Donald B. Schultz

OFFICE MACHINE PRACTICE SERIES

No. 5

THE COMPTOMETER

By

C. H. KATENKAMP

THE GREGG PUBLISHING COMPANY

OFFICE MACHINE PRACTICE SERIES

No. 5

THE COMPTOMETER

By

C. H. KATENKAMP

Head of Department of Business Education, Forest Park High School
Baltimore, Maryland

E79-F-1
Printed in the United States of America

THE GREGG PUBLISHING COMPANY
NEW YORK CHICAGO BOSTON SAN FRANCISCO TORONTO
LONDON SYDNEY

Contents

Suggestions to the Student

The constantly increasing use of machines in the modern business office has made it necessary for commercial students to acquire the ability to operate the more common office machines.

Because of this condition, the school has provided this machine for your use. Learn it as well as you can, for by doing so, you are increasing your earning capacity.

This booklet is designed to teach you how to operate the Comptometer. It teaches only such operations on the machine as every office worker should know. The special processes used in certain offices can be quickly learned if you understand the fundamentals taught in this course. Enough examples have been given to illustrate the various processes taught. If you require more problems, your instructor will furnish them for you.

The work in this booklet has been arranged so that you may proceed as rapidly as you are able. Your chances of securing a position are increased by the extent of your knowledge of office machines. Therefore, work persistently and use your time to the greatest possible advantage.

To understand the pages that follow, it is necessary for you to read every word of the instructions very carefully. Before starting to work any job, read all the instructions given for it. After you have read the instructions through, begin to work the job. In working the job, be sure that you follow directions exactly. Perform each step in the order in which it is suggested in the instruction sheet. If you follow this plan, you will have very little difficulty in learning to operate the machine.

Work by yourself as much as possible. This will help you to develop the trait of self-reliance, which, in turn, will make you more valuable as an office worker. If you have difficulty, seek the aid of your instructor, but do not ask for his assistance until you have read the instructions over at least three times and tried to work out the problem for yourself.

As you work each problem, prove it. The method of proving the problems is usually explained in the job sheet. Do not skip this. If you would develop a habit of accuracy and become a valuable office worker, you must learn how to prove your answers. Develop the habit of proving your work.

THE COMPTOMETER

Job 1

GENERAL INFORMATION

The Comptometer belongs to that class of machines called "key driven." This means that, in order to set a number in the machine, it is only necessary to depress the key that represents that number.

The Comptometer is operated by the touch method, and a high degree of speed can be acquired with diligent practice. Proficient Comptometer operators earn substantial salaries. In this course you will be taught the fundamentals of the machine, and after that, if you wish to acquire speed, extra practice will be necessary.

Parts of the Machine. As each part of the machine is described, try to locate it on the machine. Illustration 1 (page 2) will help you.

The keyboard of the machine is arranged in eight or more columns of nine keys, which are grouped in alternate green-and-white or black-and-white sections. A small figure and a large figure appear on each key top. The large figures are used for addition and multiplication and the small figures for subtraction and division.

The dials that show the result of a calculation are at the bottom of the machine. These dials are sometimes called the register.

Just above each dial is a decimal pointer. At the right-hand side of the machine, at the back, is a single red key. This is the correction key and is used to correct errors

caused by not depressing the keys all the way down when using them.

The lever on the right-hand side of the machine is the canceling lever, and is used to clear the machine.

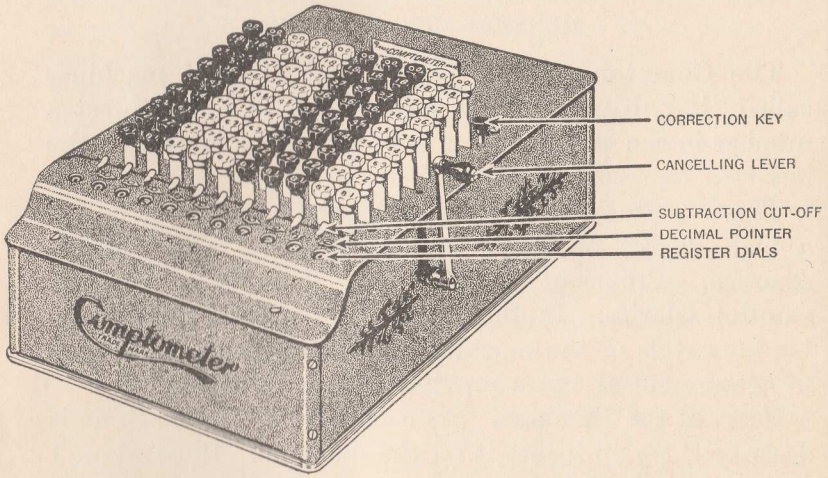

ILLUSTRATION 1. PARTS OF THE MACHINE

Position. To attain the best results, the Comptometer should be set at an angle, so that the left-hand side of the machine is in a direct line with the center of the body. The work to be performed should be placed on the desk or table to the left of the machine. The operator should always hold a pencil between the thumb and the palm of the right hand. The pencil is then in a position to record the answer as soon as the calculation has been completed. Holding the pencil in this manner also steadies the hand as it glides across the keys.

The keys should always be pressed down as far as they will go. When the keys are pressed all the way down, the key stroke is said to be complete. If you make a partial or incomplete key stroke, the keyboard will lock. The method of releasing the keyboard will be explained later.

Always work from above the machine. The machine should be placed low enough to permit the operator to hold his fingers in a vertical position when he needs to do so.

Job 2

ADDITION—ONE COLUMN

Addition is performed by depressing the keys that represent the figures to be added. The large figures on the key tops are used in addition.

There are two methods of operation. The first of these is called the "full-keyboard" method, because the entire keyboard—all the keys from 1 to 9—is used. This method should be used only when a limited amount of adding is to be done by an untrained operator, and for this reason no instruction in this method is given here.

If the quantity of adding is large, the operator should learn the touch method, in which the operator works without looking at the keys.

To assist you in operating the machine by touch rather than by sight, the tops of the keys have been made in two shapes. The keys of the odd numbers, 1, 3, 5, 7, 9, are concave (hollow). The keys of the even numbers, 2, 4, 6, 8, are flat. Feel both kinds of keys and see if you can tell the difference.

At first, you will find that it will help you to locate the keys if you will place a piece of paper or a blotter between

the row of 5's and the row of 6's. This will shut off the top of the keyboard. After you have learned the keyboard, however, you should not use this device.

Below are a number of problems. To solve them, proceed according to the directions given below:

1. Hold the pencil between the thumb and palm of the right hand.

2. Depress each number given in the extreme right-hand column of the keyboard. Try to find the keys without looking at them. This may seem difficult at first, but with practice you will soon acquire this ability.

3. When you have finished adding each problem, the total will appear in the dials in the front of the keyboard. These dials when taken together are called the register. Copy on a piece of paper the answer that appears on the register. Keep the answer to all problems on this piece of paper.

4. After each calculation it will be necessary to clear the register. The machine is cleared by use of the canceling lever, which is on the right-hand side of the machine. On some models it is necessary to push the canceling lever backward and then forward. On other models it is only necessary to pull the lever forward. In any case, be certain to return the lever to its regular position.

When you have finished canceling, the register will show only zeros.

5. Prove your work. Get the habit of proving all work that you do. This insures accuracy and makes you more valuable to your employer. To prove the answer of an addition problem, reverse the direction of adding. If you add from bottom to top first, prove the problem by adding from top to bottom.

6. Add these problems in the extreme right-hand column on the keyboard. This is called the "units" column. In the units column, the figures are depressed with the second finger (the longest) of the right hand.

7. If the keyboard locks while you are adding these columns, clear the register and begin again.

1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	3	2	2	3	3
2	2	2	2	2	3	3	2	4	2
2	1	3	2	1	2	4	3	4	5
1	2	3	3	3	2	3	4	3	3
1	1	2	1	1	1	3	4	3	2
2	2	3	2	3	1	4	3	3	1
–	–	–	–	–	–	–	–	–	–

It is not enough merely to add the problems given above once. You should add them over and over again until you acquire the ability to find the keys accurately and rapidly. It is suggested that each day, before beginning your regular work on the machine, you practice some addition problems. Speed is also most important. It can be acquired with practice.

Job 3

ADDITION—TWO COLUMNS

In adding two columns of figures on the Comptometer it is necessary to use two fingers. Use the first and second fingers of the right hand in order to solve the following problems.

1. Use the long, or second, finger of the right hand on the units column, which is the extreme right-hand column,

and the first, or index, finger on the tens column, which is next to the units column.

2. Hold the pencil between the thumb and the palm of the hand. (See Illustration 2.)

ILLUSTRATION 2

3. Locate the keys without looking at the keyboard. Remember that speed depends upon your ability to use the touch method.

4. After each problem, copy the answer from the register and then prove it. To prove an addition problem, add the figures in the opposite direction.

5. If the keys lock while you are adding these problems, clear the machine and begin again. Correction rules will be studied later.

1	2	3	4	5	6	7	8	9	10
11	11	31	21	11	23	12	12	33	33
12	22	22	32	12	33	23	22	34	44
22	11	23	22	21	32	34	33	44	45
11	12	33	23	23	22	33	34	43	55
21	21	22	11	31	11	43	44	33	54
12	22	23	21	23	21	34	23	43	45
—	—	—	—	—	—	—	—	—	—

Job 4

ADDITION—NUMBERS ABOVE 5

Thus far, you have had no problems containing numbers above 5. Such numbers were left out because, in the touch method of addition on the Comptometer, numbers above 5 are formed by combining two lower numbers. For instance, to add 6, depress the 3-key twice; to add 7, depress the 3-key and then the 4-key; to add 8, depress the 4-key twice; to add 9, depress the 4-key and then the 5-key.

When using two keys to form a number, always depress the smaller number first. For instance, 7 is formed by depressing first 3 and then 4. In the problems that follow, there are many figures above 5. Pay particular attention as to the method of forming these figures. Remember

1	2	3	4	5	6	7	8	9	10
13	84	75	55	73	95	37	78	17	28
36	48	52	48	78	94	84	87	27	39
36	83	51	88	43	29	38	98	37	63
66	66	46	38	46	33	86	89	73	62
64	72	85	36	49	39	65	91	47	57
—	—	—	—	—	—	—	—	—	—

that you are trying to acquire speed and accuracy. This can be obtained only by diligent practice. In solving these problems, follow the directions given in the preceding jobs.

Job 5

ADDITION—THREE COLUMNS

When adding three columns on the Comptometer, it is necessary to use only two fingers, the first and the second fingers of the right hand. Use the first finger of the right hand for the two left-hand columns and the second finger for the right-hand, or units, column. In solving the problems given below, proceed as follows:

1. Hold the pencil between the thumb and the palm of the right hand.

2. Use the first finger of the right hand to add the two left-hand columns and the second finger of the right hand to add the units column. For instance, in the first number in problem 1, depress the 2 and the 6 with the first finger and the 4 with the second finger of the right hand.

1	2	3	4	5	6	7	8	9	10
264	524	314	217	321	378	767	989	976	299
321	213	213	714	472	874	877	788	679	369
425	471	512	326	746	643	788	898	421	142
153	434	413	671	326	743	848	799	916	317
214	213	324	423	517	377	488	869	639	746
242	512	135	341	774	788	776	921	728	635
521	425	451	672	367	787	673	191	817	703
132	541	214	326	712	686	576	372	737	839
215	323	332	731	627	674	756	174	818	246
324	422	415	476	427	377	786	286	929	311

3. If you wish to acquire speed on the Comptometer, it is necessary to develop the ability to find these keys without looking at your hands. Therefore, try to find the column without looking at your fingers. It may be slow work at first, but speed will come much more rapidly later if you can develop this ability.

4. If the machine locks, clear it and begin again.

Solve the preceding problems and prove each.

Job 6

ADDITION—FOUR COLUMNS

Even if the problems that you are adding consist of four columns, you nevertheless use only the first and second fingers of the right hand.

1	2	3	4	5	6	7	8	9	10
2678	1450	1257	2062	47	2726	698	4000	674	134
1485	16	2235	620	2057	1607	2516	57	5176	265
617	95	710	740	45	856	4567	103	137	451
868	141	642	458	650	3013	420	4384	316	5525
13	1336	2462	54	357	2737	254	3030	4762	474
1765	856	1047	2648	3541	132	2175	4405	806	5641
547	15	14	123	67	45	4105	10	5205	513
275	1458	67	215	597	3214	42	175	47	12
86	234	2902	668	381	235	245	702	202	3275
1265	1040	15	1403	3107	3356	3034	600	43	46
244	100	30	155	786	1268	505	4517	4300	5717
1436	3141	586	86	645	351	75	77	5376	230
846	60	2856	1475	56	3406	4355	135	5444	60
82	715	1045	32	3247	541	66	578	372	500
435	1435	7158	47	45	3591	300	4680	1506	5815

1. Place the machine in the proper position.

2. Hold the pencil between the thumb and the palm of the right hand.

3. Use the second, or longest, finger of the right hand to depress the keys in the extreme right-hand column and use the first finger of the right hand to depress the keys in all other columns.

Solve the preceding problems and prove each.

Job 7

ADDITION—FIVE COLUMNS

There are two methods by which you may work when adding five columns or more.

If the figures you are adding are arranged in columns,

1	2	3	4
426784	62	47869	8974
6731624	87184	7136	6
86790	62	42618	231
3216	283216	7326	56782
647861	142689	426	83642
28645	776	6	126

5	6	7	8
42	4831576	487624	7836
89763	78133	6317	412
214	374829	62371	38
78423	3354	864	6126
6217	18120	1236	18743
18962	5893	324872	546826

it is easier to "split" the addition. "Splitting" the addition means dividing it into parts. Each part is then added separately. The numbers of any column of figures should be "split" in the most convenient manner.

1. In the first problem below add the three right-hand columns but do not clear the machine.

2. Add the remaining four columns. To do this, shift the hand to the left so that the second finger of the right hand is on the fourth column from the right. Use this finger to add the fourth column, but use the first finger to add the other three columns.

Solve the preceding problems and prove each.

Dollars and Cents. The procedure of splitting numbers is practically the same when these numbers consist of dollars and cents, except that the numbers are split between the cents and the dollars columns. For instance, in the first problem below proceed as follows:

1. Hold the pencil in the proper position.

2. Clear the machine.

3. Just above each dial is a small arrow. These arrows are called "decimal pointers." (See Illustration 1, page 2.) They are used to show where the decimal point should come in the answer. By means of these markers, the operator is able to read the answer correctly. As you are now working with dollars and cents, it is necessary to show the decimal point in the answer, so turn toward you the marker between the second and third dials from the right, like this:

00000000'00.

Turn the other decimal markers to the right so that they will be out of the way. In the answer, all figures to the

right of the decimal marker are cents and all figures to the left are dollars.

4. Using the first two fingers of the right hand, add the cents columns only.

5. Shift these same fingers to the dollars columns. Use the second finger of the right hand to add the figures in the third column from the right (which is the first of the dollars columns). Use the first finger of the right hand to add the other dollars columns.

1	2	3	4
36.42	421.14	98.21	371.98
83.04	165.75	2621.56	19.55
132.46	36.81	20.36	38.20
3184.88	5385.68	774.61	1.66
78.10	370.59	37.09	618.37
961.41	484.72	43.22	29.47
43.62	41.78	318.62	2.88
7415.48	51.53	78.44	5.68
23.79	6391.92	479.51	494.83
398.26	600.32	312.62	82.39

5	6	7	8
12.68	518.63	491.12	148.91
214.19	71.26	62.34	3.72
26.38	38.15	710.71	4225.54
697.06	163.67	854.38	2.23
84.29	23.57	178.84	7.97
784.43	72.08	97.06	394.70
7.32	31.37	834.82	4.74
619.82	52.66	456.77	3083.40
130.13	4617.30	68.33	24.90
583.94	85.31	718.52	62.68

The instructions given above should be followed whenever the work comes to you arranged in columns. Much of the work you will be called upon to perform in offices, however, will not come in this form. It will consist of checks, sales tickets, invoices, and other items appearing on separate sheets of paper. In such cases, it is not the best practice to "split" the problem, as this would mean working through the package of papers two or three times and might lead to errors.

It is better to add up to five figures with the same hand. To do this, keep the longest finger of the right hand on the units column and use the first finger of the right hand for the other four columns. Readd problems 3, 4, and 5 above in this manner. Of course, if the numbers to be added consist of more figures than you can reach (most operators can reach five or six figures), it will be necessary to "split" them even if they are on separate pieces of paper.

Job 8

ADDITION—LONG COLUMNS

To add especially long columns on the Comptometer, it is best to divide the column into sections of about thirty items each, and then add each section. In the problems below, the sections consist of only ten items, but follow the same procedure:

1. Add the first section and pencil the total, but do not cancel the machine.
2. Add the next section and pencil the total, but do not cancel the machine.
3. Add the entire problem in a like manner.

4. To prove these problems, readd, and if the total of any section differs from the pencil total, readd that section.

1	2	3	4	5	6
233.45	286.68	780.27	470.35	450.90	326.10
245.20	331.41	243.72	146.53	280.75	443.12
650.05	324.46	4.27	280.04	895.50	34.21
875.26	270.25	426.72	344.45	680.19	526.26
31.47	7.70	940.27	74.50	221.12	75.62
280.40	362.70	165.56	873.70	521.50	11.22
754.36	275.24	444.00	37.73	420.31	3.33
849.63	750.40	1.55	940.07	821.60	881.44
7.37	987.25	576.66	97.50	76.35	32.23
496.63	78.40	63.55	275.25	370.40	99.99
926.31	265.65	371 37	362.70	77.17	236.35
453.13	441.41	281.90	275.24	437.40	840.50
35.35	250.50	333.33	750.40	212.12	260.45
1.14	296.90	491.19	987.25	414.14	324.90
783.38	73.35	6.90	78.40	29.29	47.70
460.45	48.45	26.54	265.65	100.03	470.63
504.26	780.94	256.03	441.41	149.52	146.53
230.60	450.45	371.71	250.50	55.55	280.04
215.15	344.40	12.12	296.90	636.63	344.45
436.10	266.20	360.35	73.35	451.23	74.50
127.25	457.66	98.98	48.45	790.30	286.68
36.50	653.53	77.77	780.94	70.25	331.41
870.80	21.67	531.86	450.45	123.45	324.46
350.40	84.56	1.36	344.40	265.16	270.25
464.64	1.39	65.56	266.20	99.99	7.70
346.50	13.13	121.21	457.66	128.90	521.50
365.92	126.41	14.57	653.53	751.10	420.31
83.83	2.14	613.13	21.67	646.46	821.60
2.38	426.26	1.32	84.56	451.20	76.35
876.87	73.37	678.90	1.39	23.30	370.40

Job 9

THE CORRECTION KEY

If a key is not depressed all the way down when adding on the Comptometer, the number will not register and an error will be signaled by the locked keyboard. Whenever this warning is given, it is possible to make the correction and eliminate the error by making use of the correction key—the small red key on the upper right-hand side of the machine.

To Make Correction. When a key is found locked in adding, *always* go back and try to depress the last key operated.

Rule 1. If this key can be depressed, touch the red correction key and continue the addition, starting on the key that locked and signaled the error. For instance, suppose you are adding $3.45, and in doing so you push the 3-dollar key part of the way down. Then when you try the 40-cent key, you find it locked. This indicates immediately that the previous key did not register. Follow these steps:

1. Intentionally depress the 3-dollar key part way down.
2. Try to depress the 40-cent key. You find it locked. This means that the 3-dollar key did not register.
3. Go back to the 3-dollar key and give it a complete stroke.
4. Touch the correction key to unlock the keyboard.
5. Continue to add, beginning with the 4-key.
6. Notice that the correct amount is now registered in the machine.

Solve the following problems. Purposely try to depress only part way the figures printed in small type.

1	2	3	4	5	6	7	8
80	55	93	56	3^{4}	83	56	$3^{4}5$
3^{4}	2^{3}	4^{4}	5^{2}	42	4^{5}	4^{4}	505
51	94	74	3^{3}	5^{3}	2^{2}	30	$3^{7}0$
4^{5}	45	35	64	45	70	29	155

The Correction Key on Combination Numbers. Errors in addition on combination numbers (numbers formed by depressing two keys) are easily found and corrected. Follow the rule that when a key is found locked in adding, you should *always* go back and try to depress the last key operated.

Rule 2. If the last key operated is found locked, the error was made on the preceding key in the same column. Touch the red correction key, and again depress the key where the error was made. Then continue with the addition.

Consider this problem:

$2_{3}7$ 5.

1. Depress the 2-key in the customary manner. Depress the 3-key, which is the first key struck when adding 7, only part way. Depress the 4-key, which is the second key to be struck when adding 7, all the way down.
2. Now try to depress the 5 in the usual manner.
3. When you attempt to depress the 5-key, you find it locked. Go back to the 4 of the 7 and you find it locked. This signals that the error was made on the preceding key, the 3 of the 7.

4. Touch the correction key to unlock the keyboard.
5. Depress the 3 of the 7 all the way down.
6. Skip the 4 of the 7 because you have already added this number.
7. Continue with the rest of the addition in the usual manner, beginning with the 5-key.

Solve the following problems. Where the number is formed by combining two smaller numbers, the one to be given only a partial key stroke is shown in small figures.

9	10	11	12	13	14	15	16
3 4	9_{4} 9	7_{3} 0	5 6_{3}	1 5	5 7	4 4	4 5
7 9_{4}	3 4	8 4	8_{4} 7	6 9_{4}	5 1	9_{4} 5	3 6_{3}
5 5	6 9_{4}	4 5	4 3	4 4	9_{5} 6	3 9_{4}	5 5
4 3	3 4	7_{3} 2	7_{3} 2	3 5	3 2	8_{4} 2	8_{4} 7

Exception to Rule. If the key "preceding the last" is larger than the last key operated, cancel and readd.

175.00
2.57

1. Add the 1 and 7 in the customary manner and then make a partial key stroke on the 5.
2. Depress the 2 of 2.57.
3. When you try to depress the 5, you find it locked.
4. The last key operated is 2.
5. The key preceding is 5.
6. As the key "preceding the last" is in the same column and is larger than the last key operated (that is, as the 5 is larger than the 2), it is better to clear the register and readd for fear of a possible wrong answer.

In some of the following problems it will be necessary to clear the machine and begin again; in others, it will not. See if you can tell the difference.

17	18	19	20	21
3 4 5	2 9^{5} 8	1 3 5	9 9^{5} 8	4 0 4
9_{4} 5	5 4 9_{4}	9 8_{4}	4 5	2 9^{5} 5
8_{4} 4 6_{3}	8 5 1	6_{3} 4	8_{4} 4 6	8 4 3
1 3 5	9_{5} 5	2 2 2	4 0 4	4 9_{4} 0
8_{4} 4	3 8_{4} 4	8 4 5	2 2 5	6 4 5

22	23	24	25
8^{4} 4 3	6_{3} 3 4	8_{4} 5	2 5 6_{3}
2 9	8 4 3	4 0	5 2 5
4 2 2	2 9^{5} 5	2 2	4 2 9_{4}
4 8_{4} 5	2 8 2	5 0 0	8_{4} 6
1 7 5	4 2 9_{4}	2 9^{5} 5	5 4 3

Job 10

MULTIPLICATION

Multiplication is really repeated addition; so when you want to multiply, you really add. This means, of course, that the large numbers on the key tops are used. In multiplication, use the whole keyboard. Thus, when multiplying by 8, use the 8-key. Do not try to use two 4's.

The parts of a multiplication are called the "factors." For instance, in the problem below, 5 is a factor and 6 is a factor. Each factor also has a special name, as shown in this problem.

5 multiplicand
×6 multiplier
—
30 product

1. Hold the pencil in the proper position.
2. Clear the machine.
3. Use the first finger of the right hand and hold the 6-key at the extreme right-hand side of the keyboard. As you are holding the 6 on the keys, this is called the "key factor." In the instructions that follow, "key factor" refers to the numbers that you are holding on the keyboard.
4. Depress this key five times (five is called the "multiplying factor").
5. The answer will appear in the register. It is better to hold the larger number and depress the keys the number of times indicated by the smaller number. This requires fewer strokes and saves much time. For instance, in the problem 7 × 3, hold the 7-key and depress it three times, while in the problem 2 × 9, hold the 9-key and depress it twice.

To prove any multiplication, reverse the process; that is, hold the number that you did not hold the first time.

In performing the multiplications that follow, depress the keys with a smooth, regular action. Try to develop rhythm, as this will promote speed and accuracy in your work. Be sure that you depress the keys completely as you perform the multiplications. If you do not, the keyboard will lock.

Solve the following problems:

1. 6 × 7	3. 8 × 3	5. 6 × 8
2. 4 × 9	4. 9 × 5	6. 7 × 4

Job 11

MULTIPLICATION—TWO-FIGURE FACTORS

The multiplication that you have just finished had only one figure in the multiplicand. When there are two figures in the multiplicand, the procedure is the same, except that the multiplicand is held by two fingers.

In multiplying, the best results are obtained if the machine is low enough to permit the operator to keep his fingers nearly vertical when holding the key factor. Hold the fingers erect.

Consider this problem:

$44 \times 3.$

1. Hold the pencil in the proper position.
2. Clear the machine.
3. Hold the multiplicand (44), using the first finger of the left hand to hold the left-hand 4. Hold this figure in the tens column. Hold the right-hand 4 in the units column, but use the first finger of the right hand. (See Illustration 3.)
4. Multiply by the 3 units. To do this, depress both keys that you are holding three times. Depress both keys at the same time. If you do it correctly, the register will show 132.

Solve the following problems and prove each. In each case, hold the larger numbers.

1. 48×5	3. 93×3	5. 86×9
2. 61×7	4. 78×4	6. 92×8

Rhythmic Drill. In order to multiply accurately and rapidly, it is necessary that you learn how to operate the machine smoothly. This is best accomplished by trying to develop rhythm in your work. A good practice problem to obtain correct rhythmical action is to multiply 45 by 9 across the entire keyboard, beginning at the right. Hold 45 in columns 1 and 2, using the first finger of each hand, and operate nine times; move the fingers to columns 2 and 3 and operate nine times. Continue across the keyboard and try to move over each time with a smooth, even, rhythmic action. Column location is essential to key location, so try to avoid looking at your hands when you are practicing this exercise. Keep your eyes on the problem that you are solving.

Job 12

MULTIPLICATION—TWO-FIGURE FACTORS (*Continued*)

Before working the problems in this job, practice the rhythmic drill mentioned in Job 11.

In the preceding job, the multiplier consisted of only one figure. When the multiplier consists of two figures, the work is carried a little further than before.

Consider this problem:

$44 \times 35.$

1. Hold the pencil in the correct position.
2. See that the machine is in the proper position.
3. Hold the multiplicand (44) with the first finger of each hand. (See Illustration 3.)

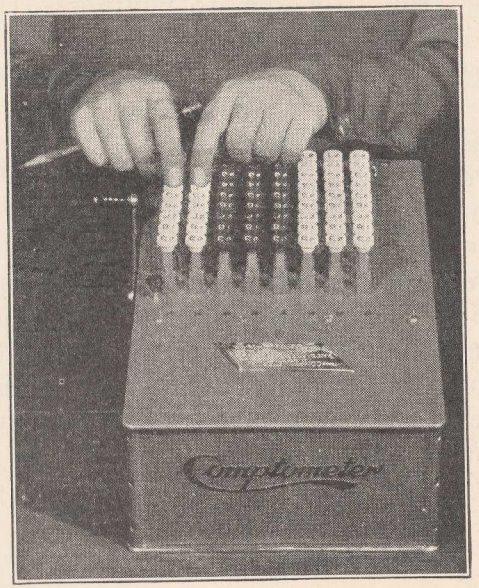

ILLUSTRATION 3

4. Multiply by the 5 units. To do this, depress both keys five times. Depress both keys at the same time. If you do this correctly, the register will read 220 when you have finished.

5. You are now ready to multiply by the next figure. As this figure is in the tens column, you must shift your position before you can multiply. As the 3 is to the left of the 5, it is necessary to shift in this direction.

6. Slide each finger one column to the left. Try to do this without looking at the keys. Column location is as essential to speed as key location. You are now in the proper position for multiplying by the 3 tens.

7. Depress both keys three times. Be sure to depress both keys at the same time. This should result in the correct answer of 1540.

8. Practice this problem until you can do it smoothly and accurately.

9. To prove, reverse the operation. Hold the 35 on the keyboard and multiply by 44.

Solve the following problems. In each case hold the larger number. Try to find the columns without looking at the keyboard. Prove each.

1. 56×12	5. 28×35	9. 12×13	13. 57×86
2. 78×23	6. 77×44	10. 18×18	14. 38×94
3. 12×92	7. 45×99	11. 44×63	15. 22×66
4. 14×57	8. 59×24	12. 96×78	

Job 13

MULTIPLICATION—THREE-FIGURE FACTORS

When one of the factors of a multiplication consists of three figures hold all these figures and proceed as before.

Consider this problem:

$834 \times 48.$

1. Be sure that pencil and machine are in the correct position and that the machine is clear. As there are three figures in this multiplicand, it is necessary to use three fingers to hold it.

2. Hold 834. Always hold the key factor in the most convenient position. In this case hold the 8-key with the first finger of the left hand and the other figures with the first and second figures of the right hand.

3. Multiply as before. The answer is 40032.

Solve the following problems. Try to find the columns without looking at the keyboard. Work with rhythm. Prove each.

1. 467 × 62	3. 898 × 39	5. 988 × 63
2. 356 × 71	4. 589 × 48	6. 621 × 89

Job 14

MULTIPLICATION—THREE-FIGURE FACTORS (*Continued*)

Before working the problems in this job, practice the rhythmic drill mentioned in Job 11.

Very often both the multiplier and multiplicand will contain three figures. Consider this problem:

657 × 345.

1. Hold the multiplicand, 657, in the three right-hand columns of the keyboard. Hold the 6 with the first finger of the left hand and the 5 and the 7 with the first and second fingers of the right hand.

Be sure to keep the pencil between the thumb and the palm of your hand.

2. Multiply by the 5 units. To do this, depress all three keys five times.

3. Multiply by the 4 tens. To do this, slide each finger one place to the left; then depress all three keys four times.

4. Multiply by the 3 hundreds. To do this, slide each finger another place to the left. Depress all three keys three times. The answer is 226665.

Solve the following problems. In each case, hold the larger number. Prove each.

1. 545 × 275	5. 456 × 235	9. 746 × 855
2. 478 × 645	6. 763 × 389	10. 769 × 324
3. 412 × 679	7. 255 × 489	
4. 734 × 279	8. 157 × 434	

Sometimes it is advisable to hold the two left-hand figures with the left hand and the units figure with the right hand. Consider this problem:

651 × 759

1. It would be rather awkward for you to hold the 51 with your right hand.

2. Hold the 65 with your left hand and hold the 1 by itself with your right hand.

Now work the following problems and prove each:

1. 871 × 175	5. 267 × 663	9. 752 × 548
2. 761 × 129	6. 541 × 126	10. 812 × 981
3. 326 × 756	7. 742 × 521	
4. 421 × 852	8. 631 × 439	

Job 15

MULTIPLICATION—FOUR-FIGURE FACTORS

It is possible that you will encounter multiplications in which the factors have four figures. When this occurs, hold two figures with each hand.

Consider this problem:

8556 × 4279.

1. Hold the 85 with the first and second fingers of the left hand and the 56 with the first and second fingers of the right hand.

2. Multiply in the usual manner. The answer is 36611124.

Solve the following problems:

1. 7657 × 8778
2. 4213 × 3214
3. 8613 × 6435
4. 7524 × 8768
5. 2113 × 7647
6. 4335 × 6558

Sometimes it will be necessary to work multiplications in which the factors contain five figures. It is possible to hold five figures with the two hands, but it is much easier to split this factor into two parts. The method of doing this will be explained later.

Job 16

MULTIPLICATION—FINGERING

Before working the problems in this job, practice the rhythmic drill mentioned in Job 11.

The problem of how to hold the fingers does not arise while the key factor consists of only two figures, for each figure is held by a different hand. When the factor consists of three or more figures, the operator should choose the most convenient manner for holding the factor. The proper fingering will make it easier to develop the rhythm and column location, which are so necessary to rapid, accurate multiplication. In order to assist you in learning how to finger the larger key factors correctly, study the following rules and the illustrations that accompany them most carefully.

Natural Fingering. Holding the fingers in a natural position without any strain is called "natural fingering." "Natural fingering" means that the figure being held by the first finger of either hand is smaller than that which is

being held by the second finger of the same hand; for instance, 57 when held with the right hand would be a natural position, because the first finger of this hand is on the 5-key while the second finger is on the 7-key. In other words, the shorter finger is holding the smaller number. The natural position for the left hand would be the same. The long finger would be on the 7 and the short finger would be on the 5.

Reverse Fingering. When it is necessary to turn the hands outward in order to place the long finger on the large number, the process is called "reverse fingering." Proceed as follows in the first problem below. Hold 2442 as the key factor. Hold the 24 with the left hand. Use the long finger on the 4. Hold the 42 with the right hand. Use the long finger on the 4. Raising the elbows slightly will greatly assist in holding reverse combinations. Hold the fingers in a curved position and relax the muscles of the forearm after each key stroke.

Solve the following problems:

1. 2663 × 2442
2. 4774 × 3551
3. 5885 × 4773
4. 6996 × 2663
5. 2441 × 8559
6. 8998 × 3663
7. 3553 × 4574
8. 4664 × 4789
9. 3663 × 8996
10. 2662 × 1551

Interposed Combinations. In holding any key factor, always hold the combination that is most comfortable. Sometimes it is better to hold the smaller key factor than the larger one, because it is easier to operate. The holding of many combinations may be simplified by interposing the fingers.

In holding 495, the 9 is held by the left hand and the 4 and 5 by the right hand.

In holding 391, the 9 is held by the right hand and the 3 and 1 by the left hand.

Solve the following problems:

11. 475 × 391	15. 828 × 938	19. 8338 × 3671
12. 281 × 829	16. 727 × 393	20. 2882 × 8228
13. 392 × 617	17. 6226 × 1762	
14. 594 × 283	18. 7117 × 2891	

Cross Hand Combinations. The process of reverse fingering can frequently be simplified by placing the hands instead of the fingers in reverse order. This is called "cross hand operation," because the left hand is used to do the work that would ordinarily be done by the right hand and the right hand is used to hold the figures that would ordinarily be held by the left hand.

Consider this problem:

2497 × 3586.

1. Try to hold it in reverse fingering, that is, with the right hand holding the 97 and the left hand holding the 24. It is necessary to extend the elbows a considerable distance in order to accomplish this. Cross hand operation makes this more simple.

2. Hold the 97 in its proper columns with the left hand. Hold 24 in its proper columns, but with the right hand.

3. Multiply in the usual manner. The answer is 8954242.

Solve the following problems:

21. 5732 × 2375	24. 2306 × 467	27. 1027 × 4501
22. 1298 × 4697	25. 6743 × 3094	28. 5821 × 782
23. 5631 × 349	26. 3421 × 732	29. 2375 × 3409

Reverse fingering cannot always be changed to cross hand fingering, because the hands will get in the way of each other.

Consider the factor 1331. This number can be held in a reverse position, but it is very difficult to hold it by the cross hand combination. Use the cross hand combination wherever possible, however.

Now that you know the different combinations by which keys may be held, you should select that factor that contains the easiest combination to hold.

Job 17

MULTIPLICATION—CIPHERS

When the Key Factor Contains Ciphers. When the key factor (that is, the factor you are holding) contains a cipher, do not hold the cipher.

Consider this problem:

450 × 134.

Consider 450 as the key factor. In holding this number, hold only the 4 and the 5. Do not try to hold the cipher, for there is no large cipher that you can hold. Skip the column in which the cipher appears. Hold the 4 in the third column from the right and the 5 in the second column from the right. Hold the 4 with the first finger of the left hand and the 5 with the first finger of the right hand. Multiply in the regular manner. The answer is 60300.

Solve the following problems:

1. 750 × 267	3. 460 × 781
2. 890 × 362	4. 320 × 272

This same principle applies when the ciphers appear between other figures instead of at the end.

Consider this problem:

405 × 134.

Consider the 405 as the key factor.

1. Hold the 5 in the units column with the first finger of the right hand.
2. Hold the 4 in the hundreds column with the first finger of the left hand. This leaves a column between the two in which no key is held.
3. As you move from right to left, be sure that this blank column remains between the two keys.

Solve the following problems:

1. 306 × 421
2. 407 × 326
3. 508 × 728
4. 609 × 415

When the Multiplier Contains Ciphers. Ciphers may appear in the multiplier as well as in the key factor. In such cases, skip the position in which the cipher appears.

Consider this problem:

451 × 205.

Consider 451 as the key factor.

1. Place the pencil and the machine in the proper position.
2. Hold the key factor in the proper position.
3. Multiply by the 5 units.
4. Move each finger one column to the left. This places your hands in the position for multiplying by the tens.
5. As there are no tens, no multiplication is performed; therefore, slide each finger another place to the left.

6. Multiply by the 2 hundreds.

Solve the following problems:

1. 326 × 407
2. 478 × 508
3. 531 × 609
4. 676 × 2003
5. 821 × 3004
6. 937 × 7002

Job 18

MULTIPLICATION—DECIMALS

Mixed Numbers. The rule for pointing off decimals when multiplying from the right of the keyboard as you have been doing is exactly the same as in pencil-and-paper multiplication—namely, add the number of decimal places in the multiplicand to the number of decimal places in the multiplier to determine the number of decimal places in the answer. Starting at the right, turn down the pointer as many places to the left as there are decimals in both factors. Always point off *before* you start to multiply.

Consider this problem:

485.2 × 3.2.

1. Place the pencil and the machine in the proper position.
2. There is one decimal place in the multiplicand and one in the multiplier, so there will be two decimal places in the answer.
3. Turn forward the second decimal pointer. All others should be turned to the right.
4. Perform the multiplication as you have always done. In this case it is much easier to hold the 32 and use 4852 as the multiplier than to try to hold 4852 and use 32 as the multiplier.

Solve the following problems. Try to develop rhythm. Be careful to use the proper combinations when holding the various factors, and depress the keys completely.

1. 38.26 × 4.25	**5.** 2.016 × .821	**9.** 62.78 × 5.21
2. 4.26 × 43.1	**6.** 217.8 × 302	**10.** .4216 × 36.09
3. 8.947 × 3.28	**7.** 427.8 × 674	
4. 8962 × 4.79	**8.** .8067 × 4.316	

When Both Factors Are Decimals. When both factors of the multiplication are decimals the procedure is exactly the same as explained above.

Consider this problem:

.267 × .871.

1. Follow the rule mentioned above. Find the total number of decimal places in the two factors. As there are three decimal places in the mutiplier and three in the multiplicand, there will be six places in the answer.

2. Turn forward the sixth decimal pointer, like this:

0000′000000

3. Multiply as instructed before. The answer is .232557.

Solve the following problems:

1. .257 × .482	**3.** .826 × .309
2. .610 × .217	**4.** .507 × .402

Preceding Ciphers. When either of the factors contains preceding ciphers, the procedure is exactly the same.

A preceding cipher is a cipher that stands between the decimal point and another figure on the right. For instance, in .005 there are two preceding ciphers, because there are two ciphers between the decimal point and the 5. In .057 there is one preceding cipher.

When there is a number to the left of the decimal point, as in 1.005, the cipher to the right of the decimal point will not be called a preceding cipher because there is a figure (1) to the left of the decimal point. Be sure that you understand this thoroughly, as you will need to know it later on.

The ciphers are not held when multiplying, but they are counted when pointing off.

Consider this problem:

.4821 × .0057.

1. Place the machine and the pencil in the proper position.

2. Determine the number of decimal places to be pointed off in the answer. In this problem, eight places should be pointed off.

3. Turn down the decimal pointer to the left of the eighth dial, like this:

00′00000000.

4. Hold 57. Use the first finger of each hand. Do not try to hold the ciphers. They have been counted in pointing off. Multiply in the usual manner.

Solve the following problems:

1. .628 × .032	**3.** .612 × .021	**5.** .672 × .0046
2. .479 × .043	**4.** .246 × .0021	**6.** .438 × .0089

Job 19

MULTIPLICATION—LEFT OF KEYBOARD

The instructions thus far have taught you how to multiply from the right-hand side of the keyboard. This

is satisfactory when small factors are used, but when large factors containing decimals are used, it is advisable to multiply from the left of the keyboard. If you have a multiplication of large factors containing decimals, such as 32.465 × 5154.2368, your machine may not be large enough to hold the product.

If the machine is not large enough to hold the product, some of the figures that should show in the answer will not appear in the dials. If it is necessary to drop some figures, it is better to drop the figures on the right, because the figures to the right are of least value. If you multiply 41.2978 by 4.1432 with pencil and paper, the answer will be 171.10504496. This answer is beyond the capacity of an eight-column machine. In writing this answer with pencil you would probably show it as 171.1051; in other words, you would drop the last five decimal figures, because, ordinarily, they are of little value. The dropping of the last decimal figures is what the machine does when multiplying by the "left-to-right" method. For this reason, if the answer contains decimals and is greater than the capacity of the machine, it is better to multiply from the left.

When the factors are whole numbers and, therefore, contain no decimals, as 412978 × 41432, the problem must be solved in another manner. Answers that are correct to the third decimal place are accurate enough for most business problems, and, for this reason, decimals beyond the third place are usually dropped. No office, though, would tolerate the dropping of whole numbers.

The next few jobs will explain how to multiply from the left of the keyboard.

Consider this problem:

26 × 45.

1. Place the pencil and the machine in the proper position. Hold 45 with the index finger of each hand in the two *left-hand* columns of the keyboard. Hold the 4 in the extreme left-hand column and the 5 in the column next to it.
2. Start multiplying from the *left* of the multiplier. Depress the keys twice to multiply by the 2 tens.
3. Slide the fingers one place to the *right.*
4. Depress the keys six times to multiply by the 6 units. The answer, 1170, will appear in the left-hand side of the dials.

Solve the following problems. Work in rhythm. Try to find the columns without looking at the keyboard. Depress the keys completely.

1. 26 × 46	3. 67 × 82	5. 82 × 75
2. 89 × 97	4. 96 × 47	6. 33 × 92

Job 20

MULTIPLICATION—FROM LEFT OF KEYBOARD—DECIMALS

It is necessary to learn to point off when multiplying from the left of the machine. Here is the rule: Start at the extreme left of the machine and count one dial for each whole number in both the multiplier and multiplicand. Turn down the decimal marker at the right of the last dial counted. Whole numbers are numbers to the left of the decimal point. For instance, in 42.6, there are two whole numbers, because there are two numbers to the left of the decimal point

Consider this problem:

$$37.5 \times 2.54.$$

1. Place the pencil and the machine in the proper position.
2. Turn all the decimal pointers to the right.
3. Apply the rule stated above. Start at the left and count one dial for each whole number in the two factors. As the whole numbers are those numbers to the left of the decimal point, there are two whole numbers in the multiplicand and one whole number in the multiplier, or three whole numbers in both.
4. Count three dials from the left and turn forward the decimal marker at the right of the third dial.
5. Multiply as instructed before. The correct answer is 95.25.

Solve the following problems. Work in rhythm. Try to find the columns without looking at the keyboard. Be careful to use the proper finger combinations when holding the various factors. These are indicated at the top of each column.

Interposed	*Reverse*
1. 28.91×612.7	4. 2.343×688.6
2. 82.19×17.82	5. 7.887×45.65
3. 37.74×3.882	6. $.5775 \times 3.454$

The dial at the extreme left of the register must always be included when counting the number of places to point off from the left.

Try this:

$$12 \times 6.$$

The dials show 072. The pointer belongs to the right of the 2. As the naught in this answer has no value, it may be dropped. This makes the correct answer 72.

Solve the following problems:

1. 13×6	3. $.13 \times 6$	5. $1.3 \times .6$
2. 1.3×6	4. $12 \times .8$	6. $13 \times .6$

Job 21

MULTIPLICATION—FROM LEFT OF KEYBOARD—WHEN BOTH FACTORS ARE DECIMALS

If both the multiplier and multiplicand contain no whole numbers, the decimal point should not be moved.

Consider this problem:

$$.612 \times .234.$$

1. Place pencil and machine in the proper position.
2. As both factors are decimals and, therefore, do not contain any whole numbers, the decimal point is not moved.
3. Multiply as before. Develop rhythm and ability to locate columns quickly and accurately.

Solve the following problems and prove each:

Interposed	*Natural*
1. $.1627 \times .9382$	4. $.7557 \times .4335$
2. $.7182 \times .6161$	5. $.2156 \times .8724$
3. $.2717 \times .3828$	6. $.5346 \times .4324$

Remember that multiplication from the left of the keyboard is used only in situations such as those described at the beginning of Job 19. Most multiplications are worked from the right of the keyboard. Unless otherwise instructed, work all the problems that follow from the right.

Job 22

MULTIPLICATION—SPLIT MULTIPLIERS

Before working the problems in this job, practice the rhythmic drill mentioned in Job 11.

Sometimes the figures used in multiplication are too large to be held conveniently. By using the finger combinations taught in Job 16, you should be able to hold four keys easily. When the key factor contains five keys, this factor may be split; that is, it is better to divide the multiplier into two parts, and hold one part at a time. Consider this problem:

12.365 × 83.456.

1. Place the pencil and the machine in the proper position.
2. As this problem is to be worked from the right, point off from the right.
3. Try to hold 83.456. It is not convenient.
4. Split the multiplier. In this case, hold the three right-hand figures of the multiplier, which are 456.
5. Multiply by 12365.
6. Return to the right-hand side of the keyboard. Hold the 83, which is the second part of the multiplier, in the same position in which you would have held it had you been able to hold all five figures of the multiplier at the same time. In other words, hold the 83 in the fourth and fifth columns from the right.
7. Multiply by 12365 again.
8. If you work correctly, 1031.93344 should appear in the dials. If you do not get this answer, clear the machine,

reread the directions, and work the problem again. In working these problems, remember to hold the proper finger combination and try to develop rhythm.

Solve the following problems. When splitting the multiplier, always hold three keys on the first operation.

1. 43.678 × 27.134
2. 62.41 × 7.832
3. 97.656 × 18.249
4. 3.6478 × 2.7142
5. 932.17 × 46.843
6. 1.2467 × 37.821
7. .29320 × 36.427
8. 68.217 × 4.3539
9. 4.7819 × 278.13
10. 26.978 × .46124

Job 23

REVIEW

These problems have been listed according to jobs. If you have forgotten any procedure, refer to the job indicated and refresh your memory by reading it. Prove each problem.

Job 7

1	2
26178	462.37
137	8.27
4561	61.40
27	378.21
684	6.27
5718	.46
62175	782.89
98213	1.06
46278	67.23
1036	426.20
42126	3.17
70041	.08
97314	27.39
21678	261.43

Job 9

3	4	5
36^{4}	671^{4}	$6.7^{3}2$
$2^{8}3$	$^{2}037$	$^{6}.217$
$4^{2}0$	$4^{2}18$	$4.^{8}60$
—	—	—

Job 16

Natural	*Reverse*
6. 4224 × 6556	10. 6875 × 1331
7. 3112 × 8668	11. 5674 × 2431
8. 6447 × 9779	12. 3454 × 4664
9. 3114 × 2112	13. 7987 × 5886

	Interposed	*Cross Hand*
14.	2882 × 7226	**18.** 8943 × 6521
15.	3993 × 9118	**19.** 6704 × 1245
16.	2771 × 8227	**20.** 20589 × 186
17.	3651 × 7348	**21.** 4587 × 2398

Jobs 17 and 18	Jobs 20 and 21	Job 22
22. .406 × .821	**28.** 1627 × .9181	**32.** 275.41 × .62325
23. .610 × .435	**29.** 61.71 × .6272	**33.** 556.53 × .80185
24. .372 × .307	**30.** 3.818 × .5161	**34.** .25312 × .03253
25. .4002 × .480	**31.** .2929 × .8283	**35.** .02884 × 88982
26. .6261 × .089		
27. .2836 × .0072		

Job 24

SUBTRACTION

In a preceding job you learned that there were two factors in multiplication. The same is true of subtraction. In paper-and-pencil subtraction these factors are called "minuend" and "subtrahend." The minuend is the number from which another number is to be subtracted. The subtrahend is the number to be subtracted. The answer is called the "remainder." These terms are shown in the example below.

98 minuend
75 subtrahend
—
23 remainder

As the following instructions refer to these terms, you should become familiar with them.

In subtracting on any key-driven machine, there are just two rules to remember:

1. Use the large figures and add the minuend (98) at the right side of the keyboard.

2. To subtract, always use the small figures and hold the amount you want to deduct, less 1.

Consider the problem shown above. In this case, hold 75 less 1, or 74, on the small keys. (See Illustration 4.)

1. Locate the "cut-off," the small nickel-plated lever at the left of each register dial. Hold the cut-off at the left of the left-hand number of the minuend. In this case hold the cut-off at the left of the second column. (See Illustration 4.) Do not release the cut-off until you have completed the subtraction.

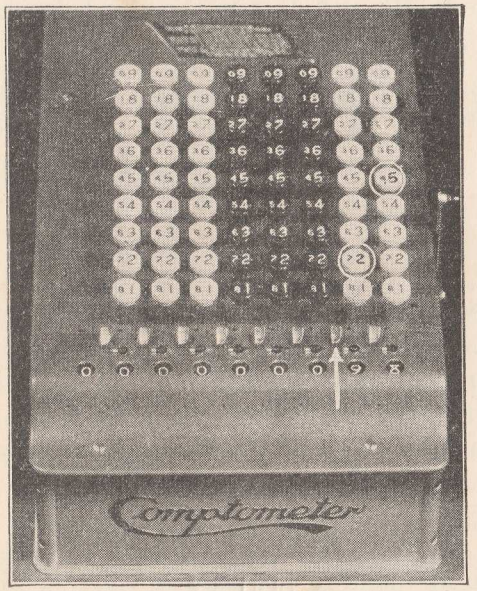

ILLUSTRATION 4

2. Use the small figures and depress the subtrahend less 1.

3. The answer, 23, should appear in the register. Prove the answer by adding the subtrahend to the figures that appear in the lower dials. The result should be the minuend.

Solve the following problems:

1. 85 − 63	3. 66 − 28	5. 7734 − 6213
2. 77 − 42	4. 854 − 623	6. 46.21 − 5.14

Decimals. Pointing off in subtraction is the same as pencil and paper subtraction. Set the decimal marker *before* you start to subtract and then set the problem around it. In problems 7 and 8 use the second decimal marker. In problems 9, 10, and 11 use the third decimal marker. In problem 12 use the fifth decimal marker.

7. 857.96−43.22	9. 72.398 − 1.178	11. 8.321 − .132
8. 715.67 − 288.46	10. 46.137 − 21.728	12. 8.21635 − 2.13786

Job 25

SUBTRACTION—BORROWING

Sometimes it is necessary to borrow when you are subtracting. This is always true when the left-hand figure of the subtrahend is larger than the figure from which it is to be subtracted. When this happens, it is necessary to proceed in a manner slightly different from before.

Consider this problem:

465.27 − 87.15.

1. Set the minuend in the right of the machine.
2. Point off.

3. Notice that the left-hand figure of the subtrahend, which is 8, is larger than the number from which it is to be subtracted, which is 6. This means that it is necessary to borrow from the number to the left of the 6, which, in this case, is 4.

4. Hold the cut-off at the left of the 4, because you must borrow from the 4. Always hold the cut-off to the left of the figure from which you are borrowing.

5. Depress 08714 on the small figures. Notice that it is necessary to strike the small cipher when you borrow.

6. The answer, 378.12, should appear in the lower dials.

Go over these instructions until you understand them thoroughly, and then work and prove the following problems:

1. 452.61 − 87.12	3. 837.41 − 56.22	5. 4331.62 − 528.87
2. 467.26 − 87.24	4. 2667.43 − 743.26	6. 25216.74 − 7240.88

This rule of borrowing applies any time you have to borrow.

Consider this problem:

426.45 − 28.32.

The left-hand figure of the subtrahend (2) is the same as the number from which it is being subtracted (2), but the figure to the right of it (8) is larger than the figure from which it is being subtracted (6), and you will, therefore, have to borrow.

Follow these steps:

1. Point off.
2. Add the minuend in the right of the machine.
3. Hold the cut-off at the left of the number from which you will borrow (in this case, at the left of the 4).

4. Depress 02831 on the small figures. Remember that it is necessary to depress the small cipher when you are borrowing. The answer, 398.13, should appear in the lower dials.

Solve and prove the following problems:

7. 477.27 − 78.16	**9.** 71.8634 − .8767	**11.** 462.51 − 63.27
8. 23.146 − 3.251	**10.** 821.73 − 25.61	**12.** 21.785 − 1.827

Job 26

SUBTRACTING NINES

You have probably noticed by this time that there are no small 9's on the Comptometer. However, 9's frequently appear in the subtrahend, and the question arises as to what to do when it is necessary to use this number.

Consider this problem:

49.57 − 9.22.

1. Add 49.57 in the right of the machine.

2. Subtract 9.21 on the small figures. You will find that there is no small 9 to subtract. Accordingly, skip the column in which the 9 would be subtracted if you had one. In this particular problem, you should subtract only the small 2 and 1. You should, however, hold the cut-off to the left of the third dial just as if the 9 in the subtrahend had been depressed.

If you have performed the work correctly, the answer of 40.35 should appear in the lower dials. If you think you understand this, solve the following problems. Prove each.

1. 258.78 − 4.97	**3.** 786.29 − 42.96	**5.** 29.89 − 9.32
2. 488.16 − 79.67	**4.** 781.89 − 49.26	**6.** 39.89 − 8.40

The rule about borrowing applies just the same when you are using 9's as when you are using any other figures.

Consider this problem:

28.31 − 9.26

1. Set 28.31 on the right of the keyboard.
2. Note that you will have to borrow.
3. Hold back the cut-off at the left of the 2, because you will have to borrow from this number.
4. Subtract 0—25 on the small keys. The dash indicates that you should skip the column containing the 9. The answer of 19.05 should appear in the lower dials.

Try these problems. Prove each answer.

7. 367.71 − 9.38	**9.** 6.2514 − .927	**11.** 847.32 − 92.63
8. 382.42 − 9.317	**10.** 187.621 − 93.526	**12.** 3.146 − .293

Even when the problems at first do not indicate the borrowing, it may be necessary to borrow. When this occurs, follow the rules shown in the second part of Job 25.

Solve these problems. Prove each.

13. 29.31 − 9.45	**15.** 829.85 − 9.96	**17.** 69.571 − 9.632
14. 879.47 − 9.54	**16.** 2.9763 − .9822	**18.** 431.67 − 31.99

Job 27

SUBTRACTION—SMALL CIPHERS

When the subtrahend contains ciphers, be sure to strike these ciphers. When using the small figures, the naught column is not skipped. Consider this problem:

3842 − 302.

1. Place the pencil and the machine in the proper position.

2. Set the minuend in the right of the machine, using the large figures.

3. Hold the cut-off to the left of the third column from the right.

4. Use the small figures and subtract the subtrahend less 1. Do not omit the column in which the naught appears in the subtrahend. You will find the naught on the small figures on the top row of keys. The correct answer is 3540.

Note that these instructions apply to ciphers that appear between two figures of value. If the cipher appears at the end, as in 320, this procedure is not necessary; 320 less 1 equals 319, and this amount would be subtracted according to the method outlined in Job 26.

Solve the following problems and prove each.

1. 896.21 − 707.06
2. 478.36 − 306.08
3. 562.89 − 200.37
4. 781.64 − 400.09
5. 213.67 − 100.05
6. 1423.87 − 607.20
7. 6721.36 − 1070.60
8. 478.994 − 200.80
9. 876.492 − 18.007
10. 613.492 − 18.007

Job 28

SUBTRACTION—ELIMINATING NINES

Before working the problems in this job, practice adding the problems in Job 8. Do not skip this assignment as it is very important that you acquire speed and accuracy in addition.

There is another method for subtracting on the Comptometer, which, when used, eliminates the need for using the cut-off and borrowing.

Consider this problem:

75 − 50

1. Use the large figures and insert the minuend at the right side of the keyboard.

2. Do not hold any cut-off, but use the small figures and subtract the subtrahend less 1 in the usual manner.

3. Depress the keys for the large 9's in all the columns to the left of the columns in which the subtrahend was depressed. In this problem, the subtrahend was set in the two right-hand columns. Therefore, depress the 9's in all the columns except these two. Begin depressing the 9's in the third column from the right and work towards the left. You can save considerable time by depressing these 9's three at a time.

The correct answer, 25, should appear in the register of your machine. Pay no attention to the 1 that appears in the extreme left-hand dial, as it does not affect the answer.

Solve the following problems. Prove each.

1. 864 − 271
2. 246.27 − 89.45
3. 431.60 − 102.27
4. 89.361 − 42.068
5. 923.45 − 67.20
6. 274.31 − 89.70
7. 305.27 − 40.62
8. 784.62 − 89.00
9. 438.75 − 52.99
10. 678.45 − 213.27

Job 29

CIPHER DIVISION

Before working the problems in this job, practice adding the problems at the end of Job 3. Do not skip this work,

as it is essential for you to develop speed and accuracy in adding.

The factors in any division problem are called the "divisor" and the "dividend." The divisor is the number that is to be divided into another number. The dividend is the number that is to be divided by another number (called the divisor).

There are two ways of dividing on the Comptometer. The first of these is called "cipher" division, and is generally used when the divisor does not contain more than two or three figures and when the dividend is small.

Consider this problem:

1050 ÷ 25.

1. Like pencil-and-paper subtraction, machine division is performed from left to right.

2. Use the large figures and enter the dividend in the machine in the *next to the last column* to the left, like this:

001050000.

In cipher division it is necessary to set the dividend in the next to the last column on the left and not in the last column.

3. As in subtraction, hold the small figures less 1. In this problem, hold 24, using the small figures. In addition to this, hold the small cipher to the left of the 24. In other words, the key factor that you are holding is 024 on the small figures.

4. Locate the dials that are directly under the divisor. In this case the divisor is 25 and the dials directly under it show 1 and 0, like this:

024 divisor
001050000 dials

The amount that appears in the dials directly under the key factor is called the remainder. (See Illustration 5.)

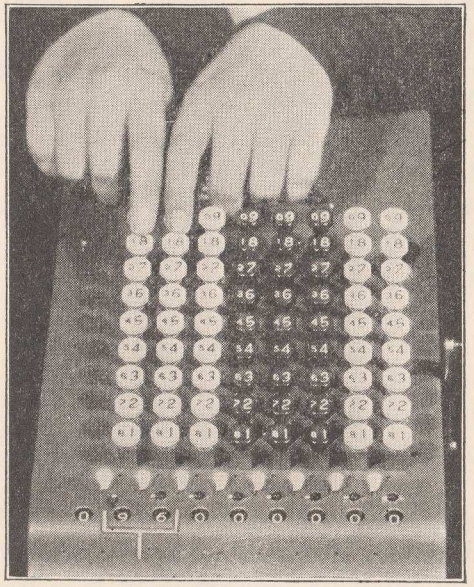

ILLUSTRATION 5

5. It is always necessary to reduce the remainder until it is *less* than the divisor. In this case the remainder, 10, is already less than the divisor, 25, so it is not necessary to reduce it.

6. Slide each finger one place to the right. Now the remainder, 105, is greater than the divisor, so it is necessary to reduce this remainder, 105, until it is less than the divisor, 25.

7. Depress the keys once. The result will be:

010800000.

Disregard the 1 that appeared in the second dial to the left, as you are not working in this column, but keep on working with the remainder, which is now 80.

8. Depress the keys again. This reduces the remainder to 55, which is still greater than the divisor.

9. Depress the keys again. This reduces the remainder to 30, which is still greater than the divisor.

10. Depress the keys again. This reduces the remainder to 5, which is less than the divisor. So we stop dividing in this position.

11. Slide each finger one column to the right. The remainder is now 50, which is greater than the divisor.

12. Depress the keys once. Pay no attention to the unit that appeared to the left, as you are not working with this column. The remainder is now 25, which is equal to the divisor.

13. The remainder must be reduced until it is *less* than the divisor. This remainder of 25 is equal to the divisor, but it must be reduced until it is less. Depress the keys again. This leaves a remainder of 0. The answer of 42 will appear in the left-hand dials.

Solve the following problems. If you have trouble, read the instructions again carefully. Prove each. To prove divisions, multiply the answer by the divisor.

1. 1242 ÷ 27	**5.** 714 ÷ 17	**9.** 825 ÷ 15
2. 854 ÷ 61	**6.** 803 ÷ 12	**10.** 368 ÷ 16
3. 552 ÷ 12	**7.** 546 ÷ 13	
4. 936 ÷ 18	**8.** 1218 ÷ 14	

Job 30

CIPHER DIVISION—POINTING OFF

The rules for pointing off when dividing for cipher division are simple:

1. Always begin by placing the decimal pointer in the same place at which the point occurs in the dividend. When no decimal point is shown in the dividend, it is understood to be to the right of the right-hand figure.

2. Because of the small cipher that is held to the left of the divisor, move the decimal point one place to the left.

3. For each whole number in the divisor, move the decimal point an additional place to the left.

Consider this problem:

1050 ÷ 25.

1. Apply Rule 1. As the decimal point is not shown in the dividend, it is understood to be to the right of the right-hand figure like this:

1050.

Therefore, set the decimal pointer to the right of the 0, like this:

001050′000.

2. Apply Rule 2. Move the decimal pointer one place to the left, like this:

00105′0000.

3. Apply Rule 3. There are two whole numbers in the divisor. A whole number is any number to the left of the decimal point. In this case the decimal point is not written,

so it is understood to be to the right of the 5. This means that there are two whole numbers in the divisor. Move the decimal pointer two more places to the left like this:

001′050000.

4. Divide as instructed before.

Solve the following problems. Prove each.

1. 676 ÷ 26	5. 1364 ÷ 22	9. 2125 ÷ 25
2. 1428 ÷ 34	6. 2345 ÷ 35	10. 2944 ÷ 32
3. 1325 ÷ 25	7. 1656 ÷ 24	
4. 1716 ÷ 26	8. 2304 ÷ 32	

Job 31

REGULAR DIVISION—POINTING OFF

Regular division on the Comptometer is also performed from the left of the keyboard. In pointing off follow the rules given in cipher division, but make no allowance for the extra cipher (see Job 30, Rule 2) in the division, as this extra cipher is not held in regular division.

The general rule is: For every whole number in the divisor, move the dividend decimal point one place to the left.

To count the number of places to the left, you must know where to start. Always set the dividend in the register as it is written; that is, with the pointer in the same place in which the decimal point occurs in the dividend. Then move the decimal point one place to the left for each whole number in the divisor. Always point off before you begin to divide.

Consider this problem:

17.28 ÷ 12.1.

1. Using the large figures, set 1728 in the machine at the left of the keyboard.

2. Turn down the decimal marker as it is written in the dividend, like this:

017′280000.

3. Apply the rule:

a. Notice that there are two whole numbers in the divisor.

b. Move the decimal point one place to the left for each whole number in the divisor. When you have finished, the answer decimal point will be to the left of the 1, like this:

0′17280000.

c. Remember that every time you use the decimal point you should turn the old decimal point back, so that it will not be in the way.

Whole Numbers. When no decimal point is written, it is always understood to be at the right of the right-hand figure.

Consider this problem:

144 ÷ 12.

1. Using the large figures, set 144 to the left of the machine.

2. Set the decimal point as written. As no decimal point is shown, it is understood to be to the right of the right-hand figure. Therefore, turn down the decimal marker to the right of the right-hand figure, like this:

0144′00000.

3. Move the decimal point one place to the left for each whole number in the divisor. As there are two whole numbers in this divisor, move the decimal point two places to the left, like this:

01′4400000.

You are now ready to divide.

Division consists of three steps, which are always followed in exactly the same order. These three steps are:

1. Equal the index finger.
2. Reduce the remainder.
3. Shift to the right, and repeat.

These steps will be explained to you in the order in which they are used

Job 32

DIVISION—EQUALING THE INDEX

The first step in division is called "equaling the index." Before you work this step, though, you will have to understand what is meant by the index. The index is the dial to the left of the columns in which you are holding your fingers. (See Illustration 6.)

The index takes the place of the estimating that we do when dividing mentally.

Consider this problem:

89) 1111 (

In solving this problem mentally, we would begin by estimating that 89 "goes into" 111 once. As you work the problem on the machine, you will note that the index does

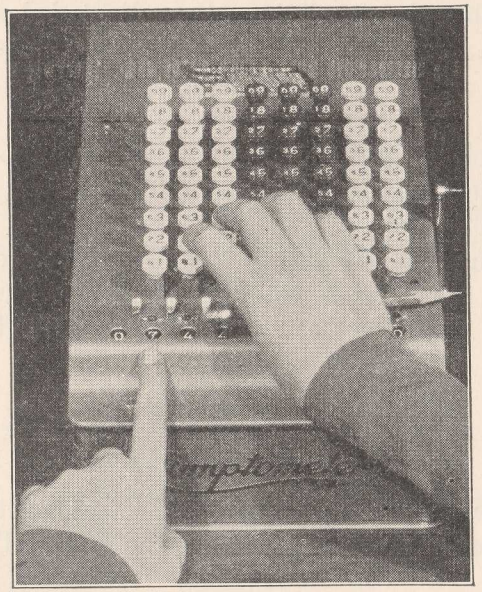

ILLUSTRATION 6

this estimating for you. To work this same problem on the machine, proceed as follows:

1. Use the large figures and set the dividend, 1111, in the left of the machine. Do not skip a column as you did in cipher division.

2. Point off. When no decimal point is written, it is understood to be to the right of the right-hand figure; so point off like this:

01111′0000.

3. Move the dividend decimal point one place to the left for each whole number in the divisor. As there are two

whole numbers in the divisor, the adjusted decimal point will be like this:

011′110000.

4. As in cipher division, always hold the divisor less 1 and use the small figures. Hold 88 (89 − 1) in the first two columns on the left.

5. The index is the dial to the left of those columns on which you are holding your fingers. (See Illustration 6, page 55.) In this problem the index is 0, like this:

88
011′110000.
I

6. As the index is 0, do nothing in this position.

7. Slide each finger one place to the right. The index is now 1:

8 8
011′110000.
I

8. Equal the index. As the index is 1, depress both keys once. The answer thus far is 012′210000.

Be sure that you understand exactly what you have done. The index was 1, so you depressed the keys once.

9. Slide each finger another place to the right.

10. The index is now 2:

88
012′210000.
I

11. Depress both keys twice. The answer is 012′430000.

12. Slide each finger another place to the right.

13. The index is now 4:

88
012′430000.
I

14. Depress both keys four times. The dials will read 012.474000. For reasons that will be given later, you may stop working this problem now.

Consider this problem:

1212 ÷ 88.

1. Using the large figures, set the dividend, 1212, in the left of the machine and point off.

2. Hold 87 on the small figures in the first two columns at the left like this:

87
012′120000.
I

3. The index is 0, so nothing is to be done in this position.

4. Slide each finger one place to the right. The index is 1, like this:

8 7
012′120000.
I

5. As the index is 1, depress the keys once. This gives an answer of 013.320000.

6. Slide to the next position:

87
013′320000.
I

The index is 3, so depress the keys three times. The answer is 013′680000.

For reasons that will be explained later, you will stop at this point.

Consider this problem:

2121 ÷ 88.

Set the dividend in the left of the machine and point off. Hold the fingers in the first two columns at the left, like this:

87
021′210000.
I

1. The index is 0. Therefore, do nothing in this position.
2. Slide to the next position:

8 7
021′210000.
I

3. The index is 2, so depress the keys twice. The register now reads 023′610000.
4. Slide to the next position:

87
023′610000.
I

5. The index is 3, so depress the keys three times.
6. The answer is 023′970000.
7. Clear the dials.

Job 33

DIVISION—WHEN INDEX CHANGES

In dividing on the Comptometer, it frequently happens that the index will change while you are trying to agree with it. When this occurs, it is necessary to continue to depress the keys until you do agree with it. For instance, if the index is 6 and you depress the keys six times, the index will sometimes change to 7 or even to 8. When this occurs, you must depress the keys an additional number of times to make them equal the index.

Consider this problem:

7251 ÷ 88.

1. Use the large figures and set 7251 in the left-hand side of the machine.
2. Point off.
3. Hold 87 on the small figures in the first two columns on the left.
4. The index is 0, so slide each finger to next position.
5. The index is 7, so depress the keys seven times.
6. As you were depressing the keys, the index changed to 8. This means that you have not yet equaled the index. You have depressed the keys seven times, but the index is 8. So, in order to equal the index, you must depress the keys another time. As you have already depressed the keys seven times, this extra time will make 8, which is the number of the index. Try it. If you have done your work correctly, the answer thus far will be 082′110000.
7. Slide to the next position.
8. The index is 2, so depress the keys twice.

9. Do this and notice that the index does not change. It is 2, and you have depressed the keys twice. So you have equaled the index. The answer thus far is 082′350000.

10. Shift to the next position.

11. The index is 3, so depress the keys three times. The answer now is 082′386000.

12. Slide to the next position. Now the index is 8. Depress the keys eight times. While you were doing this, the index changed to 9. It will be necessary to depress the keys once again in order to equal it. This makes nine depressions in all, which agrees with the index. Now the answer is 082′396800.

13. Slide to the next position.

14. The index is 6, so depress the keys six times; it changes to 7. So depress the keys once more to equal it. The answer is now 082′397640.

15. Slide to the next position.

16. The index is again 6; so depress the keys six times.

17. It changes to 7. So depress the keys once again. The answer now is 082′397724. For the present, stop here.

When you think you understand exactly what is meant by "agreeing with the index," solve the following problems. Carry the answers to the third decimal place only.

1. 3102.15 ÷ 79	3. 2968.40 ÷ 6.5	5. 45271 ÷ .67
2. 3363.71 ÷ 75	4. 81.31 ÷ 8.3	6. 78554 ÷ .82

Job 34

DIVISION—REDUCING THE REMAINDER

Before working the problems in this job, add all the problems in Job 4.

Before you can reduce the remainder you must, of course, know what is meant by this term. The meaning of the "remainder" was explained to you under cipher division. Generally speaking, the remainder is shown in the dials that appear directly underneath the figures you are holding. (See Illustration 5.)

Consider this problem:

1728 ÷ 12.

1. Using large figures, set 1728 in the left of the machine and point off.

2. Hold 11 on the small figures in the first two columns on the left. Use the first finger of each hand.

3. Look directly below your hands to the dials and see that the remainder is 17.

4. As 17 is greater than the divisor, 12, you must apply your rule and reduce the remainder until it is less.

5. Accordingly, depress both keys once. When you do this, a 1 will appear in the extreme left-hand side of the dial, but you should pay no attention to it. Remember that you are working now only with the remainder, and the remainder is that number that appears directly beneath the columns you are holding. By depressing the keys once, you get an answer of 105′280000. The remainder is now 05, and since that is less than the divisor, 12, you have finished with these columns.

6. Slide each finger one column to the right.

7. The remainder is now 52.

8. Since 52 is greater than the divisor, 12, start to reduce it.

a. Press both keys once, which reduces the remainder to 40.

b. Pay no attention to the 1 that appeared in the second dial from the left. You are concerned only with the remainder.

c. Depress the keys again. This reduces the remainder to 28, which is still greater than 12.

d. Depress both keys again, and the remainder is reduced to 16.

e. As this number is greater than 12, depress the keys again, and at last the remainder is reduced to 04, which is less than 12. So you have finished with these columns.

9. Slide each finger one place to the right. This time you are holding your fingers in the third and fourth columns from the left.

10. The remainder is now 48, so depress each key to reduce it to 36.

11. Depress them again to reduce the remainder to 24.

12. Depress them again to reduce the remainder to 12.

13. Now 12 is the same as the divisor, but the rule is that you must continue to reduce the remainder until it is less than the divisor.

14. Accordingly, depress the keys once again, which produces a remainder of 0. In other words, the problem comes out even and the answer appears at the left of the keyboard. It is 144.

If you do not understand this, go over it again thoroughly.

Now consider this problem:

379.98 ÷ 18.

1. Using the large numbers, set the dividend, 379.98, in the left of the machine, and point off. Remember you always point off *before* you work the problem. Now look at the divisor.

2. Hold 17 on the small figures at the left of the keyboard.

3. Look directly below the two columns in which you are holding the 17, and you will see that the remainder is 37. Since this is greater than the divisor, you must reduce it.

4. Depress the keys once, and the result will be 11′9998.

5. The remainder is still greater than the divisor, 18; so depress the keys again.

6. The dials now read 20.1998. Pay no attention to the figures that appear in the extreme left-hand dial. The remainder is now 1, which is less than 17. Slide both fingers to the right, so that you are now holding 17 in the second and third columns from the left of the keyboard.

7. Depress the keys once, and the result will be 21.0198. The remainder now reads 01 or 1.

8. Since 1 is less than 18, shift again to the right and depress the keys once to produce a result of 21.1018.

9. The remainder is 01, which is less than 18; so shift again. The remainder is 18. This is equal to the divisor. But the rule is that you must continue to depress until the remainder is *less* than the divisor.

10. Therefore, depress the keys once, which reduces the remainder to 0. Since there is no remainder, you must have finished your problem. This means that the problem came out even. The answer, 21.11, will appear at the left of the dials.

If you do not understand this, go over it again. If you understand what is meant by "reducing the remainder," work the following problems:

1. 61538 ÷ 29
2. 735.84 ÷ 1.2
3. 315.45 ÷ 15
4. 995.84 ÷ 3.2

Job 35

COMBINING THE THREE STEPS

Thus far, you have been taught three separate steps in division: (1) agreeing with the index, (2) reducing the remainder, and (3) shifting to the next position. In order to work division problems properly, it is necessary that all these steps be included. Here is the order: Equal the index, reduce the remainder, move to the right, and repeat.

Consider this problem:

63542 ÷ 77.

1. Use the large figures and set the dividend, 63542 in the left-hand side of the machine and point off.

ILLUSTRATION 7

2. Use the small figures and hold the divisor less 1 on the left of the keyboard.

3. As the index is 0, it is not necessary to equal it.

4. As the remainder, 63, is already less than the divisor, 77, it is not necessary to reduce it.

5. Slide each finger one place to the right. The index is now 6. (See Illustration 7.)

6. Equal it. You will equal it at 7.

7. After you have equaled the index, the remainder will be 96, as shown in Illustration 8.

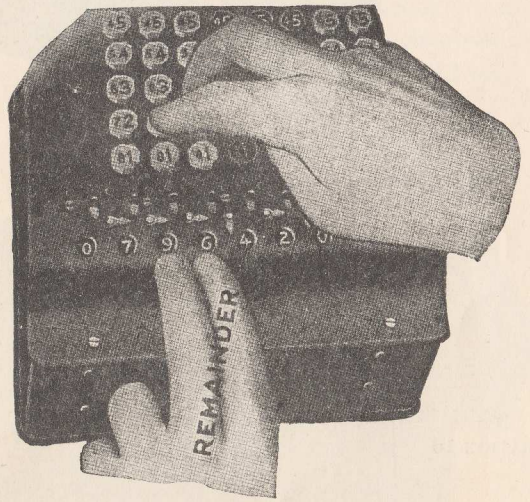

ILLUSTRATION 8

8. Reduce the remainder. Shift one column to the right.

9. The index is now 1, as shown in Illustration 9 (see page 66). Equal it. It is equaled at 2 with a remainder of 40, as shown in Illustration 10 (page 66).

ILLUSTRATION 9

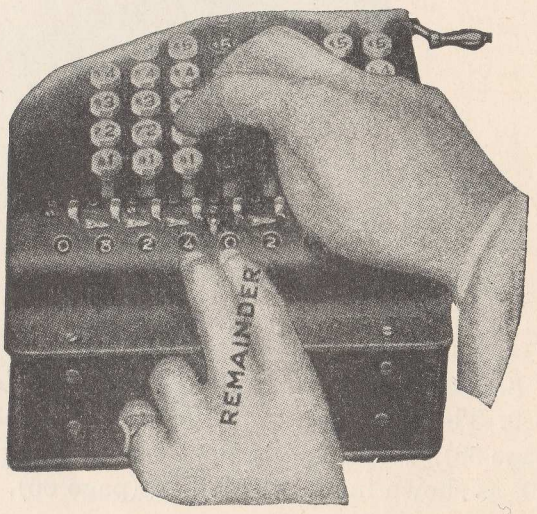

ILLUSTRATION 10

10. As the remainder, 40, is less than the divisor, 77, it is not necessary to reduce it.

11. Move the divisor one column to the right. The index is now 4, as shown in Illustration 10.

12. Equal the index. The remainder is 94, as shown in Illustration 11.

13. Reduce the remainder. Continue in this manner until you have worked entirely across the keyboard.

Many times the divisions will not come out even. In most offices, division problems are carried to the third decimal place, and if the problem does not come out even, the remainder is dropped. If extreme accuracy is desired, however, the remainder should not be dropped and the problem should be carried out as far as it will go.

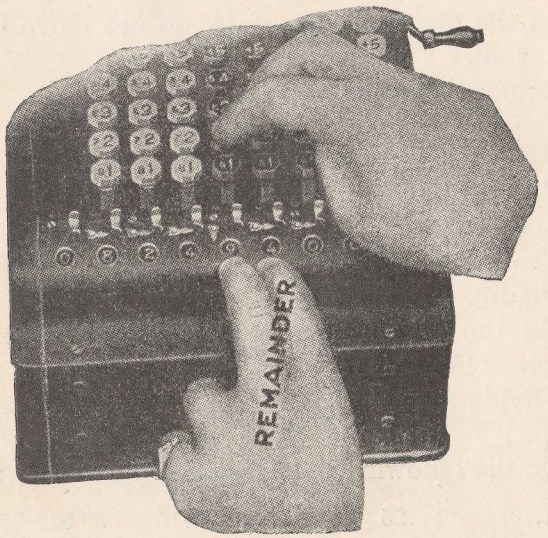

ILLUSTRATION 11

The problems shown below will have a remainder. Carry them out to the third decimal place and then drop the remainder.

1. 47.35 ÷ 55
2. 39.43 ÷ 84
3. 145.9 ÷ 63
4. 56.78 ÷ 8.6
5. 8643 ÷ 85

Job 36

DIVISION—WHEN THE DIVISOR IS A DECIMAL

Before working the problems in this job, add all the problems in Job 6. Do not skip this work, as it is designed to help you acquire speed and accuracy in adding.

Sometimes the divisor will be a decimal, that is, the decimal point will be to the left of the left-hand number. When this occurs, it means that there are no whole numbers in the divisor. Therefore, do not move the decimal point at all.

Consider this problem:

78025 ÷ .25.

1. Insert the dividend in the left of the machine and point off. The decimal point is not written in this dividend, so it is understood to be to the right of the right-hand figure.

2. As the divisor is a decimal, it contains no whole numbers. For this reason the decimal point is not moved.

3. Divide as instructed before. The answer should be 312100.

Solve the following problems and prove each:

1. 67425 ÷ .25
2. 9476 ÷ .33
3. 48630 ÷ .15
4. 699.93 ÷ .41
5. 833.25 ÷ .65
6. 2478 ÷ .74

Job 37

DIVISION—WHEN THE DIVISOR HAS PRECEDING CIPHERS

Sometimes the divisor contains preceding ciphers. If you have forgotten what is meant by a "preceding cipher," see Job 18. When the divisor has such preceding ciphers, the rule for pointing off varies slightly from the one you have learned. Thus far you have learned two rules for pointing off. They are:

1. Move the decimal point one place to the left for every whole number in the divisor.

2. Do not move the decimal point if the divisor is entirely a decimal.

The third rule is: When the divisor contains preceding ciphers, move the decimal point one place to the *right* for each preceding cipher.

Consider this problem:

8796 ÷ .027.

1. Put the dividend in the machine and point off like this: 08796′0000.

2. Look at the divisor.

3. It contains one preceding cipher. So move the decimal pointer one place to the right, like this:

087960′000

4. Do not hold the 0. Preceding ciphers are used for pointing off only. Hold 26, using small figures in the first two columns from the left, and proceed to divide in exactly the same manner as in any division.

Solve the following problems and prove each:

1. 7831 ÷ .024	3. 7921 ÷ .026	5. 36214 ÷ .0086
2. 2486 ÷ .078	4. 4267 ÷ .0087	6. 42617 ÷ .0087

Job 38

DIVISION—WHEN THE DIVISOR CONTAINS NINES

As you learned from your subtraction problems, there are no small 9's on the keyboard of the Comptometer. Accordingly, when the divisor contains 9's, you must make allowance for this fact. Hold your finger above the column in which the 9 would be held if it were there, but remember that, while you do not hold the 9, you are automatically working with it.

Consider this problem:

4783 ÷ 95.

1. Set the dividend in the machine and point off as usual.
2. When you try to hold 94 on the small keys, you find that there is no 9 to hold.
3. Accordingly, allow the finger that would hold the 9 to be idle and continue to hold the 4. Even though you are not holding the 9, however, it is being used. If you do not remember this fact while you are working the problem, you will be confused as to the index and the remainder.
4. Hold 94 in the first two columns at the left of the keyboard, like this: – 4. This means that the first column will be blank, since you cannot hold the 9.
5. Divide as instructed before. The answer is 50.347-3680.

Go over this problem several times until you understand what is meant by not holding the 9, but remembering that

it is there. Then solve the following problems and prove each:

1. 73.21 ÷ 94	3. 43.69 ÷ 98	5. 4716 ÷ 9.3
2. 2734 ÷ 95	4. 6746 ÷ 92	6. 27.13 ÷ .96

Sometimes the last number of the divisor will end in 9 after you have taken 1 away. In this case, continue to do as you did when the first part of the divisor was 9. Hold your finger above the column in which the 9 would appear, but do not attempt to depress any key in this column, as there is no small 9 to depress.

Consider this problem:

9214 ÷ 60.

1. Set the dividend in the machine and point off.
2. Hold 59 on the small figures. Note that there is no small 9 to hold. Accordingly, remember that the 9 is present, but that you do not depress it.
3. Divide in the usual manner. The answer should be 153.56666.

Try the following problems. See if you can work them without any further instruction.

1. 4761 ÷ 80	3. 2251 ÷ 30	5. 6218 ÷ .70
2. 2792 ÷ 60	4. 42.79 ÷ 40	6. .3976 ÷ .80

Remember when the divisor contains a 0 you must hold the 0. For instance, in the problem 4716 ÷ 51, you should hold both the 5 and the 0 on the small figures.

Try out the method on these problems:

7. 2789 ÷ 51	9. 89.34 ÷ 4.1	11. 9.214 ÷ 31
8. 4327 ÷ 61	10. 67.82 ÷ .21	12. 78.17 ÷ .71

It is impossible to divide by 100 in the machine, because 100 is 99 on the small keys, and as there are no small 9's, you could not hold this divisor. This is not a great difficulty, however, because when the divisor is 100, the easiest plan is to divide mentally. If you do not understand how to divide quickly by 100, ask your instructor to show you.

Job 39

DIVISION—WHEN THE DIVISOR CONTAINS THREE FIGURES

It is no more difficult to divide with a divisor containing three figures than with a divisor containing only two. The only difference is that you must remember that you are using three columns and that the remainder will usually consist of three figures and not of two figures. When you have three figures it is best to use two hands to hold the divisor. Hold the divisor in the most comfortable position. The rules for fingering mentioned in Job 16 may also be applied here.

Consider this problem:

32516 ÷ 674.

1. Set the dividend and point off.

2. Hold 673 on the small figures. In this particular problem it will be easier to hold the first two figures with the left hand and the third figure with the right hand.

3. The index is 0 and the remainder is 325, which is less than the divisor. So slide each finger one place to the right.

4. This time the index is 3. So depress the keys three times. While doing so it changes to 4. So depress the keys again. At 4 it does not change; so you have agreed with the index.

5. The remainder, 555, is less than the divisor. So slide to the next position.

This is as much explanation as will be given you. From this point on, work the problem just as if there were two numbers in the divisor. Now solve the following problems:

1. 5219 ÷ 554	**3.** 6261 ÷ 819	**5.** 2367 ÷ 190
2. 8726 ÷ 551	**4.** 4719 ÷ 188	**6.** 3.621 ÷ .678

Job 40

DIVISION—WHEN THE DIVIDEND IS A DECIMAL

Sometimes the dividend is a decimal. When this occurs, do not change the rules for pointing off.

Consider this problem:

.9865 ÷ 256.

Set the dividend in the machine and place the decimal pointer to the left of the 9. The rule is: For each whole number in the divisor, move the decimal point one place to the left. As there are three whole numbers in the divisor, try to move the decimal point three places to the left. You will see that this cannot be done. You can move it only one place. This means that you will need two more places than can be shown in the dials. So that you will not forget this, place a decimal point and two ciphers on the paper on which you will copy the result, like this: .00. When you have finished dividing, copy the answer from the dials after the ciphers that you placed on the paper, like this:

003853515.

Solve the following problems:

1. .2613 ÷ 61
2. .2781 ÷ 60
3. .1267 ÷ 171
4. .9681 ÷ 312

Job 41

REVIEW

These problems have been listed according to jobs. If you have forgotten how to solve them, refer to the jobs indicated.

Jobs 25, 26, and 27

1. 842.67 − 431.50
2. 310.56 − 207.62
3. 978.20 − 892.41
4. 431.89 − 200.70
5. 672.09 − 561.31

Job 29

6. 2130 ÷ 44
7. 2217 ÷ 21
8. 1436 ÷ 32
9. 2183 ÷ 14
10. 4261 ÷ 25

Job 38

19. 4127 ÷ 9.1
20. 8936 ÷ 8.99
21. 4718 ÷ .410

Jobs 35 and 36

11. 23614 ÷ .314
12. 47892 ÷ .607
13. 61478 ÷ .421
14. 31256 ÷ .311
15. 47832 ÷ .624

Job 37

16. 2178 ÷ .026
17. 4236 ÷ .0081
18. 7812 ÷ .0031

Jobs 38 and 39

22. .2314 ÷ 61
23. .6287 ÷ 80
24. .7461 ÷ 207
25. .4385 ÷ 909

Job 42

FRACTIONS—ADDITION

Fractions may be used on the Comptometer if they are first reduced to decimals. These decimals are frequently called "decimal equivalents." You should memorize the more common equivalents, such as the equivalents for 1/2, 1/3, 1/4, and 1/8.

A table of the more common decimal equivalents appears on page 92. Use the table in working the following problems.

The first thing to do when you have a problem involving fractions is to decide how many decimal places you wish to carry the decimal. For most office purposes, it is sufficiently accurate to carry the decimals three places. If you desire greater accuracy, however, four or more places may be used. Use four places in the problems that follow.

Consider this problem. In the left-hand column the numbers appear as fractions. In the right-hand column the same numbers are written as decimals.

12 1/2	12.5
8 1/3	8.3333
6 1/4	6.25
4 1/6	4.1667

1. Place the decimal marker at the fourth place from the right of the keyboard, because you will need four decimal places when you convert some of the fractions into decimals.
2. Use the large figures and set 12.5 with the 12 to the left of the decimal pointer and the 5 to the right.
3. Add 8.3333 by placing the 8 to the left of the decimal marker and the 3333 to the right.
4. Add 6 1/4, which is 6.25, by placing the 6 to the left of the decimal marker and the 25 to the right.
5. Add the 4 1/6, which is 4.1667, by placing the 4 to the left of the decimal marker and the 1667 to the right.
6. The answer is 31.25. Remember to use the large figures when adding. Use no key above the 5.

When you think you understand this, solve the following problems. Use the touch method.

In problems 1 and 2 set the decimal pointer in the third position. In problem 3 set the decimal pointer in the fourth position. In problems 4 and 5 set the decimal marker in the fifth position.

1	2	3	4	5
14 1/4	61 2/3	629 1/4	312.62 1/2	2.167 1/8
7 1/3	41 1/2	406 2/3	2.37 1/4	32.621 1/4
261 2/3	267 3/4	260 1/2	.89 1/3	46.837 3/8
90 1/8	19 1/8	790 1/3	36.74 2/3	.642 3/4

Job 43

FRACTIONS—SUBTRACTION

Before starting this job, work problems 1 to 8 in Job 7. Try to develop speed and rhythm.

Before you can subtract fractions on the Comptometer, it is necessary to reduce them to decimals. Once you have done this, the process is the same as in regular subtraction.

If you have forgotten how to subtract, read Job 24 again.

Solve the following problems. Prove each.

1	2	3	4	5
842 1/3	452 3/4	268.78 2/3	462 1/4	7.86 1/6
−627 1/4	−87 1/8	−8.97 3/8	−301 1/8	−.87 2/3

6	7	8	9	10
21369 2/3	218 1/6	707.06 3/8	614 3/8	47132 1/8
−17.85 1/6	−106 1/5	−406.03 1/4	−70 1/4	−865 1/3

Job 44

FRACTIONS—MULTIPLICATION

Before starting this job, work problems 21 to 29 in Job 16. Multiplication of fractions is the same as regular multiplication after you have once changed the fractions to decimals. Usually, you will need to split the multiplier when multiplying by fractions. If you have forgotten how, read Job 22. Multiply from the left. Carry the answer as far as possible. Carry decimal equivalents to three places only.

1. 87 1/4 × 96 2/3
2. 7.21 3/4 × 42 1/8
3. 24 1/5 × 472 1/2
4. 82 3/5 × 267 1/5
5. 9.21 1/3 × 6.42 1/2
6. .431 1/4 × 789 1/3
7. .278 1/4 × .62 1/5
8. .742 1/3 × .09 1/6
9. 427 2/5 × .008 1/2
10. 82 2/5 × .067 1/8

Job 45

FRACTIONS—DIVISION

Before starting this job, work the problems 11 to 20 in Job 16 again. You must first reduce fractions to decimals in order to divide. Carry decimal equivalents to three places only. Carry the answer as far as possible. The rules for dividing are no different, however. If you have forgotten, read Job 35.

1. 615 3/8 ÷ 28
2. 67 1/8 ÷ 3 1/4
3. 27.84 2/5 ÷ 67 1/3
4. 427 1/6 ÷ .25 2/3
5. 76.47 1/2 ÷ 213 1/4
6. 783 1/4 ÷ .07 1/6
7. 7416 1/8 ÷ .004 2/3
8. 642 1/3 ÷ .51 1/4
9. .756 1/6 ÷ .241 1/2
10. 782 1/5 ÷ 4.78 4/5

Job 46

FIXED OR PERMANENT DECIMAL POINT

Before starting this job, work the problems in Job 8 again. This practice is very important.

Where the decimal point changes often, it is advisable to set the decimal point in a certain place and then to work the problems around the same decimal point. For instance, suppose that you have many different problems containing many different decimal points. To change the decimal point for each problem would be a great inconvenience. It is better to place the decimal marker in a convenient position and then set the problems around it.

Consider these problems:

9 articles at $ .25
4 articles at $ .325

1. Turn forward some decimal marker—say, between the fifth and sixth columns. Any marker may be turned forward, but in picking out the marker to be turned forward, be sure to allow enough room on either side to work the problem. In this case we pick the fifth decimal marker, because the color of the keys at either side of it is different.

2. Always hold the price or decimal.

3. After you have selected the decimal marker to be used, the procedure consists of three steps:

a. Locate the units position.
b. Find the multiplying position.
c. Multiply in the usual manner.

One-Figure Multipliers. Follow the first step listed above and locate the units position. In locating the units

position, always hold the decimal. When the key factor is held on the keyboard as it is written, it is said to be in the units position; for instance, in the above problem, the key factor is .25. So in order to hold this factor in the units position, it is necessary to hold the 2 and 5 to the right of the permanent decimal point, like this: '25. (See Illustration 12.)

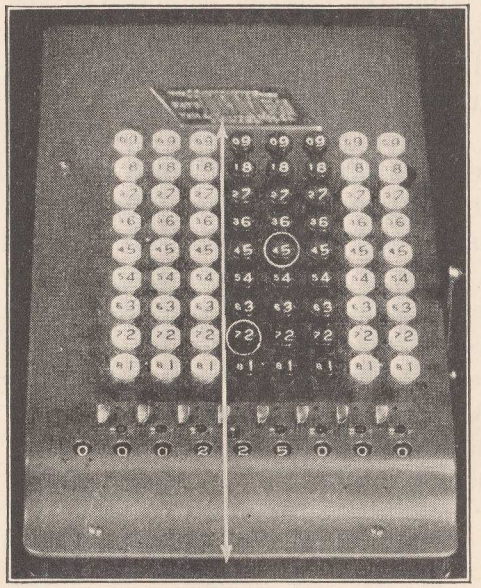

ILLUSTRATION 12

To find the first multiplying position, the procedure is as follows:

1. Notice the number to be used as the multiplying factor. Notice whether it consists of units and tens, or

hundreds, etc. In this problem, the multiplying factor, 9, consists of units only.

2. Hold 25 in the units position and multiply in the usual manner. The answer is $2.25.

The next problem is 4 articles at $.325 each. In this problem, the decimal is three places instead of two, but despite this change we do not move the decimal point. This is where we save time. Instead of moving the decimal point every time the number of places in the key factor changes, we set the decimal point in a permanent position and work the problems around it. Accordingly, do not move the decimal point, but follow the same steps outlined above.

1. Locate the units position, which in this case is '325.

2. Locate the first multiplying position. In this problem, the number of articles, 4, consists of units only, and for this reason the units position and the first multiplying position are the same. This is true whenever the number of articles consists of units only.

3. Depress the keys four times to multiply by the 4 units. The answer is $1.30.

Solve the following problems. Use the permanent decimal point.

1. 9 × .46	3. 7 × .27	5. 1.13 × 5
2. 8 × .08	4. .12 × 6	6. 2.07 × 4

Two-Figure Multipliers. The procedure explained above must be carried one step further when the multiplier consists of two figures.

Consider the problem:

19 articles at $.25.

1. Locate the units position.

2. Locate the first multiplying position. Notice that the multiplier consists of two figures—9 units and 1 ten. As the 1 ten is to the left of the 9 units, shift each finger one column to the left.

3. Multiply by the 1 ten; shift right and multiply by the 9 units. The answer is $4.75.

Solve the following problems. Do not move the decimal point.

1. .87 × 12	3. 1.29 × 22	5. 31 × 2.47
2. .46 × 27	4. 44 × .08	6. 28 × .26

Three-Figure Multipliers. To find the first multiplying position, it is necessary to shift one position to the left for each additional number in the multiplying factor.

Consider this problem:

341 articles at $.26.

1. Locate the units position. Here it is: '26.

2. Locate the first multiplying position. To do this, notice that the multiplier consists of three figures—1 unit, 4 tens, and 3 hundreds. From the units position shift two places to the left to get to the hundreds position, like this: 26'.

3. Multiply by the 3 hundreds.

4. Shift right and multiply by the 4 tens.

5. Shift right and multiply by the 1 unit.

Solve the following problems:

1. 267 articles @ $.32	3. 673 articles @ $1.05	5. $1.25 × 267
2. 425 articles @ $.48	4. $.35 × 896	6. $.08 × 541

Four-Figure Multipliers. If the multiplying factor consists of thousands, merely shift another place to the left in locating the first multiplying position.

Consider this problem:

2341 × $.22.

1. Locate the units position. Here it is: '22.
2. Locate the first multiplying position. To do this, notice that the multiplying factor, 2341, consists of four figures—1 unit, 4 tens, 3 hundreds, and 2 thousands. Accordingly, shift three places to the left to get to the thousands position.
3. Depress the key factor twice to multiply by the 2 thousands.
4. Shift right and multiply by the 3 hundreds.
5. Shift right and multiply by the 4 tens.
6. Shift right and multiply by the 1 unit. The answer is $515.02.

Solve the following problems:

1. 2861 × .32
2. 4582 × .018
3. 1347 × 1.41
4. 6873 × .84

Five-Figure Multipliers. If the multiplying factor consists of five figures, it is necessary to set the permanent decimal point in a different place if you are using an eight-column machine, because there are not enough columns to the left of the decimal point to permit you to shift far enough to get to the first multiplying position.

Consider this problem:

.34 × 52187.

1. Locate the units position.
2. Locate the first multiplying position. To do this, notice that the multiplying factor, 52187, consists of five

figures. Accordingly, attempt to shift four places to the left to get to the tens of thousands position. As you try to do this, you will notice that there is not enough room to the left of the decimal point to shift this far. This is what is meant in the first part of the job, when you are instructed to allow room on either side of the permanent decimal point to work the problem.

When you decide to work with permanent decimal points, always first ascertain the greatest number of places in the various multiplying factors and then set the permanent decimal point so that you will have enough room to shift to the proper place for multiplying.

Job 47

FIXED DECIMAL POINTS—WHEN THE MULTIPLIER IS A FRACTION

When the multiplier is a mixed number, shift the places in which you hold your fingers in accordance with the number of *whole* numbers in the fraction.

Consider the following problems:

345 1/4 articles at $3.25 each.

1. Locate the units position. Here it is: 3.25.
2. In this problem, there are three whole numbers—5 units, 4 tens, and 3 hundreds. Accordingly, shift two places to the left for the first multiplying position.
3. Multiply by the 3 hundreds.
4. Shift to the right and multiply by the 4 tens.
5. Shift to the right and multiply by the 5 units.
6. Shift to the right and multiply by the 2 tenths (not tens).

7. Shift again and multiply by 5 hundredths. The answer is 1122.0625.

Solve the following problems:

1. 265 @ 4.25
2. 467 1/8 @ 2.67
3. 732 1/5 @ 5.21
4. 16 1/2 @ .32
5. 43 1/4 @ .72
6. 526 @ 1.47

Job 48

ACCUMULATION

Sometimes it is necessary to make several multiplications, but, instead of writing down the answer of each separate multiplication, the total of all the answers is copied. This is sometimes done in making out bills. Multiply the number of items by the price per item, but leave the total in the machine. When you have completed the entire problem, copy the total.

Consider this problem:

5 articles @ 25¢
10 articles @ 35¢
17 articles @ 14¢_____

1. Start from the right of the keyboard. Use the fixed decimal point.

2. Multiply 5 by 25, but leave the product in the machine. Multiply 10 by 35. Leave the new product in the machine. Multiply 17 by 14. Since this is the end of the problem, copy the answer, 7.13, on your paper. This is called "accumulation."

Solve the following problems. Show only one answer for each problem.

1	2	3
27 × 42	321 × 267	16 × 74
62 × 71	489 × 561	87 × 69
46 × 31_____	317 × 241_____	47 × 78_____

4	5
47 × 245	271 × 378
31 × 362	426 × 173
36 × 121_____	266 × 432_____

Fixed Decimal Point. The need for fixed decimal points is greater in accumulation than elsewhere. Consider this problem:

421 × 36.2
672 × 4.21
381 × .656_____

1. Hold the decimal in each case. Always start at the units position.
2. Set the decimal pointer.
3. Locate the first multiplying position and multiply.
4. Continue as instructed before.

Solve the following problems:

6	7	8
7.31 × 274	42.8 × 672	273 × 4.56
38.3 × 361	316 × .047	782 × 27.1
.727 × 403_____	5.19 × 231_____	465 × .328_____

9	10
78.1 × 132	82.8 × 191
456 × 6.26	4.78 × 206
.757 × 646_____	.709 × 403_____

When Both Factors Contain Decimals. When both factors contain decimals, the same steps are followed.

Consider this problem:

3¼ yds. @ .25 per yard
17½ yds. @ .35 per yard
14¾ yds. @ $1.25 per yard

1. Set the decimal marker.
2. Hold the price in the units position, that is, with the 25 to the right of the decimal marker.
3. Locate the multiplying position and multiply as before.

Solve the following. Use the table on page 92 for decimal equivalents; carry decimals to three places only.

11

4 1/4 × 3.25
16 1/2 × 1.75
37 3/4 × .86_____

12

42 1/5 × .75
89 1/4 × 1.06
73 1/8 × 2.41_____

13

67 1/3 × .26
87 1/5 × 1.07
92 3/5 × .86_____

14

92 2/3 × .89
47 1/3 × .08
25 1/5 × .67_____

15

178 1/2 × .87 1/4
453 1/3 × .45 1/8
246 1/8 × 1.07 3/8_____

When the factors are composed entirely of decimals, the same procedure is followed.

Consider the following problem:

3/4 yd. @ .28
3/5 yd. @ .64
3/8 yd. @ .96_____

1. Locate the units position. In this problem the 28 is held to the right of the decimal marker.
2. Since the quantity, 3/4, is less than 1 yard, there are no units.

3. So shift right to the tenths (not tens) position. Multiply by the 7 tenths.
4. Shift right again and multiply by the 5 hundredths.
5. Perform the other multiplications in the same manner.

Solve the following problems:

16

3/4 yd. × .67
4/5 yd. × .22
1/8 yd. × .43_____

17

1/4 lb. × .53
3/8 lb. × .46
2/5 lb. × .38_____

18

5/8 lb. × .72
3/8 yd. × .46
1/8 lb. × .37_____

19

3/5 yd. × .86
4/5 yd. × .92
2/5 yd. × .26_____

Job 49

THREE-FACTOR MULTIPLICATION

In operating the Comptometer, you will frequently encounter problems having more than two factors. When this occurs it is not necessary to clear the machine after performing the first multiplication. Much time can be saved by using the index method.

Consider this problem:

45 × 55 × 77.

1. Multiply 45 by 55 on the right of the keyboard. The answer is 2475. (See Illustration 13.) Do not clear the machine.
2. The next step is to multiply 2475 by 76.

a. As 2475 is already in the dials once (see Illustration 13), it is necessary to put it in only 76 times more. The one that is in there, plus the 76 to be put in, will equal the third factor, which in this case is 77.

b. For this reason we always hold the third factor less 1 in the second multiplication.

c. Hold the 76 so that the right-hand figure of this factor, 6, is directly over the left-hand figure, 2, of the numbers in the register. (See Illustration 13.)

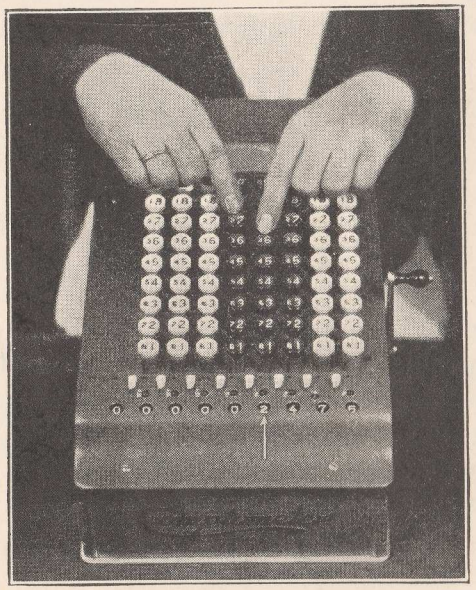

ILLUSTRATION 13

d. The figure that appears directly under the right-hand figure of the key factor is called the index.

(The key factor is the number which you are holding.) The index tells the operator how many times to depress the keys. As you move your hands to the right, the index moves to the right. The index is *always* that dial that is under the right-hand figure of the key factor.

3. Depress the keys as many times as indicated by the index. As the index is 2, depress the keys twice. The register will now read 154475.

4. Shift right. As shown below, the index is now 4. So depress the keys four times. The register will now read 184875.

5. Shift right. The index is 7. So depress the keys seven times. The answer thus far is 190195.

6. Shift right. The index is 5. So depress the keys five times. The register will now read 190575, which is the answer.

Work these steps until you understand them thoroughly.

Then solve the following problems:

1. 48 × 65 × 56
2. 35 × 486 × 54
3. 25 × 36 × 48
4. 54 × 986 × 25
5. 47 × 965 × 42
6. 36 × 48 × 567
7. 24 × .98 × 56
8. .54 × 678 × .98
9. 325 × 48 × 68
10. 21 × 32 × 46

Job 50

REVIEW

The following problems have been listed according to jobs. If you have forgotten how to work them, reread the jobs indicated.

JOB 42

1

14 1/3
27 1/8
65 1/2
42 2/5
91 2/3
———

JOB 43

2

387 1/2
−242 1/3
———

3

278 1/4
−126 1/8
———

JOB 44

4. 627.18 × .08 1/2
5. 927.42 × .19 1/4
6. 43.871 × .26 1/2

JOB 45

7. 413.1/2 ÷ 78 1/4
8. 621.25 ÷ .09 1/2
9. 428.37 ÷ .46 2/5

JOB 48

10

41 1/2 × 3.27
102 1/4 × .436
87 2/5 × .82———

11

59 1/8 × .105
62 × .08 1/2
47 1/3 × .62 1/2———

JOB 49

12. 46 × 27 × 81
13. 3.6 × .52 × 38 1/2
14. .62 × .45 × .20

Job 51

GENERAL REVIEW

1	2
36174	317.46
6218	.27
28	3.89
401	21.75
8716	.06
50942	710.34
31705	41.20
4261	.61
708	534.49
36	617.25

3. 3112 × 7667
4. 4324 × 9768
5. 4563 × 6776
6. 1232 × 2332
7. 3991 × 1882
8. 1772 × 3791
9. .301 × .742
10. .610 × .405
11. .427 × .0036
12. .089 × .4217
13. 1728 × .3142
14. 3.163 × .371
15. .214 × .876
16. 214 × .007
17. 369 × .0021
18. 136.78 × 897.12
19. 621.43 × 213.45
20. 213.67 × 378 1/4
21. 427.12 × 214 1/5

22

61.27
−425.26
17.89
36.42
.27
−9.86
———

23

362.71
−89.26
−6.42
−71.35
−4.27
−.28
———

24. 3146 ÷ .037
25. 67218 ÷ .045
26. .2671 ÷ 61
27. 31.76 ÷ 70

28

31 1/2 × 3.26
27 1/4 × .42
42 1/2 × .08 1/2———

29

42 1/2 × 10.26
67 1/4 × .76
59 1/5 × .31 1/2———

30. 326 × 478 × 293
31. 46 1/2 × 2.7 × .38

Appendix

Table of Decimal Equivalents for Fractions

100	½	⅓	¼	⅕	⅙	⅛	1/10
1	.50	.3333	.25	.20	.1667	.125	.10
2	1.00	.6667	.50	.40	.3333	.25	.20
3		1.00	.75	.60	.50	.375	.30
4			1.00	.80	.6667	.50	.40
5				1.00	.8333	.625	.50
6					1.00	.75	.60
7						.875	.70
8						1.00	.80
9							.90
10							1.00