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Break even points and their application to small industry as illustrated by the manufacture of industrial jewel bearings.

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BOSTON UNIVERSITY

College of Business Administration

THESIS

Break Even Points and Their Application to Small Industry
as Illustrated by the Manufacture of Industrial
Jewel Bearings.

by
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Chapter I

Introduction

A. Purpose of the Thesis

There has been, in managerial circles, a recent stress on the need for methods by which management personnel can digest and present cost and profit data in a brief and intelligent manner. As business operations became more and more involved and controlled, the need became more and more apparent. It is increasingly evident that management must be able to plot its profit position and to plan ahead knowing as much as possible about the effects that changes both controllable and uncontrollable, in present costs and cost relationships, will have upon profits, and the ability to earn profits.

One of the tools developed to meet this need is the 'Break-Even Point' type of analysis and thinking. Break Even points, or B-E as they will be referred to in this work, have been defined in various terms, without too much variance in the intended meaning of the definition. Typical definitions are ". . . the point at which the factors of prices, business volume, and business costs are so balanced as to return no net profit (or loss) to the owners and the proprietors of business enterprises".* In discussing the natural gas industry Break Even was defined as follows, "The Break Even Chart as developed by Professor Walter Rautenstrauch of Columbia University, is a graphic

presentation of revenue, costs, and profits, or losses at various use factors, flow, deliveries, etc. Once constructed it shows at a glance the profits or losses of a natural gas well, a pipe line, etc., at various deliveries, and also the flow or use factor at which no profits are made but also no losses are incurred, the so-called 'break-even point'." * While one of the foremost proponents of the proper use of B-E analysis, Fred V. Gardiner, simply states Break-Even as ". . . the point where profits turn to losses and losses turn to profits." **

It is the aim of this thesis to illustrate how the Break Even approach and the use of the Break Even Charts can assist management to better fulfill its functions of control, planning, of obtaining earnings on investments, protection of stockholder interests, as well as the protection of the employees and management itself. In particular the thesis is directed to the small manufacturer, the producer lacking a full time trained accountant to provide the services and information expected of an accounting department. Break Even is a tool that can be used by all industry and it is not limited in value to the large scale operations and operators.

B. Scope of the Thesis

The area of this work will be limited to an explanation of Break Even Points and a concentration on simplifying Break Even methods and presentations without eliminating any of the basic or important factors of the approach. It is aimed at the small operator, and it is

illustrated by examples taken from a small industry, the manufacture of industrial jewel bearings. It is believed that by determining the Break Even Points and by illustrating the methods used, anyone interested in Break Even as a management tool will clearly understand and better appreciate what can be attained by proper use of this approach to planning and control. As the operations and facilities of the plant upon which this thesis draws its concrete examples, are not large enough to permit the use of full time professionally trained accountants, the author intends to keep the presentation as simple as possible. Break Even at this plant can be computed by clerical personnel directed by the plant manager, it is not necessary to use professional personnel or to delay obtaining the benefits of Break Even analysis because such professional personnel are lacking. It is to be remembered however that what is being presented is not a substitution for standard approved accounting procedures. Break Even is rather, a presentation of business statistics of interest to the management as an aid in interpreting present position and cost relationships, and projecting these factors into the future on a sound basis. Two of the main benefits to be gained by use of this medium are firmer control over present operations, and more intelligent forecasting of the future.

C. Approach of the Thesis

The central avenue of approach to the utilization of break even thinking shall be through illustrations of methods and means by which break even data is accumulated, classified, computed and presented. That the method of accumulation and classification of cost

factors be proper is essential, for cost classifications are the base from which all break even conclusions are drawn. Methods of computation used are those that can be accomplished with a very minimum of normal office equipment, and by personnel having elementary knowledge of mathematics and accounting. The presentation of Break Even data in the proper form is stressed for it is the final document that is given to top management for decisions and action. The presentation must be a clear and accurate picture of business conditions as they exist, not as one might like to have them. Regardless of whether charts, graphs, tables or statements are used, they must be such as can be clearly understood and appreciated. The presentation must reflect professional pride and training to those whose duty it is to use the material in managerial decision determination.

The author has for the past eleven years been associated with one of the few industrial jewel bearing producers in the United States. The first few years were spent in a trainee capacity, in the manufacturing, sales and office positions, present capacity is that of General Manager of the plant, responsible only to the President and Treasurer. The data used herein is drawn from the records and operations of this concern and the thesis is a history of the work done in applying Break Even thought and procedures to solve managerial problems that have confronted this plant.

Break-Even is a managerial tool of control, and the author plans to show clearly how control can be attained and maintained in a small plant to the advantage of the company, its total personnel and owners, by the use of this tool.

Chapter II

Importance of Break - Even Points and Thinking

A. Necessity for Break Even Thinking

Break even points are determined because they are to management an indicator of what is occurring within management's back yard. They are a thermometer pointing the directions in which operations are headed, they are the instruments that possess the degree of flexibility necessary to show changing business conditions, and to show the adjustments necessary to meet future changing conditions.

The increased interest in this type of thinking is undoubtedly due to the general rise in the break even levels of business and industry since the pre World War II era. As this trend increases and continues, the area of safety against higher costs, decreases in sales volume, and errors resulting from managerial decisions becomes continually smaller and smaller. It is essential therefore that any manager charged with the responsibility of operating an enterprise, examine his own position in the light of these facts, and actually, do much more than mere examination, he should determine his position and if necessary proceed to effect changes in policy to improve his position. It is essential that each individual take steps to be in control of the trend of his own operations and do all that he can to increase this margin of safety, or in other words, lower his break even level of operations. The importance of the effect of the general trend is heightened when it is realized that along with the lessening margin of safety allowed by present operations goes the need

for considerably more financing in order to obtain the same sales volume of past years. The business manager faces dual problems. One of his initial steps to resolving these difficulties is to determine first where in the scheme of things the operation for which he is responsible stands. While there are probably many detailed methods in vogue for accomplishing this, one of the best is through break even data. Break even is particularly suited for this type of work because it embraces the reasoning of the manager, applied through the tools of the accountant, and finally presented so that the data is clear to all interested in the problem. Break even is the tool, it shows the way, it does not provide the answer, but is simply a method to determine potential solutions from a pre-determined position, and to allow the manager to select the one solution that seems to answer his difficulty. Through break even the management can plot or pictorially represent future conditions and the effect they may have upon present and planned operations. Until the operating managements have become convinced that here is a method of cost-income approach that will meet their needs and demands, and still remains something that does not require pure accounting accuracy, B-E cannot do the job it is capable of doing. It is essential that management men get acquainted with Break Even Points and use them intelligently. A recent survey conducted by Business Week magazine indicated the need for more managements to keep abreast of their break even levels, especially in view of the predicted decreases in sales prices for the coming years. #

The article clearly indicated that although all management men interviewed did not clearly understand break even, they all tried at least to approximate something, either by guessing or by actual budgeting in order to have some idea of their position and present level of operations.

B. Importance of Break Even Points - Nationally

In stressing the point that Break Even thinking is essential and necessary if management men are to be in a position to cope with the problems of the present and more particularly the future, it was mentioned that break even points generally have been rising. In order to bring this fact into truer focus, the following data is cited.

An Analysis of Manufacturing Companies showing pertinent data during the 1935-39 era, and the same companies showing post World War II data. *

	1935-39	Post War.
Number of Companies in group.	892	900
Standby costs per year.	3,244.1	4,500.0
Variable rate per 1,000. net output.	764.0	850.0
Break Even Point	13,883.9	30,000.0
% Break Even Point to 1935-39 output.	55.3	100.0
% Standby costs to total costs at B-E.	23.8	15.0
% Standby costs to average business 35-39.	13.1	15.0
Average business 1935-39.	24,679.7	30,000.0

Attention is drawn to the break even increase from 13,683.9 to 30,000.0, and it also must be remembered that during these same years

these firms increased the prices of their products approximately 30% over earlier levels. Following further the history illustrated by the table, we note that with a break even level of 55% of average yearly sales in 1935-39, these firms picked up in profits an average of twenty seven (\$27.00) dollars per each one hundred dollars (\$100.00) of net sales above the break even point. In the post war period these same firms break even at 115% of the 1935-39 capacity adjusted to today's selling prices, and earn approximately sixteen (\$16.00) dollars per each one hundred (\$100.00) dollars net sales above break even. * The problem is clear, and even more so when you realize that the data presented is over three years old, and costs have been constantly increasing during this past three year period.

The Prentice Hall 'Report of Business' for November 28, 1952 had the following to say referencing this problem, in discussing rising profits and narrowing margins. "If your own experience agrees with these results, don't get too complacent. Typical profit margins are still too thin for comfort. Typical break-even points are still too high. In the intensely competitive buyers' market most lines can expect in '53, the squeeze on the pre-tax profit margins is apt to grow even tighter." ** Again from Business Week the following, "Most companies do some thinking about break even points, if only loosely. Generally they find that break even points have risen in terms of volume but are about the same in terms of plant capacity. Today, a manufacturer might have to double his pre war unit production to cover his costs." ***

* 20 p17

** 12 p 187

*** 15 p 160

More and more it is apparent that our profit levels of today are predicated on the volume production and not upon a true balance of costs and income. The President's Board of Economic Advisers has stated that the key to continued prosperity is the reduction in the selling price merchandise of all types. * However when a manufacturer examines his present costs in the light of a possible cut in selling prices, he has immediate visions of the sheriff knocking at the door. While it would not be an immediate or a single cause of retrenchment and possible reduction in the amount of business in the nation, industrialists look with fear to a price cut, realizing that comparable cuts in costs can not or will not be made. Most manufacturers have cut corners and costs via the method of more efficient machinery for the past years and there isn't too much further they could go. It is generally regarded that the only amount of water in any organization is in the administrative and supervisory costs. Normally not the greatest dollar user in industry.

The high national level of industrial break even points is considered to be important because it is a measure of the industrial health of the nation. It is a determinant of the amount over and above the recession level of our present operations. The failure of one or of a group of industries in various sections of the nation to operate above the break even level will effect only a few, however should national statistics show that a great many firms are operating below or at the break even point, the effect upon the entire nation and the world would be disastrous.

C. Illustrations of Changes in National Break Even Points.

In examining this facet of the picture the best view can be obtained by a brief look at the work done in 1948 by George H. Blackett. His study showed a trend for over twenty four years of manufacturing costs, and income from sales. From this trend he devised the following notations depicting possible effects of alterations in the cost and income figures and relationships and how they would effect industry. *

1. A volume drop of 14%, prices and costs constant, results in an income drop equal to net profit before Federal taxes.

2. A drop in payroll costs to compensate for the 14% reduction in volume would lower costs, however an additional drop of 7% in volume, wipes out all profits, and means a considerable drop in employment.

3. Volume and costs constant, a reduction in selling price of 12% wipes out net profit before taxes.

4. Volume, prices and costs constant, with the exception of labor costs, an increase in the labor factor of 18% would force a rise in costs great enough to eliminate all profit before income taxes.

The above computations were made as forecasts for the year 1948. The reader can judge for himself how much change has occurred in any one or more of these factors since that date. In 1948 the third round of wage increases were up for consideration, since that time, despite controls, the nation has been faced with the fourth, fifth and sixth rounds of increases.

D. Importance of Break Even Points to an Individual Concern

Regardless of how important break even thinking is to the National level of the economy, no matter how significant the changes in that level, and the factors that influence it, unless the individual managements of the many industries in the nation take it upon themselves to analyze operations, of their individual companies, Break Even cannot succeed. To the retailer, distributor, manufacturer, break even is a tool of the 'on-the-spot' management, the tool by which cost-income relationships are discovered and utilized. It is the means by which the manager is able to appraise himself of his present position and future acts. Because it does not require the services of the accountant to determine, and because it is designed to be of service for the future, and not merely a restatement of past performance, break-even is ideally suited for managerial work. The management of a small firm must know how changes in costs, labor rates, volume, prices, taxes, etc., will effect his performance at all times, it is imperative that he understand what an increase in costs, or a decrease in volume or sales prices will do to him before such events occur. His profit and loss statement at the end of the accounting period will be ample history of what has happened, break even will give him an indication of the results before they occur. The device is especially useful when plotting factors over which the management has some measure of control, in that appraised of the approximate result of a decision in advance, judgement may be tempered and errors made fewer and less costly. On factors that are beyond the control of the manager, break even points and data indicate possible steps that may be taken to reduce the evil effects of external forces, or steps that may be taken to maximize the benefits that

could arise.

Chapter III

Collection and Classification of Break Even Data

A. Present Accounting Records.

In making an examination of the facts of business as they are now presented to management, it is all too apparent that the data management receives is past history. It is left in his hands and the manager must dig up from pure accounting records and presentations, the necessary statistical data to enable him to operate and even more important, control his operations.

The two basic reports to all business include the Statement of Profit and Loss, and the Balance Sheet. These are necessary records, they are required by law, tax rates and amounts are based upon them, investment is encouraged or discouraged by the evidence listed on these records. However they do not tell the operating manager too much about his operations, only that he was successful and showed a profit, or that he was not so successful and completed the period with a loss. Such statements seem to indicate any profit to be a percentage of sales, i.e. business made 5% or 10% profit on sales. The advocates of break even thought disagree with this type of thinking. Under break even, no business earns a flat 5% or 10% profit, it earns rather a certain amount after all expenses are met, and the data is only good for a definite volume, with definite costs and income. It does little good for the manager to know that he made a profit, if he does not know at what volume the profit occurred. How many months in the year passed by, before the profit entered the picture? How many sales were made, what

was the product mix, how were the expenses broken down ?, these are the figures that have great meaning for the operating head of the business. Using Break Even methods the manager can answer these questions, and will be able to have more control over what will appear on the certified statement at the end of the next year.

Accounting is a necessary tool of business, it is a science, factual, exacting, and governed by rules and regulations. Statements bearing the signatures of Certified Accountants provide a sense of security to management, to stockholders, to labor and to the general public. However accounting is static, it makes no pretense at being otherwise. A profit and loss statement is only good for the period it covers. A Balance Sheet is good only for the day it represents none other. Management can be lulled into false thoughts and ideas if it fails to convert this static information into dynamic facts. And use those facts to project, provide for, and seek out information affecting the future.

One of the basic principles of management is that standby costs become variable when considered in relationship to output, and controlled variable costs become fixed to output. Management must be aware of this and apply the concept if it is to obtain maximum benefit business statistics. Accounting, unfortunately is too slow to meet this need to be of effective service to management.

In order to attain some measure of control, management must use and obtain management statistics. Costs can only be controlled through correct statistical interpretation of the static information provided by accounting. Terms must be expressed in the language of the management,

rather than in the words of the accountant. Business leaders have headed in the proper direction when they first begin to transfer financial statements into managerial statistics.

Throughout this discussion, there is intended no criticism of accounting as such. Accounting has a purpose, no other phase of business activity can fill it better. It is unreasonable to expect that accounting will express future trends of happenings, the delicate relationships that exist between costs and volume, between sales and volume, are for accounting to report, but for management to determine and control.

Control of profit ultimately means control of costs. In order to control costs one must know what they are, how to determine them, and how to segregate them into proper classifications, in order that they may become clear and assume proper proportions in relation to other facets of business.

B. Costs, Fixed and Variable

Break even work is essentially cost work, in so far as the equipment necessary to get started is concerned. It is a method of cost determination and the depicting of variances in costs and their effect upon the profit picture. It is extremely essential that a clear understanding of the manner in which costs are determined and segregated be obtained before it is possible to present any graphic presentations of Break Even data, or show how it can be utilized in small business as illustrated by the industrial jewel bearing industry in this thesis.

Heading this section of the chapter, the term 'FIXED' is

applied to costs. However it is probably more correct to refer to these costs as STANDBY costs. For in truth no cost is really fixed with the idea of everlasting permanance attached to it. Rather these costs have a relationship in time, some occur for a short time, others for longer periods, some authors refer to these costs as constant expenses. The term CONSTANT is further divided into CONSTANT FIXED and CONSTANT REGULATED.* In order to obtain a full appreciation of the approaches to Break Even it is necessary to get all the detail thinking possible about costs understood. Costs are the center of our puzzle, and misunderstandings about them will leave any Break Even work attempted doomed to failure.

STANDBY expenses are those expenses that would fall within the scope of the below listed groups:

1. those occasioned by the ownership of a business, e.g. the interest on mortgages, rent, local real estate taxes, insurance, etc.
2. those assessed for the purpose of capital recovery of investment in fixed assets, e.g. depreciation, depletion, etc.
3. those which arise in its operation, e.g., executive salaries, maintenance, advertising, etc.

The first two above are true as CONSTANT FIXED costs as well, while the third is classed as a CONSTANT REGULATED expense, that is -

- a. those that are conditioned by the nature of the factory and its operation, e.g. maintenance.
- b. those determined largely by executive policy and decision, e.g. salaries, advertising. etc.

Add to this the term used by still others in the field, LAG items, those expenses that become inflexible to volume, extra clerks put on to care for extra work, and retained once the increased work load passes. * Other such STANDBY costs that continue because management believes that they are necessary include, e.g. plant guards, training programs, etc. We can also expand those mentioned earlier to include under (a) Pension plans, long term research, fixed contracts for labor and services not dependent upon volume. Add to (b) key insurance power standby, etc., although some of the later may be more properly considered under regulated control of executive decisions.

The VARIABLE expenses are those that rise and fall directly, but not necessarily in the same proportion as volume, (production and sales). Typical of these items are Direct Labor, Materials, Salesman's commissions, etc.,

For those interested in a full treatment of cost classifications for Break Even work, a reading of 'Variable Budget Control' by Fred V. Gardiner will prove most helpful. For the use of the work to follow it is only necessary to know that, costs are related either to TIME, that is the STANDBY or CONSTANT costs; and those related to VOLUME, the VARIABLE costs. In this work the cost breakdown applied to the examples will be as follows.

1. - CONSTANT FIXED COSTS - a TIME cost.
2. - CONSTANT REGULATED COSTS - a TIME cost.
3. - VARIABLE COSTS - a VOLUME cost.

Chapter IV

Computation of Break Even Levels and PointsA. Graphically:

To the average businessman Break Even Points and their determination seem to connote involved charting and graphing of mysterious data in order to reach a future that has limited value. Refutation of the ideas expressed in that last sentence, is one of the aims of this work. There is nothing involved about plotting Break Even data.

Graphs and Charts are used throughout this work to determine and illustrate break even points, and there are ample examples in the following chapters. However it is deemed reasonable to refer the reader to the basic rules for the preparation of charts so that he will not violate the principles of graphic presentation. # Also to remind the reader that his computations will only be as accurate as the factors he places on the chart and the care with which he places them there. Care should be taken to eliminate errors that crop up because of careless measuring, the use of too large or small a scale, etc.

It is not deemed advisable to place a thorough presentation on the format of Break Even Charts here, as they are used constantly in Chapter VII to illustrate the Break Even work of the RICHARD H. BIRD & CO., INC., and are also shown in Chapter V, which is devoted to graphic presentation. It is felt that the reader will be fully

aware of the construction of these charts after completing his reading, and additional instructions here would be burdensome.

B. Formulae

There are many formulae developed to determine cost data and relationships, no attempt here is made to list them all. What is attempted is to list a few that can be remembered and used, in conjunction with the charting of Break Even data. The Charts and formulae should cross check each other. For quick calculation the formula presented by R. Parker Eastwood is excellent; it is as follows: *

$$\text{Break-Even Volume} = \frac{\text{Constant costs}}{1 - \text{Variable cost ratio}}$$

The Variable cost ratio is computed as follows:

$$\text{Variable cost ratio} = \frac{\text{Variable Costs}}{\text{Gross Sales}}$$

This formula is also used to check the accuracy of the Break Even Statement. #

Other formulae include: **

$$\text{Break Even Sales Volume} = S - \left(\frac{(S - S_1) \times P}{(P - P_1)} \right)$$

Where - S - one sales volume
 S_1 - a second sales volume
 P - one profit related to S
 P_1 - second profit related to S_1

A third formula is:

$$S = \% S + F$$

Where S - Sales
% S - Variable portion of expenses
F - Fixed amount of expenses.

For those who may be interested in a more involved mathematical process, a referral to articles by Malcom L. Pye in the January and February 1948 issues of the JOURNAL OF ACCOUNTANCY is in order. In these articles Mr. Pye constructs and solves his own formulae for the determination of Break Even points. Many of his formulae pertain to complex operations and complex product mixes.

As this is mainly directed to Break Even points in a single company, of small size, and few products, there is very little need for the detailed exposition of Mr. Pye's work. The formulae listed on the previous page are more than adequate for our needs and when combined with graphic presentation answer all we ask of Break Even material.

Chapter V

Presentation of Break Even Data

A. The Break Even Statement:

In describing the program for use of Break Even material as utilized at the Ansul Chemical Co., Marinette, Wisconsin, one writer said that "Break even facts put controls in your hands". * In this chapter we wish to examine some of the ways in which those facts are presented, in what form will we find break even facts in our hands?

In taking the initial step away from conventional accounting presentations of cost material, the first type of presentation to be encountered is the 'Break Even Statement'. The Break Even Statement is a recasting of the same information used in making the conventional Profit and Loss Statement into a form which permits analysis of Volume-Cost-Profit relationships. **

The essential difference between a conventional Profit and Loss Statement is that under the first gross sales are cut down slowly by charging all expenses against them, under a single classification. While under Break Even work, all expenses must be classified into a minimum of two groups, Time and Volume costs, and must be shown as two deductions. There are advantages and disadvantages to each form. However, Break Even Statements change the static presentation of conventional data into dynamic representation of the period with a

*16 p52

**25 p106F

tendency to project within limitations the acts of the past into the future.

A very simple comparison between the two forms of presenting data is shown below, with a more detailed example shown on the following page.

Elements	Conventional Statement	Break Even Statement	
Sales:	\$ 200,000.00	\$ 200,000.00	100%
Costs, Expenses, Deductions, net.	180,000.00		
Variable Costs Net		146,000.00	73%
Marginal Income		<u>54,000.00</u>	<u>27%</u>
Fixed Expenses:		34,000.00	
Net Income:	<u>\$ 20,000.00</u>	<u>\$ 20,000.00</u>	

Note that from the above brief statements, from the one on the right, it is possible to determine that the profit margin once the break even point has been reached will be \$27.00 of each 100.00 Sales. No information approximating this is determinable from the conventional statement. The more detailed statements on the following pages will use the same general cost information so that a complete comparison may be made. #

*
Conventional Profit & Loss Statement

Sales	200,000.00	100.0%
<u>Cost of Sales:</u>		
Beginning Inventory	40,000.00	
Cost of Production	180,000.00	
Total	220,000.00	
Ending Inventory	68,000.00	
Cost of Sales	152,000.00	76.0%
Gross Profit	48,000.00	24.0%
<u>Commercial Expenses:</u>		
Selling Expenses	20,000.00	10.0%
Administrative Expenses	10,000.00	5.0%
Total Commercial Expenses	30,000.00	15.0%
Operating Profit	18,000.00	9.0%
Nonoperating Deduction	1,000.00	0.5%
Nonoperating Income	3,000.00	1.5%
Net Income	20,000.00	10.0%

Break-Even Profit & Loss Statement

Item	Total Amount	Fixed Amount	Variable Amount	Variable Percentage
Sales	200,000.00		200,000.00	100.0
Beginning Inventory	40,000.00			
Cost of Production	180,000.00			
Total	220,000.00			
Ending Inventory	68,000.00			
Cost of Sales	152,000.00	18,000.00	134,000.00	67.0
Selling Expense	20,000.00	8,000.00	12,000.00	6.0
Administrative Expense	10,000.00	8,000.00	2,000.00	1.0
Nonoperating Deduction	1,000.00		1,000.00	0.5
Sub-total	183,000.00	34,000.00	149,000.00	74.5
Nonoperating Income	3,000.00		3,000.00	1.5
Total Cost & Expenses	180,000.00	34,000.00	146,000.00	73.0
Marginal Income			54,000.00	27.0
Less Fixed Expenses			34,000.00	
Net Income			20,000.00	

Break Even Volume: \$34,000.00 divided by .27 equals \$125,930.00

B. Graphic Presentations

While the Break Even Statement has merit and value in the presentation of B-E data, the greatest amount of such presentation is done by the use of charts and graphs.

Graphic presentation of statistical and business data received its first great impetus during the First World War, and it enjoyed supreme position in statistical presentations during the Second World War. It has become very common to reduce to visual charts and graphs great funds of information that surrounds the average businessman charged with the operation of an enterprise. Graphic data makes it possible for a single exposition of facts to be given to a group of individuals at one time, with a conviction that they will understand the material easily. Columns of tabular data must be combined and reduced in the small business if the operating heads are to be expected to digest the many facts that have such important bearings upon the day-to-day decisions that must be made. #

Throughout this work there is constant reference to and illustrations of Break Even Charts. Essentially the chart as constructed and used by Professor Walter Rautenstrauch is used, and this chart is constructed as follows: The horizontal and vertical scales may be laid out in dollar volume, physical units of production, or elements of time. The basic sales lines in this chart are plotted as the bisector of the intersection of the horizontal and vertical scales. The use of this chart makes it possible to plot the data without actual knowledge of

the true sales data. Inasmuch as this type chart is used throughout the thesis, other examples will be illustrated here.

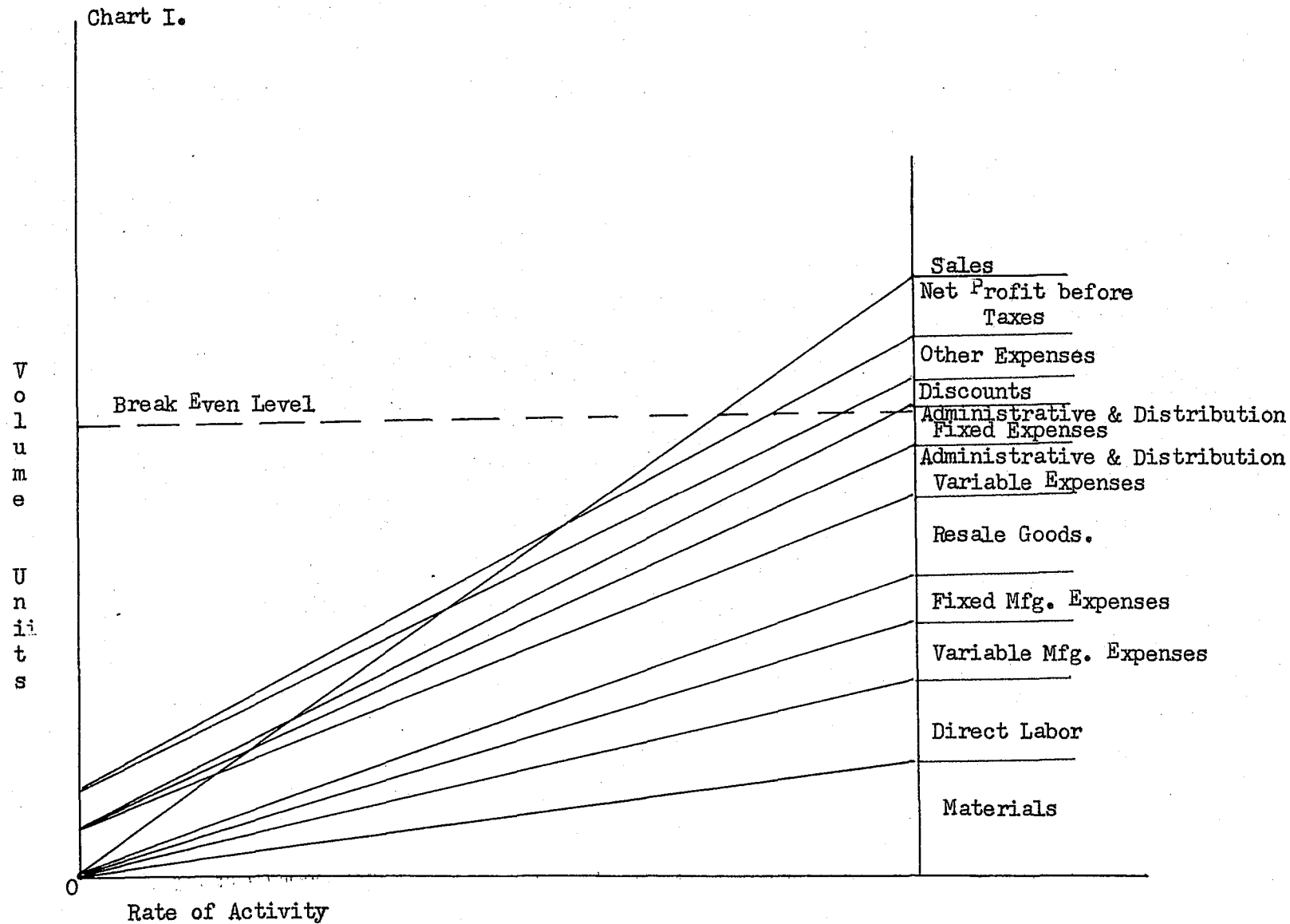
Floyd Rowland in his text states that there are three basic forms of Break Even Charts. *

1. The plan showing fixed and variable expenses separately for the major expense classifications of the business, e. g., manufacturing, selling, administration, etc.
2. The plan showing all fixed charges at the bottom of the chart.
3. The plan of separating fixed charges into depreciation and burden but showing both groups above the variable expense.

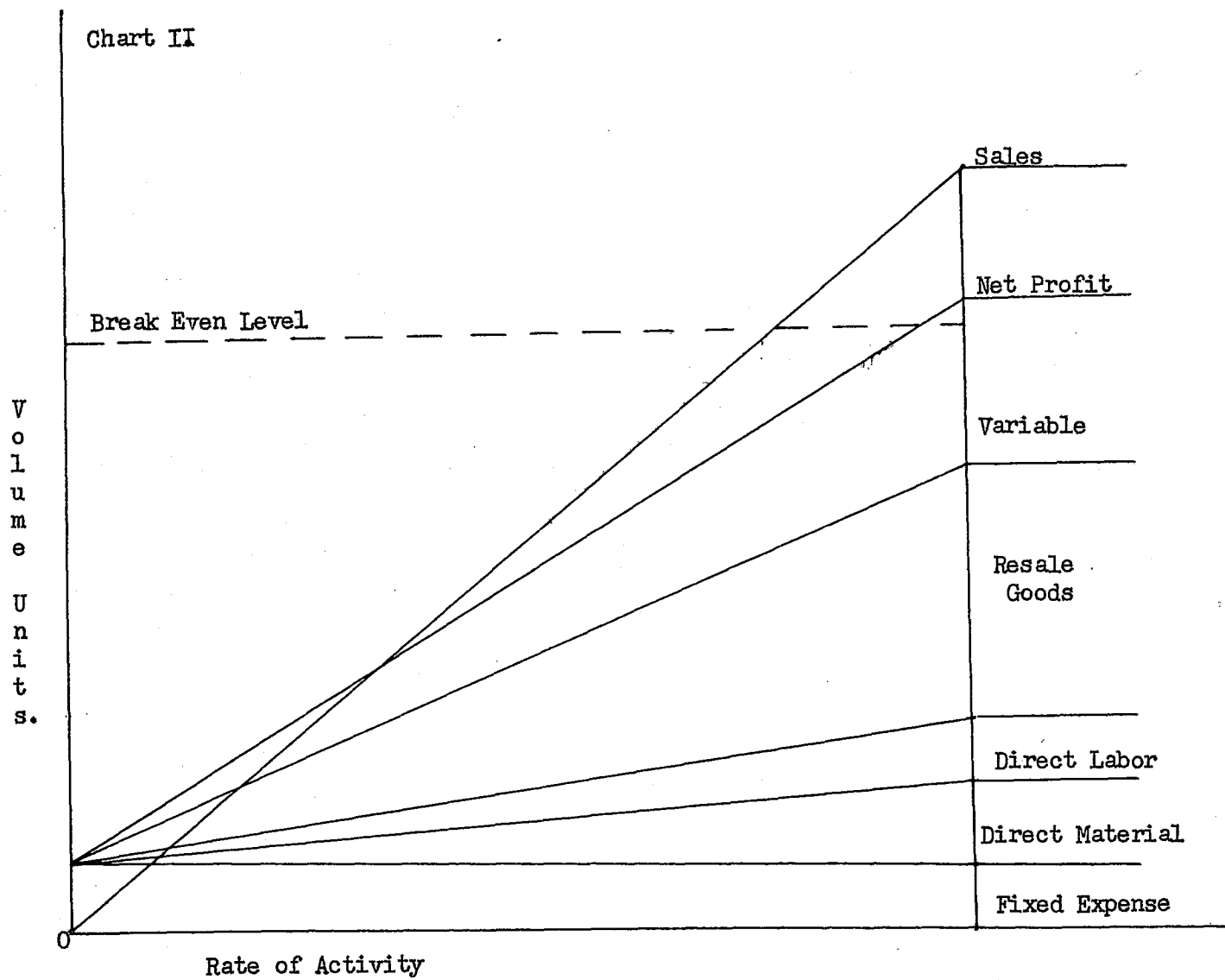
There are advantages claimed for each of the three plans, advocates of Plan 1, state that this plan shows the expenses in the sequence of the conventional Profit and Loss Statement and is therefore easier to understand and convert, one to the other. It also indicates where the sales volume at any point covers each expense. (See Chart I)

Plan 2 is one that provides that all fixed expenses be taken care of first and shows total expense tapering down to the fixed charges as business decreases. (See Chart II)

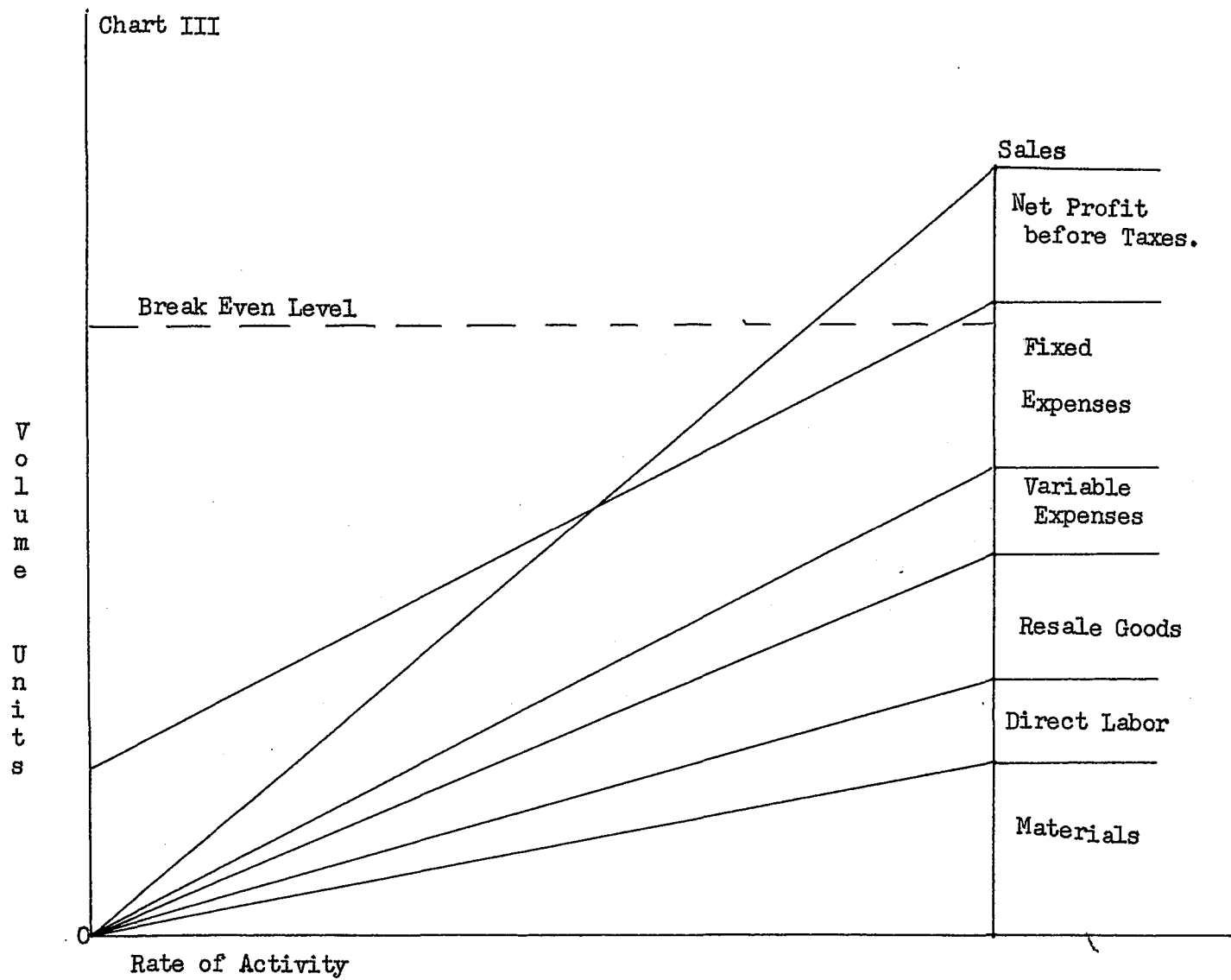
Proponents of Plan 3 point out that this plan indicates where fixed charges are covered by sales volume. This plan is shown on Chart III. The chart used in the thesis is essentially a variance on plan 2, designed to show more clearly and simply the same material with the Break Even Point an intersection with the Sales line.



Break Even Chart - by Major Expense Classifications.



Break Even Chart - Showing all Fixed Expenses at Base.



Break-Even Chart - Fixed Charges divided and plotted above Variable Expenses..

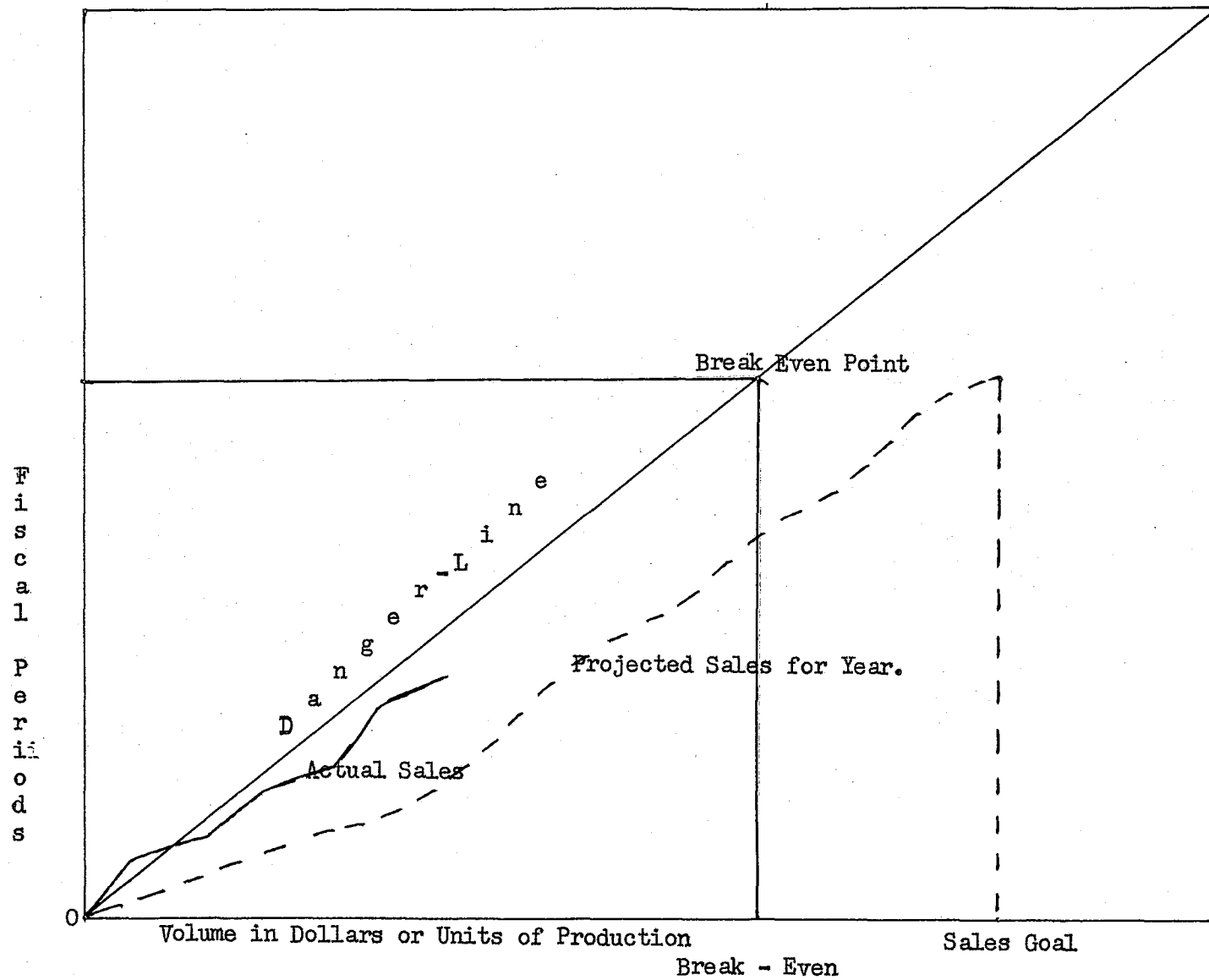
C. The Profitgraph

An adaption of the basic break even chart is the Profitgraph, which pictorially illustrates the company's progress throughout the year toward break even and ultimate profit. This type of presentation is depicted on Chart IV. *

The vertical scale represents the fiscal periods of the year, either by months, by four week periods, or by weeks. The horizontal scale represents either dollar volume of sales in terms of units of production. Dollar volume being the most common.

The outline of the graph is a square, with a diagonal drawn to represent a danger line. A vertical line is constructed at the break even sales dollar, and a horizontal constructed connecting the point of intersection of the Break Even vertical and the danger line, with the basic vertical (Y axis). The basic vertical can now be divided into the desired number of fiscal periods, 12 - 13 - 52. The first two are the more common. The projected sales volume is plotted with a proposed sales line, the dotted line on the illustration. Actual sales are plotted against the fiscal period and dollar volume as they occur. The diagonal is listed as a danger line, because if actual sales fall above this diagonal consistently then the break even point can never be exceeded, and the company can either just break even, or show a loss, by the time the last fiscal period is plotted. The goal of the operating management is to keep the sales below the diagonal at all times. How this is accomplished is another matter, but intelligent

Chart IV



Typical Profitgraph.

use of Break Even Charts and data will aid management to do just that, keep the sales in a safe area.

D. Profit Slope

An additional method of plotting profit is through a Profit Slope line chart, showing the direction and force of the Profit Path. This is simply a horizontal line marked in units of dollar volume, from 0 through break even to ultimate sales, a slope for the line that will be constructed to intersect this horizontal at B-E is determined and the intersector constructed in accordance with the determined slope. The formula for determining the slope of this line is as follows. *

$$\text{Slope of the Profit Path} = \frac{(\text{Constant Costs} + \text{Profit (-Loss)})}{\text{Sales}}$$

Illustration:

Constant Costs:	6,000,000.00
Profit	2,000,000.00
Sales	20,000,000.00

$$\text{Slope equals } \frac{6,000,000 + 2,000,000}{20,000,000}$$

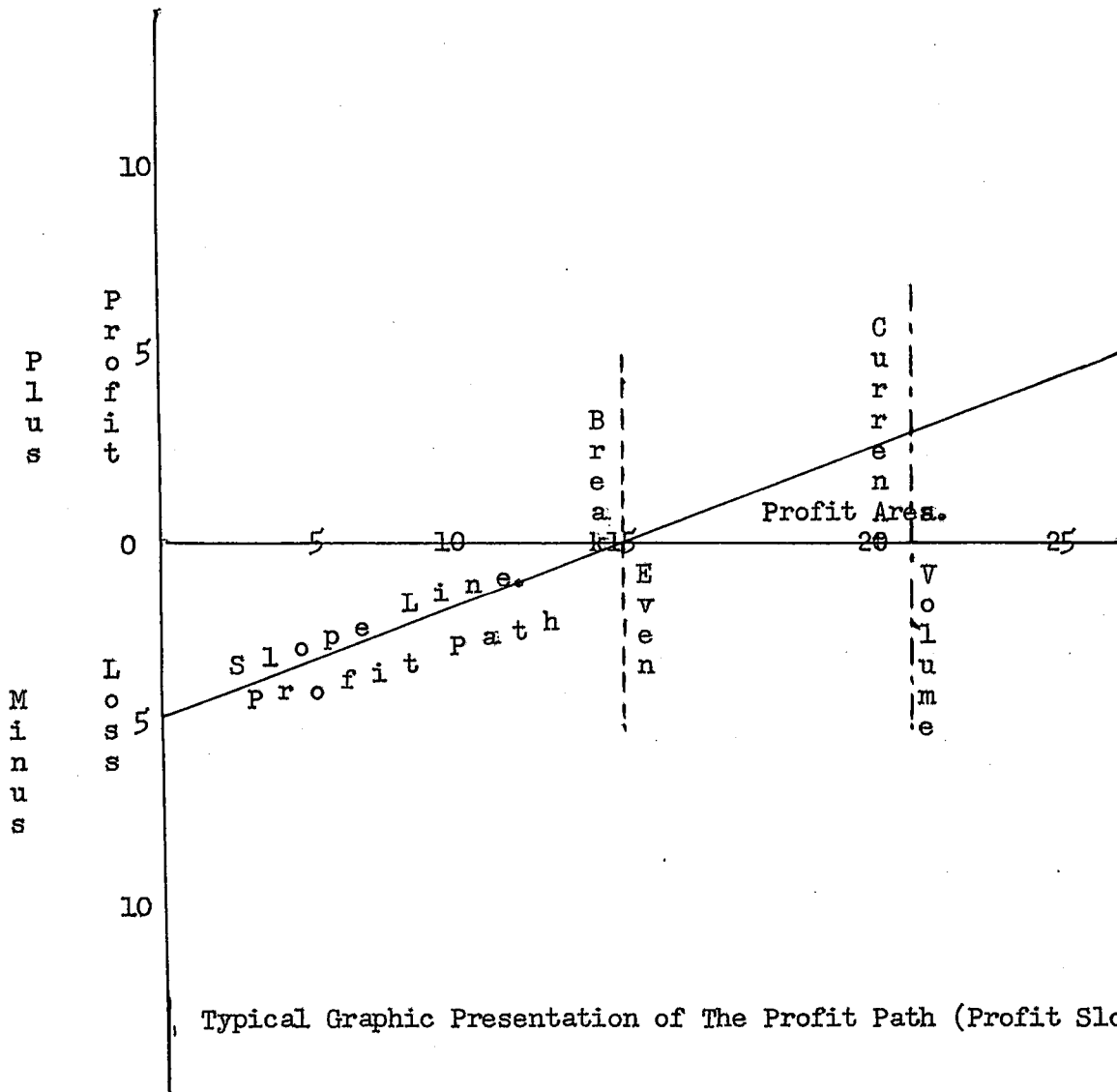
$$\text{Slope equals } +.4$$

This means that .4 represents the amount by which Profits are increased, or losses reduced with each increase in sales; e.g., with each additional \$100.00 in sales gross profits \$40.00.

This same data is illustrated on Chart No. V on the following page.

It is also possible to produce charts depicting similar data

Chart V



for each product and for each product group, and from an examination of this data determine the ideal product mix to obtain maximum profit from operations.

The many possible uses and adaptations of this type of analysis are limited only by the time and ingenuity of the management personnel interested in using Break Even data and material to solve particular management problems.

In Chapter VII, Break Even thought and work is applied to a specific company and some of the types of charts and graphic illustrations mentioned here are used in detail.

Chapter VI

Effects of Element Changes upon Break Even PointsA. The Major Parts of a Break Even Chart

Every break even chart has five basic points of interest.

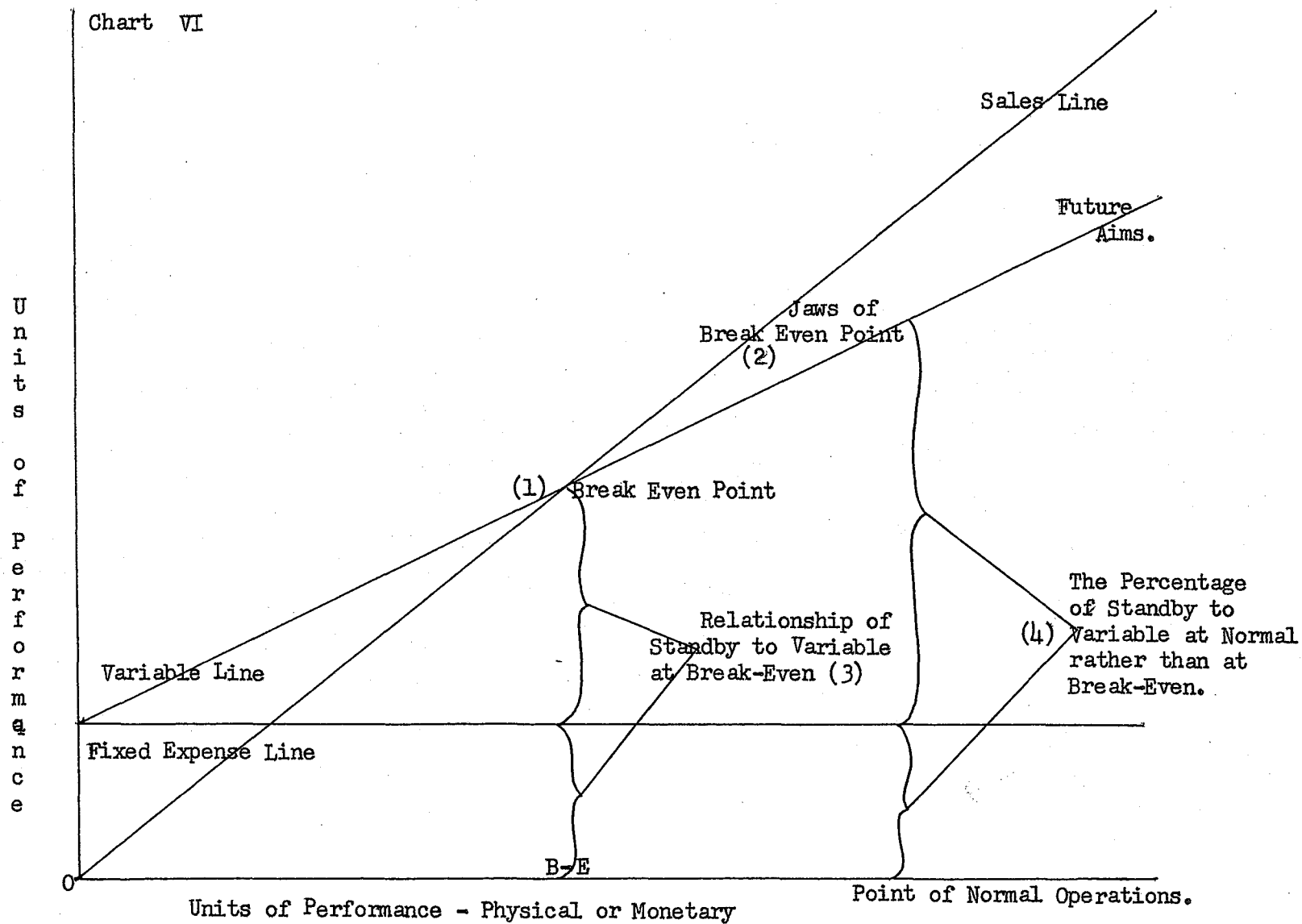
They are as follows: *

1. The break even point itself.
2. The jaws of the break even point, the space between the income line and the total cost line.
3. The relationship of stand-by costs to variable costs; or the relationship of stand-by costs to variable costs at Break Even.
4. The percentage of stand-by to variable at normal operations rather than at Break Even.
5. The projected future, the forecasting feature of Break Even.

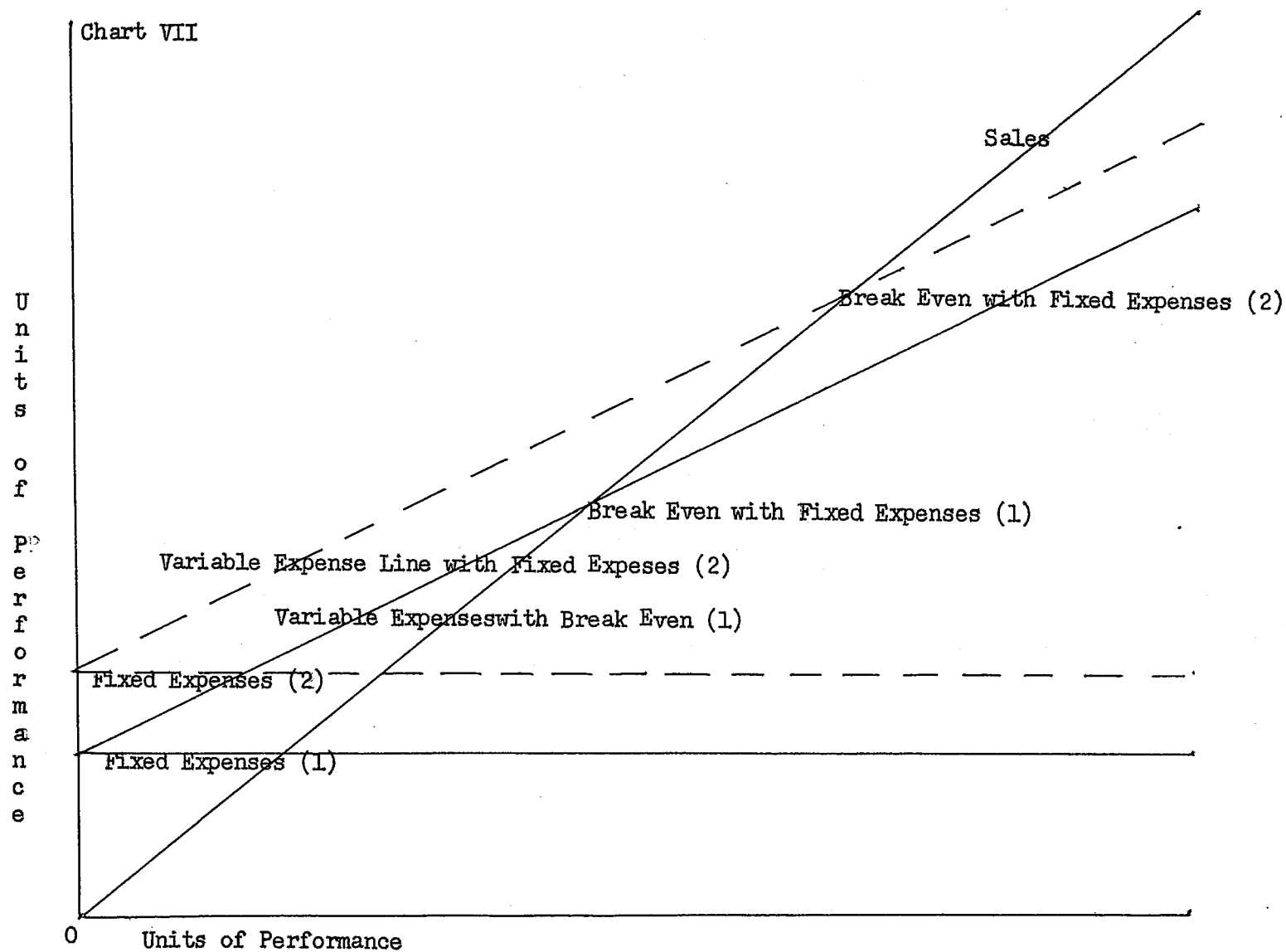
These elements are illustrated on Chart VI, and the relationship of one to another can be better appreciated.

Following this approach, we can note that a change in any one of the lines will have some effect upon the other lines and what they signify. This has led to the development of certain rules of profit as concerned with break even points. These laws of profit are -

- a) A change in stand-by expense (time costs) changes the break even point, but it does not change the marginal profit. (See Chart VII)
- b) A change in the variable expense, the expense that moves with volume, changes the break even point and also changes the margin



Basic Break Even Chart Showing Major Divisions.



Break Even Chart - Showing Effect of a Change in Standby (Fixed) Expenses upon Break Even Point.

of profit

c) A change in the selling price changes the break even point and changes the margin of profit to a greater degree than the variable costs. (See Chart IX)

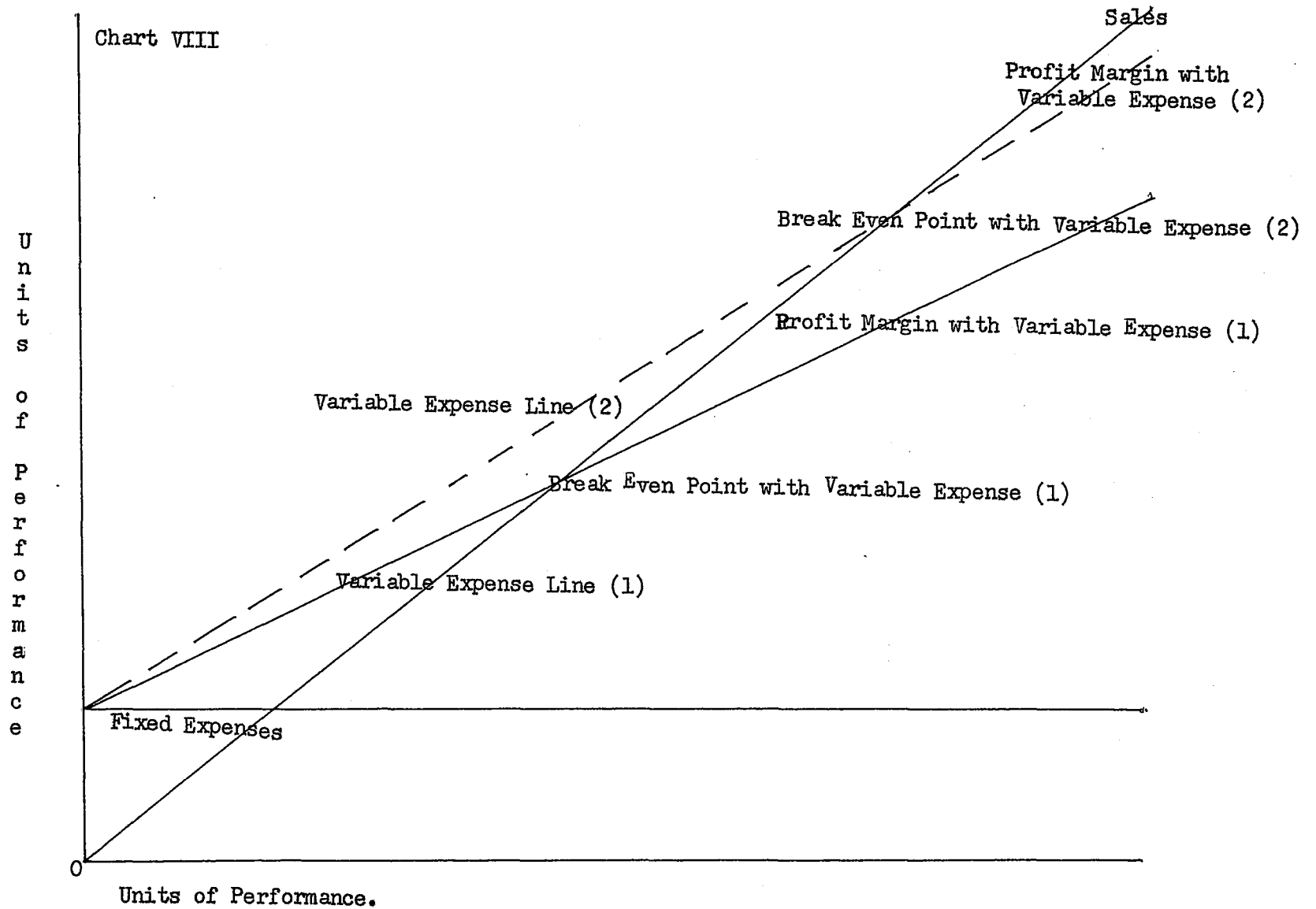
d) Marginal profits are effected only by changes in variable costs, changes in selling price or changes in the performance of the variable budget.

e) When both stand-by and variable change, the change in the break even point is extremely marked and definite. (See Chart X)

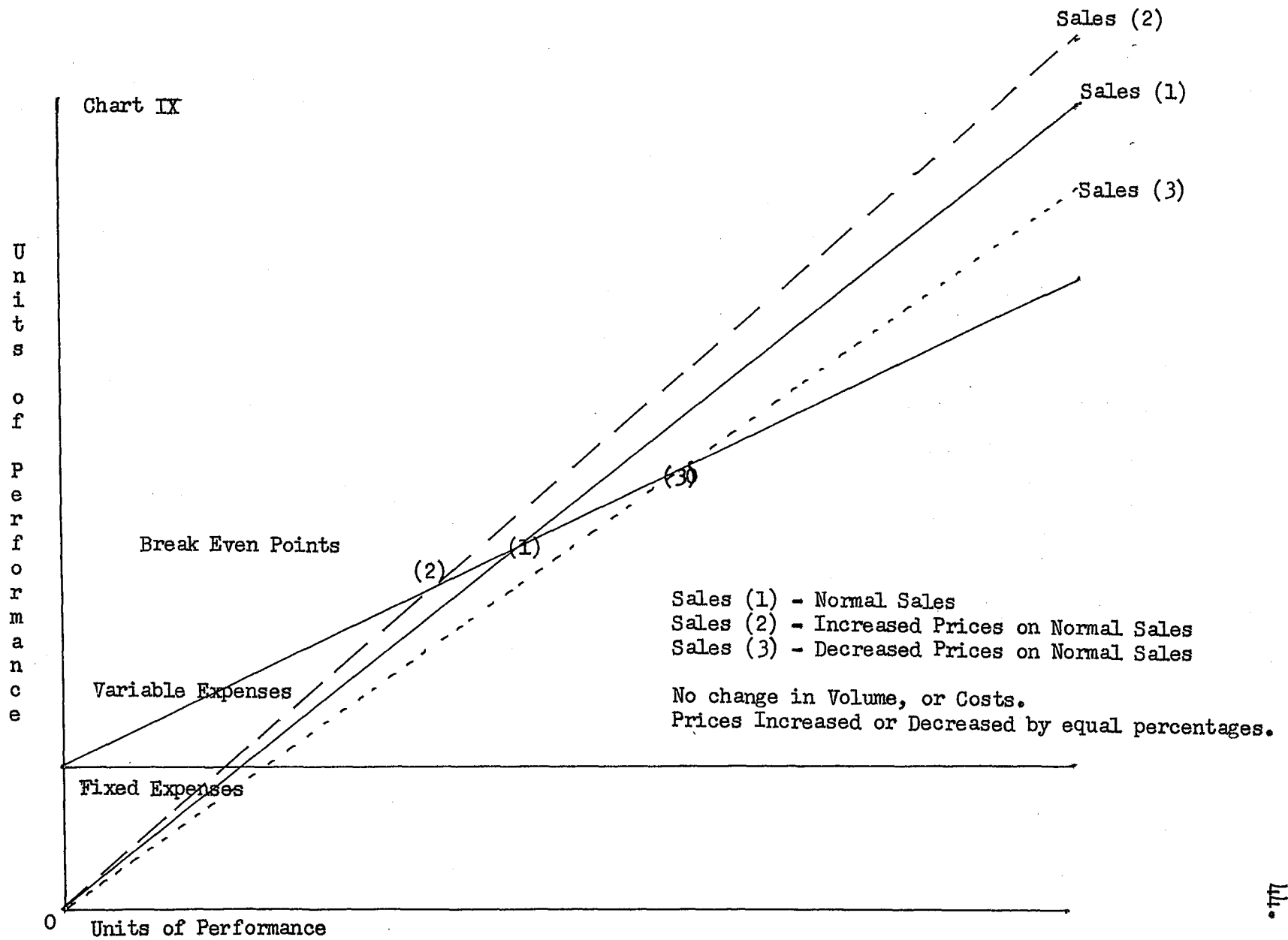
With reference to the marginal profit, that is the area expressed by the difference between the income line and the total costs line, the pickup above break even, the following is true.

When the marginal profit is small, changes in volume affect break even very little. Downward trends, however create a bigger problem of control because the variable items are so large that the normal reduction of the dollar of costs to the sales dollar is greater. In other words, if the marginal profit is small, the variable costs are high, and it takes more management attention and effort to reduce the variable enough to meet the decreased sales volume. If the volume should go up, profits will be effected very little, but should it go down sharply, the reduction effects performance materially because there are many more cost dollars to remove in order to compensate for the reduced volume.

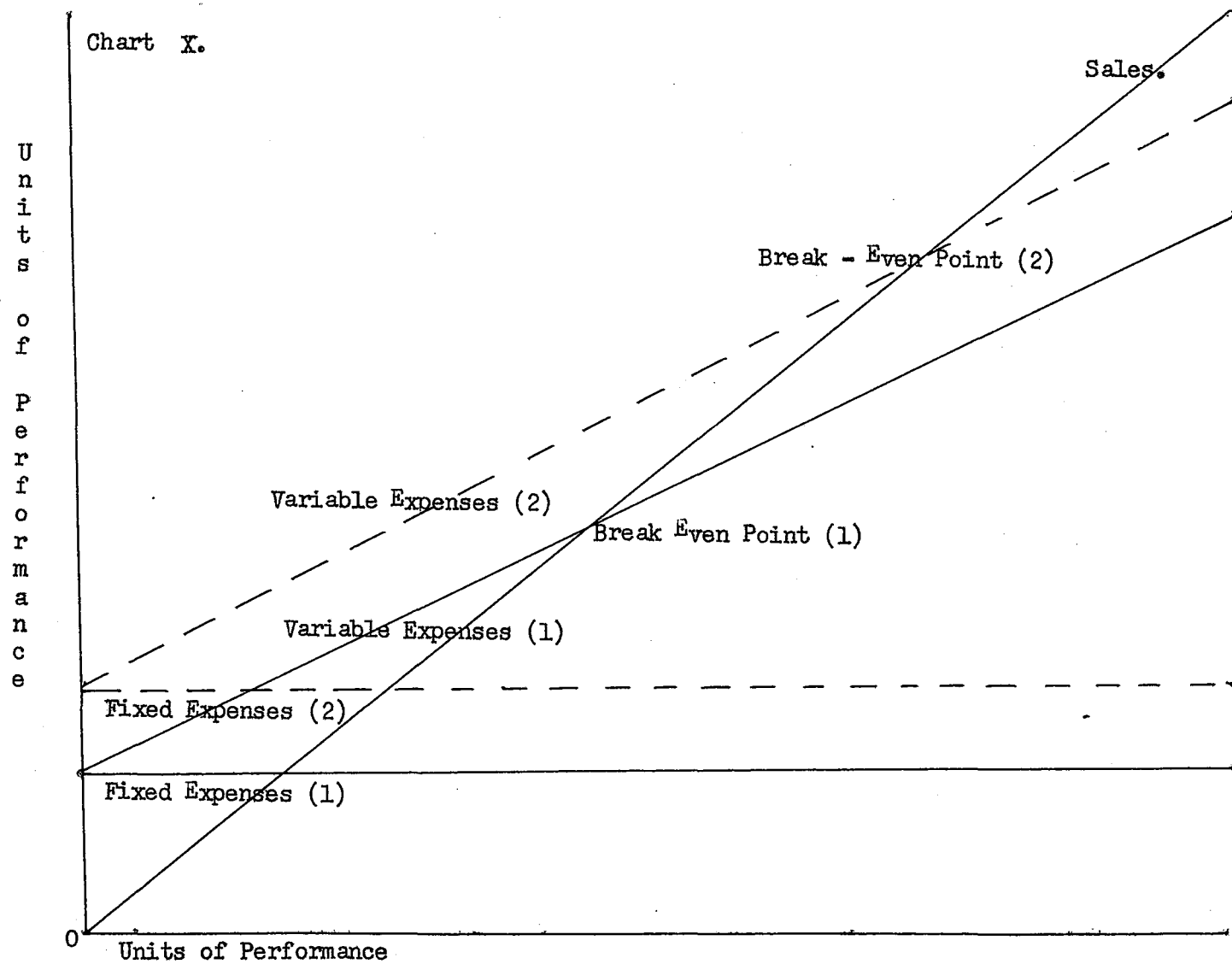
Firms with a high margin of profit, approximately 40% or more, have a break even point that is drastically affected by similar changes. Here the variable is not the high item of expense, and the pickup of profit with each item produced over the break even point is considerable;



Break Even Chart - Showing Effect of Changes in Variable Expenses upon Break Even and Profit.



Break Even Chart - Showing Effect upon Break Even Point of Price Changes, both increases and decreases.



Break Even Chart - Showing Effect of Changes both in the Standby (Fixed) Expenses and the Variable Expenses upon the Break Even Point.

e.g., 40 cents for each dollar of sales. A change in volume that removes this dollar of sales and the costs necessary to product it, materially effects both the profit and the break even point.

B. Selling Price Changes:

There are many times in the course of business operations when the topic of prices occupy the minds of management. Either setting prices on a new product, or raising or lowering of existing prices to compensate for external changes in the economy (recessions) or to meet the occurances of internal changes, (increased labor costs as a result of new contract). The use of break even data and plotting make it possible for management to determine the effects that proposed changes will have upon operations before they are put into effect. Thereby making it possible for management to eliminate many of the pitfalls and faults that result from faulty judgment because of insufficient facts improperly presented. In addition to noting the effects of price changes, both ascending and descending, the use of the B-E chart will assist in determining the exact amount that a price increase or decrease should be, in order to accomplish managements' aim.

As was mentioned earlier, in businesses where the variable cost relationship is high the effect of a price reduction upon profits is severe. In the case of a business where freight and material costs are a high portion of the high variable ratio, it must be remembered that an increase in raw materials or freight rates or both will have a serious effect upon earnings. Meat packing and the fertilizer industry are examples of this type of industry. *

Chapter VII

Break Even Application to the Jewel Bearing Industry

A. Outline of the Industry

The Jewel Bearing Industry in the United States consists of a few small producers, ranging in size from the single individual with a jewelers lathe in his basement to the factory employing fifty to seventy-five people. It is an industry that expands tremendously during periods of National distress, only to be dropped like the well known 'hot potato' as soon as the emergency ends. The industry exists in the narrow area between the volume production costs of its Swiss competitors and the duty imposed upon complete bearing imports. The Domestic industry is the producer of the small lot, the testing unit, the odd shaped low requirement bearings, and the special designs. Its materials are sapphire, diamond, glass and skilled labor. Its market is the instrument and meter manufacturers of the United States and the World. It is true that in the United States some watch companies notably, Elgin National Watch Company and Bulova Watch Company, have produced jewel bearings for their products, but beyond that the domestic production is limited as described above.

The jewel bearing is a precision made product, with tolerances such as .0001" being the rule rather than the exception. Work is performed by skilled men and women who have learned their skill from jewel makers before them. There is little in the way of production equipment in this country, the machines of the Swiss producers are not found in the United States. Undoubtedly the capacity to produce jewel

bearings lies within this nation, both in skill and in manufacturing ability, but the low operating margin given the domestic manufacturer has been a discouraging factor to the would be jewel producer. The rapid ups and downs of the industry has also been a deterrent to additional facilities being established. According to the Munition Board Sub-Committee of Jewel Bearings, the United States requires about 20,000,000 sapphire jewel bearings per year, of this total about 95% are imported units. Due to duty differentials, those producers of jewel bearings that still exist in this country, have become jewel setters, doing assembly operations and performing service functions for the ultimate user. The jewel bearing in order to be used in an instrument must be mounted in some type of holder, the adjustable screw or stud being the most common. In addition most firms that act as manufacturers and setters of jewel bearings also act as importers of jewel bearings from Swiss counterparts. However with the exception of a few cases, there is no inter-relation between the jewel bearing industry in Switzerland and the domestic producer in the United States.

The industry is one of general instability, of small size, and is a high labor cost producer. It is one of the most critical industries in the event of global war, or in the event the products of the Swiss are denied to the American instrument manufacturer. No ship could sail, no plane fly, without the accurate instruments, that depend upon jewel bearings for their operation.

A few jewel bearing manufacturers in the United States (4) manufacture a substitute for the sapphire jewel bearings, a glass unit. This bearing is used extensively in the lightweight moving element meters,

and instruments, such as voltmeters, ammeters, test equipment, all types of compasses, etc. This is a true domestic product and is free from the domination of Swiss producers, and being such has greatly alleviated the supply problem that faces users of jewel bearings. It also sells at from one third to one half the cost of a comparable sapphire.

B. Background of RICHARD H. BIRD & CO., INC.

One of the oldest and largest firms solely engaged in the jewel bearing field in the United States is RICHARD H. BIRD & CO., INC., of Waltham, Massachusetts.

Founded as a proprietorship in 1913 by Richard H. Bird, to serve the watch and instrument industry with special jewels and jewel mountings, the company grew and prospered through two wars and a major depression. In 1939 a partnership was formed with Randall P. Cameron of Lynn, Massachusetts, for the manufacture of Glass Vee Jewels, the proprietorship and the partnership were united in 1945 into a corporation under its present name.

As an indication of the rise and fall of this type of business, during World War II, this firm employed two hundred and fifty people on a two shift basis, 48 hour week, and within three months of the active end of the war, employment fell to less than thirty people on a single shift, 40 hour week. The demand for the product was still high, but the users could now reach the Swiss imports, that were denied them during hostilities, and the domestic industry fell by the wayside. A similar experience occurred during World War I, and those in the industry feel that it will happen again should war break out, or the foreign sources cut off, even temporarily.

At present the firm employs fifty-three people, including the owners, the President, Richard H. Bird, and Treasurer, Randall P. Cameron, one manager, one superintendent, and Assistant Treasurer in charge of Accounting and the Office routine, two attached to the office force and three on maintenance. Of the production force, ten are on Glass Jewel Manufacture, four are on Sapphire jewel production, seventeen on Jewel Setting, and twelve on Inspection operations throughout the plant.

C. Products

The products of the company consists of Sapphire, Vee, Ring and Cup Jewels, mounted and unmounted. Sapphire phonograph stylii, thread guides, and screw machine products incident to the production of jewel bearings for customers are also supplied. A complete line of Glass Bearings, Vee, Cup and Endstones are manufactured and mounted. Bor-Al-Sil (TM) Thread guides for the Textile industry are produced. In addition the company performs service operations, and does precision work of miniature parts for experimental work. RICHARD H. BIRD & CO., INC. has also acted as the official Government inspection agency on Federal Procurement of industrial jewel bearings for stockpiling operations.

The markets for these products are found in the manufacture of gauges, instruments, meters, both mechanical and electrical, indicating and recording types. The company does very little work for watch producers, concentrating instead upon the other fields. Sales are made by direct approach and individual selling efforts, no outside sales personnel are used. Export business is very small, a once flourishing sale to China ended with Export controls and Communist occupation of the territory.

The company imports for its own account from European sources, and

purchases considerable material from representatives of Swiss concerns located in the United States.

D. Break Even

In such an industry it is apparent that when the experience of time is placed on a semi-active status, and men with fewer years in the industry placed in operating control, the latest and still the simplest control methods be employed. It was on this basis that the management became interested in the advantages of the Break Even approaches to control.

For the purpose of illustrating the work of this concern and its managerial approach to the problem of control, it is well to note the physical limitations existing. The office force consists of the Assistant Treasurer, mainly concerned with bookkeeping and billing, etc., a secretary concerned with record keeping and correspondence, a shipping and receiving clerk, all under the supervision of the Manager, whose time is split between operating activities, sales, public relations, and managerial functions. The effective heads of the enterprise to whom the manager reports are the Treasurer and the President, who receive periodic reports of company data. Thus it is easy to see that any management controls that are to be used properly must be simple, and effective, capable of visual presentation, and immediate grasping of the ideas and thoughts contained therein. While the management of the company prepares other reports, such as budgets, cost ratios, sales programs, etc., this work is devoted to those reports and controls that surround Break Even data, and the facts that break even work makes apparent.

Generally we will limit ourselves to the year 1951, 1952, and 1953. Other years may be referred to because of some significant change that may have occurred to materially effect break even work, but the main illustrations will be taken from the above mentioned periods.

E. Application of Break Even Data to Operations

The initial step in planning break even data is the classification of accounts. The schedule of accounts of this company is as follows:

- Material, net costs - Beginning Inventory + Purchases - Final Inventory
- Direct Labor
- Supervision
- Maintenance Payroll
- Old Age Taxes
- Unemployment Taxes
- Group Insurance
- Liability Insurance
- Fire Insurance
- Depreciation of Buildings
- Depreciation of Machinery and Equipment
- Property Taxes
- Maintenance and Repairs
- Light and Power
- Heat
- Miscellaneous Factory Expense
- Water
- Medical Supplies and Services
- Shop Supplies
- Tool Expense
- Outside Manufacturing
- Officers' Salaries
- Office Salaries
- Accounting and Legal Fees
- Depreciation of Furniture and Fixtures
- Miscellaneous Office Expense
- Telephone and Telegraph
- Postage
- Traveling Expense
- Automobile Expense
- Stationery and Supplies
- Advertising
- Donations
- Dues and Subscriptions
- Taxes - Federal
- Taxes - Commonwealth of Massachusetts

The accounts are typical and the usual items that would occur in a Statement of Cost of Goods Sold.

The classification of these accounts for the purpose of Break Even Analysis is as follows:

Constant Expenses: - (Time Costs)

Fixed:

- Fire Insurance
- Liability Insurance
- Depreciation on Building
- Depreciation on Machinery and Equipment
- Depreciation on Furniture and Fixtures
- Property taxes, real estate
- Maintenance and Repairs (1)

Regulated:

- Supervision, Salaries
- Executive Salaries
- Accounting and Legal Fees
- Travel Expense
- Advertising Expense
- Donations
- Dues and Subscriptions
- Sales Discounts
- Office Salaries (1)

(1) Items that can be split into segments that are related by time and volume costs, but for the purpose of simplicity are left in a single category.

Variable Expenses: - (Volume Costs)

- Direct Labor
- Materials
- Old Age Taxes (1)
- Unemployment Taxes (1)
- Group Insurance (1)
- Light and Power
- Heat
- Miscellaneous Factory Expense

(1) See explanation above

Medical Supplies and Services
Water
Tool Expense
Shop Supplies
Miscellaneous Office Expense
Telephone and Telegraph
Automobile Expense
Stationery and Supplies
Outside Manufacturing
Maintenance Salaries (1)

With the expense items classified the way we desire it is possible to proceed into the actual determination of break even. In the above classification there may be noted some variances from the ideal mentioned earlier, however in applying any program to a specific enterprise some compromises and adjustments must be made. No general approach is tailor-made to suit a definite industry or company, Thus, while Maintenance and Repairs is listed as a Fixed Constant (Time), the salaries of Maintenance personnel are listed as a Volume cost, or variable expense. The thinking here is that regardless of the production, it is necessary to keep the area and the property in constant repair in order to protect the investments already made. These repairs would have to be made, and in the event company personnel were not available, outside facilities would be used. Thus the cost of Maintenance and Repairs becomes a Fixed Item. While the salaries paid to Maintenance personnel within the plant exist only because of the demands placed upon them for services by the production departments and productive personnel. The degree of overlapping of costs and charges is ignored by management here, unless there should be an item of major repair that would require special attention; e.g., a new roof, etc., or a major change in the productive area that would

(1) See explanation previous page

throw the account all out of line. Limitations on personnel and time affect the number of judgments of this nature that will occur, they are purposely kept to a bare minimum, but nevertheless they do exist. It must be borne in mind that the idea of break even is to present a picture, an accurate one that can be relied upon, however it is not a detailed map, and is not intended to be one. That purpose is left to conventional accounting methods and presentations.

In the classification of accounts, the Tax expenses, due the Federal Government and the Commonwealth of Massachusetts are left out, intentionally. They of course, are variable items, however in plotting our break even data we wish to note the effect of these taxes on operations, and this can best be done by plotting the complete chart without taxes and adding the taxes to show the effect upon break even. This is not necessary or common, but is just one more example of the possible adaptations that occur when a general program is applied to the desires and performances of an individual concern.

Here it might be well also to note that in planning operating budgets and quota for the coming year, this company plans its break even on a specific profit figure, with the taxes that would be present if that budgeted profit were earned.

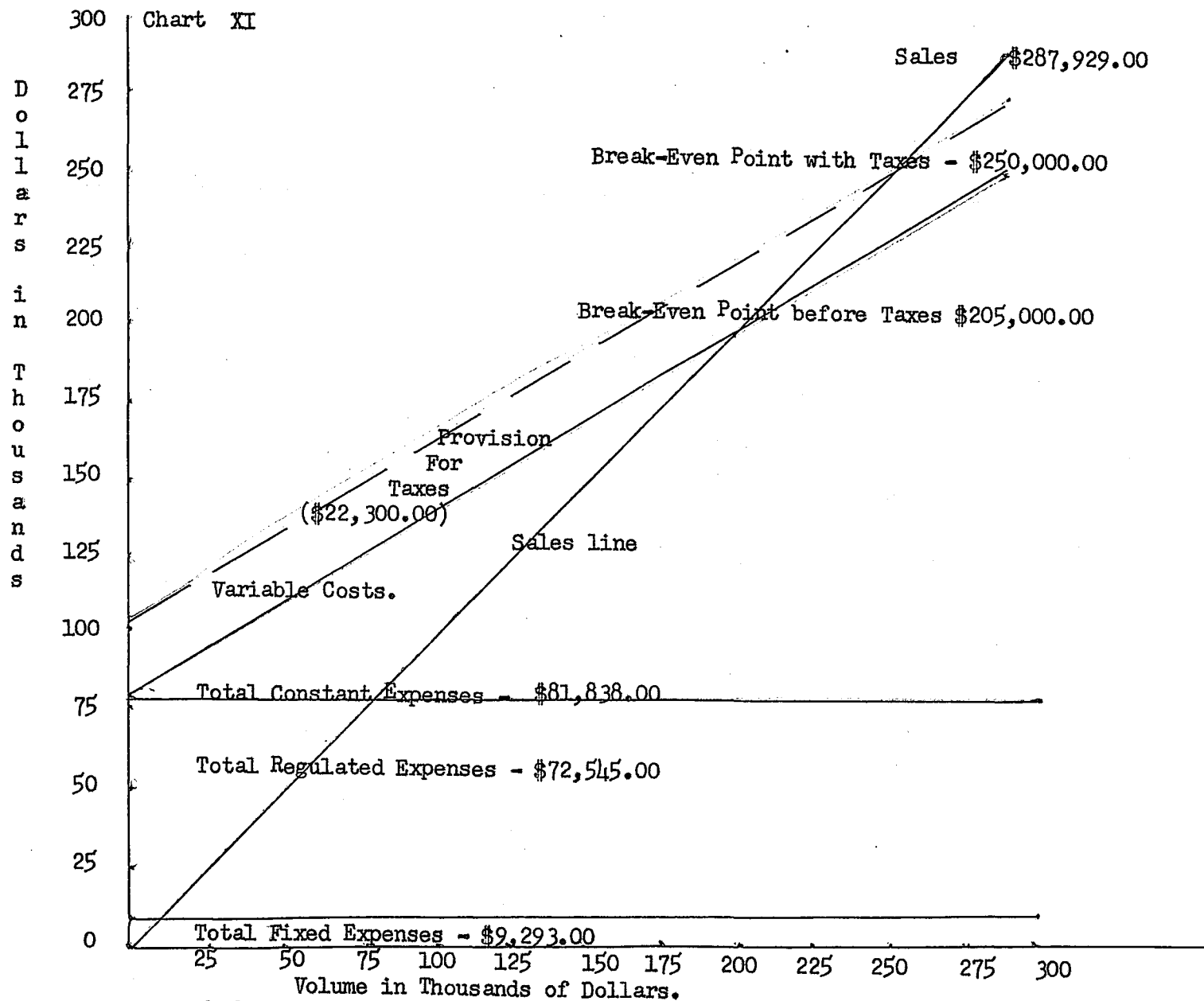
Break even data at RICHARD H. BIRD & CO., INC., is reviewed and altered if necessary every quarter. This method is used so that the management can take steps quick enough, and take the proper ones to meet current and future conditions. Conventional accounting statements are prepared semi-annually by Certified Public Accountants employed by the Directors of the company for that purpose.

The three years chosen, represent one year that is totally complete, books completely audited and certified correct, (1951), a second year that represents immediate past performance, but the records for this year (1952) are not yet audited. While the last year (1953) represents a budgeted year and a prospective break even chart for the year. For each of these years a Break Even chart in dollar volume, and in time basis is planned, as well as detailed statements as to product mix, and performance, with explanations of variances and important accounts.

F. 1951

In 1951 the company enjoyed a very good year on sales, the total amounting to \$287,929.75. This represented a substantial increase over the previous year and was basically attributable to the increased sales efforts of the management and the effect of the increased need for instrumentation in the semi-military economy. In Chart No. XI the break even data is plotted, using the methods described earlier.

From this chart it can be seen that in 1951, the company attained its B-E point before consideration of taxes at \$205,000.00. The profit pickup after this point was reached, was at a level of 45.2%. Or expressed in another manner for every \$100.00 sales volume after break even the company attained a gross profit of \$45.20. Following the chart again, the break even point considering taxes, both due the Federal Government and the Commonwealth of Massachusetts, rose to \$250,000.00, and the profit pickup decreased to \$17.70 per each \$100.00 of Sales above B-E. Thus taxes took \$27.50 of each \$100.00 earned once all constant expenses were covered.



Break Even Chart - RICHARD H. BIRD & CO., INC. - 1951

The computation of Profit Pickup (or Loss) is accomplished in this manner.

Total Sales:	287,000.00	
Less B-E Point	205,000.00	
	(a) \$ 82,000.00	- Amount of dollars

earned once the break even point is passed, or the amount of sales after B-E.

Total costs incurred:	250,000.00	
Less B-E point	205,000.00	
	(b) \$ 45,000.00	- Amount in dollars

of costs incurred in obtaining the additional sales after B-E reached.

Since at Break Even all Constant Costs are covered, the only items of costs remaining to be incurred are volume costs, variable items. And as in this case \$45,000.00 was the variable incurred in obtaining the \$82,000.00 sales, by dividing (b) by (a) we obtain the percentage of each sales dollar represented by variable costs, or 54.8 cents. This leaves 45.2 cents per sales dollar for a gross margin.

Going along further with the same line of reasoning, we note that with regard to taxes:

Total Sales:	287,000.00	
Less B-E with Taxes:	250,000.00	
	(c) 37,000.00	

Total Sales:	287,000.00	
Total Expenses with taxes:	265,000.00	
	(d) 22,000.00	

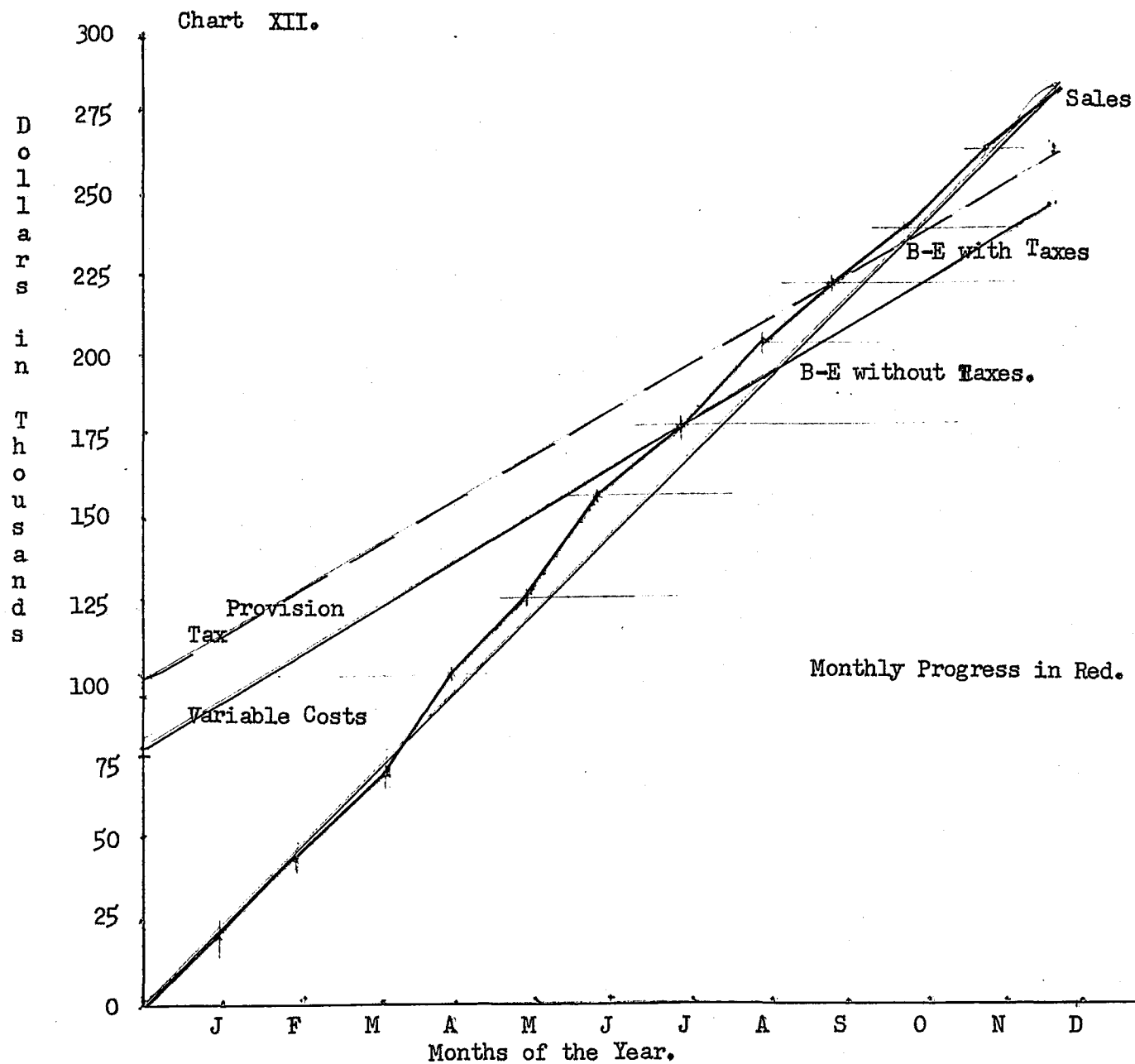
To determine the proportion of the gross earnings that was tied up in taxes divide (d) by (c) and it is found that 59.5% of the money available after the variable expenses were covered, went for taxes. This means that of the Sales dollar after Break Even of 205,000.00 was divided into three parts, 54.8 cents to cover variable

expenses, 27.5 cents to cover all taxes, and 17.7 cents for a net profit per sales dollar after B-E.

It might be well to compare here these figures with the actual accounting data for the same period. The taxes, both Federal and Commonwealth, paid by this firm for the year ending December 31, 1951 totaled 22,780.00, broken down to 19,631.00 Federal and 3,150.00 Commonwealth. The dollar volume after initial break even was \$82,000.00; the chart and the figures derived from it show that of these dollars 27.5% were to cover tax liability, this percentage amounts to a dollar figure of \$22,550.00.

Profitwise the company ended the year with a transfer to surplus of 20,779.00, the computations available from the chart show that the anticipated profit could be about \$15,000.00. The amount of deviation here is accounted for by referral to the operating statements of the company and its income from non-operating sources, as well as deviations anticipated by the rounding off of all computations and making the profit percentage a balancing one. Despite the variances, the value of the chart and its functions is well illustrated.

Chart No. XII, illustrates the same year and data, except that the horizontal base is calibrated in months rather than in dollars. Showing that the break even point prior to taxes was reached during the month of August, roughly in the third week. The B-E level for the operations including taxes was reached two months later in October. So that portrayed in this fashion, it can be seen that only after October did the company begin to earn any return for its stockholders, or earn any money that could be retained in the business. After October and the



Break Even Chart - RICHARD H. BIRD & CO., INC. - Monthly Progress toward Break Even - 1951.

passing of the second B-E point, the company returned to a marginal profit of 45.2 cents per sales dollar, reverting back to the ratio that existed if no taxes were incurred at all.

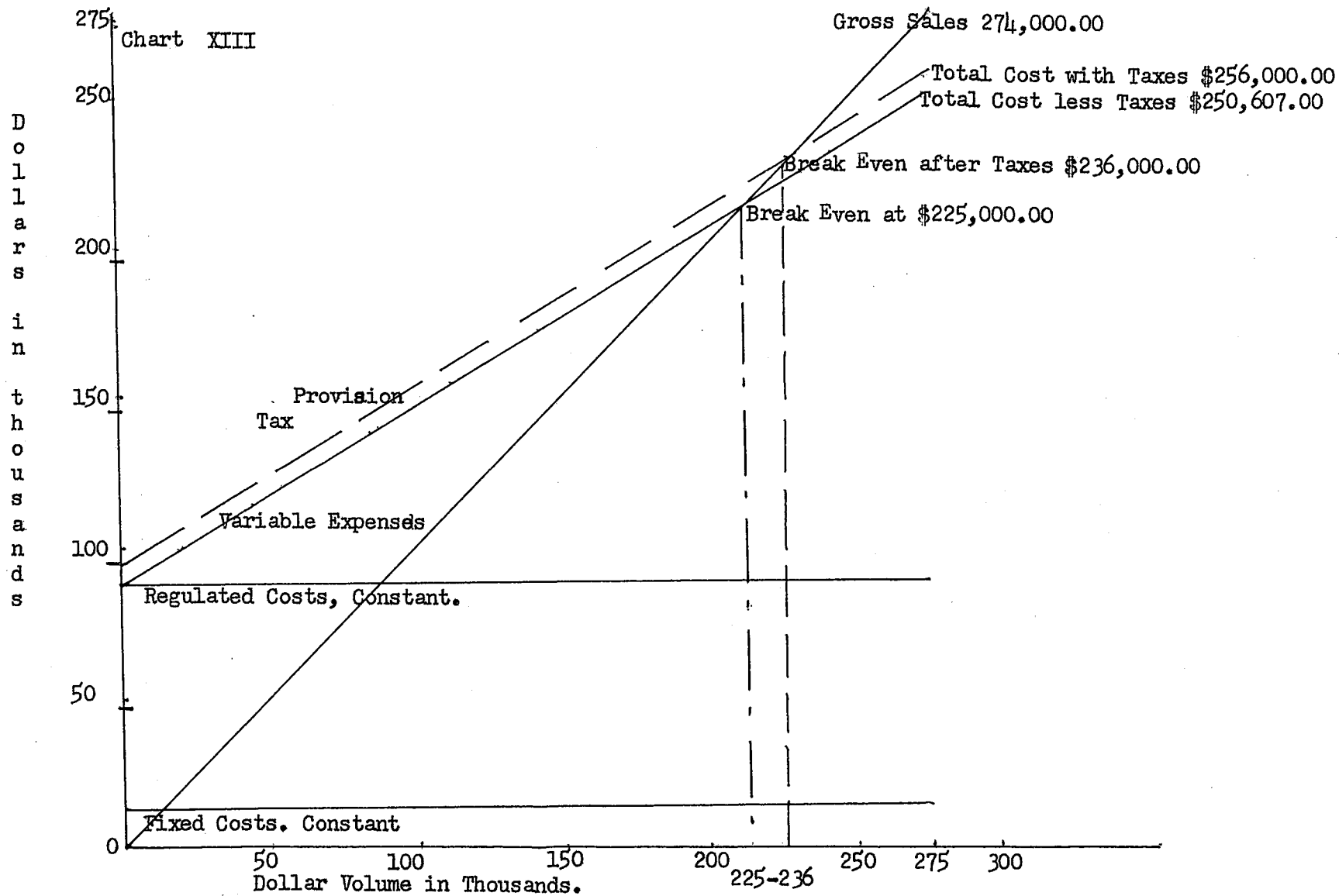
These charts also show that Break Even was achieved at 71.4% of yearly capacity.

A Profit Path for this same period would show a slope line of +3.58.

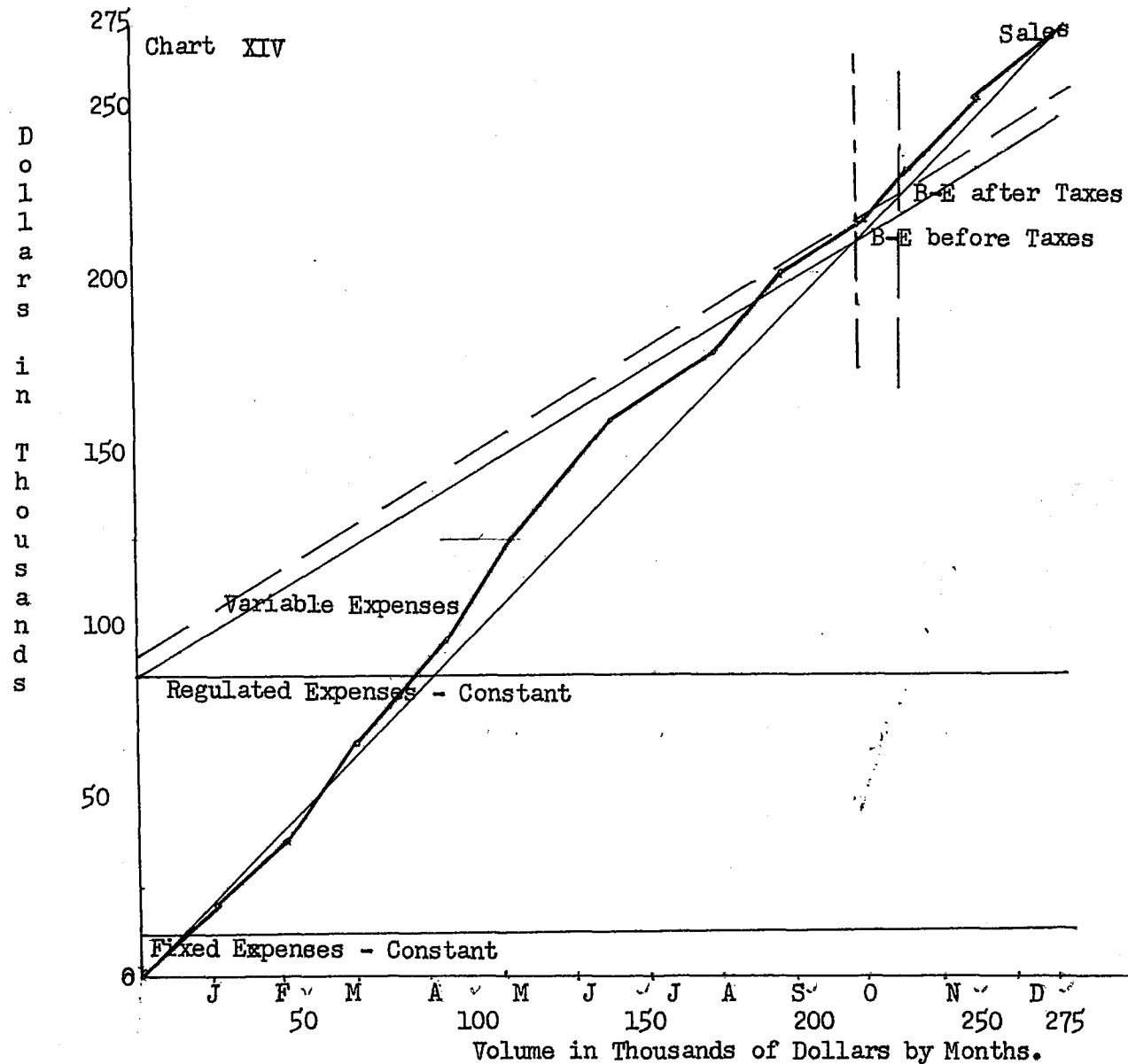
The analysis of the component factors of costs and their role upon the entire profit picture and the break even point will be shown later, once the picture for 1952 and the proposed picture of 1953 are shown in a manner similar to that of 1951. It is essential for the entire presentation, that not only the break even points for the various years be determined, but that the product mix, and how it affects margins be known, and also that an analysis of the variable expenses be made so it can be clearly shown to management where and what steps must be taken to accomplish varying purposes. Knowing Break Even is not even half the battle, it is far more important to know what can be done to lower or change it so that the company continually prospers despite fluctuating conditions both external and internal.

G. 1952

1952 is represented by the charts on the following pages, Chart No. XIII and XIV. From the basic break even chart we see that the initial point was at a dollar volume of \$225,000.00. Following the analysis given for 1951, we note that this year the operations broke even at 78.4% of total sales, and also that of the dollar sales after break even 53% was devoted to covering Variable expenses, and that 47% was left of each



Break Even Chart - RICHARD H. BIRD & CO., INC. - 1952



Break Even Chart - RICHARD H. BIRD & CO., INC. - 1952 - Monthly Progress toward Break Even.

dollar for gross margin. It is estimated that at the present tax levels, that 14% of the total dollar margin of profit will go for taxes, leaving 33% for a net gain after break even and taxes. This compares with 17.7 cents in 1951. The main reason for the big difference here is the Excess Profits Section of the Internal Revenue Code. In 1951 the company was subject to the provisions of Excess Profits and in 1952 will avoid the added taxation under this section.

However a closer examination of the two charts picturing the two years, shows other considerations that face management; e.g., with a \$10,000.00 decrease in sales volume; why the great drop in gross profit from 40,000.00 to 22,000.00? Why the increase in relative capacity break even points, from 71.4 in 1951 to 78.4 in 1952? What steps can be taken to modify and change these conditions? How about the drop in the variable cost per sales dollar after break even from 54.2 in 1951 to 53.0 in 1952; this drop was not too significant, how can it be greater in 1953? These are typical of the questions that break even charts point up, and request answers for. The chart proposes management must dispose. The second chart XIV shows the progress toward Break Even on a monthly basis.

In answering some of the questions proposed by the variances noted in 1951 and 1952, management must examine its Product Mix, and its fixed costs. For it has been stated by H. T. McAnly that "Break Even points can only be reduced by increasing the contribution of margin above variable cost and/or reducing fixed expense". * It is the first of these two items that we will examine to determine the

gross profit variance mentioned in the previous paragraphs between 1951 and 1952, with the relatively low difference in gross sales.

We note that in the sales dollar in 1951 and 1952 there is very little difference in the variable ratios assigned. However this does not exclude variable costs from examination. The type of industry and its manner of operation forces management to examine all items, and in particular the Product Mix, of Glass and Sapphire Sales, the two main products, to determine the effect each one has upon ultimate profit. This is done for the three years in comparative tables that follow.

H. Projection into 1953:

Before taking a detailed Product analysis and the contributions to profit of the two main lines of business, let us complete the three year picture by examining the 1953 projection. Bear in mind that the year 1951 was totally complete, the break even charts and data could be cross checked with audited figures. In 1952 computations, the final figures are just computations and cannot be positively checked as the final audit is not complete at this writing. As a consequence it is only possible to estimate the gross profit, and the taxes; it also follows that the gross margin pickup after break even is also an estimate, to be proved later. In looking into the future in order to plan a total break even chart for 1953, we are faced with constant estimates and budgetary guesstimates.

The plan followed by the company under consideration runs as follows. Initial act is to determine as accurate as possible the amount of business that will be done in the coming year. This basic market analysis is accomplished by evaluating the orders on hand, the prospective

accounts, and the possibility of new accounts. Another factor is determining what proportionate share of the total business available will come to Waltham. A third factor is the capacity of the present plant. In planning the sales estimate all three factors play important roles. The capacity of one department on a straight time forty hour week is tentatively set at 100,000 bearings per week; this totals 5,000,000 per year on a fifty week year. Examination of past performance shows that this department has been called upon in the past to produce for sale in 1951, 3,250,000 pieces and in 1952, 3,400,000 pieces. The presentation of a new product, and the adaption of present lines indicate that in 1953, the department will be called upon to produce approximately 4,500,000 units. Two factors are present here, the increased amount of instrumentation in the nation and its increase that comes to Waltham, and the internal fact that this department began 1953 with a very low inventory. Normally six weeks stock is carried, however less than two weeks stock was on hand at the end of 1952. The company has earned a reputation for rapid service and this can only be retained by the maintenance of adequate inventories.

The quota for the first department sets the goal for the second area, the Inspection Department, and inasmuch as it provides the Setting Department with approximately 60% of its work, the initial estimate carries throughout the entire factory. The material so far has been on the Glass products, which as previously mentioned is a totally domestic product. In addition it is necessary to estimate the amount of sapphire manufacture, of sapphire jewel sales and of sapphire jewel mounting that will be done. Past records indicate that at the present level in the

general economy the company may expect sales here to reach about \$100,000.00. It is difficult to ascertain exactly how this work will be distributed; these sales include a heavy share of material costs, which is not shared with other products. However from a production view it is essential that personnel be provided to handle the mounting of at least 10,000 sapphire jewels per week.

The next step is to determine the amount of dollar sales that may be realized as a result of these operations. Since we estimated the sapphire sales in dollars, it is only necessary now to evaluate the Glass revenue. Feeling that prices generally will hold the line during the coming year, and that sales will reach 4,000,000 bearings at an average cost of \$5.00 per C, we arrive at a total Glass revenue of \$200,000.00 for a total revenue of 300,000.00 for the entire plant. Revenue from Glass included the revenue from the mounting of glass products.

Then follows the analysis of the expenses that will be incurred to obtain this sales volume. The amount of labor needed is based on the individual needs of each department as determined by conferences between the Manager, Superintendent and foremen of the departments. The material costs are based on past use, and the anticipated purchases of Swiss jewels to meet the estimated sapphire jewel sales. Individual department budgets for labor are planned and detailed, both as to number of people and wherever possible actual rates to be paid are listed against each employee. Total wage payments are listed, regular pay, holiday pay, vacation pay, bonus pay, etc. are included. As labor is the main item in the costs of this company, more attention is paid to this item than

to others, that in other firms may rank very high in the cost analysis. A glance at the tables listing the major expense classifications will show clearly the importance of wages to the company in relation to other items. After budgeting for labor and other wage plans and groups, Executive salaries, maintenance salaries, office salaries, etc.; the other expense items are classified according to the account classification mentioned earlier. The accounts assigned are reviewed with the President and Treasurer, wage rates approved, amended or changed to be in accord with top level thinking and the break even data prepared. The table on the following page presents the 1953 Expense Budget.

Chart XV shows the general Break Even chart data for 1953, based upon the estimated sales of 300,000.00. It shows Constant Fixed Expenses at \$9,452.00 and Constant Regulated Expenses at \$81,570.00 or a total constant expense of \$91,022.00 for the year. Horizontal lines are constructed at these points to indicate this information. The sales line is constructed to show the proposed sales of 300,000.00. The total expense line showing the variable expenses is shown by the line running from the total constant expense point to \$276,300.00 (the total of all expenses). As shown by the chart the expense line intersects the sales line at the Break even point, \$237,500.00. By formula the Break Even Point is mathematically computed to actually be \$237,650.00, but it must be remembered that break even is not an exact tool regardless of computation by graph or formula.

There is much more information available from this Chart of 1953. The estimated profit pickup after break even is computed at 43.2 cents of each sales dollar. This would indicate a profit of \$26,990.00

1953 Budget Breakdown for Break Even Plotting

Constant Expenses - Fixed:

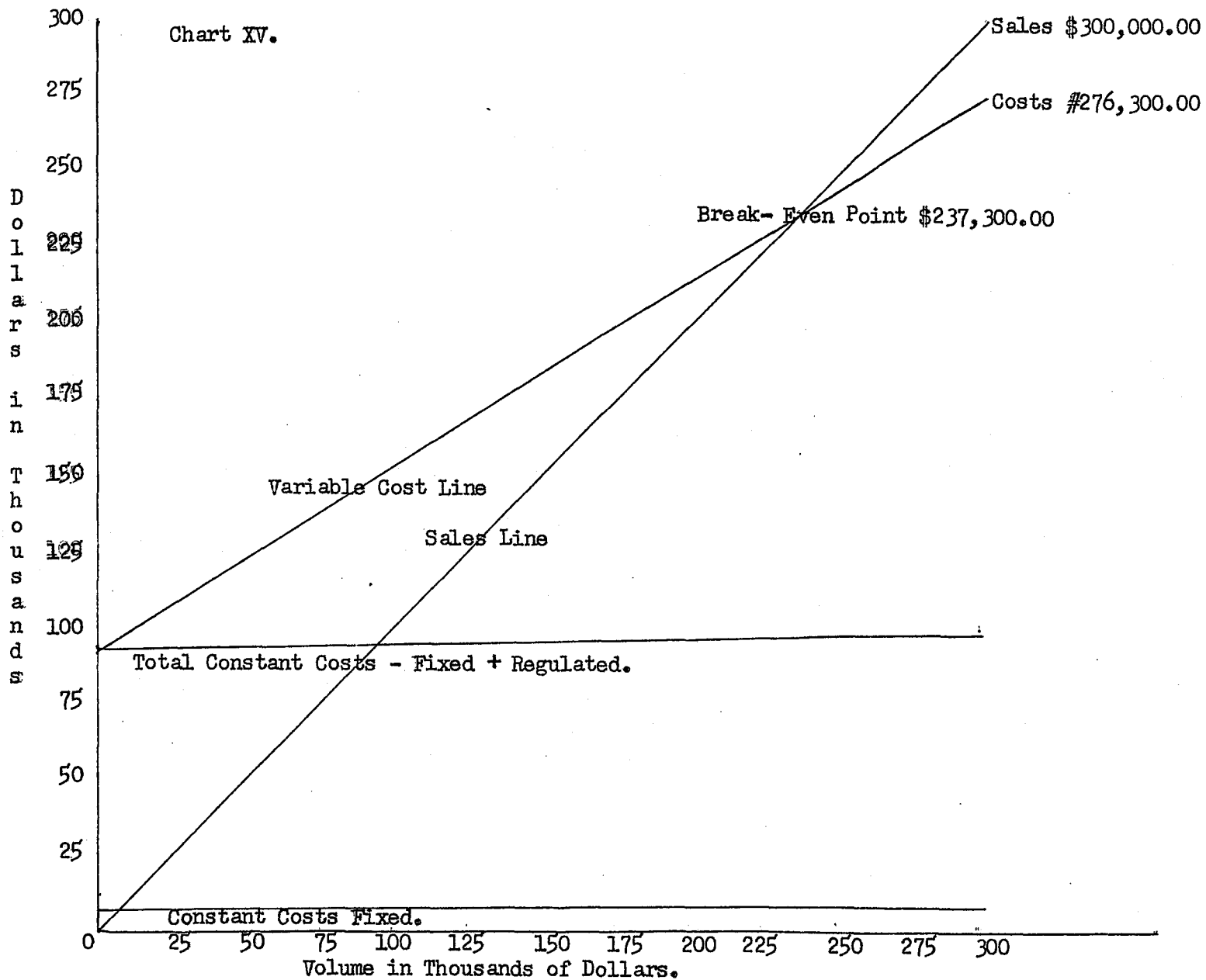
Fire Insurance	2,200.00	
Liability Insurance	400.00	
Depreciation on Bldg., 1 Spruce	402.60	
Depreciation on Mach. & Equip.	2,600.00	
Depreciation on Furniture & Fixtures	400.00	
Property Taxes, Real Estate	450.00	
Maintenance & Repairs	<u>3,000.00</u>	9,452.60

Constant Expenses - Regulated:

Executive Salaries	48,620.00	
Supervision Salaries	18,200.00	
Accounting & Legal Fees	1,500.00	
Traveling Expenses	1,500.00	
Advertising Expenses	4,500.00	
Donations	750.00	
Dues & Subscriptions	500.00	
Office Salaries	3,000.00	
Sales Discounts	<u>3,000.00</u>	81,570.00
		91,022.60

Variable Expenses:

Direct Labor	108,037.90	
Materials	50,000.00	
Old Age Taxes	2,100.00	
Unemployment Taxes	3,750.00	
Group Insurance	3,000.00	
Light & Power	1,050.00	
Heat	560.00	
Misc. Factory Expense	3,000.00	
Medical Supplies & Services	625.00	
Water	60.00	
Tool Expense	350.00	
Shop Supplies	450.00	
Outside Manufacturing	1,250.00	
Maintenance Salaries	7,356.40	
Misc. Office Expense	150.00	
Telephone & Telegraph	1,200.00	
Automobile Expense	1,000.00	
Stationery & Supplies	600.00	
Postage	<u>750.00</u>	
Estimated Sales:	300,000.00	185,289.30
Estimated Profit:	25,000.00	<u>276,311.90</u>
Estimated Taxes:	10,000.00	
Break Even at:	237,500.00	



Break Even Chart - RICHARD H. BIRD & CO., INC. - 1953 Estimated.

for the year. A gross profit of this amount under present tax rates would result in a combined Federal and State tax of \$14,300.00, leaving a net profit of \$12,690.00, this amount is indicated in the chart by the area that is shaded.

The chart also indicates that the amount of variable expenses attributable to each sales dollar is 56.8 cents. A tabulation of similar data for the three year period 1951-1953 reveals the following:

<u>Year</u>	<u>Variable costs per sales dollar:</u>
1951	54.8 cents
1952	53.0 cents
1953	56.8 cents - estimated.

The chart also indicates that this company will reach its break even level at 79% of total sales, for the three years this figure ran as follows:

<u>Year</u>	<u>Break Even as a Percentage of Total Sales</u>
1951	71.4 %
1952	78.4 %
1953	79.0 % - estimated.

The data shown in the two short tables above gives excellent indications of the value of break even analysis. It now becomes managements duty to explain the reason for the rising level of break even in view of the sales volume, and to explain the reason for the constant increase in variable costs. How this explanation is accomplished in this particular company is by an examination of the items that make up the break even structure. First a breakdown of the major expense classifications is obtained and the data disclosed analized and appraised.

Here again it is well to mention that individual attention is paid to Wage costs, as they are a very major item of expense. The material account is rechecked, and the variances of significance noted in the expense items of the other classifications. For while it is true that the projected level of break even is 79% of total sales, in 1953, of the total sales dollars 61% covers variable items, 30% covers Constant Expenses and 9% remains as the gross profit. Each item must be treated individually as an expense and each classification collectively in appraising its contribution to the company.

The table on the following page shows the proportions of expenses as related to total sales for the three years, 1951, 1952, and 1953. The pages following present a detailed statement of the accounts and the expenses attributed to each in the periods noted. Explanations and reasons for variances are detailed as they are deemed necessary. The reasons given are the same as those presented to top management, at the time this data is prepared annually.

Ratios of Cost Factors to Total Sales

Variable Costs per Sales Dollars:

1951	59.5 %
1952	61.8 %
1953	61.0 %

Constant Regulated Costs per Sales Dollar:

1951	25.2 %
1952	27.8 %
1953	27.2 %

Constant Fixed Costs per Sales Dollars:

1951	3.2 %
1952	4.2 %
1953	3.15 %

I. Analysis of Cost Factors:

Table No. 4 lists the variable expense items during the three years. These are the figures used in setting up the Break Even charts presented earlier in the Chapter.

Upon examination it becomes evident that the major items here are Direct Labor and Materials. The degree of variance between the years in these accounts accounts for the differences noted in the totals for the years. Some of the other accounts show variances, some of which are attributable to reclassification of individual expenditures; i.e., from Miscellaneous Factory Account to Shop supplies, a more accurate accounting for the expenditure. Outside Manufacturing is work that is performed by an outside machinist on Bird machines, using Bird materials and tools. This account was not necessary when the firm employed its own full time machinist for experimental work. Generally, however, the average accounts run true to form, the big jumps and drops are in the Materials and Direct Labor accounts.

The drop from \$102,138.00 to \$84,616.00 on the Direct Labor was due to a rescheduling of orders late in 1951, which carried over into the greater part of 1952. At this time it was the policy of the company to reduce its inventory of finished products and until late in 1952 it was not necessary to increase the work force to meet quotas. In October of 1951 twelve people were dropped from the payroll, and in October of 1952 three more. There were other separations during the year but very minor and infrequent. However, late in 1952, in December, six additions were made, and in January of 1953 seven more were employed. Of this new group only eight of the thirteen were retained as applicable

Table 4.

Breakdown of Variable Cost Factors by Account and Year

Account	1951	1952	1953
Direct Labor	102,138.00	84,616.00	108,037.00
Materials	44,498.00	60,171.00	50,000.00
Old Age Taxes	1,919.00	1,676.00	2,100.00
Unemployment Taxes	3,648.00	3,179.00	3,750.00
Group Insurance	3,309.00	3,690.00	3,000.00
Light & Power	1,010.00	989.00	1,050.00
Heat	564.00	603.00	560.00
Misc. Factory Expense	4,157.00	3,073.00	3,000.00
Medical Supplies & Services	590.00	772.00	625.00
Water	64.00	60.00	60.00
Tool Expense	316.00	678.00	350.00
Shop Supplies	445.00	294.00	450.00
Outside Manufacturing		1,535.00	1,250.00
Misc. Office Expense	148.00	168.00	150.00
Telephone & Telegraph	1,050.00	1,213.00	1,200.00
Automobile Expense	582.00	751.00	1,000.00
Stationery & Supplies	88.00	944.00	600.00
Postage			750.00
Maintenance Salaries	6,898.00	6,815.00	7,356.00
TOTALS:	<u>171,424.00</u>	<u>171,227.00</u>	<u>185,289.00</u>
			* Estimates on each item.
Variable costs per Sales Dollar after Break Even	54.8 cents	53.0 cents	56.8 cents
Variable Costs per Total Sales	59.5 %	61.8 %	61.0 %

to jewel bearing work. Thus while in 1951 there were approximately 40 direct labor workers, during the greater part of 1952 only 30 were employed in the same capacity. The projection for 1953 indicates that there will be approximately 36 to 40 on the direct labor payroll. It is interesting to note that while in 1951 the work force was greater than at present, the amount of work produced today exceeds that of the earlier date by 8 to 10%.

The Material costs for any particular year are directly related to the amount of Sapphire sales for the period. Thus in 1951 with sapphire sales of \$87,251.00 materials totaled \$44,498.00 while in 1952 with sales of \$96,114.00, the materials account equaled \$60,171.00. The figures for materials are obtained by adding purchases of materials to the beginning inventory, and subtracting the final inventory for the period. While not all materials are assigned to sapphire sales, the purchases of sapphire jewels and materials constitute the greatest single category with the Material's Account. The projection for 1953 follows very closely the trend established in earlier years in assigning a value to this item.

J. Constant Costs:

Fixed:

Table No. 5 lists the Fixed Constant costs items in a similar manner as the variable were previously listed. This area is very critical in attacking the problem of how to lower the break even point of operations. These costs form the base upon which other cost factors are built. Under the type of classification used by the author, constant costs are covered in two sections. The first of these

Table 5

Breakdown of Constant Cost Factors by Account and Year

Fixed Costs:

	1951	1952	1953
Fire Insurance	2,109.00	2,762.00	2,200.00
Liability Insurance	369.00	253.00	400.00
Depreciation on Buildings	402.00	402.00	402.00
Depreciation on Machinery & Equipment	1,755.00	2,365.00	2,500.00
Depreciation on Furniture & Fixtures	318.00	381.00	400.00
Property Taxes, Real Estate	433.00	344.00	450.00
Maintenance & Repairs	<u>3,907.00</u>	<u>5,229.00</u>	<u>3,000.00</u>
TOTALS:	<u>9,293.00</u>	<u>11,736.00</u>	<u>9,452.00</u> * Estimates
Ratio of Fixed Constant Costs to Total Sales:	3.2%	4.2%	3.15%

sections is the fixed items. Upon examination there is very little to be learned from this account in the way of expense reduction. The only account that allows much maneuvering is the last one, Maintenance & Repairs. This account is subject to criticism, but its location was explained earlier, and if one concedes that no repairs were made that were not necessary there is little that can be cut from this item in the future. The rather heavy amount spent in 1952 was due to a revision in the first floor plan and was a non-reoccurring expense, and no provision was made for it in the future.

K. Constant Expenses:

Regulated Expenses:

Again we remain in an area that greatly affects the position of the break even point in our operations. Regulated expenses. Those that are set by executive decision and remain at the decided level until altered by subsequent executive edicts.

Of the items listed here those that show constant increase are, Supervision Salaries, Travel Expenses, Advertising and Donations. Of this group Supervision Salaries shows the greatest increase of slightly under \$5,000 for the three year period. Adjustments in the salary level of these employees was considered advisable by top management, due to the increased complexity of the operations of the business and the increased responsibility placed on these individuals due to the desires of the owners to be relieved of the constant day-to-day decisions that are necessary to successful operations.

The increases in Advertising and Travel Expense, go hand in hand; they were made for the same purpose, to put the company's story

Table 6

Breakdown of Constant Costs by Account and Year

Regulated Costs:

Account	1951	1952	1953
Executive Salaries	47,920.00	48,145.00	48,620.00
Supervision Salaries	13,960.00	15,732.00	18,200.00
Accounting & Legal Fees	1,215.00	1,493.00	1,500.00
Travel Expense	947.00	1,085.00	1,500.00
Advertising Expense	1,749.00	3,494.00	4,500.00
Donations	100.00	530.00	750.00
Dues & Subscriptions	503.00	731.00	500.00
Office Salaries	2,937.00	2,776.00	3,000.00
Sales Discounts	3,214.00	3,178.00	3,000.00
TOTALS:	<u>72,545.00</u>	<u>77,164.00</u>	<u>81,570.00</u> * Estimates
Ratio of Constant Regulated Costs to Total Sales:	25.2%	27.8%	27.2%

before as many eyes as possible. The products are strictly limited in appeal and all advertising must be concentrated and selective if it is to be of value. It is felt that the present company budget allows for adequate coverage of the prospective market, without complete saturation in any one medium. Travel is considered vital, as the actual personal contact with customers has been found to be most satisfactory, to cement relations, and to keep abreast of the trade information and trends. Also it should be brought out that while the company is located in Massachusetts, the bulk of its customers lie west of New York, and for the most part are concentrated in the Mid-West. Recently the instrumentation developments on the West Coast have been most interesting, and while the 1953 budget does not allow for a personal canvass of this area, it may well be that the 1954 budget will have such a provision. Or the 1953 plan may have to be revised to include a West Coast canvass; this will be decided by top management once the trend for 1953 is clearly defined. The Donations account is increasing by the decision of the management for the company to actively share in the fund-raising efforts of the community; this formerly was done by the owners solely, with the Corporation taking no part. Now both the owners and the Corporation take part in the programs as they are presented.

Those are the basic accounts, and their relation to one another. Management can see clearly how increases in one effect others, and the break even point. It is now the obligation of management to examine realistically the pattern of the coming twelve months, in the light of the proposed budget, and to make adjustments to compensate for changes both external and internal.

The procedure used by the management here is to review break even data every quarter, constructing quarterly break even data, reviewing charts and revising the original forecast if necessary. The original chart is kept in the office and sales constantly plotted on a weekly basis to determine the degree of variance so that any trends may be noted quickly and immediately brought to the attention of management for action.

L. Wages - Payroll

Earlier it was mentioned that one of the greatest items of cost that affect this concern was the gross payroll. On table 7 there is a payroll analysis for the three year period. The table breaks down the total payroll expenses into those that are determined by executive decisions, and those that are volume items. The relationship between the two types of payroll expenses is also given, and it is well to note that in the year that showed a total profit of \$22,000.00 less than the previous year, the ratio of these factors of payroll increased by 5%. The projection for 1953 keeps these factors at the 1951 ratio or better.

With reference to the Direct wages paid in the periods, two figures are given: the first showing the general wage level including all employees, and the second which excludes those in a training capacity, whose wages act to greatly lower the actual wage level, that must be used in planning cost estimates. The payrolls used to compute these figures are taken from January rates for each year, thus the time element is consistent although the number of employees present at each period varies considerably.

The second of the two figures mentioned above tells the more

Table 7

Wage and Salary Analysis by Account and Year

Account	1951	1952	1953
Executive Salaries (A)	47,920.00	48,145.00	48,620.00
Supervision Salaries (A)	13,960.00	15,732.00	18,200.00
Office Salaries (A)	2,937.00	2,776.00	3,000.00
Maintenance Salaries (B)	6,898.00	6,815.00	7,356.00
Direct Labor Wages (B)	102,138.00	84,616.00	108,037.00
TOTALS:	<u>173,853.00</u>	<u>158,084.00</u>	<u>185,213.00</u>
Ratio of Regulated Salaries to Total Wage Payments:	37.3%	42.1%	37.7%
Average Hourly Direct Labor Rate: Period taken in each year in January.	1.064 per hour	1.25 per hour	1.295 per hour
Number of employees - Skilled:	24	36	31
Trainees:	16	1	5
Average Wage Skilled Operators:	1.207 per hr.	1.257 per hr.	1.343 per hr.
Percentage increase over 1951 of wage paid skilled operators:	-0-	4.1%	11.2%

(A) Constant Regulated Accounts

(B) Variable Accounts

interesting story. The skilled workers' wages have risen in this plant from 1.207 per hour to 1.343 per hour in the two year stretch from January 1951 to January 1953. This is a percentage increase of 11.2% and this, despite wage controls that were in effect during the period, and it also is well to mention that all increases granted were within the scope of existing regulations. This matter of this increase comes up again in the discussion on Product Mix, and also in determining if management will take steps to compensate the profit margin for this increase or any portion of it by increasing sales prices.

M. Analysis by Product Line

The determination of profit is approached by many avenues, the volume of sales, the dollar value of sales, the number of repeat sales, the effects of returns and allowances, the amount of collectible invoices, etc. For the firm being discussed all of these items are important, but of paramount importance is the type of sale made, as indicated by the product line. The tables on the following pages indicate the sales of the company by product classification and the expenses assigned to each product. Overhead items have been assigned on the arbitrary basis of proportion to total sales; e.g., a single product amounts to 50% of the gross sales, it bears 50% of the total unapplied overhead incurred during the year.

Table No. 8 depicts the Product Breakdown into its main sales figures. For ease of presentation the sales have been grouped into these areas.

1. Glass Bearings, mounted, unmounted, mounted in Bird supplied or customer supplied screws, etc.

Table 8

Product Line Analysis by Main Divisions

Product	1951	1952	1953
Glass Bearings, Set, unset, all types	195,370.00	171,635.00	200,000.00
Sapphire Bearings Mounting only (1)	9,316.00	10,018.00	10,000.00
Jewels & Mounting	<u>77,935.00</u> 282,621.00	<u>86,096.00</u> 267,749.00	<u>80,000.00</u> 290,000.00
Other Sales, Misc. etc.	<u>5,308.00</u>	<u>9,441.00</u>	<u>10,000.00</u>
Total Sales:	287,929.00	277,190.00	300,000.00
Ratios to Total Sales:			
Glass Bearings	68.4%	61.9%	66.7%
Sapphire Bearings Mounted only (1)	3.2%	3.6%	3.3%
Mounted & Unmounted	26.8%	31.0%	26.6%
Other Sales	<u>1.6%</u> 100.0%	<u>3.5%</u> 100.0%	<u>3.4%</u> 100.0%

(1) No material costs involved in this sale classification.

2. Sapphire sales, mounted, unmounted, manufactured and purchased; the work done on mounting jewels supplied by customers is calculated separately, but presented as a single figure for Sapphire Profit or Loss.

3. Other Sales - Screw Machine products, Calipers, Inspection, Thread guides and Miscellaneous.

The distinction is made in the sapphire classifications because of the lack of a material charge in the mounting of customers' jewels in settings.

The relationships between group sales and total sales are given because that is the arbitrary basis used to assign each product its proper share of overhead expenses.

Table No. 9 shows the total Glass Sales and the expenses assigned to this product line. The direct labor is determined by assigning each employee to the proper department and determined by the type of work performed; in a case where the employee splits his time, the split has been made on the same basis as the assignment of overhead expenses, ratio to sales.

Table No. 10 shows the comparative data for sapphire sales for the same periods.

Initial examination shows that for the three year period the Glass Operating statements show a constant profit, while the sapphire statements do not. Actually for the year 1952, the gross operating profit for the entire enterprise approximated very closely the profit on the Glass operations less the loss on Sapphire:

Table 9

Product Analysis by Assignment of Direct & Indirect Costs as Incurred and by Ratio to Sales.

Product - Glass Bearings: Set, unset, all types.

Account	1951	1952	1953
Sales:	195,370.00	171,265.00	200,000.00
Materials:	4,200.00	3,800.00	4,500.00
Direct Labor - Actual	78,699.00	63,474.00	81,380.00
Gross Profit:	<u>112,471.00</u>	<u>103,991.00</u>	<u>114,120.00</u>
Share of Overhead items:	72,932.00	79,892.00	80,616.00
(ratio to sales:)		1,564.00	
Net Profit on Line:	<u>39,539.00</u>	<u>22,535.00</u>	<u>33,504.00</u>

Table 10.

Analysis of Product Line by Assignment of Direct & Indirect Costs

Products:

Sapphire Mounting, only (A)

Sapphire, manufacture, supply and mounting (B)

Account	1951		1952		1953	
	<u>A</u>	<u>B</u>	<u>A</u>	<u>B</u>	<u>A</u>	<u>B</u>
Sales:	9,316.00	77,935.00	10,018.00	86,096.00	10,000.00	80,000.00
Materials:	-----	32,509.00	-----	43,821.00	-----	42,000.00
Direct Labor	3,811.00	11,086.00	5,588.00	12,578.00	5,157.00	16,879.00
Overhead Items:	<u>3,412.00</u>	<u>28,575.00</u>	<u>4,152.00</u>	<u>35,755.00</u>	<u>3,903.00</u>	<u>30,748.00</u>
Net Sapphire Gain/Loss	2,093.00	5,765.00	278.00	6,058.00	940.00	9,627.00
	7,858.00		5,780.00		8,687.00	

Glass Margin ± 22,535.00

Sapphire Loss: 5,780.00

Net Margin: 16,755.00

Actually the operating profit for the year is estimated at about \$22,000.00 The income from other sales and non-operating factors making the difference.

From the tables on the margins produced by each of the two main lines of products, it is clear that management must take steps to insure the Sapphire Department's elimination of the deficit. It is out of the question to consider elimination of the department, for sapphire is a very integral part of the plant program. Due to the ability of the company to handle this type of work, it obtains a greater share of the work that ultimately ends up on the more profitable glass line. However it does not follow that merely because it is such an integral part that it must be carried at a constant loss.

Here one of the facets of break even charts that was mentioned earlier comes into play, that phase of planning that allows management to jockey prices and volume around until the proper price-cost-margin relationships are established. So that when a price advance or decline is announced to the trade it is done so with the managerial assurance that the results have been anticipated and that the change will accomplish the desired results. With reference to the sapphire sales it seems that a price increase of approximately 10% across the board will cause this operation to be successful. Before making such a broad revision in prices it is wise to examine very closely the items that make up the total Sapphire sales. Notice that for 1953 Column A shows a net profit of

approximately 9% while the sales in Column B show a net loss of approximately the same percentage, but the sales in Column B are predicated to be eight times that of Column A. It follows then that the first consideration of a price revision should be done on the individual items that constitute the sales of Column B. For 1952 a similar trend was evidenced; Column A in 1952 ended the year with a 2% profit, while Column B with 8.6 times the amount in sales completed the year with a 7% loss.

If we assume that it is desirable that sapphire sales net the company approximately a 6% return, we can construct the necessary break even charts to determine what the sales must be in order to attain this margin; that is, provided it is deemed wise to raise prices. If it is felt that costs must be reduced we can also construct a chart to determine what are the costs we can safely incur and still maintain the desired margin.

It must be borne in mind that in order to net about 6% or \$5,400.00 it is necessary to show a gross earning record of about \$7,000.00 or 8% on the \$90,000.00 sales.

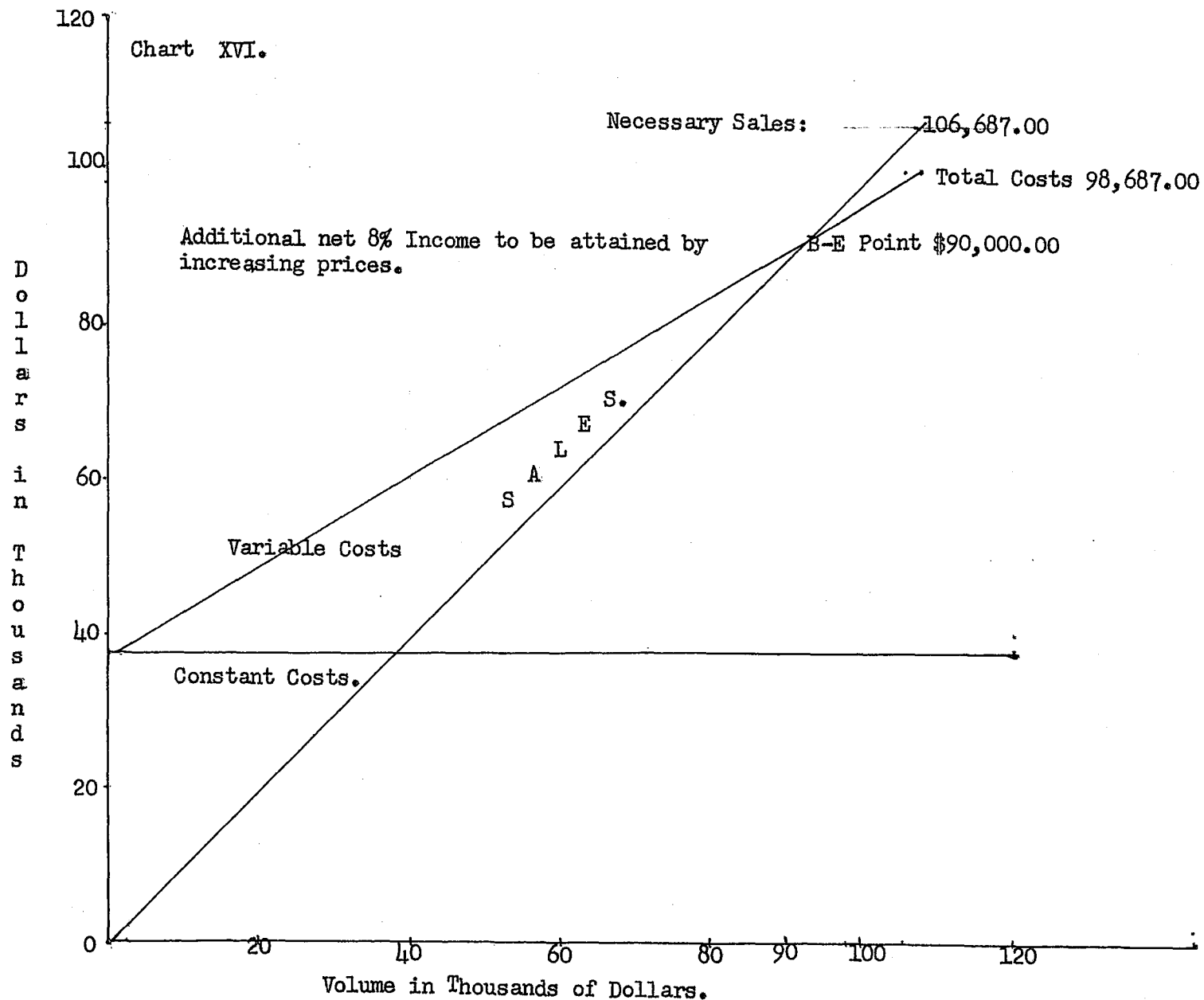
Taking the data from the two Charts XVI and XVII to show these alternatives we see that:

a. If prices are to be raised:

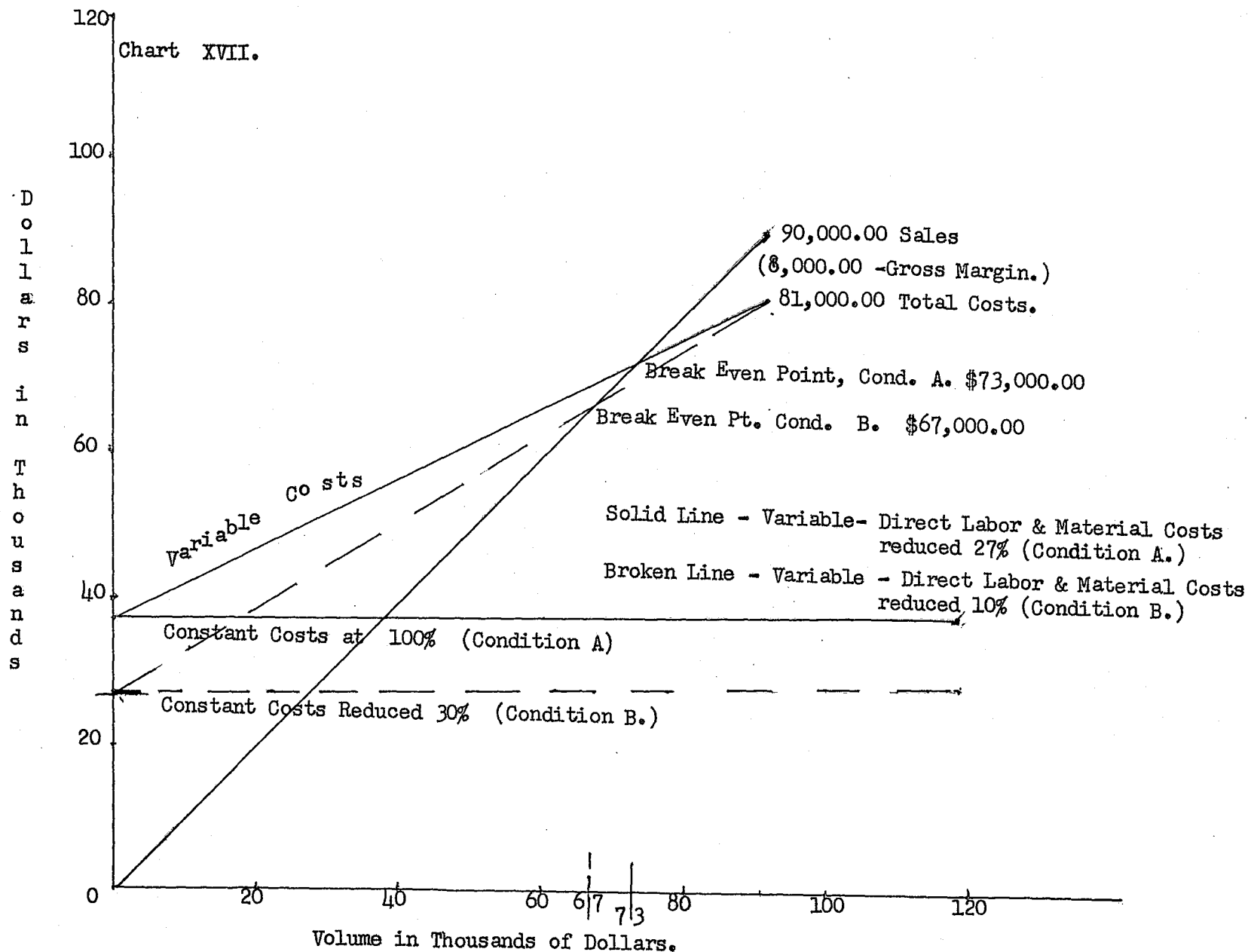
In order to obtain the desired margin the price rise must allow for sales of \$106,687.00 or a percentage increase of 17.7%.

b. If costs are to be cut, and total drop is to occur in Direct Labor and Material accounts:

The other expenses remain the same, at \$34,000.00; it is



Break Even Chart - Used Prior to Managerial Decision on Cost Reduction vs. Price Increase.



Break Even Chart - Used Prior to Managerial Decision on Cost reduction vs. Price Increase.

necessary to lower by more efficient buying and use of labor the Material and Labor accounts by 27% or \$17,000.00.

c. If costs are to be cut, on a proportionate basis, all sharing:

The Material and Labor costs are lowered 10% and the other costs lowered 30% the same relative amount of profit can be gained. Here the Material and Labor account would total \$57,600.00 and the other costs, charted as a constant would be \$24,000.00.

Thus is briefly stated one managerial problem that break even analysis brings into focus. No solution is ever given, for that in the final step is up to management, but that decision whatever it may be, has a better chance of being correct because of the use of such managerial tools as the break even presentation.

Chapter VIII

Conclusion

A. It has been stated that the law of management is the law of profits, and the law of profits is profit control. Profit control is merely the law of separating time (Constant) costs from volume (Variable) costs and the expression of this separation through the processes of bookkeeping and statistical management. # Throughout this work, the main item of profit control used was the Break Even point and Break Even analysis. The central theme of the thesis is the application of this profit control theory to the operations of a single firm, small in size, and limited in product line. It is hoped that through the illustrations and thoughts presented applicable to this firm, that the function of Break Even analysis and its value will be clearly apparent to the reader. The degree to which Break Even is used at RICHARD H. BIRD & CO., INC., is limited through factors of the industry and the firm, it is designed to aid and assist the management in making proper decisions, it is not used to its fullest extent as the company has neither the time, personnel, nor need for the elaborate presentations that can be made. One of the major selling points for Break Even thought is the fact that it can be adapted in scale and cope to meet the needs and desires of all types and sizes of managements, from firms the size of General Electric to RICHARD H. BIRD & CO., INC., without losing its effectiveness or worth.

The break even chart may be made in a variety of ways and may contain much detail, depending upon purpose and goals. The chart may be used to illustrate and dramatize an idea, as well as portray facts. It is used as a tool of analysis, to aid management to appraise a condition, and evaluate alternate courses of action. It may be used as an instrument of control, as in profit control, to keep costs in line with rate of activity, and for determining the responsibility for deviations from budgeted plans and performance. Among the specific uses that the Break Even Chart may serve are the following:

1. As a tool of flexible budgetary control.
2. As an aid to investment and credit control.
3. As an aid in determining price policy.
4. As an educational and public relations device in negotiations between management and labor.
5. As a means for the appraisal of distribution policies.
6. As an aid in assessing building and modernization programs. *

These are the more common uses, however it must not be felt that Break Even will serve every purpose, and every person may obtain every answer by using this tool. This is not so. Generally it is safe to say that the more complex and involved that one tries to make the Break Even point analysis, the less value it will have. To be effective it must be simple and flexible.

When applying Break Even work and procedure to operations that have been completed, it can be determined how long it took to make the

operations profitable. The subsequent analysis of the expenses that make up the Break Even level, will point up, and force second looks at these items from a different point of view. This type of procedure was illustrated in the review of the years 1951 and 1952.

When applying Break Even to the future, it is possible to measure in advance the effectiveness of future decisions, and actions concerning those decisions. Typical decisions are similar to the functions for which break even has been proven successful to managements; i.e., price and wage policies, capital investments, sales expansion, product combinations, etc. It aids in determining whether the decisions will aid or hinder management in adapting itself and the operations of the company to constantly changing future conditions. Break Even will provide a pattern against which all conditions of performance may be measured. Important deviations are to be noted and followed up without delay, so that any necessary adaptations may be made without loss of time and potential profits.

Regardless of how Break Even information is used, it remains a necessary link in the chain of control which business management needs to attain and maintain an adequate margin of safety. Through such control management can preserve its ability to solve successfully the problems of today and tomorrow.

As a final word, the break even chart must not be held accountable for defects in accounting. The chart is merely a graphic device that begins where accounting leaves off. The best safeguard against a possible misinterpretation of the Break Even Chart and Break Even Analysis is
- greater familiarity and understanding of the assumptions and limitations

of accounting.

The End

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VI. Persons Interviewed

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29. John J. Manning, C.P.A.
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