in from the brushes in the same machine cycle however

3 (a) Either the reading brushes or the calculator may be used
(b) Only the calculator can be used to read into the counter

4 (a) Only the Calc
(b) Both Punch and Calc

5 Yes, provided you do not read into the same storage units you read out of

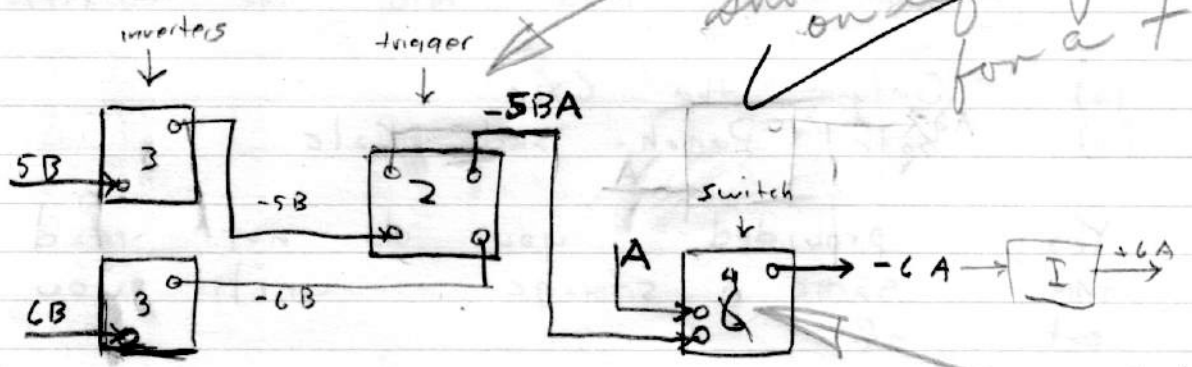
6 Wire from reading brush to storage pos. hub & from ord cycle to storage group.

7 Connect from the F.S. readout hub to the program cycle hub. Connect from the program cycle hub to the GS readin hub.

8. The pulses should be negative and of 50 v amplitude

9 All except the 12 punch

10

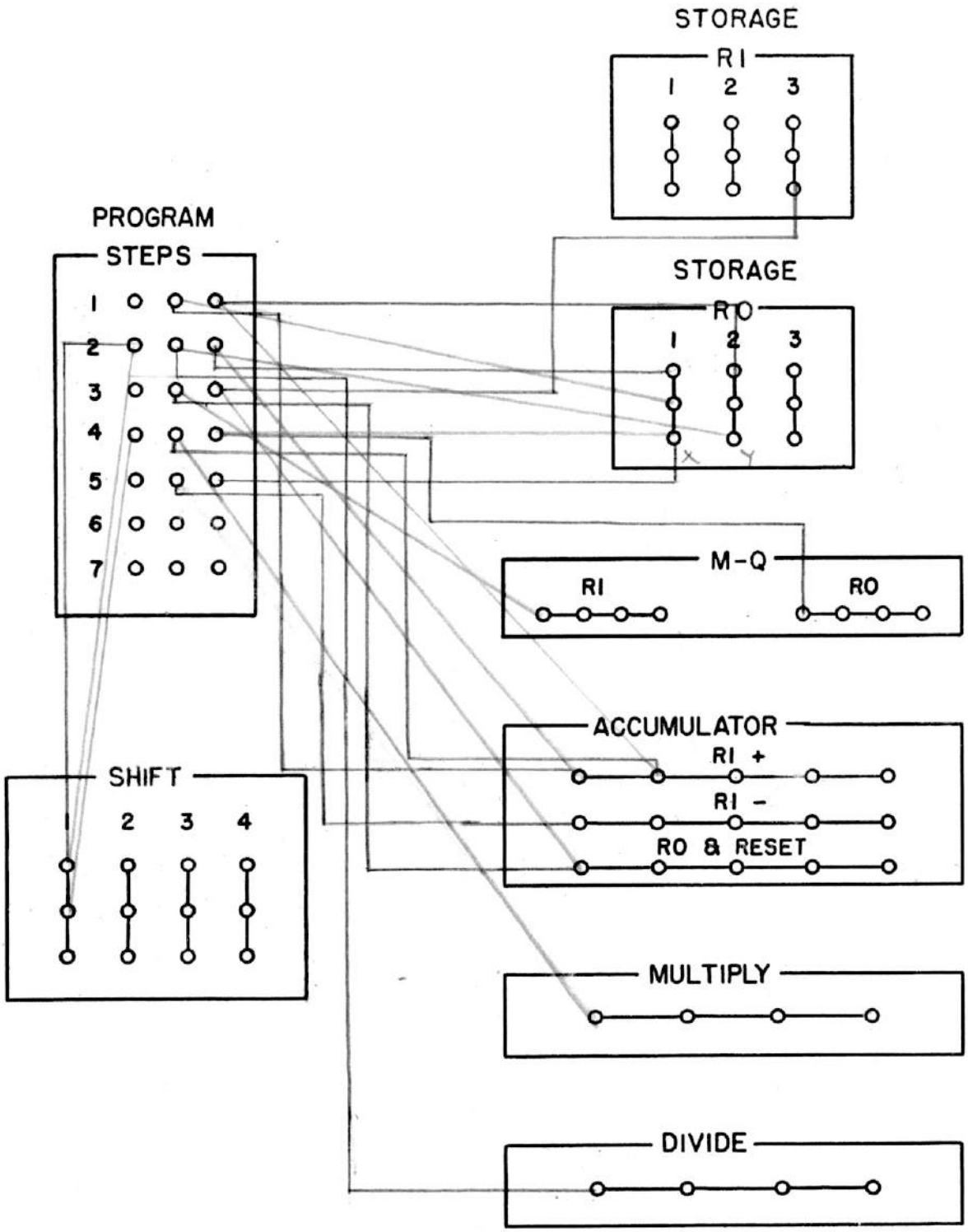


this should have been on left plate for a +5BA

$0.1\frac{y}{x} - x$

$100xy + 10x^2$

$10x(x+10y)$



50 no's stored 450-499
Add, print sum

000	Reset & Add	450
001	Add	012
002	Store	012
003	Reset & Ad	014
004	Subtract	000
005	Jump if minus	010
006	Reset & Add	000
007	Add	013
008	Store	000
009	Jump	000
010	Print	012
011	stop	---
012	[+00000]	
013	+00001	
014	+01498	

000	RE Add	005
001	Sub	014
002	Jump if minus	005
003	Print	—
004	stop	—
005	R E A	[101]
006	sub	100
007	Jump if minus	010
008	add	100
009	store	100
010	R E A	005
011	add	015
012	store	005
013	Jump	000
014	01200	
015	00001	

largest of no's stored in 100 - 199

(2)

100	Reset & add	L(00700)	location of set
101	Store address	301	
102	Store address	302	
103	add	L(00100)	number in set
104	store address	310	
105	reset & add	105	
106	jump	300	
107	continuation of main program		

300	Add	L(00002)
301	store address	313
302	Reset & add	700
303	Multiply	700
304	Add	314
305	Store	314
306	Reset & add	302
307	Add	L(00001)
308	store	302
309	Store	303
310	subtract	01[---]
311	Jump if minus	302
312	Reset & Add	314
313	Jump	[-]
314		[-----]

Problem (1) ... prove

$$(A\bar{B} + B\bar{C} + C\bar{A})(\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A}) = (A+B+C)(\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A})$$

$$\downarrow$$

$$A\bar{B}\bar{B}\bar{C} + B\bar{C}\bar{C}\bar{A} + C\bar{A}\bar{A}\bar{B} = \quad ''$$

$$\downarrow$$

$$A\bar{B}\bar{C} + B\bar{C}\bar{A} + C\bar{A}\bar{B} = \quad ''$$

$$\downarrow$$

$$A(\bar{B}\bar{C} + \bar{A}\bar{B} + \bar{C}\bar{A}) + B(\bar{C}\bar{A} + \bar{B}\bar{C} + \bar{A}\bar{B}) + C(\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A})$$

$$(A+B+C)(\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A}) = (A+B+C)(\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A})$$

Show

$$A\bar{B} + B\bar{C} + C\bar{A} \neq A + B + C$$

but when $A = 1$, $B = 1$ $C = 1$

$$0 \neq 1$$

Prove $AB + BC = (A+C)(A+D)(B+C)(B+D)$

$$= (A + AC + AD + CD)(B + BC + BD + CD$$

$$= [A(1+C+D)+CD][B(1+C+D)+CD)$$

$$= (A+CD)(B+CD)$$

$$= ACD + BCD + AB + CD$$

$$= AB + CD(1+A+B)$$

$$= AB + CD$$