INSTRUCTION MANUAL

Jarrell Ash

DIVISION OF FISHER SCIENTIFIC CO.

SEIDEL CALCULATING BOARD 30-100

JARRELL-ASH DIVISION/FISHER SCIENTIFIC COMPANY/ 590 LINCOLN STREET, WALTHAM, MASS. 02154

JARRELL-ASH DIVISION/FISHER SCIENTIFIC COMPANY, WALTHAM MASS 02154

INSTRUCTION MANUAL

for

MODEL 30-100

SEIDEL CALCULATING BOARD

Jarrell
Ash
DIVISION OF FISHER SCIENTIFIC CO.

Engineering Pub. No. 30-100 - Rev. 1 $4.00 November 1969

JARRELL-ASH DIVISION/FISHER SCIENTIFIC COMPANY, WALTHAM MASS 02154

Warranty

All Jarrell-Ash products are guaranteed against defective parts or workmanship for one year, except for electronic components which carry the guarantee of their manufacturer. In keeping with a policy of continued research and improvement, the Jarrell-Ash Division reserves the right to alter specifications and to supply equipment differing from that described. Defective items will be replaced free of charge, transportation charges to be borne by the customer.

DAMAGE IN SHIPMENT

IT IS THE RESPONSIBILITY OF THE BUYER TO INITIATE ANY CLAIMS FOR SHIPPING DAMAGE.

On all shipments the customer is responsible for reporting any damage in shipment to the carrier and for arranging inspection of any damaged parts. In the case of shipment F. O. B. Waltham, the customer is responsible for filing any damage claims with the carrier.

Although Jarrell-Ash instruments are sturdily constructed, they can be damaged through severe handling in shipment. The Jarrell-Ash Division cannot make any adjustment for such damage and will charge for any repairs and/or parts necessary.

Carefully examine the crate for superficial evidence of rough treatment. Even if such evidence is not apparent, do not waive claim for damage, since hidden damage can often be revealed only by close inspection of the assembled instrument. Reimbursement from the carrier will be facilitated, if the preceding recommendations are followed.

REPAIRS

The entire instrument has been constructed of rugged components selected for long life provided reasonable care is shown. If any major parts need repair or replacement, contact the nearest Jarrell-Ash Division representative or the factory for advice.

Investigation of failures, and repair of electronic components should be performed only by qualified personnel.

RETURN OF GOODS

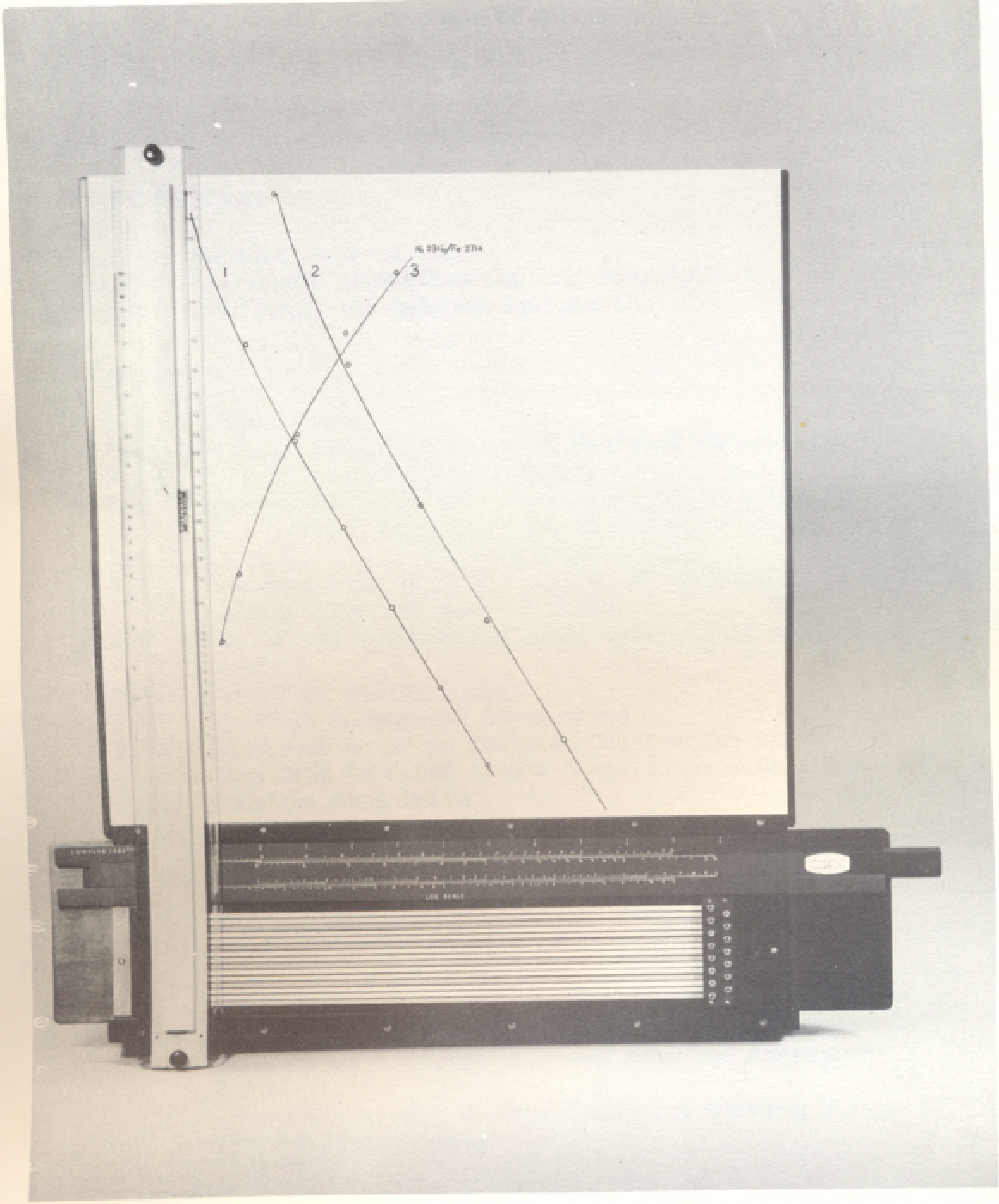
Jarrell-Ash sales policies do not permit goods to be returned to the factory for credit, repair, restocking or replacement under existing warranties including goods damaged in transit, without prior authorization. Indicate serial number of any instrument being returned.

CONTRACT DATA

Manufacturer's Model Number ____________________

Manufacturer's Serial Number ____________________

Customer's Contract Number ____________________



MODEL 30-100

TABLE OF CONTENTS

SECTION PAGE

1 INTRODUCTION

2 OPERATION

LIST OF ILLUSTRATIONS

FIGURE PAGE

SECTION I INTRODUCTION

1.1 GENERAL DESCRIPTION

The Jarrell-Ash Calculating Board consists of a plotting board and a variety of movable scales designed to facilitate rapid and accurate plotting of spectrographic calibration and working curves. The plotting area is an 18-inch square burnished plastic surface on which may be drawn any curves for which logarithmic graph paper would otherwise be necessary. This surface may be easily cleaned with a cleaner such as "Noxon".

The scales comprise two vertical and five horizontal scales. The two vertical scales consist of a two-cycle logarithmic scale used for plotting element concentration values and a scales based on the Seidel transformation used for plotting spectral line transmittance values. Photographic emulsion calibration curves constructed by plotting transmittance values against a Seidel scale are much straighter at their ends than the S-shaped curves which result when an ordinary logarithmic scale is used for these values.

Four of the horizontal scales are two pairs of logarithmic scales, a two-cycle set and a folded one-cycle set. The two-cycle scales are generally used for plotting relative intensities during construction of a calibration curve, and for the determination and plotting of spectral line intensity ratios, with or without background correction. In cases where the analytical range is limited, the folded one-cycle scales may be used for the construction of expanded curves, more easily read than those made from two-cycle scales. The fifth horizontal scale is an equal parts scale, useful in plotting relative intensities of portions of spectral lines resulting from the use of a seven-step filter or rotating disc.

The panel of 15 working curve steps provided is removable, allowing easy interchange with similar panels when different groups of alloys are to be analyzed. These strips are supplied in three colors to minimize confusing of the curves during analytical work.

The Calculating Board is of great value to the analytical spectroscopist when a great many routine analyses are to be run. It eliminates the need for separate plotting of working curves and plate calibration curves on graph paper, and reduces clerical errors since no arithmetic computations are required.

1.2 COMPONENT IDENTIFICATION AND DESCRIPTION

1.2.1 Model 30-100 Seidel Calculating Board - Figure 1

●	Plotting Surface - a large white plastic surface on which curves may be drawn.
V	Vertical Scale Mount - a sliding vertical wooden bar with two attached transparent scales.
L_v	Vertical Log Scale - a 2-cycle logarithmic scale fixed to the left side of V.

1.2.1 Model 30-100 Seidel Calculating Board - Figure 1 (continued)

T Seidel Transmittance Scale - a scale of transmittance values based on the Seidel Transformation, fixed to the right side of V.

I Indicator Line - an inscribed vertical line below scale T.

H Horizontal Scale Mount - a sliding horizontal aluminum board on which are mounted a slide rule and a working strip board.

- Horizontal Log Scales - a slide rule containing five scales
  - A. A fixed 2-cycle logarithmic scale
  - B. A movable 2-cycle scale mounted on the slide (S) above A
  - C_F A fixed folded 1-cycle logarithmic scale
  - D_F A movable folded 1-cycle scale on (S) below C_F
  - E An equal-parts fixed scale, each division of which represents a ratio of 1.585 as measure on the A scale, inscribed above the C_F scale.
  - Working Strip Board - an aluminum board containing 15 colored plastic strips on which element concentration scales may be drawn.

1.3 AUXILIARY AND RELATED EQUIPMENT

30-100G	Extra panel of fifteen working curve strips in three colors
30-100-G-4	Individual working curve strip (White)
30-100-G-5	Individual working curve strip (Yellow)
30-100-G-6	Individual working curve strip (Orange)
30-030	Fluorescent Lamp to mount on top edge of board
30-040	Accessory Kit for 30-100 Calculating Board, including two bottles "Noxon" Cleaner, twelve colored pencils, plastic cover, and Ship's curve for constructing calibration curves.
30-100A09	Replacement cable for 30-100 Calculating Board

SECTION 2 OPERATION

2.1 INSTALLATION

2.1.1 Receiving and Initial Assembly of Model 30-100

The Calculating Board is packed in a cardboard carton. Exercise care in unpacking so that small parts are not inadvertently discarded.

2.1.1.1 After the board has been unpacked and cleaned of excelsior, attach the U-shaped wire stand to the tilting table.

2.1.1.2 Slide the scales into position and attach the working strip board over the two pins on the scale mount H. See Figure 1 for a completely assembled Calculating Board.

2.1.1.3 All parts should slide easily. If any binding of the scales is noticed, locate and correct the cause.

2.1.1.4 Attach the illuminating lamp, if ordered, with the two wood screws provided. The lamp may be plugged directly into any 110-120 AC line.

2.1.1.5 As accessories, a box of colored pencils (preferably water-soluble), a can of "Noxon" or similar cleaner, and at least one ship's curve should be present.

2.2 METHODS FOR PREPARATION OF EMULSION CALIBRATION CURVES

2.2.1 Introduction

Standard texts on spectrochemical analysis should be consulted regarding the theory of the photographic process and the method of preparing calibration curves in general. Typical references are:

2.2.1.1 J. R. Churchill, Industrial and Engineering Chemistry, Analytical Edition 16 (1944), p. 653.

2.2.1.2 L. H. Aherns, Spectrochemical Analysis, Addison-Wesley Publishing Co., Cambridge, Mass. (1954), Ch. 9.

2.2.1.3 R. A. Sawyer, Experimental Spectroscopy, Prentice-Hall Inc. New York (1951), Ch. 10.

2.2.1.4 C. Feldman, Methods for Emission Spectrochemical Analysis, American Society for Testing Materials, Philadelphia, Pa. (1953), p. 15.

2.2.1.5 N. H. Nachtrieb, Principles and Practice of Spectrochemical Analysis, McGraw Hill, New York (1950), Ch. 6.

2.2.1.6 C. E. Harvey, Spectrochemical Procedures, Applied Research Laboratories, Glendale, California (1950), Chs. 3, 10.

2.2.1 Introduction (continued)

The preparation of a calibration curve will be described only in its direct application to this Calculating Board. The calibration exposure is taken in the normal manner through a step filter or a step sector. The two step method, two line method, or the seven step calibration system can be used. In all of these, a series of 5 to 8 transmittance values, differing by amounts corresponding to the relative exposure factor of the sector or filter used, will be obtained. Note that on the upper edge of the scale mount H of the Calculating Board, evenly stepped spaces are marked which correspond to the step ratio of 1.585 usually encountered with Jarrell-Ash and equivalent equipment. If a different step ratio is encountered, use the appropriate distance on the log scale.

2.2.2 Seven-Step Method (used with Step Sectors or Filters with a Step Ratio of 1.585). See Figure 1, Curve 1.

2.2.2.1 Slide Mount H until its scales are approximately centered below the plotting surface. Mark its position so that if jarred it can be returned to its original location.

2.2.2.2 Select any group of 7 of the divisions on scale E near the center of the board.

2.2.2.3 Move Mount V until the right edge of scale T lies at the extreme left of the 7 divisions selected.

2.2.2.4 Place a dot on the plotting surface beside the position on scale T representing the highest transmittance value obtained from microphotometer readings of a seven-step calibration line.

2.2.2.5 Move Mount V to the next division on scale E and make a mark at the position on scale T representing the next highest reading.

2.2.2.6 Repeat step 5 until all transmittance values have been used.

2.2.2.7 Draw the best fitting smooth curve through the plotted points.

2.2.3 Two-Step Method (Step Sector or Filter with an Intensity Ratio of 2.0). See Figure 1, Curve 2 and Figures 2 and 3.

2.2.3.1 Read and record the transmittance values of a series of 15 to 20 lines whose dark portion readings fairly evenly cover the total range of the percent transmittance scale on the microphotometer. Readings from both the dark portion and the light portion of each line should be obtained.

2.2.3.2 Plot the readings obtained in Step 1 for each chosen line on linear graph paper, using the light portion reading as the abscissa (T_L) and the dark portion as the ordinate (T_D) for each point.

AVERAGING CURVE FOR PAIRED TRANSMITTANCE VALUES
TRANSMITTANCE READINGS FROM OPPOSITE ENDS OF TWO-STEPPED LINES

DARK (T_D)	LIGHT (T_L)
1.1	4.0
1.8	6.8
3.6	10.4
5.7	17.7
8.8	26.8
10.8	34.0
16.8	44.6
22.3	57.2
27.8	63.1
31.8	67.8
42.4	78.2
49.7	83.2
60.3	90.4
77.1	95.9
81.7	96.7
84.3	97.7

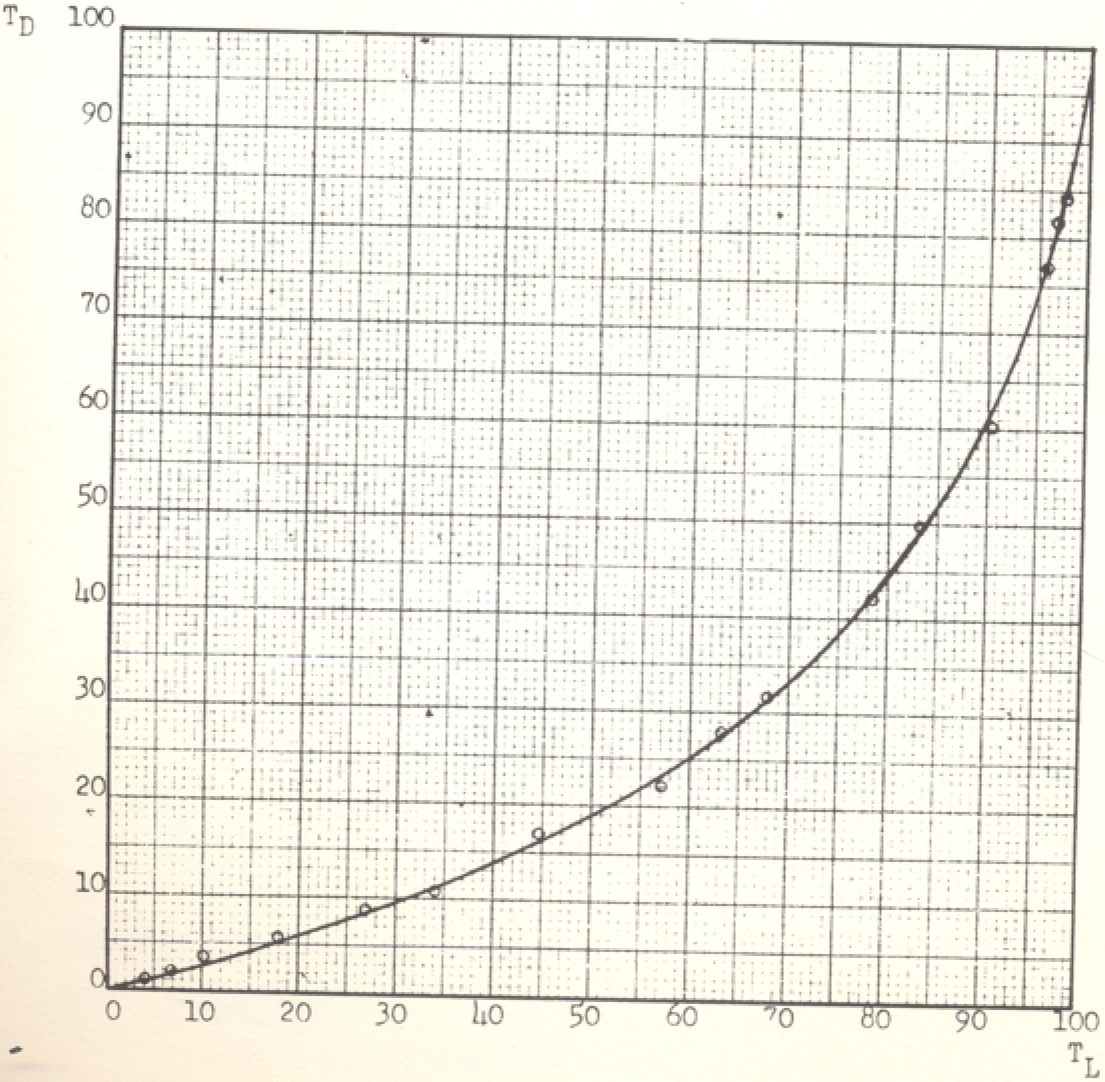
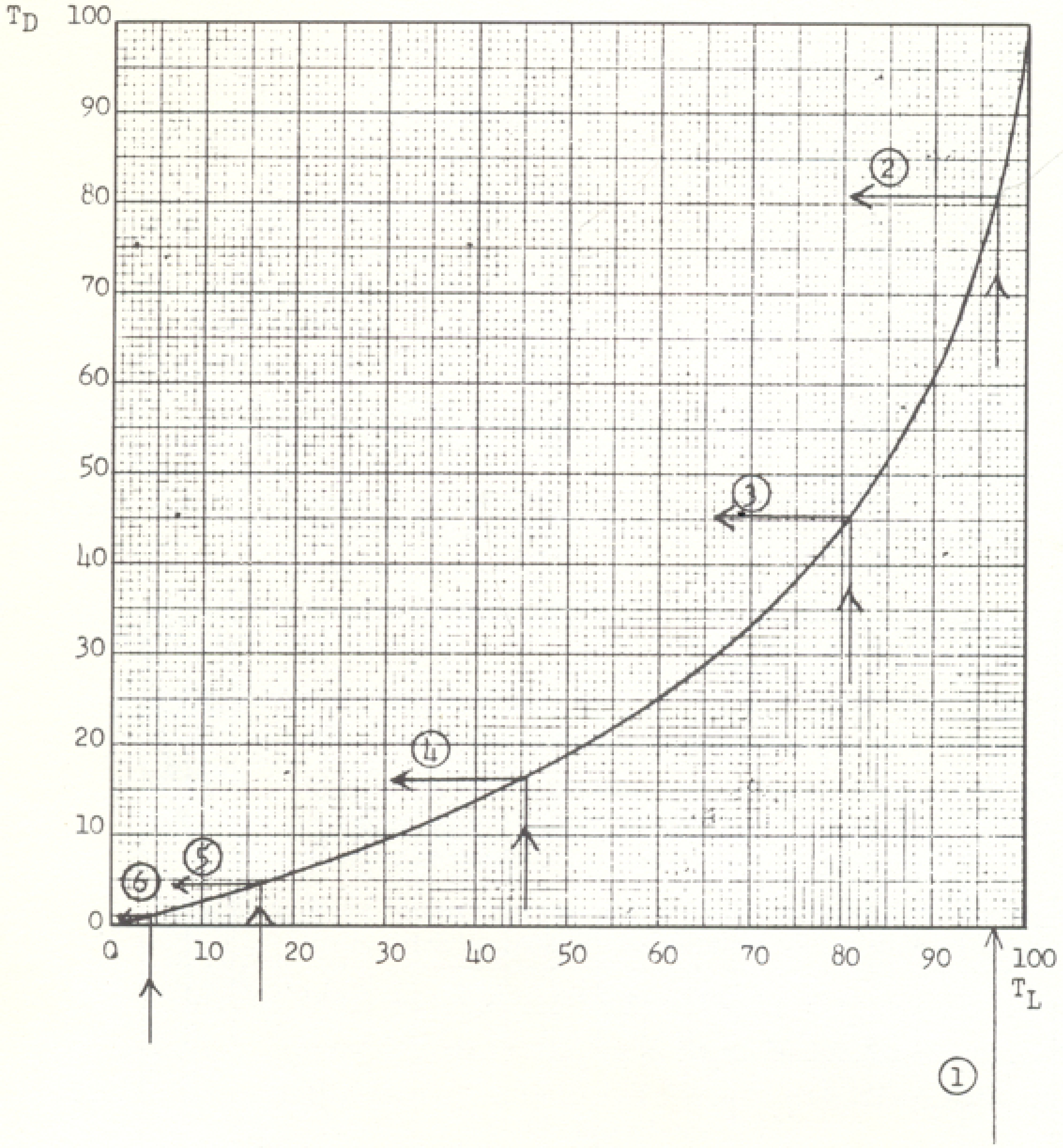


Figure 2

TRANSMITTANCE VALUES OBTAINED FROM THE AVERAGING CURVE



TRANSMITTANCE VALUES		A POSSIBLE CORRESPONDING SET OF INTENSITY VALUES
1.	97	2
2.	81	4
3.	45 1/2	8
4.	16 1/2	16
5.	4 1/2	32
6.	1	64

Figure 3

2.2.3 Two-Step Method (continued)

2.2.3.3 Draw the best fitting smooth curve through the approximately 20 points plotted above. This will be the averaging curve for paired transmittance values. For any point on this curve the transmittance value read as the ordinate represents light twice as intense as that represented by the abscissa transmittance value. See Figure 2.

2.2.3.4 From the averaging curve obtain a series of transmittance values as follows: (See Figure 3.)

2.2.3.4.1 The first value will be 97. This is the highest value which can be plotted with the Seidel scale.

2.2.3.4.2 From an abscissa (T_L) value of 97 read up to the curve and across for a corresponding ordinate (T_D) value (81 in Figure 3). This ordinate will be the second transmittance value.

2.2.3.4.3 Using the ordinate value just obtained (81) as a new abscissa, read up to the curve and across for another new ordinate value (45-1/2 in Figure 3), the third transmittance value.

2.2.3.4.4 Repeat Step 3 until an ordinate value less than 2 is obtained.

2.2.3.4.5 Select a set of intensity values, each of which differs from its neighbors by a factor of 2.0. See Figure 3 for one possible set.

2.2.3.5 On the Plotting Board, plot the highest transmittance value (97) beside scale T when V is moved to a position where the lowest selected intensity value (2 for the set in Figure 3) appears under I on scale A.

2.2.3.6 Repeat step 5 for all other transmittance-intensity value pairs.

2.2.3.7 Draw the best fitting smooth curve through the plotted points.

2.2.4 Two-Step Method (for Sectors or Filters with intensity ratios other than 2.0).

This method is the same as method 2-2.3, except that the intensities of the light beams which form the two ends of each spectral line differ by the ratio used. Therefore, in the set of intensity values chosen, in Section 2.2.3.4.5, each value will differ from its neighbors by this ratio rather than by 2.0 For example, if the ratio should be 1.4, a suitable set of intensity values might be: 2.0, 2.8, 3.9, 5.5, ...81.0.

x1.4

2.3 PREPARATION OF WORKING CURVES (see Figure 1, Curve 3)

2.3.1 Introduction

In order to prepare analytical working curves, standard samples of appro-

2.3.1 Introduction (continued)

priate concentrations must be run and the transmittance of proper internal standard and alalytical lines determined. An internal standard and alalytical line transmittance must be known for each exposure of each standard and for each element in the standard. The working curve is a plot of the intensity ratio of analytical line to internal standard line versus percent concentration. Refer to standard texts of spectrochemical analysis for an explanation of the internal standard principle.

2.3.2 Preparation Method

2.3.2.1 Slide Mount H until its scales are approximately centered below the plotting surface. Mark its position so that if jarred it can be returned to its original location.

2.3.2.2 Move V until the calibration curve intersects scale T at a position corresponding to the transmittance of the internal standard line.

2.3.2.3 Move Slide S until the number(1)at the center of the B scale falls under the indicator line I.

2.3.2.4 Move V until the calibration curve intersects scale T at the transmittance value of the analytical line.

2.3.2.5 Record the reading which appears beneath I on scale B. This reading is the ratio of the intensity of the light which formed the analytical line to that which formed the internal standard line.

2.3.2.6 Move V until I is over the point on scale A corresponding to the reading recorded above.

2.3.2.7 Make a mark on the plotting surface beside the location on scale L_V corresponding to the concentration of the analytical element.

2.3.2.8 After all points have been plotted in the above manner, draw the best fitting smooth curve through them.

2.4 DETERMINATION OF THE CONCENTRATION OF AN ELEMENT IN A SAMPLE, FROM THE WORKING CURVE.

Use this method if only a few analyses are to be made from a working curve. If the same curve is to be used for many analyses, time will ultimately be saved by making a working strip from the curve as will be described in Section 2.5.

2.4.1 Method of Concentration Determination

2.4.1.1 Determine the ratio of the intensity of an analytical line to that of an internal standard line for a standard sample as in Section 2.3.2.2 - 2.3.2.5.

2.4.1.2 Move V until the working curve intersects scale L_V at a reading corresponding to the concentration of the element in the standard.

2.4.1.3 Move H until the reading on Scale A, corresponding to the ratio in Section 2.4.1.1 lies under I. Mark the location of H as in Section 2.3.2.1.

2.4.1.4 Determine the intensity ratio of analytical line to internal standard line for each of the unknown samples.

2.4.1.5 When V is moved to the number on scale A corresponding to each intensity ratio, the concentration of the unknown may be read where scale L_V intersects the working curve.

2.5. CONSTRUCTION OF WORKING CURVE STRIPS

If more than two or three analyses are to be made from a working curve, a working curve strip is advantageous.

2.5.1 Method of Construction (see Figure 4)

2.5.1.1 Set H at the same position as in Section 2.3.2.1.

2.5.1.2 Loosen the cap screws which hold the working strips in position. Move each strip to the right until about a quarter inch of the end shows and re-tighten the screws.

2.5.1.3 Move V until the working curve intersects scale L_V at convenient concentration numbers such as 0.1, 0.2, 0.3, etc.

2.5.1.4 Make a short vertical line at the right edge of V on the working strip at each setting and label it with the appropriate concentration.

2.5.1.5 After the last concentration line has been drawn, move the working strip without disturbing V until that line lies under I and clamp the strip in position.

2.6. DETERMINATION OF CONCENTRATION OF AN ELEMENT IN A SAMPLE, FROM THE WORKING STRIP

2.6.1 Using a standard sample, move V so that the calibration curve intersects scale T at a position corresponding to the transmittance reading of the internal standard line.

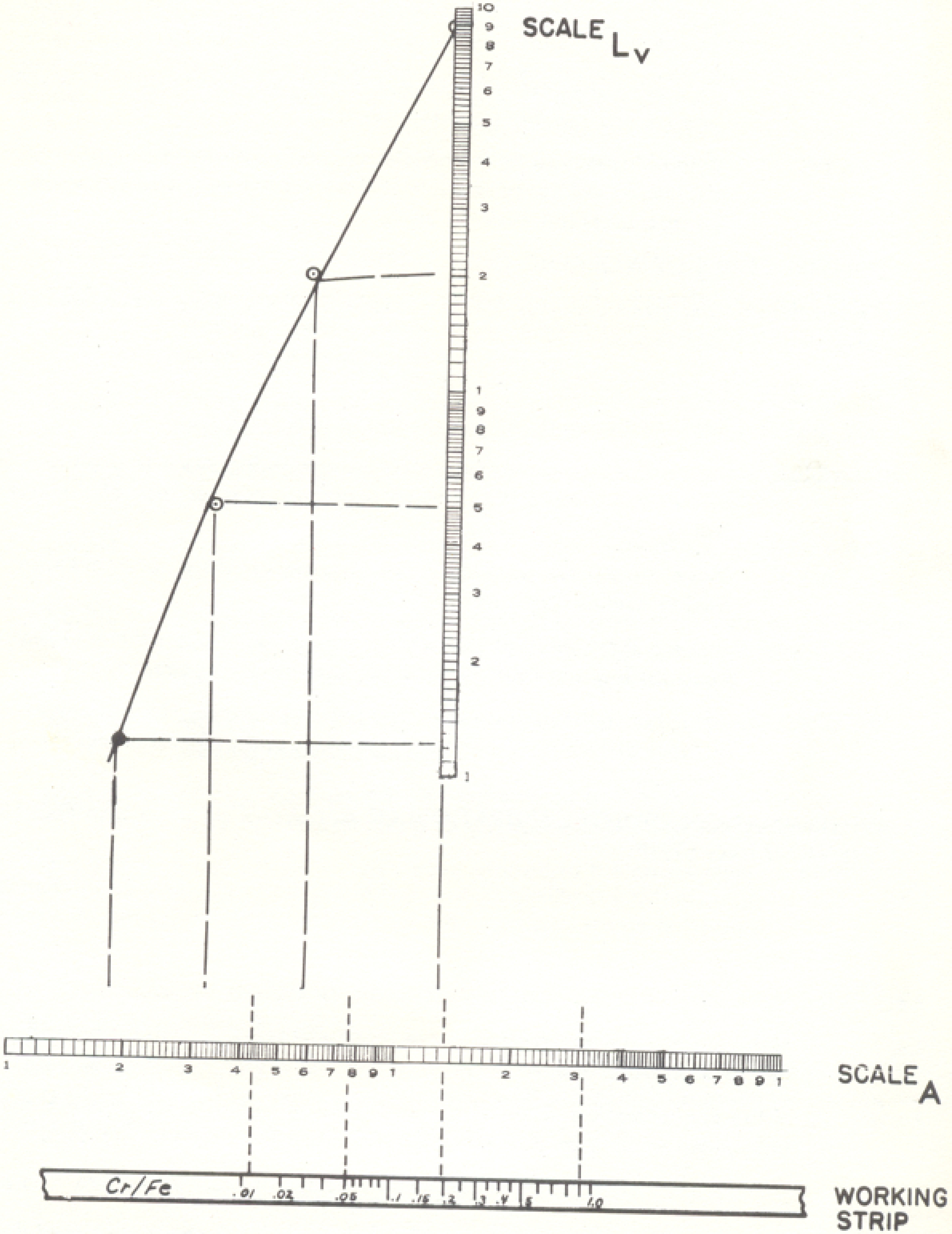
2.6.2 Move H until the number 1 in the center of scale A is under I.

2.6.3 Move V until the calibration curve intersects scale T at the transmittance value of the analytical line.

2.6.4 If the concentration value of the analytical element in the standard sample does not appear under I on the working strip, move the strip until it does.

2.6.5 For unknown samples, repeat steps 2.6.1 through 2.6.3 above and read the concentrations of the unknown element under I on the working strip.

SEIDEL CALCULATING BOARD



CONSTRUCTION OF A WORKING CURVE AND WORKING STRIP, USING 2-CYCLE SCALES.

FIGURE 4

2.7 USE OF THE CALCULATING BOARD WITH DIRECT READER RESULTS

A calibration curve is unnecessary since the readout numbers produced by a direct reading spectrograph are proportional to intensity ratios.

2.7.1 Slide mount H until its scales are approximately centered below the plotting surface. Mark its position so that if jarred it can be returned to its original location.

2.7.2 Move V so that readout numbers for standard samples appear on scale A under I.

2.7.3 Plot corresponding concentrations beside scale L_V.

2.7.4 Draw the best fitting curve through the resulting points. This is the working curve.

2.7.5 When V is moved so that readout numbers on scale A appear under I, concentrations of unknown samples may be read where the working curve intersects scale L_V.

2.7.6 Working strips may be constructed as in Section 2.5.1.

2.7.7 Concentrations of unknown samples may now be read directly from the working strips below readout number values on scale A.

2.7.8 Frequent checking of readout numbers against concentration for standard samples is recommended.

2.8 USE OF C_F AND D_F SCALES

Where intensity ratios are expected to lie within a limited range, the C_F and D_F scales may be used instead of the A land B scales, for greater readability. In such a case, alternate steps on the equal parts scale E should be used for setting up the calibration curve. Alternate step lines on scale E are marked with a white dotat the bottom.

2.9 SPECTRAL BACKGROUND CORRECTIONS

2.9.1 Introduction

In the above calculations the background is assumed to be zero or negligible. However, it is occasionally necessary to make a correction for background to obtain more nearly linear working curves. When this correction is applied, higher accuracies are obtainable on weak spectrum lines, particularly when the background tends to be variable even though the general spectrum intensity is the same from exposure to exposure. This situation is generally encountered when the background is largely produced by electrodes rather than the sample. For example, in a spark discharge, using metal disc samples and a carbon counter electrode, the background is produced principally by the sample and air in the analytical gap - thus it will be relatively constant or else proportional to the exposure and the internal standard line. However, in a DC Arc method, appreciable background may be produced by the carbon of the electrodes. Vaporizing more

2.9.1 Introduction (continued)

or less carbon for a given amount of sample will change the background and therefore the line plus background even for different exposures of the same sample. If background transmittance is greater than 95%, it is generally neglected unless the spectral line is extremely weak. However, for weak lines increased exposure is sometimes used to produce a more accurate measurement of line plus background with consequently higher background.

In general, methods of correcting for background make use of the following relationships:

1. $$\frac{I_{A}}{I_{IS}} = r \frac{I_{A} / I_{Bkgd\ A}}{I_{IS} / I_{Bkgd\ IS}} \qquad \text{where } r = \frac{I_{Bkgd\ A}}{I_{Bkgd\ IS}}$$

2. $$I_{Line + Bkgd} = I_{Line} + I_{Bkgd}$$

3. $$\frac{I_{Line}}{I_{Bkgd}} = \frac{I_{Line} + I_{Bkgd}}{I_{Bkgd}} - 1$$

where "I" indicates the intensity of the light which produces either an analytical line (I_A), an internal standard line (I_{IS}), or the background associated with such a line ($I_{Bkgd\ A}$ or $I_{Bkgd\ IS}$). Three methods are used for obtaining line intensity ratios with background corrections.

2.9.2 Background Correction for both Internal Standard and Analytical Line

2.9.2.1 Obtain a transmittance reading for an internal standard line plus background.

2.9.2.2 Obtain a transmittance reading for the background associated with the above line by averaging readings taken from the "clear" areas on each side of the line.

2.9.2.3 Set V so that the calibration curve intersects scale T at the average background value.

2.9.2.4 Move the horizontal scale mount H until the center index (1) of scale A is at I.

2.9.2.5 Move V so that the calibration curve intersects scale T at the value of internal standard line plus background.

2.9.2.6 Read the number at I on scale A.

2.9.2.7 Subtract 1 from the result of step 6.

2.9.2.8 Move V until I intercepts the value obtained in step 7 on the A scale.

2.9.2.9 Move scale mount H until the center index (1) of scale A is at I.

2.9.2.10 Repeat steps 2.9.2.1 and 2.9.2.2 for an analytical line.

2.9.2.11 Set V so that the calibration curve intersects scale T at the average background value for the analytical line.

2.9.2 Background Correction for both Internal Standard and Analytical Line (continued)

2.9.2.12 Move slide S until the center index (I) of scale B is at I.

2.9.2.13 Move V so that the calibration curve intersects scale T at the value of the analytical line plus background.

2.9.2.14 Read the number at I on scale B.

2.9.2.15 Subtract I from the result of step 2.9.12.13

2.9.2.16 Read the corrected intensity ratio on scale A opposite the result of step 2.9.2.15 on scale B. This is the ratio against which the concentration of the analytical element may be read (from either a working curve or calibrated working strip).

2.9.3 Background Correction for Internal Standard Line Only

This method may be used when the background associated with the analytical line is negligible.

2.9.3 (I to 9) Same as steps 2.9.2.I - 2.9.2.9

2.9.3.I0 Move V so that the calibration curve intersects scale T at the value of the analytical line plus background.

2.9.3.II Read the corrected intensity ratio on scale A at I.

2.9.4 Background Correction for Analytical Line Only

This method may be used when the background associated with the internal standard line is negligible. It is the most frequently used method of background correction.

2.9.4.I Set V so that the calibration curve intersects scale T at the value of internal standard line plus background.

2.9.4.2 Move scale mount H until the center index (I) of scale A is at I.

2.9.4.(3 to 9) Same as steps 2.9.2.I0 - 2.9.2.I6

2.9.5 Background Corrections Should Be Applied With Care

Never make background corrections on an unknown sample if the working curve was set up without such corrections. Conversely, always make background corrections on samples where the working curve was so corrected. Serious errors can result if these rules are not followed. Consult standard texts on the subject for the theory and applications of background correction.

2.10 CONSTRUCTION OF AN EMULSION CALIBRATION CURVE FROM DATA OBTAINED FROM A STEP-FILTER WITH A NON-CONSTANT STEP RATIO

Occasionally, a step filter may be found whose optical density does not vary consistently by a factor of 2 (equivalent intensity ratio = 1.585). In such a case the evenly spaced intervals of scale E should not be used. When such a filter is calibrated, its optical characteristics are usually reported in one of two ways. Either the transmittance of each step is compared to the transmittance of the clear step as 100%, or the density (log 1/transmittance) of each step is compared to the density of the clear step as zero. Results of such a calibration might appear thus:

STEP	% T	d = log 1/T
1 (clear)	100	0
2	57.8	.238
3	37.1	.431
4	19.6	.707
5	7.08	1.15
6	4.14	1.38
7	3.18	1.50

If the calibration is reported in terms of T or % T, the data may be used directly on the Seidel Calculating Board; if it is reported as densities it must be converted to % T values before being used. Either logarithm tables or a slide rule may be used. From a logarithm table each transmittance value is the antilogarithm of one minus its corresponding density value. In the case of step 3 in the above example T = antilog (1 - .431) = antilog 0.569. When using a slide rule one may find a transmittance value on the CI scale opposite the corresponding density value on the equal parts, or logarithm scale.

After the % T of each step is known and after a spectrogram has been made through the filter, the procedure for using the results as the basis of a calibration curve is:

2.10.1 . Move scale mount H so that the number 1 in the middle of Scale A (to be called 10 in this discussion) is approximately centered below the plotting surface. Mark its location so that if moved it may be returned to its original position.

2.10.2 . Calling the number 1 at the right end of Scale A 100, move mount V until its right edge is at 100.

2.10.3 . Beside scale T plot the transmittance of the darkest portion of a seven-step spectrum line.

2.10.4 . Move mount V to the left until its right edge lies at the % T value of the second filter step (57.8 in the example).

2.10.5 Plot beside scale T the value of the next-to-darkest spectrum line step.

2.10.6 Proceed as in steps 2.10.4 and 2.10.5 until all possible points have been plotted.

2.10.7 Draw the best fitting smooth curve through the plotted points. This is the emulsion calibration curve for this filter. If the filter is to be used often, marks could be placed on slide mount H at points corresponding to % T values of the filter steps.

Use of the two-cycle scale A has been suggested for simplicity. If a one-cycle scale is desired, the above procedure may be altered slightly:

2.10.8 Move slide S to the right until the left end of scale D_F lies directly below the right end of scale C_F.

2.10.9 Move mount H until the number 1 in the center of scale D_F lies below the extreme right edge of the plotting surface.

2.10.10 Calling the number 1 in the center of scale D_F 100 and the number 1 in the center of scale C_F 10, move V until its right edge is at 100.

2.10.11 Beside scale T plot the transmittance of the darkest portion of the seven-step spectrum line.

2.10.12 Move mount V to the left until its right edge lies at the % T value of the second filter step (57.8 in the example).

2.10.13 Plot beside scale T the value of the next-to-darkest spectrum line step.

2.10.14 Proceed as in steps 2.10.12 and 2.10.13 until all possible points have been plotted.

2.10.15 Draw the best fitting smooth curve through the plotted points. This is the emulsion calibration curve for this filter. If the filter is to be used often, marks could be placed on slide mount H at points corresponding to % T values of the filter steps.

TABLE

REPLACEABLE PARTS

CKT REF.	DESCRIPTION	MFR.	JACO STOCK NO.	RS*
	Noxon Cleaner-14 oz. can		30-040-1	2
	Set of 12 pencils	Mongal Art	30-040-2	1
	Ship Curve	Keuffel & Esser Co. # 57-1685-33	30-040-3	1
	Plastic Dust Cover	Plastic Fabricator Inc.	30-040-4	1
	Replacement Cable (For Replacement use only)	Gen. Cement Mfg. Phosphor Bronze 040 Dia. #70-500 11' 4" lg.	30-100-A09	1
	Parallel Ruling Attachment Kit #191001 (includes cable and pulley mounting hardware)	Mayline 7302A	30-100-A03	1
	Extra Panel of fifteen working curve strips in three colors.		30-100-G	
	Individual working curve strip (white)		30-100-G-4	
	Individual working curve strip (yellow)		30-100-G-5	
	Individual working curve strip (orange)		30-100-G-6	
	Fluorescent Lamp to mount on top edge of board.		30-030	

*Recommended Spare

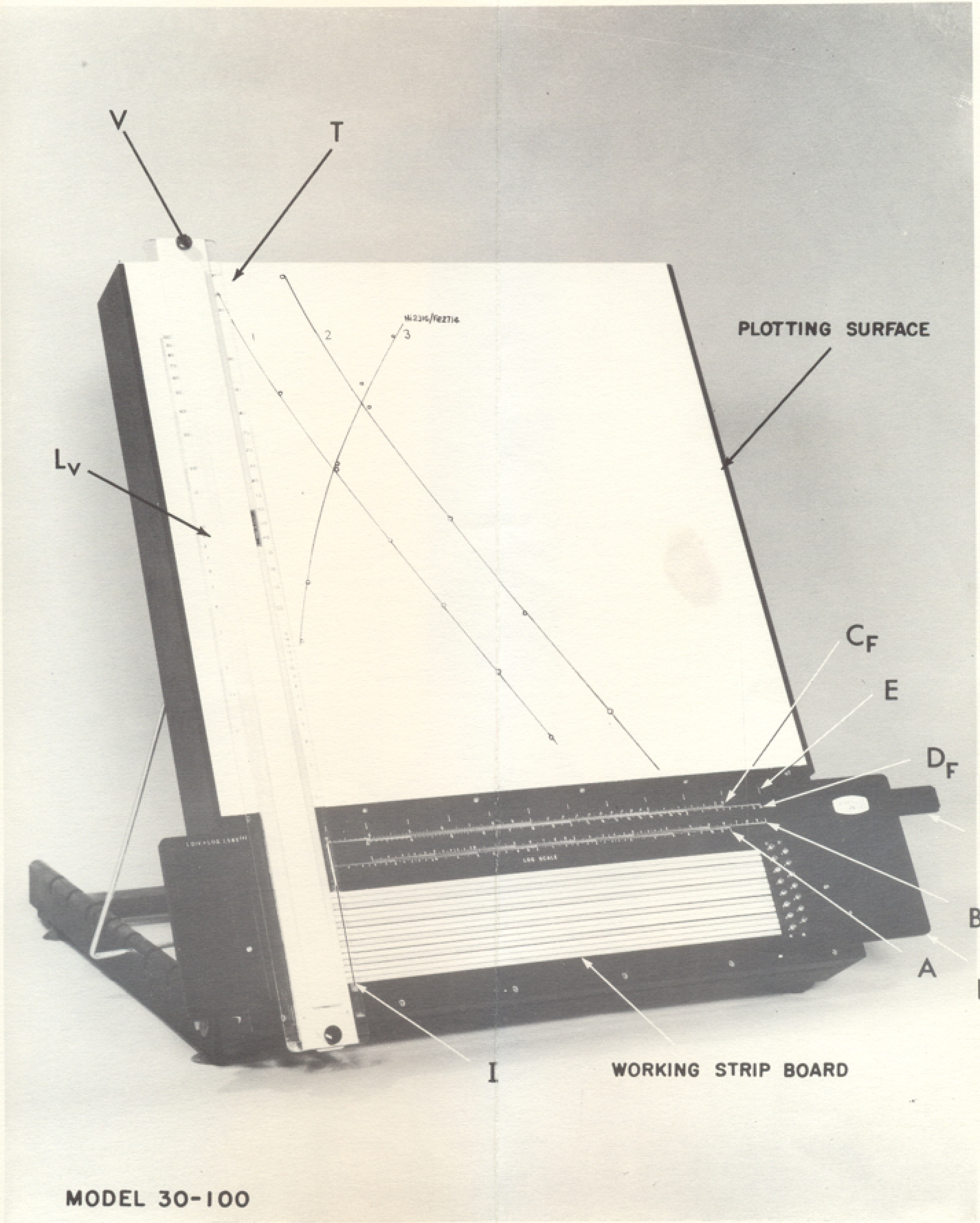

V
T
PLOTTING SURFACE
L_V
Ni2316/Fe2714
1
2
3
C_F
E
D_F
S
B
A
H
LOG SCALE
I
WORKING STRIP BOARD
MODEL 30-100

FIG. I