ORIGINAL-ODHNER

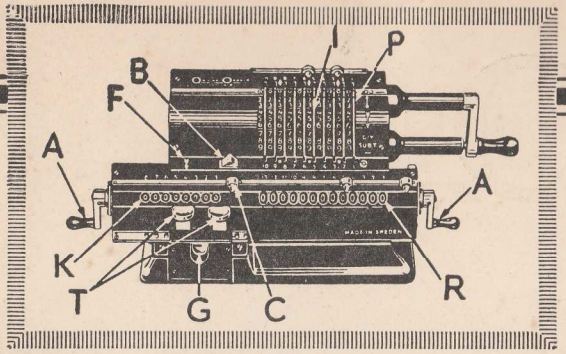
Directions *for the use of* calculating machines

SUMNER JACKSON LTD.

GILBERT WOOD (A/M) LIMITED

Head Office :
73-75-77 NORWOOD ROAD,
HERNE HILL,
LONDON, S.E. 24.
Tel. : Tulse Hill 7211.

and at
33 BROWN STREET,
MANCHESTER, 2,
Tel. : Blackfriars 1902.



THE ORIGINAL-ODHNER CALCULATING MACHINE has three registers: The Setting Board (1), the Multiplier or Proof-register (K) and the Product- or Result-register (R). These registers correspond to the two factors and the result in every multiplication and division.

Any amount, which is set on the setting board, will be added into the Result-register each time the crank is rotated in the positive (clockwise) direction marked with an arrow pointing on + Mult Add, provided that the carriage (C), which contains the Proof- and Result-register, is placed in its extreme left-hand position. If the carriage is moved one, two or more steps to the right the amount is added 10 times, 100 times and so on.

The Proof-register indicates how many revolutions the crank has made.

If thus an amount is set on the Setting Board, which is accomplished by bringing down the setting levers in the various slots, so that they correspond with the respective figures of the amount on the figure plate, and the crank is turned a certain number of times, the Result-register always shows the product of the amount set and the amount appearing in the Proof-register. Vice versa the Proof-register shows the quotient between the amount, which appears in Result-register and the amount set on the Setting Board.

The above description is the basis for all calculations and should always be borne in mind. Place the machine in front of you at the right-hand side. The position of the machine should then be such, that the right-hand end of it is nearer you than the left-hand end. When your hand is placed on the crank the lower part of your arm should have approximately the same direction as the main shaft of the machine.

To set an amount on the Setting-Board place your right hand in the way shown in illustration 1 (page 3 of the cover) and bring the respective setting lever down in the slot to the desired figure. Only the tip of the index finger should be used. The setting levers are numbered from 1 to 10 counted from the right. When in these directions for the use we explain as follows: "Set 135 (3—1)", the figures within the parenthesis indicate the numbers, with which the proper levers to be used are marked. In this particular case the lever Nr. 3 should be put on figure 1, the lever Nr. 2 on figure 3 and the lever Nr. 1 on figure 5.

Cont. on 3rd page of this cover.

ORIGINAL-ODHNER

Addition.

1. Ascertain that all registers are zeroised and set on the setting board the first amount to be added.
2. By means of a positive turn of the crank (in the direction of the plus arrow) this amount is transferred to the result-register.
3. Zeroise the setting levers ; set the second amount and transfer it to the result-register by means of one turn of the crank.
4. Proceed in the same way with all other amounts of the addition.

The amount which then appears in the result-register is the total of the addition. On machines with ten's transmission in the proof-register, this will show the number of additions made or rather the number of factors of the completed addition.

On machines without ten's transmission the number of the factors of the addition can be checked by means of setting the tenth lever on 1, which is left on the setting dial during the whole operation. The result-register will then in its left-hand part and separately from the total show the number of said factors.

The following must be carefully noted :

Do not zeroise the result-register during the operation.

Do not move the carriage.

Set the amounts so that same lever always is used for the unit figures.

Example : 75384 + 6278 + 9507 = ?

1. Zeroise all dials.
2. Set 75384 (5—1).
3. Make one positive turn of the crank and zeroise the levers.
4. Set 6278 (4—1).
5. Make one positive turn of the crank and zeroise the levers.
6. Set 9507 (4—1).
7. Make one positive turn of the crank.

Read the result 91169 in the result-register.

The order in which the amounts are added is without importance.

	Setting board
Proof-register	Result-register

Subtraction.

1. Set the minuend on the levers, transfer it to the result-register and zeroise the levers.
2. Set the amount, which should be subtracted, and make a negative turn of the crank (in the direction of the minus arrow).
   The result-register will show the result.

Serial additions to the same amount.

1. Enter the number which appears in all the additions into the result-register.
2. Set the amounts to be added, one after one. Make for each of them first one positive turn of the crank and read the result. Make then one negative turn so that the original amount reappears and the machine is ready for the next addition.

Example : 54368 + 2752 = 57120 54368 + 4484 = 58852
54368 + 34075 = 88443 54368 + 1737 = 56105
54368 + 18349 = 72717

Serial subtractions from the same amount.

The minuend is entered into the result-register. The amounts to be subtracted are set one after one on the levers. For each of them make first one negative turn, read the result, and make then one positive turn.

Example : 6235 — 855 = 5380 6235 — 391 = 5844
6235 — 627 = 5608 6235 — 248 = 5987
6235 — 425 = 5810

	Setting board
Proof-register	Result-register

Arithmetical complements.

The arithmetical complement of an amount is the difference between the unit of the next higher order and the amount in question.

For instance the arithmetical complement of 36 is

100 — 36 = 64 and

of 0·15 = 1 — 0·15 = 0·85

„ 0·001 = 1 — 0·001 = 0·999

„ 2578 = 10000 — 2578 = 7422

You obtain the arithmetical complement of an amount, if you, starting from the left, subtraet each figure from 9, except the last one to the right, which you subtract from 10.

The amount itself plus the arithmetical complement will make 1, provided the number is a fraction. Otherwise the sum will be 10,000 or 1000, etc. according to the size of the amount.

The arithmetical complement is used by per cent calculations on the machine. By multiplication and division by per cent figures it frequently occurs that the complement of the percentage is very useful.

This complement of the percentage is the amount which added to the percentage itself makes 1.

For instance the complement

of 25 %	is 0·75
„ 10 %	„ 0·90
„ 5 %	„ 0·95
„ 1·5 %	„ 0·985
„ 0·25 %	„ 0·9975

For certain calculations on the machine the arithmetical complement must be developed to correspond to the machine. This developed idea will be called the mechanical complement of the amount and is defined as follows:

The mechanical complement of an amount is the difference between the unit, which corresponds to the extreme capacity of the machine (for a 13-figure machine 10 000 000 000 000) and the amount itself.

The mechanical complement by a 13-figure capacity machine

of 36	is 9999999999964
„ 0·15	„ 99999999999·85
„ 0·001	„ 9999999999·999
„ 2578	„ 9999999997422

	Setting board
Proof-register	Result-register

You find the mechanical complement by subtracting all the figures of the amount in question from 9 except the one to the extreme right, which is subtracted from 10 ; afterwards a suitable number of nines are placed before the number obtained.

When setting the mechanical complement of 365 on the 10 levers set 9999999635.

By means of the mechanical complement an addition can be substituted for a subtraction as follows : Enter the minuend into the result-register in the usual way. Add the mechanical complement of the amount which should be subtracted.

To subtract a certain amount from several different amounts.

The mechanical complement of the amount, which should be subtracted, is entered into the result-register. Set the amounts, from which it should be subtracted ; for each of them make first one positive turn, read the result and then one negative turn.

The easiest way to enter the mechanical complement in the result-register is to set the amount itself and to make one negative turn of the crank.

Multiplication.

If you have to multiply an amount set on the levers by e.g. 152, you make two positive turns of the crank, when the carriage is in its initial (first) position, that is when the arrow points on 1. You move the carriage one step to the right and make 5 positive turns of the crank. Through this procedure the number is multiplied by 50 and the product is added to the first product, which is already in the machine. After having moved the carriage further one step to the right at last one turn of the crank is made. The number is then multiplied by 100 and the product is added to the previous products. The total appearing in the result-register is consequently the desired product.

Example : 89026 × 17012 = ?

1. Set on the levers 89026 (5—1).
2. Make 2 (1) positive turns of the crank in the first position of the carriage.
3. Move the carriage one step to the right.
4. Make 1 (2) turn, and then further 7 (4) and 1 (5) turns, i.e. the different numbers of revolutions are made in the second, fourth and fifth position of the carriage.

Now the proof-register shows in white figures 17012, which means that the amount set is multiplied by 17012. The result-register shows the result 1514510312.

Note.—The two amounts to be multiplied can be substituted for each other, and consequently the result will be the same, if you set 17012 on the levers and multiply by 89026. In the latter case, however, it would have been necessary to make 25 turns of the crank, whereas in the former way as described above only 11 turns are needed. You should always set on the levers the amount for which the total value of the figures is the highest.

Examples :

122	×	133	=	16226
401	×	352	=	141152
333	×	333	=	110889
1005	×	51	=	51255
486786	×	543	=	264324798
687684	×	345	=	237250980
55555	×	55555	=	3086358025
84945	×	3245	=	275646525
4050607	×	113·0002	=	457719401·1214
3903	×	15·00801	=	58576·26303

	Setting board
Proof-register	Result-register

Division (Subtractive).

Enter the dividend in the Result-register at the extreme left-hand side of it. Move the carriage to the extreme right position. Zeroise the Proof-register and the setting levers. Set the divisor on the levers on the top of the dividend starting from the left, but be sure that the part of the dividend, which is underneath the divisor, is a larger amount than the divisor. Otherwise set the divisor one step more to the right.

Now the divisor shall be subtracted as many times as possible from the dividend. The number of subtractions made is registered in the Proof-register.

After the subtraction is made as many times as the divisor is contained in the corresponding part of the dividend, the carriage is spaced one step to the left. Now the same operation is repeated and so on until the entire dividend is consumed.

If during this procedure too many subtractions are made, the bell will ring. This indicates that a positive turn has to be made in order to correct the subtraction, which was made too much. If more than one turn in excess has been made just as many turns in the reverse direction must be completed. The bell again sounds when the figures are correct.

The Proof-register shows the quotient.

Example : 85607 ÷ 439 = ?

1. Carriage in extreme right position.
2. Set 85607 (6—2) and transfer it by means of one positive turn into the Result-register. It will appear in dials 13—9.

	Setting board
Proof-register	Result-register

3. Zeroise Proof-register and levers. Be sure to clear out the " 1 " which appears in the Proof-register, because if not, the quotient result will be wrong.
4. Set 439 (6—4). Fix the decimal point in all registers.
5. Now the division begins. Make 2 (8) negative turns. The bell rings, which shows that one negative turn was made in excess. Make therefore one positive turn, the sound of the bell indicates now that the figures are correct.
6. Move the carriage one step to the left. Make 10 (7) negative turns ; as the bell rings make one positive.
7. Move the carriage one step at a time to the left and then make 5 (6), 4 (3), 5 (2) and 5 (1) negative turns. In each position one more turn would make the bell ring.

The remainder in the Result-register, 0.00255, is so small that it can be neglected. The quotient is 195.00455 and appears in the Proof-register.

Division (Positive).

The positive division is made by setting divisor on the levers and then adding it until the dividend appears in the Result-register.

This method is better described in the following example:

$$900 \div 375 = ?$$

1. Set 375 (3—1).
2. Carriage in extreme right position.
3. Make 2 (8) positive turns, the Result-register shows 750. After one turn more the dials would show 1125, which is more than the dividend, which is 900. Content yourself therefore with the two turns in this position and space the carriage one step to the left.
4. 4 (7) turns will bring the amount in the Result-register exactly up to the desired 900.
5. Fix the decimal points (page 10).
6. Read the result in the Proof-register, 2.4 in white figures.

When using a machine with ten's transmission in the Proof-register it is not necessary to let the respective figures in the Result-register remain lower than the value of the dividend in each position of the carriage, but it is to advantage to make a positive turn in excess, when by negative turns in the following position the result is arrived at with less turns than should be necessary by only positive turns, i.e., positive and negative turns should alternate in order to save turns.

This method cannot be recommended when the dividend contains a large number of figures, which are hard to remember.

Because the dividend is not set and entered into the Result-register, it is, however, very timesaving, when — as in the example above — the dividend contains only one or two figures except zeros.

It is also very useful in combined calculations.

	Setting board
Proof-register	Result-register

Division.

(With arithmetical complement in the Result-register).

This method, which is of importance only in a few combined calculations, differs from the negative method in the following way: The dividend is entered into the Result-register by means of a negative turn of the crank, so that the mechanical complement (Page 3) appears. After the divisor is set on the levers, the figures in the Result-register are evened out to zero by means of *positive* turns. The Proof-register shows the quotient in white figures.

Example: 85607 ÷ 439 = ?

1. Carriage in extreme right position.
2. Set the dividend 85607 (6—2).
3. Enter the dividend into the Result-register by means of a *negative* turn of the crank.
4. Zeroise levers and Proof-register.
5. Set the divisor 439 (6—4).
6. Make positive turns — observing the bell, which warns for turns in excess, and moving the carriage step by step to the left — until the figures in the Result-register are as close to zero as possible. Make consequently 1 (8), 9 (7), 5 (6), 4 (3), 5 (2) and 5 (1) positive turns.
7. Read the result 195.00455.

On machines with ten's transmission in the Proof-register positive and negative turns can be made alternately whenever thereby turns are saved.

	Setting board
Proof-register	Result-register

Division.
(With arithmetical complement on the levers).

This method is advantageous only if the dividend as a result of a previous operation already appears in the right part of the Result-register.

Example: 256800 : 37 = ?

We suppose that 256800 appears in dials 6—1 of the Result-register.

1. Carriage in position 4.
2. Set the arithmetical complement of the divisor, 999963 (6—1).
3. Make 6 (4) positive turns, i.e. until the dividend has been reduced so much, that its two first figures are less than the divisor.

   Note.—The addition of the mechanical complement is equivalent to the subtraction of the amount itself (Page 3).
4. Move the carriage and make further 9 (3), 4 (2) and 0 (1) positive turns.
5. The result 6940 appears as well in the left part of the Result-register as in the Proof-register.

This method can be applied with advantage only by certain combined calculations (Page 15).

To find the geometrical complement.

The geometrical complement of an amount is the number, which, multiplied with the amount itself, gives 1 as result. It is found by dividing 1 with the amount in question. This can be done by either of the methods for division.

Because the dividend is exactly 1, a simplification can, however, be made. One imagines that the dividend 1 is entered into the (non-existing) 14th dial of the Result-register. One consequently saves the trouble of entering the dividend into the Result-register and can use the bell also by positive division.

Example : Which is the geometrical complement of 235 ?

1. Set 235 (6—4).
2. Make, while observing the bell, 4 (8) 2 (7) 5 (6) 5 (5) 3 (4) 1 (3) 9 (2) and 1 (1) either positive or negative turns.
3. The result 0.0042553191 appears in the Proof-register.

Examples : Find the geometrical complements of the following amounts :

1) 7	4) 655	7) 240
2) 29	5) 747	8) 78
3) 235	6) 998	9) 132

Results :

1) 0.14285714	2) 0.034482758	3) 0.0042553191
4) 0.0015267176	5) 0.0013386881	6) 0.0010020040
7) 0.0041666667	8) 0.012820513	9) 0.0075757576

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Short Cuts in Multiplication.

By using subtraction alternating with addition in multiplication you can considerably reduce the number of turns necessary, so that in no place more than 5 turns are needed.

Example : 856 × 97 = 856 (100—3) = 856 × 100 — 856 × 3 = 83032.
When multiplying by 97 it would have been necessary to make 16 turns ; when multiplying by 100—3 four turns suffice.

The calculation is made as follows :

1. Set 856 (3—1).
2. Move the carriage to the third position.
3. Make 1 (3) positive turn. Move the carriage to the first position and make 3 (1) negative turns.
4. Read the result 83032.

On machines without ten's transmission in the Proof-register this will after the operation is completed show 103, but the 3 is red, which means that it shall be deducted from 100, and the multiplier shall be read as 100—3 = 97.

On machines with ten's transmission, however, the multiplier is shown in white figures as 97.

Examples :

1)	99	×	99	=	99	×	(100— 1)	=	?
2)	999	×	999	=	999	×	(1000— 1)	=	?
3)	88	×	88	=	88	×	(100— 12)	=	?
4)	777	×	777	=	777	×	(1000—223)	=	?

	Setting board
Proof-register	Result-register

5) 9876 × 9876 = 9876 × (10000—124) = ?
6) 32043 × 81 = 32043 × (101— 20) = ?
7) 254324 × 727 = 254324 × (1030—303) = ?
8) 473602 × 7889 = 473602 × (10000—2111) = ?
9) 473602 × 192 = 473602 × (202— 10) = ?

Results : 1) 9801 ; 2) 998001 ; 3) 7744 . 4) 603729 ; 5) 97535376 ; 6) 2595483 ; 7) 184893548 ; 8) 3736246178 ; 9) 90931584.

Note.—When making short cuts in multiplication on machines with large capacity, it is necessary always to start the multiplication from the left, i.e. with the highest figure of the multiplier.

Mixed examples :

Make the following calculations with as few turns as possible :

1) 256·65 × 125 = ?
2) 54.376 × 24 = ?
3) 8765.5 × 1765 = ?
4) 2.345 × 18 = ?
5) 56.78 × 27 = ?
6) 278 × 192 = ?

Results : 1) 132081.25 ; 2) 1305.024 ; 3) 33121107.5 ; 4) 42.210 ; 5) 1533.06 ; 6) 53376.

To fix decimal points.

If it is easy to find mentally the number of decimals in the result, a multiplication or division can be made as if all figures were numbers without consideration to the decimal places. This not being the case the mechanical way must be used for ascertaining the correct numbers of decimal places. For this purpose levers and dials in all registers are numbered from right to left. Movable decimal points can be used to fix the dial or lever, which indicates the unit figure.

When you want to find out how many decimal places there are in an amount entered into or appearing in a register, you have to count all dials to the right of the unit figure, irrespectively if they contain figures or only zeros.

Decimal places in the product.

The product of two amounts has as many decimal places as the two amounts together.

Example : 12·4 × 9·5 = 117·80.

On levers	12·4	(3—1)	1 decimal place.
In Proof-register	9·5	(2—1)	1 ,, ,,
In Result-register	117·80	(5—1)	2 ,, places.
or			
On levers	12·4	(8— 6)	6 decimal places.
In Proof-register	9·5	(5— 4)	4 ,, ,,
In Result-register	117·80	(13—10)	10 ,, ,,

It would of course be wrong to separate two decimal places in the product, without taking in consideration the way the figures appear in the machine.

Decimal places in the quotient.

The number of the decimal places in the quotient is the same as the difference between the number of decimals in the dividend and in the divisor. If the dividend has 10 decimal places, and the divisor 4 decimal places, the quotient has 6 decimal places.

Example : 12436 : 36000 = 0·345.

Before commencing the negative division the amounts are placed as follows :

Setting board	Setting board
0000036000·	
Proof-register ·00000000	12436·00000000 Result-register

Proof-register	Result-register

The quotient has 8—0 = 8 decimal places.

Fixing decimal places in certain cases.

If you have to find the total of a number of products, each of which has different numbers of decimal places, it is necessary to decide in advance where the units shall be placed in the different registers.

Suppose that you have to figure out the total of the following products :

15·326821 × 2·45
0·00316 × 244·145
23·2 × 5·42
16 × 3·255
0·011 × 151

On the setting board as well as in the Proof-register you will have to fix as many decimal places as correspond to the largest number of decimals, which will occur in the setting board and in the Proof-register respectively.

In this particular case you will have to fix on the setting board 6 decimals and in the Proof-register 3. The Result-register will consequently have 9 decimals.

Naturally the way the decimals are located may not be changed during the operation, and all numbers must be placed just as the once fixed decimal points indicate.

The result will consequently be : 217·807209650.

Simultaneous multiplication of several amounts.

Example : 83 and 17 have to be multiplied simultaneously by 1255 and the two products shall appear simultaneously in the Result-register.

1. Carriage in fourth position (there are 4 figures in the multiplier).
2. Set 83 (9—8) and 17 (2—1).
3. Multiply by 1255 and fix decimals separately for each of the multiplications.
4. Read the results 104165 and 21335 to the left and right respectively in the Result-register.

On account of the comparatively small number of places in the different registers only small amounts can be multiplied simultaneously in this way.

Examples :

516 / 412 } × 9·42 Result : 4860·72 ; 3881·04

78 / 98 } × 0·8271 „ 81·0558 ; 64·5138

Multiplication by one unvariable factor.

To this class of multiplications belong such multiplications, where one amount has to be multiplied by a series of different quantities. For these calculations it is advantageous to use machines with ten's transmission ; they can, however, be performed conveniently also on machines without ten's transmission in the Proof-register.

Example :

412 × 1·425 = 587·100
516 × 1·425 = 735·300 (5 turns)
527 × 1·425 = 750·975 (2 „)
639 × 1·425 = 910·575 (4 „)
928 × 1·425 = 1322·400 (5 „)
2837 × 1·425 = 4042·725 (5 „)

The calculation is made as follows :—

1. The unvariable factor 1·425 is set. Multiply by 412. Read the result.
2. Without zeroising any of the registers the figures of the multiplier 412 are changed to 516 by means of a few turns of the crank. This is done by 1 (3) positive turn and 4 (1) positive turns.
   Proceed in the same way with the other factors.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Double multiplication.

The mathematical expression for this calculation is

$$a \times b \times c = x$$

There are several methods for calculations of this type :

First method :

This method is suitable for beginners. It is made as follows :

$$a \times b \times c = ab \times c$$

You multiply first two of the factors. You read the product and set it on the levers, and after zeroising Result- and Proof-register you multiply by the third factor.

Examples : 435 × 625 × 275 = 74765625
5432 × 2468 × 326 = 4370413376
23571 × 13542 × 12346 = 3940824458772

Second method :

This method is used as follows :

$$a \times b \times c = \frac{ab + ab\,(10c - 1)}{10}$$

You multiply first two factors. You add to the result the product of itself and the third factor multiplied by 10 and reduced by one.

Example : 65 × 43 × 89 = 248755

	Setting board
Proof-register	Result-register

1. Multiply 65 by 43, so that the product appears in dials 4—1. The product is 2795. Leave it in machine, because it shall be added to the product, which subsequently will be made. It will also function to indicate the number of turns to be made in next operation.
2. Set on the levers (3—1) the third factor multiplied by 10 and reduced by 1, consequently 889.
3. Carriage in fourth position.
4. Make 2 (4) positive turns, because the first figure is 2. After the two turns this figure will have disappeared, because there is a 9 above it on the levers.
5. Make subsequently 7 (3), 9 (2) and 5 (1) positive turns. One after the other the 9 on the levers thus brings the figures on zero, which is the proof that the correct number of turns has been made.
6. The product 248755 appears with one decimal place in the Result-register, and the Proof-register shows the first product.
   Note.—In order to save turns short cuts should be made when possible. In this particular case by making 1 positive turn in excess in the fourth position and then 2 negative turns in the third position, 1 negative turn in the second position, and finally 5 positive turns in the first position the number of turns is reduced from 23 to 11 which can be reduced to 10 by omitting the second position and making 5 negative turns in the first position.

Examples :

1235	×	3·5	×	2·5	=	10806·25
648	×	5·75	×	3·25	=	12109·50
946	×	38	×	7	=	251636
482·6	×	46	×	9	=	199796·4
225·2	×	66	×	7·5	=	111474

ORIGINAL-ODHNER

Division with unvariable divisor.

First method.

Every division can be made in such a way that the dividend is multiplied by the geometrical complement (Page 8) of the devisor. Everybody uses this method daily in several small calculations. Nobody would divide 450 with 25 in any other way than multiplying with the geometrical complement.

This method can be used when a number of dividends have to be divided by one constant divisor. The calculation is made as a multiplication with one unvariable factor. (Page 11).

$$1492 : 36 = 1492 \times 0{\cdot}02777778 = 41{\cdot}44444$$
$$1512 : 36 = 1512 \times 0{\cdot}02777778 = 42{\cdot}00000$$
$$618 : 36 = 618 \times 0{\cdot}02777778 = 17{\cdot}16667$$
$$490 : 36 = 490 \times 0{\cdot}02777778 = 13{\cdot}61111$$
$$266 : 36 = 266 \times 0{\cdot}02777778 = 7{\cdot}38889$$
$$132 : 36 = 132 \times 0{\cdot}02777778 = 3{\cdot}66667$$

Find out the geometrical complement of 36

$$\frac{1}{36} = 0{\cdot}0277777 \text{ (Page 8).}$$

Set this amount on the levers and make the multiplications successively.

Second method: (To be used when the number of divisions is small).

Example: Divide 46·50 3·2069
61·25 by 14·50. *Result*: 4·2241
49·20 3·3931

1. Set 145 (9—7).
2. Divide by the positive method (Page 6) in 46·50. Make the following turns: 3 (5) 2 (4) 6 (2) and 9 (1) positive turns. Read the quotient 3·2069.
3. Continue without zeroising the positive divisions, but now in 61·25. Make thus further 1 (5) and 2 (3) positive and 3 (2) negative and 2 (1) positive turns. Read the result 4·2241 and so on.

It is advantageous for this operation to use a machine with ten's transmission. A standard machine can, however, also be used. If the 10th lever is placed at one, the left part of the Result-register works as a Proof-register with ten's transmission

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Multiplication and simultaneous addition or subtraction of the products.

If you have to add a number of products, and need not know the value of each product, this can be made in such a way that after each multiplication only the Proof-register is zeroised and the products are left in the Result-register.

Products, which have to be subtracted, are made by negative turns.

Be sure to place the decimal points correctly.

1.		2.		3.	
491 × 65		4·25 × 15 =	63·75	143 × 1·85 =	264·55
612 × 19		13·62 × 224 =	3050·88	262 × 2·32 =	607·84
96 × 81		1·12 × 31 =	34·72	72 × 8·30 =	597·60
		13·81 × 64 =	883·84	1261 × 0·12 =	151·32
Total	51319	Total	4033·19	Total	1621·31

Multiplication and simultaneous addition of the products and of the multipliers.

If in example 1 above you desire to know the combined quantity of the multiples, you set the last (10th) lever on 1 and let it remain during the whole calculation. The left part of the Result-register will then show the desired quantity of 165.

In a machine with ten's transmission also the Proof-register can be used for adding the multipliers.

Addition of quotients.

In a machine with ten's transmission in the Proof-register the quotient in subsequent divisions can be added. In such cases the Proof-register is not zeroised after each division.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Simultaneous multiplication and division.

$$\frac{349 \times 418}{23} = 6342{\cdot}69565217$$

First method :

Multiply 349 by 418 so that the product appears in the left part of the Result-register. Set thus 418 (5—3) and make 3 (8) 4 (7) and 9 (6) turns. Zeroise the Proof-register, but leave the product 145882. Set 23 (5—4) and divide negatively. Read the result 6342·6956 in the Proof-register.

Second method :

Divide negatively 349 by 23. Zeroise the Result-register, but not the Proof-register, where the quotient 15·173913 remains. Set 418 (3—1) and multiply by the quotient, i.e. turn the crank till the multiplier shows O. Read the result in the Result-register 6342·695634.

Third method :

Set 418 (8—6) and at the same time 23 (2—1). Divide 23 by means of the positive method (page 6) in 349, that is build up 349 in dials 7—5 of the Result-register. Make thus 1 (6) 5 (5) 2 (4) positive and 2 (3), 6 (2) and 1 (1) negative turns. Simultaneously the quotient will be multiplied by 418. Read the result 6342·69 in the Result-register.

This method can only be used for comparatively small amounts (see pages 38 and 39).

On the one hand the two factors have to be set as close to each other as possible in order to obtain sufficient accuracy, but on the other hand the calculation is made the more difficult the closer the figures are set, because the product, which is built up, lays itself over the dividend.

For small calculations after the rule of three it is, however, splendid.

as for instance : $\frac{22}{7} \times 13$; $\frac{84}{12} \times 16$ a. s. o.

Fourth method :

A more accurate result is obtained, if the third method is modified so that the positive division with arithmetical complement in the Result-register is substituted for the normal positive division. (Page 7).

Enter 349 negatively in the dials 9—7 of the Result-register. The Result-register records 9999651.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Set 23 (2—1) and at the same time 418 (6—4).

Divide 23 in 349 by evening out the right part of the Result-register as close to 0 as possible, and letting the division leave room for the multiplication. Make thus 2 (8) positive, 4 (7), 8 (6), 2 (5), 6 (4), 8 (2), and 7 (1) negative turns. The result is recorded in the Result-register 6342·695634.

You have to train yourself in finding the best way of alternating between positive and negative turns of the crank. In this particular case the short cuts are made in the following way: 2 (8) positive, 5 (7) negative, 2 (6) positive, 3 (5) negative, 4 (4) positive, 1 (3) negative, 1 (2) positive and 3 (1) positive turns.

You will observe that this method gives a very large number of correct figures in the product.

Fifth method:

This method is similar to the fourth one. For the division, however, is used the method with arithmetical complement on the levers (page 3).

Enter 349 in dials 8—6 of the Result-register.

Set 4179977 (7—1) that is 418 to the left and the complement of 23 to the right.

Make 1 (7), 5 (6), 1 (5), 7 (4), 3 (3), 9 (2), and 1 (1) positive turns. Read the result 6342·69.

If only one 9 is used (i.e. if you set 417977) the result will be more accurate, but the operation more difficult to execute.

The decimal point:

In order to find the right place for the decimal in the result in mixed calculations of this type, each individual division or multiplication has to be treated separately.

As for instance in the fourth method above:

For the division: the dividend 349 has 6 decimal places on the machine.
the divisor 23 ,, 0 ,, ,, ,,
the quotient thus ,, 6 ,, ,, ,,

This quotient is also one factor in the multiplication thus 6 decimal places on the machine.
The other factor 418 has 3 ,, ,, ,, ,,
The result thus has 9 ,, ,, ,, ,,

Double multiplication and division.

Example :

$$\frac{685 \times 5{\cdot}25 \times 24}{36500} = 2{\cdot}3646575342.$$

It is quite simple to solve this problem in a way similar to the second method in page 15.

Make then the multiplication so that the product appears in a suitable position for the subsequent division.

The calculation is, however, made more rapidly in a way similar to the fourth method on page 15.

Set 685 (3—1).

Multiply negatively (3—1) by 5·25.

Zeroise levers.

The Result-register now records 9999999640375.

Set the divisor 365 (3—1) to the right and the second multiplier 24 (6—5) to the left, thus only one lever being left on zero between the two amounts on the setting board. Thus to have the benefit of the largest possible capacity of the machine in order to obtain correct figures.

In the Result-register there appears on the left-hand part of it an unbroken row of 9's. Move the carriage until the last one to the right of these 9's comes right underneath the lever 4, which remains on zero between the two amounts set.

The relative positions of the three factors now in the machine should thus be as follows :—

Setting board
0000240365
9999999640375
Result-register.

As described on page 15 the division is made by evening out to zero the mechanical complement in the Result-register by means of adding the divisor. The 9 underneath the lever 4 serves the purpose of controlling this bringing on zero process. Therefore direct your attention on that 9 and start making positive turns. Already 1 turn brings the 9 on zero and gives a surplus above zero of 5375 in dials 4—1. This surplus must be reduced to as near zero as possible. To that effect move the carriage to its 2nd position, i.e. that the divisor 365 comes on top of the 537.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Now make one negative turn, bringing 537 down to 172, which is less than the divisor 365. Move the carriage further one step to the left to its 1st position and go on making negative turns. After 4 turns the remainder is 265, which is less than 365, but one turn more will bring it as close to zero as the capacity of the machine permits. After fixing the decimal point read the result : 2·364.

In order to avoid confusion with the figures in the left-hand part of the register, which result from the simultaneous multiplication by 24, follow with the thumb of your left hand the figures brought to zero one after one covering up the ones to the left of it.

When leaving just one lever on zero between the amounts set on the setting board and when making the negative multiplication in such position of the carriage that the unit figure of the percentage appears in dial 3 of the Proof-register, i.e. all figures to the left and inclusive of dial 3 are whole numbers of the percentage, while the figures to the right of said dial are decimals of the percentage, the decimal point will always come after dial 9 in the Result-register.

The example given above is obviously an interest calculation. Now if a bank has to buy two (or more) bills from a customer, and desires to obtain the interest for both (or all) bills in one sum, the calculation will be of this type :

$$\frac{24 \times 685 \times 5{\cdot}25}{36500} + \frac{32 \times 960 \times 5{\cdot}25}{36500} = 6{\cdot}783$$

Then you can first add the products 24 × 685 and 32 × 960, placing them in correct position and then make the division with 36500 and the simultaneous multiplication by 5·25.

A similar situation arises when you have to find out the interest on a loan, where the rate of interest has been changed during the time the loan has been outstanding. Then you have to add the products of rate of interest and number of days and then divide by 36500 and multiply by the capital.

Multiplication and division beyond the capacity of the machine.

Multiplication :

An example will give the necessary explanation

$$12934{\cdot}865 \times 11{\cdot}2456755 = 145461{\cdot}2944$$

Set 12934·865 (8—1).

The capacity of the machine is sufficient only for multiplication by 11·2456.

Make this multiplication and zeroise levers and Proof-register.

Set the number once more, but this time three steps to the right (there are three figures left in the multiplier), take away the last three figures and change the fourth one from 4 to 5. Set thus 12935 (5—1). Multiply by 755 and read the result 145461·2944.

Division :

After the division is performed as far as the capacity of the Proof-register allows, note the result and zeroise the quotient. Transfer the remainder in the Result-register and/or the divisor at such positions that the division can be continued.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Square roots.

The mechanical method for finding square roots is based on the following formula

$$1 + 3 + 5 + 7 + 9 + 11 \ldots . + (2n—3) + (2n—1) = n^2.$$

Example: $\sqrt{966289} = 983$

1. Enter 966289 in dials 13—8 of the Result-register.
   a) Zeroise the Proof-register.
   b) Zeroise the levers.
   c) Divide by the decimal points 966289 in groups of 2 figures each, starting from the right, (by decimal figures start from the left i. e. from the decimal point).
   d) Carriage in 8th position.
2. Set the 5th lever at 1, and subtract it by means of a negative turn from the left-hand group 96. Move the same lever to 3, and then to 5, 7, 9, 11 (5th and 6th lever), 13, 15, 17 and 19, and each time you make one negative turn. When you make the turn with 19 on the levers the bell will ring. Make therefore a positive turn. Reduce the number set on the levers by one unit, thus to 18.
3. Move the carriage one step, thus to 7th position. Set the fourth lever at 1, and subtract successively 181, 183, 185, 187, 189, 191, 193, 195, 197. At the last subtraction the bell will ring. Make therefore a positive turn. Reduce the number by one unit, thus to 196.
4. Move the carriage one step, thus to 6th position. Subtract successively 1961, 1963 and 1965. After the last subtraction the Result-register shows 0. The Proof-register shows the square root 983.

Examples: $\sqrt{994009} = 997$ $\qquad$ $\sqrt{17582} = 132{,}5791$

$\sqrt{8945943889} = 94583$

$$\frac{\sqrt{538972}}{\sqrt{763145}} = \sqrt{\frac{538972}{763145}} = \sqrt{0{,}7062511} = 0{,}84038747$$

$$4 \times \sqrt{(4{,}3^2 — 2{,}9^2)} \times \frac{0{,}72}{3} = 3{,}05$$

Separate the groups 1'75'82 entered in dials 13—9. Carriage in the 7th position, which allows the biggest capacity of the machine. Start the operation with lever Nr. 7.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Mopurgos' method to find the point of intersection between two lines.

The equations of the two lines are: $X = 4y + 3$
$X = y + 4$

Two machines are used at a time.

In the first machine :
Enter 3 into the 8th dial of the Result-register and set 4 (1). Zeroise Proof-register.

In the second machine :
Enter 4 into the 8th dial and set 1 (1). Zeroise Proof-register.

Now each machine corresponds to one of the equations because no matter how the crank may be turned and the carriage moved, the point where x is shown in the Result-register and where y is shown in the Proof-register will be located on the line in question.

If both machines can be brought to show the same figures in the Proof-register as well as in the Result-register, these figures will indicate the y and x of the point of intersection.

The Proof-registers show already the same number : 0. If both machines are turned in the same way until the Result-registers show the same figures, we will find the desired y and x.

After	1 (8)	positive	turn	the	Result-registers	show	5	and 7
,,	7 (7)	negative	turns	,,	,,	,,	4·3	,, 4·2
,,	4 (6)	positive	,,	,,	,,	,,	4·34	,, 4·36
,,	7 (5)	negative	,,	,,	,,	,,	4·333	,, 4·332
,,	3 (4)	positive	,,	,,	,,	,,	4·3333	,, 4·3332

The Proof-register shows 0·3333

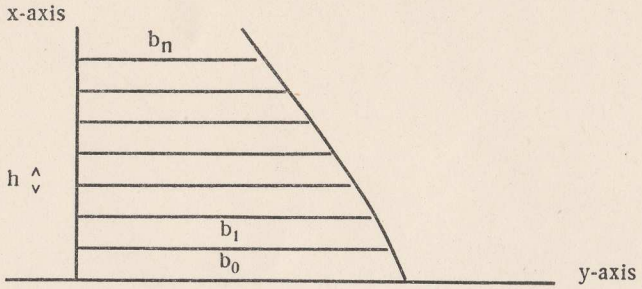
For the point of intersection : $X = 4{\cdot}3333$ and
$Y = 0{\cdot}3333$

For very small calculations as the above example the calculation can be made with only one machine.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

To find the moment of inertia of a surface.



The surface is divided into n strips of the same width and parallel to the y-axis. The width of the strip is h. The lengths of the strips are measured (b_0, b_1 etc.). The moment of inertia is

$$Iy = h^3\,(b_1) + 4b_2 + 9b_3 - - - + (n-1)_2 \times b_n - 1 + n^2\,\frac{bn}{2}$$

Example:

h = 5 (if possible choose a simple figure, because it simplifies the calculation).

n = 7,
b_1 = 2,15
b_2 = 2,12
b_3 = 2,09
b_4 = 2,04
b_5 = 2,00
b_6 = 1,94
b_7 = 1,87

	Setting board
Proof-register	Result-register

Further instructions regarding the models with ten's transmission in the proof-register.

The figure wheels in the proof-register of our standard models, e.g. model 7, have two rows of figures 0—9. The white one showing positive turns of the crank, the red one negative turns. Some of our models (24 and 29), however, are provided with ten's transmission in the proof register and the figure wheels have one row of white figures 0—9 only, showing positive as well as negative turns of the crank. If the crank of these models is turned more than nine times, while the carriage is fixed in one and the same position, the proof-register shows the correct figures, because when the crank is turned the tenth time the 9 is altered into 0 and the figure shown by the neighbouring figure wheel added by one. The same, if the proof-register is showing 10 and the crank is turned one time in negative direction, while the carriage is resting in the unit position, the proof-register will show 9.

On machines with ten's transmission a switching of the proof-register has to take place, if you wish to change from positive to negative calculation and vice versa. Previously this switching was made through a little lever, which was pushed to one side or the other. Now the proof-register is automatically switched ; after zeroising the proof-register is in neutral position and the first turn of the crank is determining, if it is going to operate positively or negatively. If you wish to calculate positively, the first turn of the crank must be a positive one. After zeroising the proof-register is operating negatively, if the first turn of the crank is a negative one.

P.T.O.

	Setting board
Proof-register	Result-register

The ten's transmission is in many cases of great value. The most important cases are the following :

By using *short cuts in multiplication* (page 9) the proof-register of machines with ten's transmission is showing the correct figures, which facilitates the control, and not as on the other machines white and red figures alternatingly. This fact, however, is of less importance to a trained calculator, as he is able to calculate both with and without short cuts in multiplication entirely automatically and without controlling the proof-register after each operation. As per the instructions above regarding the switching of the proof-register you have to see, that the first turn of the crank is a positive one.

When dividing the results are to be read in the proof-register. Then the ten's transmission permits calculation by means of alternately positive and negative turns of the crank and you do not need to fear to obtain a result consisting of white and red figures and difficult to read. When dividing subtractively the proof-register ought to operate negatively. Thus the first turn of the crank shall be a negative one.

If you have to *multiply* various amounts *with one unvariable factor* (page 11) the ten's transmission is offering a great advantage. If the unvariable factor is to be multiplied by 49 and then by 51, the second result is obtained by means of two further turns of the crank only, while the carriage is resting in the unit position, and the proof-register is at once showing the new multiplier.

On machines with ten's transmission *the quotients in subsequent divisions can be added.* If the proof-register is not zeroised after each division, the quotients are added automatically (page 14).

When adding the proof-register is checking the number of the factors of the addition. The same result is obtained on machines without ten's transmission, if you set the tenth lever on 1, which is left on the setting dial during the whole operation.

ORIGINAL-ODHNER

Special instructions for machines with back transfer device e.g. model 127, 29, 37, 39, 24 and 25.

The back transfer device functions in the following manner:
A number recorded in the result-register is to be transferred to the setting board.

1. Clear the setting board.
2. Put the carriage in position 1.
3. Press the button at the right hand side of the result-register.
4. Clear the result-register, thus carrying the number to the setting levers.

If the number in the result register contains more figures than you want transferred back to the setting levers, say an excessive number of decimals, place the carriage so as to have the redundant figures to the right of the setting board.

Example 1 :

353 pieces at 1·75 ..	=	Crs. 617·75
15% discount	=	,, 92·66
		Crs. 525·09
$2\frac{1}{2}$ % cash discount..	=	,, 13·13
Net due		Crs. 511·96

1. Set up 353 (3—1).
2. Multiply by 1·75 (3—1) = 617·75.
3. Carriage in position 1. Clear setting board and proof-register (but not result-register).
4. Press the back transfer key at the right hand side of the result-register and then clear this register.
5. Multiply by 15 (2—1) = 92·6625.
6. Clear the result-register but not the setting board and proof-register.
7. Multiply by 100 through one positive turn of the handle in position 3 (100 %) and then eliminate the 15 recorded in the proof-register by repeated negative turns of the handle (100 % less 15 %). Read off 525·0875.

8. Clear the setting board and proof-register, press the back transfer key and then clear the result-register.
9. Multiply by 2·5 (2—1). Read off 13·1271875.
10. Clear the result-register (but not the setting board and proof-register).
11. Multiply by 100 (one positive turn of the handle in position 4) and eliminate the 2·5 recorded in the proof-register by repeated turns of the handle. Read off 511·9603125.

Example 2 : $\dfrac{5465}{728 \times 32}$

1. Multiply as usual 728 × 32.
2. Transfer the product 23296 to the setting levers by the use of the back transfer key as described above.
3. Put the carriage in position 8.
4. Enter the dividend into the result-register by turning the handle (positive division). See page 6. Result : 0·23458963.

Distribution of Costs, Gas — and Electricity Works.

A. The running expenses for three systems of pipes or conducting lines are

A	= 3450 m.	Cr. 399·88
B	= 6480 ,,	,, 751·09
C	= 12165 ,,	,, 1410·03
	Total 22095 m'	Cr. 2561.—

in total Cr. 2561 :—. How much are the expenses for each system ?

Divide first 2651 by 22095. The result 0·1159085 is the expense for each meter. Set this amount on the levers and multiply successively by each of the above mentioned lengths. (Page 11).

Result : see above.

45 *seconds.*

B. If the systems during the same time have delivered :

A 2615 units
B 3625 ,,
C 4210 ,,

how much are the running expenses for each unit ?

Divide in the usual way the expenses by the quantity for each system separately, thus :

A 399·88 : 2615 = Cr. 0·1529
B 751·09 : 3625 = ,, 0·2072
C 1410·03 : 4210 = ,, 0·3349

65 *seconds.*

Setting board	
Proof-register	Result-register

Pro-rating.

A profit of Cr. 165229,—shall be pro-rated to 4 railway lines A-D on the base of the following lengths.

How much is the share due to each line :

Line	Kilometres	Share of profit
A :	129	32197·19
B :	156	38936·14
C :	168	41931·23
D :	209	52164·44
	662	Cr. 165229,—

Divide 165229 by 662. The result, Cr. 249·59063, indicates the profit on each km. Set this amount as a constant multiplier and multiply successively with the different numbers of kms. (Page 11).

30 *seconds.*

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Exchange.

Cr. 355 :— should be exchanged into Lire.
Cr. 89 :— = Rmk 100 :— = Lire 452·12.

Formula : $\frac{452{\cdot}12 \times 355}{89}$

Set 452·12 (5—1), place carriage in position 8 and multiply by 355 commencing with the figure 3. The Result-register records the product = 160502·6000000. Zeroise Proof-register and setting levers. Set 89 (7—6) on the levers for the usual negative division. The result appears in the Proof-register — 1803·40 Lire.

20 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Exchange.

How much are Rmk 100 :— in Cr. if the rate of exchange is 112·30 and $\frac{1}{4}$% costs deducted ?

Formula : $\dfrac{100\ (100-\frac{1}{4}\ \%)}{112{\cdot}30}$

Set 100 (6—4). Move the carriage to position 6. Reduce by $\frac{1}{4}$ % by means of 2 (6) and 5 (5) negative turns. Result : 99·75. Divide this amount by 1123 with the usual negative method. Fix the decimal point. *Result :* Cr. 88·82.

25 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Exchange.

How many Cr. are Rmk 560 if Cr. 100 = Rmk 112.
„ „ Sch. „ „ 560 „ Sch. 100 = „ 59.

Formulas : $\frac{560 \times 100}{112}$ and $\frac{560 \times 100}{59}$

Move carriage to the extreme right-hand position, set 560 (6—4) and transfer it to the Result-register. Divide by 112. Multiply the 5 in the Proof-register by 100 by means of placing the decimal point and read the result 500·00000. Make 5 positive turns so that the 5 in the Proof-register disappears and the Result-register over again records 560. Set 59 (5—4) and divide as before.

Result : Sch. 949·15 and Cr. 500 : —.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Wages.

A workman's wages are Cr. 1·19 an hour in 47 hours. In addition there are 4 hours with a 50 % increase and besides Cr. 11·37 for piece work. From the total amount should be deducted Cr. 12 :— paid in advance, 1·12 for taxes and 13·95 for rent.

47 hours at 1·19	55·93	
4 „ with 50 % increase	7·14	
Piece work	11·37	74·44
Deductions :		
Advanced	12,—	
Taxes	1·12	
Rent	13·95	27·07
	Net Cr.	47·37

Set 1·19 (3—1) and multiply first by 4 plus 50 % = 6 hours. Record the result 7·14, continue turning the crank till 47 appears in the Proof-register, read and record the result 55·93, add 7·14 by making 6 more positive turns on the crank (1) and add 11·37. Record the total 74·44.

Set 999999. Zeroise Proof-register, but not Result-register. Multiply by 12·00 (4—3). Result-register now records 00012·000062·44 i.e., you have subtracted 12 from 74·44 and the 12 are placed 6 steps to the left. Zeroise Proof-register, multiply by the next item 1·12 and so on. After the last deduction you have the net amount to the right and the total deductions to the left in the Result-register.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Checking of Invoices.

The invoice below should be checked:

12	only at	3·75	each	45 : —
8	,,	13·45	,,	107 : 60
1	,,	5·50	,,	5 : 50
7	,,	9·25	,,	64 : 75
			Total	222 : 85 Cr.
			12% discount	26 : 74
			Net Cr.	196 : 11

Multiply in the usual way 3·75 by 12. Set the result, 45, and move the carriage to its extreme right-hand position (8). Make a positive turn. Replace the carriage in position 1, make one negative turn and the product of the first multiplication, 45, disappears. Make the next multiplication, set the result 107·60, move the carriage to the right and add to the 45, which already are recorded in the left-hand part of the Result-register. Continue in the same way as before with all items. Then zeroise all registers. Set 12 to the left (9—8) and 100 — 12 = 88 to the right (1—2), multiply by 222.85 and place the decimal points. The discount is recorded in the left-hand part and the net amount in the right-hand part of the Result-register.

70 seconds.

If it is not necessary to check each item, all the multiplications can be made consecutively without zeroising the Result-register. After the last multiplication the Result-register records the total of 222·85. This amount is set, zeroise Result- and Proof-register, multiply by 12. The discount is now recorded = 26·74. Move the carriage to position 3, make one positive turn that the Proof-register records 1·12. Multiply *negatively* by 0·12 that the Proof-register shows 1·00 and the Result-register 1961080, which is the net amount.

40 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

Setting board	
Proof-register	Result-register

Piece-work.

A factory gives to three workmen, A., B. and C, a certain job at a price of 2400 :—as piece work. The hourly wages and time employed are specified below.

How much will each have as regular wages and as profit, that is his share of the surplus after wages are paid, which is pro-rated according to hourly wages and time employed.

Workmen	Hourly wages	Time empl.	Total wages	Profit
A:	4·75	148·50	705·40	439·34
B:	3·50	125·—	437·50	272·49
C:	3·—	112·—	336·—	209·27
Combined totals			1478·90	921·10
Agreed amount			2400·—	
Difference			921·10	: 1478·90
				= 0·62283

The figures on the dotted lines are known.

The total of regular wages for each workman results from usual multiplications. From the agreed price (2400 : —) deduct the combined total of the wages (1478 : 90). Divide the difference 921 : 10 in the usual way by the combined total of wages (1478 : 90) which equals to 0·62283. Set this latter amount on the levers (5—1) as a constant factor and multiply with the total wages for each workman one after another without zeroising between, by which procedure results the share due to each workman.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Combined discounts.

Cr. 1150:— less 25% less 5% less 1·5%

Multiply the arithmetical complements of the different percentages by each other, thus 0·75 × 0·95 × 0·995 = 70·89375% which is equal to the total discount.

Multiply 70·89375% by 1150 (see page 32) and the Result-register records the result Cr. 815·28.

30 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Combined multiplications.

Example : 65 × 43 × 89 = 248755.

Multiply first 65 × 43 = 2795, and let this product remain in the Result-register. The multiplication by the third factor can be made in two different manners :

(a) *First method :* (The " Maselli-method ").

Multiply first mentally the 3rd factor 89 by 10 and subtract 1 = 889, set this amount on the levers (3—1), move the carriage to position 4 so that the figure 2 of the multiplier comes underneath the 9 of the multiplicand. Thence commences the multiplication in the way, that by positive turns the amount recorded in the Result-register is brought to Zero, i.e. in each of the respective positions of the carriage the crank is rotated in the positive direction, until the respective dial of the Result-register shows zero. Of course here as by usual multiplication the number of turns can be decreased by making one turn in excess in a position before a figure larger than 5 and then correcting the figures by negative turns in the next position till the desired zero is reached (page 12).

By reading the result do not forget to separate one decimal place. The Proof-register needs no consideration.

(*b*) *Second method :*

This method differs from the first method in the following respects. From the third factor 1 is subtracted (without previous multiplication by 10) and set (2—1) and by positive turns the first product in the Result-register (2795) is transferred to the Proof-register (which should have been zeroised after the first multiplication). At the first sight this method may seem more convenient than the " Maselli-method," but it has the disadvantage that by transferring the figures from the first multiplication to the Proof-register, these must be carefully kept in mind.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Percentage.

The prices below are subject to a decrease of 15 %. Figure out the new prices.

Old prices :	New prices :
Cr. 2·76	Cr. 2·35
,, 4·60	,, 3·91
,, 5·75	,, 4·89
,, 6·75	,, 5·74
,, 7·24	,, 6·15

Formula : $\frac{2{\cdot}76 \times 85}{100}$

Set 85 as a constant factor on the setting board and multiply successively by the different items without zeroising the registers between.

20 seconds.

	Setting board
Proof-register	Result-register

Percentage.

The prices below are subject to an increase of 12 %. Figure out the new prices :

Old prices :	New prices :
Cr. 3·45	Cr. 3·86
,, 5·75	,, 6·44
,, 4·60	,, 5·15
,, 6·75	,, 7·56
,, 7·90	,, 8·85

Formula : $\frac{3{\cdot}45 \times 112}{100}$

Set on the setting board 1·12 as a constant factor and multiply by the different items without zeroising the registers between.

20 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover

Calculation of size and weight.

How much does a piece of paper weigh which has a size 135 × 23 cm. and a weight of 92 grams each square metre.

Formula : 1·35 × 0·23 × 92.

Multiply in the usual way 1·35 × 0·23 = 0·3105. Let this product remain in the Result-register and multiply by 92, using the method for combined multiplication (page 32) or our model 27 with back transfer (page 12, 3rd method).

Result : 28·566 grams.

15 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Calculation of size and weight.

How much does a piece of paper weigh which has a size of $13\frac{1}{2} \times 25\frac{1}{2}$ inches and a weight of 106 grams each square metre.

(1 inch = 25·4 millimetres.)

Formula : 13·5 × 25·5 × 2·54 × 2·54 × 0·0106 = 23·5422.

Multiply first in the usual way 13·5 × 25·5 = 344·25 and then continue to multiply by the remaining factors, using the method for combined multiplication (page 32) or our model 27 with back transfer (page 2, 3rd method).

25 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Calculation of size and weight.

How much does a ream of paper weigh when each sheet of paper has a size of 36·5 × 29 cm. and a weight of 29 grams each square metre.

1 Ream = 500 sheets of paper.

Formula : 36·5 × 29 × 0·0029 × 500 = 1534·825.

Combined multiplication (see page 32 or 12).

Result : 1534·825 grams = 1·534825 kilos.

20 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

The rule of three.

One dozen of a merchandise costs Cr. 175·20. How much costs 1 only and how much 293 only of the same merchandise ?

$$\textit{Formula :}\quad \frac{175{\cdot}20 \times 293}{12}$$

Set 12 to the left and 293 to the right-hand side of the setting board. Move the carriage to its 4th position. Divide 175·20 by 12 using the method for positive division (page 6, page 15 third method).

Result : In the Proof-register appears the price for each : Cr. 14·60 and in the left-hand part of the Result-register : Cr. 4277·80 = the price for 293 only.

10 seconds.

	Setting board
Proof-register	Result-register

The rule of three.

9 dozens 11 only at Cr. 123 : — each gross (= 12 dozens).

(a) By using our table of conversion for dozens and pieces to decimals of a gross :
9 dozens and 11 pieces = 0·82639.
Formula : 0·82639 × 123.
Usual multiplication. Result : 101·65.
11 seconds.

(b) Without table.

Formula : $$\frac{123 \times (9 \times 12) + 11}{144}$$

Move the carriage to the 4th position. Set 11 (6—5) and turn the crank once in the positive direction. Zeroize levers and Proof-register. Set 12 (6—5) and multiply by 9. Continue multiplying by 123 using the method for combined multiplication (page 32 or 12) and finally divide the last product by 144.

Result : Cr. 101·65.

35 seconds.

	Setting board
Proof-register	Result-register

Per Cent Calculation.

A merchandise is purchased at a price of Cr. 143 :—. The selling price should be so calculated as 27 % of it is the gross profit.

How much will be : (a) The selling price.
(b) The increase in percentage of the purchasing price.
(c) The profit.

Formula : $\frac{143 \times 100}{73}$

Set to the left 143 (9—7) and to the right the arithmetical complement to 27 = 73 (2—1). Move the carriage to position 5 and divide 73 in 100 using the positive method (pages 6 and 15).

The result-register now records in its left-hand part 195·89, which is the selling price.

Replace the carriage to position 5. Make one negative turn. The Result-register now records 52·89, which is the profit, and finally the Proof-register records 36·99, which is the increase in percentage on the purchasing price.

30 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Pro-rating.

Figure out the proportions expressed in per cent of the following amounts to a total turnover of Cr. 93638 :

Wages	Cr.	2428·32	*Result :*	2·59 %
Rent	,,	936·—		1·00 ,,
Travelling expenses	,,	4122·—		4.40 ,,
Advertising.....	,,	538·50		0·58 ,,
Office expenses	,,	2346·50		2·51 ,,
Various	,,	2738,—		2·92 ,,
	Total Cr.	13109·32		14·00 %

Formula : $\frac{2428{\cdot}32,\ \text{etc.} \times 100}{93638}$

First Method :

Set to the extreme right of the setting board 93638. Move the carriage to the extreme right (8th) position and divide the 93638 in 2428·32 ; 936, — etc. successively by the positive method for division (page 6). The Proof-register and the Result-register must be zeroised after each individual operation, when using machines without tens transmission in the Proof-register.

75 seconds.

Second method.

Figure out the geometrical complement of 93638 (page 13) (= 1 : 93638). Set this on the setting board as a constant factor and multiply successively by the various amounts without zeroising either the Proof- or the Result-register between the individual operations.

70 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Conversion of Pounds sterling, shillings and pence to Pounds and decimals of a Pound. (Without using a table).

£16 17s. 8d. = ?

Set 16 (2—1). Move the carriage to position 6 and multiply by 1. Zeroise the setting board and set 17 (2—1). Move carriage to position 4. Multiply by 5 (the conversion number for 1 shilling). Zeroise setting board. Set 8 (1) and multiply by 417 (the conversion number for 1 penny) in positions 3, 2, and 1. The Proof-register records 1·05417.

Result : 16·88336.

20 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Conversion of decimals of a Pound sterling to shillings and pence.

£6·94587 = £ s. d. ?

Place 6·94587 to the extreme left of the Result-register (dials 13—8). Carriage in position 8. Set on the setting board the decimal equivalent of 1 shilling = 0·05 so that it corresponds with the proper place in the Result-register, i.e. lever 5. Find out by means of negative turns of the crank, how many times the 5 is contained in the decimal numbers corresponding to shillings underneath (in this case 94). The result will be recorded in the Proof-register = 18s. Now set the decimal equivalent for 1 penny = 0·00417 so that it corresponds with the proper decimal places in the Result-register (levers 6—4 and carriage in position 6). After completed negative turns, the Proof-register displays the further result of 11d.

Result : £6 18s. 11d.

20 seconds.

For the figures within the brackets, see the explanations in the general directions on the cover.

	Setting board
Proof-register	Result-register

Conversion of British weight to kilograms.

How much does 1 Kilo in Cr. cost if 1 cwt. costs 22s. 9d. and the rate of exchange is £1 = Cr. 18·14 ?

1 cwt. = 50·8032 kilos.

Formula : $\dfrac{18{\cdot}14 \times 273}{50{\cdot}8 \times 240}$

Multiply in the usual way 50·8 by 240 = 12192·0. Zeroise Proof-register. Move carriage to position 4. Set to the extreme left on the setting board 18·14 and multiply by 273. Move carriage to position 8 and divide by the first product, which remains in the right-hand part of the Result-register.

Result Cr. 0·406.

20 seconds.

	Setting board
Proof-register	Result-register

Multiplication by British currency.

(Percentage calculation).

6 % of £16 17s. 8d. = ?

Move carriage to position 8. Set to the extreme right on the setting board 240 and multiply by 16. Multiply then in the same position without zeroising the Result-register 17 × 12 and add to the combined product 8. Result: 4052. Multiply this amount by 0·06 using the Maselli-method (page 32). Result: 243·12 pence which should be converted to £ s. d. as per pages 46 or 47.

Result £ 1 — 3.

40 seconds.

	Setting board
Proof-register	Result-register

Conversion of pence to Pounds sterling, shillings and pence.

(Without table)

A. By using the mechanical complement.

71376·200 d. = £ s. d. ?

Place the amount of pence in the extreme right-hand part of the Result-register (dials 8—1). Move the carriage to position 7 in order to bring the " 71 " right underneath levers 2—1. Set to the extreme right on the setting board 976 (the mechanical complement for 240 to 10000 omitting the zero). It is of no importance, how many 9's are set ahead of the complemental figures. The more 9's, the more to the left the result will appear in the Result-register. Now crank in the positive direction till the figures in the Result-register right underneath " 76 " are less than 24. In this case two turns. The Result-register now displays 0002023376·200. Move the carriage one step to the left and turn crank as before, until the figures underneath " 76 " are less than 24, i.e. 9 turns. Move carriage further one step to the left and turn crank as before. After 6 turns there remains 336·2 and after one turn more only 96·2. *It is of great importance to note carefully when the remainder of pence is less than* 240 *because at this point the division by* 240 *must be discontinued.* The Proof-register now records the amount of whole Pounds sterling = 297. Now go on dividing by 12 in order to convert the remainder of pence to shillings. To that effect set 88 (the arithmetical complement to 12) right on top of 96 and turn the crank in positive direction till the remainder is less than 12. In this case 8 turns. The Result-register now records 0002970800·200.

Result : £297 8s. 0·2d.

20 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Conversion of pence to Pounds sterling, shillings and pence.

(Without table).

B. By negative division.

71376·200 d. = £ s. d. ?

Place 71376·2 in the extreme left-hand part of the Result-register (Dials 13—8). Divide in the usual negative way by 240 until the remainder of pence is less than 240 (£1 = 240d.). In the Result-register then remains 96·2 which should be further divided by 12 (1s. = 12d.) until the remainder of pence is less than 12.

Result (recorded in the Proof-register): £297 8s. 0·2d.

20 seconds.

	Setting board
Proof-register	Result-register

Checking of Invoices.

(**British currency**) (without table).

	£	sh.	5.
	2	16	7
	—	11	9
	3	19	11
	—	6	4
— 2·5 %	—	3	$10\frac{1}{2}$
	7	14	7
	7	10	$8\frac{1}{2}$

By the adding all amounts expressed in £ and s. are converted to pence, i.e. multiplied by 240 and 12 respectively. Result 1855. In order to check the net amount the 1855 are multiplied by 0.975 (= 1—0·025) using the method for combined multiplication (page 32). The Result 1808·625 are converted to £ s. d. as per pages 46 and 47.

50 seconds.

	Setting board
Proof-register	Result-register

Invoices.

(**British currency**) (with table).

23491 kilos at 18s. 6d. each ton.

1 ton = 1016 kilos.

18s. 6d. = £0·925 (according to table).

Formula : $\frac{23491 \times 0{\cdot}925}{1016}$

Place the carriage in position 5 and multiply 23491 by 0·925 (5, 6, 7) = 21729·175, which amount subsequently is divided by 1016. The Proof-register records the result : 21·38698. The table gives as

Result : £21 7s. 9d.

40 seconds.

	Setting board
Proof-register	Result-register

For the figures within the brackets, see the explanations in the general directions on the cover.

Invoices.

(**British currency**) (with table).

$275\frac{1}{4}$ yards of cloth at a price of £0 5s. 3d. each yard ?

Less 2 % discount = ?

Formula : 275·25 × 0·2625 (× 0·98) :

Multiply in the usual way 275·25 × 0·2625. Zeroise Proof-register, but not Result-register and continue the multiplication by 98 as per page 32.

Result (in the Proof-register) : Before deduction of the discount £72·253125 = £72 5s. 1d.
Less the discount £70·808063 = £70 16s. 2d.

	Setting board
Proof-register	Result-register

Calculation of the cubic contents.

(Wood wares).

Figure out the cubic contents of

64 door jambs at 2650 m/m length
275 m/m width
45 m/m depth

Formula : 64 × 2650 × 275 × 45.

Multiply as per page 32 or using our model 27 with back transfer. After fixing the decimal point read the

Result : 2·0988 m^3.

25 seconds.

	Setting board
Proof-register	Result-register

Calculations for wood goods.

Thickness : 26 m/m	Length : 4 m.	Width cm.										
		8	10	11	12	13	14	15	16	17	18	
		12	15	20	18	14	17	8	5	6	4	119
								Number.				

Set 8 to extreme right and set 1 to the extreme left on the setting board and multiply by 12. Zeroise Proof-register, set 10 and multiply by 15 and so on (width by number) without zeroising the Result-register. Those multiplications completed the Result-register displays to the left 119 which is the combined number of pieces and to the right 1476. Zeroise the 1 to the left on the setting board and continue the multiplication of 1476 by 26 and then the product by 4 as per page 32 or using our Model 27 with back transfer. After fixing the decimal point read the

Result : 1·53504 m^3.

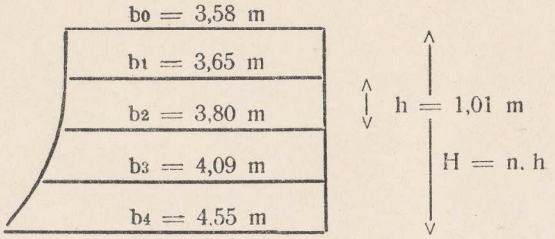
65 seconds.

	Setting board
Proof-register	Result-register

Calculation of surfaces

according to Simpson's formula.

Figure out the surface as per the adjoining illustration:
n = the number of elements.
The general form of the Simpson formula is:



$$y = \frac{h}{3}\left[b_0 + 4\,(b_1 + b_3 + \ldots\ldots + b_{n-1}) + 2\,(b_2 + b_4 + \ldots\ldots + b_{n-2}) + b_n\right]$$

The meaning of the signs used is displayed by the above illustration.
In this particular case the surface is divided in 4 sections so called elements of surface, by means of parallel lines. The lengths of those lines are measured. The width of each element must also be known. $\left(h = \frac{H}{n}\right)$

Formula: $y = \frac{h}{3}\,(b_0 + 4b_1 + 4b_3 + 2b_2 + b_4)$ or in this case:

$$y = \frac{1{,}01}{3}\,(3{,}58 + 4 \times 3{,}65 + 4 \times 4{,}09 + 2 \times 3{,}80 + 4{,}55) = \frac{1{,}01 \times 46{,}69}{3}$$

Move the carriage to position 6 in order that the ultimate product will appear in a suitable position for the subsequent division. Enter 3,58 in the Result-register. Multiply then 4 × 3,65 etc. all the time with the carriage in the same position that the different products are properly accumulated in the Result-register. After adding the last 4,55 the result is 46,69, which then multiply as per Page 32 (or using our Model 27) by 1,01. The final product is then in the usual way divided by 3.

Result (in the Proof-register): 15,72 m².

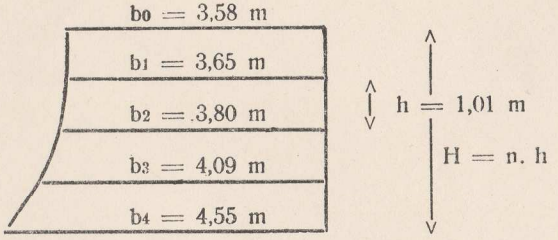
50 seconds.

	Setting board
Proof-register	Result-register

Calculation of Surfaces

according to Borda's formula

This formula is more approximating than the Simpson formula described in page 53.
Figure out the surface as per the adjoining illustration.
n = the number of elements.
The general form of the Borda formula is



$$h\left[\frac{b_0 + b_n}{2} + b_1 + \ldots\ldots\ldots + b_{n-1}\right]$$

(See in further respects Page 53).

In this particular case

$$h\left[\frac{b_0 + b_4}{2} + b_1 + b_2 + b_3\right] \text{ or}$$

$$y = 1{,}01\ [0{,}5\ (3{,}58 + 4{,}55) + 3{,}65 + 3{,}80 + 4{,}09]$$

Add first 3·58 + 4·55. Multiply the total, 8·13 by 0·5 as per (Page 32 or Page 12, 3rd method). After fixing decimal point, the product will be 4·065. Add to this amount the items 3·65, 3·80 and 4·09. The total 15·6050 should then be multiplied by 1·01 as per Page 32 or using our model 27.

Result : 15·76 m_2.

35 seconds.

	Setting board
Proof-register	Result-register

Calculations for wood goods.

Length in feet :	Quantity :
6	57
7	62
8	104
9	26
10	48
11	73
12	112
13	14
14	22
15	93
16	86
17	79
18	65
19	34
20	45
21	83
22	67
23	25
24	18
16013 feet.	1113

Set 6 to the extreme right and 1 to the extreme left. Multiply by 57. Zeroise Proof-register, but not Result-register. Set 7 instead of 6 and let the 1 remain. Multiply by 62. Go on in the same way with the remaining items. After the multiplications are completed, the Result-register records to the right the combined length and to the left the combined quantity.

Result : 16013 feet.
1113 pieces.

	Setting board
Proof-register	Result-register

Calculation of Surfaces.
Painters.

How large is the combined surface of walls and ceiling of a room, which has a length of 4·4 metres, width 3·85 metres and height 3·35 metres.

Formula : 2h (1 + w) + lw.

Set 6·70 (= twice the height) and multiply by the total of length and width, i.e., first by 4·40 and then without zeroising Result-register by 3·85. The Result-register now records 55·275, which thus is the combined surface of the four walls. Zeroise setting board and Proof-register and add the surface of the ceiling by setting 3·85 and multiplying it by 4·40.

Result : 72·215 m^2.

16 seconds.

	Setting board
Proof-register	Result-register

Calculation of Surfaces.
Painters.

4 walls of a room, which has a length of 5·23 mtrs.,width 4·19 mtrs. and height 3·15 mtrs., should be painted. From the combined surface of the walls should be deducted 2 windows of each 1·12 × 1·85 mtrs. and 2 doors of 1·20 × 2.12 mtrs. and 2·05 × 0·90 mtrs. respectively. The wages amount to Cr. 3·65 each square metre. How many square metres should be painted and how much are the wages ?

Formula : [2 × (5·23 + 4·19) × 3·15 — 2 × 1·12 × 1·85 — 1·20 × 2·12 — 0·90 × 2·05] × 3·65.

Set 5·23 and multiply by 2. Change the figures set to 4·19 and multiply again by 2. Multiply the product 18·84 by 3·15 (page 32 or with the model 27). Zeroise Setting board and Proof-register, but not Result-register which displays 59·3460. Set successively 2·24 ; 2·12 ; and 2·05 and multiply *negatively* (in the reverse direction) by 1·85 ; 1·20 and 0·90 respectively. Multiply finally the result 50·813 by 3·65 as per page 32 or using the model 27.

Result : 50·813 m^2 in the Proof-register at Cr. 3·65 each = Cr. 185·47.

60 seconds.

	Setting board
Proof-register	Result-register

Calculation of Surfaces.
(Contractors).

How many bricks are required for a wall of 7·25 mtrs. length, 2·50 mtrs. height and 0·50 mtrs. width.

Each brick has a size of 30 × 15 × 7·5 cm.

For the adherence material should be deducted 12 %.

Formula : $\left[\frac{7{\cdot}25 \times 2{\cdot}50 \times 0{\cdot}50}{0{\cdot}30 \times 0{\cdot}15 \times 0{\cdot}075}\right]$ 0·88

1. Figure out the cubic contents of the wall as per page 32, placing the figures in such manner that the product appears in the left-hand part of the Result-register. The result, 9·0625 m^3, remains. Proof-register and Setting board are zeroised.
2. Figure out in the same way the cubic contents of a brick, but in such manner that the result appears in the right-hand part of the Result-register. The result, 0·003375 m^3 is zeroised by setting the same amount on the levers right on the top of it and making one negative turn.
3. Divide 9·0625 by 0·003375 already entered and set, which gives the result : 2685·18.
4. Set 88 (the arithmetical complement of 12 % and multiply until the red figures in the Proof-register are brought to zero.
   Result : 2363 bricks.
   80 seconds.

	Setting board
Proof-register	Result-register

Foreign bills of exchange.

In are quoted bills on	Stockholm	London	£1 costs Cr.
London	18·04	—	18·04
Hamburg	88·10	20·64	18·18
Paris	72·10	25·40	18·31
Amsterdam	150·85	12·20	18·40

How should Stockholm pay a debt in London taking advantage of the most favourable rate of exchange ?

Multiply 88·10 by 20·64 and divide by 100 = 18·18. Zeroise all registers and multiply 72·10 by 25·40 and so on.

Result : See above. Stockholm should remit directly Pounds sterling.

30 seconds.

	Setting board
Proof-register	Result-register

Pro-rating. (Piece work).

Four workmen are charged to built a summer house at an agreed price of Cr. 575 :—. How much should each workman have, if the total is pro-rated to time employed and the hourly wages, which are as follows ?

A.	39	hours	at Cr.	2·25	= 87·75	Cr. 191·52
B.	18	,,	,, ,,	2·65	= 47·70	,, 104·11
C.	28	,,	,, ,,	2·40	= 67·20	,, 146·67
D.	32	,,	,, ,,	1·90	= 60·80	,, 132·70
					Cr. 263·45	Cr. 575·—

First figure out the regular wages for each workman by multiplying the number of hours by the wages. The agreed price, Cr. 575 :—, is then divided by the total of wages Cr. 263 : 45.

Result : 2·1825773, which amount is set as a constant factor and then multiplied successively by the amounts representing the total of regular wages for each workman, without zeroising the Result-register between each operation.

Result : See above.

80 seconds.

	Setting board
Proof-register	Result-register

Negotiating bills.

The bills here below should be discounted at $4\frac{3}{4}\%$:

		Capital × days.	Discount :
Cr. 2569 :—	75 days	192675	Cr. 25·42
„ 1685 :—	69 „	116265	„ 15·34
„ 12590 :—	112 „	1410080	„ 186·05
		1719020	Cr. 226·81

How much is the discount ?

Formula : $\dfrac{\text{capital} \times \text{days} \times \text{rate}}{100 \times 360}$

The table below shows the rate divided by 36000.

Multiply for each bill the capital by the number of days and pencil the results. Then set the amount, which the table shows as corresponding to $4\frac{3}{4}\% = 0{\cdot}000131944$ and multiply successively, without zeroising between the operations, by the amounts written down before.

90 seconds.

TABLE.

%		%	
1	0·000027777	$5\frac{3}{4}$	0·000159722
$1\frac{1}{4}$	0·000034722	6	0·000166666
$1\frac{1}{2}$	0·000041666	$6\frac{1}{4}$	0·000173611
$1\frac{3}{4}$	0·000048611	$6\frac{1}{2}$	0·000180555
2	0·000055555	$6\frac{3}{4}$	0·000187500
$2\frac{1}{4}$	0·000062500	7	0·000194444
$2\frac{1}{2}$	0·000069444	$7\frac{1}{4}$	0·000201388
$2\frac{3}{4}$	0·000076388	$7\frac{1}{2}$	0·000208333
3	0·000083333	$7\frac{3}{4}$	0·000215277
$3\frac{1}{4}$	0·000090277	8	0·000222222
$3\frac{1}{2}$	0·000097222	$8\frac{1}{4}$	0·000229166
$3\frac{3}{4}$	0·000104166	$8\frac{1}{2}$	0·000236111
4	0·000111111	$8\frac{3}{4}$	0·000243055
$4\frac{1}{4}$	0·000118055	9	0·000250000
$4\frac{1}{2}$	0·000125000	$9\frac{1}{4}$	0·000256944
$4\frac{3}{4}$	0·000131944	$9\frac{1}{2}$	0·000263888
5	0·000138888	$9\frac{3}{4}$	0,000270833
$5\frac{1}{4}$	0·000145833	10	0,000277777
$5\frac{1}{2}$	0·000152777		

	Setting board
Proof-register	Result-register

Interest on a saving account.

An account in a saving bank shows as follows :

		Days till end of year :	Deposits :	Withdrawals :	Balances :	Interest : Deb.	Interest : Cred.
Jan.	1	365			144		5·04
Feb.	10	325	115		259		3·58
April	4	271	75		334		1·95
Aug.	8	146		49	285	0·69	
Oct.	2	91	149		434		1·30
Dec.	26	6		70	364	0·04	
Dec.	31				364		

Result : Cr. 11·14.

How much is the interest for the year at a rate of $3\frac{1}{2}\%$?

The interest is figured in such manner that for the balance at the beginning of the year and for each deposit and for each withdrawal the interest is figured out to the end of the year. For the balance at the beginning of the year and for the deposits the interest is credited and for the withdrawals it is charged.

Formula : $\dfrac{\text{capital} \times \text{rate} \times \text{days}}{365 \times 100}$ or in this case $C \times \left[\dfrac{\text{rate} \times \text{days}}{36500}\right]$

The factor within the brackets is figured out each morning : For instance on the 8th August :

$\dfrac{3{\cdot}5 \times 146}{36500} = 0{\cdot}014$. This amount is set on the Setting board and remains there untouched all day long, by means of which the interest by a simple multiplication by the capital can be figured out at the moment of each deposit and withdrawal.

At the end of the year the interests charged and credited are balanced. The balance is the interest for the year. If the rate of interest is changed during the year, the balance at that moment is to be considered as withdrawn and the interest to the end of the year as per the previous rate charged. The same balance is then to be considered as a deposit and interest to the end of the year as per the new rate credited.

	Setting board
Proof-register	Result-register

Compound interest.

To what amount does a capital of Cr. 1236 accumulate :— with compound interest during 3 years at a rate of 5·5 % ?

Capital = C ; The ultimate value of the capital = B ; The rate of interest = p ; The number of years = n.

After one year : $B = C + \frac{p \times C}{100} = C \left[1 + \frac{p}{100} \right]$

This gives the following

Formula : $B = C \left[1 + \frac{p}{100} \right]^n$ and in this particular case :

$$B = 1236 \left[1 + \frac{5{\cdot}5}{100} \right]^3 = 1236 \times 1{\cdot}055^3 = 1236 \times 1{\cdot}055 \times 1{\cdot}055 \times 1{\cdot}055.$$

Result : Cr. 1451 : 36.

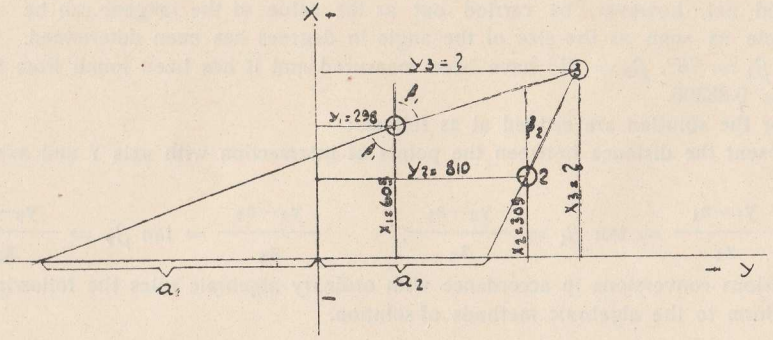
30 seconds.

	Setting board
Proof-register	Result-register

Intersection Calculations.

EXAMPLE I.

(Forward Intersection.)



In the above figure the position of the points 1 and 2 in relationship to the known co-ordinate system, represented by the two axes x and y, is known.

The position of the points is fixed because we know the perpendicular distances (x_1 and y_1; x_2 and y_2) from the respective axes.

Thus we know:

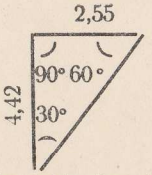
for point 1: $x_1 = + 605$
$y_1 = + 298$
for point 2: $x_2 = + 305$
$y_2 = + 810$

It is now required to find the position of point 3, i. e., we seek x_3 and y_3.

We measure therefore at point 1 the size of the angle which the line in the direction of point 3 makes with the axis x (or, more correctly, with a line parallel to the axis x). This angle is named β_1 The corresponding angle at point 2, β_2, is measured.

N. B. In order to arrive at the desired values of x_3 and y_3, we must avail ourselves of a so-called function of

the angles measured, which is called the Tangent (tan). The tangent is equal to the ratio between the two short sides of a rightangled triangle which contains the angle in question. In the triangle on the right the angles are 90°, 60° and 30°. The short sides are 2.55 and 4.42 metres respectively. Tan 30° is thus equal to 2.55 : 4.42 = 0.577. This calculation need not, however, be carried out as the value of the tangent can be obtained from a table as soon as the size of the angle in degrees has been determined.



Assuming that $\beta_1 = 78°$, $\beta_2 = 21°$ have been measured and it has been found from the table that tan $\beta_1 = 4.7046$ and tan $\beta_2 = 0.38396$.

The formulae for the solution are arrived at as follows:

(a_1 and a_2 represent the distance between the points of intersection with axis Y and axis X. In the example a_1 is negative).

$$\frac{y_1 - a_1}{x_1} = \tan \beta_1 = \frac{y_3 - a_1}{x_3}; \qquad \frac{y_2 - a_2}{x_2} = \tan \beta_2 = \frac{y_3 - a_2}{x_3}$$

By means of various conversions in accordance with ordinary algebraic rules the following groups of formulae are obtained, which conform to the algebraic methods of solution.

METHOD 1.

$$a_1 = y_1 - x_1 \tan \beta_1$$
$$a_2 = y_2 - x_2 \tan \beta_2$$
$$x_3 = \frac{a_2 - a_1}{\tan \beta_1 - \tan \beta_2}$$
$$y_3 = a_1 + x_3 \tan \beta_1 = a_2 + x_3 \tan \beta_2$$

The calculation is effected in accordance with the following procedure: —,

Known values:

$x_1 = 605.0$ $\quad x_2 = 305.0$ $\quad \tan \beta_1 = 4.7046$

$y_1 = 298.0$ $\quad y_2 = 810.0$ $\quad \tan \beta_2 = 0.3839$

Solution: — Work with the tangent in the setting mechanism (4 decimals) and with the values of x and y in the revolution mechanism (proof register) (2 decimals).

Multiplication: $x_1 \tan \beta_1 = 2846.28$; $\quad x_2 \tan \beta_2 = 117.09$.

Addition or subtraction: $a_1 = y_1 - x_1 \tan \beta_1 = -2548.28$; $\quad a_2 = y_2 - x_2 \tan \beta_2 = 692.91$; $\quad \tan \beta_1 - \tan \beta_2 = 4.3207$

Shillings (s) and pence (d) in Decimals of Pound Sterling (£)

Pence =		1	2	3	4	5	6	7	8	9	10	11
		0·00417	**0·00833**	**0.01250**	**0·01667**	**0·02083**	**0·02500**	**0·02917**	**0·03333**	**0·03750**	**0·04167**	**0·04583**
Sh. 1	**0·05**	0·05417	0·05833	0·06250	0·06667	0·07083	0·07500	0·07917	0·08333	0·08750	0·09167	0·09583
2	**0·10**	0·10417	0·10833	0·11250	0·11667	0·12083	0·12500	0·12917	0·13333	0·13750	0·14167	0·14583
3	**0·15**	0·15417	0·15833	0·16250	0·16667	0·17083	0·17500	0·17917	0·18333	0·18750	0·19167	0·19583
4	**0.20**	0·20417	0·20833	0·21250	0·21667	0·22083	0·22500	0·22917	0·23333	0·23750	0·24167	0·24583
5	**0·25**	0·25417	0·25833	0·26250	0·26667	0·27083	0·27500	0·27917	0·28333	0·28750	0·29167	0·29583
6	**0.30**	0·30417	0·30833	0·31250	0·31667	0·32083	0·32500	0·32917	0·33333	0·33750	0·34167	0·34583
7	**0.35**	0·35417	0·35833	0·36250	0·36667	0·37083	0·37500	0·37917	0·38333	0·38750	0·39167	0·39583
8	**0.40**	0·40417	0·40833	0·41250	0·41667	0·42083	0·42500	0·42917	0·43333	0·43750	0·44167	0·44583
9	**0·45**	0·45417	0·45833	0·46250	0·46667	0·47083	0·47500	0·47917	0·48333	0·48750	0·49167	0·49583
10	**0.50**	0·50417	0·50833	0·51250	0·51667	0·52083	0·52500	0·52917	0·53333	0·53750	0·54167	0·54583
11	**0.55**	0·55417	0·55833	0·56250	0·56667	0·57083	0·57500	0·57917	0·58333	0·58750	0·59167	0·59583
12	**0·60**	0·60417	0·60833	0·61250	0·61667	0·62083	0·62500	0·62917	0·63333	0·63750	0·64167	0·64583
13	**0·65**	0·65417	0·65833	0·66250	0·66667	0·67083	0·67500	0·67917	0·68333	0·68750	0·69167	0·69583
14	**0·70**	0·70417	0·70833	0·71250	0·71667	0·72083	0·72500	0·72917	0·73333	0·73750	0·74167	0·74583
15	**0·75**	0·75417	0·75833	0·76250	0·76667	0·77083	0·77500	0·77917	0·78333	0·78750	0·79167	0·79583
16	**0·80**	0·80417	0·80833	0·81250	0·81667	0·82083	0·82500	0·82917	0·83333	0·83750	0·84167	0·84583
17	**0·85**	0·85417	0·85833	0·86250	0·86667	0·87083	0·87500	0·87917	0·88333	0·88750	0·89167	0·89583
18	**0·90**	0·90417	0·90833	0·91250	0·91667	0·92083	0·92500	0·92917	0·93333	0·93750	0·94167	0·94583
19	**0·95**	0·95417	0·95833	0·96250	0·96667	0·97083	0·97500	0·97917	0·98333	0·98750	0·99167	0·99583

$\frac{1}{8}$d. = 0·000521 $\frac{1}{4}$d. = 0·001042 $\frac{1}{2}$d. = 0·002083 $\frac{3}{4}$d. = 0·003125

Pence in decimals of 1 shilling

Pence	Decimals of Shilling	Pence	Decimals of Shilling	Pence	Decimals of Shilling
$\frac{1}{4}$	·02083	$4\frac{1}{4}$	·35417	$8\frac{1}{4}$	·68750
$\frac{1}{2}$	·04167	$4\frac{1}{2}$	·3750	$8\frac{1}{2}$	·70833
$\frac{3}{4}$	·06250	$4\frac{3}{4}$	·39583	$8\frac{3}{4}$	·72917
1	·08333	5	·41667	9	·75
$1\frac{1}{4}$	·10417	$5\frac{1}{4}$	·4375	$9\frac{1}{4}$	·77083
$1\frac{1}{2}$	·125	$5\frac{1}{2}$	·45833	$9\frac{1}{2}$	·79167
$1\frac{3}{4}$	·14583	$5\frac{3}{4}$	·47917	$9\frac{3}{4}$	·81250
2	·16667	6	·5	10	·83333
$2\frac{1}{4}$	·1875	$6\frac{1}{4}$	·52083	$10\frac{1}{4}$	·85417
$2\frac{1}{2}$	·20833	$6\frac{1}{2}$	·54167	$10\frac{1}{2}$	·8750
$2\frac{3}{4}$	·22917	$6\frac{3}{4}$	·5625	$10\frac{3}{4}$	·89583
3	·25	7	·58333	11	·91667
$3\frac{1}{4}$	·27083	$7\frac{1}{4}$	·60417	$11\frac{1}{4}$	·9375
$3\frac{1}{2}$	·29167	$7\frac{1}{2}$	·6250	$11\frac{1}{2}$	·95833
$3\frac{3}{4}$	·3125	$7\frac{3}{4}$	·64583	$11\frac{3}{4}$	·97917
4	·33333	8	·66667	12	1·000

Pence and fractions of pence as decimals of £1

	0d.	1d.	2d.	3d.	4d.	5d.	6d.	7d.	8d.	9d.	10d.	11d.	
		·0041667	·0083333	·0125000	·0166667	·0208333	·0250000	·0291667	·0333333	·0375000	·0416667	·0458333	
$\frac{1}{2}$	·0020833	·0062500	·0104167	·0145833	·0187500	·0229167	·0270833	·0312500	·0354167	·0395833	·0437500	·0479167	$\frac{1}{2}$
$\frac{1}{4}$	·0010417	·0052083	·0093750	·0135417	·0177083	·0218750	·0260417	·0302083	·0343750	·0385417	·0427083	·0468750	$\frac{1}{4}$
$\frac{3}{4}$	·0031250	·0072917	·0114583	·0156250	·0197917	·0239583	·0281250	·0322917	·0364583	·0406250	·0447917	·0489583	$\frac{3}{4}$
$\frac{1}{8}$	·0005208	·0046875	·0088542	·0130208	·0171875	·0213542	·0255208	·0296875	·0338542	·0380208	·0421875	·0463542	$\frac{1}{8}$
$\frac{3}{8}$	·0015625	·0057292	·0098958	·0140625	·0182292	·0223958	·0265625	·0307292	·0348958	·0390625	·0432292	·0473958	$\frac{3}{8}$
$\frac{5}{8}$	·0026042	·0067708	·0109375	·0151042	·0192708	·0234375	·0276042	·0317708	·0359375	·0401042	·0442708	·0484375	$\frac{5}{8}$
$\frac{7}{8}$	·0036458	·0078125	·0119792	·0161458	·0203125	·0244792	·0286458	·0328125	·0369792	·0411458	·0453125	·0494792	$\frac{7}{8}$
$\frac{1}{16}$	·0002604	·0044271	·0085938	·0127604	·0169271	·0210938	·0252604	·0294271	·0335938	·0377604	·0419271	·0460938	$\frac{1}{16}$
$\frac{3}{16}$	·0007813	·0049479	·0091146	·0132813	·0174479	·0216146	·0257813	·0299479	·0341146	·0382813	·0424479	·0466146	$\frac{3}{16}$
$\frac{5}{16}$	·0013021	·0054688	·0096354	·0138021	·0179688	·0221354	·0263021	·0304688	·0346354	·0388021	·0429688	·0471354	$\frac{5}{16}$
$\frac{7}{16}$	·0018229	·0059896	·0101563	·0143229	·0184896	·0226563	·0268229	·0309896	·0351563	·0393229	·0434896	·0476563	$\frac{7}{16}$
$\frac{9}{16}$	·0023438	·0065104	·0106771	·0148438	·0190104	·0231771	·0273438	·0315104	·0356771	·0398438	·0440104	·0481771	$\frac{9}{16}$
$\frac{11}{16}$	·0028646	·0070313	·0111979	·0153646	·0195313	·0236979	·0278646	·0320313	·0361979	·0403646	·0445313	·0486979	$\frac{11}{16}$
$\frac{13}{16}$	·0033854	·0075521	·0117188	·0158854	·0200521	·0242188	·0283854	·0325521	·0367188	·0408854	·0450521	·0492188	$\frac{13}{16}$
$\frac{15}{16}$	·0039063	·0080729	·0122396	·0164063	·0205729	·0247396	·0289063	·0330729	·0372396	·0414063	·0455729	·0497396	$\frac{15}{16}$

Examples: $4\frac{3}{8}$d. = 0·0182292.
$7\frac{13}{16}$d. = 0.0325521

$2/7\frac{7}{16}$:—2/– = 0·1000000
$7\frac{7}{16}$ = ·0309896
$2/7\frac{7}{16}$ = 0·1309896

4742 × $6\frac{1}{8}$d. = £·0255208 × 4742 = £121·0196336 = £121 0s. $4\frac{3}{8}$d.

Pence and fractions of pence as decimals of £1

32nds	0d.	1d.	2d.	3d.	4d.	5d.	6d.	7d.	8d.	9d.	10d.	11d.	32nds
1/32	·0001302	·0042969	·0084635	·0126302	·0167969	·0209635	·0251302	·0292969	·0334635	·0376302	·0417969	·0459635	1/32
3	·0003906	·0045573	·0087240	·0128906	·0170573	·0212240	·0253906	·0295573	·0337240	·0378906	·0420573	·0462240	3
5	·0006510	·0048177	·0089844	·0131510	·0173177	·0214844	·0256510	·0298177	·0339844	·0381510	·0423177	·0464844	5
7	·0009115	·0050781	·0092448	·0134115	·0175781	·0217448	·0259115	·0300781	·0342448	·0384115	·0425781	·0467448	7
9	·0011719	·0053385	·0095052	·0136719	·0178385	·0220052	·0261719	·0303385	·0345052	·0386719	·0428385	·0470052	9
11	·0014323	·0055990	·0097656	·0139323	·0180990	·0222656	·0264323	·0305990	·0347656	·0389323	·0430990	·0472656	11
13	·0016927	·0058594	·0100260	·0141927	·0183594	·0225260	·0266927	·0308594	·0350260	·0391927	·0433594	·0475260	13
15	·0019531	·0061198	·0102865	·0144531	·0186198	·0227865	·0269531	·0311198	·0352865	·0394531	·0436198	·0477865	15
17	·0022135	·0063802	·0105469	·0147135	·0188802	·0230469	·0272135	·0313802	·0355469	·0397135	·0438802	·0480469	17
19	·0024740	·0066406	·0108073	·0149740	·0191406	·0233073	·0274740	·0316406	·0358073	·0399740	·0441406	·0483073	19
21	·0027344	·0069010	·0110677	·0152344	·0194010	·0235677	·0277344	·0319010	·0360677	·0402344	·0444010	·0485677	21
23	·0029948	·0071615	·0113281	·0154948	·0196615	·0238281	·0279948	·0321615	·0363281	·0404948	·0446615	·0488281	23
25	·0032552	·0074219	·0115885	·0157552	·0199219	·0240885	·0282552	·0324219	·0365885	·0407552	·0449219	·0490885	25
27	·0035156	·0076823	·0118490	·0160156	·0201823	·0243490	·0285156	·0326823	·0368490	·0410156	·0451823	·0493490	27
29	·0037760	·0079427	·0121094	·0162760	·0204427	·0246094	·0287760	·0329427	·0371094	·0412760	·0454427	·0496094	29
31	·0040365	·0082031	·0123698	·0165365	·0207031	·0248698	·0290365	·0332031	·0373698	·0415365	·0457031	·0498698	31

Examples :—(a) $9\frac{25}{32}$ pence = 0·0407552. (b) $7/8\frac{11}{32} = 7/- = 0{\cdot}35$

$8\frac{11}{32} = 0{\cdot}0347656$

0·3847656

Inches and $\frac{1}{8}$ inches in decimals of a foot

Inches	Decimals of a foot	Inches	Decimals of a foot	Inches	Decimals of a foot	Inches	Decimals of a foot
$\frac{1}{8}$	0·01042	$3\frac{1}{8}$	0·26042	$6\frac{1}{8}$	0·51042	$9\frac{1}{8}$	0·76042
$\frac{1}{4}$	0·02083	$3\frac{1}{4}$	0·27083	$6\frac{1}{4}$	0·52083	$9\frac{1}{4}$	0·77083
$\frac{3}{8}$	0·03125	$3\frac{3}{8}$	0·28125	$6\frac{3}{8}$	0·53125	$9\frac{3}{8}$	0·78125
$\frac{1}{2}$	0·04167	$3\frac{1}{2}$	0·29167	$6\frac{1}{2}$	0·54167	$9\frac{1}{2}$	0·79167
$\frac{5}{8}$	0·05208	$3\frac{5}{8}$	0·30208	$6\frac{5}{8}$	0·55208	$9\frac{5}{8}$	0·80208
$\frac{3}{4}$	0·06250	$3\frac{3}{4}$	0·31250	$6\frac{3}{4}$	0·56250	$9\frac{3}{4}$	0·81250
$\frac{7}{8}$	0·07292	$3\frac{7}{8}$	0·32292	$6\frac{7}{8}$	0·57292	$9\frac{7}{8}$	0·82292
1,—	0·08333	4,—	0·33333	7,—	0·58333	10,—	0·83333
$1\frac{1}{8}$	0·09375	$4\frac{1}{8}$	0·34375	$7\frac{1}{8}$	0·59375	$10\frac{1}{8}$	0·84375
$1\frac{1}{4}$	0·10417	$4\frac{1}{4}$	0·35417	$7\frac{1}{4}$	0·60417	$10\frac{1}{4}$	0·85417
$1\frac{3}{8}$	0·11458	$4\frac{3}{8}$	0·36458	$7\frac{3}{8}$	0·61458	$10\frac{3}{8}$	0·86458
$1\frac{1}{2}$	0·12500	$4\frac{1}{2}$	0·37500	$7\frac{1}{2}$	0·62500	$10\frac{1}{2}$	0·87500
$1\frac{5}{8}$	0·13542	$4\frac{5}{8}$	0·38542	$7\frac{5}{8}$	0·63542	$10\frac{5}{8}$	0·88542
$1\frac{3}{4}$	0·14583	$4\frac{3}{4}$	0·39583	$7\frac{3}{4}$	0·64583	$10\frac{3}{4}$	0·89583
$1\frac{7}{8}$	0·15625	$4\frac{7}{8}$	0·40625	$7\frac{7}{8}$	0·65625	$10\frac{7}{8}$	0·90625
2,—	0·16667	5,—	0·41667	8,—	0·66667	11,—	0·91667
$2\frac{1}{8}$	0·17708	$5\frac{1}{8}$	0·42708	$8\frac{1}{8}$	0·67708	$11\frac{1}{8}$	0·92708
$2\frac{1}{4}$	0·18750	$5\frac{1}{4}$	0·43750	$8\frac{1}{4}$	0·68750	$11\frac{1}{4}$	0·93750
$2\frac{3}{8}$	0·19792	$5\frac{3}{8}$	0·44792	$8\frac{3}{8}$	0·69792	$11\frac{3}{8}$	0·94792
$2\frac{1}{2}$	0·20833	$5\frac{1}{2}$	0·45833	$8\frac{1}{2}$	0·70833	$11\frac{1}{2}$	0·95833
$2\frac{5}{8}$	0·21875	$5\frac{5}{8}$	0·46875	$8\frac{5}{8}$	0·71875	$11\frac{5}{8}$	0·96875
$2\frac{3}{4}$	0·22917	$5\frac{3}{4}$	0·47917	$8\frac{3}{4}$	0·72917	$11\frac{3}{4}$	0·97917
$2\frac{7}{8}$	0·23958	$5\frac{7}{8}$	0·48958	$8\frac{7}{8}$	0·73958	$11\frac{7}{8}$	0·98958
3,—	0·25000	6,—	0·50000	9,—	0·75000	12,—	1·00000

Decimal Equivalents of Common Fractions

1/2 — 0·5

1/4 — 0·25
3/4 — 0·75

1/8 — 0·125
3/8 — 0·375
5/8 — 0·625
7/8 — 0·875

1/3 — 0·33333
2/3 — 0·66667

1/6 — 0·16667
5/6 — 0·83333

1/9 — 0·11111
2/9 — 0·22222
4/9 — 0·44444

5/9 — 0·55556
7/9 — 0·77778
8/9 — 0·88889

1/12 — 0·08333
5/12 — 0·41667
7/12 — 0·58333
11/12 — 0·91667

1/15 — 0·06667
2/15 — 0·13333
4/15 — 0·26667
7/15 — 0·46667
8/15 — 0·53333
11/15 — 0·73333
13/15 — 0·86667
14/15 — 0·93333

1/16 — 0·0625
3/16 — 0·1875
5/16 — 0·3125
7/16 — 0·4375

9/16 — 0·5625
9/16 — 0·5625
11/16 — 0·6875
13/16 — 0·8125
15/16 — 0·9375

1/32 — 0·03125
3/32 — 0·09375
5/32 — 0·15625
7/32 — 0·21875
9/32 — 0·28125
11/32 — 0·34375
13/32 — 0·40625
15/32 — 0·46875
17/32 — 0·53125
19/32 — 0·59375
21/32 — 0·65625
23/32 — 0·71875
25/32 — 0·78125
27/32 — 0·84375
29/32 — 0·90625
31/32 — 0·96875

1/64 — 0·015625
3/64 — 0·046875
5/64 — 0·078125
7/64 — 0·109375
9/64 — 0·140625
11/64 — 0·171875
13/64 — 0·203125
15/64 — 0·234375
17/64 — 0·265625
19/64 — 0·296875
21/64 — 0·328125
23/64 — 0·359375
25/64 — 0·390625
27/64 — 0·421875
29/64 — 0·453125
31/64 — 0·484375
33/64 — 0·515625
35/64 — 0·546875
37/64 — 0·578125
39/64 — 0·609375
41/64 — 0·640625
43/64 — 0·671875
45/64 — 0·703125
47/64 — 0·734375

49/64 — 0·765625
51/64 — 0·796875
53/64 — 0·828125
55/64 — 0·859375
57/64 — 0·890625
59/64 — 0·921875
61/64 — 0·953125
63/64 — 0·984375

Qrs. and lbs. in Decimals of 1 Cwt.

lbs.		1/2	1	2	3	4	5	6
		0·00446	**0·00893**	**0·01786**	**0·02679**	**0·03571**	**0·04464**	**0·05357**
Qrs.	1 **0·25000**	0·25446	0·25893	0·26786	0·27679	0·28571	0·29464	0·30357
	2 **0·50000**	0·50446	0·50893	0·51786	0·52679	0·53571	0·54464	0·55357
	3 **0·75000**	0·75446	0·75893	0·76786	0·77679	0·78571	0·79464	0·80357
lbs=		7	8	9	10	11	12	13
		0·06250	**0·07143**	**0·08036**	**0·08929**	**0·09821**	**0·10714**	**0·11607**
Qrs.	1 **0·25000**	0·31250	0·32143	0·33036	0·33929	0·34821	0·35714	0·36607
	2 **0·50000**	0·56250	0·57143	0·58036	0·58929	0·59821	0·60714	0·61607
	3 **0·75000**	0·81250	0·82143	0·83036	0·83929	0·84821	0·85714	0·86607
lbs =		14	15	16	17	18	19	20
		0·12500	**0·13393**	**0·14286**	**0·15179**	**0·16071**	**0·16964**	**0·17857**
Qrs.	1 **0·25000**	0·37500	0·38393	0·39286	0·40179	0·41071	0·41964	0·42857
	2 **0·50000**	0·62500	0·63393	0·64286	0·65179	0·66071	0·66964	0·67857
	3 **0·75000**	0·87500	0·88393	0·89286	0·90179	0·91071	0·91964	0·92857
lbs=		21	22	23	24	25	26	27
		0·18750	**0·19643**	**0·20536**	**0·21429**	**0·22321**	**0·23214**	**0·24107**
Qrs.	1 **0·25000**	0·43750	0·44643	0·45536	0·46429	0·47321	0·48214	0·49107
	2 **0·50000**	0·68750	0·69643	0·70536	0·71429	0·72321	0·73214	0·74107
	3 **0·75000**	0·93750	0·94643	0·95536	0·96429	0·97321	0·98214	0·99107

Cwts., Qrs. and lbs. in Decimals of 1 ton

0 Qr.

Cwts.	Qrs. and lbs.															
	0·0	0·½	0·1	0·2	0·3	0·4	0·5	0·6	0·7	·08	0·9	0·10	0·11	0·12	0·13	0·14
0	00	000223	000446	000893	001339	001786	002232	002679	003125	003571	004018	004464	004911	005357	005804	00625
1	05	050223	050446	050893	051339	051786	052232	052679	053125	053571	054018	054464	054911	055357	055804	05625
2	10	100223	100446	100893	101339	101786	102232	102679	103125	103571	104018	104464	104911	105357	105804	10625
3	15	150223	150446	150893	151339	151786	152232	152679	153125	153571	154018	154464	154911	155357	155804	15625
4	20	200223	200446	200893	201339	201786	202232	202679	203125	203571	204018	204464	204911	205357	205804	20625
5	25	250223	250446	250893	251339	251786	252232	252679	253125	253571	254018	254464	254911	255357	255804	25625
6	30	300223	300446	300893	301339	301786	302232	302679	303125	303571	304018	304464	304911	305357	305804	30625
7	35	350223	350446	350893	351339	351786	352232	352679	353125	353571	354018	354464	354911	355357	355804	35625
8	40	400223	400446	400893	401339	401786	402232	402679	403125	403571	404018	404464	404911	405357	405804	40625
9	45	450223	450446	450893	451339	451786	452232	452679	453125	453571	454018	454464	454911	455357	455804	45625
10	50	500223	500446	500893	501339	501786	502232	502679	503125	503571	504018	504464	504911	505357	505804	50625
11	55	550223	550446	550893	551339	551786	552232	552679	553125	553571	554018	554464	554911	555357	555804	55625
12	60	600223	600446	600893	601339	601786	602232	602679	603125	603571	604018	604464	604911	605357	605804	60625
13	65	650223	650446	650893	651339	651786	652232	652679	653125	653571	654018	654464	654911	655357	655804	65625
14	70	700223	700446	700893	701339	701786	702232	702679	703125	703571	704018	704464	704911	705357	705804	70625
15	75	750223	750446	750893	751339	751786	752232	752679	753125	753571	754018	754464	754911	755357	755804	75625
16	80	800223	800446	800893	801339	801786	802232	802679	803125	803571	804018	804464	804911	805357	805804	80625
17	85	850223	850446	850893	851339	851786	852232	852679	853125	853571	854018	854464	854911	855357	855804	85625
18	90	900223	900446	900893	901339	901786	902232	902679	903125	903571	904018	904464	904911	905357	905804	90625
19	95	950223	950446	950893	951339	951786	952232	952679	953125	953571	954018	954464	954911	955357	955804	95625

Cwts., Qrs. and lbs. in Decimals of 1 ton

0 Qr.

Cwts.	Qrs. and lbs.												
	0·15	0·16	0·17	0·18	0·19	0·20	0·21	0·22	0·23	0·24	0·25	0·26	0·27
0	006696	007143	007589	008036	008482	008929	009375	009821	010268	010714	011161	011607	012054
1	056696	057143	057589	058036	058482	058929	059375	059821	060268	060714	061161	061607	062054
2	106696	107143	107589	108036	108482	108929	109375	109821	110268	110714	111161	111607	112054
3	156696	157143	157589	158036	158482	158929	159375	159821	160268	160714	161161	161607	162054
4	206696	207143	207589	208036	208482	208929	209375	209821	210268	210714	211161	211607	212054
5	256696	257143	257589	258036	258482	258929	259375	259821	260268	260714	261161	261607	262054
6	306696	307143	307589	308036	308482	308929	309375	309821	310268	310714	311161	311607	312054
7	356696	357143	357589	358036	358482	358929	359375	359821	360268	360714	361161	361607	362054
8	406696	407143	407589	408036	408482	408929	409375	409821	410268	410714	411161	411607	412054
9	456696	457143	457589	458036	458482	458929	459375	459821	460268	460714	461161	461607	462054
10	506696	507143	507589	508036	508482	508929	509375	509821	510268	510714	511161	511607	512054
11	556696	557143	557589	558036	558482	558929	559375	559821	560268	560714	561161	561607	562054
12	606696	607143	607589	608036	608482	608929	609375	609821	610268	610714	611161	611607	612054
13	656696	657143	657589	658036	658482	658929	659375	659821	660268	660714	661161	661607	662054
14	706696	707143	707589	708036	708482	708929	709375	709821	710268	710714	711161	711607	712054
15	756696	757143	757589	758036	758482	758929	759375	759821	760268	760714	761161	761607	762054
16	806696	807143	807589	808036	808482	808929	809375	809821	810268	810714	811161	811607	812054
17	856696	857143	857589	858036	858482	858929	859375	859821	860268	860714	861161	861607	862054
18	906696	907143	907589	908036	908482	908929	909375	909821	910268	910714	911161	911607	912054
19	956696	957143	957589	958036	958482	958929	959375	959821	960268	960714	961161	961607	962054

Cwts., Qrs. and lbs. in Decimals of 1 ton

1 Qr.

Cwts.	Qrs. and lbs.															
	1·0	1·½	1·1	1·2	1·3	1·4	1·5	1·6	1·7	1·8	1·9	1·10	1·11	1·12	1·13	1·14
0	0125	012723	012946	013393	013839	014286	014732	015179	015625	016071	016518	016964	017411	017857	018304	01875
1	0625	062723	062946	063393	063839	064286	064732	065179	065625	066071	066518	066964	067411	067857	068304	06875
2	1125	112723	112946	113393	113839	114286	114732	115179	115625	116071	116518	116964	117411	117857	118304	11875
3	1625	162723	162946	163393	163839	164286	164732	165179	165625	166071	166518	166964	167411	167857	168304	16875
4	2125	212723	212946	213393	213839	214286	214732	215179	215625	216071	216518	216964	217411	217857	218304	21875
5	2625	262723	262946	263393	263839	264286	264732	265179	265625	266071	266518	266964	267411	267857	268304	26875
6	3125	312723	312946	313393	313839	314286	314732	315179	315625	316071	316518	316964	317411	317857	318304	31875
7	3625	362723	362946	363393	363839	364286	364732	365179	365625	366071	366518	366964	367411	367857	368304	36875
8	4125	412723	412946	413393	413839	414286	414732	415179	415625	416071	416518	416964	417411	417857	418304	41875
9	4625	462723	462946	463393	463839	464286	464732	465179	465625	466071	466518	466964	467411	467857	468304	46875
10	5125	512723	512946	513393	513839	514286	514732	515179	515625	516071	516518	516964	517411	517857	518304	51875
11	5625	562723	562946	563393	563839	564286	564732	565179	565625	566071	566518	566964	567411	567857	568304	56875
12	6125	612723	612946	613393	613839	614286	614732	615179	615625	616071	616518	616964	617411	617857	618304	61875
13	6625	662723	662946	663393	663839	664286	664732	665179	665625	666071	666518	666964	667411	667857	668304	66875
14	7125	712723	712946	713393	713839	714286	714732	715179	715625	716071	716518	716964	717411	717857	718304	71875
15	7625	762723	762946	763393	763839	764286	764732	765179	765625	766071	766518	766964	767411	767857	768304	76875
16	8125	812723	812946	813393	813839	814286	814732	815179	815625	816071	816518	816964	817411	817857	818304	81875
17	8625	862723	862946	863393	863839	864286	864732	865179	865625	866071	866518	866964	867411	867857	868304	86875
18	9125	912723	912946	913393	913839	914286	914732	915179	915625	916071	916518	916964	917411	917857	918304	91875
19	9625	962723	962946	963393	963839	964286	964732	965179	965625	966071	966518	966964	967411	967857	968304	96875

Cwts., Qrs. and lbs. in Decimals of 1 ton

1 Qr.

Cwts.	Qrs. and lbs.												
	1·15	1·16	1·17	1·18	1·19	1·20	1·21	1·22	1·23	1·24	1·25	1·26	1·27
0	019196	019643	020089	020536	020982	021429	021875	022321	022768	023214	023661	024107	024554
1	069196	069643	070089	070536	070982	071429	071875	072321	072768	073214	073661	074107	074554
2	119196	119643	120089	120536	120982	121429	121875	122321	122768	123214	123661	124107	124554
3	169196	169643	170089	170536	170982	171429	171875	172321	172768	173214	173661	174107	174554
4	219196	219643	220089	220536	220982	221429	221875	222321	222768	223214	223661	224107	224554
5	269196	269643	270089	270536	270982	271429	271875	272321	272768	273214	273661	274107	274554
6	319196	319643	320089	320536	320982	321429	321875	322321	322768	323214	323661	324107	324554
7	369196	369643	370089	370536	370982	371429	371875	372321	372768	373214	373661	374107	374554
8	419196	419643	420089	420536	420982	421429	421875	422321	422768	423214	423661	424107	424554
9	469196	469643	470089	470536	470982	471429	471875	472321	472768	473214	473661	474107	474554
10	519196	519643	520089	520536	520982	521429	521875	522321	522768	523214	523661	524107	524554
11	569196	569643	570089	570536	570982	571429	571875	572321	572768	573214	573661	574107	574554
12	619196	619643	620089	620536	620982	621429	621875	622321	622768	623214	623661	624107	624554
13	669196	669643	670089	670536	670982	671429	671875	672321	672768	673214	673661	674107	674554
14	719196	719643	720089	720536	720982	721429	721875	722321	722768	723214	723661	724107	724554
15	769196	769643	770089	770536	770982	771429	771875	772321	772768	773214	773661	774107	774554
16	819196	819643	820089	820536	820982	821429	821875	822321	822768	823214	823661	824107	824554
17	869196	869643	870089	870536	870982	871429	871875	872321	872768	873214	873661	874107	874554
18	919196	919643	920089	920536	920982	921429	921875	922321	922768	923214	923661	924107	924554
19	969196	969643	970089	970536	970982	971429	971875	972321	972768	973214	973661	974107	974554

Cwts., Qrs. and lbs. in Decimals of 1 ton

2 Qrs.

Cwts.	Qrs. and lbs.															
	2·0	2·½	2·1	2·2	2·3	2·4	2·5	2·6	2·7	2·8	2·9	2·10	2·11	2·12	2·13	2·14
0	025	025223	025446	025893	026339	026786	027232	027679	028125	028571	029018	029464	029911	030357	030804	03125
1	075	075223	075446	075893	076339	076786	077232	077679	078125	078571	079018	079464	079911	080357	080804	08125
2	125	125223	125446	125893	126339	126786	127232	127679	128125	128571	129018	129464	129911	130357	130804	13125
3	175	175223	175446	175893	176339	176786	177232	177679	178125	178571	179018	179464	179911	180357	180804	18125
4	225	225223	225446	225893	226339	226786	227232	227679	228125	228571	229018	229464	229911	230357	230804	23125
5	275	275223	275446	275893	276339	276786	277232	277679	278125	278571	279018	279464	279911	280357	280804	28125
6	325	325223	325446	325893	326339	326786	327232	327679	328125	328571	329018	329464	329911	330357	330804	33125
7	375	375223	375446	375893	376339	376786	377232	377679	378125	378571	379018	379464	379911	380357	380804	38125
8	425	425223	425446	425893	426339	426786	427232	427679	428125	428571	429018	429464	429911	430357	430804	43125
9	475	475223	475446	475893	476339	476786	477232	477679	478125	478571	479018	479464	479911	480357	480804	48125
10	525	525223	525446	525893	526339	526786	527232	527679	528125	528571	529018	529464	529911	530357	530804	53125
11	575	575223	575446	575893	576339	576786	577232	577679	578125	578571	579018	579464	579911	580357	580804	58125
12	625	625223	625446	625893	626339	626786	627232	627679	628125	628571	629018	629464	629911	630357	630804	63125
13	675	675223	675446	675893	676339	676786	677232	677679	678125	678571	679018	679464	679911	680357	680804	68125
14	725	725223	725446	725893	726339	726786	727232	727679	728125	728571	729018	729464	729911	730357	730804	73125
15	775	775223	775446	775893	776339	776786	777232	777679	778125	778571	779018	779464	779911	780357	780804	78125
16	825	825223	825446	825893	826339	826786	827232	827679	828125	828571	829018	829464	829911	830357	830804	83125
17	875	875223	875446	875893	876339	876786	877232	877679	878125	878571	879018	879464	879911	880357	880804	88125
18	925	925223	925446	925893	926339	926786	927232	927679	928125	928571	929018	929464	929911	930357	930804	93125
19	975	975223	975446	975893	976339	976786	977232	977679	978125	978571	979018	979464	979911	980357	980804	98125

Cwts., Qrs. and lbs. in Decimals of 1 ton

2 Qrs.

Cwts.	Qrs. and lbs.												
	2·15	2·16	2·17	2·18	2·19	2·20	2·21	2·22	2·23	2·24	2·25	2·26	2·27
0	031696	032143	032589	033036	033482	033929	034375	034821	035268	035714	036161	036607	037054
1	081696	082143	082589	083036	083482	083929	084375	084821	085268	085714	086161	086607	087054
2	131696	132143	132589	133036	133482	133929	134375	134821	135268	135714	136161	136607	137054
3	181696	182143	182589	183036	183482	183929	184375	184821	185268	185714	186161	186607	187054
4	231696	232143	232589	233036	233482	233929	234375	234821	235268	235714	236161	236607	237054
5	281696	282143	282589	283036	283482	283929	284375	284821	285268	285714	286161	286607	287054
6	331696	332143	332589	333036	333482	333929	334375	334821	335268	335714	336161	336607	337054
7	381696	382143	382589	383036	383482	383929	384375	384821	385268	385714	386161	386607	387054
8	431696	432143	432589	433036	433482	433929	434375	434821	435268	435714	436161	436607	437054
9	481696	482143	482589	483036	483482	483929	484375	484821	485268	485714	486161	486607	487054
10	531696	532143	532589	533036	533482	533929	534375	534821	535268	535714	536161	536607	537054
11	581696	582143	582589	583036	583482	583929	584375	584821	585268	585714	586161	586607	587054
12	631696	632143	632589	633036	633482	633929	634375	634821	635268	635714	636161	636607	637054
13	681696	682143	682589	683036	683482	683929	684375	684821	685268	685714	686161	686607	687054
14	731696	732143	732589	733036	733482	733929	734375	734821	735268	735714	736161	736607	737054
15	781696	782143	782589	783036	783482	783929	784375	784821	785268	785714	786161	786607	787054
16	831696	832143	832589	833036	833482	833929	834375	834821	835268	835714	836161	836607	837054
17	881696	882143	882589	883036	883482	883929	884375	884821	885268	885714	886161	886607	887054
18	931696	932143	932589	933036	933482	933929	934375	934821	935268	935714	936161	936607	937054
19	981696	982143	982589	983036	983482	983929	984375	984821	985268	985714	986161	986607	987054

Cwts., Qrs. and lbs. in Decimals of 1 ton

3 Qrs.

Cwts.	Qrs. and lbs.															
	3·0	3·½	3·1	3·2	3·3	3·4	3·5	3·6	3·7	3·8	3·9	3·10	3·11	3·12	3·13	3·14
0	0375	037723	037946	038393	038839	039286	039732	040179	040625	041071	041518	041964	042411	042857	043304	04375
1	0875	087723	087946	088393	088839	089286	089732	090179	090625	091071	091518	091964	092411	092857	093304	09375
2	1375	137723	137946	138393	138839	139286	139732	140179	140625	141071	141518	141964	142411	142857	143304	14375
3	1875	187723	187946	188393	188839	189286	189732	190179	190625	191071	191518	191964	192411	192857	193304	19375
4	2375	237723	237946	238393	238839	239286	239732	240179	240625	241071	241518	241964	242411	242857	243304	24375
5	2875	287723	287946	288393	288839	289286	289732	290179	290625	291071	291518	291964	292411	292857	293304	29375
6	3375	337723	337946	338393	338839	339286	339732	340179	340625	341071	341518	341964	342411	342857	343304	34375
7	3875	387723	387946	388393	388839	389286	389732	390179	390625	391071	391518	391964	392411	392857	393304	39375
8	4375	437723	437946	438393	438839	439286	439732	440179	440625	441071	441518	441964	442411	442857	443304	44375
9	4875	487723	487946	488393	488839	489286	489732	490179	490625	491071	491518	491964	492411	492857	493304	49375
10	5375	537723	537946	538393	538839	539286	539732	540179	540625	541071	541518	541964	542411	542857	543304	54375
11	5875	587723	587946	588393	588839	589286	589732	590179	590625	591071	591518	591964	592411	592857	593304	59375
12	6375	637723	637946	638393	638839	639286	639732	640179	640625	641071	641518	641964	642411	642857	643304	64375
13	6875	687723	687946	688393	688839	689286	689732	690179	690625	691071	691518	691964	692411	692857	693304	69375
14	7375	737723	737946	738393	738839	739286	739732	740179	740625	741071	741518	741964	742411	742857	743304	74375
15	7875	787723	787946	788393	788839	789286	789732	790179	790625	791071	791518	791964	792411	792857	793304	79375
16	8375	837723	837946	838393	838839	839286	839732	840179	840625	841071	841518	841964	842411	842857	843304	84375
17	8875	887723	887946	888393	888839	889286	889732	890179	890625	891071	891518	891964	892411	892857	893304	89375
18	9375	937723	937946	938393	938839	939286	939732	940179	940625	941071	941518	941964	942411	942857	943304	94375
19	9875	987723	987946	988393	988839	989286	989732	990179	990625	991071	991518	991964	992411	992857	993304	99375

Cwts., Qrs. and lbs. in Decimals of 1 ton

3 Qrs.

Cwts.	Qrs. and lbs.												
	3·15	3·16	3·17	3·18	3·19	3·20	3·21	3·22	3·23	3·24	3·25	3·26	3·27
0	044196	044643	045089	045536	045982	046429	046875	047321	047768	048214	048661	049107	049554
1	094196	094643	095089	095536	095982	096429	096875	097321	097768	098214	098661	099107	099554
2	144196	144643	145089	145536	145982	146429	146875	147321	147768	148214	148661	149107	149554
3	194196	194643	195089	195536	195982	196429	196875	197321	197768	198214	198661	199107	199554
4	244196	244643	245089	245536	245982	246429	246875	247321	247768	248214	248661	249107	249554
5	294196	294643	295089	295536	295982	296429	296875	297321	297768	298214	298661	299107	299554
6	344196	344643	345089	345536	345982	346429	346875	347321	347768	348214	348661	349107	349554
7	394196	394643	395089	395536	395982	396429	396875	397321	397768	398214	398661	399107	399554
8	444196	444643	445089	445536	445982	446429	446875	447321	447768	448214	448661	449107	449554
9	494196	494643	495089	495536	495982	496429	496875	497321	497768	498214	498661	499107	499554
10	544196	544643	545089	545536	545982	546429	546875	547321	547768	548214	548661	549107	549554
11	594196	594643	595089	595536	595982	596429	596875	597321	597768	598214	598661	599107	599554
12	644196	644643	645089	645536	645982	646429	646875	647321	647768	648214	648661	649107	649554
13	694196	694643	695089	695536	695982	696429	696875	697321	697768	698214	698661	699107	699554
14	744196	744643	745089	745536	745982	746429	746875	747321	747768	748214	748661	749107	749554
15	794196	794643	795089	795536	795982	796429	796875	797321	797768	798214	798661	799107	799554
16	844196	844643	845089	845536	845982	846429	846875	847321	847768	848214	848661	849107	849554
17	894196	894643	895089	895536	895982	896429	896875	897321	897768	898214	898661	899107	899554
18	944196	944643	945089	945536	945982	946429	946875	947321	947768	948214	948661	949107	949554
19	994196	994643	995089	995536	995982	996429	996875	997321	997768	998214	998661	999107	999554

Multiplicators for calculation of interests

Multiplicator The year = 360 days	Rate of interest %	Multiplicator The year = 365 days	Multiplicator The year = 360 days	Rate of interest %	Multiplicator The year = 365 days
0·000027777	1	0·000027397	0·000159722	5¾	0·000157534
0·000034722	1¼	0·000034247	0·000166666	6	0·000164384
0·000041666	1½	0·000041096	0·000173611	6¼	0·000171233
0·000048611	1¾	0·000047945	0·000180555	6½	0·000178082
0·000055555	2	0·000054795	0·000187500	6¾	0·000184932
0·000062500	2¼	0·000061644	0·000194444	7	0·000191781
0·000069444	2½	0·000068493	0·000201388	7¼	0·000198630
0·000076388	2¾	0·000075342	0·000208333	7½	0·000205479
0·000083333	3	0·000082192	0·000215277	7¾	0·000212329
0·000090277	3¼	0·000089041	0·000222222	8	0·000219178
0·000097222	3½	0·000095890	0·000229166	8¼	0·000226027
0·000104166	3¾	0·000102740	0·000236111	8½	0·000232877
0·000111111	4	0·000109589	0·000243055	8¾	0·000239726
0·000118055	4¼	0·000116438	0·000250000	9	0·000246575
0·000125000	4½	0·000123288	0·000256944	9¼	0·000253425
0·000131944	4¾	0·000130137	0·000263888	9½	0·000260274
0·000138888	5	0·000136986	0·000270833	9¾	0·000267123
0·000145833	5¼	0·000143836	0·000277777	10	0·000273973
0·000152777	5½	0·000150685			

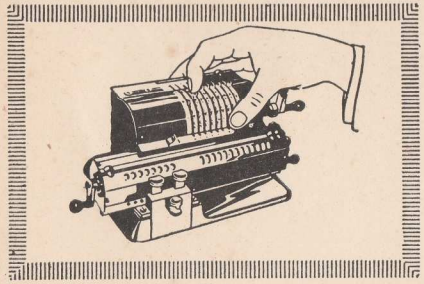
British and metric conversion factors

Metric to British.

To convert :			
			Weight.
Grammes	to Drams	multiply by	0·5644
Kilogrammes	,, Ozs.	,,	35·274
,,	,, Lbs.	,,	2·2046
,,	,, Stones	,,	0·1574
,,	,, Qrs.	,,	0·0787
,,	,, Cwts.	,,	0·0196
,,	,, Tons	,,	0·00098
			Length.
Metres	to Inches	multiply by	39·3701
,,	,, Feet	,,	3·2808
,,	,, Yards	,,	1·0936
,,	,, Chains	,,	0·0497
Kilometres	,, Furlongs	,,	4·971
,,	,, Miles	,,	0·6214
			Area.
Square Centimetres	to Square Inches	multiply by	0·1550
,, Metres	,, ,, feet	,,	10·7639
,, ,,	,, ,, yards	,,	1·1960
Ares ,,	,, Perches	,,	3·9539
,,	,, Roods	,,	0·0988
,,	,, Acres	,,	0·0247
			Liquid.
Litres	to Gills	multiply by	7·0392
,,	to Pints	,,	1·7598
,,	,, Quarts	,	0·8800
,	,, Gallons	,,	0·2200

British to Metric.

To convert :			
			Weight.
Drams	to Grammes	multiply by	1·772
Ozs.	,, Kilogrammes	,,	0·02835
Lbs.	,, ,,	,,	0·4536
Stones	,, ,,	,,	6·3502
Qrs.	,, ,,	,,	12·7005
Cwts.	,, ,,	,,	50·8023
Tons	,, ,,	,,	1016·04
			Length.
Inches	to Metres	multiply by	0·0254
Feet	,, ,,	,,	0·3048
Yards	,, ,,	,,	0·9144
Chains	,, ,,	,,	20·1168
Furlongs	,, Kilometres	,,	0·201168
Miles	,, ,,	,,	1·6093
			Area.
Square Inches	to Square Centimetres	multiply by	6·4516
,, Feet	,, ,, Metres	,,	0·0929
,, Yards	,, ,, ,,	,,	0·8361
Perches	,, Ares	,,	0·2529
Roods	,, ,,	,,	10·117
Acres	,, ,,	,,	40·468
			Liquid.
Gills	to Litres	multiply by	0·1421
Pints	,, ,,	,,	0·5682
Quarts	,, ,,	,,	1·1365
Gallons	,, ,,	,,	4·5459



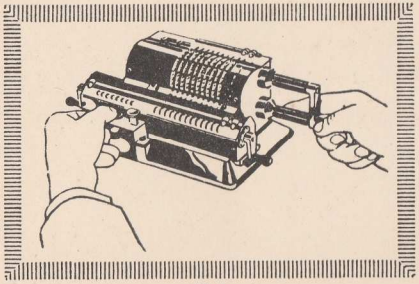
Ill 1.

★ By rotating the crank be sure that every revolution is completed. If by accident you have commenced a revolution not desired, it is just the same necessary to complete it and the fault is corrected by one revolution in the opposite direction.

Only the wrist, not the arm, should be put in motion by cranking.

By moving the carriage place the hand as shown in illustration 2 and press down one of the keys (T). When the key (G) is pressed down, the carriage is released entirely and can be moved freely.

The dials in the Proof-register are numbered from 1 to 8 (on machines with larger capacity to 11). An arrow (F), which points on these figures, indicates the position of the carriage. When we explain an operation as follows: "Make 3 (5) positive turns" the figure within the parenthesis indicates the proper position of the carriage, in which the crank should be turned 3 times, in this particular case the position 5, that is the arrow should point on the figure 5 (dial Nr. 5).



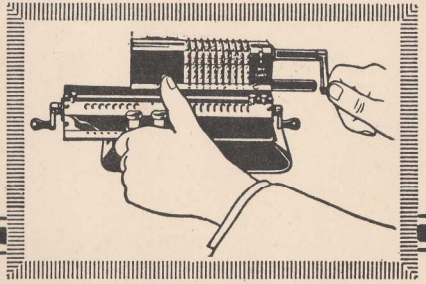
Ill 2.

To zeroise the Result-register and the Proof-register turn the corresponding small zeroising crank (A) once.

To clear the levers to zero pull the key (B) to the left and turn the crank $\frac{1}{4}$ revolution and then return the crank to its initial position. As shown in illustration 3 it is not necessary to move the left hand from its position on the spacing device.

On machines without ten's transmission in the Proof-register the figure wheels have two columns. The white figures indicate positive revolutions and the red ones negative. If a dial in the Proof-register shows a white 8 only one more positive revolution may be made, otherwise the Proof-register will show an incorrect figure. The two columns have the 9's in common and they are red.

On machines with ten's transmission in the Proof-register there is only one column indicating positive or negative revolutions made.



Ill 3.

Printed in England
by James Harwood Limited
Derby

(15791)