The answer is thus on the (2+6)—(5-1), i.e. the the 4th circle.

11. Set unity line below cursor as there is no further numerator. This does not affect the location of the answer (0.4), which is therefore on the 4th circle.

With a little practice, these additions and subtractions can be carried out mentally during the manipulation of the calculator, with the result that the answer can be found on the long scale without first carrying out the calculation on the short scale.

A METHOD FOR DETERMINING THE CIRCLE ON WHICH TO FIND THE ANSWER

A method for finding the circle on which to read the answer when using the "Long Scale" of a Fowler's Calculator, and which obviates having to previously work out the problem roughly on the "short" Scale, has been devised by Mr. D. Gordon Bagg, B.Sc., F.R.I.C., M.I.Chem.E., and we give it here, with his kind permission. Provided the complications mentioned are carefully observed, the method, which has been in use by him for many years, is infallible, and can be likened to the handling of log characteristics.

The "Long Scale" consists of six concentric circles which for the purposes of this method should be numbered consecutively from 1 to 6, commencing with the inner circle. Briefly, to find the circle on which the answer occurs, the numbers of the circles carrying the various numerators and denominators should be added together or subtracted according to whether the operation is multiplication or division. Thus, if the operation is a simple division of say 6 by 3, the number 6 on the 5th circle is set under the datum line, and the cursor is set to 3 on the 3rd circle. Subtracting the number of the denominator circle from the number of the numerator circle, the answer will be on the 5-3 or 2nd circle when the unity line is set below the cursor. If the operation is the multiplication of the same two numbers, 6 is set under the datum line, and the cursor is set to unity. The 3 is then set under the cursor, and the answer will be on circle 3 plus 5, i.e. circle 8. As there are only 6 circles, the 7th and 8th will be a return to the 1st and 2nd, so that the answer will appear on the 2nd circle. If the circle number of the denominator is greater than that of the numerator, 6 must be added to the latter to make a straight subtraction possible. Thus if 24 (3rd circle) is to be divided by 60 (5th circle), the answer (0.4) will be on the (3+6) — 5, i.e. the 4th circle.

A complication occurs when the unity line on the scale appears between the red datum line and the cursor line, working in a clcckwise direction from the datum line. The number appearing below the cursor must then be treated as though on a continuation of the corresponding circle below the datum line, i.e. the jump in circle number at the unity line must be ignored. For example, if 30 is to be divided by 25, the former number on the 3rd circle is set below the datum line and the cursor is set to the latter. 25 appears on the 3rd circle, but as in this case the unity line appears between the datum line and the cursor in a clockwise direction from the former, the jump from 2nd to 3rd circle at 21.54 must be ignored and the 25 must be assumed to appear on the 2nd circle. The answer (1.2) then appears on the 3-(3-1) or 1st circle.

Similarly, if the calculation is commenced by setting the unity line below the datum line, it must be treated as though it is set on the right of the datum line, i.e. the number of the circle to which the cursor is next set must be reduced by 1. For example, suppose several numbers are to be divided by 24. The unity line is set below the datum line and the cursor is set to 24, which appears on the 3rd circle. For the reason stated above, 24 is taken as being on a continuation of the 2nd circle, and 2 is therefore subtracted from the numbers of the circles on which the various numerators appear. Thus if the numerator is 96 (6th circle) the answer appears on the 6-(3-1) or 4th circle. If the numerator is 72 (also 6th circle) the unity line appears between the datum line and cursor, and the answer will be on the (6-1)-(3-1) or 3rd circle.

The following calculation embodies the several points raised

$$\frac{75 \times 36 \times 12 \times 64}{16 \times 30 \times 24 \times 90 \times 50}$$

and the operations are as follows :—

1. Set unity line below datum line.
2. Set cursor to 16 on 2nd circle. The circle number to be subtracted is 2-1, i.e. 1.
3. Set 75 (6th circle) below cursor. Subtract 1 (from operation 1) from 6. The answer so far is on circle 5.
4. Set cursor to 30 (3rd circle). Subtract 3 from the 5 resulting from the last operation. The answer so far is on circle 2.
5. Set 36 (4th circle) below cursor. Unity line appears between datum line and cursor, so add (4-1), i.e. 3, to the 2 from the last operation. The answer now appears on circle 5.
6. Set cursor to 24 (3rd circle). Unity line still appears between datum and cursor, so subtract (3-1), i.e. 2, from the 5 from last operation. Answer is now on circle 3.
7. Set 12 (1st circle) below cursor. Unity line still appears between datum and cursor, so add (1-1) i.e. nothing, to 3. Answer is still on circle 3.
8. Set cursor to 90 (6th circle). As 6 or multiples thereof can be ignored in the final circle number, no attempt need be made to subtract 6 from 3, and the answer is till on the 3rd circle.
9. Set 64 (5th circle) below cursor. Adding 5 to the last 3, the answer should now appear on the 8th circle. This exceeds 6 by 2, so that the answer now appears on the 2nd circle.
10. Set cursor to 50 (5th circle). Unity line again appears between datum line and cursor. so that 50 must be taken as on the 4th circle. 4 cannot be subtracted directly from 2, and 6 must be added to the circle number resulting from operation 9.