The following paper is reprinted in facsimile form as the most primary and authentic source of Lee Harrison’s original concept for electronic animation. These notes eventually materialized as the ANIMAC animation system. —D.D.
THE CLOCK OR MASTER OSCILLATOR, IS A STABLE, VARIABLE-FREQUENCY WAVEFORM GENERATOR, THE OUTPUT OF WHICH

THERE ARE TWO SIGNAL OUTPUTS OF THE CLOCK OR MASTER OSCILLATOR, ONE IS A SQUARE WAVE, THE OTHER, A SINE WAVE. THE OUTPUTS ARE AT THE SAME FREQUENCY.

THE FUNCTION OF THE CLOCK IS TO FURNISH THE DRIVING SIGNALS TO THE DEVICES. IT IS ALSO A MEANS BY WHICH THE WORKINGS OF THE DEVICE ARE "TIME-SYNCHRONIZED." WE REFER TO THE OUTPUT OF THE CLOCK AS "HIGH FREQUENCY," BECAUSE WE COUNT DOWN (BY MEANS OF A COUNTER TO BE DESCRIBED LATER) TO THE "FRAME FREQUENCY," OR THIS ESTABLISHING A FRAME RATE. FRAME RATE IS THE RATE AT WHICH WE DRAW ONE COMPLETE FIGURE ON THE DISPLAY SCREEN.

BECAUSE THE COUNTER PERFORMS A FIXED-RATIO COUNTDOWN, THE LOW FREQUENCY IS ALWAYS A LOWER MULTIPLE OF THE HIGH FREQUENCY. THIS BY VARYING THE HIGH FREQUENCY, WE AUTOMATICALLY VARY THE LOW FREQUENCY OR FRAME RATE. DURING THIS DEVELOPMENTAL PERIOD, WE OPERATING AT FRAME RATES BETWEEN 34 AND 30 CYCLES PER SECOND (CPS). 30 CPS IS DESIRABLE AT THIS TIME BECAUSE 1) THE LIGHTING IN OUR WORKSHOP IS SUCH THAT AT A SLOWER FRAME RATE, WE SEE A BOTHERSOME FLICKER, AND 2) IT IS VERY EASY TO SYNCHRONIZE THE FREQUENCIES TO CO-CYCLE LINE FREQUENCIES (just twice the frame rate) AND THEREBY ELIMINATE WHAT IS KNOWN AS "HUM" OR LINE NOISE, WHICH IF NOT SYNCHRONIZED CAUSES A SLOW WOBBLE OF THE PICTURE.

IN THE FUTURE, WE WILL INSTALL A FEEDBACK TIMING CONTROL IN THE COUNTER CIRCUIT WHICH WILL AUTOMATICALLY SYNCHRONIZE ALL FREQUENCIES TO THE LINE (50 CPS) AND

THIS ELIMINATE THE NECESSITY OF HAND ADJUSTMENTS AND ALSO ASSURE AN EXACT 34 CPS FRAME RATE.

THE SQUARE WAVE OUTPUT IS FED DIRECTLY INTO THE COUNTER. IT IS ALSO THE DRIVING SIGNAL FOR THE HORIZONTAL DEFLECTION GENERATOR OF THE 8KIN SCANNER (TO BE DESCRIBED LATER).

THE SINE WAVE OUTPUT IS FED INTO TWO OF THE SAMPLERS (SAMPLER GATES), ALSO INTO A 90 DEGREE PHASE SHIFTER, WHOSE OUTPUT NOW BECOMES A COSINE WAVE (IN RELATION TO THE ORIGINAL SINE WAVE), WHICH IS SUBSEQUENTLY FED INTO THE OTHER SET OF SAMPLERS, ALSO BOTH SINE AND COSINE WAVES ARE FED INTO MODULATORS (TO BE DESCRIBED LATER).

THE FUNCTION OF THE CLOCK MAY BE TAKEN OVER BY THE TAPE RECORDER, WHERE THE CLOCK SIGNALS ARE RECORDED ON ONE OF THE CHANNELS, AND USED AS DRIVING SIGNALS OF THE DEVICE, THIS SYNCHRONIZING ALL CHOSEN SIGNALS WITH THE TAPE CLOCK.
COUNTER & TIMING CONTROL

The counter is a chain of bistable multivibrators. The input to the first BSMV in the chain is the high frequency square wave from the clock. The output of the first BSMV is a square wave which is exactly 1/2 the frequency of the input. Thus each BSMV in the chain halves its input frequency.

At the present time we have 9 BSMVs in the counter chain. This gives a countdown ratio of 2^9:1. Thus for a frame rate of 24 frames/sec, the high frequency must be 12,288 cps.

There is nothing magic about this selected ratio of 2^9 to 1. The choice of it at this time was governed by the ease with which we are able to use the high frequency in the function (sine-cosine) generator network. If the frequencies used in that network got too high, the generator doesn't perform well as well as we'd like it to, we have not had time to redesign the network. However, it works well up to 16 or 17 kc. Therefore, the use of the sine-cosine function generator is limited to 16 kc. In other words, the higher frequency we use, the greater "bone & skin resolution" we may have (this will be explained later).

The output of the first BSMV,ii besides being fed into the 2nd BSMV, is also fed into the delay multivibrators in the above-mentioned sine-cosine function generator network, and acts as a driving signal for those delay units. In other words, it causes the delay units to be sampling of the same sine-cosine waves in the samples at 1/2 the frequency of the sine-cosine waves in the samples. Thus there are 2 cycles or to sample from.

The significance of this is that we can get more than a 360 rotation, a bone. (To be discussed more fully.)

The timing control is a feedback network which synchronizes all frequencies (high & low) to the 60 cps line frequency, thus assuring an exact 5 cps frame rate.

SUMMARY: The electronic equipment operates on power received from a 24-cycle supply line. This power at 60 cps is present in wires and cables near the equipment, and has a tendency to radiate a certain amount of this power to adjacent parts. The result is that there is always present a slight voltage ripple on the lines, in the amplifiers, and even in the d.c. regulated-voltage supplies. This can be eliminated by shielding the equipment and connecting the power supply to it. By doing this, all of the frequencies to this equipment, for example, is an oscillator which runs at 360 cycles.

There are 3 inputs to the timing control: one is the 360 cps from the counter, the other is 60 cps from the line. The 360 cps is fed into a BSMV whose output is therefore 18 cps, the line frequency (60 cps) is fed into a 361 counter (known feedback) and its output is 12 cps. These 3 frequencies are then fed into a phase-comparator, the output of which is then fed into a d.c. controlled oscillator, whose mean output frequency will be the desired high frequency which when fed into the front end of the...
ELECTRONIC GATE-COMPUTOR OR MONOSTABLE MULTIVIBRATOR CHAIN

The chain of monostable multivibrators is an electronic commutator which opens and closes a series of "bone" gates in a sequential manner. In other words, the MSNV's furnish the driving (opening and closing) signals to the gates.

The input to the first MSNV in the chain is a pulse (500 nsec) which comes from the counter, when the pulse arrives, it causes the MSNV to flip into its other (unstable) state, for a length of time as determined by its integral R.C. network. By varying R, the length of time during which the MSNV is in its unstable state may be varied. When the flip has elapsed, during this "open" time, a change in voltage occurs on one of its outputs. This voltage is used to open a number of gates connected to it. When the open time has elapsed, the MSNV automatically flips back into its original state (stable) and changes back the output voltage driving the gates, thus closing them. During the flip back, a pulse similar to the one that caused the original flip is generated at another output point, and thence is sent to the next MSNV in the chain where a similar operation occurs, thus opening the next group of associated gates, for a time described by R associated with that MSNV. This commutating action continues until all the MSNV's in the chain have gone through individual cycles.

The driving output of the MSNV's (shown in Fig. 1) is used to perform a number of tasks, for example, this output may be used to close the electronic switches across the

INTEGRATING CAPACITORS, thus causing the display beam to "fly back" to its starting point. These signals are then applied as inputs to the flyback circuits. As described earlier in more detail, another use of the MSNV output is to dim or blank out the display beam by applying the MSNV output to the grid of the display CRT, the beam is "turned off" during the open time of the MSNV so engaged in this manner, flyback retraces, and certain bone-placing retraces - (as in the arms) where the beam must move from the starting point, up to the shoulder and thence proceed to draw the arm, and during that "placement" bone drawing, the beam is blanked out.

As mentioned before, the length of time that MSNV remains in its open position is determined by R of the integral R.C. network, thus by varying one of the resistances associated with each MSNV-RC network, an operator is able to "set-up" a figure or character to have the desire "bone" lengths, and overall structure. He also, in this setup procedure, determines the sequence in which the particular bones will be drawn, in determining this sequence he makes the necessary connections, the flyback circuit, blanking circuit, in addition to determining and setting up the desired bone lengths.

The MSNV chain is a switching, commutating network, which regulates the opening and closing of the bone gates. The various tasks which it performs could be done in other ways, such as (a) mechanical systems (b) binary counter systems with and/or diode networks (c) other electronic arrangements (d) radio mechanical systems.

A SINE-COSINE FUNCTION GENERATOR HAS IN ITS NETWORK A DELAY MULTIVIBRATOR, A NARROW-OUTPUTInsensitive MULTIVIBRATOR, 2 WAVE-SAMPLING GATES AND A HOLDING CAPACITOR ON THE OUTPUT (OR EACH SAMPLING GATE). THE DELAY MULTIVIBRATOR HAS TWO INPUTS, ONE INPUT COMES FROM THE 2ND STAGE OF THE (H) H-PORT OF THE COUNTER, AT +1/2 THE HIGH-FREQUENCY AND IS OF SQUARE-WAVE TYPE. THIS INPUT CAUSES THE DELAY M.V. TO CHANGE STATES, IT WILL REMAIN IN THIS STATE UNTIL IT FLIPS BACK AUTOMATICALLY INTO ITS ORIGINAL STATE. THE LENGTH OF TIME THAT IT REMAINS IN THE INVISIBLE STATE IS DETERMINED BY THE 2ND INPUT, THIS 2ND INPUT COMES FROM THE GATES) IS A D.C. VOLTAGE whose VALUE DETERMINES THE LENGTH OF THE DELAY M.V. WILL DELAY.

THE OUTPUT OF THE DELAY M.V. IS DIFFERENTIATED AND CLIPPED, SO THAT ONLY A PULSE REPRESENTING THE TRAILING EDGE OF THE CHANGE OF STATES IS SENT ON TO THE NARROW-PULSE N.C. M.V.


BECAUSE OF THE HOLDING CAPACITOR ASSOCIATED WITH THE OUTPUT OF EACH SAMPLING GATE, THERE APPEARS ACROSS EACH CAPACITOR A D.C. VOLTAGE REPRESENTING A PULSING WAVE OF SINE OR COSINE. FOR A NORMAL-LENGTH BONE, THE OUTPUT VOLTAGE IS A SMALL, BRIEF SPURGE, RESADING THE TIME THE DELAY IS DIFFERENTIAL.
THE INTEGRATOR IS A HIGH GAIN AMPLIFIER WHICH HAS A FEEDBACK CAPACITOR TO ITS INPUT. ITS FUNCTION IS TO PERFORM CONTINUOUS INTEGRATION OF THE SIGNALS PRESENTED TO ITS INPUT. THERE ARE THREE INTEGRATORS IN THE DISPLAY GENERATOR, ONE FOR EACH COORDINATE (X, Y, Z).

If the input to an integrator is a positive signal, the output is a ramp function. The initial conditions (starting voltages on the output which determine the starting point of each coordinate) are determined by the voltage across the feedback capacitor. If there is no discharge of that capacitor, the integrator will give the integral of a sequence of inputs to the output. The output will be a ramp function, and the initial conditions determine the starting point of each coordinate.

The function of the integrator is to allow the display beam to be described by different voltages. The function of the integrator is to allow the display beam to be described by different voltages.

Intermediate views may be obtained by combining all three integrator outputs in proper amounts, and this allows the operator of the device to view a photograph of an object or figure from any position. The function of combining these integrator outputs in a proper fashion is carried out by the camera angle network to be discussed later.

The value of voltage presented to the input of an integrator determines the slope of the change of output voltage at the output. If the integrator input voltages to the X and Y integrators represent the cos θ and sin θ, respectively, the output of the integrators when fed into the horizontal and vertical amplifiers and a display scope will cause the beam to draw a line on the scope whose angle to the horizontal is θ.
The function of the flipback network is to shut out or discharge the capacitors (c) associated with the integrators at desired times during the sequence of counts and at the end of one cycle of the generation. Discharging of the capacitors causes the beam of the display CRT to fly back to the starting position.

An electronic switch discharges the capacitor, pulses which close the switch coming from an amplifier which is in turn fed by pulses of the selected multivibrators of the microsecond. Also, a pulse whose duration is determined by the time of the last flip-flop is generated by a bistable multivibrator. This flipback bistable receives a pulse from the last flip-flop and closes, this pulse fires the flip-flop and its output causes the switches to close.

The microsecond is in the "close" state with it receives another input pulse which this time comes from the counter, the same pulse which starts the chain of flip-flops.

Diodes connect all of the pulse inputs to the amplifier which activates the switches so as to prevent pulses from feeding back into the gates and thus creating a sequence.

The electronic switches remain closed during the duration of a pulse, and discharge them long or short.

The function of the flipback network is to algebraically combine the various voltage representations of the sine, cosine, sine, cosine, etc., of the video signal A, to give the proper waveformic representations of the geometric projections of the figure or object being generated. For quick reference, a tabular representation of these various signals is given below.

- **sin o** is the sine and cosine of the angle **O**
- **cos o** is the cosine of the angle **O**

**Ramp functions of voltage, the outputs of integrators X, Y and Z respectively:**

- **Kt** is a scaling factor, which is a device function of the gains of display amplifiers and the gains of the integrators. Also a function of the amplitude of the input sine and cosine waves to the integrators. For simplicity these effects are accounted for by the use of this "lumped constant" **Kt**.

- **sin (Kt i)** whose frequency (the high frequency) is determined by **Kt** and whose amplitude is considered to be equal to a sine (one unit) (for a normal sinusoidal representation we'd have to use a sin Kt). To denote this wave, but we simplify the expression by letting **O =** 1 unit, **which is about 10^6**.
A capital A is used to denote the video signal which comes from the skin scanner. This is a wide band signal whose upper frequencies are very high.

To show the inter-relationship of the various signals, a photograph is given below for bone 1 and bone 2.

Two algebraic functions are performed by the portion of the device which we call the skin network, namely multiplication and addition.

Associated with each multiplier are input and output amplifiers, which are electronically necessary to allow an analogue multiplier to perform the task of multiplication. Each multiplier requires a "center tap" input, thus the three inputs to multipliers.

The important thing here is not how we perform the particular task but that we do perform it.

Adders are merely resistor networks which add the various signals presented to it.

Algebraically speaking, the skin network takes the previously mentioned signals and combines them so that

\[ x = k_t \cos \theta \cos \phi + A \cos \theta \sin \phi \cos \kappa + A \sin \phi \]
\[ y = k_t \sin \theta \cos \phi + A \cos \theta \sin \phi \cos \kappa + A \cos \theta \sin \phi \]
\[ z = k_t \sin \phi + A \cos \phi \cos \kappa \]

Here, \( x, y \) and \( z \) represent the \( x, y \) and \( z \) vectorial components of the figure. By presenting any \( 2 \) of these signals to the \( x \) and \( y \) inputs of a display CRT, the resulting drawing will be a projection of the 3 dimensional figure on the plane determined by the components selected by the geometric selection and combination of all three of these components. Any view or projection of the 3 dimensional figure can be seen.
THE FUNCTION OF THE CAMERA ANGLE NETWORK IS TO
ergeometrically combine the X, Y, and Z components of the
ture in such a manner as to allow for the
presentation of any projection or view of the
ure. When the outputs of this network are
presented to the X and Y channels of a display CRT,

1 ALGEBRAIC FUNCTIONS ARE PERFORMED: THE FIRST
IS MULTIPLICATION BY A CONSTANT, THE SECOND IS
ADDITION.

The "multiplication by a constant" is, in effect
the taking of the sine and cosine of the
vector, and is accomplished by a network of
variable sine and cosine potentiometers, addition
is performed using a fixed resistance network.

ANGLES θ' (theta prime) and ϕ' (phi prime)
represent the rotation of the XY plane about
the X axis and the XZ plane about the Z axis.

1 SINE-COSINE POTS, GAUGED TOGETHER (AR 
A COMMON SHAFT) IS THE MECHANISM FOR PERFORMING
THE PROPERLY-RELATED MULTIPLICATION BY CONSTANTS.

THERISA AREuch mechanisms, rotation of
the shaft of one, controls the viewing angle
θ'. The other, controls ϕ'. Amplifiers associated
with the network of sine-cosine pots are an
electronically necessary part.

The two outputs of this network are fed into
the X and Y channels of the display CRT, and represent
the beam positional information necessary to draw the

Eventually, we'll use controlling servo motors to
position the shafts of θ' and ϕ', so that the camera
angles may be recorded on the control tape.
Recorder, along with other controlling information.
Indeed, we'll record signals to which the
servo's will react, thus recording the camera
angles.
SKIN GENERATOR

The function of the skin generator is to generate a video signal whose magnitude represents the distance between the bone (vector) and the surface of skin of the object or figure being drawn.

The skin generator is a flying spot scanner which scans a specially prepared photograph, the density of which contains the desired thickness information.

The skin generator is a high-speed computer which converges proper sequence, the thickness information, or the thickness which is contained in a form of electrical device, information storage device or medium.

The flying spot scanner is a special cathode ray tube in which the beam sweeps out a prescribed raster (pattern of lines). The beam produces a short persistence spot of light on the face of the tube. This spot of light is optically conducted and focused on the photographic transparency which transmits varying amounts of light according to the film density. Thus the photographic transparency modulates the intensity of the light, as the spot sweeps across it. This modulated light is collected by a condensing lens and focussed on a photomultiplier tube which converts the modulated light into a voltage signal (video). (In general, this system acts as a high-speed computer, computing many fields of information in the original stream.

The video signal is then added (vectors speaking) to the bone signal and giving the positional information to the display beam which represents the thickness of the object or figure being drawn.

The movement of the flying spot is controlled by deflection amplifiers in scanner. The controlling deflection wave forms are generated in the deflection generators which are multiple half cycle from clock, which are synchronized and driven by an input from the clock.

The raster (pattern) of movement of the spot of the scanner is basically rectangular, with some localized modifications in the pattern for special skin distortion effects as in lip, eye, or other facial movements and plastic-type movements. (Such as wrinkle effects, which would be automatically developed as a function of bone angles.)

The skin generator may also be used to develop other skin information such as color, texture, shading, etc. This will be discussed later.

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The function of the recording network is to record the multi-channel output signals (mixed and single-channel signals) for the playback of these signals. The recorder is a multi-channel recorder, with one channel recorded in the clock rate signals for synchronization; signals recorded for selectivity recording, and signals of individual interval-time of groups of gate signals are accomplished with recording gates, which are activated by the multihitorg associated with the bone gates desired to be recorded. A signal may be employed to hold these gates recorded. Gates opened if it is desired to use in all of the bone, as an operator may see at the time the same. If the tape moves across the write heads and of the tape recording, the tape is situated "upstream" from the read heads, as far as tape motion is concerned, the signals which are passed by the recording gates are then recorded on the tape by the write heads. The signals thus recorded are almost immediately read by the read heads. When the signals are amplified and sent into the tone generation network.

The tape format is shown below:

[Diagram of tape format]

The clock channel has recorded on it the high frequency saw wave plus the interlaminar frame pulse. These signals are separated after reading, and the saw waves are sent to the bone generator, and the frame pulses are sent to the counter chain. After the 0 and D channels are filled with recorded signals, selective re-recording is accomplished by making connections between the selected ASMs and the recording gates, so that the gates are opened only during the times of occurrence of the opening of the ASMs. The 0 and D gates are associated with the selected ASMs, the line reading, and only.

For example, suppose an operator is limited to re-record the angular actions of the 4th and 6th bone. He'd connect the phase output of the 4th and 6th bone to the recording gate. This is the output of the phase terminal of the recording gate, and thus the only time the recording took place would be at the correct spots on the tape that corresponded to the previously recorded actions of bone 4 and 6. The write head in being activated at those times would obliterate the previously recorded signals and leave the newly desired signals on the tape. The rest of the time, the recording gates are closed, and the read heads pick up the old as well as the new signals, and transmit them through the device to stimulate the desired action on the display.

Other tape channels are used in similar fashion to control, record, and control other parameters of the bone, for example, the 0 (0) channel is used to control the rotational position (or twist).
CONTROL OF MOTION by OTHER CHARACTERS

By controlling the emotions, the body's automatic functions, and other special sensations, the body can be made to react more effectively to the environment. This is achieved through the use of a network of neurons called the emotion centers, which are interconnected with the motor centers of the brain. The emotion centers receive input from the sensory centers, which are involved in the perception of the world. The input is then processed by the emotion centers, which generate emotional responses. These responses are then sent to the motor centers, which control the body's actions.

The emotion centers are located in the limbic system of the brain, which is involved in the regulation of emotions. The limbic system is connected to the motor centers through a network of neurons called the reward system. The reward system is involved in the reinforcement of behavior, and it is activated when the body is engaged in activities that are enjoyable or rewarding.

The motor centers are involved in the execution of movements and behaviors. They receive input from the emotion centers, which determines the nature of the movement or behavior. The motor centers then generate the appropriate neural signals to control the muscles, which carry out the movements.

In summary, the body's responses to the environment are controlled by a network of neurons that link the sensory, emotional, and motor centers of the brain. This network allows the body to react to the environment in a way that is adaptive and effective.
THE ELECTRONIC SIGNALS COMING OUT OF THE
CAMELLA ANGLE NETWORK ARE BEAM-POSITIONING
SIGNALS (JUST AS FINGERS CONTROL THE POSITION
OF A PENCIL ON PAPER). THE FUNCTION OF
THE SHADING (AND COLOR) NETWORK IS TO CONTROL
THE BEAM INTENSITY AS IT DRAW THE FIGURE
OR OBJECTS RECONSTRUCTED ON THE
IMAGE SCREEN (HIGH FREQUENCY) VARIATIONS IN INTENSITY
ASSOCIATED WITH SKIN SHADES, SHADINGS, TEXTURES,
Etc., WHICH ARISE FROM THE SURFACE
VARIATIONS IN THE SKIN. (COLOR VARIATION IN
 THIS SENSE ARE THOUGHT OF IN TERMS OF A THREE-
COLOR, (MULTI-COLOR) PROCESS WHERE PURPLE
IS ONE OF THE THREE DISPLAY SCOPES, ARE OPTICALLY
SUPPRESSED, AND EACH SCOPE HAS A COLOR FILTER
ON ITS FACE. BY VARYING THE INTENSITIES OF THE
3 BEAMS THE OUTPUT IMAGE HAS FULL
SPECTRUM COLOR CAPABILITY. THIS TROPIC IS CALLED SHADING (AND COLOR NETWORK.)

THE SKIN VISION SIGNAL CONTAINS THE
INFORMATION ABOUT THE CONTINUOUS-NASALLY
ORTHOGONAL DISTANCE BETWEEN BONE AND SKIN.
IN THE FULL-BASIC FORMAT THE RATE OF CHANGE
OF THE VIDEO SIGNAL IS USED TO CONTROL HIGH
FREQUENCY SKIN VARIATIONS TO ACCENTUATE THE
SKIN FEATURES WHICH OCCUR BETWEEN THE
BONES OF THE OBJECT BEING DISPLAYED IN THIS
FASHION BY DIFFERENTIATING THE SKIN VIDEO
A RATE-OF-CHANGE SIGNAL IS OBTAINED; A THRESHOLD NETWORK DETECTS ALL RATES ABOVE A
STANDARD ABSOLUTE VALUE. THE CLINICAL OUTPUT
ACROSS THE THRESHOLD FUNCTION IS AMPLIFIED AND
SCALED, ALONG WITH THE INITIAL INPUT
ACCIDENTALLY INCORPORATING EDGE EFFECTS (SEC.
2.

THE SIGNALS ARE PRODUCED IN ACCORDANCE WITH THE
SKIN VECTOR POSITION WHICH IS A FUNCTION OF THE PHASE OF THE HIGH
FREQUENCY SIGNAL WAVE FORMED FROM THE POINT
IN ADDITION A HIGH FREQUENCY WOBBLE
OR A FOCUS FLARE MAY BE EMPLOYED TO
HEAVY-UP OR THICKEN THE EDGES. THIS
ACTION ALSO BEING THE SHADINGS SIMULATED WITH PHASE OF THE WAVEFORM,
TO PRODUCE FLAT COLOR EFFECTS OR GRAY OR TEXTURES WHICH
May BE PRODUCED BY BASED IN THE INTENSITY-
MODULATING SIGNALS. WHEN NEEDED, THE
BONE GATES DESIGNED FOR THAT PURPOSE. THE
INPUT TO THE GATES IS A HIGH FREQUENCY OF
A CERTAIN LENGTH WHICH WHEN APPLIED TO MODULATE THE BEAN INTERMEDIATE
DURING THE DRAWING OF A PARTICULAR BONE WILL GIVE
A TEXTURED PATTERN. MORE SPECIFICALLY, VIDEO
SIGNS CONTAINING DESIGNS OF PRESCRIBED
DESIRED DESIGNS MAY BE APPLIED IN THIS MANNER. TO GIVE THE
IDEOLOGICAL EXISTING APPEARANCE OF AN OBJECT
AS A SOAP BOX OR OTHER CONSUMER
PRODUCED AS A STAMP PATTERNS ON AN OBJECT
OR A SCREW PATTERNS ON AN ANIMAL CHARACTERS
TO GENERATE THIS INTENSITY VIDEO, ANOTHER
SCANNER WOULD BE REQUIRED OR A STAMP IMAGE
SCANNING TECHNIQUE WHERE SPECIFIC MEANS ARE
USED TO HAVE THE SKIN-SCANNING SYSTEM OF THE
FLYING SPOT FOUCUSED ON TWO OR MORE
FILMS - WHERE ONE FILM CONTAINS THICKNESS
INFORMATION AND ANOTHER CONTAINS SURFACE
COLOR, PATTERN OR TEXTURE INFORMATION.
OVERLAP PREVENTION AND SCAN CONVERSION

Because the display beam is drawing a 2-dimensional protection of a 3-dimensional image in a continuous manner, it is necessary to provide a means of preventing the beam from drawing over a portion of the image which has already been drawn. This is a special device for "overlap prevention" has the function of doing away with "ghost" image or scan overlap. 

Overlap may be defined as two types. One type occurs when a "black" part or part of the image on the side away from the viewer is drawn. This overlap is prevented by turning off the intensity of the beam according to the vectorial position of the skin vector which is a function of phase of the high frequency, and angle between the camera angle (which governs the position of the plane of projection) and 1. 

The second type of overlap occurs when one part of an object or figure overlaps another part or where one figure is in front of another. By using a special display tube which has in it, two or more electron guns, one of which is a "write" gun, another of which is an "erase" gun (having selective erase capability), and having the erase gun precede the write gun by employing a slight delay in the write signals (both guns getting the same display signals except overlap may be prevented, as long as the object or part of the object which is to be displayed is drawn in the sequence compatible with this method (mainly the

A multi-gun scope this employs will contain the image that is drawn for a length of time. It is necessary to photograph or scan converting. A scan conversion tube may be used to read the image into a scanning pattern which is compatible with television transmission or a close line raster which would be compatible for the superposition of figures on a background.

At this point in the generation of animated pictures it is necessary to consider picture quality in terms of resolution. The problem of resolution becomes acute when high scanning speed is used. This necessitates high bandwidth requirements. Thus it is contemplated that the special picture techniques (superimposition, overlap prevention, scan conversion) will be carried on at a relatively slow rate, and at the same speed at which the actual animation will be carried on in real time (where the device operates). The signals into a line/scan format. But the eventual film recording of the animated sequences will be at a slower rate, and of course all animation is controlled by the pre-programmed animation with low repetition scanning rates. High resolution is compatible with small film grain may be attained.