

	SRAM	DRAM	HDD	FLASH	PROBE	OUM	MTJ-MRAM	3D-MRAM	MATRIX	1T FeRAM	0T FeRAM
Cell size	50F ²	8F ²	5F ²	5F ²	5F ²	5F ²	8F ²	5F ²	5F ²	8F ²	5F ²
Minimum "F"	10 nm	30 nm	10 nm	30 nm	3 nm	10 nm	40 nm	40 nm	10 nm	10 nm	10 nm
Max. bits/cell	1	1	1	4	1	2	1	1	1	1	1
Max. layers	1	1	1	1	1	4	1	12	12	1	16
Maximum density	0.1 Tb/in ²	0.07 Tb/in ²	1 Tb/in ²	0.4 Tb/in ²	10 Tb/in ²	8 Tb/in ²	0.04 Tb/in ²	0.75 Tb/in ²	12 Tb/in ²	0.6 Tb/in ²	16 Tb/in ²
Cost/area (AU)	10	10	1	10	10	16	10	16	16	10	16
Min. cost/bit (AU)	100	140	1	22	1	2	250	20	1.3	15	1
Retention	with power	0.1 sec	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs	> 10 yrs
Endurance	> 10 ¹⁵	> 10 ¹⁵	> 10 ¹²	10 ⁶	> 10 ⁵	> 10 ¹³	> 10 ¹⁵	> 10 ¹⁵	1	> 10 ¹⁴	> 10 ¹⁴
Byte access	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No
Min. read time	0.2 ns	1 ns	10 ⁶ ns	5 ns	10 ⁶ ns	5 ns	1 ns	10 ⁴ ns	10 ⁴ ns	1 ns	5 ns
Min. write time	0.2 ns	1 ns	10 ⁶ ns	10 ⁶ ns	10 ⁶ ns	50 ns	1 ns	10 ⁴ ns	10 ⁴ ns	1 ns	10 ns
Write energy/bit	LOW-HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	HIGH	MED.-HIGH	MED.-HIGH	HIGH	LOW	LOW
Revenue (2002)	\$4 Billion	\$17 Billion	\$20 Billion	\$8 Billion	DEV.	DEV.	DEV.	RES.	DEV.	\$0.1 Billion	RES.

FIG. 1

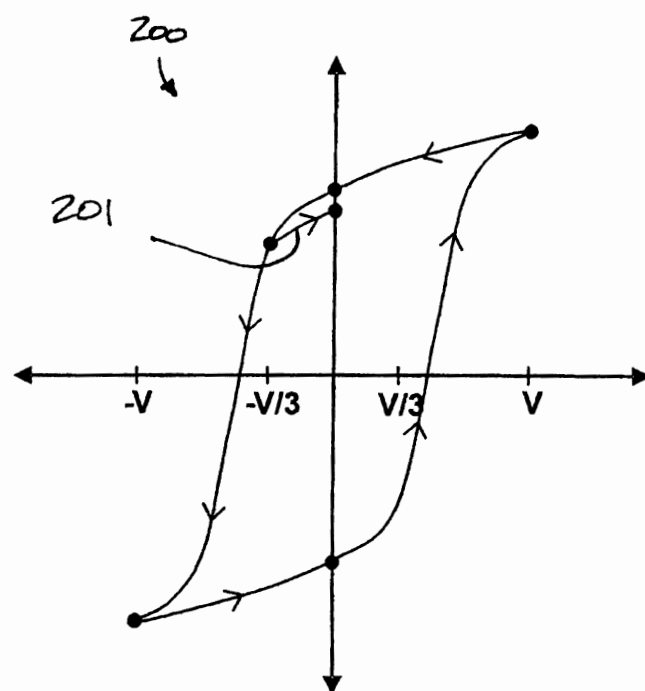


FIG. 2

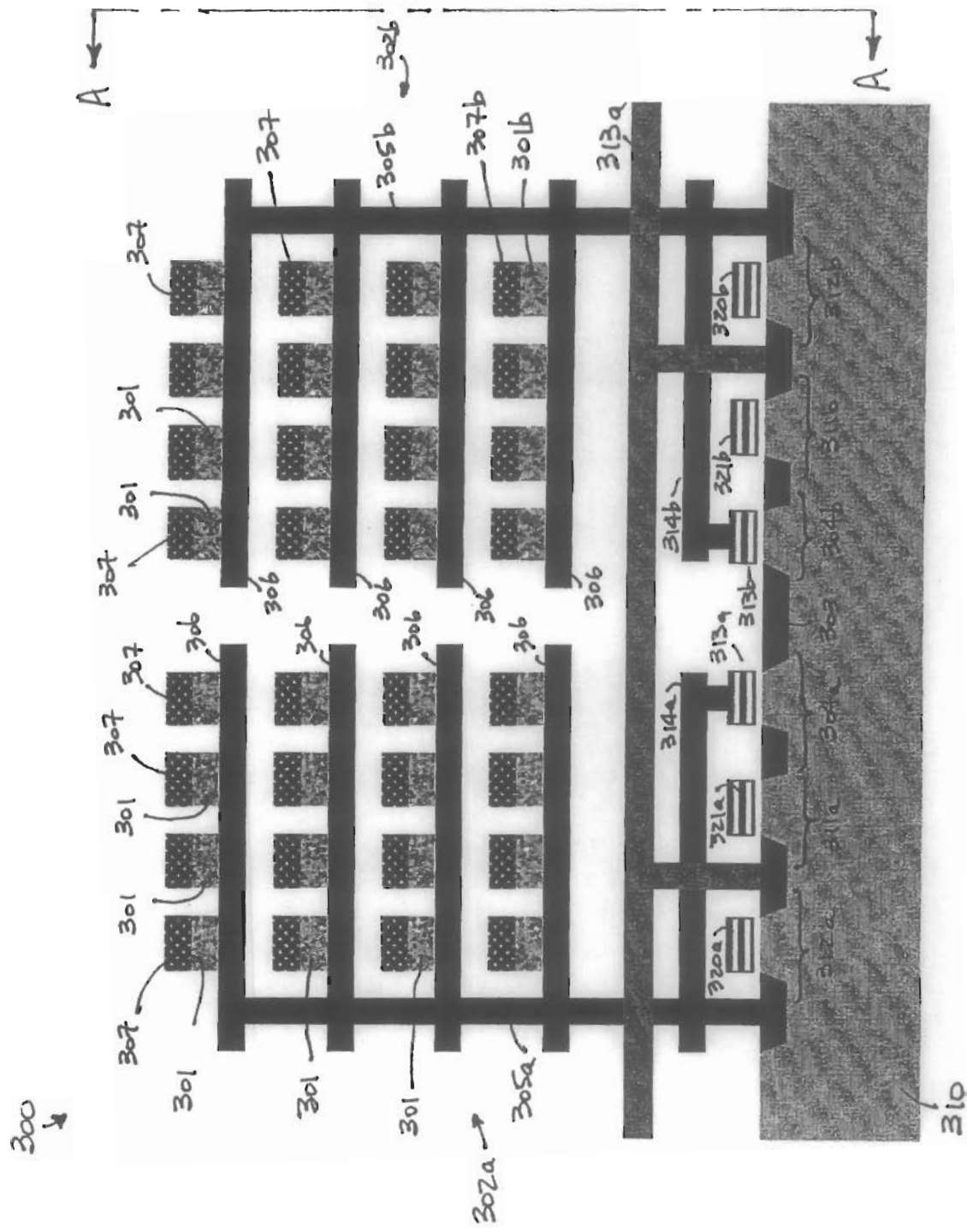
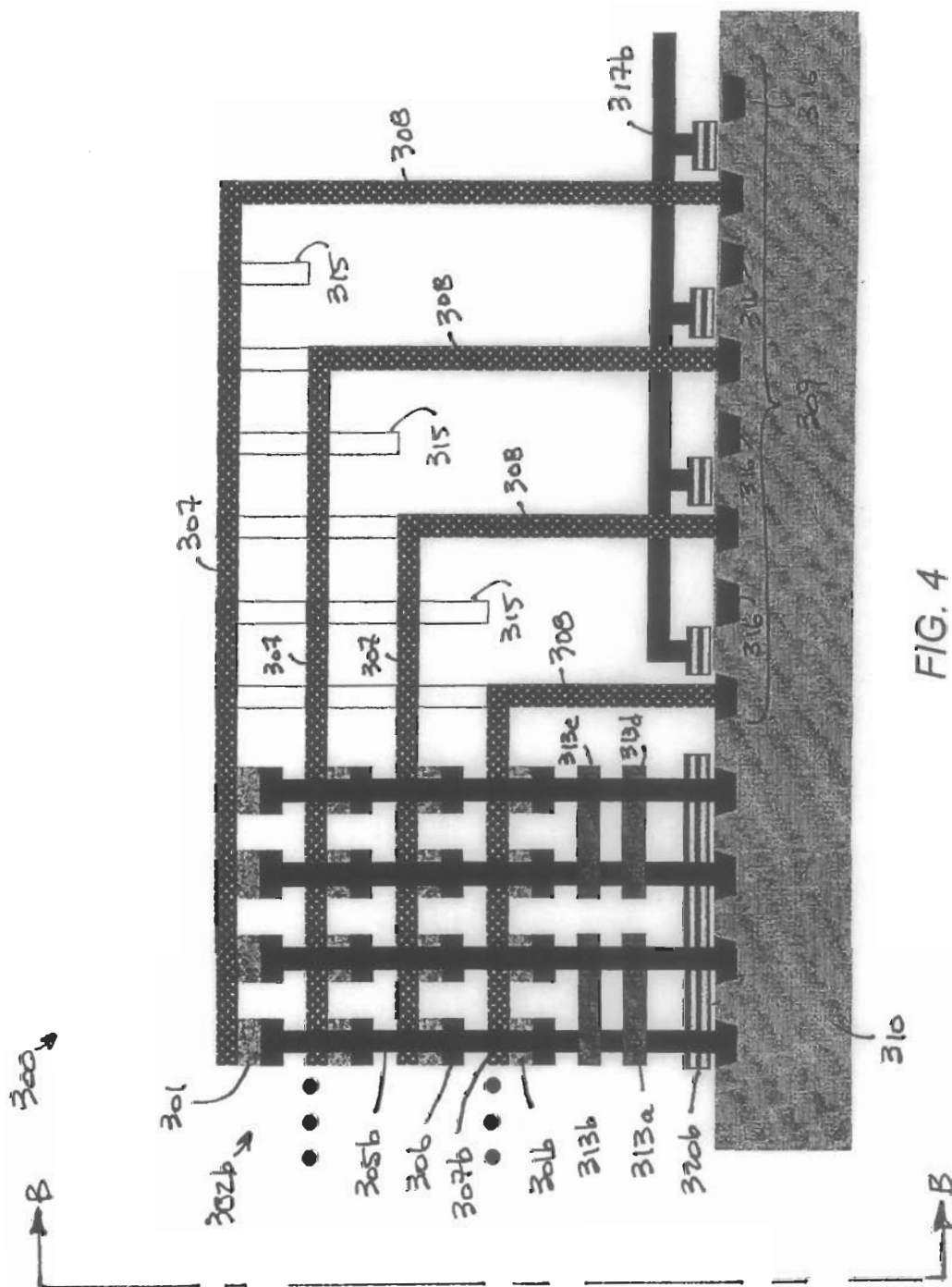


FIG. 3



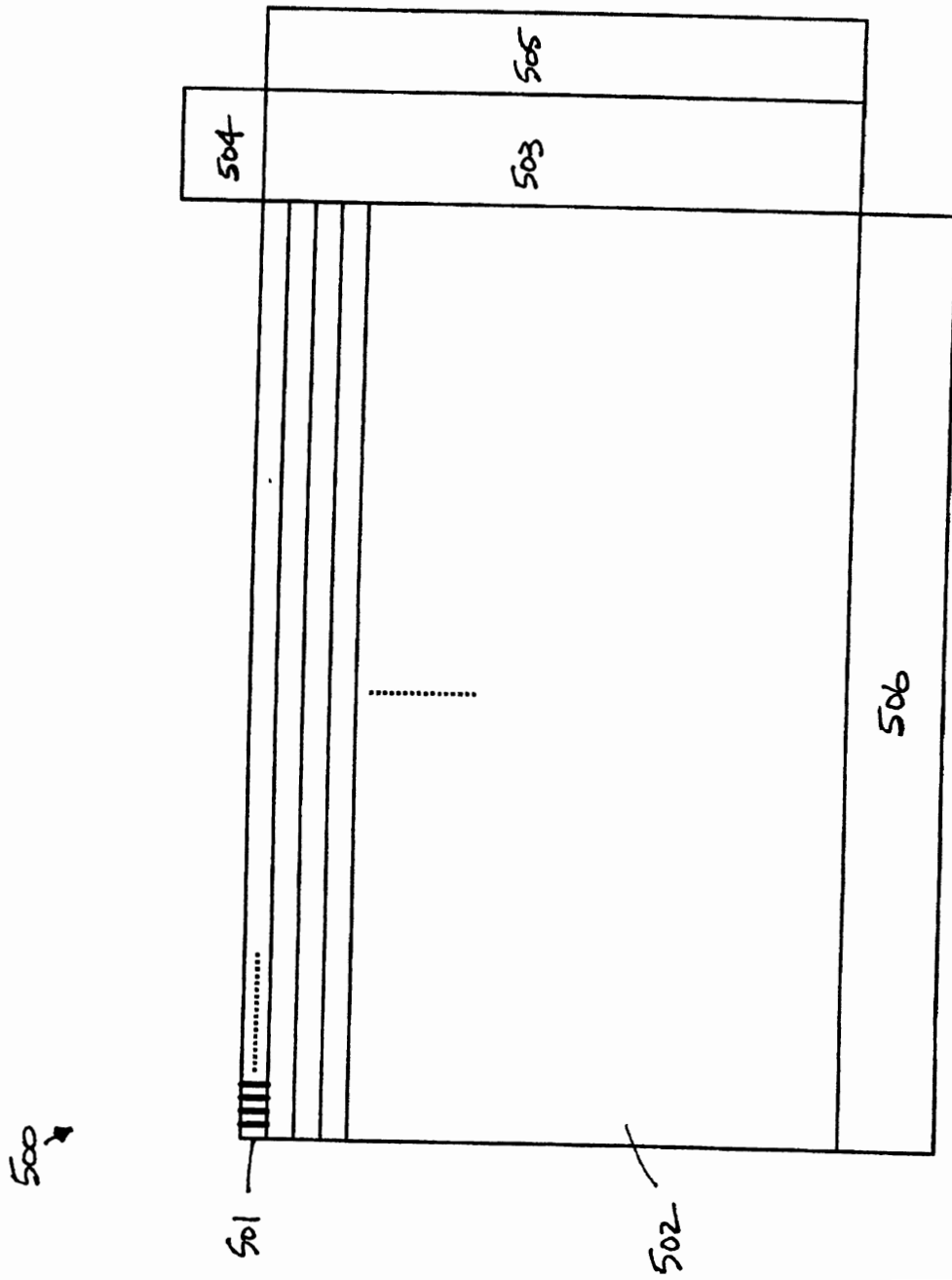


FIG. 5

600 →

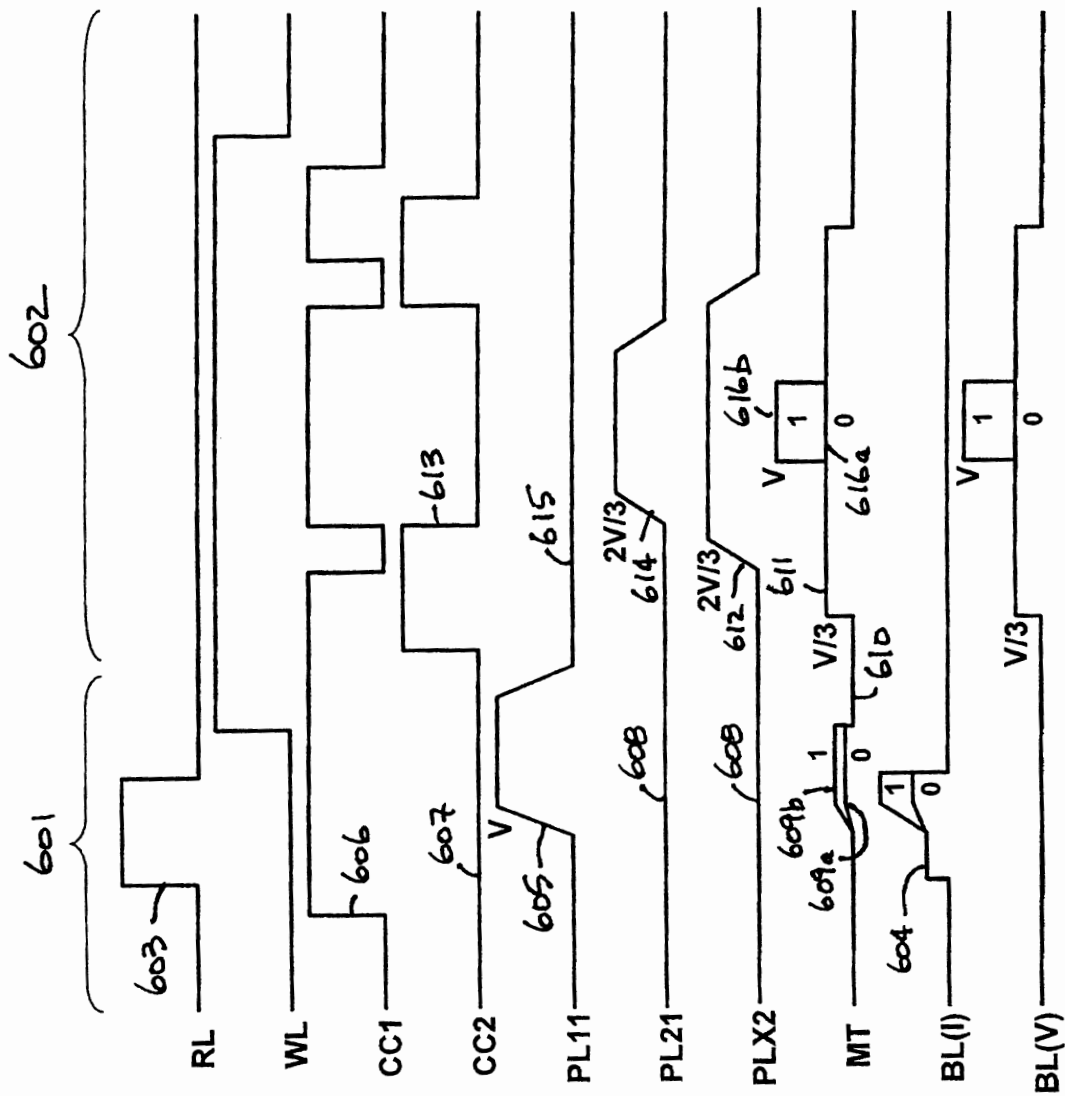


FIG. 6

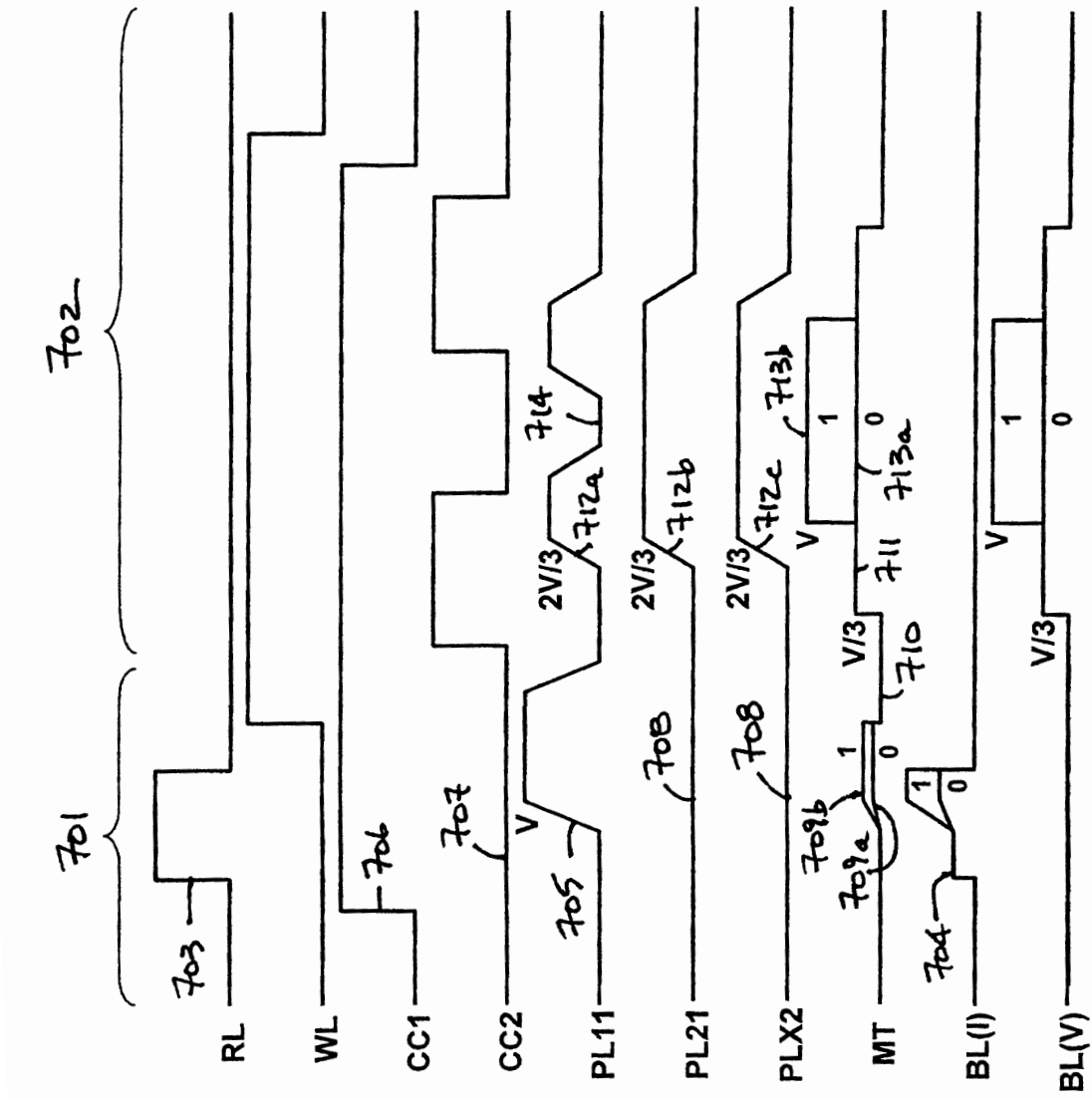


FIG. 7

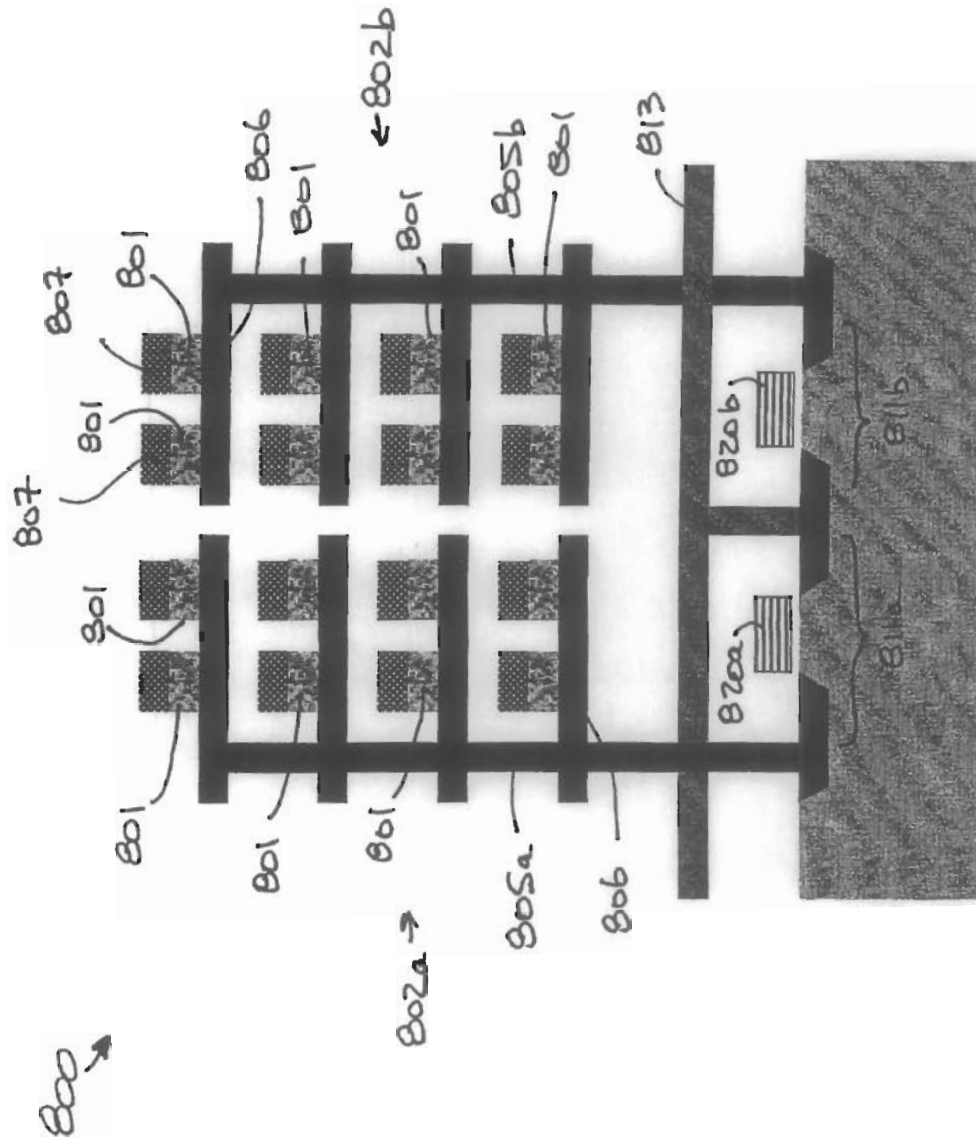


Fig. 8