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The Old "Commission and Tax" Problem

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The Journal of Accountancy of January, 1921, contained my article, *Computation of Commission and Federal Taxes.* It dealt with the problem of computing the commission payable on profits after deducting the federal tax, the commission itself being a deductible item in the calculation of the tax. The tax can not be computed without knowing the amount of the commission, nor the commission without knowing the amount of the tax.

The solution of problems of this sort is quite simple. Ordinary public-school arithmetic or algebra will solve all those with which the average practitioner has to deal. Many people, however, are mystified by them and the most ridiculous notions are current about their difficulties. Some consider them incapable of solution by direct methods, others imagine that higher algebra is involved. On the whole, the difficulty seems to lie in the approach or the method of stating the problem in such a way that the solution logically follows.

In the above-mentioned article a number of problems are rather exhaustively discussed—perhaps too exhaustively to appeal to the busy man. The problems are, moreover, based on the 1920 federal income and excess-profits tax. However, the discussions and demonstrations hold good and remain applicable to present conditions.

The subject is still more or less alive. It comes up in actual practice and in C. P. A. examinations. A revival may be in order to stimulate a lagging interest. I have especially in mind the future members of the profession—those who study for their C. P. A. degree. My experience with junior and senior assistants gives me no high estimate of their ability to solve those problems in arithmetic or algebra that go a little beyond the mechanical processes of these subjects and that call for a little reasoning.

They adhere too much to the common belief that to get there is the principal thing and little attention is paid to method and form. As a rule, methods of trial and error are used and it is thought entirely legitimate to produce the answer by crude approximations and after various trials.

This attitude of mind may not be entirely unworthy, but certainly has little merit. In these days, when mostly high school

or even college graduates enter the profession, the student of accountancy may be expected to know his arithmetic and lower algebra. He should, therefore, be able to solve such problems by purpose and design, instead of trying various methods that may bring him near the correct answer.

In this article a few problems are dealt with that are more in accordance with the present tax situation. Also a simpler and more direct approach and solution are given than in the old article and theoretical discussions are avoided.

PROBLEM I

The earnings of a concern before deducting commission and taxes are $100,000.

A commission of 20% is paid to the management after paying 15% federal and 10% state taxes. The federal tax is payable after deducting commission and state tax and the state tax after deducting commission and federal tax.

Compute the amounts of commission, federal and state taxes and the balance of profit.

If we consider the problem solved we find that the balance of profit (x) is equal to

1. A certain amount (a) less state tax (10% or $\frac{10}{100}$ of a) or $\frac{90}{100}a$
2. A certain amount (b) less federal tax (15% or $\frac{15}{100}$ of b) or $\frac{85}{100}b$
3. A certain amount (c) less commission (20% or $\frac{20}{100}$ of c) or $\frac{80}{100}c$

Taxes and commission are herein expressed in fractions of (a), (b) or (c). They may also be expressed in fractions of the balance of profit (x), viz:

1. State tax $= \frac{10}{100}a = \frac{10}{90}$ of $\frac{90}{100}a = \frac{10}{90}x$ or $\frac{1}{9}x$
2. Federal tax $= \frac{15}{100}b = \frac{15}{85}$ of $\frac{85}{100}b = \frac{15}{85}x$ or $\frac{3}{17}x$
3. Commissions $= \frac{20}{100}c = \frac{20}{80}$ of $\frac{80}{100}c = \frac{20}{80}x$ or $\frac{1}{4}x$

The fact that taxes and commission can be stated in terms of the same amount—the balance of profit (x) is the important

reality to impress upon the mind, for this manner of statement at once leads to the solution of the problem.

SOLUTION OF PROBLEM I

It is evident that the balance of profit plus taxes and commission equals $100,000 or:

$$x+\frac{1}{9}x+\frac{3}{17}x+\frac{1}{4}x=\$100,000$$

or, after multiplying both sides of the equation by $9\times17\times4$ or 612, we have

$$612x+68x+108x+153x=61,200,000$$
$$941x=61,200,000$$
$$x=\$65,037.20$$

Balance of profit		$ 65,037.20
State tax—1/9 of 65,037.20		7,226.35
Federal tax—3/17 of 65,037.20		11,477.15
Commission—1/4 of 65,037.20		16,259.30
Earnings before deducting taxes and commission		$100,000.00
Proof—State tax		
Gross earnings as above		$100,000.00
Deduct—Federal tax	$11,477.15	
Commission	16,259.30	
		27,736.45
		$ 72,263.55
Deduct—10% state tax		7,226.35
Balance of profit		$ 65,037.20
Proof—federal tax		
Gross earnings as above		$100,000.00
Deduct—State tax	$ 7,226.35	
Commission	16,259.30	
		23,485.65
		$ 76,514.35
Deduct—15% federal tax		11,477.15
Balance of profit		$ 65,037.20

Proof—Commission		
Gross earnings as above		$100,000.00
Deduct—State tax	$ 7,226.35	
Federal tax	11,477.15	
		18,703.50
		$ 81,296.50
Deduct—20% commission		16,259.30
Balance of profit		$ 65,037.20

PROBLEM II

The earnings of a concern before deducting commissions and taxes are $100,000.

A commission of 5% is paid the president after paying 5% to other officers, as well as 15% federal and 10% state taxes. The commission to the other officers is payable before deducting the president's commission and the state tax, but after deducting the federal tax.

The federal tax is payable after deducting the two commissions and the state tax.

The state tax is payable after deducting both commissions, but before deducting the federal tax.

The above earnings of $100,000 are stated after deducting $10,000 expenses not allowed by the federal government and before deducting $5,000 allowed by the state.

Compute the amounts of commissions, taxes and balance of profit.

A problem of this sort is not at all unusual. Its complications are more imaginary than real and its solution is substantially the same as that of problem I.

SOLUTION OF PROBLEM II

Balance of profit x

President's commission ..... $\frac{5}{95}$ or $\frac{1}{19}x$

Federal tax ..... $\frac{15}{85}$ or $\frac{3}{17}(x+10{,}000)$

State tax ..... $\frac{10}{90}$ or $\frac{1}{9}\left[x-5{,}000+\frac{3}{17}(x+10{,}000)\right]$

Other officers' commission

$$\frac{5}{95}\text{ or }\frac{1}{19}\left\{(x+\frac{1}{19}x)+\frac{1}{9}\left[(x-5{,}000)+\frac{3}{17}(x+10{,}000)\right]\right\}$$

The balance of profit plus commissions and taxes being $100,000 we have the following equation.

$$x+\frac{1}{19}x+\frac{3}{17}(x+10{,}000)+\frac{1}{9}\left[(x-5000)+\frac{3}{17}(x+10{,}000)\right]$$
$$\frac{1}{19}\left\{(x+\frac{1}{19}x)+\frac{1}{9}\left[(x-5000)+\frac{3}{17}(x+10{,}000)\right]\right\}=100{,}000$$

or, after multiplying both sides of the equation by $19\times19\times17\times9$ or 55,233, we have:

$$55{,}233x+2{,}907x+9{,}717x+97{,}470{,}000$$
$$+6{,}137x-30{,}685{,}000+1{,}083x+10{,}830{,}000$$
$$+2{,}907x+153x+380x-1{,}045{,}000$$
$$=5{,}523{,}300{,}000$$
$$\text{or } 78{,}547x+76{,}570{,}000=5{,}523{,}300{,}000$$
$$\text{or } 78{,}547x=5{,}446{,}730{,}000$$
$$x=\$69{,}343.58$$

Balance of profit		$ 69,343.58
President's commission—1/19 of 69,343.58		3,649.66
Federal tax—3/17 of (69,343.58+10,000) or 3/17 of 79,343.58		14,001.81
State tax—1/9 of (69,343.58−5000+14,001.81) or 1/9 of 78,345.39		8,705.04
Other commissions—1/19 of (69,343.58+3,649.66+8,705.04) or 1/19 of 81,698.28		4,299.91
Earnings before deducting taxes and commissions		$100,000.00

Proof—President's commission

Gross earnings as above		$100,000.00
Deduct—Federal tax	$14,001.81	
State tax	8,705.04	
Other commission	4,299.91	
		27,006.76
		$ 72,993.24
Deduct—5% commission		3,649.66
Balance of profit		$ 69,343.58

Proof—Federal tax		
Gross earnings as above		$100,000.00
Deduct—President's commission	$ 3,649.66	
State tax	8,705.04	
Other commission	4,299.91	
		16,654.61
		$ 83,345.39
Add—Unallowed deduction		10,000.00
		$ 93,345.39
Deduct—15% federal tax		14,001.81
		$ 79,343.58
Deduct—Unallowed deduction		10,000.00
Balance of profit		$ 69,343.58
Proof—State tax		
Gross earnings as above		$100,000.00
Deduct—President's commission	$ 3,649.66	
Other commissions	4,299.91	
Allowable deductions	5,000.00	
		12,949.57
		$ 87,050.43
Deduct—10% state tax		8,705.04
		$ 78,345.39
Add—Allowable deduction		5,000.00
		$ 83,345.39
Deduct—Federal tax		14,001.81
Balance of profit		$ 69,343.58
Proof—Other officers' commission		
Gross earnings as above		$100,000.00
Deduct—Federal tax		14,001.81
		$ 85,998.19

Deduct—5% commission		$ 4,299.91
		$ 81,698.28
Deduct—President's commission	$ 3,649.66	
State tax	8,705.04	
		12,354.70
Balance of profit		$ 69,343.58

PROBLEM III

We now take the same earnings and percentages of commission and taxes as in problem I except that each is itself a deductible expense.

Instead of making the computation more difficult, it becomes simpler for the stated percentages of commission and taxes are in such a case also the percentages of the balance of profit (x) viz:

Balance of profit	$x =$	$ 68,965.52
Commission	20% of $x =$	13,793.10
Federal tax	15% of $x =$	10,344.83
State tax	10% of $x =$	6,896.55
Together	145% of $x =$	$100,000.00
	$x =$	$ 68,965.52

PROBLEM IV

If again we take the same earnings and percentages as in problem I but, instead of all expenses, only the commission is itself deductible from earnings, we have in accordance with the solutions of problems I and III:

Balance of profit	$x =$	$ 67,223.20
Commission	$1/5\ x =$	13,444.64
Federal tax	$3/17\ x =$	11,862.92
State tax	$1/9\ x =$	7,469.24
	$\frac{1138}{765} x =$	$100,000.00
	$x =$	$ 67,223.20

PROBLEM V

This is a modification of problem I to the extent that 20% commission is paid on the current year's increase in the profits after deducting taxes, the previous year's amount being $60,000.

Again the solution is practically by the same procedure as in problem I, viz:

$$x+\frac{1}{9}x+\frac{3}{17}x+\frac{1}{4}(x-60{,}000) = \$\ 100{,}000.00$$

$$941x-9{,}180{,}000 = 61{,}200{,}000.00$$

$$941x = 70{,}380{,}000.00$$

$$x = \$\ 74{,}792.77$$

Balance of profit	$ 74,792.77
State tax—$\frac{1}{9}$ of $74,792.77	8,310.31
Federal tax—$\frac{3}{17}$ of $74,792.77	13,198.73
Commission—$\frac{1}{4}$ of $14,792.77	3,698.19
Earnings before deducting taxes and commission	$ 100,000.00

In most cases that are met in practice only two interdependent items of expense enter into the problem, namely, the commission and the federal tax. In the above problems a third and even a fourth item is introduced to show that their number does not affect the method of approach and solution. With only two items of expense there is less figuring to be done but procedure and principle remain the same.

It should now be plain that problems of this kind can be solved by simple, direct method. No general formulas such as are given here and there need be remembered. A proper approach leads to the correct solution.