selves engaged in retailing concerning problems of distribution, not only in their own retailing spheres, but in the producing and manufacturing field as well, and that the Department will gather, correlate and compile the facts and figures of distribution, and that it will give the results such practical analysis, interpretation and publicity as will best serve the interests of the consumer, producer and distributor alike."

PROFIT, TOTAL SALES AND RENT.

BY J. A. W. LUCK.

Profit is customarily computed from the selling price of merchandise. It is therefore important to know the relation which exists between the percentage profit of the selling price and the percentage profit of the cost price. Strictly speaking, it is immaterial what manner is used to compute the profit, so long as a uniform method is used throughout all calculations. Butler Brothers in their "Way System Book" give tables, which show the amount that must be added to the cost price to yield a given percentage of the selling price. A very convenient method is the graphical representation of these two quantities. By establishing a mathematical relation between the two percentages an equation is formed which may be plotted upon squared paper. The accuracy will depend merely upon the scale of the plot.

Let A = Purchasing Price — a = Percentage Profit of P. P.
B = Selling Price — b = Percentage Profit of S. P.
u = Gross Profit

then $Aa = 100\,u$, and $Bb = 100\,u$, also $A = B - u$

therefore $Bb = Aa$ or $B = Aa/b$ (1)

$b = 100\,u/B$ (2)

$a = 100\,u/(B-u)$ (3)

In Figure 1, Curve A represents Fquation 2, percentage as ordinate and gross profit as abscissa. Curve B represents Equation 3 showing the relation as in Curve A. Curve C shows the relation b as ordinate to a/b as abscissa. In all three cases B is taken as unity.

TABLE I.

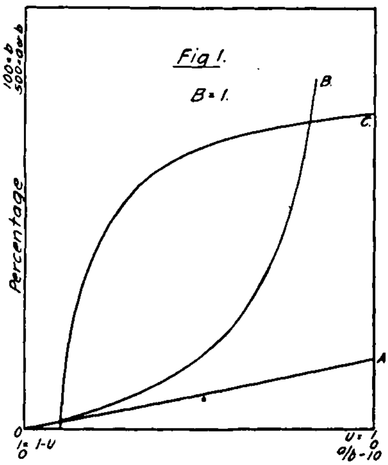
a.	b.	u.	a/b.
0	0	0	1
1.01	1	0.01	1.01
11.11	10	0.1	1.11
25	20	0.2	1.25
66.66	40	0.4	1.66
100	50	0.5	2
150	60	0.6	2.5
400	80	0.8	5
900	90	0.9	10
9900	99	0.99	100
∞	100	1	∞

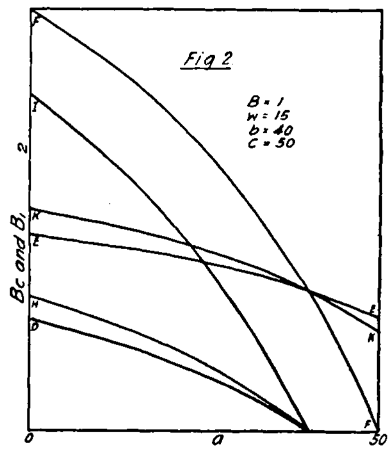
When $b = 100$, A must be equal to zero. The merchandise has been received gratis. It is to be noted that any value B for such merchandise will be equivalent to a gross profit of a 100%.

Equation 1 is the most important one, particularly if it is used in conjunction with Curve C. If we consider the purchasing price $A = 1$, then $B = a/b$. The abscissa of curve C, therefore, represents values of B. Consequently, for any value of A, it is necessary only to multiply the value a/b obtained from Curve C for any value of b by A to obtain the value of B.

Frequently merchants are compelled to lower prices of their merchandise, usually due to competition, but also due to the desire to attract new customers to the establishment. However, few stores are so located that price cutting will bring them additional trade; to the bulk of the trade the result is a loss of part of the total receipts, gross profit and a consequent reduction of the net profit. Unless favorable conditions prevail, price cutting cannot be carried on very long because the net profit is lowered more rapidly than the gross profit. A method to overcome a loss of this kind is to introduce new merchandise which will yield a large return.

In order to have a clear conception of the profit of a business, a knowledge of the kind of merchandise sold is very necessary. The profit which is realized must be distributed properly, a loss in one case must be offset by a proportionately larger gain on some other articles.





For the proper adjustment of selling prices a system must be established and maintained. Unfortunately, the sales slip, which is one of the best methods to keep track of the individual articles, is not used to any large extent in the drug business. It is therefore necessary to divide the merchandise into profitable and unprofitable departments, using separate registers or a single register capable of registering departmental sales.

Such a system properly used will detect a decrease in the profit immediately. This loss can be easily checked by selling additional profitable merchandise. The amount of this new merchandise can be readily calculated in the following manner.

1. GROSS PROFIT CONSTANT.

B = original total sales	b = original gross % profit
B_a = reduced total sales	a = reduced gross % profit
A_0 = cost of new goods	S = loss of gross profit
B_c = selling price of A_0	c = gross % profit of B_c
B_1 = new total sales	b_1 = new gross % profit

$$B - bB/100 + aB_a/100 = B_a$$

Therefore $B_a = B(100-b)/(100-a)$ (4)

Loss of gross profit $= bB/100 - aB_a/100 = cB_c/100 = S$

Therefore $B_c = 100B(b-a)/c(100-a)$ (5)

Also $A_c = B_c(100-c)/100$

and since $B_1 = B_a + B_c$

$B_1 = B[100(b-a) + c(100-b)]/c(100-a)$ (6)

In Figure 2 Equation 5 is represented by the Curve D, and Equation 6 by the Curve E. It is readily seen that as B_1 increases additional help may be needed to take care of this increase. Naturally, this will result in the reduction of the net profit. A better policy is to consider this problem by keeping the net profit constant.

2. NET PROFIT CONSTANT.

Let w = % of the total sales necessary to pay wages. For convenience, we may separate the gross profit into four items, namely, net profit, wages, rent, and a value which we will call the index figure and represent it by the letter I. This index figure varies with each establishment and depends upon the capital investment and the overhead other than wages and rent. We may express this by the equation $bB/100 = I + r + W + P$.

P = net profit W = wages

I = index figure r = rent

For convenience we will write $I + r = O$.

$$bB/100 - wB/100 = O + P = b_1B_1/100 - wB_1/100$$

$$b_1B_1 = bB - wB + wB_1 = aB_a + cB_c$$

combining these equations with equation 4 and eliminating B_a,

$$B_c = B(100-w)(b-a)/(100-a)(c-w) \quad (7)$$

and $$B_1 = B[(100-w)(b-a) + (100-b)(c-w)]/(c-w)(100-a) \quad (8)$$

Equation 7 is represented by Curve H in Figure 2, and Curve K is the plot of Equation 8.

3. PER CENT. GROSS PROFIT CONSTANT.

Therefore $b = b_1$ and

$$aB_a + cB_c = (B_a + B_c)b = bB_1$$

$$B_a = B_c(c-b)(b-a)$$

Eliminating B_2 by means of Equation 4 we obtain the relations

$$B_c = B(100-b)(b-a)/(100-a)(c-b) \quad (9)$$

and $$B_1 = B(100-b)(c-a)/(100-a)(c-b) \quad (10)$$

The Equations 9 and 10 are represented in Figure 2 by the Curves I and F, respectively.

In case 3 it was assumed that the overhead expenses remain constant. Should this not be the case, because either rent or wages or both are increased, the percentage gross profit may be increased to offset this change. An interesting study is case 1 when no attempt is made to sell additional profitable merchandise. We therefore have the condition that $B_1 =$, is greater or less than B. Consequently $bB/100 = O + pB/100 + wB/100$

where p = percentage net profit w = percentage wages

$$B(b-w-p)/100 = O$$

Also $b_1B_1/100 = O + p_1B_1/100 + wB_1/100$

where p_1 = the new net percentage profit

Therefore $B(b-w-p) = B_1(b_1-w-p_1)$

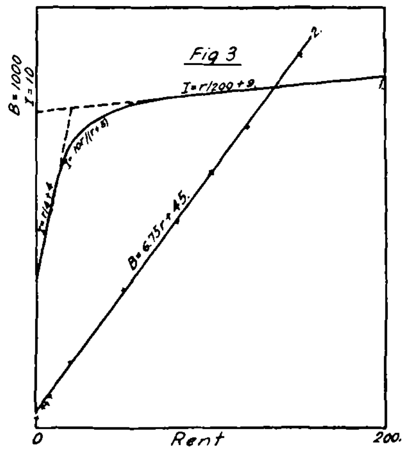
or $$p_1 = b_1 - w - (b-w-p)B/B_1 \quad (11)$$

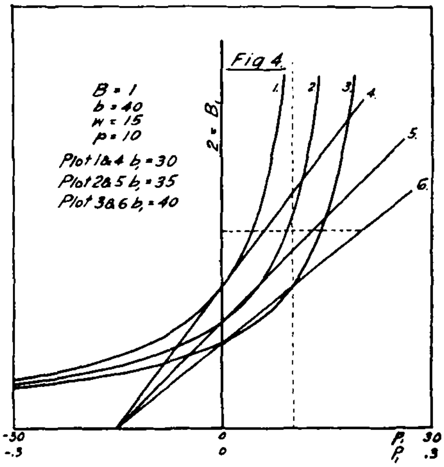
and $$p_1B_1/100 = P_1 \quad (12)$$

If we take B as unity, p_1 will show the percentage profit for any value B_1 at a fixed value b_1. This may also be stated as follows: p_1 is the net percentage profit when the total sales and the gross percentage profit are represented by B_1 and b_1, respectively.

The graphic representation of Equations 11 and 12 are shown in Figure 4. The hyperbolic Curves 1, 2 and 3 are obtained by plotting p_1 against B_1, when b_1 is equal to 30, 35 and 40%, respectively. These curves show at a glance the amount of total sales a business must have to yield a fixed net percentage profit if the gross profit is changed or the reverse. To obtain a net profit of 10%, Curve 3 gives the value $B_1 = 1$, Curve 2 the value $B_1 = 1.5$ and Curve 1 the value $B_1 = 3$. Unless fortunate circumstances intervene such increases are difficult to attain, since already strenuous efforts must be made to obtain total sales equivalent to the rentals of to-day.

The straight lines 4, 5 and 6 are obtained by plotting values of P_1 against the corresponding values of B_1. Therefore, these lines show the net profit obtainable from increased sales at the same or different percentage gross profit. For a net profit $P_1 = 0.1$, line 6 shows $B_1 = 1$, line 5 shows $B_1 = 1.25$ and line 4 shows $B_1 = 1.666\ldots$ There is a further use of this plot, if a straight line is drawn parallel to the abscissa for any value of B_1, the line will intercept the curve and its corresponding straight line at points which represent the percentage net profit and net profit, respectively.





In general it will be found that case 3 presents the most profitable method to follow of the cases outlined above.

In determining the total sales necessary to gain a certain net profit at a fixed rental it is advantageous to make use of the index figure. As previously stated, the index figure includes all expenditure charged to the overhead account with the exception of the disbursements for wages and rent. It is important to include a charge for depreciation in this figure. "Butler Bros." suggest to write off each year, for three successive years, 25% of the value of the fixtures and then carry them on the books at 25%. In determining the proper relation for the index figure we have assumed a depreciation charge of 10% per annum.

The index figure is a variable quantity, and an exact figure for each drugstore can only be determined from the records of the store. Nevertheless, we can arrive at an approximate value by comparing the index figure with the daily rental of each establishment. By comparing a large number of data it is found that for small values of r, r and I are related to each other in the manner represented by the equation

$$I = r/4 + 4 \tag{13}$$

For daily rentals between \$6 and \$90, I and r may be represented by the hyperbolic equation

$$I = 10r/(r + 5) \tag{14}$$

Above \$90 the available data are very meager and the following equation may be correct only in isolated cases:

$$I = r/200 + 9 \tag{15}$$

In Figure 3 these equations are represented by Curve 1.

Equation $bB/100 = I + r + W + P$ may be rewritten as

$kB = I + r$ where $k = (b-w-p)/100$ and combining this with Equation 13 we get

$$B = (5r + 16)/4k \tag{16}$$

and from Equation 14

$$B = (15r + r^2)/(r + 5)k \tag{17}$$

and from Equation 15

$B = (201r + 1800)/200k$, this may be changed to

$$B = (r + 9)/k \tag{18}$$

since 1/200 is a small quantity.

Equations 16, 17 and 18 are represented by the crosses on Curve 2, Figure 3.

In the application of this method to very small stores a modification should be adopted. It is apparent that the wage charge decreases very rapidly as the total sales decrease and a point is reached when a fixed percentage charge will not suffice for the payment of wages. Therefore, for so-called one man stores it is better to make a fixed charge instead of a percentage charge for both wages and net profit. The fundamental equation may then be written as

$$bB/100 - W - P = I + r.$$

By assuming the value 14 for W and P and substituting Equation 13 for I we obtain the equation

$$B = 100(5r/4 + 18)/b. \tag{19}$$

In the construction of the plot of Figure 3, b was given the value of 40 and k consequently became 0.15. By considering Equation 19 in conjunction with the crosses of Curve 2, it is noticeable that these points lie practically on a straight line. The equation of this line is

$$B = 6.75r + 45 \tag{20}$$

and it will be found that with the exception of low values of r this equation gives results which compare favorably with the equations previously mentioned.

In Table II computed values of B for given values of r, obtained by means of the above equations, are tabulated. Examination shows that Equation 20 suffices for all practical purposes.

TABLE II.

r.	I.			B.				
	13.	14.	15.	16.	17.	18.	19.	20.
0	4			26.7			45	45
4	5.0			60			57.5	72
6	5.5	5.4		76.7	76.4		63.8	85.4
8	6	6.2		93.3	93.3		70	97
10	6.5	6.7		110	111.1			112.5
20	9	8			186.7			180
50		9.1	9.3		393.9	393.3		382.5
100		9.5	9.5		730	726.7		720
120		9.6	9.6		864	860		855
150		9.7	9.8		1064.5	1060		1057.3
200			10		1398.3	1393.3		1395
400			11		2732.5	2726.6		2745

It may be advantageous to compare Equations 16, 19 and 20 for rentals between 0 and 4. This is shown in Table III.

TABLE III.

r.	16.	B. 19.	20.
0	26.7	45	45
1	35	48.1	51.8
2	43.3	51.3	58.5
3	51.7	54.4	65.3
4	60	57.5	72

When complete data are available the problem is very much simplified, but by means of this method the approximate total sales of a drugstore for a fixed rental can be readily computed.

LONG ISLAND CITY, N. Y.

O'Henry wrote part of his last story—"Let me feel your pulse"—in Asheville.

Ex-presidents John F. Hancock, of Baltimore, and Joseph L. Lemberger, of Lebanon, Pa.

GREATER SOCIAL RESPONSIBILITIES DEMAND A DEEPER INTEREST IN POLITICAL AFFAIRS.

Several years ago in an address, the lamented President Harding said:

"Team work finds its highest exemplification in the successful manufacturing organization. He who gives the most receives the most. The rewards of competitive industry do not go by favor but by capacity.

"We want in government the methods of industry, and we should avail ourselves to a greater degree than ever before of the wisdom of men who have made American industry one of the wonders of the modern world.

"The great technical professions form the cornerstone of material civilization. Their practitioners are derelict to their greater social responsibilities in their indifference to political affairs."