OFFICE MACHINE PRACTICE SERIES

No. 2

THE BURROUGHS CALCULATOR

By

C. H. KATENKAMP

THE GREGG PUBLISHING COMPANY

OFFICE MACHINE PRACTICE SERIES

No. 2

THE BURROUGHS CALCULATOR

By

C. H. KATENKAMP

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

THE GREGG PUBLISHING COMPANY

NEW YORK CHICAGO BOSTON SAN FRANCISCO TORONTO
LONDON SYDNEY

K-78-F-5

Printed in the United States of America

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 Burroughs Calculator. 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 BURROUGHS CALCULATOR

Job 1

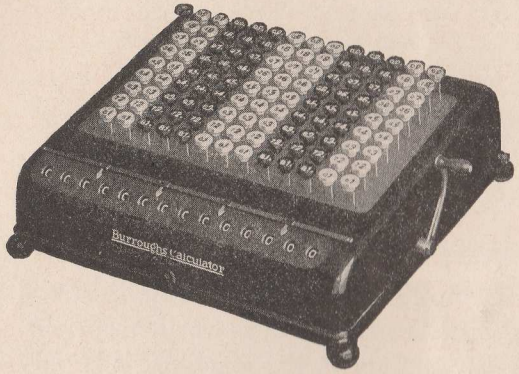
PARTS OF THE MACHINE

The Burroughs belongs to that class of machines described as "key driven." This means that the keys work on springs, and that in order to set a number in the machine, it is only necessary to depress a key. Some models of this machine are electrically equipped, but the method of operating these differs but little from the method taught in the following pages.

The Burroughs Calculator is operated by the touch method, and a high degree of speed can easily be acquired by conscientious practice. A proficient Burroughs operator can earn a very substantial salary. Because of lack of time, you will be taught only the fundamentals of the machine, and after that further practice will be necessary if you wish to acquire additional speed.

As each part of the machine is described, try to locate that part on the machine.

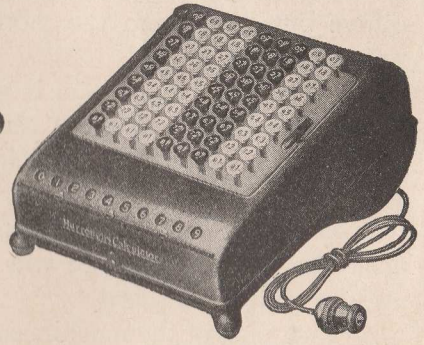
The keyboard of the machine is arranged in five or more columns of nine keys each, which are grouped in alternate black and white sections. Illustration 1 shows a thirteen-column machine and a nine-column machine. On each key top are two figures—one large figure and one small figure. The large figures are for addition and multiplication, and the small figures are for subtraction and division. The blank key at the top of the left side is used in subtraction.



Style 5 13 05

Style 5 05 05

Style 5 09 05



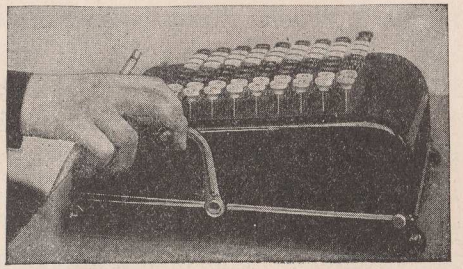
Electric Model

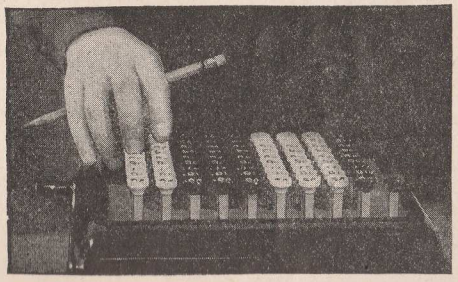
ILLUSTRATION 1

The dials that show the result of a calculation are at the front of the machine. Just above the dials is a set of decimal pointers.

On the right-hand side of the machine is a lever or handle. This is used to clear the machine. Pulling this lever forward clears the dials. As soon as it is released it returns to its

Clearing the Machine





Holding a Pencil

Position of Machine

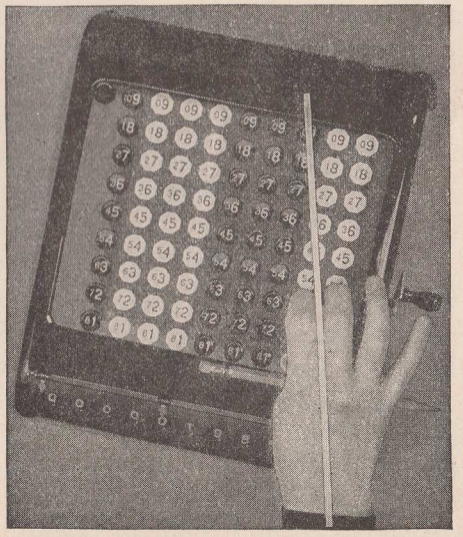


ILLUSTRATION 2

normal position automatically. An electrically driven model is cleared by depressing the electric clearing bar, which is at the right of the keyboard. (See Illustration 1.)

Position. To attain the best results, the Burroughs should be set at an angle, so that the left-hand side of the machine is in direct line with the center of the body. The work to be performed should be placed to the left of the person operating the machine. The operator should always hold a pencil between the thumb and the palm of the right hand. This keeps the thumb out of the way and keeps the pencil in a position to record the answer as soon as the calculating has been completed. It also makes the hand steadier and gives the operator greater confidence. The arm should be held in a comfortable position slightly above the keyboard, as shown in Illustration 2.

Job 2

ADDITION

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

There are two methods of operation. The first of these methods is called the "full-keyboard method."

The full-keyboard method is so called because the entire keyboard is used; that is, all the keys from 1 to 9 are used. This method should be used only when a limited amount of adding is to be done by an untrained operator. If the quantity of adding is large, the operator should learn the touch method. When using the touch method, the operator works the machine 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, such as 1, 3, 5, 7, 9, are concave. The keys of the even numbers, as 2, 4, 6, 8, are flat. Feel both kinds of keys and see if you can tell the difference.

In order further to simplify the task of learning to operate by touch, the number of figures that you use is reduced. In touch-method addition, no key above the 5 is used. All numbers over 5 are set by combining two other numbers. For instance, to write 6, depress the 3-key twice; to write 7, depress the 4-key and then the 3-key; to write 8, depress the 4-key twice; to write 9, depress 5 and then 4. Operate the higher key first in adding the combinations for 7 and 9.

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.

You are now ready to begin adding. Start with the first of the problems on page 7. Hold the pencil between the thumb and the palm of the hand and use the first and second fingers of the right hand. (The first finger is the finger next to the thumb.) Start to add by depressing the keys in the two right-hand columns. The extreme right-hand column is usually called the "units" column. The one next to it is called the "tens" column. The next one to that (the third from the right) is usually called the "hundreds" column. Depress the shorter finger first in the tens column and then the longer finger in the units column.

Do not try to depress both fingers at the same time, as this will break your operating rhythm. This rhythm is

essential in developing speed in operating the machine. When adding, the movements of the hand and of the arm should be timed to insure smooth, regular action—not too fast nor too slow. The proper speed for beginners is about two key strokes a second.

Add the first of the problems without looking at the keys and in rhythm.

After you have finished adding the first column, the total will appear in the dials at the front of the machine. Copy this total on a piece of paper and then clear the machine by pulling the lever forward. The dials will then register 0, indicating that the machine is clear. If the machine is electrically driven, clear it by depressing the electric clearing bar.

Every operation on any calculating machine should be proved. To prove a column of addition, add in the opposite direction. Thus, if you have been adding down the column, add the column again by beginning at the bottom of the column and moving up.

It is not enough merely to add the following problems once. You should add them over and over again until you acquire the ability to locate the keys accurately, rapidly, and rhythmically. It is suggested that each day before beginning your regular work on the machine you practice the problems given below. Speed in addition is most important, and it can be easily acquired by diligent and regular practice. *Always clear your machine before starting an operation.*

Here are the problems. Be sure to follow the instructions given above. In problems 11–20, be careful to follow the rule that numbers above 5 are made by combining other numbers.

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

11	12	13	14	15	16	17	18	19	20
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
—	—	—	—	—	—	—	—	—	—

Addition—Three Columns. When adding three columns on the Burroughs, it is necessary to use only two fingers, the first and the second fingers of the right hand.

When adding three columns, use the first finger for the two left-hand columns and the second finger for the right-hand 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 figures and the second finger of the right hand to add the units figure. For instance, in the first number in problem 1, strike the 2 and the 6 with the first finger of the right hand and the 4 with the second finger of the right hand.

3. If you wish to acquire speed on the Calculator, it is necessary to develop the ability to find these keys without looking at your hands. Therefore, try to find the columns

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.

On any key-driven machine it is best to prove every operation. Always add each column twice, once from bottom to top and once from top to bottom. Solve the following problems and prove each:

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	674	776	921	728	635
521	425	451	672	367	377	673	191	817	703
132	541	214	326	712	788	576	372	737	839
215	323	332	731	627	787	756	174	818	246
324	422	415	476	427	686	786	286	929	311

Job 3

ADDITION—FOUR COLUMNS

Even if the problems you are adding consist of four columns, you nevertheless use only the first and second fingers of the right hand in adding them. To solve the problems given below, proceed according to the following directions:

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 three left-hand columns; for instance, in the first problem below, strike the 2, 6, and 7 with the first finger of the right hand.

3. Use the second finger of the right hand to add the units column; for instance, in the first number in the problem below, strike the 8 with the second finger of the right hand.

4. Solve the following problems and prove each:

1	2	3	4	5	6	7	8	9	10
2678	16	1257	2062	47	2767	698	4000	674	134
1485	1450	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
547	856	1047	2648	3541	132	2175	4405	806	5641
1765	50	14	123	67	45	4105	10	5205	513
275	1458	67	215	597	3214	42	175	47	12
86	715	2902	668	381	235	245	702	202	3275
1265	1435	15	1403	3107	3356	3034	600	43	46
244	234	30	155	786	1268	505	4517	4300	5717
1436	1040	586	86	654	351	75	77	5376	230
846	100	2856	1475	56	3406	4355	135	5444	60
82	314	1045	32	3247	541	66	578	372	500
435	60	7158	47	45	3591	300	4680	1506	5815

Job 4

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, 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 following problems and prove each:

1	2	3	4	5
426784	62	47869	8974	42
6731624	87184	7136	6	89763
86790	62	42618	231	214
3216	283216	7326	56782	78423
647861	142689	426	83642	6217
28654	776	6	126	18962

Dollars and Cents. The procedure of splitting numbers is practically the same when these numbers consist of dollars and cents, except that in such cases, 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 the dials is a small rod to which are attached some arrows, called "decimal markers." These can be moved to the right or left. 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, slide one of the decimal markers to a position between the second and third dials, like this:

0'00.

Slide the other decimal markers to the extreme left so that they will be out of the way. In your 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	570.59	37.09	618.37
961.41	484.72	43.22	29.47
43.62	41.78	318.41	2.88
7415.48	51.53	312.62	5.78
23.79	6391.92	78.44	494.83
398.26	600.32	479.51	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	465.77	3083.40
30.13	4617.30	718.52	24.90
583.94	85.31	68.33	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, 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 5

MULTIPLICATION

Multiplication is really repeated addition; so when you want to multiply on the Burroughs, 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. These factors also have special names, 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 (5 is called the "multiplying factor").
5. The answer will appear in the lower dials. The touch method, which you were studying, applies only to addition, so that you may feel perfectly free to look at the keys when locating numbers that you expect to hold in multiplying. 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.

Solve the following problems and prove each:

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

Job 6

MULTIPLICATION—TWO-FIGURE MULTIPLICAND

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.

Consider this problem:

$$55 \times 3.$$

1. Hold the pencil in the proper position.
2. Clear the machine.
3. Hold the multiplicand (55), using the first finger of the left hand to hold the left-hand 5. Hold this figure in the tens column. Hold the 5 in the units column, but use the first finger of the right hand, as shown in Illustration 3.

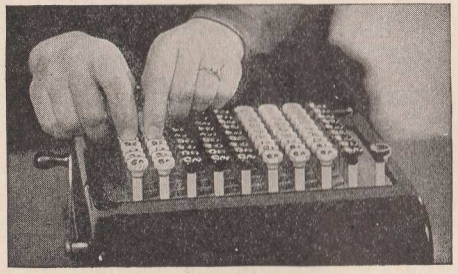


ILLUSTRATION 3. TWO-HAND OPERATION

4. Multiply by the 3 units. To do this, depress each key that you are holding three times. If you do it correctly, the lower dials will show 165.

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

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 a 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.

Job 7

MULTIPLICATION—TWO-FIGURE MULTIPLIER

Before working the problems in this job, practice the rhythmic drill mentioned in Job 6.

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

Consider this problem:

$$78 \times 35.$$

1. Hold the pencil in the correct position.
2. See that the machine is in the proper position.
3. Hold the multiplicand (78) with the first finger of each hand. (See 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 dials will read 390 when you have finished.

5. You are now ready to multiply by the next figure, 3, which is in the tens column. Before you can multiply, you must shift your position. 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 is 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, as far as possible. This should result in the correct answer of 2730.

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

9. To prove, reverse the operation. Hold 35 on the keyboard and multiply by 78.

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

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 8

MULTIPLICATION—THREE-FIGURE FACTORS

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

Consider this problem:

834 × 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 factor, 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 hundreds with the first finger of the left and the other two figures with the first and second fingers of the right hand.

3. Multiply as before. Your answer should be 40032.

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

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

Job 9

MULTIPLICATION—THREE-FIGURE FACTORS (*Continued*)

Before working the problems in this job, practice the rhythmic drill mentioned in Job 6.

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 that you keep your 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. Then 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	6. 763 × 289
2. 478 × 645	7. 255 × 489
3. 412 × 679	8. 157 × 434
4. 734 × 279	9. 746 × 855
5. 456 × 235	10. 769 × 324

Sometimes it is more 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.

3. Multiply in the usual manner. The answer is 494109.

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 10

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	3. 6513 × 5435	5. 2113 × 7647
2. 4213 × 3214	4. 7524 × 8768	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. How to do this will be explained later.

Job 11

MULTIPLICATION—FINGERING

Before working the problems in this job, practice the rhythmic drill mentioned in Job 6.

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 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. These two positions are shown clearly in Illustration 4.

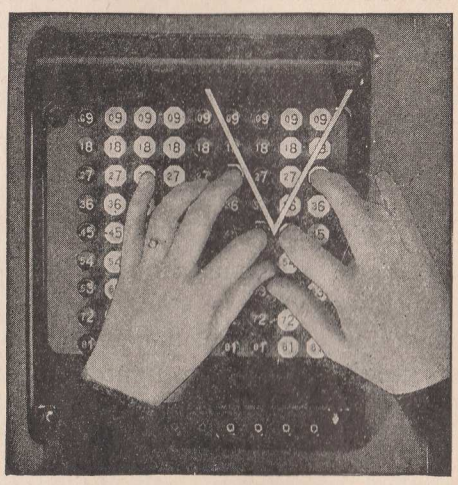


ILLUSTRATION 4. NATURAL COMBINATIONS

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." Raising the elbows slightly will greatly assist in holding reverse combinations. Hold the fingers in a curved position and relax the muscles

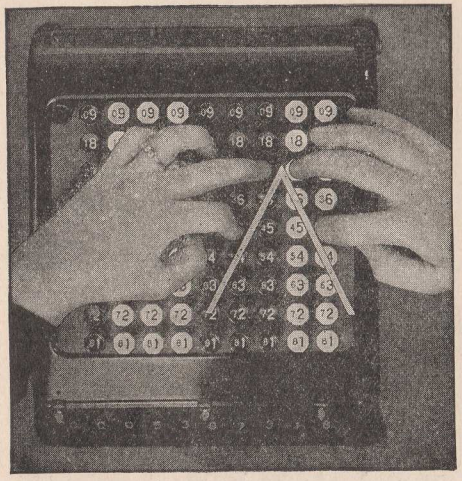


ILLUSTRATION 5. REVERSE COMBINATIONS

of the forearm after each key stroke. (See Illustration 5.) Solve the following problems:

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

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 large one, because it is easier to operate. The holding of many combinations may be simplified by interposing the fingers. Illustration 6 shows the interposed method of holding keys.

In holding 475, the 7 is held by the left hand and the 4 and 5 by the right hand.

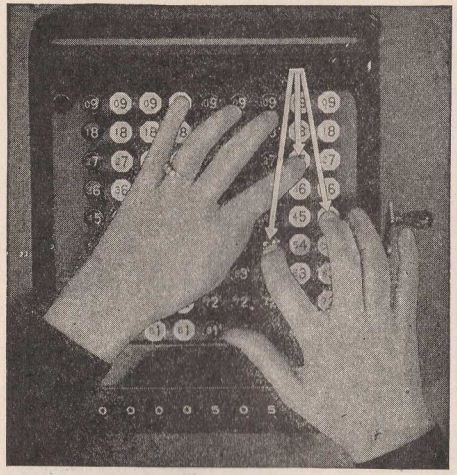


ILLUSTRATION 6. INTERPOSED OPERATION

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 × 616	**17.** 6226 × 1762	
14. 594 × 283	**18.** 7117 × 2891	

Cross Hand Combination. 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. (See Illustration 7.) 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 much more simple.

2. Hold the 97 in its proper columns with the left hand, as shown in Illustration 7. Hold 24 in its proper columns but with the right hand, as shown in Illustration 7.

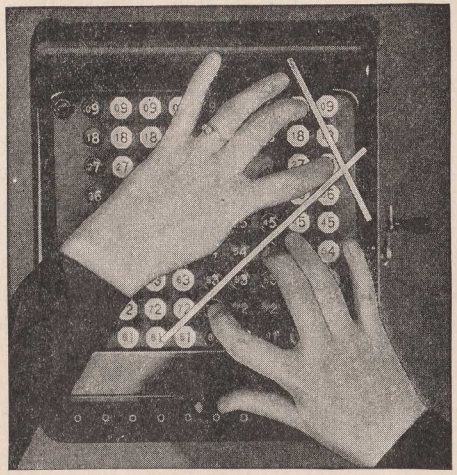


ILLUSTRATION 7. CROSS HAND OPERATION

3. Multiply in the usual manner. The answer is 8954242. It is much more convenient to hold this keyboard figure by cross hand operation than it is by reverse fingering. 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 use the cross hand combination to hold it. 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.

Long finger nails are the greatest cause of fumbling in multiplying. Nails should be trimmed closely so that they will not come in contact with the key tops.

Job 12

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.

1. 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.

2. 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	**3.** 508 × 728
2. 407 × 326	**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 column 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 13

MULTIPLICATION—DECIMALS

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, move the pointer as many places to the left as there are decimals in both factors.

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. Starting at the extreme right, move the decimal marker two places to the left.

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.

5. Solve the following problems. Always point off before you start to multiply. 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
2. 4.26 × 43.1
3. 8.947 × 3.28
4. .8962 × 4.79
5. 2.016 × .821
6. 217.8 × 302
7. 427.8 × 674
8. .8067 × 4.316
9. 62.78 × 5.21
10. .4216 × 36.09

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 multipier and three in the multiplicand, there will be six in the answer.

2. Move the decimal pointer to the left of the sixth dial, like this:

0000'000000.

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

Solve the following problems:

1. .257 × .482
2. .610 × .217
3. .826 × .309
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 five. In .057 there is one preceding cipher, for the same reason.

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. Move 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 taken care of 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 14

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 would 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. The figures to the right of the decimal point are fractions, while those to the left of the decimal point are whole numbers. For this reason, it is a good policy to multiply from the left of the keyboard when the answer is likely to be greater than the capacity of the machine. 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. Your 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 15

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: Place a pointer to the extreme left of the machine, and then move the pointer one place to the right for each whole number in both the multiplier and the multiplicand. 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 × 2.54.

1. Place the pencil and the machine in the proper position.
2. Slide the decimal pointer to the extreme left of the machine.
3. Apply the rule stated above. Move the decimal pointer one place to the right 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. Slide the decimal pointer three places to the right, as in Illustration 8.
5. Multiply as instructed before. If you have done your work correctly, your answer will be 95.25, as shown in Illustration 8.

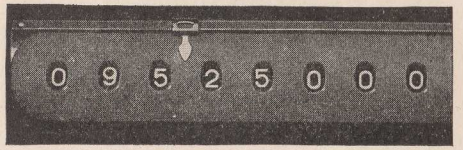


ILLUSTRATION 8. THE DIALS AT THE LEFT

Solve the following problems. Work in rhythm. Try to find the columns without looking at the keyboard. Be careful to use the proper combinations when holding the various factors.

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 × 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 × 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 × 6	5. 1.3 × .6
2. 1.3 × 6	4. 12 × .8	6. 13 × .6

Job 16

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 × .234.

1. Place the pencil and the machine in the proper position.
2. Place the pointer at the extreme left of the machine.
3. As both factors are decimals and, therefore, do not contain any whole numbers, the decimal point is not moved.
4. Multiply as before. Develop rhythm and ability to locate columns quickly and accurately. Solve the following problems and prove each:

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

Job 17

MULTIPLICATION—LEFT OF KEYBOARD—PRECEDING CIPHERS

If you have forgotten what is meant by "preceding ciphers," see Job 13.

In order to point off for preceding ciphers, the rule mentioned in Job 15 must be carried a little further.

The rule is: For each preceding cipher move the decimal pointer one place to the left. Consider this problem:

328 × .0031.

1. Under the old rule you would move the decimal pointer three places to the right, for there are three whole numbers in the two factors, like this:

000′0000000.

2. Notice how many preceding ciphers are contained in the multiplier. In this problem there are two.
3. As there are two preceding ciphers in the multiplier, move the decimal point two places to the left, like this:

0′000000000.

4. Hold the 31 in the usual manner, that is, by the first finger of each hand. Do not try to hold the ciphers. The ciphers are used when pointing off; they are not used in actual multiplication.
5. Multiply in the usual manner. Solve the following problems:

1. 671 × .021	**3.** 6.41 × .061	**5.** 27.138 × .061
2. 478 × .0032	**4.** 781.34 × .053	**6.** 421 × .027

Job 18

MULTIPLICATION—SPLIT MULTIPLIER

Before working the problems in this job, practice the rhythmic drill mentioned in Job 6.

Sometimes the figures used in multiplication are too large to be held conveniently. By using the finger combinations taught in the preceding job sheet, 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 so 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 do your 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 combinations 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 19

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 4		Job 11	
1	2	*Natural*	*Reverse*
26178	462.37	3. 4224 × 6556	7. 6875 × 1331
137	8.27	4. 3112 × 8668	8. 5674 × 2431
4561	61.40	5. 6447 × 9779	9. 3454 × 4664
27	378.21	6. 3114 × 2112	10. 7987 × 5886
684	6.27		
5718	.46	*Interposed*	*Cross Hand*
62175	782.89	11. 2882 × 7226	15. 8943 × 6521
98213	1.06	12. 3993 × 9118	16. 6704 × 1245
46278	67.23	13. 2771 × 8227	17. 20589 × 186
1036	426.20	14. 3651 × 7348	18. 4587 × 2398
42126	3.17		
70041	.08		
97314	27.39		
21678	261.43		

Jobs 12 and 13	Jobs 15 and 16	Job 17
19. .406 × .821	25. 1627 × .9181	29. 275.4 × .00025
20. .610 × .435	26. 61.71 × .6272	30. 556.5 × .00185
21. .372 × .307	27. 3.818 × .5161	31. .2531 × .0325
22. .4002 × .480	28. .2929 × .8283	32. .0288 × 8898
23. .6261 × .089		
24. .2836 × .0072		

Job 18

33. 124.67 × 389.71
34. 436.28 × 30.607
35. 60.142 × 3.1763

Job 20

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 frequently called the "remainder." These terms are shown in the example below:

46 minuend
23 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 at the right side of the keyboard.

2. To subtract, always use the small figures for the amount you want to deduct, taking 1 less from the right-hand figure of value. Then depress the small ciphers in the columns to the left of those in which the subtrahend was depressed.

Consider this problem:

898 – 775.

1. Use the large figures and set the minuend, 898, at the right side of the keyboard.

2. Use the small figures and depress the subtrahend less 1. In this example the subtrahend is 775, so depress 774 (775–1) on the small keys. Then depress several small cipher keys to the left of the columns used for the amount being subtracted. As the three right-hand columns were used for the subtrahend, you should depress the ciphers in the columns to the left of these three as shown in Illustration 9. Depress as many ciphers as you can conveniently hold with the left hand. In the illustration, the operator is depressing four.

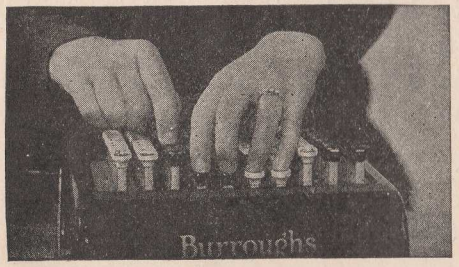


ILLUSTRATION 9. OPERATING CIPHER KEYS

3. When you have done this, the answer, 123, will appear at the right of the dials and one unit will be carried into the dial at the left.

4. This unit can be easily cleared by pressing the small ciphers in the left-hand columns in which they have not yet been pressed and also the blank key at the back of the left side of the keyboard. In this problem four ciphers were depressed to the left of the subtrahend. Depress the rest and also the blank key. The unit will be cleared. Try it.

The speed of the operation will be increased by taking out these ciphers in groups of three. It is not necessary to depress all the small cipher keys for every subtraction, however. Depress only enough to carry the 1 far enough so that it will not be confused in the answer.

Consider this problem:

138624 – 16.

1. Set the minuend in the machine.
2. Subtract 15 (16–1) on small figures and depress only three ciphers to the left. This will leave an incorrect answer.

In order to determine the correct answer, depress three more keys to the left. This will carry the 1 unit far enough to the left to prevent it from interfering with your answer. The correct answer is 138608.

Decimals. Pointing off in subtraction is exactly the same as pointing off in addition.

Consider this problem:

762.74 – 1.65.

1. Use large figures and add the minuend, 762.74, in the right side of the machine.
2. Point off.
3. Using the small figures, set 1.64 (1.65–1) at the right of the keyboard and at the same time depress small ciphers in the columns to the left.
4. The answer will be 761.09.
5. Prove the answer. To do this, add the number that you have just subtracted to the number in the dials. The answer should be the same as the minuend.

Solve the following problems and prove each one:

1. 896 – 232
2. 1278 – 243
3. 16752 – 3415
4. 27.46 – 1.73
5. 182.93 – 43.16
6. 876.42 – 73.26
7. 9278.35 – 864.24
8. 67.342 – 42.788
9. 98.767 – 63.156
10. 8.2163 – 6.7857

Job 21

SUBTRACTING NINES

You have probably noticed by this time that there are no small 9's on the Burroughs. Some subtrahends contain 9's, and the question naturally arises as to what to do when this occurs. Consider this problem:

49.57 – 9.22.

1. Place the pencil and the machine in the proper position.
2. Add 49.57 in the right of the machine.
3. Subtract 9.21 on the small figures. You will find that there is no small 9 to subtract. Accordingly, you merely skip the column in which the 9 would be subtracted if you had one. In this particular problem, you would subtract only the small 2 and 1.
4. In filling out the unused columns with small ciphers, do not depress any ciphers in the third column from the right. Although you did not strike any number in this column when you were subtracting, you must consider that the column has been used. Therefore, begin striking the small ciphers in the fourth column from the right.

If the work is performed correctly, 40.35 should appear in the dials.

This procedure applies whenever 9's are used in the subtrahend.

Consider this problem:

96.52 – 9.99.

1. Place the pencil and the machine in the proper position.
2. Using the large figures, set 9652 at the right of the machine.
3. Use the small figures. Subtract the subtrahend. To do so, strike 8.
4. Although you did not strike any keys in the second and third columns from the right, these columns have been used. For this reason, begin striking the small ciphers in the fourth column from the right. If you have done the work correctly, 86.53 will appear in the dials.

Solve the following problems and prove each:

1. 867.43 – 89.93
2. 678.92 – 92.96
3. 369.27 – 199.27
4. 1678.98 – 989.29
5. 2469.89 – 1979.19
6. 7189.93 – 2989.69

Job 22

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. Use the small figures and subtract the subtrahend less 1.
4. Depress as many small ciphers as necessary. Remember to depress these ciphers in groups of three.
5. Strike the blank key at the left-hand side of the keyboard if necessary.

If you have done your work correctly, 3540 will appear in the dials. Prove the answer.

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 21.

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. 876.721 – 2.009
10. 613.492 – 18.007

Job 23

SUBTRACTION—CREDIT BALANCES

Before working the problems in this job, add all the problems listed in Job 2. Do not skip this work, as it is necessary for you to develop speed in addition.

When the subtrahend is larger than the minuend, the procedure includes an additional step. Consider this problem:

64 – 96.

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

2. Use the large figures and set the minuend in the machine at the right of the dials.

3. Use the small figures and subtract the subtrahend. As the subtrahend is 96, it will be necessary to subtract 95 (96–1). Refer to Job 21 and note that this subtrahend contains a 9 that is not depressed. Remember that it is necessary to depress the small ciphers at the left of the columns used by the subtrahend.

4. When you have done this, the answer will be 9999999-968, as shown in Illustration 10. This is called a "nega-

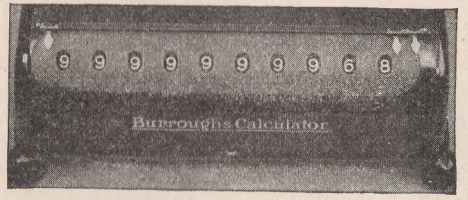


ILLUSTRATION 10. A NEGATIVE TOTAL

tive total," or sometimes a "credit balance." The number of 9's that appear to the left of the 68 will depend upon how many small ciphers you depress. To find the correct answer, this negative total must be converted. To do this, proceed as follows:

5. Hold the amount that appears in the lower dials less 1, but do not hold the 9's. In this problem, hold the 67 on the small figures.

6. Depress these keys once. This will clear the machine.

Depress these keys again. This second operation will show the true credit, which, in this case, is 32. As this is a

negative answer, it must be written with a minus sign, like this: −32. This is most important. When the minus sign is omitted, the answer is incorrect.

1	2	3	4	5
36	47	68	72	40
−86	−58	−91	−81	−75
—	—	—	—	—

Credit Balances. Perhaps you have been wondering why it was necessary to do all the work outlined above when it would be so much easier simply to place the larger number in the machine first and subtract the smaller from it. The answer is that the operator is not always able to tell at the start whether a problem will have a positive or a negative answer. It is only when he strikes the final figure that he is able to tell. In such a case, he must know how to convert the negative balance. Consider this problem:

28
−72
36
−24
—

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

2. In this problem you must continue until the last operation has been performed. Do not clear the machine until you have subtracted the last number.

3. Add 28, subtract 72, add 36, subtract 24. In performing these subtractions, it is necessary to strike the small ciphers as usual.

4. If you have done your work correctly, the answer will be 9999999968, as shown in Illustration 10.

5. Convert this answer in accordance with the instruc-

tions given above. Do not forget the minus sign. The converted answer is −32.

Solve the following problems. Some of them will have positive and others negative answers.

1	2	3	4	5
.75	.23	.41	.12	−.94
−.89	.42	−.98	−.24	63
.44	−.75	.84	.75	.72
−.98	−.28	−.22	−.63	−.23
−.28	.37	.25	−.45	.77

Job 24

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). Division on the Burroughs calculating machine is like repeated subtraction.

There are two ways of dividing on the Burroughs. 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 division is repeated 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. As you hold the small cipher in the ninth column, the small 2 in the eighth column, and the small 4 in the seventh column, you note that the divisor (25) is over 10 in the dials.

5. It is always necessary to reduce the amount in the dials until it is less than the number by which you are dividing. In this case the number in the dials (10) is less than the divisor (25), so it is not necessary to reduce it.

6. Slide each finger one place to the right. Now the divisor (25) is less than the number that appears under it (105), 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 0108000000. 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. Therefore, the division is ended in these three columns.

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. It must, therefore, 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.

1. 1242 ÷ 27	**5.** 714 ÷ 17	**9.** 825 ÷ 15
2. 854 ÷ 61	**6.** 804 ÷ 12	**10.** 368 ÷ 16
3. 552 ÷ 12	**7.** 546 ÷ 13	
4. 936 ÷ 18	**8.** 1218 ÷ 14	

Job 25

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 as 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:

001050'0000.

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

00105'00000.

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 more places to the left, like this:

001'0500000.

4. Divide as instructed before.

Solve the following problems:

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

Job 26

STROKE-WHEEL DIVISION—POINTING OFF

Stroke-wheel division on the Burroughs Calculator is also performed from the left of the keyboard, and hence the rules for pointing off are important. The general rule is: For every whole number in the divisor move the decimal point of the dividend 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 dials as it is written; that is, with the pointer in the same place that the point occurs in the dividend. Then move the decimal point one place to the left for each whole number in the divisor.

Consider this problem:

17.28 ÷ 12.1.

1. Using the large figures, add 17.28 in the machine at the left of the keyboard.
2. Set the decimal pointer as it is written in the dividend, like this:

017'2800000.

3. Apply the rule:
   a. Notice that there are two whole numbers in the divisor.

   b. Therefore, move the decimal point two places to the left, which means that when you finish, the answer decimal point will be to the left of the 1, like this:

0'172800000.

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, slide the decimal pointer to the right of the right-hand figure, like this:

0144'000000.

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:

01'44000000.

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 stroke wheel.
2. Reduce the remainder.
3. Shift to the right.

These steps will be explained to you in their order.

Job 27

STROKE-WHEEL DIVISION—EQUALING THE STROKE WHEEL

The first step in division is to equal the stroke wheel. The stroke wheel is the figure that appears in the dial to the left of the columns in which you are holding your fingers. (See Illustration 12, page 61.)

Consider this problem:

1111 ÷ 89.

1. Use the large figures and set the dividend, 1111, in the machine. Set this dividend in the extreme 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:

01111'00000.

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

011'1100000.

4. Hold 88 (89–1), using the small figures in the first two columns to the left. Do not hold any small cipher as in cipher division.

5. The stroke wheel is the column to the left of those columns on which you are holding your fingers. In this problem the stroke wheel is 0.

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

7. Slide each finger one place to the right. The stroke wheel is now 1.

8. Equal the stroke wheel. As the stroke wheel is 1, depress both keys once. The answer thus far is 012'2100000.

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

9. Slide each finger another place to the right.

10. The stroke wheel is now 2:

88
012'2100000.
S

11. Depress both keys two times. The answer is 012'-4300000.

12. Slide each finger another place to the right.

13. The stroke wheel is now 4:

88
012'4300000.
S

14. Depress the keys four times. The dials will read 012'4740000. 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 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
012'1200000.
S

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

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

```
  8 7
012'1200000.
  S
```

5. As the stroke wheel is 1, depress the keys once. This gives an answer of 013'3200000.

6. Slide to the next position:

```
   87
013'3200000.
   S
```

The stroke wheel is 3, so depress the keys three times. The answer is 013'6800000. For reasons that will be explained later, you will stop at this point.

Consider this problem:

2121 ÷ 88.

Eighty-eight is 87 on the small figures. 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
021'2100000.
S
```

1. The stroke wheel is 0. Therefore, do nothing in this position.

2. Slide to the next position:

```
  8 7
021'2100000.
  S
```


3. The stroke wheel is 2, so depress the keys twice. The register now reads 023'6100000.

4. Slide to the next position:

```
   87
023'6100000.
   S
```

5. The stroke wheel is 3, so depress the keys three times.

6. The answer thus far is 023'9700000, or 23.97.

7. Clear the dials.

Job 28

STROKE-WHEEL DIVISION—WHEN THE STROKE WHEEL CHANGES

In dividing on the Burroughs, it frequently happens that the stroke wheel 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 stroke wheel is 6 and you depress the keys six times, sometimes the stroke wheel will change to 7 or even to 8. When this occurs, you must depress the keys an additional number of times to make it equal the stroke wheel. 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 stroke wheel is 0, so slide each finger to the next position.

5. The stroke wheel is 7, so depress the keys seven times.

6. As you were depressing the keys, the stroke wheel changed to 8. This means that you have not yet equaled the stroke wheel. You have depressed the keys seven times, but the stroke wheel is 8, so, in order to equal the stroke wheel, you must depress the keys another time. As you have already depressed the keys seven times, this extra time will make eight, which is the number that the stroke wheel is. Try it. If you have done your work correctly, the answer thus far will be 082′1100000.

7. Slide to the next position.

8. The stroke wheel is 2, so depress the keys two times.

9. Do this and notice that the stroke wheel does not change. It is 2, and you have depressed the keys two times, so you have equaled the stroke wheel. The answer thus far is 082′3500000.

10. Shift to the next position.

11. The stroke wheel is 3, so depress the keys three times. The answer now is 082′3860000.

12. Slide to the next position. The stroke wheel now is 8. Depress the keys eight times. While you were doing this, the stroke wheel changed to 9. As you have depressed the keys only eight times, you have not equaled the stroke wheel, for the stroke wheel is 9. To equal it, it will be necessary to depress the keys once again. This makes nine depressions in all, which agrees with the stroke wheel. Now the answer is 082′3968000.

13. Slide to the next position.

14. The stroke wheel 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′3976400.

15. Slide to the next position.

16. The stroke wheel 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′3977240. For the present, stop here.

Consider this problem:

7333 ÷ 89.

1. Insert the dividend and point off.

2. Hold 88 on the small figures at the left.

3. The stroke wheel is now 0; therefore, slide to the next position.

4. The stroke wheel is now 7, which means that you should depress the keys seven times. In performing this operation, the stroke wheel changed to 8, so you have not yet equaled it. You must depress the keys once more in order to make 8. Do so. This time the stroke wheel did not change, so you have agreed with the stroke wheel. The answer now is 082′1300000.

5. Slide to the next position.

6. The stroke wheel is now 2; so depress the keys twice. The stroke wheel does not change; therefore, you have equaled it. The answer is 082′3500000.

7. Slide to the next position.

8. The stroke wheel is now 3; so depress the keys three times. The answer is 082′3830000.

9. The stroke wheel does not change; so slide to the next position.

10. The stroke wheel is now 8, so depress the keys eight

times. The stroke wheel will change to 9. Therefore, in order to equal the stroke wheel, you must depress the keys once more. Your answer thus far should be 082′3929000.

11. Slide to the next position. The stroke wheel is now 2, so depress the keys twice; in doing so the stroke wheel changes to 3. Therefore, it is necessary to depress the keys once again. When you have done this, the answer will be 082′3932300.

12. Slide to the next position. The stroke wheel is 2; so depress the keys twice. The stroke wheel has not changed; so you have equaled the stroke wheel. The answer is 082′3932520.

13. The stroke wheel is now 5, so depress the keys five times. As the stroke wheel did not change, slide to the next position. The answer is now 082′3932575.

14. Clear the machine.

Job 29

STROKE-WHEEL DIVISION—REDUCING THE REMAINDER

Before working the problems in this job, add all the problems in Job 4. Do not skip this work, as it is important.

Before you can reduce the remainder, you must, of course, know what is meant by the "remainder." The remainder is the amount shown in the dials that appear directly underneath the figures you are holding. (See Illustrations 11, 14, and 17, pages 60, 63, and 65.) If you are holding figures in the first two columns, the remainder will appear in the dials directly under the first two columns. If you are holding figures in the fourth and fifth columns, the remainder would be in the dials directly under the fourth and fifth columns. The second step in division is to reduce this remainder until it is less than the number by which you are dividing. 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′2800000. 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. Glance down from the columns in which you are holding your fingers, and notice that the remainder is 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. This number is still greater than 12.

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

e. As this number is greater than 12, depress the keys again, and at last the remainder comes 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. Set the dividend, 379.98, in the left of the machine, using the large numbers, 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.

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 your 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 you must depress the keys again. Do so.

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. As the remainder, 19, is greater than the divisor, 18, 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 your 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 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. 6153̈8 ÷ 29
2. 735.84 ÷ 1.2
3. 315.45 ÷ 15
4. 995.84 ÷ 3.2

Job 30

STROKE-WHEEL DIVISION—COMBINING THE THREE STEPS

Thus far, you have been taught three separate steps in division: (1) agreeing with the stroke wheel, (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 stroke wheel, reduce the remainder, and move over to the right.

Consider this problem:

3465 ÷ 45.

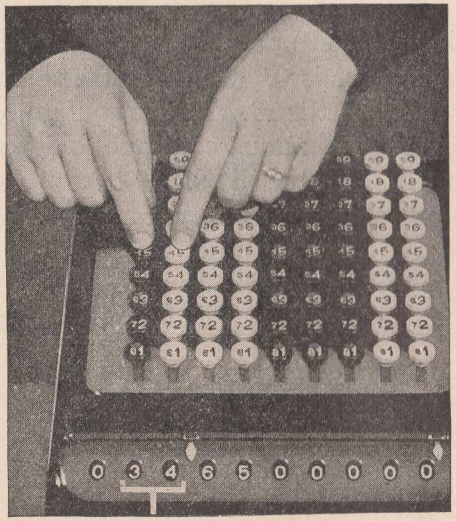


ILLUSTRATION 11. DIVISOR IS NOT CONTAINED IN 34

1. Set 3465 on the left of the machine on the large figures and point off.

2. Hold 44, using the small figures.

3. Agree with the stroke wheel. As the stroke wheel is 0, you need do nothing at this time. (See Illustration 11.)

4. The second step is to reduce the remainder. The remainder is 34, and since 34 is less than the divisor, 45 (see Illustration 11), you do not need to reduce it. Therefore, in this particular problem, do nothing in the first two columns.

5. The third step is to slide to the next position.

6. Now begin the three steps again. Agree with the stroke wheel. The stroke wheel is 3 (see Illustration 12), so you depress the keys three times. In doing so, the

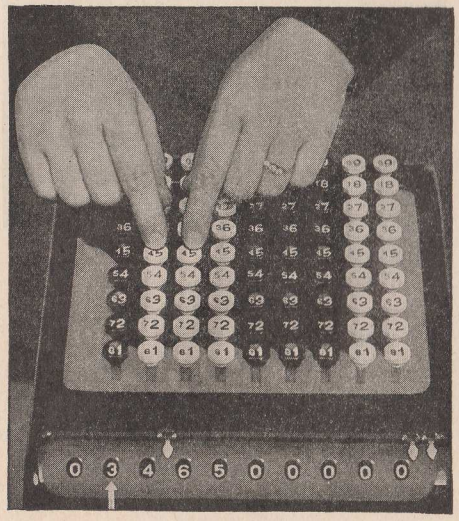


ILLUSTRATION 12. STROKE WHEEL IS 3.

stroke wheel changed to 5 (see Illustration 13), so depress the keys two more times. As you do so, the stroke wheel advances to 6. So depress the keys once more. This produces the answer shown in Illustration 14. You have now agreed with the stroke wheel and are ready for the second step, which is to reduce the remainder.

ILLUSTRATION 13. STROKE WHEEL IS 5

7. The remainder is 76. As this is greater than the divisor, 45, it must be reduced. Depress the keys once. The remainder is reduced to 31, as shown in Illustration 15.

8. Notice at this time that the stroke wheel changed. Pay no attention to this. Remember this rule at all times: After you have once agreed with the stroke wheel, pay no attention to it. The stroke wheel will frequently change

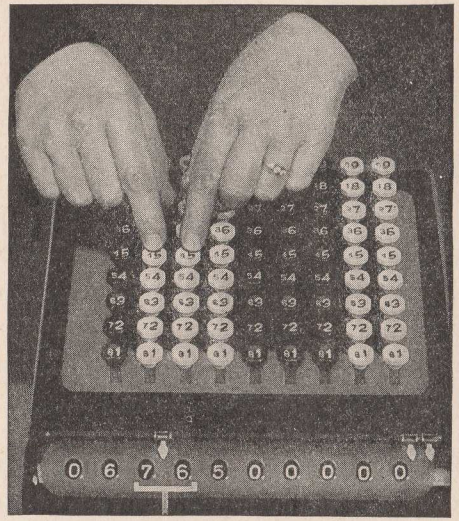
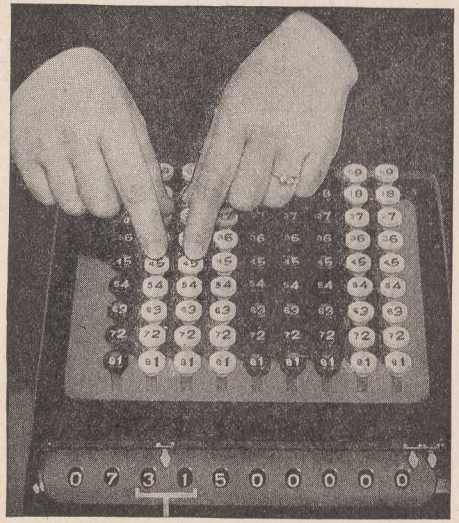


ILLUSTRATION 14
REMAINDER

ILLUSTRATION 15
MOVE OVER



when you are reducing the remainder, but this makes no difference in your work.

9. Shift to the next position, as shown in Illustration 16.

10. The stroke wheel is 3, as shown in Illustration 16, so depress the keys three times. As you do so, the stroke wheel advances to 4; so depress the keys once more.

11. This time the stroke wheel changes to 5, as shown in Illustration 17; so depress the keys once again.

12. This time the stroke wheel does not change; so it has been equaled.

13. The next step is to reduce the remainder, which is 90. (See Illustration 17.)

14. This will require two strokes.

15. After the second stroke, the remainder will be 0. This means that the problem comes out even. The answer will appear to the left of the dials.

If you do not understand these instructions thoroughly, read them over again until you do.

Solve the following problems and prove each. To prove division problems, simply multiply the answer by the divisor.

1. 3216 ÷ 67	3. 1980 ÷ 36	5. 4371 ÷ 47
2. 882 ÷ 21	4. 5427 ÷ 67	6. 754 ÷ 58

Many times the divisions will not come out even. In most offices, division problems are carried to the third 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. The problems shown below will have a remainder. Carry them

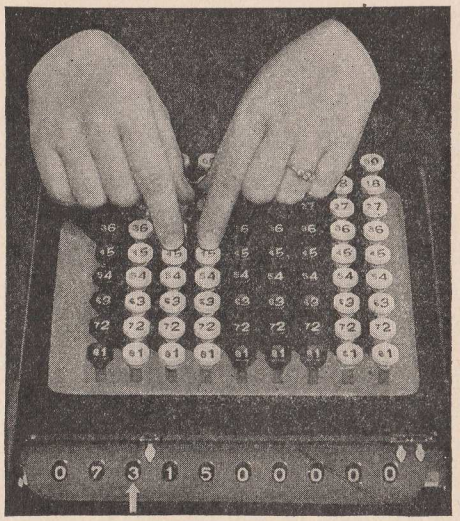
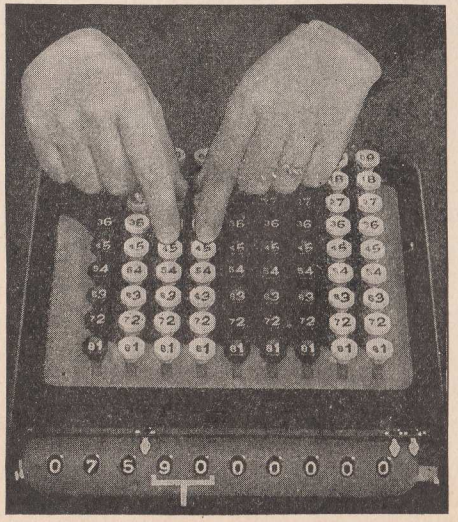


ILLUSTRATION 16
STROKE WHEEL IS 3

ILLUSTRATION 17
REMAINDER



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 31

DIVISION—WHEN THE DIVISOR IS A DECIMAL

Before working the problems in this job, add all the problems in Job 2. 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.
4. 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 32

STROKE-WHEEL 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 13. When the divisor has such preceding ciphers, the rule for point 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′00000.
2. Look at the divisor.
3. It contains one preceding cipher, so move the decimal pointer one place to the right.
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
2. 2486 ÷ .078
3. 7921 ÷ .026
4. 4267 ÷ .0087
5. 36214 ÷ .0086
6. 42617 ÷ .0087

Job 33

DIVISION—WHEN THE DIVISOR CONTAINS NINES

As you learned from your subtraction problems, there are no small 9's on the keyboard of the Burroughs. Accordingly, when the divisor contains 9's, you must make allowance for this fact. Do not hold your finger in 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. When you try to hold 94 on the small figures, you find that there is no 9 to hold.

2. Accordingly, allow the finger that would hold the 9 to be idle, and continue to hold the 4. However, even though you are not holding the 9, it is being used. If you do not remember this while you are working the problem, you will be confused as to the stroke wheel and the remainder.

3. Hold 94 in the first two columns at the left of the keyboard. This means that the first column will be blank, since you cannot hold a 9.

4. Divide as instructed before. The answer is 50.-3473680. Go over this problem several times until you understand what is meant by not holding the 9, but remembering that it is there. When you have done so, 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 in the column in which the 9 would appear above the key, but do not depress the key, 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.

4. 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 key factor 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 the method out 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

Job 34

DIVISION—WHEN THE DIVISOR CONTAINS THREE FIGURES

It is no more difficult to divide by a divisor containing three figures than by 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 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 convenient position.

Consider this problem:

32516 ÷ 674.

1. Insert 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 stroke wheel 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 stroke wheel 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 stroke wheel.
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.** 23.67 ÷ 190	**5.** 4719 ÷ 188
2. 8726 ÷ 5.51	**4.** 6261 ÷ .819	**6.** 3.621 ÷ .678

Job 35

STROKE-WHEEL 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 nine. The rule is: For every 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 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	**3.** .1267 ÷ 171
2. .2781 ÷ 60	**4.** .9681 ÷ 312

Job 36

REVIEW

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

	Jobs 20, 21, and 22	Job 23	
		6	**7**
1.	842.67 − 431.50	171.32	141.61
2.	310.56 − 207.62	−67.48	.68
3.	978.20 − 892.41	134.61	−326.07
4.	431.89 − 200.70	−371.45	4.57
5.	672.09 − 561.31	22.61	6.86

Job 24	Job 31	Job 32
8. 2130 ÷ 44	**13.** 23614 ÷ .314	**18.** 2178 ÷ .026
9. 2217 ÷ 21	**14.** 47892 ÷ .607	**19.** 4236 ÷ .0081
10. 1436 ÷ 32	**15.** 61478 ÷ .421	**20.** 7812 ÷ .0031
11. 2183 ÷ 14	**16.** 31256 ÷ .311	
12. 4261 ÷ 25	**17.** 47832 ÷ .624	

Job 33	Job 35
21. 4127 ÷ 9.1	**24.** .2314 ÷ 61
22. 8936 ÷ 8.09	**25.** .6287 ÷ 80
23. 4718 ÷ .410	**26.** .7461 ÷ 207
	27. .4385 ÷ 909

Job 37

FRACTIONS—ADDITION

Before working the problems in this job, work the first ten problems in Job 11 again. This practice is most important.

The Burroughs Adding Machine Company manufactures a calculating machine that will calculate fractions. (See Illustration 18.) However, fractions may be worked on the regular machine also, if these fractions are first reduced to decimals. These decimals are frequently called "decimal equivalents." You should memorize the more common decimal 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 88. Use the table in working the following problems.

The first thing to do when you have a problem involving fractions is to decide for yourself how many decimal places you wish to carry the decimal. For most office purposes,

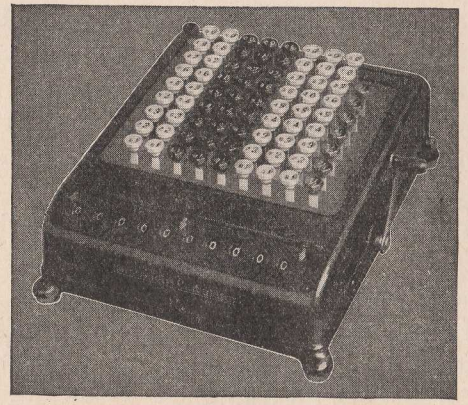


ILLUSTRATION 18. 1/8 FRACTIONAL KEYBOARD

it is sufficiently accurate to carry the decimals three places. If you desire greater accuracy, however, four or six 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. 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 keys 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 seventh 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 38

FRACTIONS—SUBTRACTION

Before starting this job, work problems 11 to 20 in Job 11. Try to develop speed and rhythm.

Before you can subtract fractions on the regular Burroughs Calculator, 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 20 again.

In deducting 1 from the subtrahend, be sure to deduct 1 from the last figure on the right. Do not deduct 1 from

the last *whole* number on the right but from the last *figure* on the right. For instance, in the first problem below, the subtrahend, 267¼ (267.25), is set on the keyboard as 267.24.

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 39

FRACTIONS—MULTIPLICATION

Before starting this job, work problems 21 to 29 in Job 11.

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 18. Multiply from the left. Carry the answer as far as possible. Carry decimal equivalents to three places.

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 × .008 1/2
10. 82 2/5 × .067 1/8

Job 40

FRACTIONS—DIVISION

Before starting this job, rework the problems in Job 13.

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 30. Carry decimal equivalents to two places only.

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 ÷ 21 1/4
6. 783 1/4 ÷ .07 1/6
7. 7416 1/8 ÷ .004 2/3
8. 642 1/3 ÷ .31 1/4
9. .756 1/6 ÷ .24 1/2
10. 782 1/5 ÷ 8 4/5

Job 41

FIXED DECIMAL POINTS

Before starting this job, work the problems in Job 15 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; so you place the decimal marker in a convenient position and then set the problems around it.

Consider this problem:

9 articles at 25c.

1. Select some decimal marker—say, between the fifth and sixth columns.

2. Hold the .25 to the right of the decimal point, using the large figures, as you always do in multiplication. This places the hands on the black columns.

3. Depress the keys nine times. This produces an answer of $2.25.

4. Record the answer and clear the machine.

5. Suppose the next problem was: 34 articles at $3.25 each.

6. Clear the dials for the present, but leave the decimal marker where it was.

7. Hold the price in the units position. The units position is that position in which the decimal point in the price is directly over the fixed decimal point in the dials. In this problem, hold the 3 to the left of the fixed decimal point and the 25 to the right, as shown in Illustration 19. This is called the units position.

8. Depress the keys four times to multiply by the 4 units.

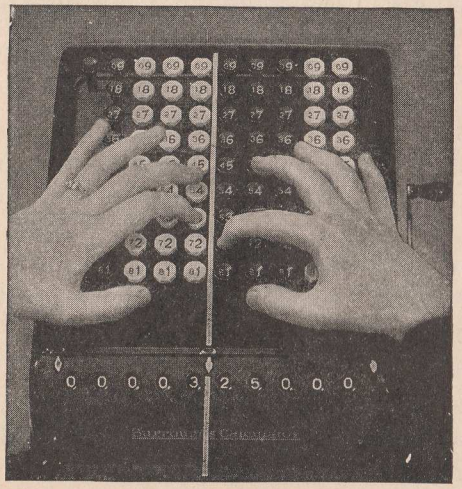


ILLUSTRATION 19. UNIT POSITION

9. Slide the hands one place to the left and depress the keys three times to multiply by the 3 tens.

10. The answer is $110.50. Go over these problems again, and when you think you understand the use of the fixed decimal point, solve the following problems. Do not move the decimal point. Always hold the price.

1. 22 × 3.25	**3.** 61 × 3.75	**5.** 321 × 2.24
2. 55 × 4.25	**4.** 82 × 2.46	**6.** 473 × 4.31

Job 42

FIXED DECIMAL POINTS—WHEN THE MULTIPLIER IS A FRACTION

When the multiplier is a fraction, shift the places in which you hold your fingers in accordance with the number of whole numbers in the fraction. Consider the following problem:

354¼ articles at $3.25 each.

1. In working fixed decimal points, always hold the price of the article. Hold the price in the units position at first.

2. As there are 3 hundred articles, we must shift to the hundreds position. In other words, we must shift two places to the left. Therefore, move each finger two places to the left.

3. Start to multiply with the left-hand figure, which is 3.

4. Shift to the right one position and multiply by the 5.

5. Shift to the right one position and multiply by 4.

6. Shift to the right one position and multiply by 2.

7. Shift again and multiply by 5. Your answer is 1151.3125.

Consider another problem:

61¼ articles at 16c.

1. Hold the 16c in the units position. That is, with the 1 and the 6 to the right of the decimal point.

2. The number of articles consists of tens, so shift each finger one place to the left.

3. Multiply by the 6 tens.

4. Shift one place to the right. Multiply by the 1 unit.

5. Shift one place to the right. Multiply by the first decimal figure, which is 2.

6. Shift one place to the right and multiply by the second decimal figure, which is 5.

7. The answer is 9.80.

Solve the following problems:

1. 265 @ 3.25	**3.** 732 1/5 @ 5.21
2. 467 1/8 @ 2.67	**4.** 16 1/2 @ .32
	5. 43 1/4 @ .72

Job 43

ACCUMULATION

Sometimes in an office you make several multiplications, but, instead of writing down the answer of each multiplication, you write down the total of all the answers. This is sometimes done in making out bills, or in checking incoming 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 @ 25c
10 articles @ 35c
17 articles @ 14c _____

To solve this problem, three separate multiplications must be performed, but the machine is not cleared until the last multiplication has been made.

1. Start from the right of the keyboard.
2. Multiply 5 by 25, but leave the product in the machine.
3. Multiply 10 by 35, but leave the new product in the machine.
4. 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 between fifth and sixth columns.
3. Hold the 36 to the left of the pointer and the 2 to the right.
4. Multiply by the 1 unit.
5. Shift to left. Multiply by 2 tens.
6. Shift to left. Multiply by 4 hundreds. Do not clear the machine.
7. Hold the second decimal. Hold the 4 to the left of the decimal point and the 21 to the right. This is the units position.
8. Multiply as before.
9. In the third multiplication, the units position shows three figures to the right of the decimal point.

Solve the following problems:

6	7	8
7.31 × 274	42.8 × 672	273 × 4.56
38.3 × 361	316 × .407	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 Are Decimals. When both factors are decimals, it may be necessary to shift to the right. As you know, multiplication can be worked from either the right or the left. In Job 42, the multiplications around the fixed decimal point were made from left to right. In

accumulation, it is probably better to work them in this manner too. Consider this problem:

3 1/4 yds. at .25 per yard
17 1/2 yds. at .35 per yard
14 3/4 yds. at $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. Examine the multiplier—it is 3 1/4, or 3.25. It contains 3 units and a decimal.
4. Multiply by the 3 units.
5. As the remaining figures are decimals, it is necessary to shift to the *right*. In the preceding job only whole numbers were used, so the shift was made to the left. Shift to the left for whole numbers but to the right for decimals.
6. Shift right and multiply by the 2 ten*ths* (not tens).
7. Shift right again and multiply by the hundred*ths* (not hundreds).
8. Hold the next price (.35) in the units position.
9. Examine the multiplier. This multiplier consists of both whole numbers and decimals. It is better to multiply from left to right. This multiplier has more than units. It has 1 ten. For this reason it is better not to multiply by the units first.
10. Hold the price in the units position.
11. Shift one place to the left to get in the tens position.
12. Multiply by 1 ten.
13. Shift right and multiply by 7 units.
14. Shift right and multiply by 5 ten*ths*.

15. Hold the next price in the units position.
16. Shift one place to the left to get in the tens position.
17. Multiply by the 1 ten.
18. Continue to multiply as instructed before. The answer should be 25.375.

Solve the following. Use the table on page 88 for decimal equivalents; carry decimals to three places only.

11	12	13
4 1/4 × 3.25	42 1/5 × .75	867 1/3 × .26
16 1/2 × 1.75	89 1/4 × 1.06	7 1/5 × 1.07
37 3/4 × .86 _____	73 1/8 × 2.41 _____	92 3/5 × .86 _____

14	15
92 2/3 × .89	178 1/2 × .87 1/4
47 1/3 × .08	453 1/3 × .45 1/8
25 1/5 × .67 _____	246 1/8 × 1.07 3/8 _____

Job 44

STROKE-WHEEL MULTIPLICATION

Stroke-wheel multiplication is used when three factors are to be multiplied.

Consider this problem:

25 × 75 × 35.

1. Multiply 25 × 75 on the right of the keyboard. The answer is 1875.
2. The next step is to multiply 1875 by 34.
   a. As 1875 is already in the machine once, it is necessary to put it in only 34 more times. Therefore, multiply by 34 (35–1).

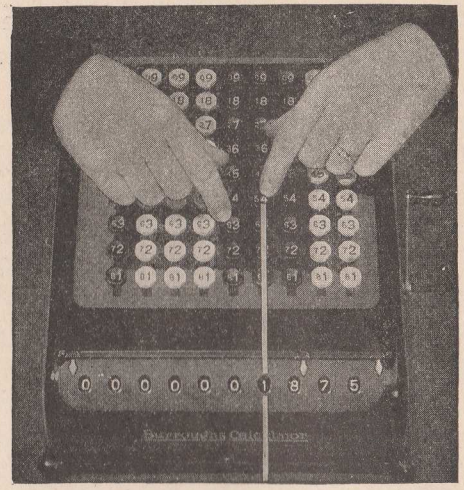


ILLUSTRATION 20. OVER THE LEFT FIGURE

b. Hold the third factor (34) on the keyboard so that the 4 is just over the figure 1 in the dials, as in Illustration 20.

c. Depress the keys as many times as indicated by the stroke wheel in the dials.

The stroke wheel is the dial figure that appears just under the right-hand figure that you are holding. (See Illustration 20.) The first stroke wheel is 1, so depress the keys once.

d. Shift right.

e. The next stroke wheel is 8, so depress the keys eight times.

f. Shift right.

g. The next stroke wheel is 7, so depress the keys seven times.

h. Shift right.

i. The last stroke wheel is 5, so depress the keys five times.

3. The answer is 65625.

Work these steps over until you understand them thoroughly. The total number of decimal places in all of the factors must be pointed off.

Solve the following problems:

1. 48 × 65 1/2 × 56
2. 35 × 486 × 504
3. .25 × 36 1/2 × 48
4. 54 × 986 × .255
5. 47 1/2 × 965 × .42
6. 36 1/2 × 48 × 567
7. 24 × .98 × 56
8. .54 × 687 × .98
9. 325 × 48 × 68
10. 21 × 32 × 46

Job 45

REVIEW

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

JOBS 37 and 38

1	2
14 1/3	.42 1/2
27 1/8	− .37 1/3
65 1/2	− 62 1/4
42 2/5	79 1/8
91 2/3	28 2/5

JOB 39

3. 627.18 × .08 1/2
4. 927.42 × .19 1/4
5. 43.871 × .26 1/2

JOB 40

6. 413 1/2 ÷ 78 1/4
7. 621.25 ÷ .09 1/2
8. 428.37 ÷ .46 2/5

JOB 43

9. 41 1/2 × 3.27
102 1/4 × .436
87 2/5 × .82 ___
10. 59 1/8 × 1.05
62 × .08 1/2
47 1/3 × .62 1/2 ___

JOB 44

11. 46 × 27 × 81
12. 3.6 × .52 × 38 1/2

Job 46

GENERAL REVIEW

Job 4		Job 11	Jobs 12 and 13
1	2	**3.** 3112 × 7667	**9.** .301 × .742
36174	317.46	**4.** 4324 × 9768	**10.** .610 × .405
6218	.27	**5.** 4563 × 6776	**11.** .427 × .0036
28	3.89	**6.** 1232 × 2332	**12.** .089 × .4217
401	21.75	**7.** 3991 × 1882	
8716	.06	**8.** 1772 × 3791	
50942	710.34		
31705	41.20		
4261	.61		
708	534.49		
36	617.25		

Jobs 15, 16, and 17	Job 18	Job 23	
13. 1728 × .3142	**18.** 136.78 × 897.12	**22.** 61.27	**23.** 362.71
14. 3.163 × .371	**19.** 621.43 × 213.45	−425.26	−89.26
15. .214 × .876	**20.** 213.67 × 378 1/4	17.89	−6.42
16. 214 × .007	**21.** 427.12 × 214 1/5	36.42	−71.35
17. 369 × .0021		.27	−4.27
		−9.86	− .28

Jobs 26 to 35	Job 43	
24. 3146 ÷ .037	**28.** 31 1/2 × 3.26	**29.** 42 1/2 × 10.26
25. 67218 ÷ .405	27 1/4 × .42	67 1/4 × .76
26. .2671 ÷ 61	42 1/2 × .08 1/2	59 1/5 × .31 1/2
27. 31.76 ÷ 70		

Job 44

30. 326 × 478 × 293

31. 46 1/2 × 2.7 × .38

Appendix

TABLE OF CHAIN DISCOUNT EQUIVALENTS

Rate	5	7½	10	12½	15	16⅔	20	22½	25
Net	.95	.925	.90	.875	.85	.83333	.80	.775	.75
2½	.92625	.90188	.8775	.85313	.82875	.8125	.78	.75563	.73125
5	.9025	.87875	.855	.83125	.8075	.79167	.76	.73625	.7125
5–2½	.87994	.85678	.83363	.81047	.78731	.77187	.741	.71784	.69469
5–5	.85738	.83481	.81225	.78969	.76713	.75208	.722	.69944	.67688
5–5–2½	.83594	.81394	.79194	.76995	.74795	.73328	.70395	.68195	.65995
7½	.87875	.85563	.8325	.80938	.78625	.77083	.74	.71688	.69375
7½–2½	.85678	.83423	.81169	.78914	.76659	.75156	.7215	.69895	.67641
7½–5	.83481	.81284	.79088	.76891	.74694	.73229	.703	.68103	.65906
10	.855	.8325	.81	.7875	.765	.75	.72	.6975	.675
10–2½	.83363	.81169	.78975	.76781	.74588	.73125	.702	.68006	.65813
10–5	.81225	.79088	.7695	.74813	.72675	.7125	.684	.66263	.64125
10–5–2½	.79194	.7711	.75026	.72942	.70858	.69469	.6669	.64606	.62522
10–7½	.79088	.77006	.74925	.72844	.70763	.69375	.666	.64519	.62438
10–10	.7695	.74925	.729	.70875	.6885	.675	.648	.62775	.6075
10–10–5	.73103	.71179	.69255	.67331	.65408	.64125	.6156	.59636	.57713
10–10–5–2½	.72175	.69399	.67524	.65648	.63772	.62522	.60021	.58145	.5627
10–10–10	.69255	.67433	.6561	.63788	.61965	.6075	.5832	.56498	.54675
10–10–10–10	.62330	.60689	.59049	.57409	.55769	.54675	.52488	.50848	.49208
10–10–10–10–10	.56097	.54620	.53144	.51668	.50192	.49208	.47239	.45763	.44287

Table of Decimal Equivalents for Fractions

1.00	1/2	1/3	1/4	1/5	1/6	1/8	1/10
1	.50	.33 1/3	.25	.20	.16 2/3	.12 1/2	.10
2	1.00	.66 2/3	.50	.40	.33 1/3	.25	.20
3	.....	1.00	.75	.60	.50	.37 1/2	.30
4	.....	.....	1.00	.80	.66 2/3	.50	.40
5	.....	.....	.....	1.00	.83 1/3	.62 1/2	.50
6	.....	.....	.....	.....	1.00	.75	.60
7	.....	.....	.....	.....	.....	.87 1/2	.70
8	.....	.....	.....	.....	.....	1.00	.80
9	.....	.....	.....	.....	.....	.....	.90
10	.....	.....	.....	.....	.....	.....	1.00