Nov. 21, 1950 I. E. BIRDSALL 2,530,447

ABACUS

Filed Feb. 5, 1948 2 Sheets-Sheet 1

FIG. 1.

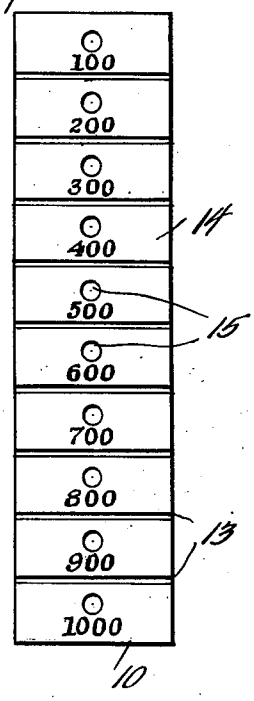


FIG. 2.

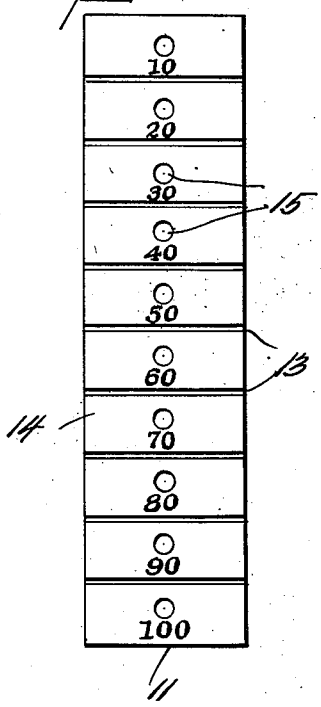


FIG. 3.

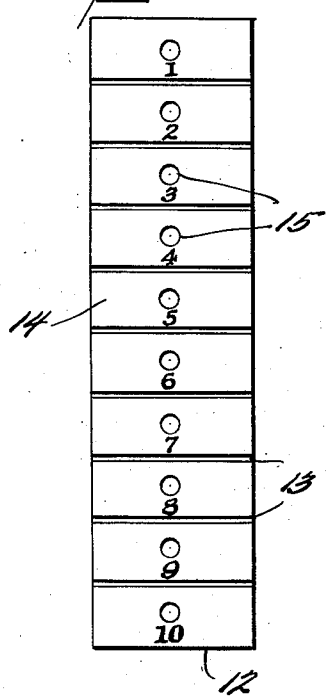


FIG. 4.

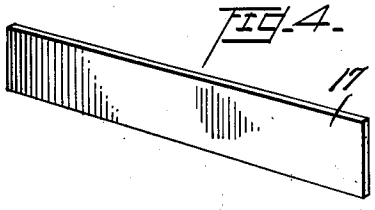
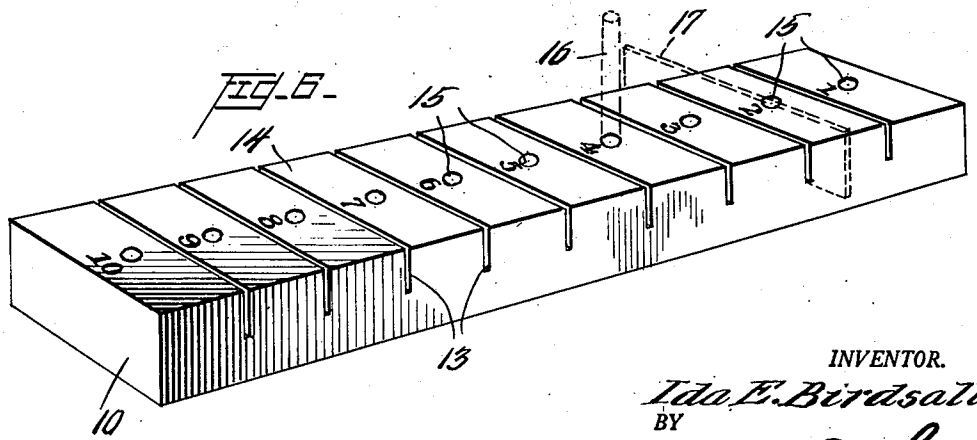


FIG. 5.



FIG. 6.



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Nov. 21, 1950 I. E. BIRDSALL 2,530,447

ABACUS

Filed Feb. 5, 1948 2 Sheets-Sheet 2

FIG. 7.

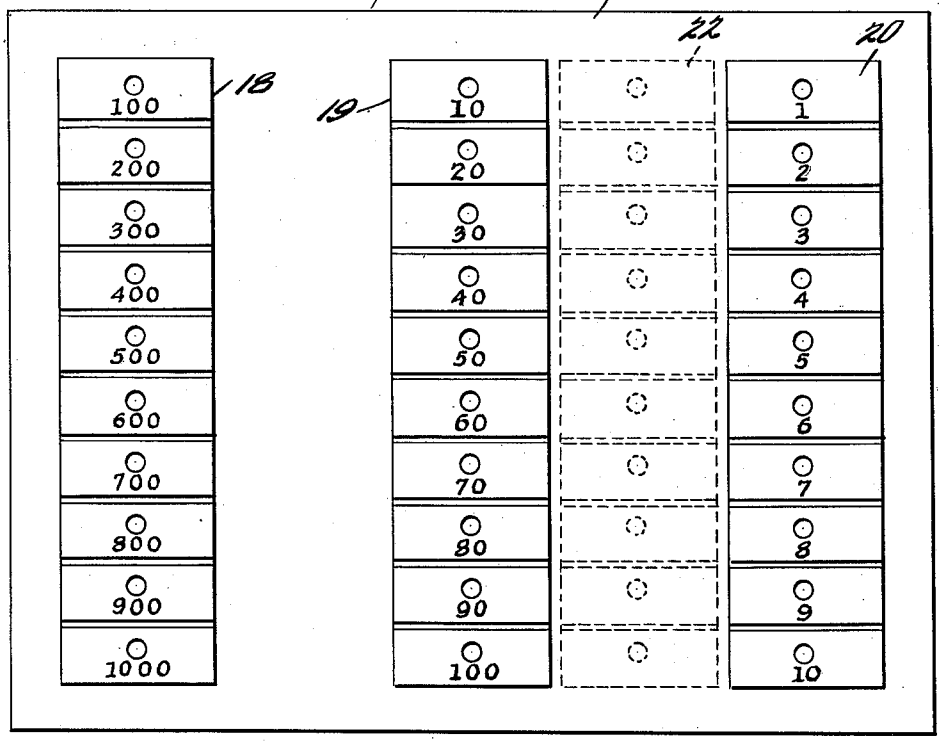


FIG. 8.

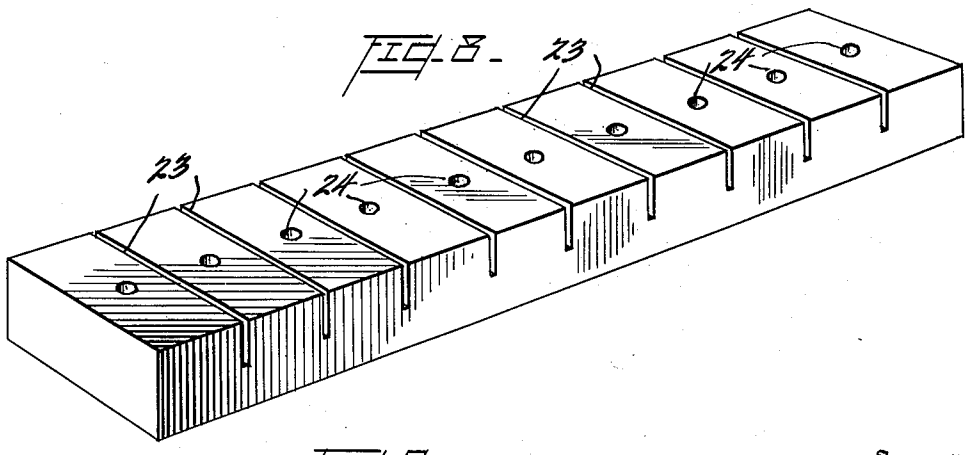
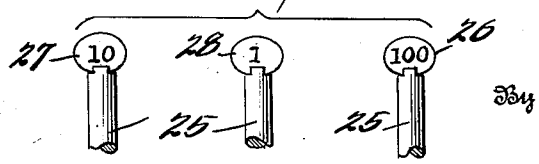


FIG. 9.



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UNITED STATES PATENT OFFICE

2,530,447

ABACUS

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Application February 5, 1948, Serial No. 6,399

1 Claim. (Cl. 35—33)

1

My invention relates to a modernized and improved abacus, and it is an object of the same to provide an abacus that shall preserve all the advantages of speedy and accurate calculation found in the old and well-known type of abacus while also having improvements tending toward facility of use, economy of construction and ready mutability for use under various conditions.

Referring to the accompanying drawings, which are made a part of this application and in which similar reference characters indicate similar parts:

Figs. 1, 2 and 3 are plan views of three units, one or more of which may be used in combination for making calculations,

Fig. 4 is a perspective of an element used with the devices shown in Figs. 1, 2, 3 and 6,

Fig. 5 is a perspective of another element that is used in making calculations,

Fig. 6 is a perspective of a unit, illustrating the manner of operation,

Fig. 7 is a plan of a modified form of the invention,

Fig. 8, a perspective of a part shown in Fig. 7, and

Fig. 9, a detail of parts shown in Fig. 7.

In the drawings, reference characters 10, 11 and 12 indicate generally three units of the device of my invention, which units are preferably formed as separate blocks that can be placed in close juxtaposition side by side, but which can be formed as upstanding projections on a base that can be integral with the blocks or affixed thereto in any desired manner or for some uses the blocks will be provided with means for temporarily attaching them removably to any suitable base for holding them in desired relationship. Preferably the units are each of different color from the others of a set.

Each of the blocks is shown as having slots or saw cuts 13 at intervals, the cuts preferably numbering nine, so as to divide the upper surface of a unit into ten similar parallelograms. At a suitable point on each of said faces a hole 15 is provided, preferably at the center of the face, for receiving the lower end of a pin 16, such pins being provided in number equal to the number of holes or substantially so, and being made of wood or other conveniently available material. Preferably the pins for each block of a set are of different color.

For insertion in the slots 13 I provide strips of stiff material which should be smooth and hard and so proportioned as to fit easily in the slots and be readily removable therefrom. It is desirable that the strips be made of so-called plastic material that is relatively free from any tendency to break or split and which can be washed without damage thereto. Usually there will be more than one strip for each block, and they may be

2

of different colors so that the strips and the pins may be of a different color from the block for contrast. Obviously also the block, the pins, and the strips therefor may each be of different color, or all of the same color, according to the conditions of use or because of personal preference or for any other reasons.

A numeral is located adjacent each hole 15, the numerals on the first block at the right being of the order of units, those on the next block to the left being of the order of tens, those in the third of hundreds, and so on as far as may be desired.

In the use of the device of my invention three blocks may be located near one another as shown in Figs. 1, 2 and 3 and pins set up in the holes thereof as indicated in dotted lines for one of the holes in Fig. 6. For purposes of computation strips 17 will be inserted in appropriate slots. For example if the number 67 is to be added to the number 211, the operator may set a strip in the groove below the space marked 60 in the middle column and another below the space marked 7 in the units column; then insert three strips respectively in the slot one space below the occupied one in the first column at the right in the next slot below the occupied one in the middle column, and a third in the slot below the number 200 in the left-hand column. The order described may obviously be varied. Then the result may be read at once as 278 by reading across the board just above the strips. In the case of subtraction the operations are the reverse of those just described. The pins could be omitted, but are of advantage as affording visual means to assist in speedy and proper placement of the slips 17, and also they may be relied on for computation by unskilled persons, the blind, and under special conditions, as where the light is dim or wanting.

Where the sum of numbers in a column exceeds ten the operation known as carrying is involved, and here the strip that would be inserted in a slot is carried over to the next column. If, for instance, the sum of 67 and 124 is required, the strips for one number are first set up, as below 60 in the middle column and below 7 in the units column. Then the setting up of the next number proceeds from the units column onward by first attempting to insert the next strip four spaces below the slot numbered 7, which, of course, cannot be done as the sum exceeds 10 by one. So the strip is set up in the middle column one space below the one already in that column or at the seventh position. Now another strip is inserted two spaces lower down in the middle column, or at the ninth place. Then a strip is set into the first space in the hundreds column and the result again can be read by reading the numerals above the lowermost slots in the respective columns, i. e., 191. The sequence described is merely illustrative, as will be obvious. For

subtraction the reverse operation is practiced. The highest sum that can be computed on the blocks, as shown, is 1110.

In the teaching of the operations of adding and subtracting, which involve "carrying" in the one case and "borrowing" in the other, a useful expedient is disclosed in Fig. 7. Here there are shown three blocks 18, 19 and 20 which may have the same construction as above described or may be different within the limits of my invention, and the number of which may vary, as above explained. In this instance the blocks are fixedly mounted upon a base 21 or may be made integral therewith or removably affixed thereto, as preferred.

Another block 22 (Fig. 8) which I call an insertion block, is formed as a separate member and may be placed between any pair of blocks on the base 21, according to the columns where computations are being made. The block 22 has nine cross slots 23 and ten holes 24, as in the case of the other blocks, and the base may be formed with some means coacting with the block 22 for holding its slots in line with those of the fixed blocks, if desired, e. g., a slight depression may be formed between the pairs of fixed blocks into which the bottom portion of the removable insertion block may fit to hold it against accidental movement, or it may be a duplicate of the other blocks except for the omission of any numerals adjacent the holes 24.

In the use of the modified form of the invention for addition the insertion block is placed between the appropriate fixed blocks, dependent on whether units, tens, hundreds, etc. are being added. If two numbers, as 6 and 8, are to be added in the column at the right of the insertion block six pegs can first be placed in the holes of that row, then eight more pegs being attempted to be added would fill the remaining holes with an overflow of four pegs, which overflow pegs would then be placed in the insertion block, thus forming a group of fourteen pegs. Now these fourteen unitary pegs are to be changed into one ten and four digits and the insertion block removed. As a result, the children come to understand that six plus eight amounts to fourteen and that fourteen can be changed into one ten and four units for convenience, the one ten being placed in tens row below the tens already there. Supposing that the numbers to be added are 26 and 28, the operation may proceed just as above outlined except that two tens are already in the tens column and the placing of the third ten must be followed by placing the other two tens of the number 28 below those now in the second column, when the total of 54 can readily be read from the abacus, the insertion block being removed or not as preferred.

Supposing that 28 is to be subtracted from 46, the insertion block is placed between the units and tens columns and one ten is removed from the four tens standing in that column. The ten is converted into ten ones and they are placed in the insertion block. Now the units block plus the insertion block contain sixteen ones, from which he can readily remove eight, leaving eight ones, all of which he will place in the ones column, and the insertion block removed.

This is the first step, and as a second step the child will remove two pegs from the tens row, i. e., the two tens showing the number 28, and thus leaves one peg standing in the tens row, therefore the answer stands as 18.

It will be understood that after the pupil becomes expert in the use of the abacus with the insertion block he will ordinarily tend to dispense with the same, since the operations of carrying and borrowing become easy and the insertion block is no longer needed.

As an aid in teaching money values I may provide ten pegs 25 for each column, with flat heads 26, 27, 28, etc., as may be needed, the heads of the ten pegs of each set being provided respectively with numerals; to-wit, all pegs for the right-hand column to bear the numeral 1; all pegs for the second fixed columns to bear numeral 10; all pegs for the third fixed column (counting from the right) to bear numeral 100 and so on.

Now to demonstrate that ten units equal one ten, there will be set up in the right-hand column ten pegs bearing numeral 1 on their heads, or otherwise appearing on said pegs. As in changing money, i. e. changing ten pennies to one dime, these ten pegs may be removed from the board and a single 10 peg set up at the top of the second fixed column, where the numeral below it indicates the value.

In the first column the value of four 1's in the first four holes is indicated at the lowermost occupied hole. In like manner the first column may be filled four times, for example. Then after each filling the ten 1's are removed and a 10 added to the second fixed column and, after four such additions the numeral 40 below the lowest occupied hole indicates the total, showing that four 10's equal 40, five 10's equal 50, etc.

In like manner it may be shown that ten 10's equal 100, four times ten 10's equal 400, ten 100's equal 1,000, etc.

It will be obvious to those skilled in the art that many variations may be made in the devices herein disclosed, all without departing from the spirit of the invention; and, therefore, I do not limit myself to what is shown in the drawings and described in the specification, but only as indicated in the appended claim.

Having fully thus described my invention what I claim is:

A calculating device comprising a base, parallel elongated elements fixedly located on said base, said elements having transverse slots dividing the surface of each element into a plurality of fields each having a hole adjacent one of said slots, pegs adapted to fit in said holes, slips of sheet material adapted to fit in said slots, and a removable insertible block proportioned to fit between two of said parallel elements, said insertion block having a number of slots and holes spaced equally with the slots and holes of the adjacent parallel elements.

IDA E. BIRDSALL.

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