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NASA SP-5919 (02)

TECHNOLOGY UTILIZATION

GRAPHIC ARTS TECHNIQUES AND EQUIPMENT

A COMPILATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Foreword

The National Aeronautics and Space Administration has established a Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace community. By encouraging multiple application of the results of its research and development, NASA earns for the public an increased return on the investment in aerospace research and development programs.

This document is one in a series intended to furnish such technological information. Divided into four sections, the document presents groups of innovative devices plus techniques that have been found useful in speeding the operation of a graphics shop while maintaining, and, in some instances, improving the quality of the finished product.

Additional technical information on individual tools and techniques can be requested by circling the appropriate number on the Reader Service Card included in this Compilation.

The latest patent information available at the final preparation of this Compilation is presented on the page following the last article in the text. For those innovations on which NASA has decided not to apply for a patent, a Patent Statement is not included. Potential users of items described herein should consult the cognizant organization for updated patent information at that time.

We appreciate comment by readers and welcome hearing about the relevance and utility of the information in this Compilation.

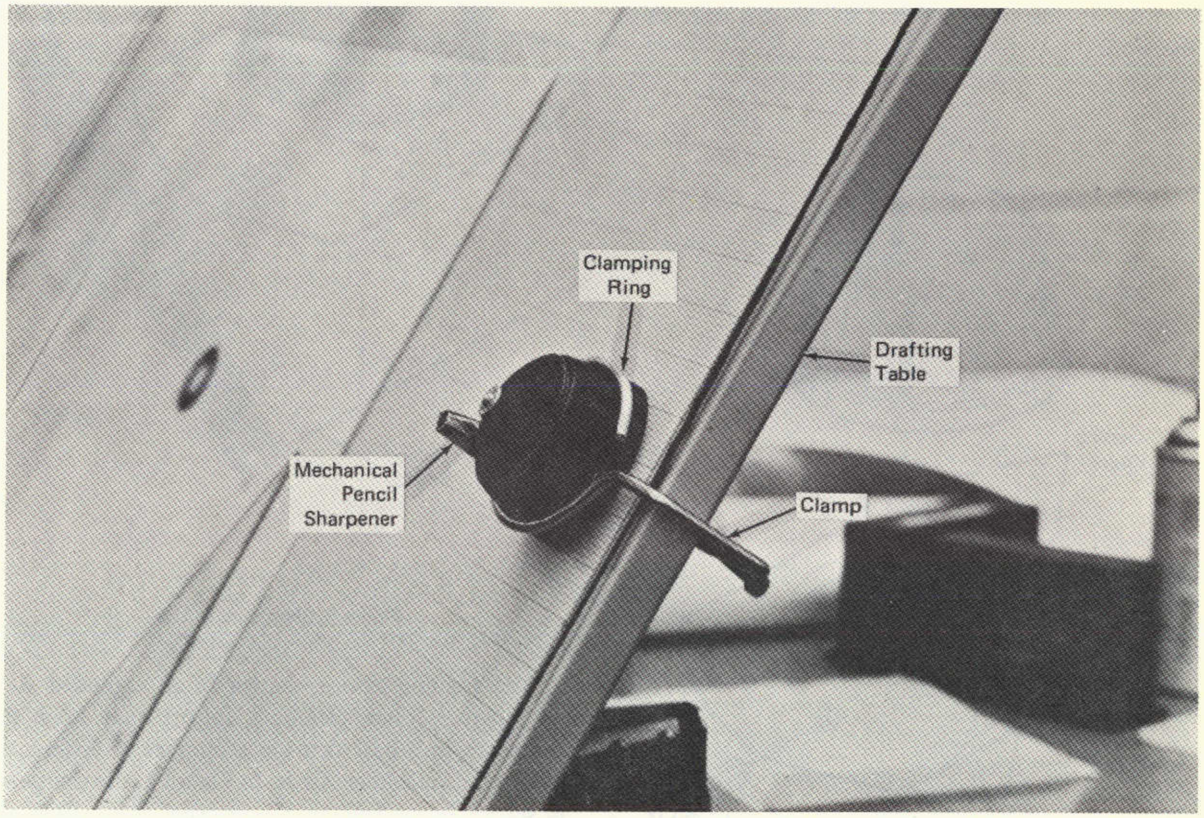
Jeffrey T. Hamilton, *Director*
Technology Utilization Office
National Aeronautics and Space Administration

For sale by the National Technical Information Service, Springfield, Virginia 22151. $1.00

Contents

Section 1. Modification to Graphics Tools

MECHANICAL-PENCIL-SHARPENER CLAMP



An adjustable drafting board is usually used at such a slanted position that all loose material or objects must be placed elsewhere or fastened down. Considering the frequency of use of the drawing pencil mechanical sharpener, it is very inconvenient for the user to have to be reaching for it each time it is needed.

A clamp (see figure) was designed to hold the mechanical sharpener firmly at an edge of the drafting board in any location the user desires. The clamp is made from a stainless steel rod which has a ring formed at its top. The bottom of the clamp is drilled and tapped to receive a threaded shaft with a knurled head on one end and a ball and socket-type circular flat plate on the other.

With the sharpener placed on the board at the desired edge, the ring of the clamp is placed over the sharpener and moved down until it engages the the widening tapered side. The knurled head of the threaded shaft is then rotated until the flat plate engages the underside of the drawing board. This secures the sharpener in place, regardless of the angle of the board.

Source: D. Pritchard of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10221)

No further documentation is available.

ROTATING HOLDING DEVICE FOR MECHANICAL PENCIL SHARPENERS

This innovation, although similar to the device described in the preceding item (KSC-10221), offers the additional advantage of permitting the mechanical sharpener to be held securely in a vertical or near-vertical position regardless of the drawing board angle. This eliminates the problem of having lead shavings trickle from the side of the sharpener onto the work.

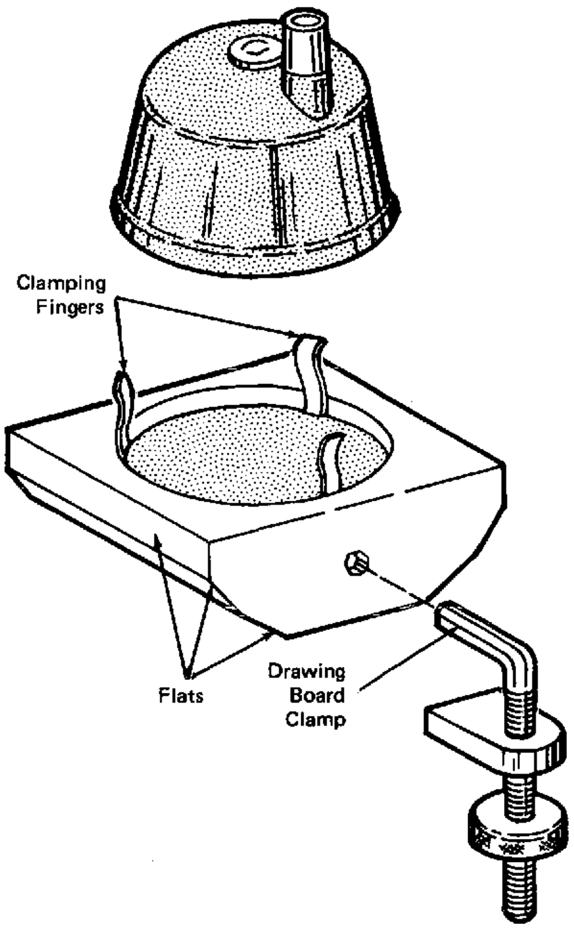


Figure 1. Exploded View

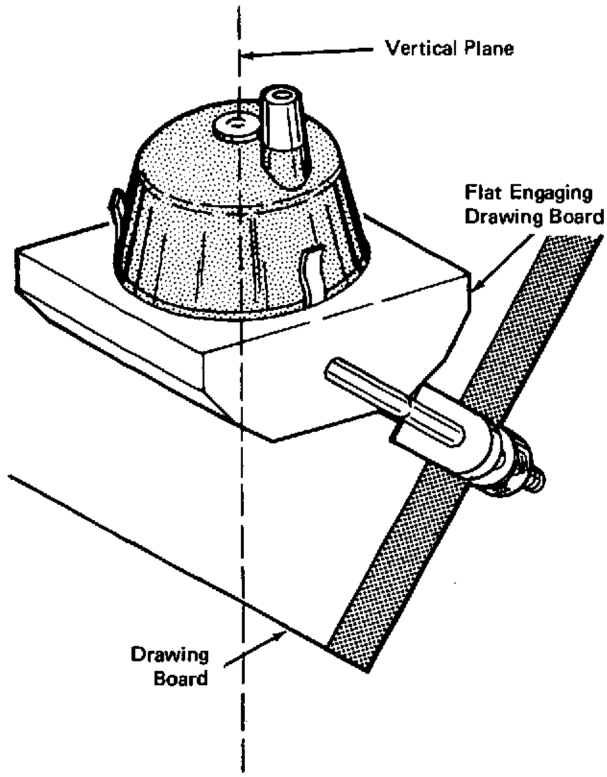


Figure 2. Sharpener in Use

The holding device, shown in an exploded view in Figure 1, has clamping fingers that hold the sharpener in a base that has a number of differently angled flats machined on it. In Figure 2, the sharpener is shown being held in a horizontal plane although the drawing board has been adjusted to an angle considerably off the horizontal.

Source: P. J. Cavanna of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10289)

No further documentation is available.

TELEPRINTER USES THERMAL PRINTING TECHNIQUE

An alphameric/facsimile printer receives serial digital data in the form of a specified number of bits per group, with the time duration of each bit a specified number of milliseconds. Each group of bits is followed by a data pause which will last a specified number of milliseconds. The printer prints a black dot on the thermally sensitive paper for each digital "one" received and prints nothing for each digital "zero" received. The first data bit per group is placed at the left edge of the paper and each succeeding bit is placed a specified distance to the right of the preceding dot position on the paper.

The thermal print head is composed of the same number of printing elements as there are bits per group. These print elements are arranged in a single line oriented across the specified width of the paper. Electrically, these print elements are energized in convenient subgroups. Each element in a subgroup has a common electrical terminal with other elements in the subgroup, and this common terminal is grounded by a solid state switch when it is the proper time for one or more of the elements in the subgroup to be heated in accordance with the incoming signal. The other terminal of each thermal element is connected via the gate terminal, a silicon-controlled rectifier (SCR), to a solid state shift-register stage which momentarily memorizes the incoming serial digital data. The shift register can memorize data for several subgroups of thermal elements; so at the time it is interrogated, it contains data for several subgroups of thermal elements.

A dc voltage is applied continuously to the anode of the SCR. If the cathode of the SCR is grounded and if there is a "one" in the shift register state to which the gate of the SCR is connected, the SCR will conduct. A print pulse is routed through an "AND" gate along with the grounder signal to the base of the grounder transistor. The print pulse turns on the grounder for an appropriate number of milliseconds. Since one side of a thermal printing element is connected to the cathode of the SCR, current will pass through the thermal element to the common electrical terminal for the group if the common is grounded by the grounder transistor at that time.

If there is a "zero" in the shift register stage to which the gate of the SCR is connected, the SCR will not conduct when the print pulse turns on the grounder transistor, and consequently, no current will flow in the thermal element connected to the SCR cathode.

The roll or fan-fold paper, coated with a thermally sensitive dye, is stored in or near the teleprinter assembly. The paper is routed between a pressure roller and the thermal head assembly. The paper is then pulled around the pressure roller as they both turn in discrete angular steps. The paper then passes through guides behind a preview window to a slot in the front panel where it exits for viewing by the observer.

Source: R. D. Perkins, W. E. Perkins,
D. G. Thomas, and J. W. Taylor of
The National Cash Register Co.
under contract to
Johnson Space Center
(MSC-11327)

No further documentation is available.

SCRIBED LINE ADDITIONS EXTEND DRAFTING TRIANGLE USE

It is often necessary for a draftsman to construct a line perpendicular to the tangent of a curved line. This can be done by the conventional construction shown in the Figure 1b, where a radius is swung on either side of the specified tangent point to the curved line. At the intersection of the radius marks and the curved line, larger radii are swung. A line connecting the two large radius intersections will then be the perpendicular required if the first constructed radii were consistent with the curvature of the given line, i.e., the curvature of the given line encompassed by the radii is equal on either side of the designated tangent point. By using this construction, the lines and points of construction tend to clutter the drawing. They take time and must be erased after being used.

A standard 45° - 45° - 90° draftsman's triangle can be modified as shown in Figure 2 to greatly simplify the addition of a perpendicular line tangent to a given curved line at a designated point. A perpendicular to the hypotenuse is first scribed at the midpoint of the triangle. Next a line parallel to the hypotenuse is scribed near the center opening. A series of sets of semicircles are scribed from the parallel line to the intersection of the perpendicular and parallel lines. For convenience, the semicircular lines should be numbered by pairs.

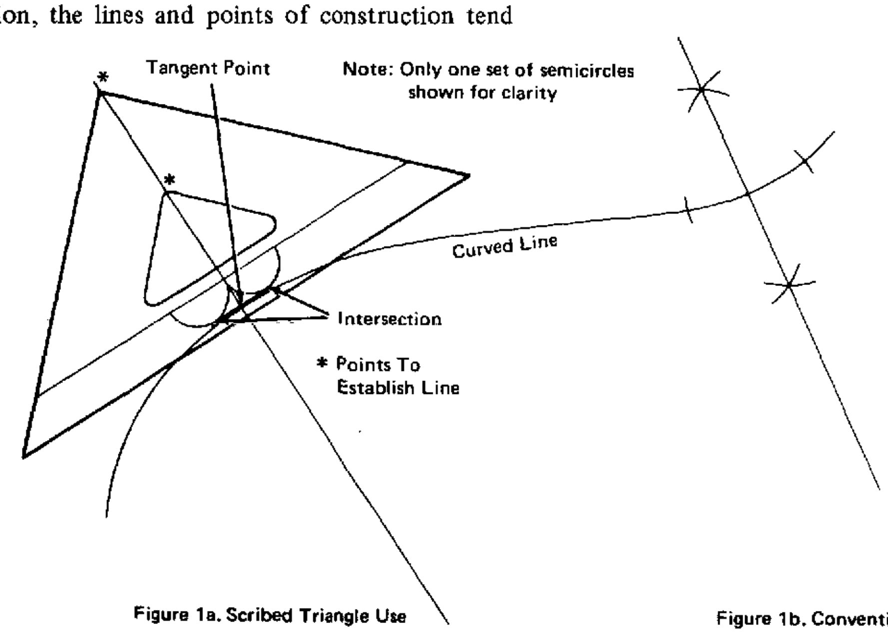


Figure 1a. Scribed Triangle Use

Figure 1b. Conventional Construction

Figure 1. Comparison of Scribed Triangle Use and Conventional Construction

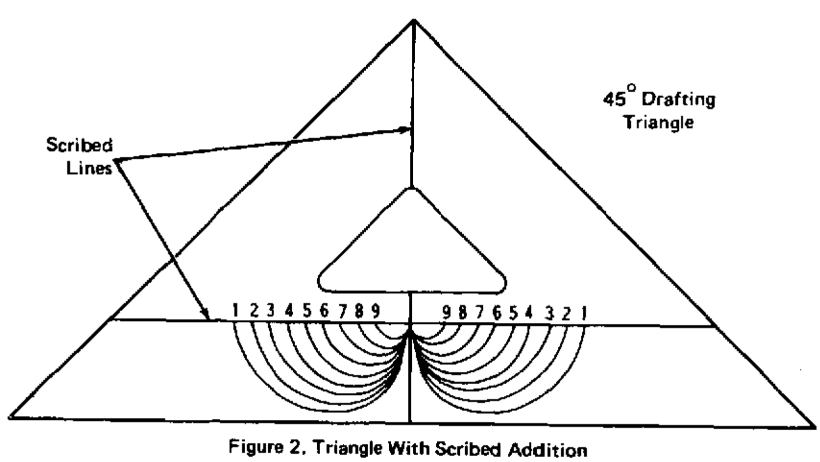


Figure 2. Triangle With Scribed Addition

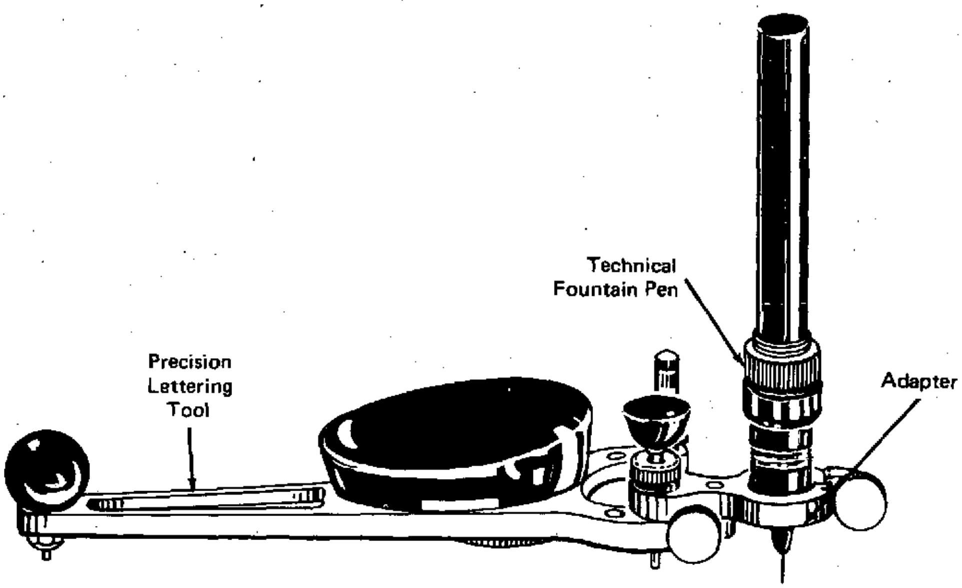
To use this triangle it is only necessary to place the triangle such that a set of semicircles coincide with the given curved line and that the perpendicular intersects the given tangent point (see Figure 1a). The selection of which set of semicircles to use will depend on the shape of the curved line. To increase accuracy, the largest possible set should be used. The size constraint is only in the curvature of the given line as explained previously for conventional construction. When the proper set of semicircles are in position, the exposed perpendicular edges are pointed, i.e., the drawing paper is marked with a pointed tool. A line connecting the points will be the required line.

Calculations could be made so that two different semicircles could be used to accurately draw lines at angles to curved lines. While a 45° triangle is described herein, any other triangle or sheet of clear plastic with one straight edge could be used to construct this tool. The use in either case would be identical to that described.

Source: J. Q. Adams of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10695)

No further documentation is available.

ADAPTER FOR PRECISION LETTERING SETS



Assembled Pen and Adapter Tool

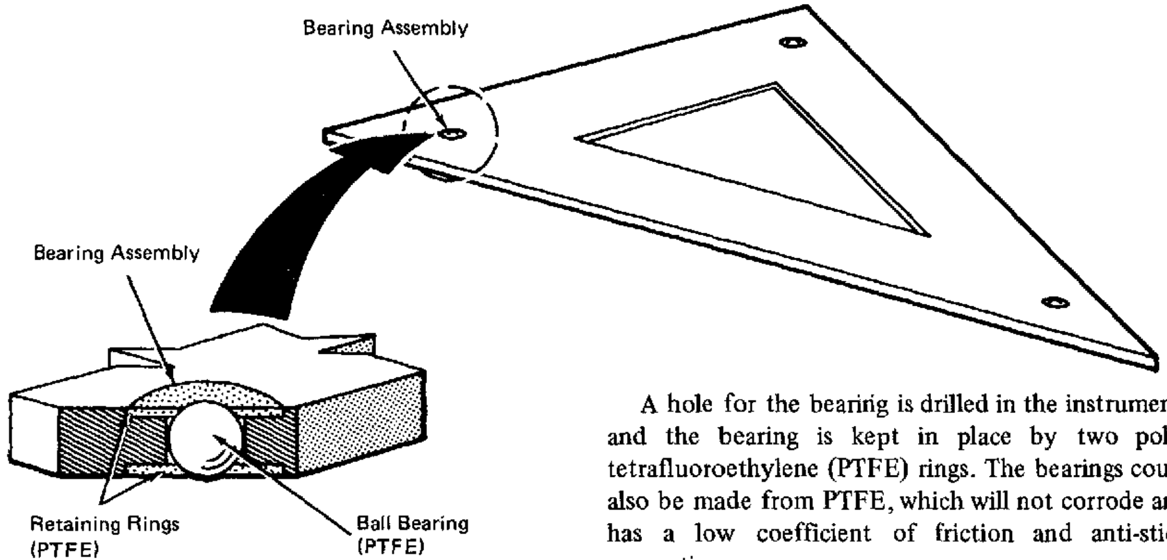
Everyone who has labored with a precision lettering ("bucket") pen, on a large job, is familiar with the requirements of frequently refilling the "bucket" and cleaning the lettering pen. An adapter has been developed that permits a technical fountain pen to be used with the precision lettering scriber, in place of the "bucket" pen. The technical fountain pen offers the advantages of greater ink capacity plus freedom from the danger of accidental spillage.

The adapter for the precision lettering scriber is shown in the figure. It is installed and held in place in the frame of the scriber in the same manner as the original bucket pen.

Source: H. Bowes of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10165)

Circle 1 on Reader Service Card.

CONCEPT FOR MODIFYING DRAFTING INSTRUMENTS TO MINIMIZE SMEARING



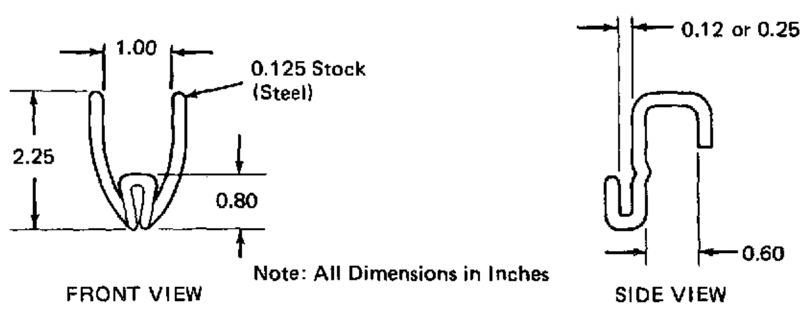
Drafting instruments, such as triangles, T-squares, or French curves, can smear ink or pencil lines when moved across a drawing. A proposed solution to this problem suggests using ball-bearing standoffs to keep the instrument out of contact with the paper. The concept is shown in the illustration with a typical draftsman's triangle.

A hole for the bearing is drilled in the instrument, and the bearing is kept in place by two polytetrafluoroethylene (PTFE) rings. The bearings could also be made from PTFE, which will not corrode and has a low coefficient of friction and anti-stick properties.

Source: T. A. Rennie of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10056)

No further documentation is available.

SLIDING ADAPTER FOR ELECTRIC ERASER



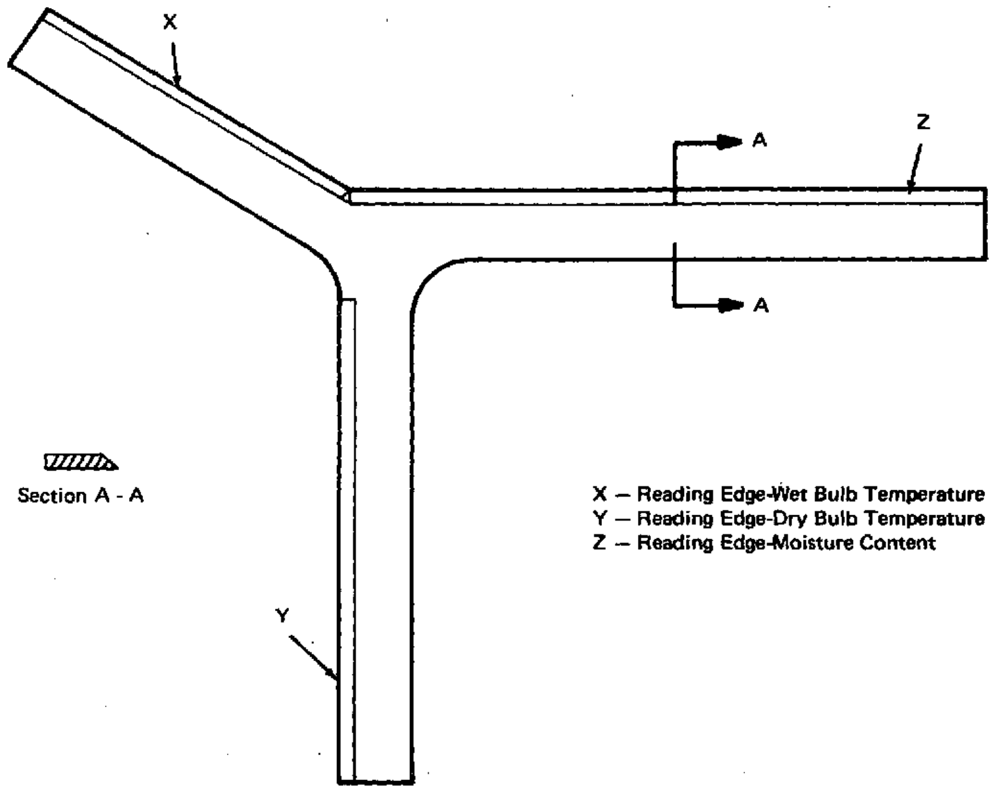
When draftsmen need to make corrections on drawings, they must usually take a few steps to reach the electric eraser and return to the area involved. An electric eraser-holding adapter has been constructed (see figure) to permit the draftsman to hang the adapter and eraser from the edge of the pencil tray and slide it back and forth along this edge to any area requiring erasures.

Source: S. E. Hatcher of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10273)

No further documentation is available.

Section 2. New Graphics Tools

TOOL FOR READING PSYCHROMETRIC CHARTS



Psychrometric Chart Reading Tool

An improved, more direct method of obtaining data from psychrometric charts has been developed.

A three-legged, clear plastic tool, as shown in the drawing, has the angles of each leg correspond with the angles of psychrometric chart [a graphic representation of the properties of a mixture of air and water vapor] construction for each of the three required scales. The reading edges, uppermost surfaces on two of the legs, and the left surface on the vertical leg, are tampered to the chart contact surface.

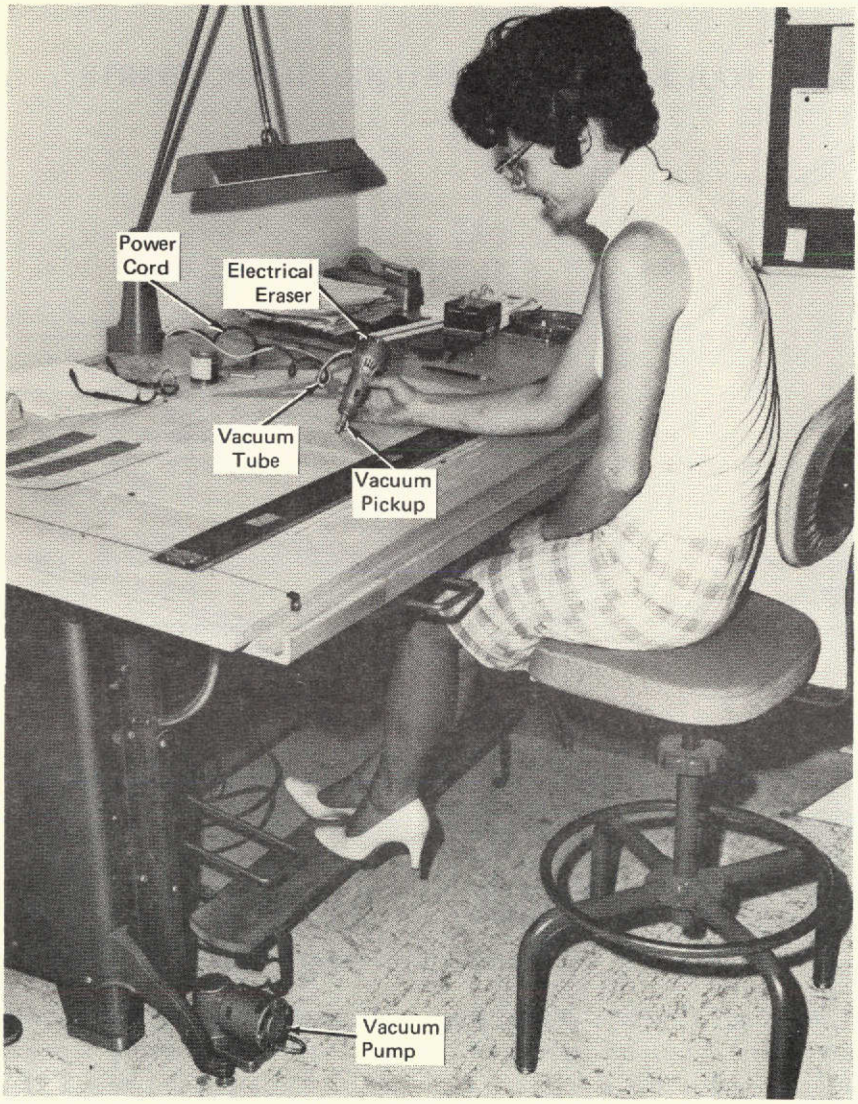
The upward extending leg of the tool is aligned with the wet bulb temperature scale and the left side of the downward leg with the dry bulb temperature scale of the psychrometric chart. At the intersection of these two chart locations, the horizontal line is followed to the right scale of the chart and grains of moisture per pound of dry air directly read.

Design and use of this tool will be of interest to air conditioning, heating, aerospace, chemical, and meteorological industries. A similar tool can be used with any three-variable chart, and in general, a suitable instrument can be constructed to assist in reading almost any complicated chart.

Source: Frank T. De Angelo of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10358)

No further documentation is available.

ERASURE DEBRIS REMOVAL



In using electric erasers on mechanical drawings, draftsmen are constantly required to stop erasing and reach for a brush to remove the debris from the drawing surface. This is not only time consuming, but can also result in an accumulation of erasure debris at the lower edge of the drawing board, which could interfere with the movement of a parallel straightedge on the board.

This innovation uses a "vacuum cleaner" to resolve the problem. As shown in the figure, a vacuum pump is connected to a small hose that ends as a pickup tube immediately beneath the rubber head of the electric eraser. As erasures are made, the pickup tube removes the debris.

Source: L. M. Weber of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10495)

Circle 2 on Reader Service Card.

DRAFTING TEMPLATE

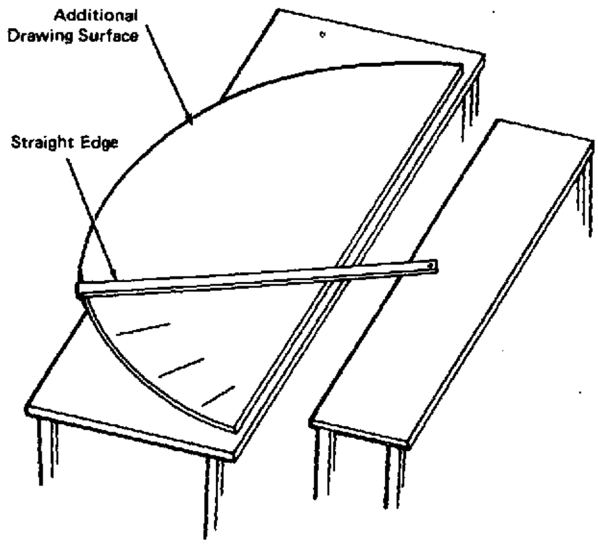


Figure 1. Old Method

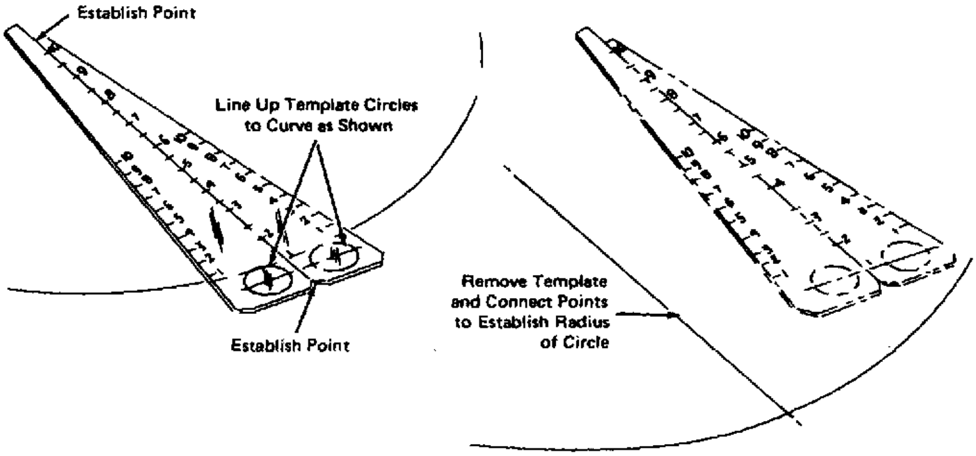


Figure 2. Template Used to Establish Radius

When the center of a large circle or curve is located somewhere beyond the edge of his drawing board, the draftsman experiences considerable difficulty in establishing a line normal to the curve. To establish such a line, a temporary center must be located. This (see Figure 1) is done by using another table or other stationary surface where the center is estimated to be. Following this, a straightedge can be used to establish a line normal to the curve.

This drafting template offers the draftsman a shortcut that is both quick and accurate. To establish a line normal to the curve, the template (Figure 2) is merely laid on the curved line and scribed circles are aligned tangent to the curved line. A straight line is then drawn between the centers of the two circles and the point of intersection with the curve is a true normal.

Source: E. A. Churchill of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-15890)

No further documentation is available.

ELEMENT-LINE LOCATOR

In this innovation, a simple guide has been fabricated that, in conjunction with a protractor, locates the element lines on a curved or conical surface in both orthographic and perspective drawings and converts degrees of arc to linear measurements.

To establish the element lines on a curved or conical surface, a vertical line is drawn through the center of the curve or cone projecting toward the apex of the curve or cone. Since the radius of curve or cone is known, the next step is to construct a line perpendicular to the vertical line at a point where the radius is 57.30 in. The protractor is then affixed to the drawing at this intersection of lines. (The reason for a radius of 57.30 in. is that at this point one degree equals one inch.) The legs of the guide are then spread apart and the inside

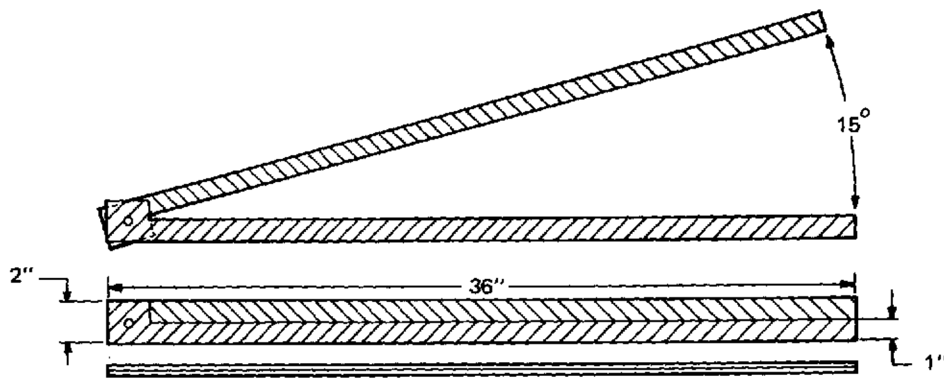


Figure 1. Element-Line Locator

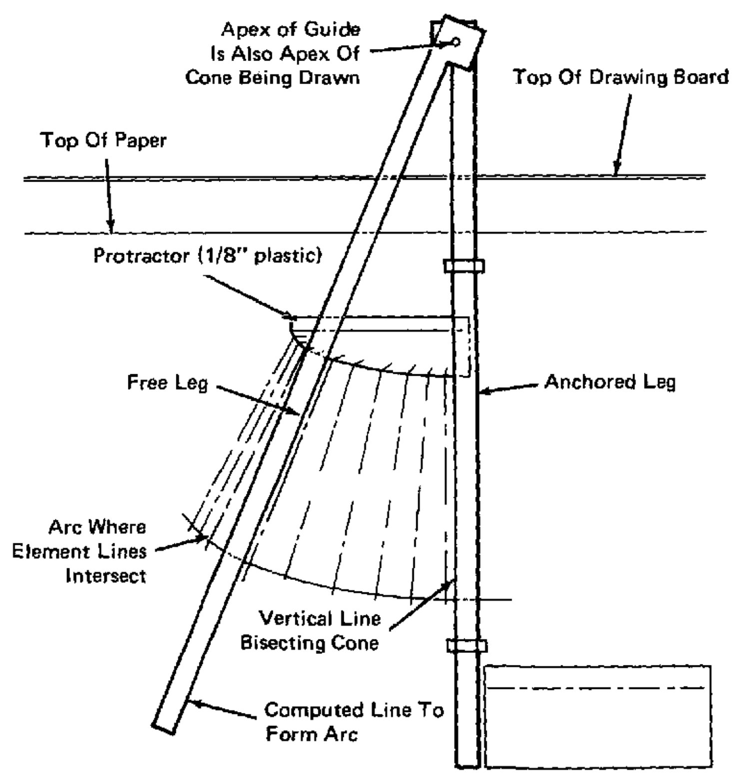


Figure 2. Element Lines as Formed with Free Leg of Locator

edge of one of the guide legs is laid along the vertical line with the apex of the guide pointing in the direction of the apex of the cone or curve. The guide is then slid along the vertical line of the drawing, and the leg opposite the one on the vertical line is either spread or contracted until it forms an angle with the outside edge of the cone or the outside point of the curve. At this time, the apex of the guide and the apex of the curve or cone will be established at the same point. The leg of the guide, which is lying along the vertical line of the drawing is now affixed to the drawing for stability, and the free leg is swung along the protractor to the desired degree. When the free leg is positioned at the desired point of measurement, a line is drawn along the inside edge of the leg, thus constructing the element of the curve or cone.

Figure 1 shows the element-line locator, and Figure 2 shows it being used in conjunction with a 15 degree protractor. The locator can be used with any-degree-of-angle protractors as well as with the orthographic protractors used in engineering drawings.

Source: D. B. Bisset and
H. S. Bowden of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-11590)

No further documentation is available.

DEVICE FOR PRINTING ALPHANUMERIC LISTINGS AND DIGITAL DATA PLOTS

A commercially available high-speed printer has been modified to perform x-y plotting of digital data. The resulting device performs the dual function of printing and plotting at relatively low cost.

In the plotting mode, the device is capable of producing a typical [7-in. (18 cm) square] plot in less than 25 seconds. Any number of points can be plotted in this time, with a resolution of 1 part in 500 (0.2%). Several variables can be plotted simultaneously using a different symbol for each variable. The plotter generates any one of a number of different grid patterns, complete with titles, axis labels, and numerical scales. When not plotting, the device can be used as a 300 character-per-second printer.

The unmodified printer is designed to write on electrosensitive paper using a moving conductive stylus. Characters are made up from elements of a 5 x 7 dot matrix that is printed by applying current pulses to the scanning stylus. A special translator is required for use with the printer, to translate input information into the pulse sequence required by the printer.

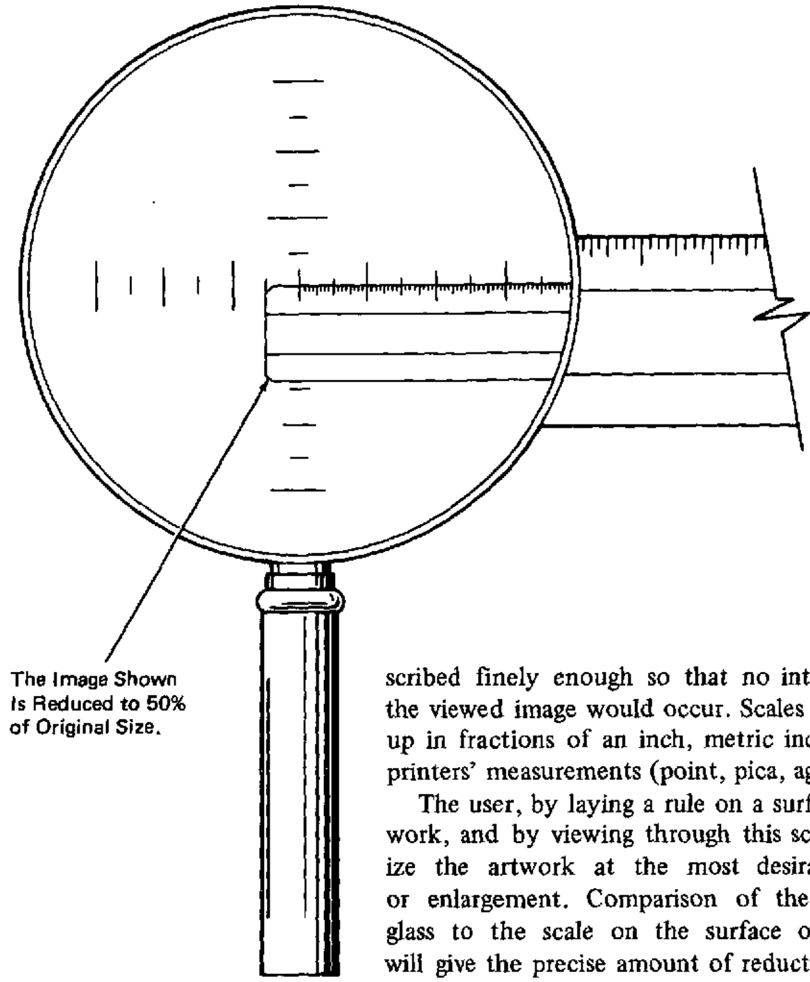
Modification of the printer to a plotting device requires three developments. The paper advance mechanism of the printer is modified to allow printing to be done in the blank areas forming the vertical spacing between alphanumeric lines. The synchronizing system used with the moving stylus is modified, with a resulting improvement in the resolution of the printing device. A small digital computer is used to replace the original character translator, allowing the generation of additional printing elements required for plotting. In many cases, the device will find applications in existing computer-oriented systems without additional computer hardware.

The following documentation is available from:
National Technical Information Service
Springfield, Virginia 22151
Single document price $6.00
(or microfiche $1.45)

Reference: NASA-TN-D-5474 (N69-38654), A Device for Producing Both Hard Copy Alphanumeric Listings and Digital Data Plots

Source: J. Oglesbee
Lewis Research Center
(LEW-10954)

SCALING GLASS



In handling original artwork, the illustrator is frequently confronted with the problem of scaling items for their most effective illustration.

The figure shows an innovation that quickly helps the draftsman in this situation. The scaling glass affords the user a series of parallel lines spaced at discrete intervals (several could be designed for various ranges), beginning at the center and progressing outward along each axis. Each line would be scribed finely enough so that no interference with the viewed image would occur. Scales could be made up in fractions of an inch, metric increments, or in printers' measurements (point, pica, agate, etc.).

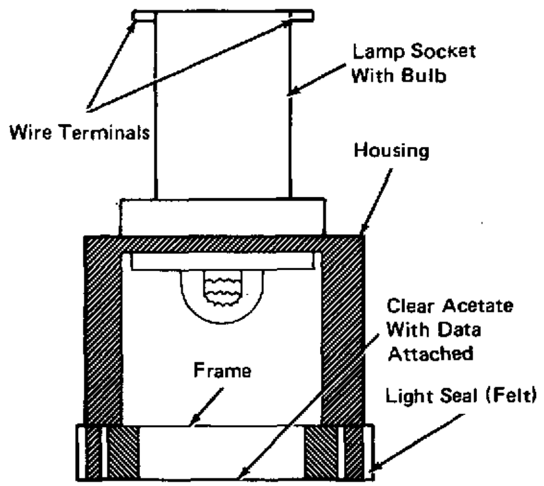
The user, by laying a rule on a surface of the artwork, and by viewing through this scale, can visualize the artwork at the most desirable reduction or enlargement. Comparison of the scale on the glass to the scale on the surface of the artwork will give the precise amount of reduction or enlargement required. This permits the draftsman to check final size and improve areas that would not otherwise reproduce well.

Source: R. T. Wilson of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10334)

No further documentation is available.

DATA FLASHER FOR ELECTRIC IMAGE SYSTEM PHOTO ENLARGER

Weather maps, such as those made from the Tiros satellite, must include interpretive data if they are to be used by nonspecialists. In the past, satellite photographs were prepared from enlarged negatives derived from telemetered data; then, explanatory data were typed on each copy of the enlarged photograph.



Data Flasher

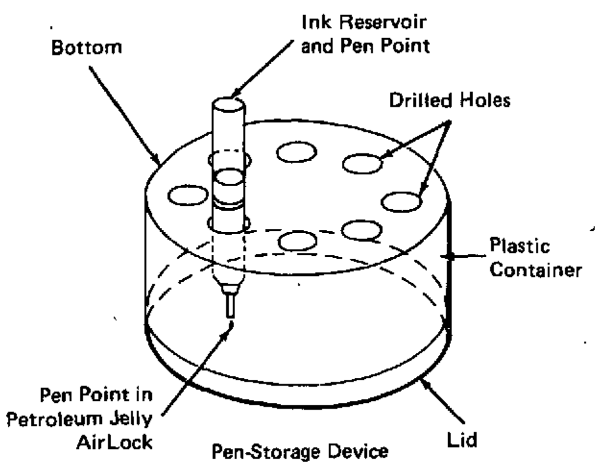
A new "Data Flasher" (see figure) adds the interpretive data to the photograph at the same time it is enlarged. The data are prepared on a clear acetate film strip attached to the bottom of the removable frame. The exposure time of the flasher is determined by the type of film used and the density of the light. The exposure time can be regulated manually or by an automatic timer; the density of the light can be regulated by a rheostat. The power source may be ac or dc with the appropriate regulating circuitry. The Data Flasher is a flexible device and allows a variety of data to be added from frame-to-frame or within a single frame.

Source: R. B. Shifflett
Goddard Space Flight Center
(GSC-11202)

No further documentation is available.

METHOD FOR STORING INK LETTERING PENS

Pens used for ink lettering graphics production items such as sketches and charts, have a tendency to clog through drying out when not used for a long time. This can result in appreciable time spent in cleaning the pens and frequently results in their being discarded.



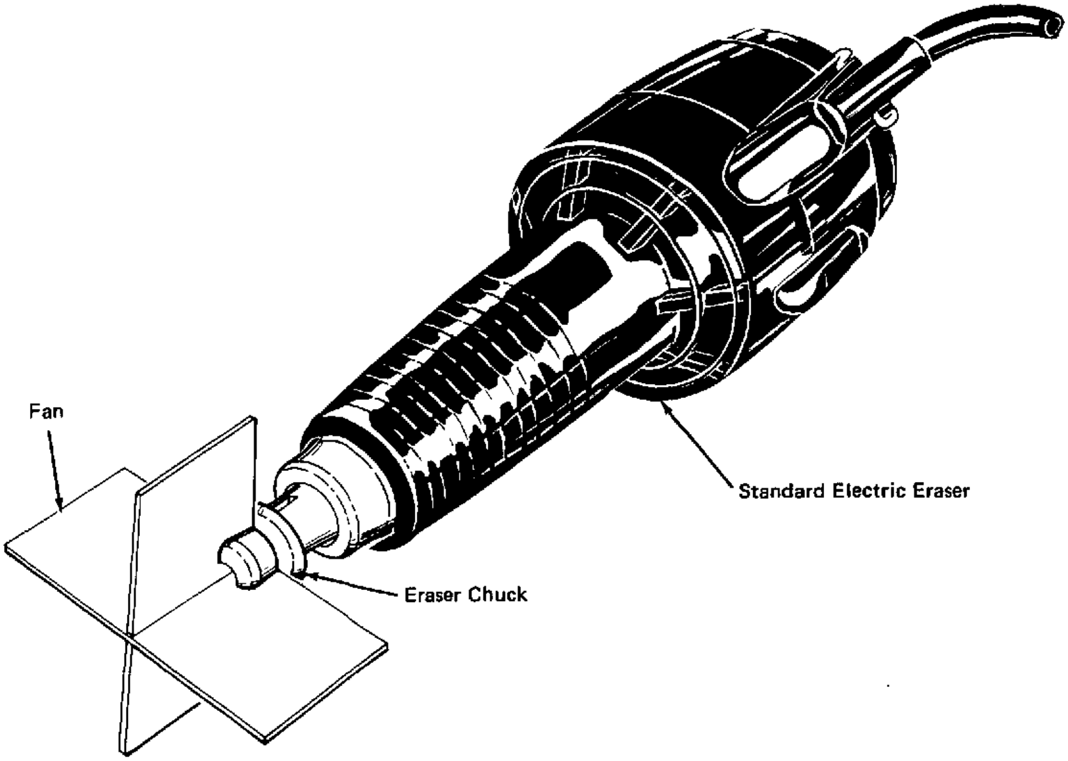
Pen-Storage Device

This innovation avoids such problems by maintaining the pen points in a moist, air-free state through their immersion (when not in use) in a shallow bath of petroleum jelly. As shown in the figure, an ordinary plastic container has a number of holes in its bottom, and a quantity of petroleum jelly is placed in its lid. The entire assembly is inverted. When ink lettering pens are placed in the holes, their points penetrate the petroleum jelly bath, and no air is in contact with them. A filled pen can be withdrawn, and its point wiped clean and put to use in a matter of seconds. The storage device can be used with many types of commercially available lettering pens.

Source: W. R. Albrechtsen of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17798)

No further documentation is available.

DRAFTING INK DRYER



Eraser Converted to Drafting Ink Dryer

Every draftsman knows the frustration of waiting for newly applied ink to dry, so that he can proceed with his triangle or straightedge, to complete a drawing which is part of documentation that is on a "now" deadline basis.

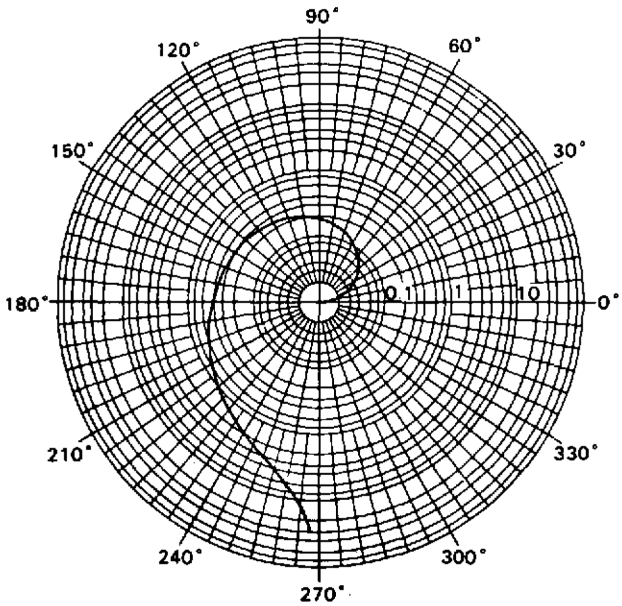
This innovation solves the problem. A small, portable fan (see figure) has been developed from a draftsman's electric eraser to form a paddlewheel-type fan that is held above the freshly-applied ink to evaporate the moisture from it. The fan blades, of card stock, paper board or plastic, are installed in the slots of the chuck that normally holds the eraser. The device is then actuated and held immediately above the area to be dried. Drying is accomplished in a matter of seconds, permitting the draftsman to use his tools above the newly linked area much sooner than would otherwise have been possible.

Source: W. R. Deshaw of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10185)

No further documentation is available.

Section 3. Visual Aids for Graphics

COMPUTERIZED POLAR PLOTS BY A CATHODE RAY TUBE/GRID OVERLAY METHOD



Completed Plot

This is a technique for producing fast, accurate Nyquist (frequency-response-phase/amplitude) plots. A cathode ray tube (CRT) plotter is used with a transparent grid overlay. The overlay is aligned with four calibration dots and, therefore, is not affected by CRT drift or changes in vertical or horizontal gain.

The plot tapes are programmed to plot the data trace, the four calibration dots, and the labeling. The plots are traced on special paper producing a permanent, hard copy. A grid overlay is chosen that aligns with the calibration dots on the hard copy plot (see figure) and the two are taped together.

Rapid and accurate hard copy printouts and duplicates of polar grid plots or tracings can be obtained using this method. Advantages are: (1) The plot is not affected by cathode ray tube; (2) changes in vertical and horizontal gain do not affect the reading; (3) data are traced four times (producing heavier line weight); and (4) previous methods produced about 6 plots per hour; this method produces over 50 per hour.

The grid overlays are made by drawing the grid pattern, 16 inches in diameter, on a polyester resin and then reducing to a standard 6 inch size (from 40.5 to 15 cm).

This innovation may be of interest to those engaged in industrial research, educational research, and industrial temperature/pressure monitoring. The technique can be used wherever polar plots established from a computer are utilized.

Source: E. L. Shoup and J. M. Freeman of
The Boeing Co.
under contract to
Marshall Space Flight Center
(MFS-14464)

Circle 3 on Reader Service Card.

AMPLITUDE AND FREQUENCY READOUT OVERLAY

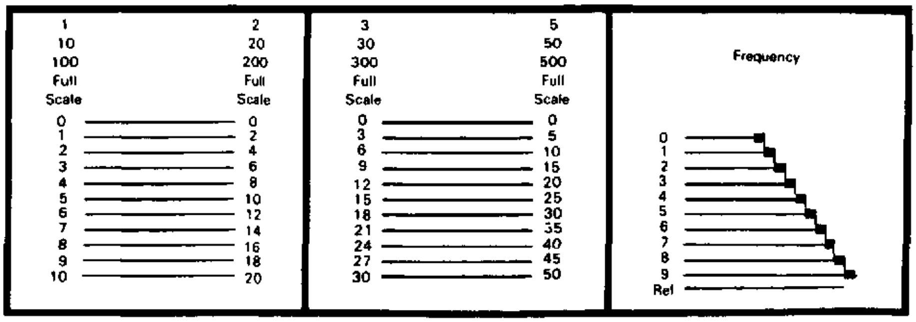


Figure 1. AMPLITUDE AND FREQUENCY READOUT OVERLAY
(Calibration: 1" = Full Scale)

A new and simple method measures amplitudes and frequencies on oscillograph records as might be used with vibration testing and analysis. Oscillograph traces are generally calibrated for a full scale deflection of one inch and the reference frequency is recorded using a digital marker. Present methods for measuring amplitudes use an engineering scale to measure trace deflections, and the digital frequency code calibration at the beginning of the record to measure the frequencies of interest.

An amplitude and frequency readout overlay (Figure 1) simplifies the interpretation of oscillograph traces for full-scale deflections of one inch.

Amplitude. (Figure 2) The scale on the overlay is selected to correspond with the one inch full-scale calibration on the oscillograph record. The "0" line of the selected scale is placed along one edge of the data envelope; the level in peak "g's" is read directly off the scale where the opposite side of the envelope terminates.

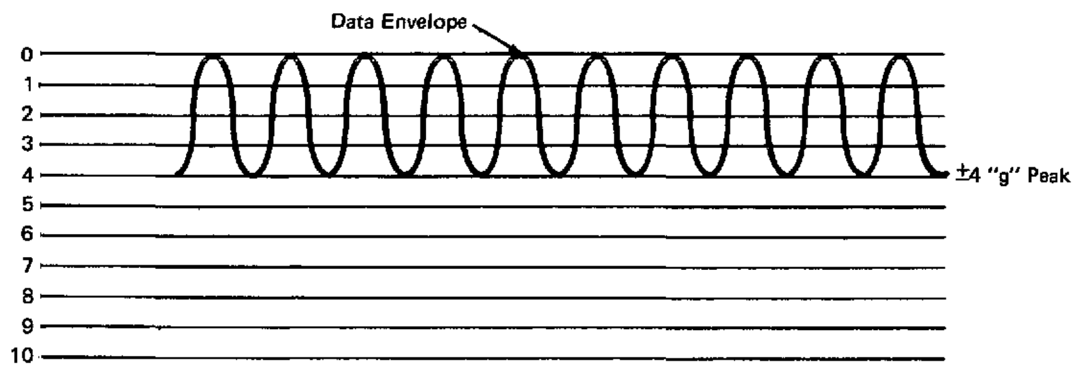


Figure 2. AMPLITUDE READOUT
(Calibration: 1" = 10 "g" Peak Full Scale)

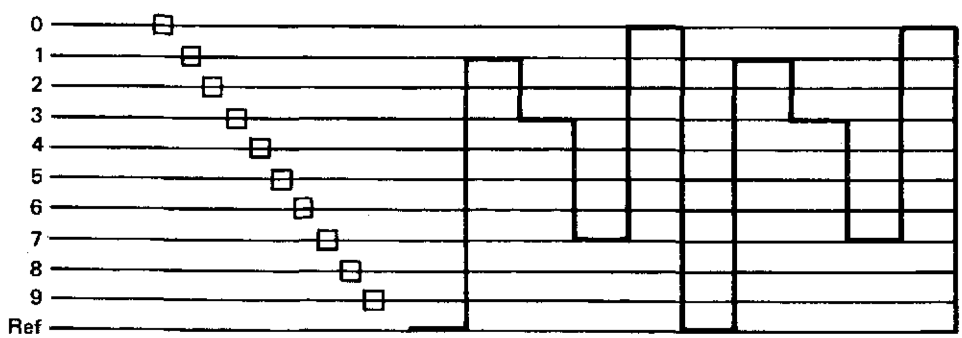


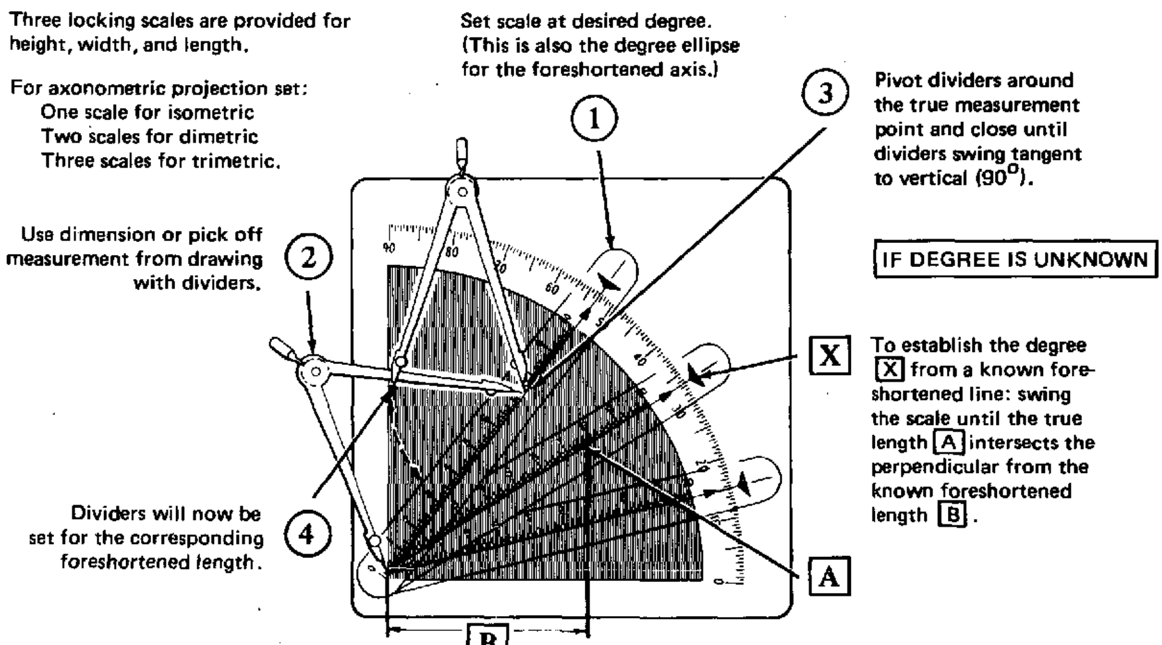
Figure 3. FREQUENCY READOUT
(Frequency: 1370 Hz)

Frequency. (Figure 3) The digital coded frequency trace, which provides steps from 0 to 9 in a four decimal readout, must be calibrated to deflect 0.1 inch per step on the oscillograph record. The overlay is then placed over the coded trace, and the frequency is read directly. This overlay will increase accuracy in data interpretation and save time in analyzing oscillograph records.

Source: A. E. Fitch
Goddard Space Flight Center
(GSC-10183)

Circle 4 on Reader Service Card.

DEGREE AND LINE LENGTH PROPORTION COMPUTER FOR AXONOMETRIC DRAFTING



Note: The hypotenuse of a right triangle is the true length and the base leg is the foreshortened length. The angle between the true length and the foreshortened length is the degree of ellipse for the foreshortened axis.

This drafting aid, when used in conjunction with a standard drafting divider, provides direct scaled measurements, thus eliminating the need for numerical calculation. A set of ruler-type scales (see figure) are mounted so that they pivot around the origin of a one-quadrant protractor. The selected scale is rotated to a known reference angle, forming a right triangle. True length dimensions are found on the hypotenuse and the foreshortened lengths are obtained by directly measuring the corresponding adjacent side.

This direct use of the fine grid of parallel lines to relate the foreshortened and true measurements is simple to execute and eliminates any possibility of calculation errors. A set of these devices in graduated sizes makes a versatile tool for the draftsman or technical illustrator.

Source: E. D. Braman of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17986)

No further documentation is available.

VISUAL DISPLAY PANEL FUNCTIONS AS COMPUTER INPUT/OUTPUT DEVICE

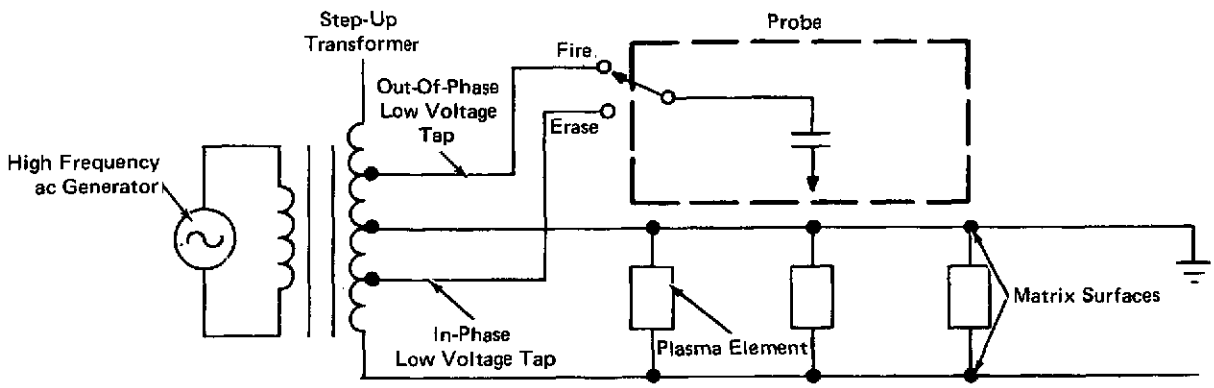


Figure 1. Probe Drive

A graphic visual display panel has been developed from computer data entry and readout. The device permits information entry and erasure using a probe, and has an inherent storage capability for use with time-shared systems. Data input need not be online. An operator can recognize and correct entry errors before introducing data into the computer. Other advantages include direct display of computer input and output, simplicity, and low fabrication cost.

Basically, the device consists of many gas filled cavities inside a glass plate with transparent covers. Ionizing the gas permits display of data read in or out of the computer. By maintaining the matrix of plasma elements at a sustaining voltage, data can be entered by supplying sufficient additional voltage to ionize selected matrix elements. An external probe fires any selected element. Once fired, the element remains ionized after removing the probe. Phase reversal of the probe current supply enables the voltage to be reduced at a selected element to a point below the sustaining voltage, thus causing selective erasure. The inherent memory features of the plasma elements permit storage of the information until required by a computer.

Figure 1 shows a method for implementing the probe drive. A high frequency ac generator and step-up transformer provide cell sustaining voltages and in-phase and out-of-phase probe drive voltages. The switch selects in-phase or out-of-phase voltage providing erase or write capabilities respectively.

Figure 2, a nonconducting substrate, contains cavities formed by etching, drilling or other suitable techniques. These cavities are filled with an inert gas such as neon (typically with traces of nitrogen or

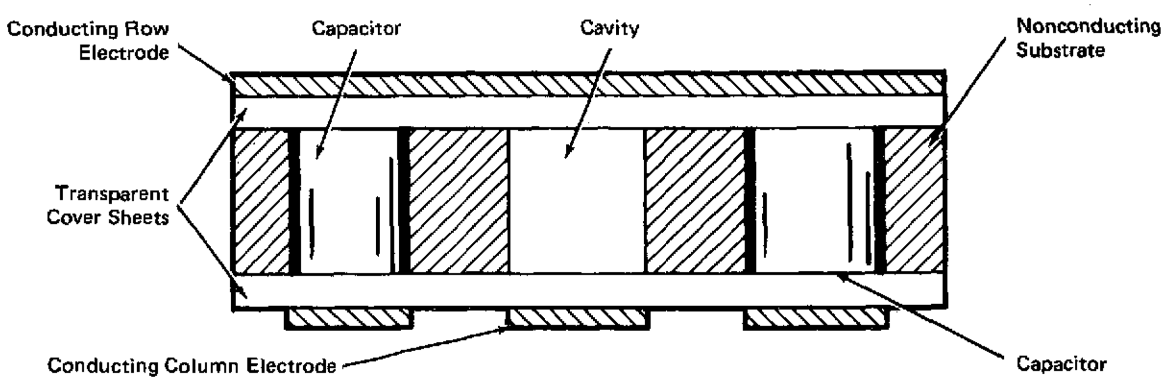


Figure 2. Cross Section of a Series of Plasma Elements

carbon monoxide as additives) at a pressure about 50 to 200 Torr. Transparent, nonconducting cover sheets prevent escape of the gas and maintain the appropriate gas pressure. Conducting row electrodes (only one is shown) and conducting column electrodes are deposited on the exterior surfaces of the cover sheets; either or both the row and column electrodes must consist of transparent conductors to permit observation of the gas ionization in the cavities when voltage is applied.

External electrodes help to increase the useful lifetime of the cell by several orders of magnitude. However, internal electrodes may be driven with direct current or low frequency alternating current. Since external electrodes are capacitively coupled to the cavity, they require high frequency alternating current on the order of several hundred kilohertz for operation. This capability for capacitive coupling makes it possible to utilize an external probe for selective firing of the elements.

Although plasma elements with external electrodes have been used, elements with internal electrodes would also be possible, providing appropriate changes were made in circuit constants. Also, while the probe used passive RC networks, a probe containing a unity gain amplifier could be used and would eliminate the requirement for a dropping resistor on the "write" position of the probe. Where only single analog quantities require entry, a linear array of elements could be used rather than the crossed matrix array.

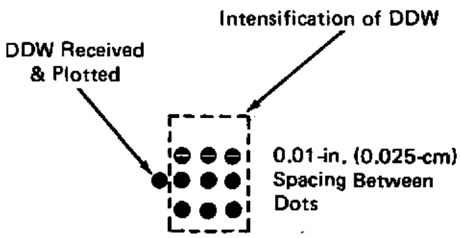
Source: E. H. Hilborn
Electronics Research Center
(ERC-10223)

Circle 5 on Reader Service Card.

HIGH SPEED DIGITAL PLOTTER TRACE INTENSIFICATION

This technique is an enhancement method for multistylus graphic plotting systems. The plotter styluses can print a three-dot-by-three-dot matrix upon receipt of a digitally encoded signal representing a single dot. The digital plotter prints grid and timing lines and character annotation. Previously, when the small dots fell on a line they were indistinguishable from the line.

The basic plotter is controlled by 3 racks of NOR logic, including 3 memories. 1024 styluses plot by dots; one dot for each 10 bit data word received. A logic change now permits 9 dots (a matrix of 3 x 3 dots) to be plotted for each 10-bit data word received (see figure).



Matrix of Dots

When the digital data word (DDW) is received by the plotter, it causes one of 1024 styluses to mark the paper with a dot. The trace intensification circuitry stores the DDW in memory. One hundredth of an inch of paper travel later, the DDW marks the same stylus, and by addition and subtraction marks the stylus on each side of the original. This process is repeated twice more, forming a three-by-three matrix of dots (each dot is enhanced, since it derives from three styluses). Since the styluses are only one hundredth of an inch apart, the effect of each group of three styluses is one dark dot, enhanced from the previous technique by a factor of three.

Source: F. L. Rosenthal of
Rockwell International Corp.
under contract to
Marshall Space Flight Center
(MFS-16773)

Circle 6 on Reader Service Card.

CONCEPT FOR HIGH SPEED COMPUTER PRINTER

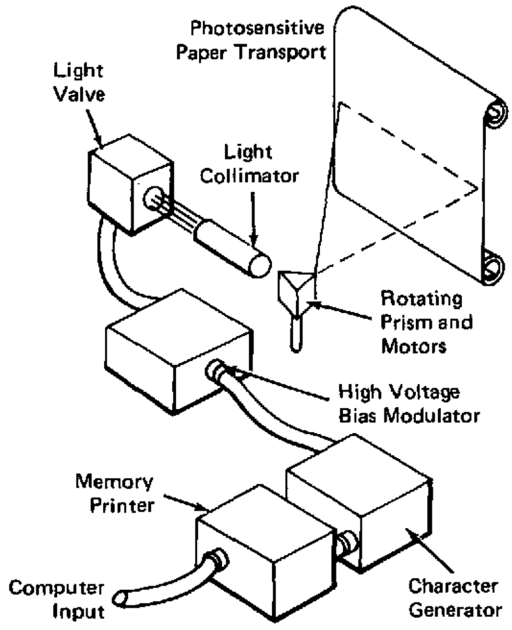
Most printers currently use mechanically actuated type. Magnetic ink is often used, and is sprayed toward the paper, shaping the different characters magnetically. These printers are very fast, rated at 132 characters per line, and 1200 lines per minute.

This new conceptual design for a high speed computer printer uses a Kerr cell as a light shutter for controlling the print on photosensitive paper. Applied to output data transfer, the information transfer rate of graphic computer printers could be increased to speeds approaching the data transfer rate of computer central processors (5000 to 10,000 lines per minute). This information should interest designers and manufacturers of peripheral computer equipment, computerized newspaper and manuscript publication industries, and has possible application for rapid reporting of stock market quotations.

The printer operates by projecting a modulated light beam which is scanned across photosensitive paper or film. Several scans are required to form the complete characters in the line of information. The unique feature of this printer is the use of the light valve (Kerr Cell) for character definition as direct output of the computer. However, several other display methods are possible. One method would be to group several of these light valves; by careful selection of which valve is either on or off, a complete character could be formed and printed.

As shown in the figure, the printer is composed of separate components. The heart of the printer is the light valve or electronic shutter, used to modulate the light beam which forms the characters to be printed. The actual time for the shutter or light valve to go from fully closed through fully open back to fully closed is approximately 15×10^{-9} seconds (15 nanoseconds), or it could cycle 66×10^{6} times in one second. Therefore, the limiting factor is not the shutter, but the sensitivity of the paper or film.

The optical system of the printer is a straightforward projection system; if space did not allow, a fiber optics system could be utilized for placement of the light valve at a more convenient remote location. The transport system encompasses the mechanism to store the photosensitive paper or film. move it past the printing point, process the printed paper (either wet or dry), and maintain a synchronous speed with the electronic printing process.



Simplified Mechanical Schematic

The last major components of the computer printer are the required electronic circuits. The memory printer contains the necessary electronics to accept and retain a complete line of information from the computer. This information is retained until the character generator acts upon it, then resets itself for the next line of information. The memory printer also supplies the necessary synchronization pulses to the prism and transport servo system.

The prime electronic circuit is the character generator which supplies the modulation signal to the high voltage bias modulator during the scan, forming that portion of the individual characters which appears in the particular scan line. The output of this character generator controls the high voltage bias, which furnishes the necessary voltage stress across the light valve to actuate the polarization characteristic.

Source: J. W. Stephens of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10373)

Circle 7 on Reader Service Card.

SHORTENED PROCEDURE FOR OBTAINING REPRODUCIBLE COPIES OF 35 mm COLOR SLIDES

A new procedure has been devised for making reproducible copy (vellum) from a 35 mm color slide. Existing techniques require that first, an enlarged film negative be made from the slide; second, a photoprint or film positive be made of the enlarged film negative; third, the film positive be photographed onto a Xerox plate; and fourth, the image be transferred from the Xerox plate onto vellum. This procedure is time consuming and expensive.

A new technique reduces the steps required to obtain reproducible copies of 35 mm color slides. A 35 mm slide is projected directly onto a Xerox plate, eliminating the necessity for producing a photoprint or film positive of the slide. The new procedure reduces both processing time and expense.

The equipment used in the process includes a Xerox Model D Processor, Xerox E plates, and a photoenlarger capable of projecting a 35 mm slide.

With the new procedure, the selected 35 mm color slide is placed in a photographic enlarger, and the desired image is projected onto the enlarger easel. After the image size (normally 8-1/2" x 11") has been locked in and the focus set, the enlarger is turned off and a Type E Xerox plate is positioned on the enlarger easel. (The slide is projected under red safelight.)

When the slide is projected on the plate, a fairly low light level is used to avoid scattering on the Xerox plate. The exposure time of the Xerox plate will vary with the color of the subject matter on the slide. Tests to determine proper exposure time may be required until operator knowledge is developed. Exposure time is comparable to using low to medium-speed projection type photographic paper. Line or continuous tone slides may be used, but the end result will always be line toned due to the nature of the Xerox process.

After the Xerox plate is exposed, it is processed in the normal fashion and the image is transferred to a vellum sheet.

This technique cannot be implemented directly on late-model Xerox copiers such as the 2400, which have light-sensitive, electrostatic drum inputs.

Source: Frank Levine of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-09957)

No further documentation is available.

COMPUTER GENERATION OF TELEVISION IMAGES

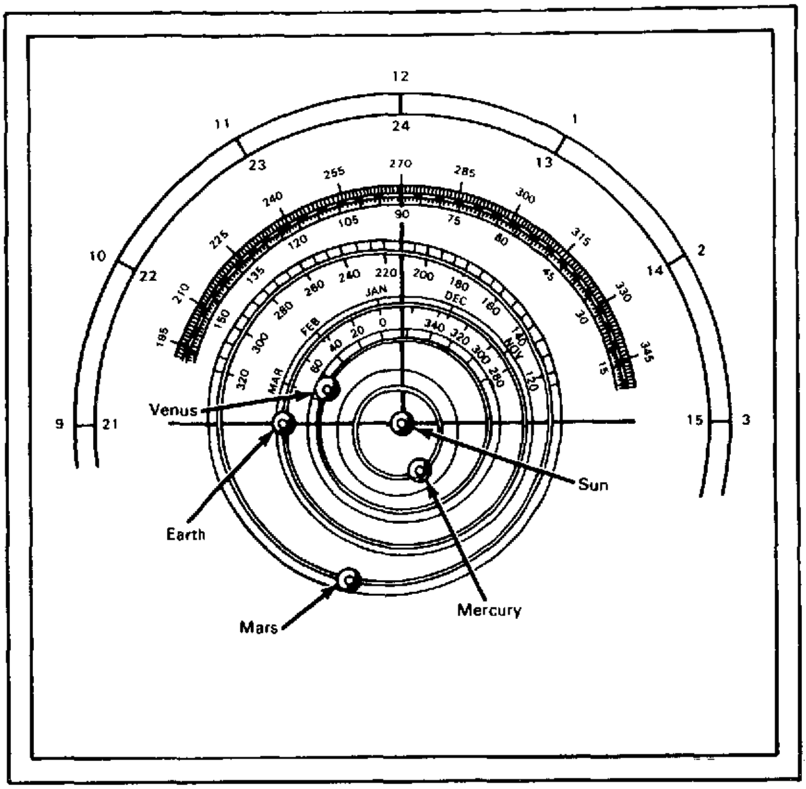
A lunar simulation program demonstrates the feasibility of creating a realistic visual simulation of the lunar surface with a digital computer. The program was run on an IBM 360/65, producing magnetic tapes with instructions for a Stromberg-Carlson 4020 Computer/Recorder. Several series of photographs were made from the 35 mm positive film output of the SC-4020. Although not produced in real time, these pictures nevertheless use many of the same techniques developed for a real-time simulator. Of particular importance is the use of conceptual crater generators, or of pieces of hardware that implement standardized formulas to represent crater shape.

The report outlines a system that combines known techniques of data representation and hybrid (analog/digital) computation with some very powerful and novel methods of electronic image synthesis. Although the techniques were specifically applied to the lunar surveyor simulator, they would also be useful in many other types of real-time display generation.

Source: J. C. McMenamin of
Pennsylvania Research Associates, Inc.
under contract to
Marshall Space Flight Center
(MFS-21538)

Circle 8 on Reader Service Card.

ANALOG SOLAR SYSTEM MODEL RELATES CELESTIAL BODIES SPATIALLY



It was decided to design a portable analog model of the solar system to demonstrate the true and apparent day-to-day motions of the Sun and its orbiting planets. The model was to include the means to plot the paths of man-made satellites and space probes.

A portable planetarium that indicates the relative time and space angular locations of the Sun and planets has been produced. Distance-measuring scales, angular-direction indicators, and typical probe trajectories are included.

In this innovation, a flat box has a small sphere located at its center to represent the Sun. Successively larger annular plates around the Sun sphere represent Mercury, Venus, Earth, and Mars respectively. These plates are properly oriented about the ecliptic pole and are offset centrally to represent the actual aphelion and perihelion of each body's orbit as it relates to the Sun. The inclination and declination in relation to the celestial equator is readily represented by tilting the plates in predetermined positions relative to one another. Grooves in the plates are adapted to receive sliding blocks that hold small spheres to represent the four planets. Each of the annular plates has the days marked on its periphery, starting at the perihelion at 20-day intervals around the orbital plane through the aphelion and on to the perihelion again. The plate representing Earth's orbit has the months as well as the days marked about its periphery. A square plate that conforms to the normal plane of the bottom of the box is centrally mounted around the assembled annular plates in a position to represent the Sun's movement as viewed from Earth. A companion model demonstrates the yearly progress of the outer planets through the year 2000 AD. It differs from the inner planets model in relative distances represented by a factor of 20.

A goniometer and a clinometer with distance scales (in millions of nautical and statute miles) can be used to determine an individual planet's inclination or declination in relation to the Earth or any of the other planets. The scale is used to measure the relative communication distances between any planet and the Sun.

A support on the rear of the box can tilt the model forward 23.5° to simulate the inclination of Earth's equator to its orbit plane. In addition, daily time periods and instrument coordinates for line-of-sight observation or for tracking of probes or planets are indicated directly on a 24-hour clock dial.

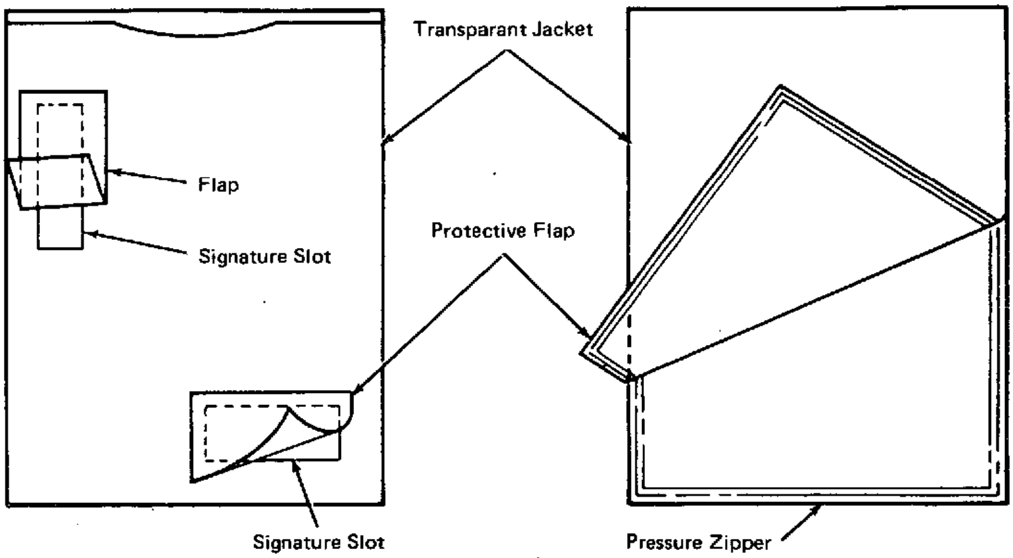
To demonstrate the path of a space probe, calculations are made for a certain firing date, and an overlay is prepared on clear acetate. By placing the overlay on the model, the positions of the probe in time can be quickly observed in relation to the Sun, Earth and other planets from launch through planned orbit.

Source: Herbert R. Baerg of
JPL/Cal Tech
under contract to
NASA Pasadena Office
(JPL-195)

Circle 9 on Reader Service Card.

Section 4. Graphic Arts Shop Hints

REUSABLE TRANSPARENT JACKET FOR DOCUMENT PROTECTION



Transparent Document Jacket

Documents that require frequent handling for purposes of review, approval, and signature need some kind of protective device to ensure their original neat and clean appearance.

This transparent jacket (see figure) offers such protection and provides flap-covered signature slots that can be used for approval signatures, office stamps, notation, etc., while the body of the document is completely protected.

Source: H. E. Niemeyer of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10010)

No further documentation is available.

ROLLED DOCUMENT VIEWING AID

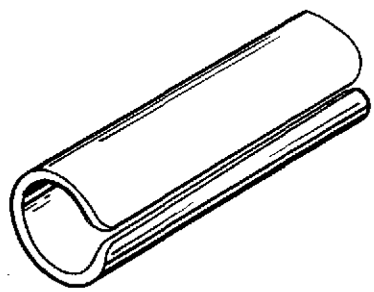


Figure 1. Document Holder

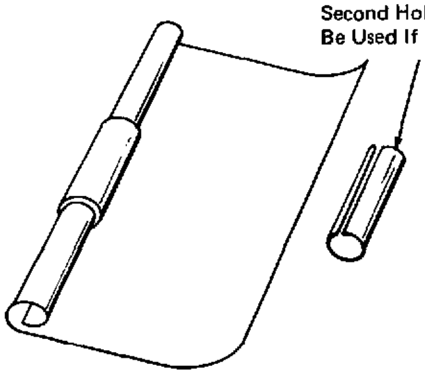


Figure 2. Holder in Use

This device is a real help for the viewing or reference marking of those large, unhandy documents such as graphs, charts, schematics, etc., that are stored in a rolled-up condition. Almost everyone has experienced the frustration of having them reroll when not restrained, or fall off of whatever they are resting on, and damage to them is sometimes difficult to avoid.

This device (see figures) allows complete and easy control in the handling of large rolled-up documents. The document holder is shown in Figure 1. It is a plastic or cardboard tube with a lengthwise slit that has smoothly rounded ends. Figure 2 shows the holder in use. The rolled-up document is placed in the holder, and one end is fed out through the slit to the extent necessary to view the area of interest. If most or all of the document must be viewed gradually, a second holder may be used to accept and store the portion already viewed.

Source: W. R. Deshaw of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10153)

No further documentation is available.

TECHNIQUE FOR REMOVING ENGINEERING DOCUMENTATION FROM MYLAR AND PHOTO ORIGINALS

Conventional documentation eradication techniques leave much to be desired. Use of an electric eraser will remove lines but can damage the surface so that the area cannot be used again. A commercially available eradicator has been used successfully, but is very expensive and takes a good deal of time. Bleach and water, and a mylar eraser with water have been tried, but the former was ineffective and the latter was too time consuming.

A commercially available, ordinary household cleaner formulation was tried in this new application with very successful results. The formulation was placed in a sponge-top applicator such as those used to wet envelope adhesives. The formulation was spread over the part of the drawing that was to be erased, and the documentation was emulsified. The emulsion was removed by wiping the area with a tissue. The cleaner formulation is nonflammable, nontoxic, does not damage the drawing surface, leaves no film, and requires no rinsing.

Source: T. A. Rennie of
The Boeing Co.
under contract to
Kennedy Space Center
(KSC-10277)

Circle 10 on Reader Service Card.

Patent Information

The following innovations, described in this Compilation, have been patented or are being considered for patent action as indicated below:

Teleprinted Uses Thermal Printing Technique (Page 3) MSC-11327

Title to this invention, covered by U.S. Patent No. 3,476,877, has been waived to the National Cash Register Co., Menlo Park, California 94025.

Analog Solar System Model Relates Celestial Bodies Spatially (Page 22) JPL-195

This invention has been patented by NASA (U.S. Patent No. 3,287,832). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
NASA Pasadena Office
Mail Code I
4800 Oak Grove Drive
Pasadena, California 91130