March 25, 1924. 1,487,703

J. M. McG. BARR

CALCULATING MACHINE

Filed July 9, 1923 3 Sheets-Sheet 1

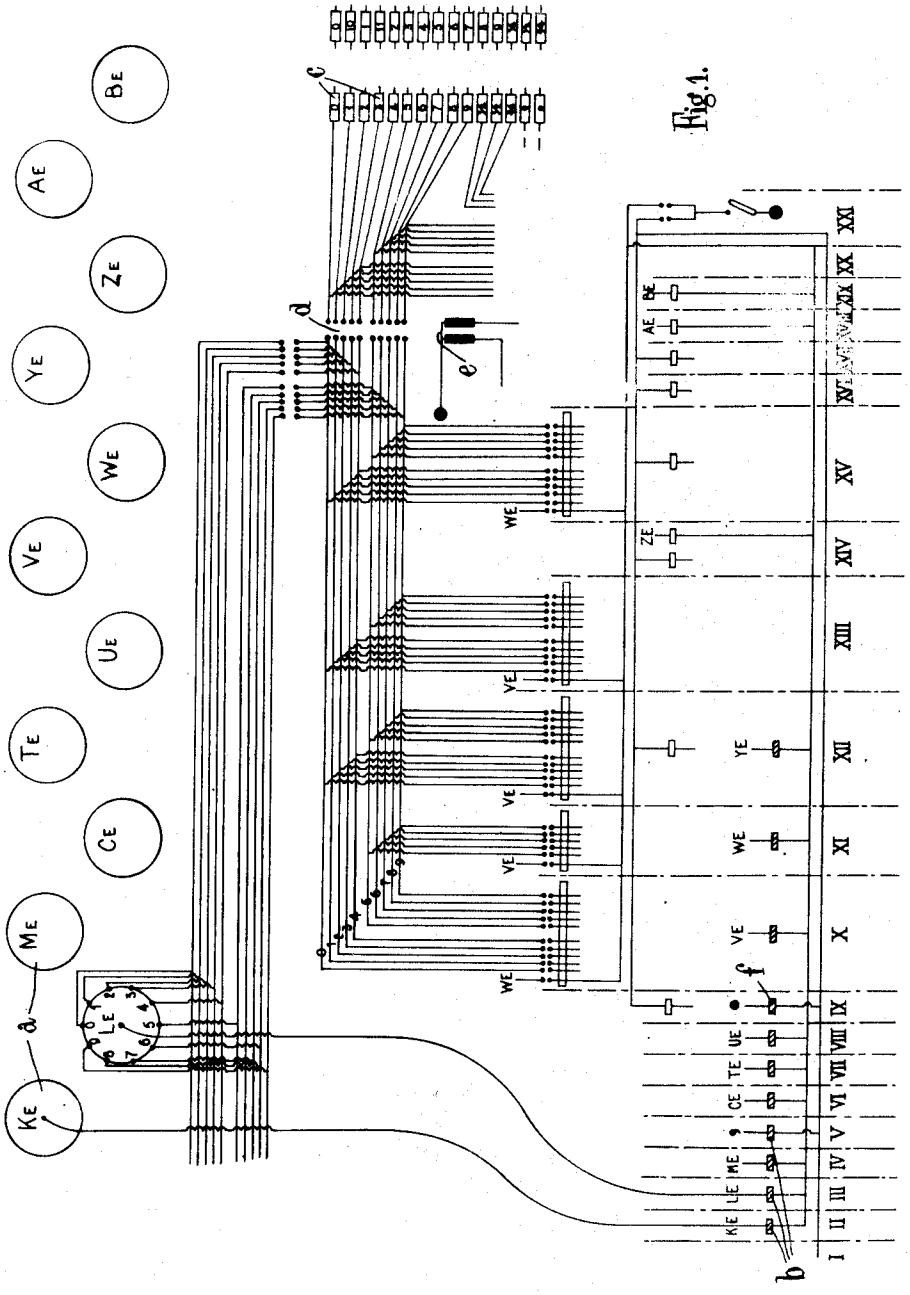

Fig. 1.

Inventor
J. M. McG. Barr
By Marks & Clerk Attys

March 25, 1924. 1,487,703

J. M. McG. BARR

CALCULATING MACHINE

Filed July 9, 1923 3 Sheets-Sheet 2

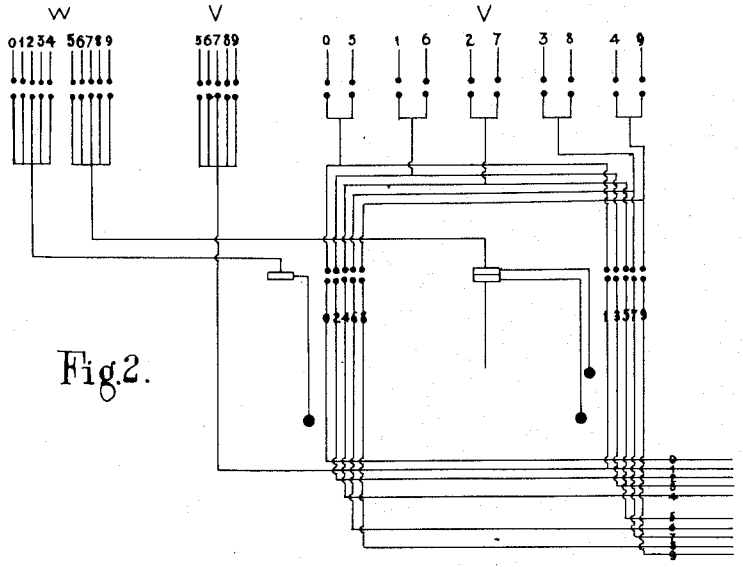

Fig.2.

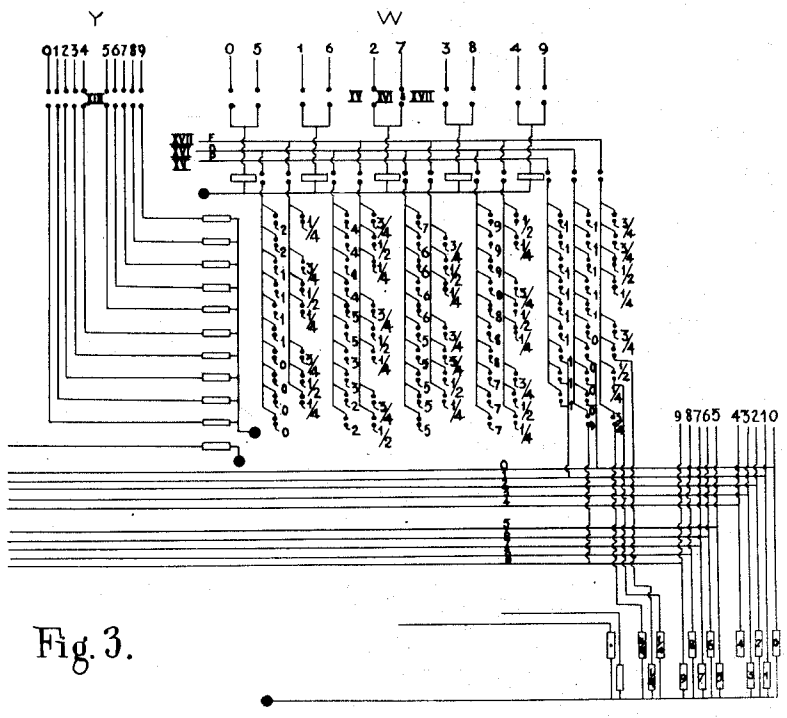

Fig.3.

Inventor
J. M. McG. Barr
By Marks & Clerk Attys.

March 25, 1924. 1,487,703

J. M. McG. BARR

CALCULATING MACHINE

Filed July 9, 1923 3 Sheets-Sheet 3

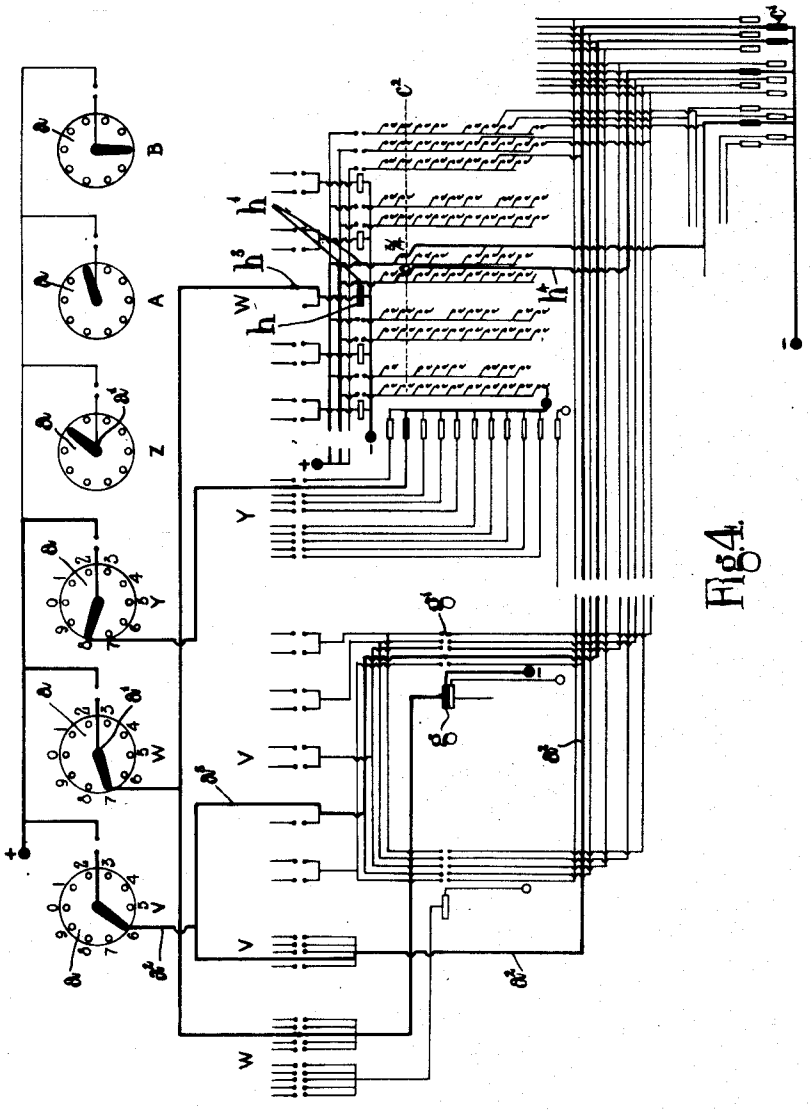

Fig4.

Inventor
J. M. McG. Barr
By Marks & Clerk Attys.

Patented Mar. 25, 1924. 1,487,703

UNITED STATES PATENT OFFICE.

JAMES MARK McGINNIS BARR, OF LONDON, ENGLAND.

CALCULATING MACHINE.

Application filed July 9, 1923. Serial No. 650,503.

To all whom it may concern:

Be it known that I, JAMES MARK McGINNIS BARR, a citizen of the United States of America, and residing at 68 Victoria Street, London, S. W. 1, England, have invented certain new and useful Improvements in Calculating Machines, of which the following is a specification.

This invention relates to calculating machines of the kind in which discrete numbers (by which I mean numbers expressing pounds, shillings, and pence, or tons, hundredweights, quarters, etc.) typed or registered by the operator are converted into decimal or other notation before being transferred to the counting or computing mechanism.

The object of the present invention is to provide calculating machines of the above character with means whereby the decimal or other notation may be converted into any other system of numerics or into a system of discrete numbers either for the purpose of exhibiting these numbers visibly to be read or to cause them to be automatically printed.

The accompanying drawings illustrate diagrammatically one convenient arrangement and disposition of machine in accordance with my invention.

Figure 1 is a diagram showing the computing mechanism and connections to printing arrangements.

Figures 2 and 3 are diagrams representing co-ordinators for converting decimal notation into discrete numbers, and

Figure 4 is a diagram showing certain of the counters and illustrating one example of conversion from decimals on the counters to discrete numbers on the printing or exhibiting mechanism.

In carrying my invention into effect I provide the machine with any number of counters *a* of suitable form, the number of which depends upon the capacity of the machine, and in the example illustrated I have indicated these counters with the letters K, L, M, C, T, U, V, W, Y, Z, A, B, where K represents hundreds of thousands, L tens of thousands, M thousands, C hundreds, T tens, U units, and the letters V, W, Y, Z, A, B represent the numbers following the decimal point, that is, tenths, hundredths, thousandths, etc.

The letter E combined with the counter letters signifies result, since the counters shown are arranged for recording the result of an addition, subtraction or multiplication, while in general the machine would be provided with a second similar set of counters for representing totals.

At the lower part of Figure 1 there are shown a number of contacts *b* which are adapted to co-operate with a brush or the like actuated by a distributor or other means depending upon the carriage position of the typewriter or other factor determining the denomination of any particular key depressed, the respective carriage positions being indicated by the figures I, II, III, etc. to XXI. The distributor is impulsed synchronously with the typing impulses given by the operator, or alternatively by the machine itself automatically when printing an answer. To make the significance of the figures I, II, III, etc. clear let it be assumed that the counters stand as follows:—

K L M, C T U . V W Y Z A B
7 4 0, 0 0 0 . 6 7 8 1 2 5

representing a sterling line, then, since, .678125 of a pound is equal to 13 shillings and 6¾ pence, the machine will print

7 4 0 , 0 0 0 — — I 3
II III IV V VI VII VIII IX X XI XII

— — — 6 ¾
XIII XIV XV XVI XVII

It will be seen that the distributor causes nothing to be printed in the positions IX, X and XIV for a sterling line, thus giving the required spaces between the pounds and shillings and pence.

The printer relays actuating the printing lever of the typing or other printing machine are indicated at *c* and the contacts *d* are adapted to be controlled by a switch *e* which I will refer to as the printer transfer switch.

The arrangement is such that for printing the highest denominations down to and including unity, the figures registered on the

counters are printed by the machine by means of direct connected circuits closed successively for each counter, the counters being each provided with a contact arm a' (Figure 4) which is turned, during the operation of the counters, to a position determined by the number shown on the counter. Thus, if the counter L (for tens of thousands), stands at 4, the distributor, when it moves to the position marked III in the line, will send a current (by means of a brush moved by the distributor) through the appropriate distributor contact b, through the counter arm in counter L E, through the wire 4 leading therefrom, through the corresponding switches d' and d and through the printer relay 4 which prints the figure 4 on the paper in position III which is reserved for the denomination tens of thousands. This operation is performed for any denomination down to and including unity.

When the distributor reaches the position IX it co-operates with the contact f to actuate the printer transfer switch e in such a manner as to open the contacts d, thus breaking the direct connection between the counters and the printer relays.

In such a case the connection from the V, W, Y, Z, A, B counters can only be made to the printer relays through what I term co-ordinators which consists of electromagnets having co-ordinated relations in connection with sets of contacts which operate these magnets and contacts which are operated by the magnets, such that when the value of the first digit is co-ordinated with the second and these with the third and so on I cause to be excited and to operate a magnet appropriate to the pre-calculated converted value of the digits.

Two of such co-ordinators are shown in Figures 2 and 3 with their co-related distributor positions. In these figures the references F, D, P represent respectively fractions of pence, units of pence and tens of pence, and it will be seen that the P, D, F conductors are made alive respectively in the distributor positions XV, XVI and XVII.

The 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 conductors shown in the central part of Figure 1 are also shown in the upper parts of Figures 2 and 3 and by working through any particular example of calculation shown in decimal system on the counters it will be seen that the converted value is printed by the printing mechanism. Thus, taking the above example of the setting of the counters, it has been shown how the higher denominations down to and including unity are printed, and it now remains to be shown how .678125 is converted and printed as 13 shillings and $6\frac{3}{4}$ pence.

Referring to Figure 4 it will be seen that the distributor, on reaching the position X will make the contacts shown for that position which will cause a current to flow from the counter W along the circuit reserved for W at the value 7. This causes the switch g to operate and latch shut. (Note: Various switches remain latched closed until released by the unlatchers at the end of line.) Therefore the contacts g' controlled by g will remain closed until released at the end of the operation. This set of contacts is closed as a preliminary to further actions (to be explained) and in the position X nothing is required to be printed.

The distributor will next arrive at position XI and it is to be remembered that in this position the tens of shillings (if any) are to be printed. In this case the contacts shown are closed and since the counter V stands at 6 a current will traverse the conductor a^2 shown in the example and print, by direct operation of the printer relay c', the figure 1 in position XI.

In position XII, which is the place for units of shillings in the answer, the distributor makes the appropriate contact.

The counter V being at 6 a current is made to flow from the V counter through the conductor a^3 and since g' was previously closed the circuit is completed to print the figure 3 for units of shillings, which is correct in the example chosen. In other words, since V is at 6 and W is at 7 the decimal for pound sterling is .67 etc. and this can only result from a shillings value of 13. If any other example of decimal value were taken the operation for interpretation would be similar and correct results would be attained. This is because, for any system of discrete quantities dealt with I predetermine the co-ordinate meaning of all possible values of the group of digits and utilize their relations to interpret the values and to print the required result.

The next position is XIII and here the distributor utilizes the blank space in the answer to determine which of the set of Y relay switches shall operate.

The counter Y being at 8 a particular relay is operated and this closes a set of predetermined contacts c^2 which analysis of the requirements of sterling values show to be peculiar to the value of Y. That is to say, that when the denomination represented by Y is at a given value there is a set of several particular values for pence which correspond to that given value of Y. As to which of these several values of pence will be required in an answer there is an inherent ambiguity until the concomitant value of W is taken into consideration, and this is done by the distributor in the next position but one. Note: In the next position, i. e., 15, there is in this example no value to be printed. That is to say, in the example chosen, the value of W being 6, when the

appropriate positional contacts are closed in position XVI the correct value of pence will be printed as indicated by the thick lines.

A relay h operated by the current from the counter W closes contacts h' predetermined to be closed by it and these contacts in conjunction with those previously closed by the current from Y counter cause the 6 to be printed.

It must be understood that each of the Y relays when operated from the counter Y close and latch shut a whole horizontal row of contacts (such as c^2), ready for use when the W counter operates to send current through a particular set of horizontal contacts.

When the position XVI is reached the W contacts h^3 shown for this position are closed by the distributor, and simultaneously the wire marked D XVI is joined by the distributor to a positive pole so that a current flows along the wire h^4 to the printer relay 6 and the figure 6 is printed.

In the next position XVII the W contacts h^3 for this position are again closed and simultaneously the wire F XVII is joined by the distributor to the positive pole. In this case in this position XVII current flows to find the fraction ¾ as required, and the ¾ is printed.

If the decimal values chosen as example had been different the results would have been different, but the mode of interpretation would have been the same. It is to be noted that if the value of the W counter had been 4 or 9 a value would have been printed in all these positions XV, XVI, XVII, that is 1, 1 and ¾, meaning tens of pence 1, units of pence 1, fractions of pence ¾. This means, had the example been W counter at 4 or 9 and Y counter at 8 the pence value would have been 11¾.

It is to be understood that all discrete numbers can be interpreted in the manner explained for pounds, shillings and pence provided that it is predetermined by co-ordination what values of decimal digits represent particular results in the discrete system.

Naturally the number of co-ordinating parts employed will vary according to the system of discrete numerics employed, but the relations of distributor, contacts, relays, switches and final printing of digits will follow the line of this invention without a deviation from the principles here laid down.

It will be understood that the foregoing details are given by way of illustration only since the invention may be applied with equal effect and like advantage to any form of calculating machine in which the conversion from the decimal or other notation into some other system of numerics is required before the result can be read on the machine or printed by the machine and I may modify the arrangements for transferring the results from the counters to the printing mechanisms, the means for converting decimals or other notation into other systems of numerics depending upon the character of machine to which the invention is to be applied or any practical requirements that may have to be fulfilled.

Claims:

1. In a calculating machine means for converting a number in the decimal system of notation into the equivalent number or numbers in a denominational system comprising a series of counters, each of which is capable of giving indication of all digits and corresponds to a predetermined position in the decimal system of notation, printing means indicating the number in the denominational system, and electrical means interposed between the printing means and the counters and selectively controlled by the counters, said electrical means controlling the printing means to indicate the number in the denominational system.

2. In a calculating machine the combination of a series of counters, each of which is capable of giving indication of all digits and corresponds to a predetermined position in the decimal system of notation, said counters indicating a decimal fraction of pounds sterling, means for indicating the equivalent in shillings, pence and fractions thereof, a plurality of electric circuits selectively controlled by the decimal counters to convert the decimal fraction into the equivalent in shillings, pence and fractions thereof, and means for operating said first mentioned means.

3. In a calculating machine, a series of counters indicating an integral number of pounds sterling, a series of counters indicating a decimal fractional number of pounds sterling, a series of printer relays, means whereby the said printer relays are electrically connected to and selectively operated by the first series of counters until visual indication of the integral number of pounds sterling is transmitted, and means whereby said printer relays are disconnected from said first series of counters and electrically connected to said second series of counters, a plurality of electrical coordination circuits interposed between the said second series of counters and the relays whereby the relays are caused to indicate the equivalent number of shillings and pence.

4. In a calculating machine, a series of counters indicating an integral number of pounds sterling, a plurality of electrical circuits controlled by the said counters, printer relays in the said circuits, means for electrically connecting said relays to said counters and for disconnecting said relays from said counters after the printing of the

integral number, a second series of counters indicating a decimal fraction of pounds sterling, a plurality of electrical circuits controlled by the second series of counters and connected to said series of printer relays to convert the fraction of pounds sterling into the equivalent of shillings and pence.

5. The structure recited in claim 4 in combination with a series of relays for the indication of fractional pence and coordinator electric circuits responsive to and controlled by the decimal fractional counters.

In testimony whereof I have signed my name to this specification.

JAMES MARK McGINNIS BARR.