Proposals for further development of direct video.

Additional research into direct video falls into five categories:

1. Circuit development designed to increase the <u>image vocabulary</u> of direct video;

2. Circuit and hardware development oriented to facilitating the <u>process</u> of combining image elements into dynamic progressions, including both transudcer design and implementation of sequential control;

3.

3. Packaging improvements, including smaller modules in an integrated enclosure and full use of printed circuit technology;

4. Documentation of technical and operational information;

5. Further development of the theory for image generation and manipulation.

Specific projects which I would like to develop include the following topics:

category 1

a* improved video bandwidth of output stages (mixer and color mixer) with voltage controlled gain factors. an eight channel system with 10 Mhz bandwidth would allow for quite complex image generation.

b* development of voltage controlled color mixers, which would provide programmed color transitions in addition to the present mannual mixture. linear controls would relace present rotary controls used for determing saturation. full RGBY mixing for complete contol of precise color. ~~nine color chord modules~~.

c* construction of more geometrical controur generators with phase locakable featurea so as to provide stable images. amplitude, frequency, and phase modulation functions under voltage control to provide for manipulation of image contours.

d* development of non-linear waveform proces-spors to increase the vocabulary of contours to includecircular, exponential, parabolic, and random in addition to the presently available linear and sinusoidal contours.

e* elaboration of the presant reference signal generatoors to be used in conjunction with the elements of c and d to produce more complex contour manipulation, with no restrictions on center and edge symmetries. phase, frequency, and amplitude modulation to allow for rotation and perspective spaces.

f* construction of additional signal processor elements such as algebraic combiners for addition and subtraction of control signals and analog multipliers for voltage controlled image manipulations.

g* improved line and point generators. circuits which are less noise suceptable and which have slope- correcting factors designed to make a continuous sweep from vertical to horizontal while maintaining a constant line width and not be coming segmented

h* construction of additional geometric ~~unit~~ region processors ~~with vertical interval~~ to provide for more complex interaction between image components.

i* development and construction of more elaborate textural and shading elements. it is possible that additional contour sources will also serve as shading elements.

j* implementaiton of vertical interval switching where feasable so as to ~~allow for continuous change of images~~ make switching transients 'invisible'.

The following projects are process oriented circuits

and hardware:

a* further development of joystick controllers, both two and three dimensional types. one problem with these controllers is that the output voltage contains low frequency noise produced by he potentiometers supplied with the sticks. smoother action can be obtained by substituting cermet pots or by an integrator. visual readout of volteg level would be desireable.

b* development of touch sensitive keyboard controls.

c* exploration of biotransducers as control devices, including alphawave, blood pressure, ekg, and other body and mental function to control voltage transducers.

d* devlopment of sequential control techniques for production of time sequences of images. the structure of such techniques would be along the following design to generate control voltage contours:

an N cell macroregister, operable as groups of independent microregisters, with each cell containing independent control voltage settings and state switches. associated with each cell is a duration time and a transition time which determines the rate of a monotonic change in control voltage from one cell to the next.

both analog and digital techniques would be utilized to produce a register which would be programmable with either knob settings or other other storage media but which also could "learn" a given passage by following the moves of a human operator playing the passage. numeric and symbolic display of register states would provide visual determination of its states.

such techniques lead logically to:

e* implementation of a small scientific computer such as PDP-8 or equivalent to execute control instructions delivered by the operator.

f* use of magnetic disc for storage and retrevial of video information. such a device would provide interesting image manipulations, including rotation and most manipulations achieved with computer image generating schemems.

g* implementation of data tablet or light pen for direct entry of image components into the electronic system. such a method would enhance the most general method of relaizing an image, which is to draw it!

the entire first half of 1971 was spent fabricating a suitable package for the circuitry and control 666666666 transducers. finally, near the end of july phase 1 of direct video ins tuemtn number 1 was operational. used to form mother goose

now where is it?

Image philosophy and Design Philosphy

form — geometrical contours planes, lines points angles and curves orientation to the scan raster frame of references illusion of perspective

motion — time rate of change of elements of form, ~~that is, time variati~~ons ~~in t ch relationship between form defining signals and~~ the s~~cnanning locus~~ translation rotation of contours

texture — establishment ~~behaviour~~ of contours in the video signal intensity — the brightness gradient;

color — determination of the hue, saturation and brightness of image elements

hybrid circuit modules operating with the control voltage method of parameter variation which would vary the elements of an image displayed on a color tv monitor

differs from digital computer methods

accept scanned raster of display- non random access sequentail address display system wherein each individual part of the total image is addressed once each 33.33 millisec (30 hz, the frame rate

however, successive elements of a given image may occur at the line rate or slightly longer apart in duration, 60-100 usec as a range.

so in fact, a given image may be refreshed along its way in less than 1 millisecond

these theorietical design notions are now incorporated in a prototype direct video instrument. Some one dozen control modules are intercinnected with circuit cards ~~located~~ to provide a volotage controlled system of image generation.

before describing the present contents of the protoype let me mantion some general technical and operational aspects of the instrument.

form — including: the establishment of geometrical contours on the display surface; determining the "order" of geometry, as points, lines, planes, and illusions of perspectives fixing angles and curves and thier orientation with respect to the raster axis;

motion — essentially, the time rate of change of position of elements of form; translation, rotation, of geometrical elements;

texture — establishment of brightness contours in the video signal, that is determining the intensity gradient ~~over the at points o~~ of image componenets;

color — determination of the hue, saturation and brightness of image elements;

These theoretical notions are now incorporated in a prototype direct video instrument. Some one dozen control modules are interconnected with circuit cards to provide a voltage controlled system of image generation. Before describing the contents of the protype instrument let me mention some general technical and operation aspects of the instrument:

1. Signal output is NTSC standards color video. Direct video processing amplifiers have a -3 db bandwidth of 4 MHz and the entire system is genlockable to external video.

2. Image parameters are voltage controlled and compatible with Buchla Electric Music Box modules as well as other electronic signal sources.

3. Black and white camera signals or VTR playback signals may be introduced into the instrument for use as image sources in addition to electronically generated images.

4. Image generating section of instrument is independent of video system standards. ~~Video~~ Inputs to the instrument consist of the system drive, blakning, and sync pulses, ~~System~~ while the outputs are parallel RGB video signals (Y channle optional). Instrument may be easily used with PAL 425 or 625 line fommats, SECAM 625 or 815 line formats, high resolution color or other video formats simply by using appropriate sync sources and encoder and adjustmen to f internal calibration controls.

Listed here is a description of present control hardware: Signals are distributed by patch cords which route, control, pulse, and image source signals to appropriate modules.

a) 4- independent color chord mixng modules for determing hue, saturation, and brightness of image elements. Both positive and negative colo functions are controllable in an RGB mixing format with Y (brightness) being matrixed in the encoder. (An additional cha nel for control of Y is optional, although negative color functions allow one to obtain non- standard saturation-brightness relationships). Rotary knobs control the saturation of of each primary hue.

b) 1- quad mixer module with 11 switch selectable inputs, elementary texture control in the form of a signal integrator, and gated output stages which provide the "key" function. Inputs are selected with digital thumbwheel switches, while master level controls adjust the output level of each channel. The outputs of the ~~cole~~ mixer module feed the color chord modules directly, while inputs to the mixer are patched into a jack panle. A toggel switch activates the integrator with the time constant of integration being adjustable with a knob. Another toggel is available for preview application. Each channel also has a gate pulse input for turning off the output of that channel with suitable gate pulses.

c) 1- dual video processor module consisting of two high bandwidth video amplifiers with adjustable gain (+6 db maximum) and contrast level. Also contains threshold detector with two independent complimentary pulse outputs and eithr mannual or external control voltage threshold level adjustment. Mat be used with Black and White cmaeras (such as Sony DXC-2000, the Center optical system video mixer, or balck and white VTR playback. May also be used with color video signals although results are not necessarily predictable.

d) 2- two dimensional joystick controllers- for sources of control voltage. Each controller has two independent processors each with three outputs and separate center-stck voltage level ~~adjustment~~ and voltage range adjustments.

e) 4 simple reference signal sources, horizontal and vertical- edge and center references (the center references ~~being voltage controllable~~ may be modulated)
These signals are used primarily in the voltage to positions converters and as texture shading elements.

f) 8 voltage- to-position converters arranged in two independent arrays each array having 2 reference signal inputs. Each converter has a switch to select the input references and accepts either contour signals or control voltages as inputs. Outputs are two independent complimentary pulses which are used to generate regions, lines, points, and curves in in conjunction with the 3 following image processor modules:

g) 1- octal geometric region processor. Eight independent binary operators which accept two inputs and deliver three independent AND/OR function outputs. Used to process regions and produce points.

h) 1- quad geometrical unit generator for producing lines and points. Two modes of operation allow for producing vertical to near-horizontal lines and horizontal lines. Line width adjustable with module control or external control voltage. Input operation provides for outlining of regions on leading, trailing, or both region edges. Outputs are two independently switchable complimentary pulses.

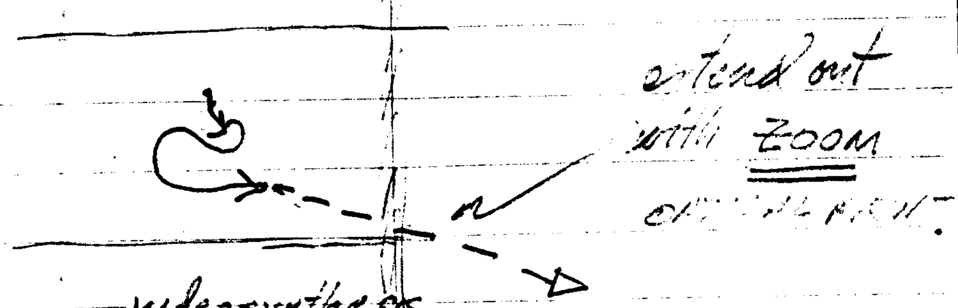
i) 1-prototype geometrical contour source consisting of a voltage controlled triangl/square waveform oscillator which is phase-locakble to either line or field rates.

j) oscilloscope monitoring cicuitry which allows various parameters of the instrument to be measured and observed.

Also used are two lab signal sources which serve as wideband oscillators for additional contour sources ar as control voltage sources for parmeter variation.

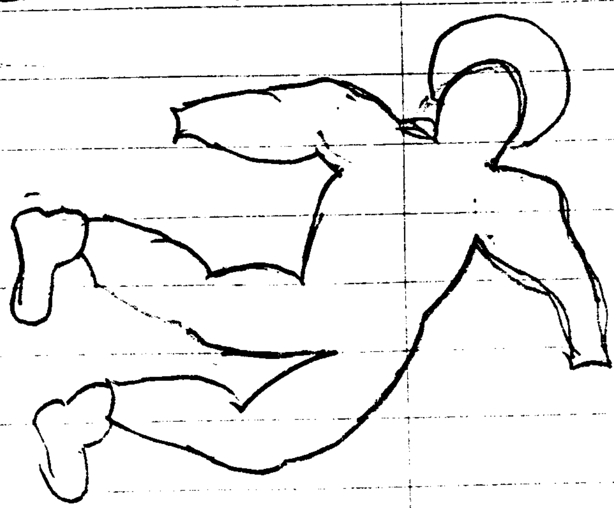
At this time ~~this~~ the circuitry ~~has been~~ is undergoing evaluation and has been operating reliably since the end of july. 1971

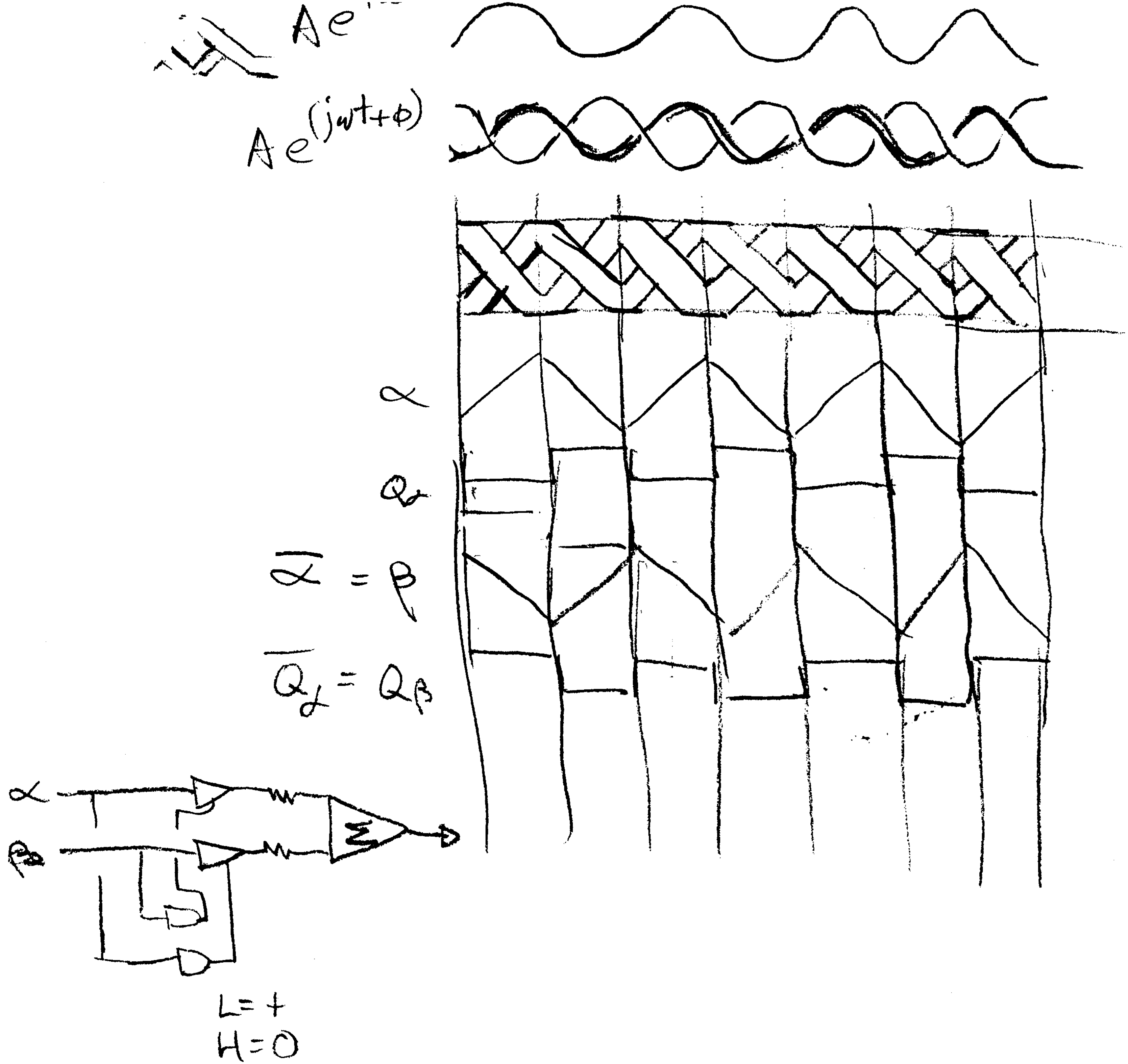
human element treatments
(the passage from
cycle to cycle!



videosynthesis

EFFECT	DIRECTION
1. DIRECT COLOR	↑↓
2. NEGATIVE COLOR	"
3. EDGE FIGURE	"
4. KEY INTO FIGURE	"
5. FLAMING FEEDBACK FIGURE	
6. MODULATED EDGE	
7. LUMINOUS DUST – COLOR TEXTURES – etc.	





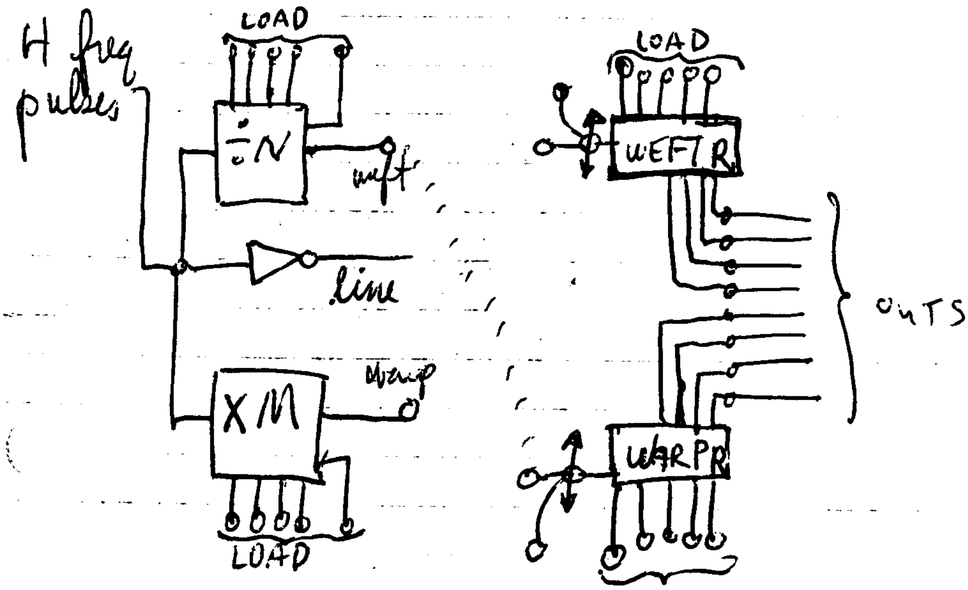
Ae
Ae(jwt+φ)
α
Qα
α̅ = β
Q̅α = Qβ
α
β
Σ
L=+
H=0

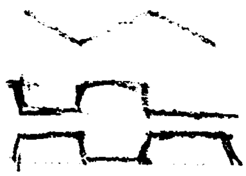
$\frac{62.5}{x}$ $\qquad x = M\left(\frac{62.5}{52.5}\right)$

The WARP register is ACTIVATED BY A HIGH FREQUENCY CLOCK PULSE, THE WARP CLOCK

ITS frequency IS DETERMINED BY THE NUMBER OF WARPS DESIRED IN THE WEAVE.

ACTIVE LINE TIME = 52.5 μsec
\# of WARPS = M
frequency of WARP CLOCK $= \frac{1}{T}$ $\qquad T = \frac{52.5\ \mu sec}{M}$ *





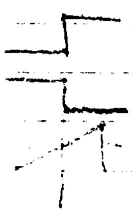
$Q \mid \overline{Q}$

Z_0

R_0	L_0		
1	0	→	Q
0	1	←	$\overline{Q}$

$\text{line } j\ ) + \{ Q R_0 \ell (j+1) + \overline{Q} R_0 \ell (j+1) \}$

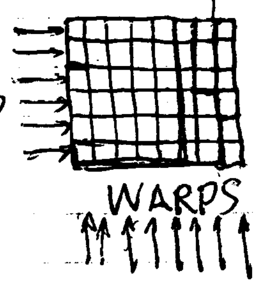
SEPARATED :



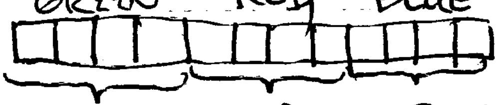
RITHM

1-7-87 Stephen Beck

VIDEO WEAVING



COLOR 4 bits / COLOR = 16 levels / line
3 primary colors



$(2^4) \times 3$ colors $= 2^{12}$ TOTAL
$= 4096$ COLORS

"whites" occurs when ever

$|G| = |R| = |B|$

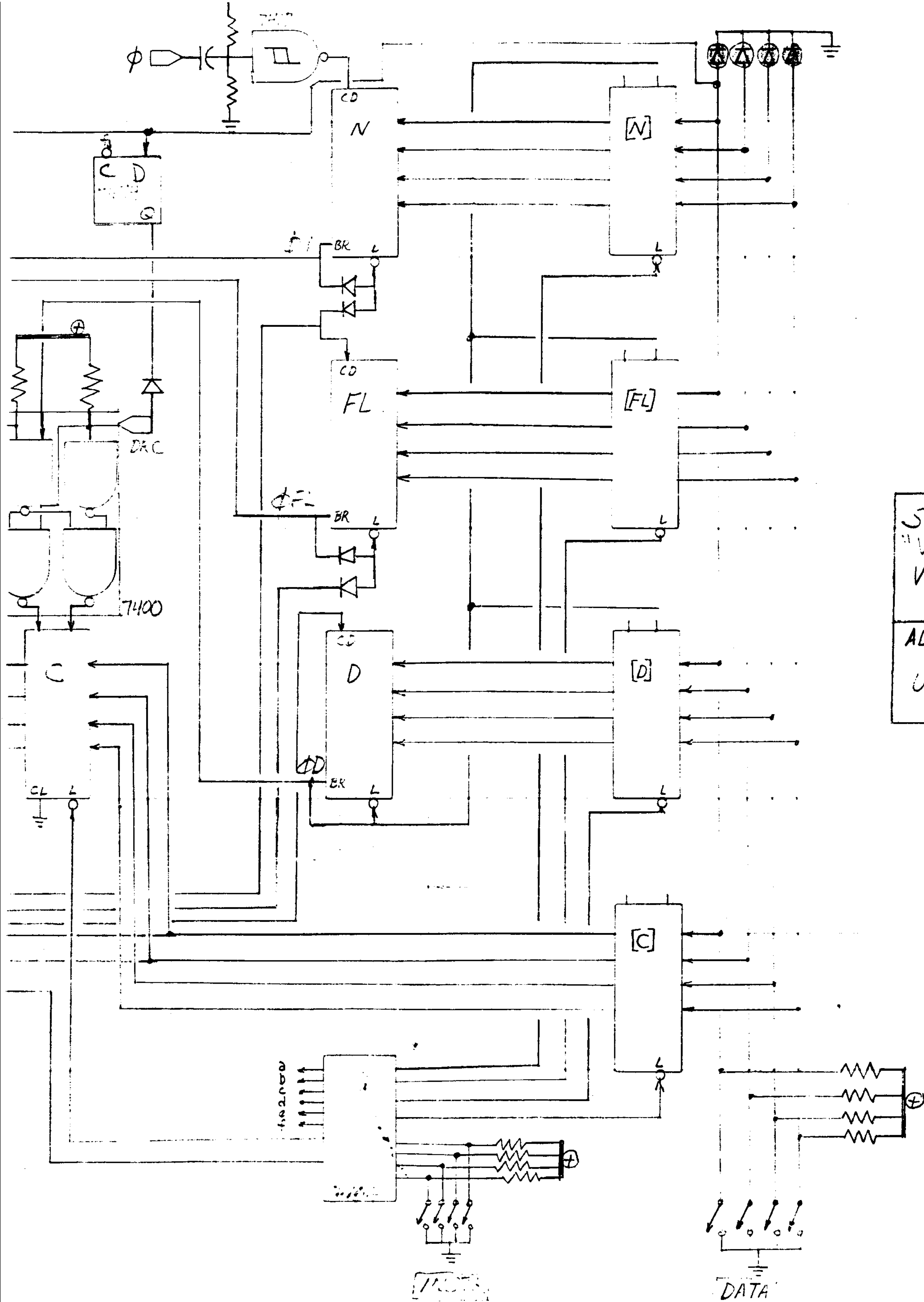
MAKING 16 values total

0000 0000 0000 = black
0001 0001 0001 = dark grey
1111 1111 1111 = max. white

ex.

0000 1000 1000 = 50% Magenta
0000 1000 1111 = violet

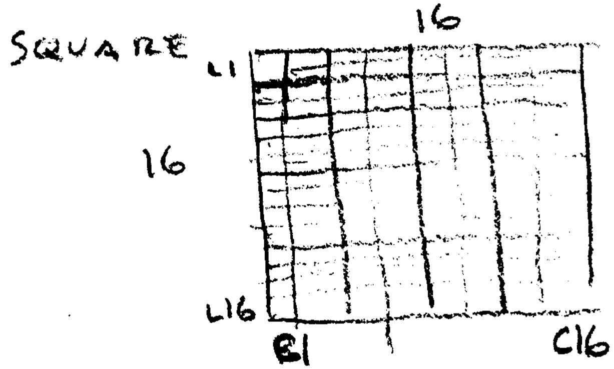
1000 1000 1111 = blue tint



STEPHEN BE
"VIDEO WEAV
VISUAL PROCE
APRIL 1975

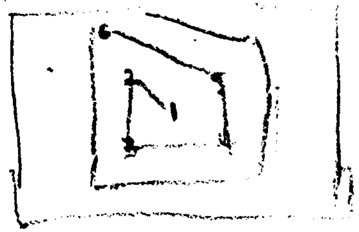
ALL CIRCUITS =
74193
UNLESS OTHE
NOTED!

MAGIC SQUARES ANIMATION

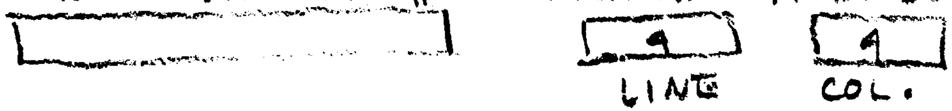


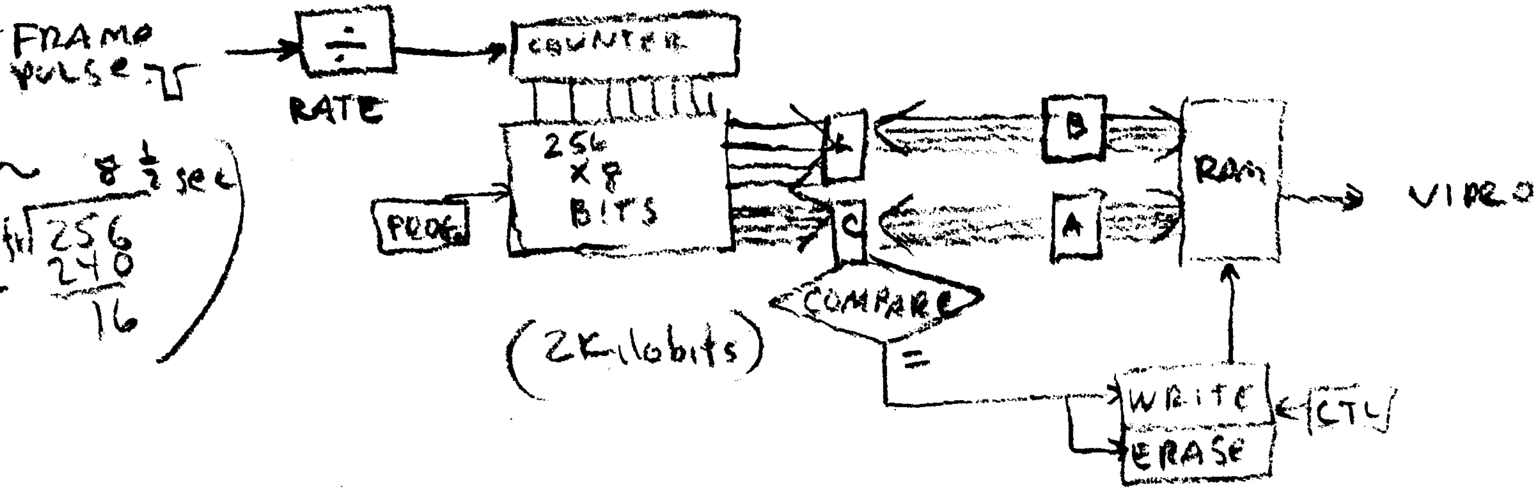
16 x 16
ROW COLUMN
4 BITS x 4 BITS

TRANSLATE ANT MAGIC SQUARE INTO RAM FRAME by FRAME
SEQ.

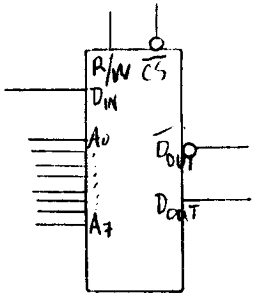


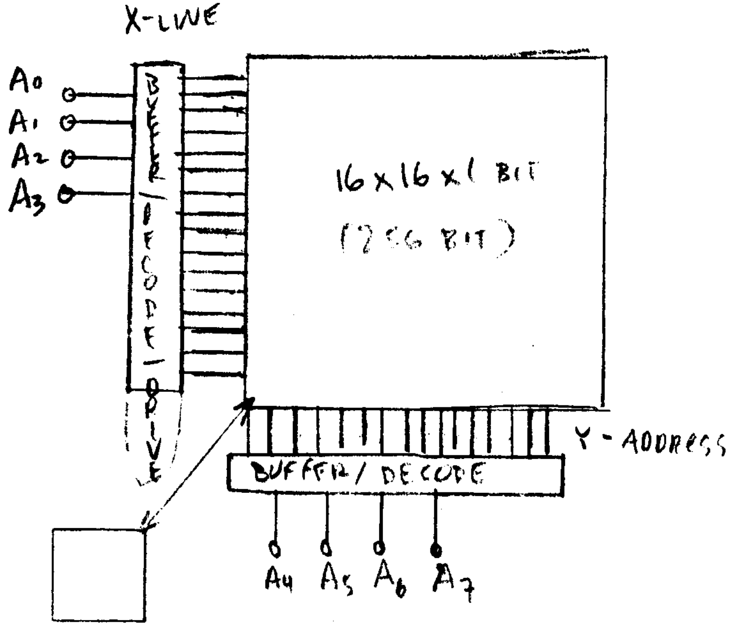
MAGIC SQUARE # = MEMORY ADDRESS IN PATTERN MEMORY





(~ 8 1/2 sec
30 fr/sec) 256
240
16)





DIN = DATA INPUT

DOUT = DATA OUTPUT

A0 - A7 = ADDRESS INPUTS

R/W = READ/WRITE INPUT
READ = 0
WRITE = 1

CS = CHIP SELECT INPUT
SELECT = 0
INHIBIT = 1

Vs = +5v

VL, VDD = -9v