(Model.)

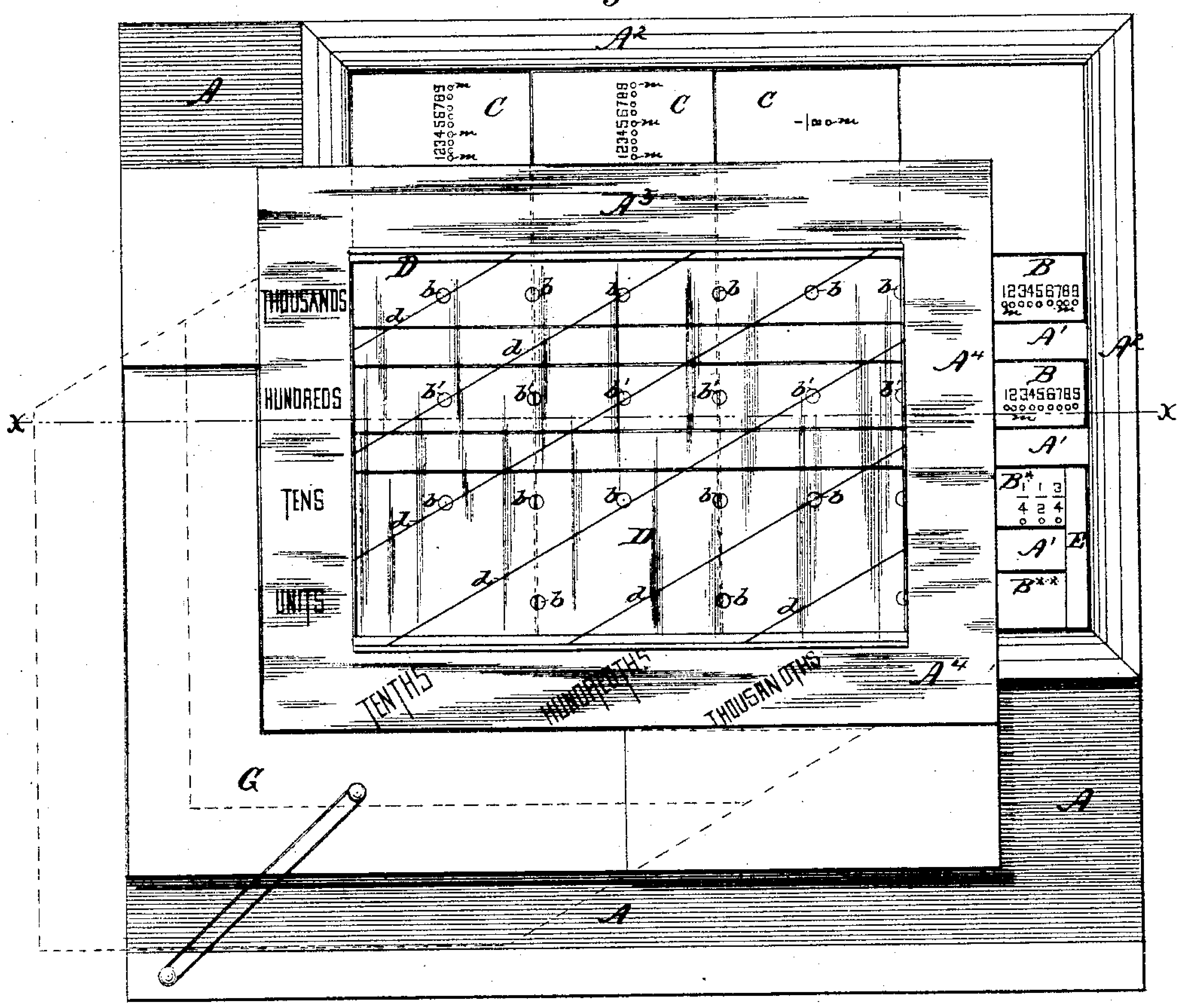
3 Sheets—Sheet 1.

I. E. TALLMAN.

CALCULATING MACHINE.

No. 287,192. Patented Oct. 23, 1883.

Fig. 1.



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(Model.) 3 Sheets—Sheet 2.

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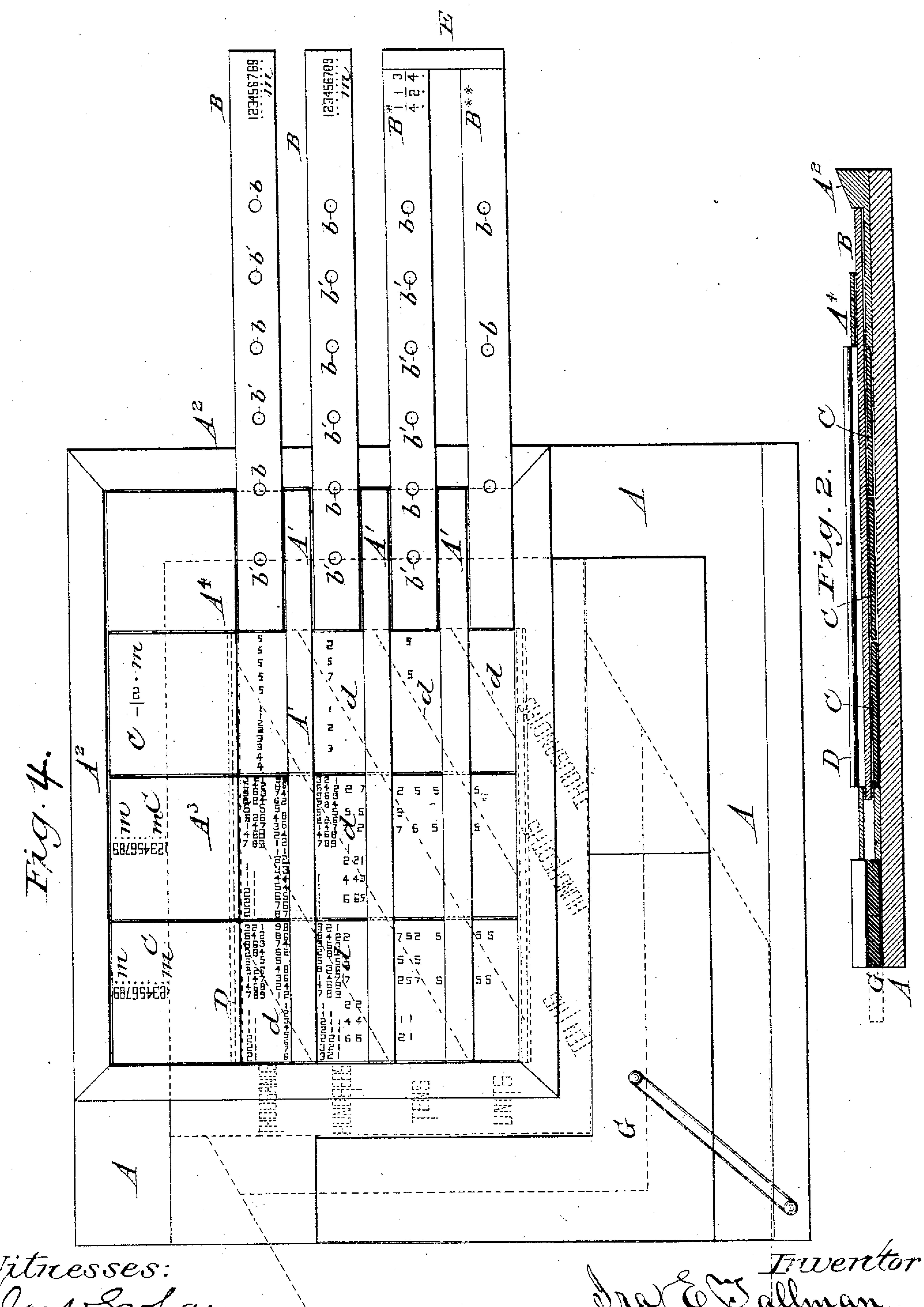

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(Model.)

3 Sheets—Sheet 3.

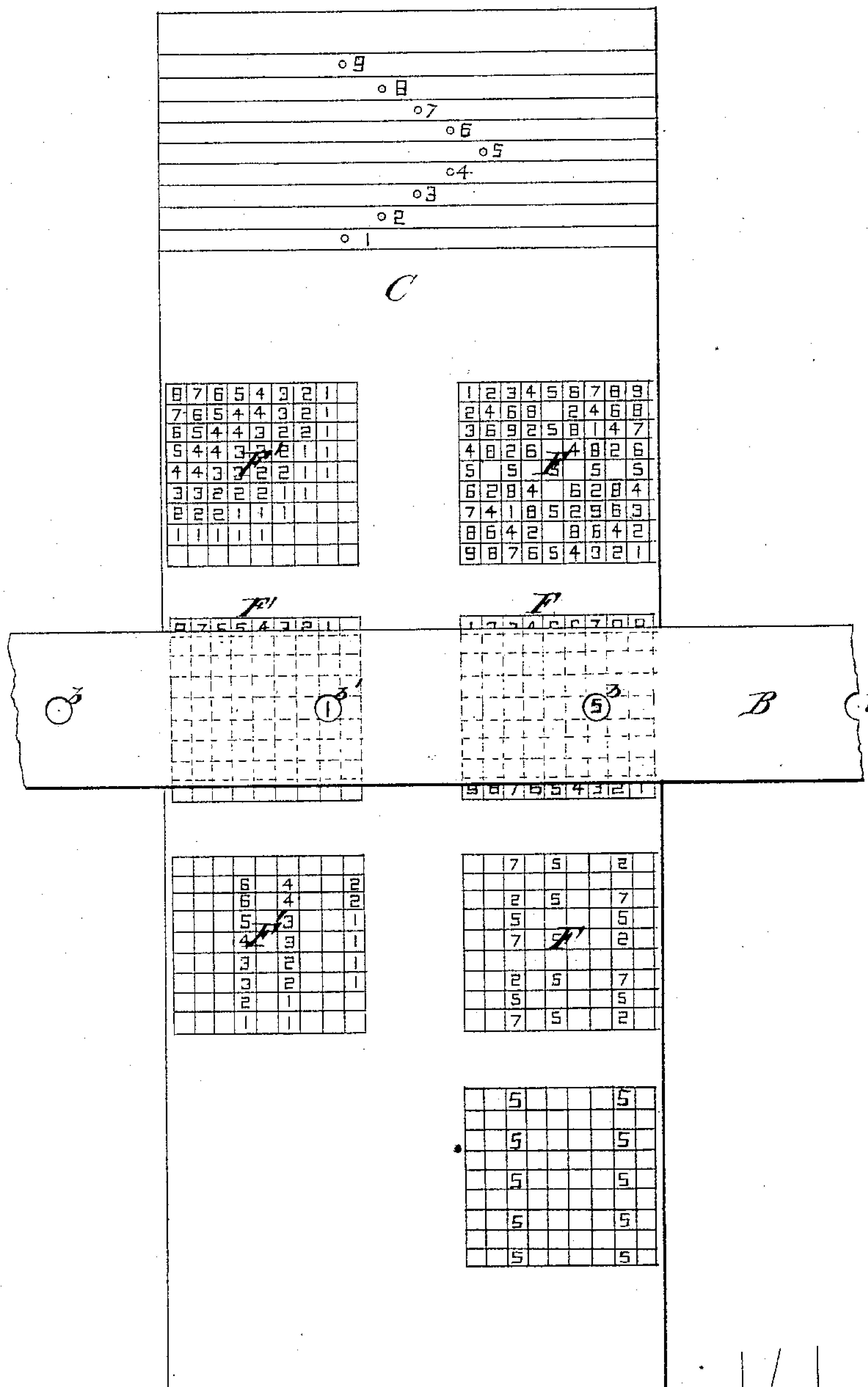
I. E. TALLMAN.

CALCULATING MACHINE.

No. 287,192.

Patented Oct. 23, 1883.

Fig. 3.



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UNITED STATES PATENT OFFICE.

IRA E. TALLMAN, OF PATERSON, NEW JERSEY.

CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 287,192, dated October 23, 1883.

Application filed May 25, 1883. (Model.)

To all whom it may concern:

Be it known that I, IRA EDGAR TALLMAN, of Paterson, Passaic county, in the State of New Jersey, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

My improved machine is based on the principle of what are known as "Napier rods," in which a number of rods or strips of material are placed parallel to each other and give the desired results by shifting them in position the one relatively to the other, the results being indicated by figures previously impressed on the faces of the rods and brought into juxtaposition by the shifting. I employ analogous rods or bars—one for the units, one for tens, &c.—similarly placed, but made wider, so as to carry more figures; and I provide rods or bars extending across the first and main set and capable of being placed transversely, which cross-bars are provided each with holes, so that they conceal all the figures, except the one or two in line with the holes. The transverse bars are shifted according to one of the quantities, and the vertical bars are shifted according to the other. The result presents through the holes in the transverse bars the figures on the vertical bars, which give the required amount. The holes in one of the transverse bars give the units, the holes in the next transverse bar above give the tens, and so on up to any desired number. A corresponding number of bars may extend below the units, giving the decimals. The sums thus given require to be added together; but I have devised means for greatly facilitating this latter operation. Inclined bars, or simple guide-lines on a plate of glass in front of the whole, aid the eye in running across and ascertaining all the tens in the several amounts. The next inclined series gives all the hundreds, and so up and down. The product therefore requires, in fact, to be written but once. Assuming that there are no decimals, the operator looks at the number given in the hole in the unit inclined space and writes down the figure. Then, mentally adding the several figures found between the next pair of inclined lines, and counting them all for tens, he writes down the right-hand figure of the sum thereof, as the ten, and carries the other figure or figures to the left thereof into the third column, and so on. Marks are provided with suitable plain figures, to aid in adjusting the several bars in their positions. Means are employed for insuring sufficient friction to hold them with reasonable firmness in their several places, where they may be adjusted. An easily-operated slide is provided for readjusting all the bars to zero after each operation, ready to commence the next.

The device may be conveniently made of a size like an ordinary checker-board. The strips may be of pasteboard, or other substantial material of sufficient thickness. I can use metal, ivory, hard rubber, or fine-grained wood. The several figures may be printed in ink, or engraved, or otherwise impressed; or both these means may be adopted for having the several figures clearly, legibly, accurately, and permanently placed.

I have devised means of multiplying with the most commonly-used vulgar fractions without requiring the operator to know the decimal equivalents. It lies in marking the proper number of stiffly-connected bars with the figures for multiplying by the required decimals, and engraving or otherwise marking on the projecting ends of the bars the vulgar fractions alone, or the vulgar fractions and also their decimal equivalents.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a plan of my entire machine ready for operation, adjusted to zero. Fig. 2 is a vertical section on the line *x x* in Fig. 1. Fig. 3 is a plan view, representing a portion of a transverse bar and a portion of a vertical bar on a larger scale. Fig. 4 is a face view of the main portion with the transverse bars drawn out and the front glass, with its frame, removed.

Similar letters of reference indicate corresponding parts in all the figures.

A is a foundation-board, and A' A^2, &c., strips of the same or different material, glued or otherwise firmly secured thereon, forming, together with the foundation-board, the fixed frame-work of the machine.

B are transverse bars, mounted between suitable guiding-strips, A'. They are provided with holes *b b'*, as shown.

C are the vertical bars in rear of the transverse bars B. These vertical bars C carry the figures. In front of the whole is a plate of isinglass, D, having diagonal lines *d* plainly marked thereon.

The figures are arranged in squares F F′, one square to be presented to each hole *b* *b*′. Each square has eighty-one equal spaces, the square being divided into nine equal parts, both transversely and vertically. If we hold one of the bars C in position, and shift a bar, B, the upper row of figures in its several squares is presented to the several holes *b* *b*′. The changes of position of one of the transverse bars B will present through the holes *b* *b*′, in succession, all the several figures produced by multiplying one by the given figure which is represented by such horizontal bar. To aid beginners, the framing A^3, opposite the margin of the spaces between the inclined lines *d*, should be marked with units, tens, hundreds, and below the units with tenths, hundredths, &c. To facilitate the adjusting of the bars B and C in their required positions, the holes *m* in the projecting ends are distinguished by figures.

The bars C have, corresponding to each of the two holes *b* in each of the transverse bars B, two squares, F and F′, side by side, a little distance apart. The changes of position of the two bars are never sufficient to take the hole *b* entirely away from the square F, or to take the hole *b*′ entirely away from the square F′. Each change of a bar, C, upward or downward presents to the hole *b* a different horizontal row of the figures in the square F, and presents to the hole *b*′ a corresponding horizontal row in the square F′. Each change of the position of one of the transverse bars B presents to the hole *b* a different vertical column of figures in the square F, and presents to the hole *b*′ a corresponding different vertical column in F′. It will now be seen that the hole *b* in the units' transverse bar B can, by shifting the two bars B and C, be brought into the right position for multiplying any of the nine digits by the same or another of the nine digits, and that for each multiplication there is a distinct space in the square F, which will be presented to the hole *b*. The figure stamped or otherwise produced on that portion of the square is the last figure of the product of those two numbers. The use of the other square, F′, is to similarly present the tens of the product when the figures are sufficiently high to make tens. Hundreds are never required in working with our ordinary decimal notation, because the squaring of the highest number, nine, is only eighty-one, which requires but two figures, and consequently calls for but the two squares F′ and F.

One end of each bar B and of each bar C is exposed. A series of nine small equidistant holes, *m*, on the exposed end of each bar, at the proper distance apart, serves, by inserting a point in one of the holes and moving it inward, as a means both of conveniently moving the bar and of readily engaging it to insure its being stopped at the right point. To aid learners, the several holes are marked, respectively, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Suppose I seek to multiply 4 into 6. By inserting the bodkin in the hole 4 in the unit vertical bar C, and moving the bar until the bodkin is arrested by its contact with the edge of the strip A^3, I insure that the bar is placed in the exactly correct position to multiply by 4. Then, by inserting the bodkin in the hole 6 in the unit-bar B, and moving it until the bodkin is arrested against the edge of the strip A^4, I am certain that the holes *b* and *b*′ are set in the correct position. Then, by inspecting the figures presented through the holes *b* and *b*′ I read at once the product 24, finding the 4 in the right-hand hole, *b*, and the 2 in the left-hand hole, *b*′.

The same process is followed with no more complication in multiplying other numbers together. Thus to find the number of hours in a year of three hundred and sixty-five days we shift three of the vertical bars C, placing the bodkin in the hole 5 in the unit-bar and moving it down, then inserting the bodkin in the hole 6 in the tens-bar C and moving it down, and finally inserting the bodkin in the hole 3 in the hundreds-bar C and moving it down, then inserting the bodkin in the hole 4 in the units-bar B and moving it to the left, then inserting the bodkin in the hole 2 in the tens-bar B and moving it to the left. The multiplying is now effected, and it only remains to read the result by the aid of the inclined lines. We find in the inclined column units no figure. We set down as the units 0. In the next inclined column, tens, we find 2 and 4, which, added, produce 6. We set down the six tens. In the next inclined column, hundreds, we find 2, 1, 2, and 2, which, added by a mental operation, as before, make 7. We set down the seven hundred. In the next inclined column, thousands, we find 6, 1, and 1, which, added, make eight thousands, which we write down, and read 8,760. The two transverse bars below the units-bars are marked B* and B**. These are connected rigidly together by a cross-bar, E, glued or otherwise firmly secured to the bars B* and B**, so that the moving of one of these bars will move the other. This is to facilitate the multiplication by the vulgar fractions ¼ ½, &c. I will designate the transverse bar E and its several attached bars B* B**, &c., when necessary, by the single term "fraction-bars." If it is required to carry the subdivision to eighths, there should be another transverse bar correspondingly connected to these two, so as to provide for three decimals, and if to sixteenths, there should be four bars connected, to provide for four decimals. These bars, thus harnessed together for executing the vulgar fractions, may at any time be instantly drawn out and laid aside and their places filled by corresponding bars movable separately. Then, by taking out the several bars C C′, &c., and substituting others figured at their lower ends, where they pass under these decimal-bars, in the same manner as in the parts above, the machine may be used for calculations of the ordinary character, adjusting the bars for the decimals in the same manner and with the same effect as the several bars for the units, tens, &c. The slide for readjusting the bars to zero is marked G.

Modifications may be made in the forms and proportions. Instead of holes *b b'*, I can make those portions of the bars transparent. I propose in some cases to use very small figures, and to provide lenses at *b b'*, to magnify the figure which is presented thereto, while the other figures are either concealed or rendered less prominent by being not magnified. I can use bars B with deep notches in one edge, to serve instead of the holes *b b'*. It is only essential that the figures required—one for each of the corresponding squares of figures in the several bars C—be exhibited and pointed to or indicated, so that they can be instantly distinguished from other associated figures in the several squares.

Instead of fastening together two or more of the bars for the vulgar fractions, I can use one bar wide enough to do the whole. To make this substitution it is necessary simply to take out the partition A' between the two bars B* B** and introduce one wide enough, with the several figures in the right positions thereon.

I claim as my invention—

1. In a calculating-machine, a series of parallel bars, C, bearing the squares F F', figured as described, in combination with the series of transverse bars B, having each two holes or indicating-points, *b b'*, arranged for joint operation, as herein specified.

2. In a calculating-machine, the fixed bars A^3 and A^4, in combination with the two series of bars B and C, one carrying figures and the other provided with the apertures or indicating-points *b b'*, and having a portion of the length of each bar provided with equidistant holes *m*, arranged to serve with an instrument engaged therein in adjusting the several bars and causing them to be stopped by the bars A^3 A^4, as herein specified.

3. In a calculating-machine having two series of bars, B C, equipped substantially as shown, the rigid connecting means E, connecting two or more decimal-bars, to facilitate the calculation with vulgar fractions, as herein specified.

4. In a calculating-machine having two sets of bars, B C, equipped substantially as shown, the slide G, adapted for rapidly and easily replacing the whole series to their zero positions, as herein specified.

5. The calculator herein described, consisting of the fixed frame having longitudinal and transverse guides, the slides moving in directions at right angles to each other, and the transparent plate having inclined lines, all combined and adapted to serve as and for the purposes set forth.

In testimony whereof I have hereunto set my hand, at Paterson, New Jersey, this 21st day of May, 1883, in the presence of two subscribing witnesses.

IRA EDGAR TALLMAN.

Witnesses:

FRANK VAN CLEVE,

THOMAS W. RANDALL, JR.