

H. R. GRIFFEN, DEC'D.
 C. S. GRIFFEN, ADMINISTRATRIX.
 CALCULATING OR COMPUTING MACHINE.

APPLICATION FILED MAR. 8, 1906. RENEWED MAY 20, 1910.

979,391.

Patented Dec. 20, 1910.

13 SHEETS—SHEET 1.

Fig. 1. a

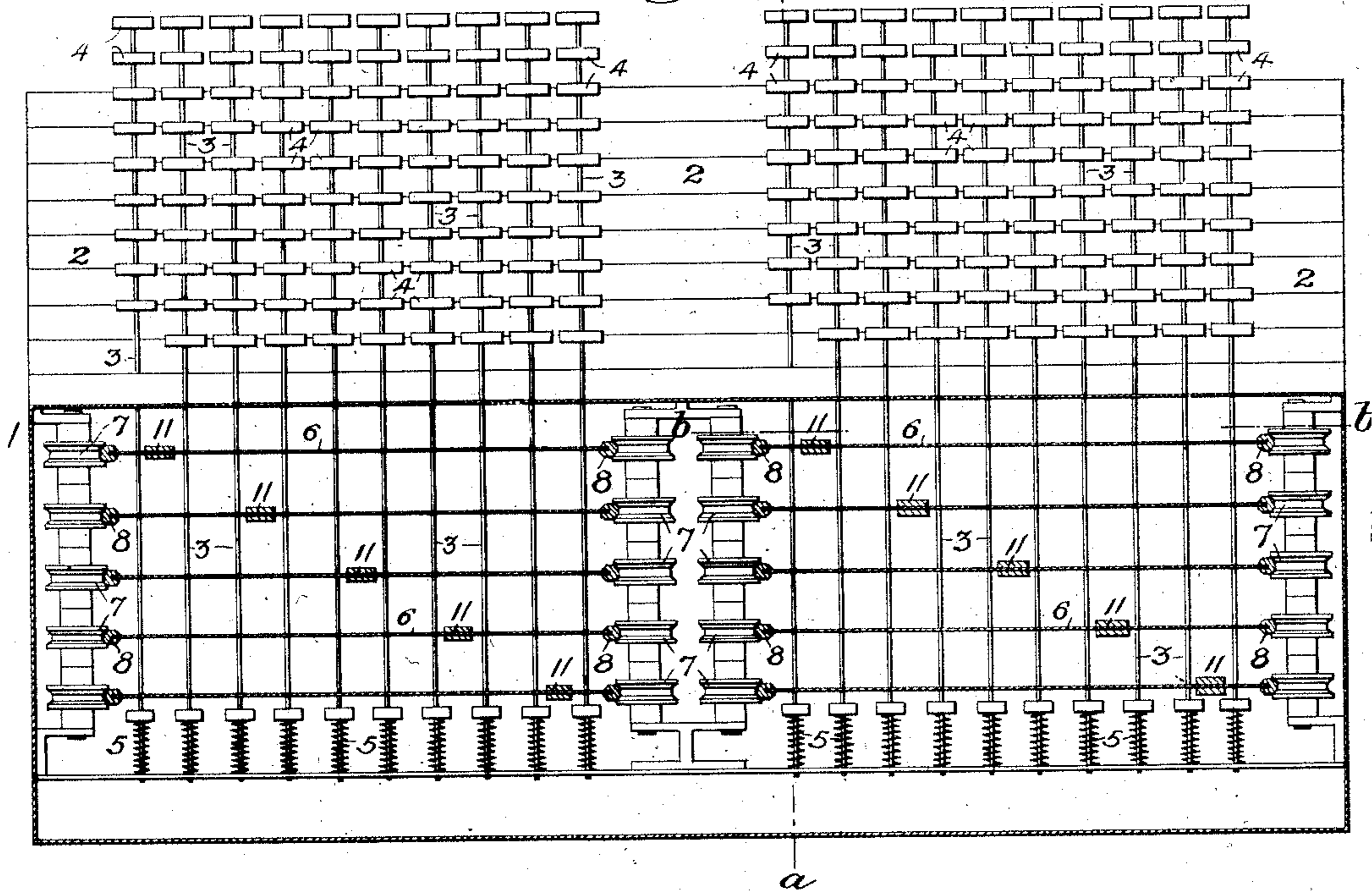
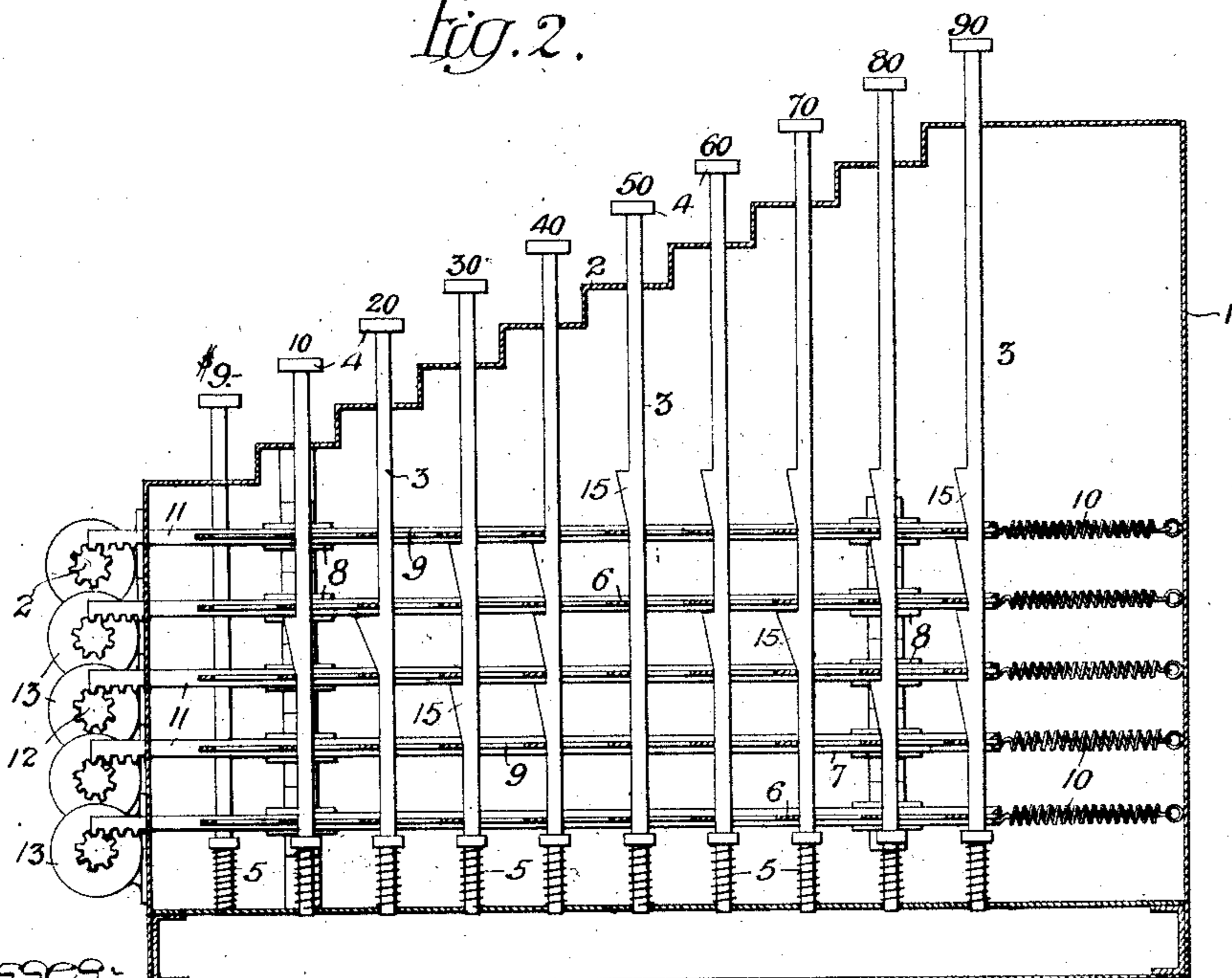


Fig. 2.



Witnesses:

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Augustus K. Oppes

Inventor:

Henry R. Griffen

by his Attorneys;

Norman & Norman

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13 SHEETS—SHEET 2.

Fig. 3.

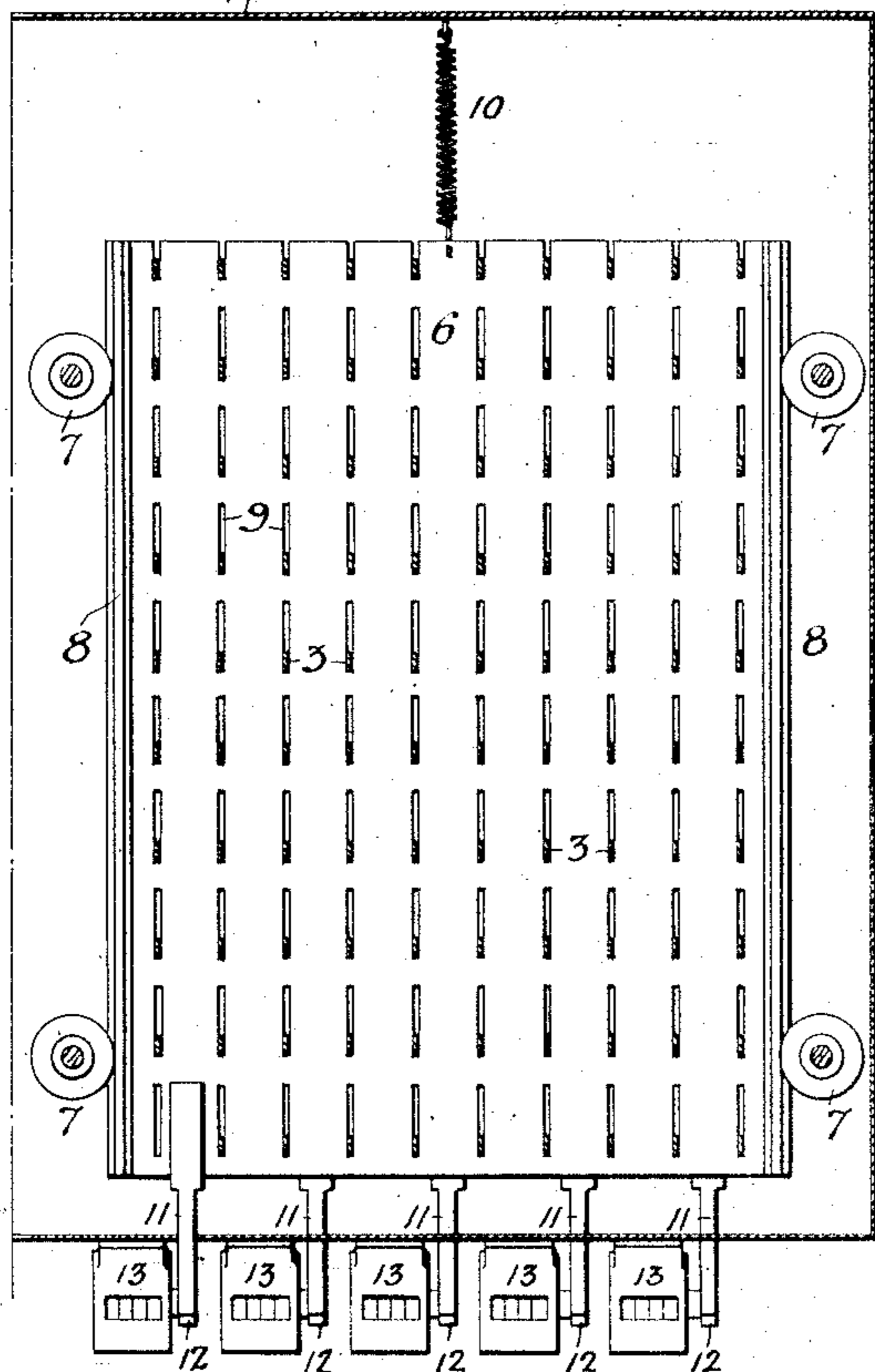


Fig. 14.

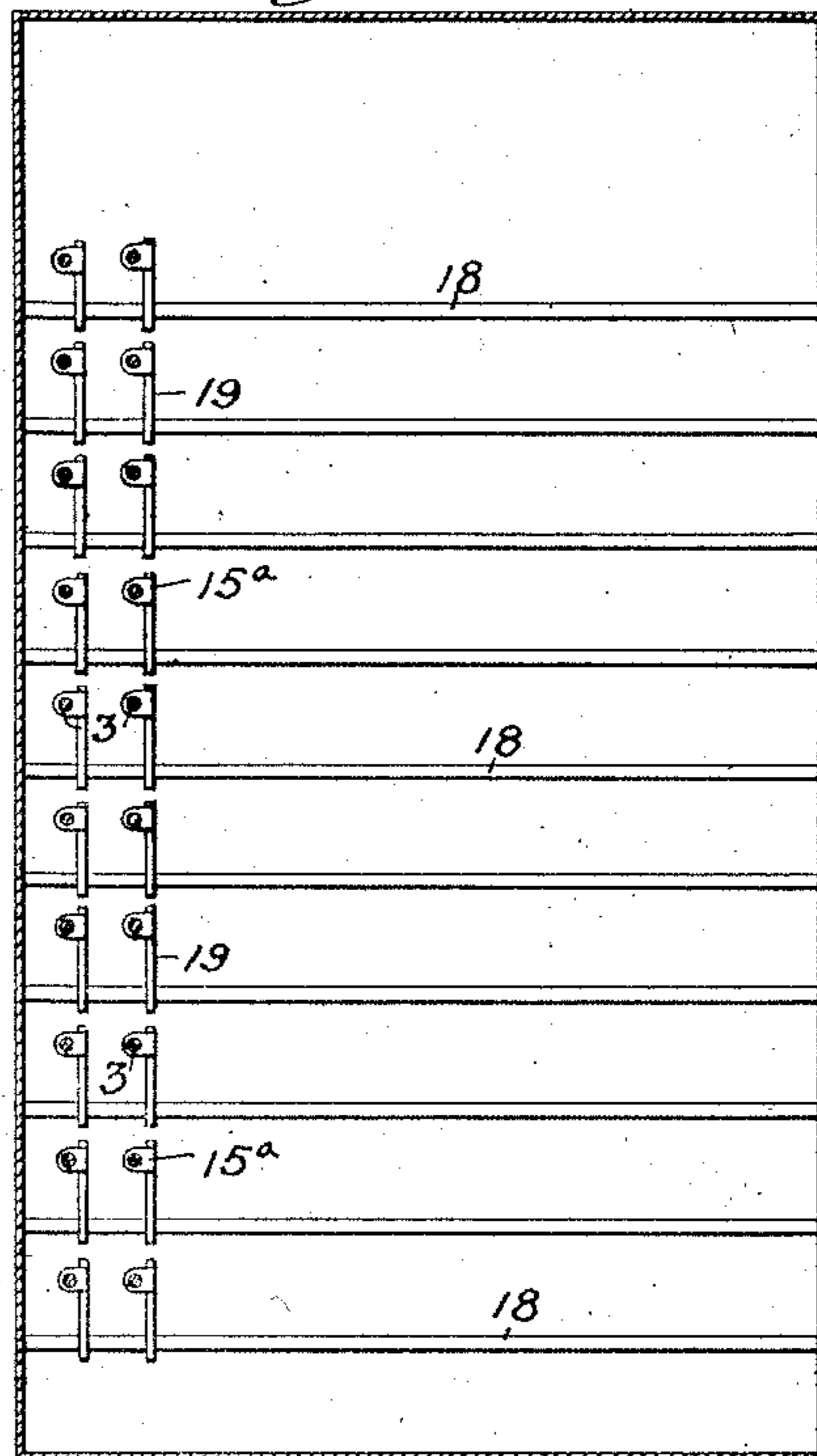


Fig. 15.

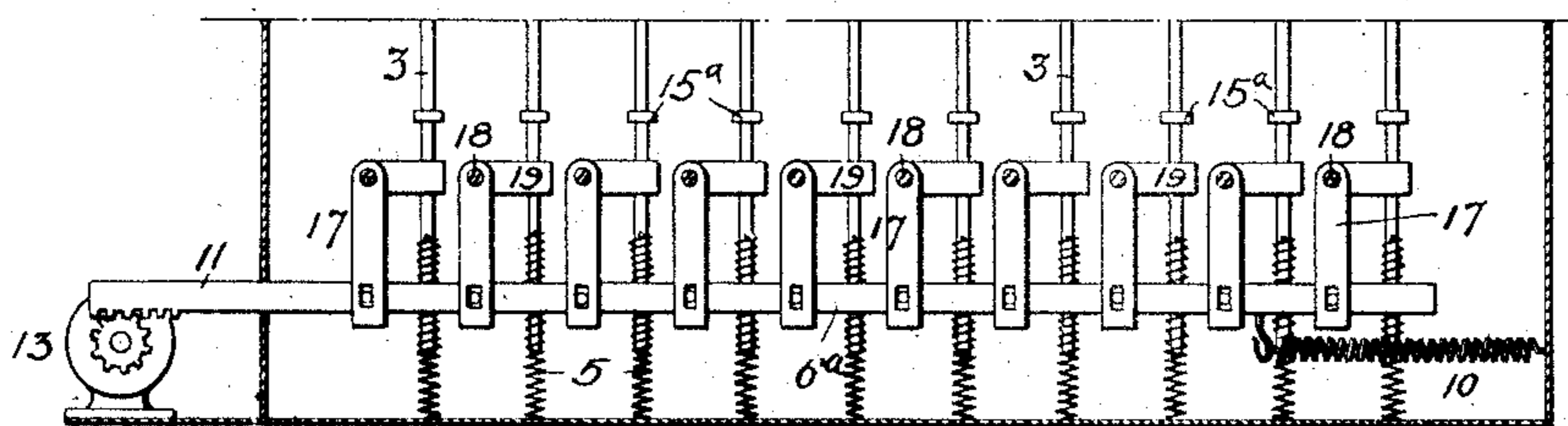
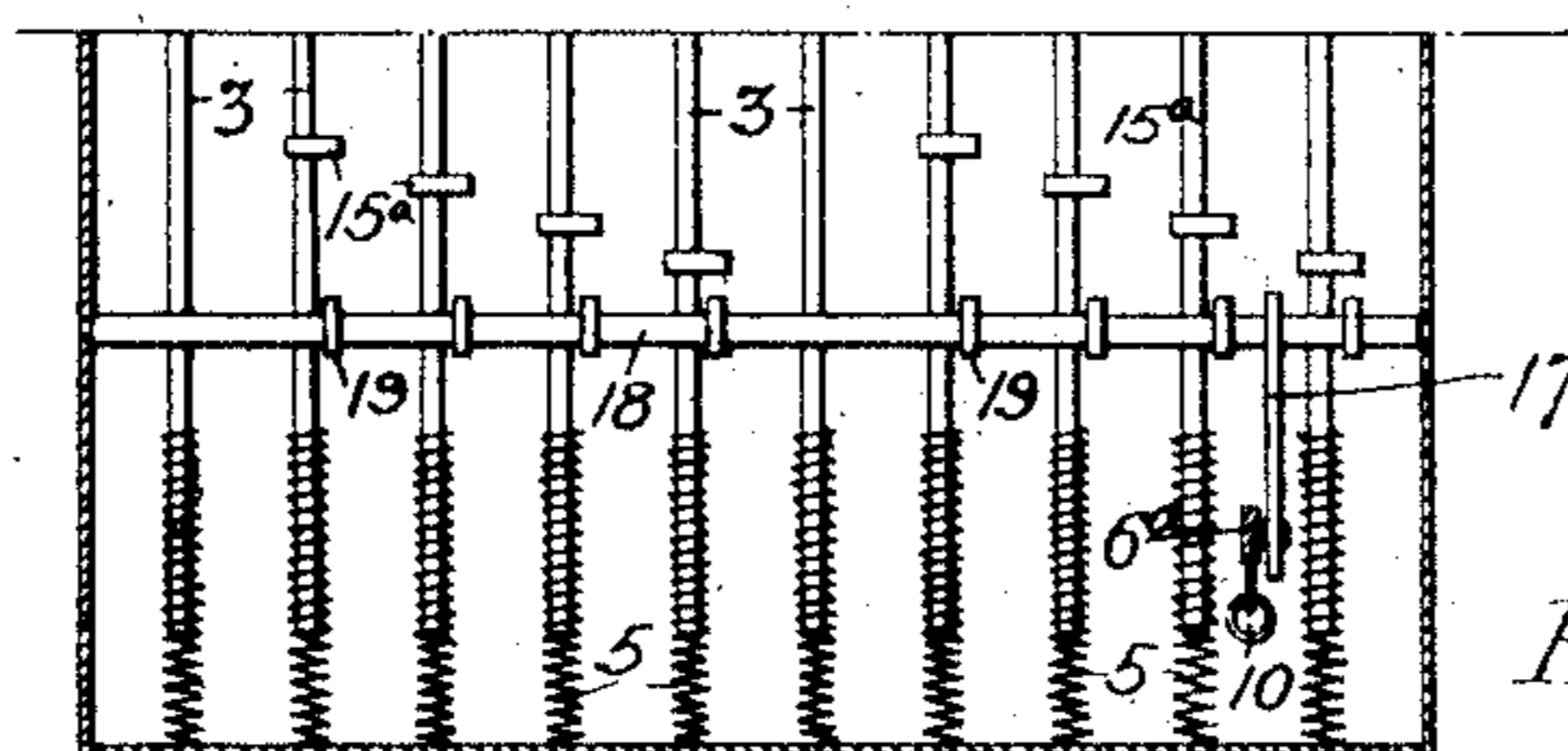


Fig. 16.



Witnesses:

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979,391.

13 SHEETS—SHEET 3.

Fig. 4.

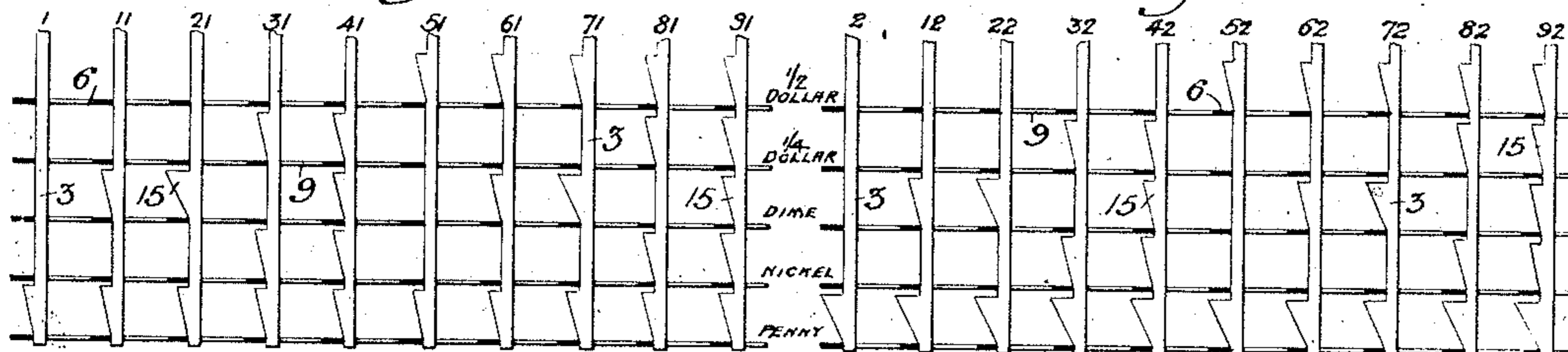


Fig. 5.

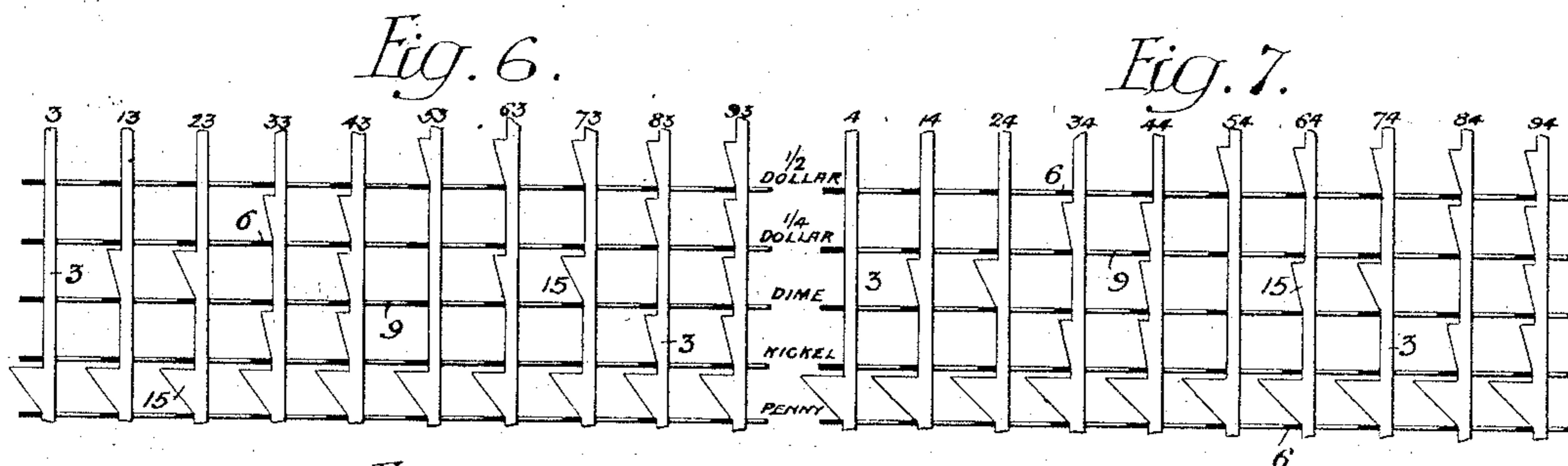


Fig. 6.

Fig. 7.

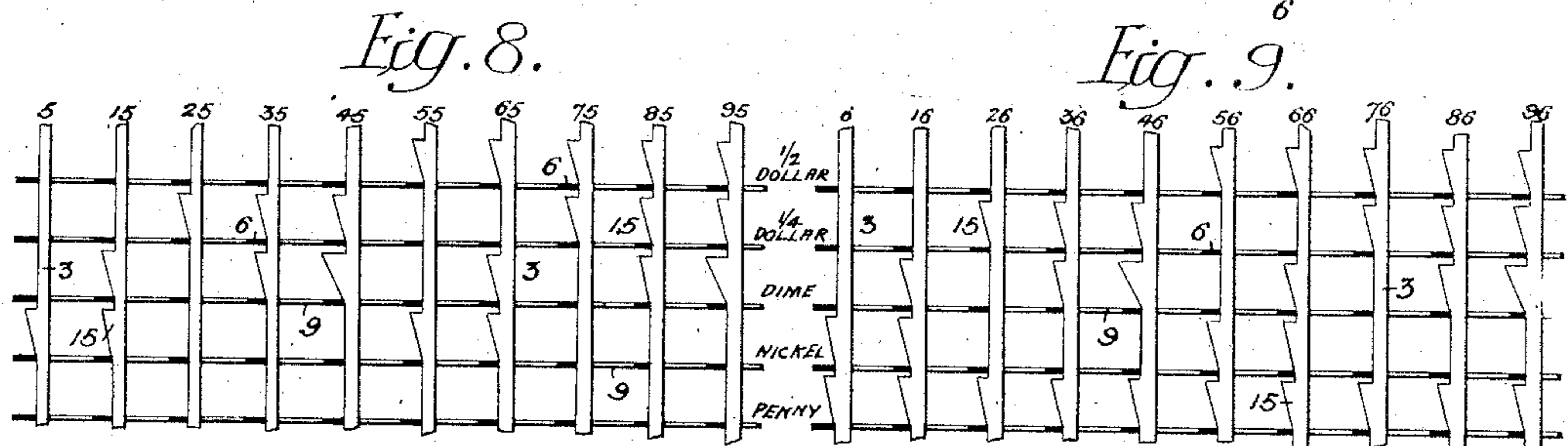


Fig. 8.

Fig. 9.

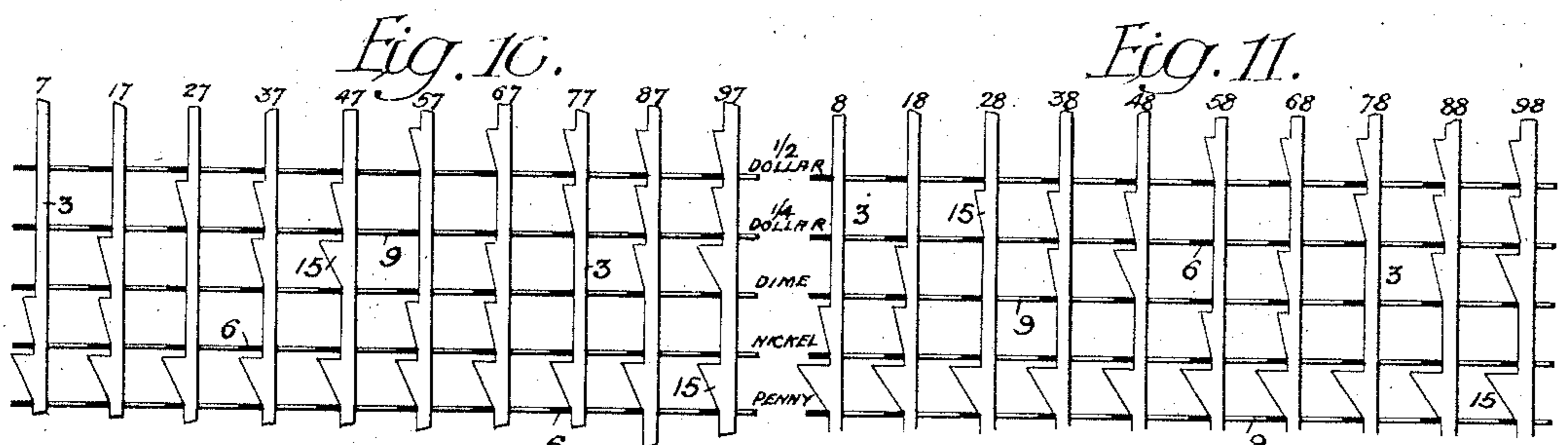


Fig. 10.

Fig. 11.

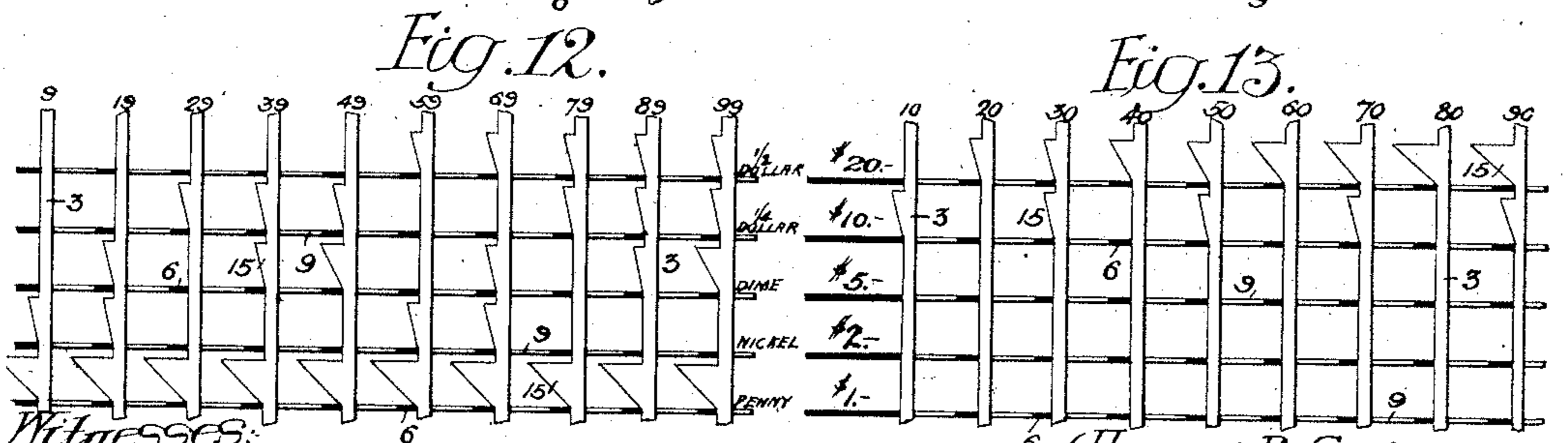


Fig. 12.

Fig. 13.

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13 SHEETS—SHEET 4.

Fig. 17.

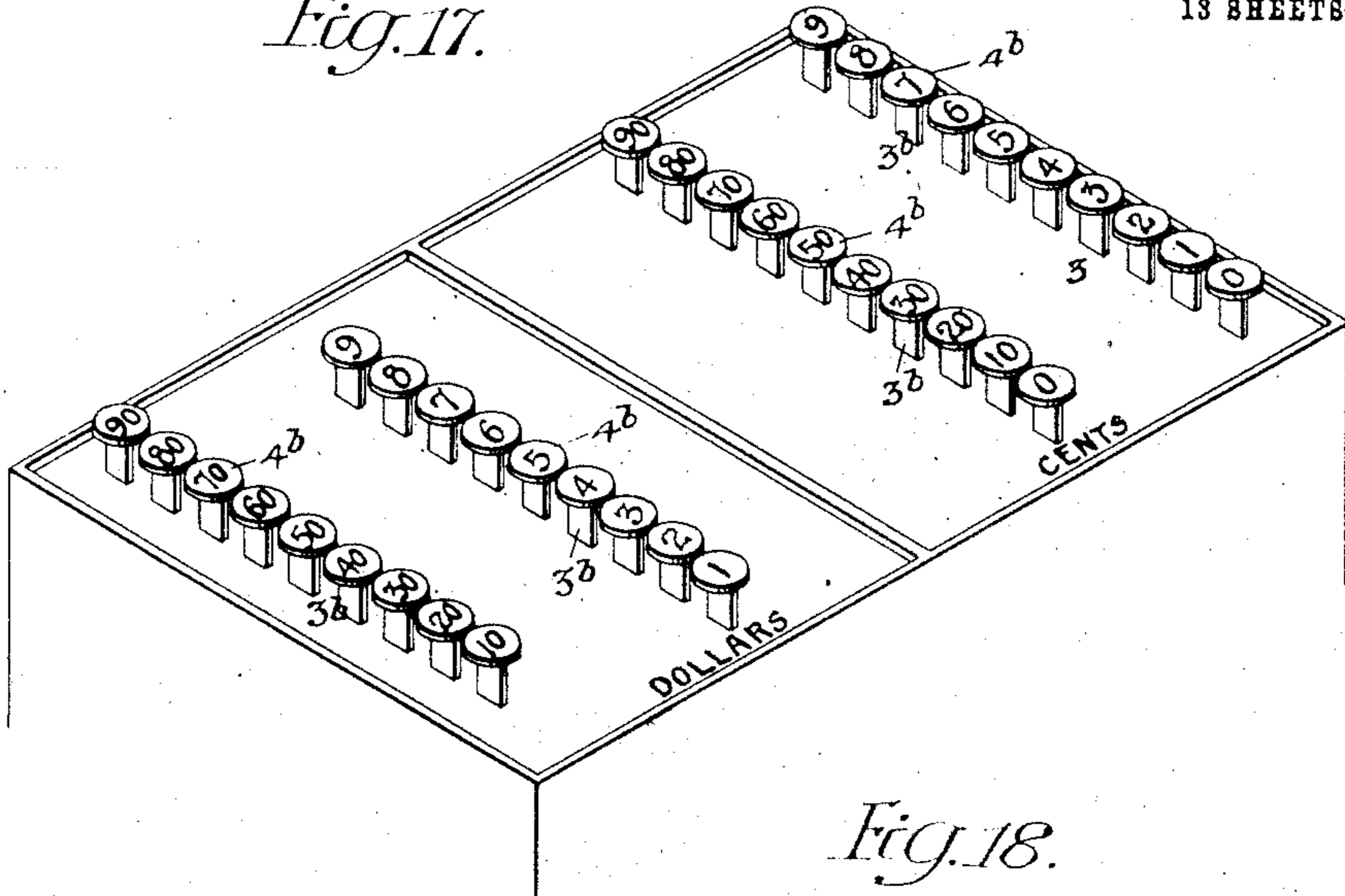


Fig. 18.

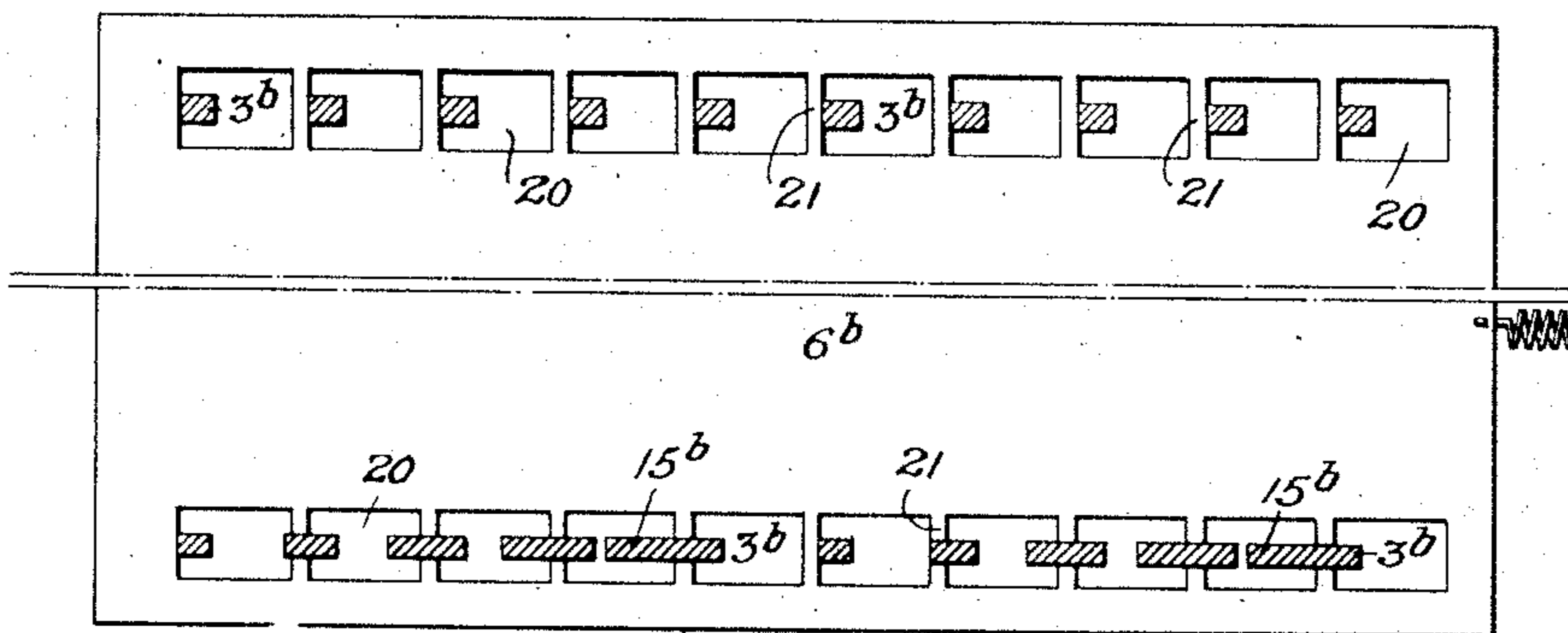
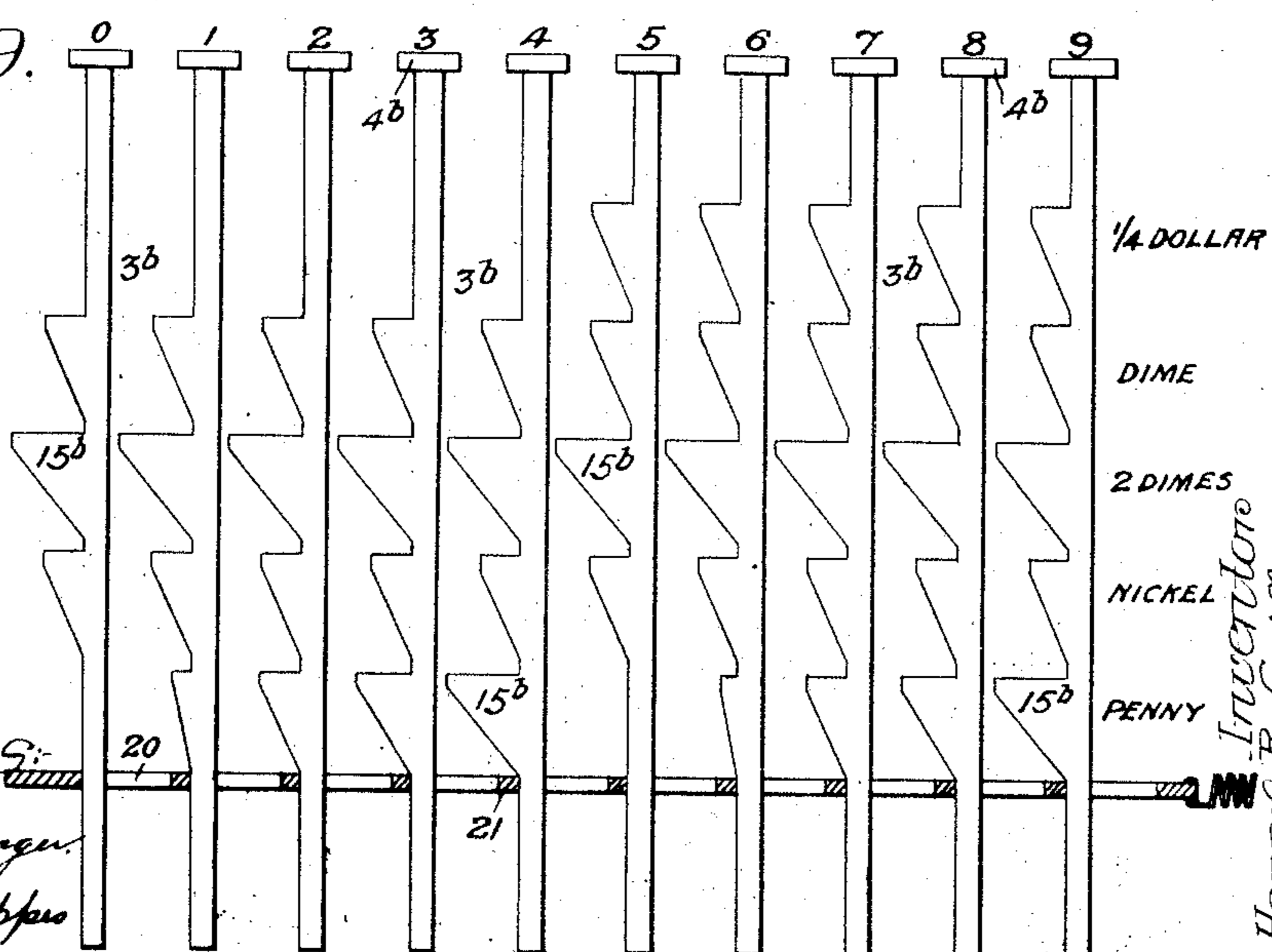


Fig. 19.



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13 SHEETS—SHEET 5.

Fig. 20.

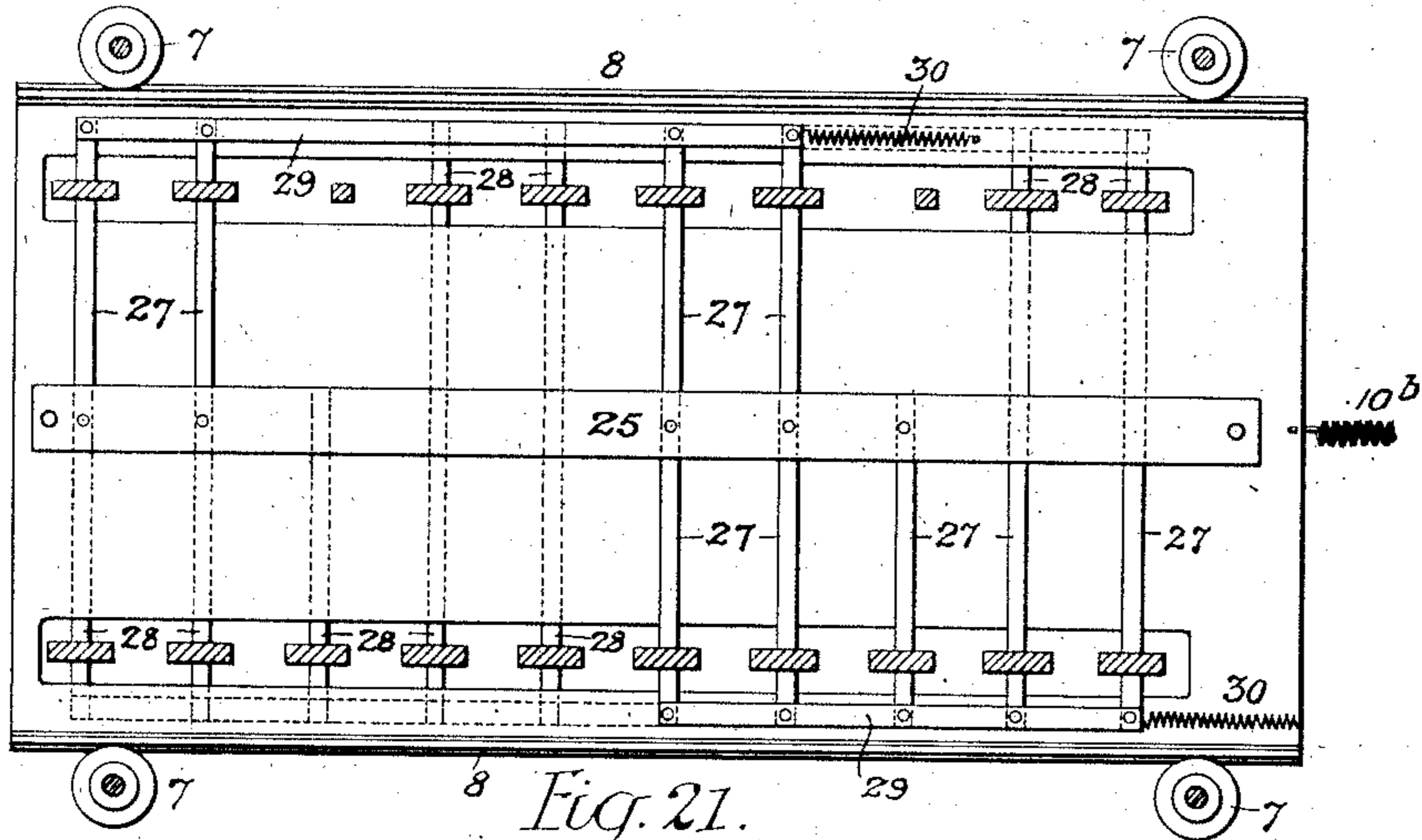


Fig. 21.

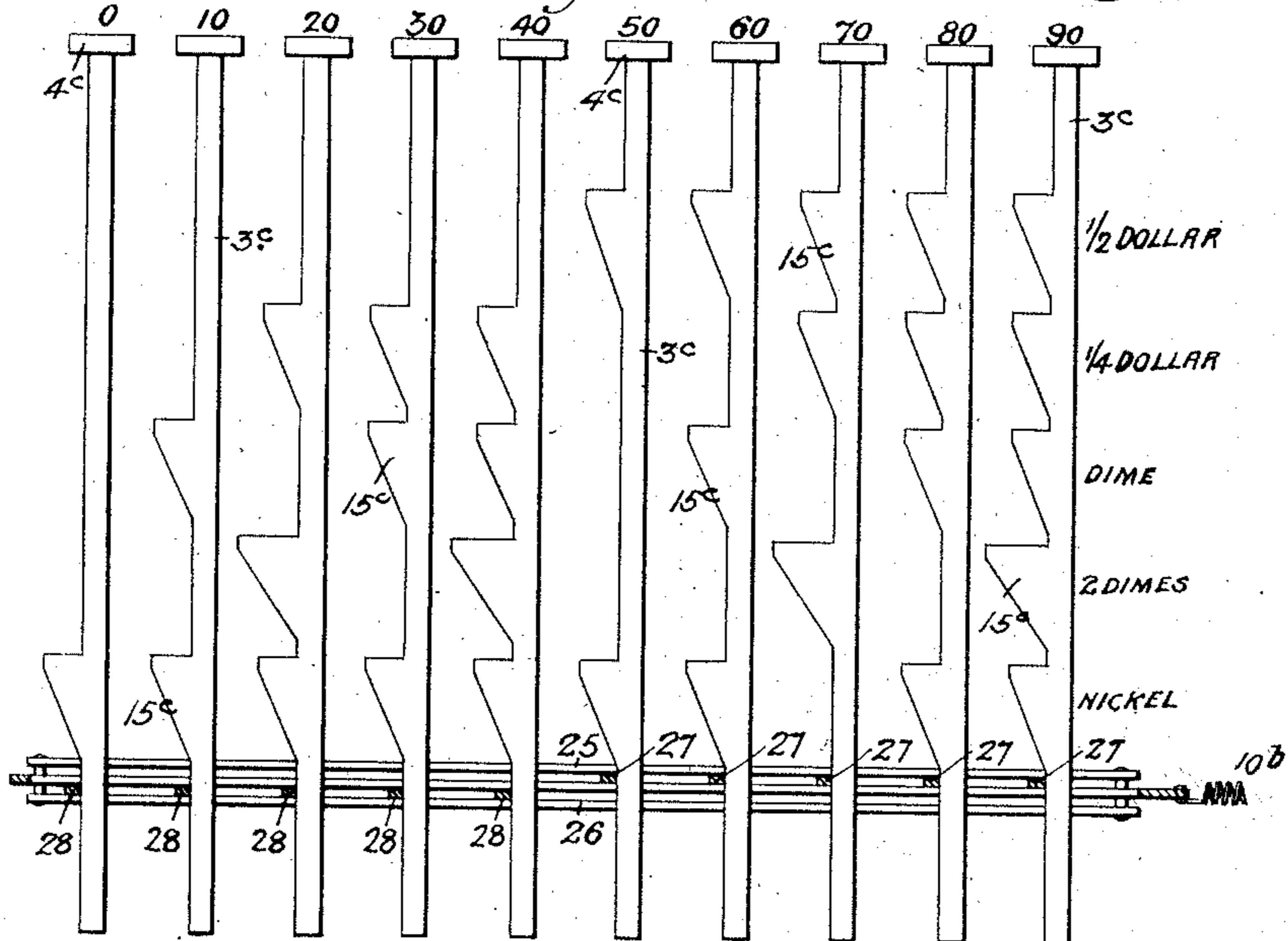
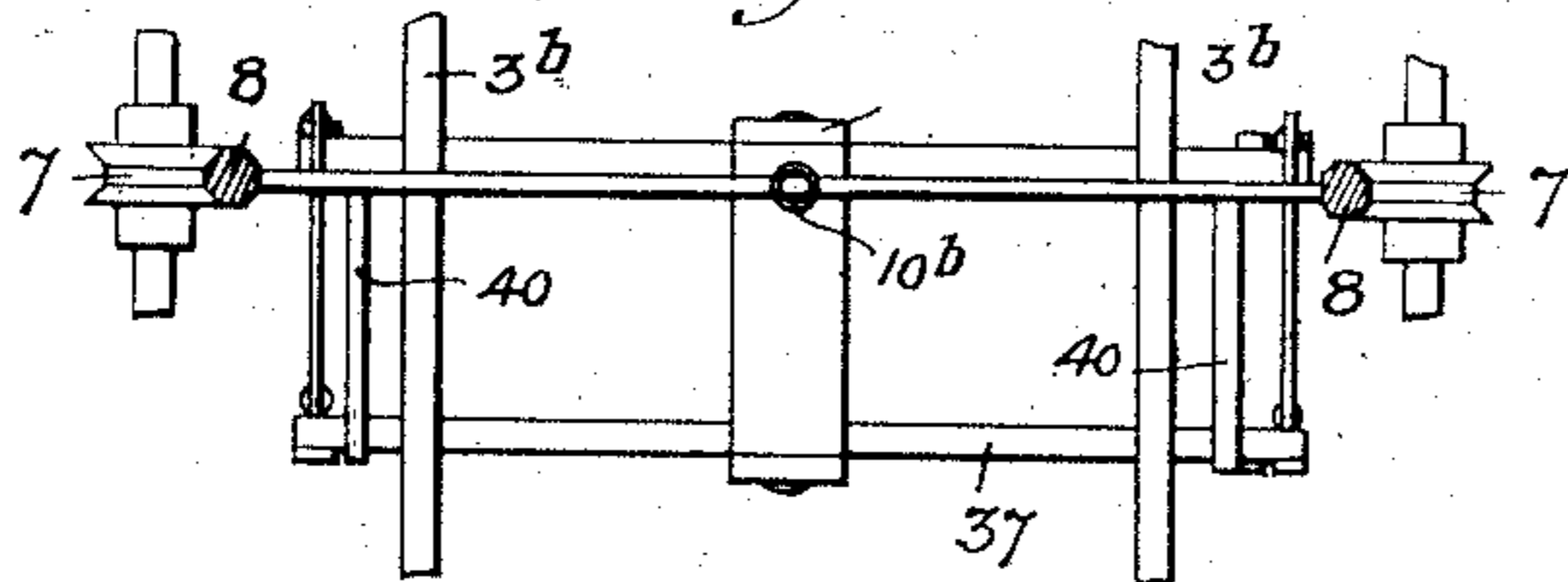


Fig. 25.



Witnesses:

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13 SHEETS—SHEET 6.

Fig. 22.

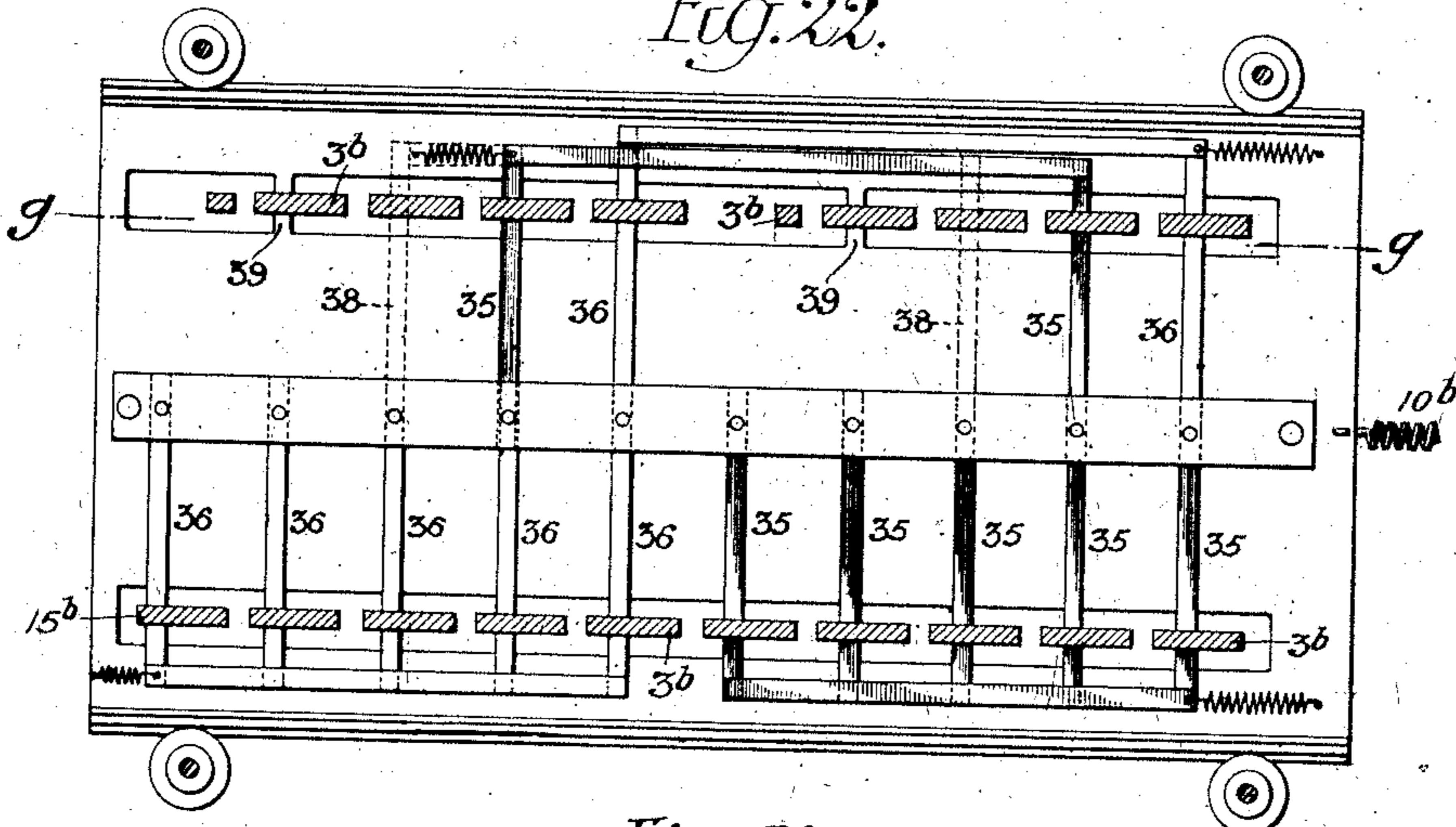


Fig. 23.

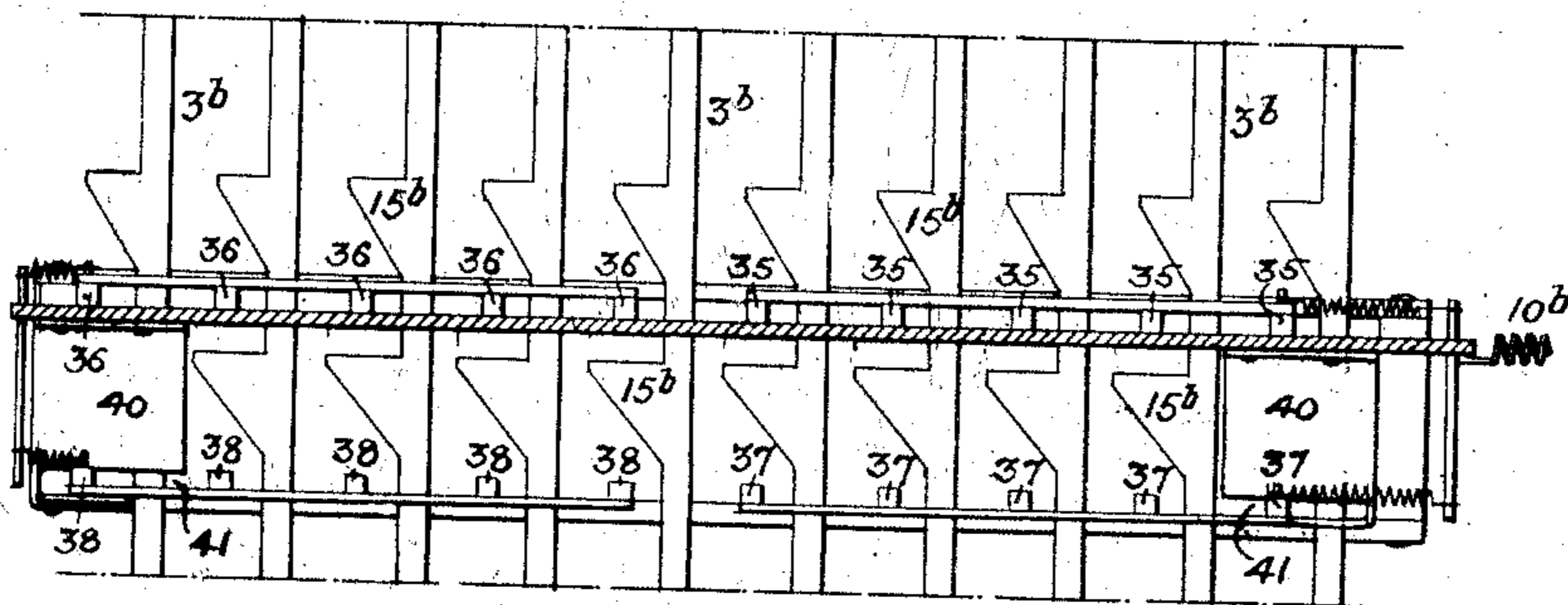
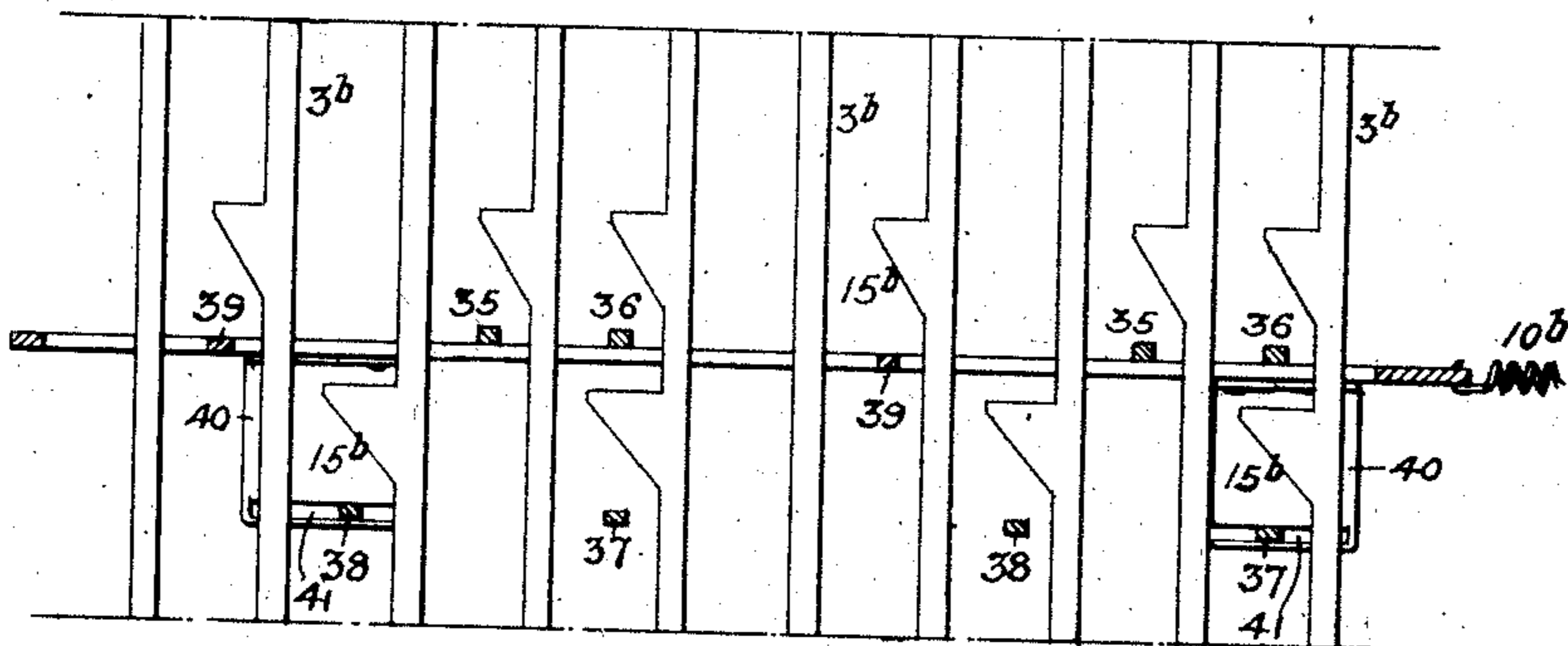


Fig. 24.



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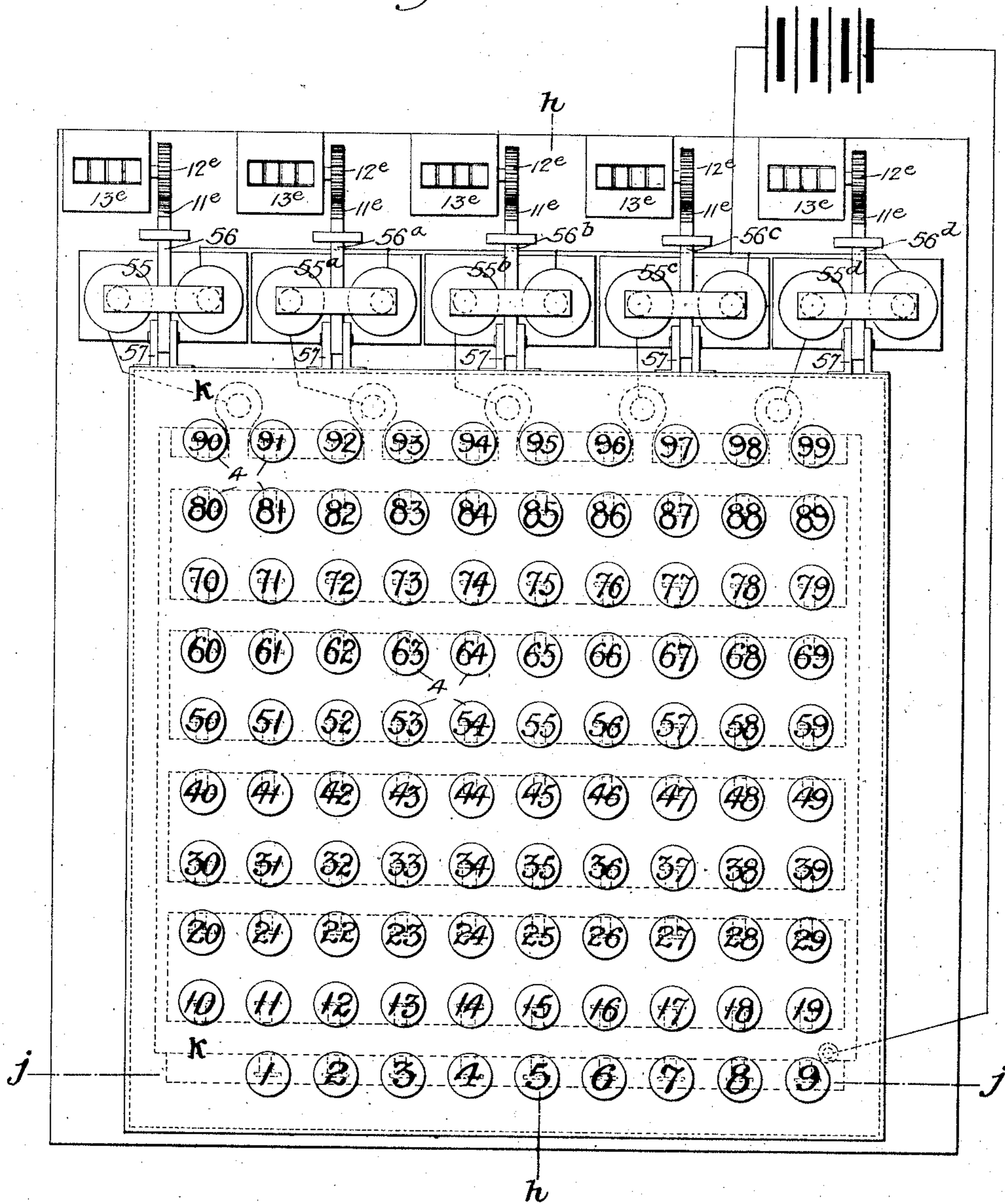
APPLICATION FILED MAR. 8, 1906. RENEWED MAY 20, 1910.

979,391.

Patented Dec. 20, 1910.

13 SHEETS—SHEET 7.

Fig. 26.



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13 SHEETS—SHEET 8.

Fig. 27.

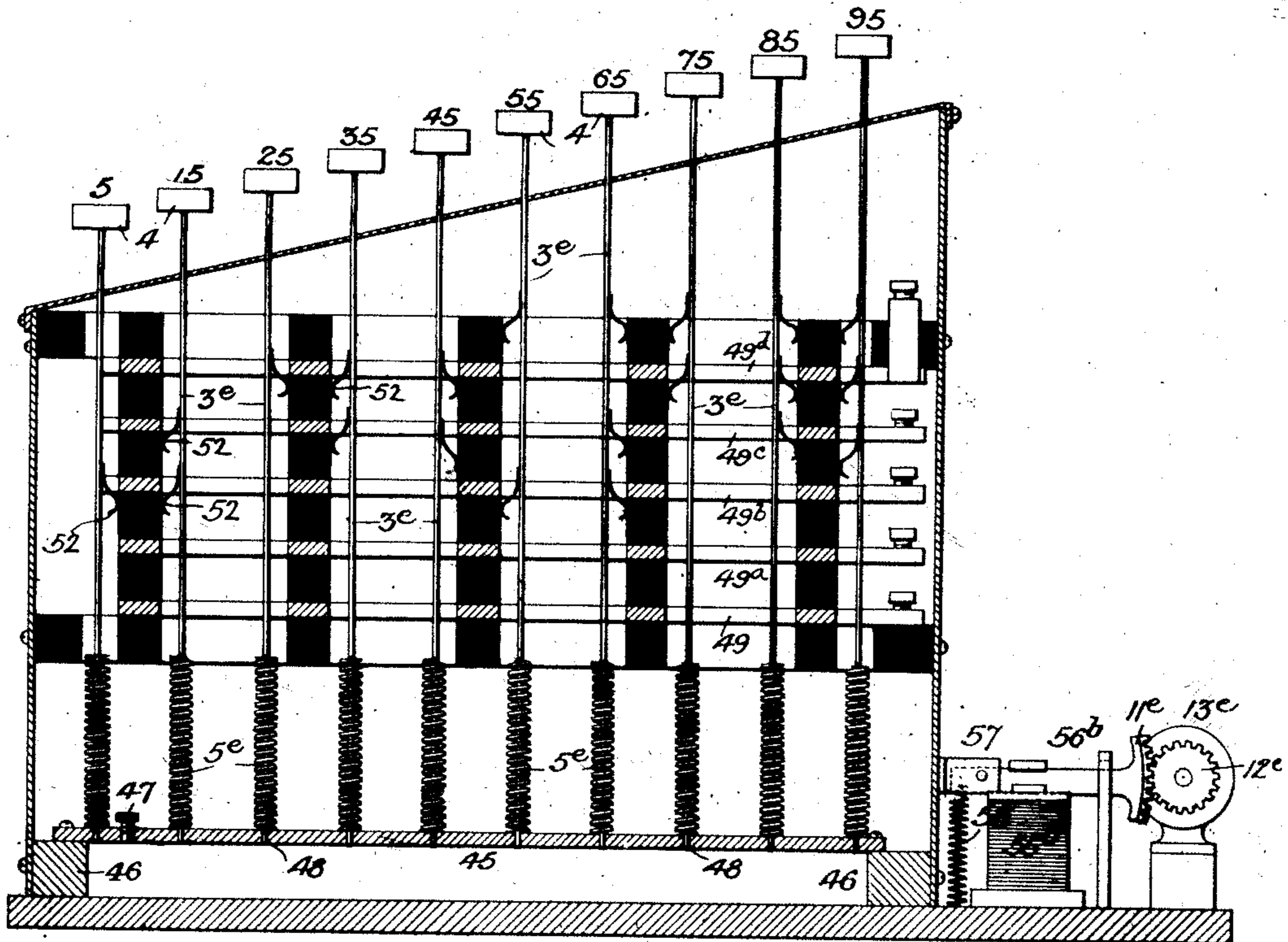
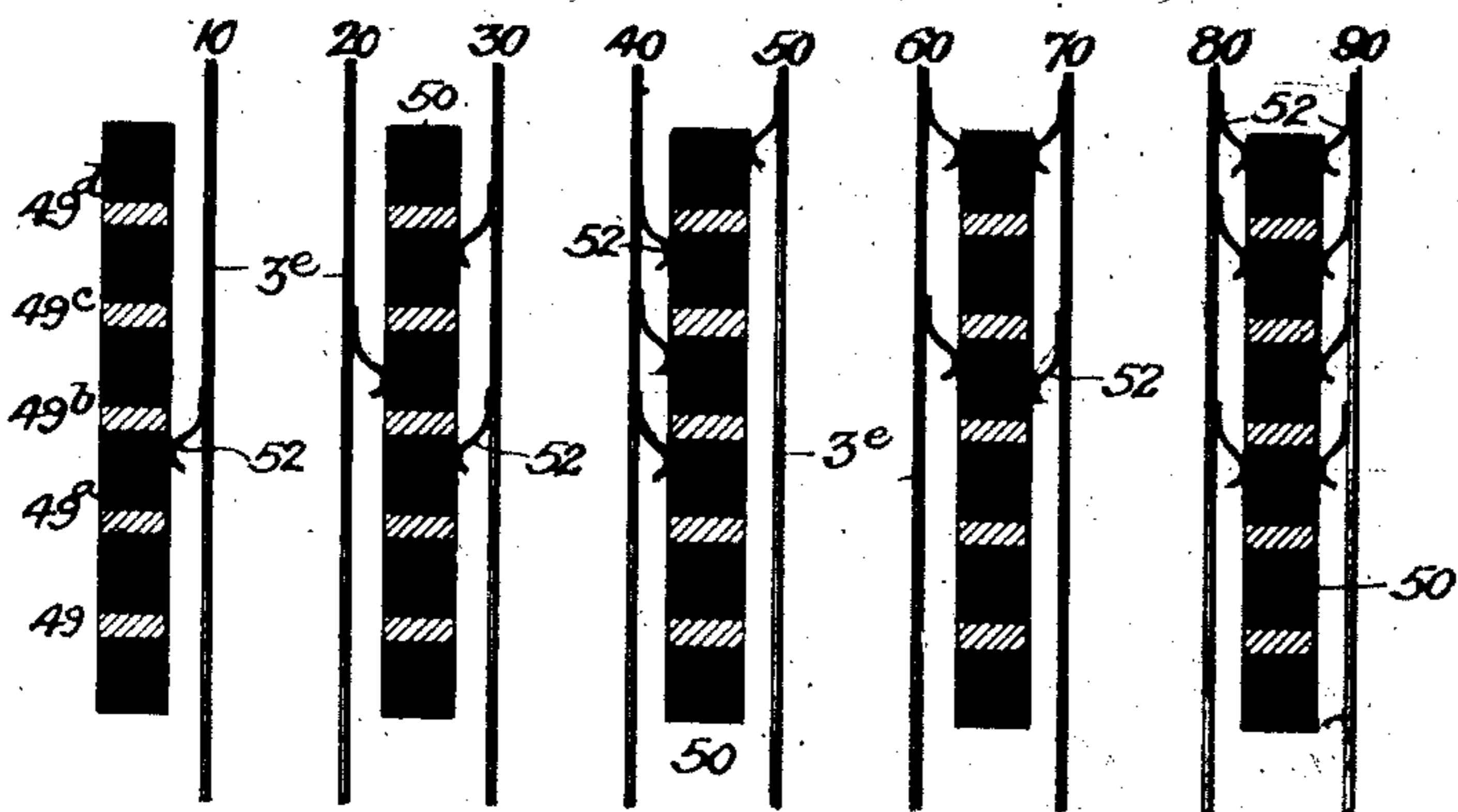


Fig. 29.



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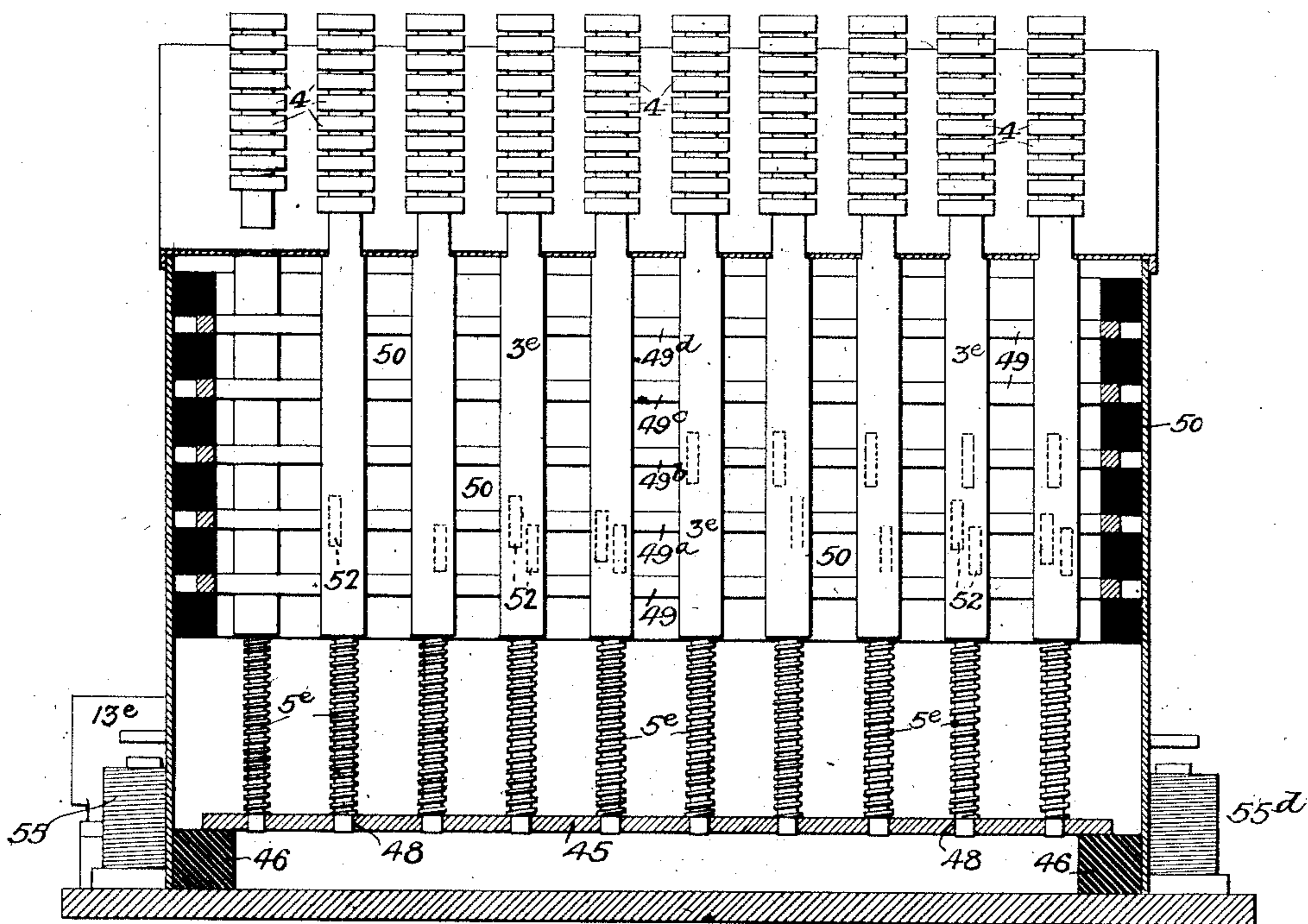
APPLICATION FILED MAR. 8, 1906. RENEWED MAY 20, 1910.

979,391.

Patented Dec. 20, 1910.

13 SHEETS—SHEET 9.

Fig. 28.



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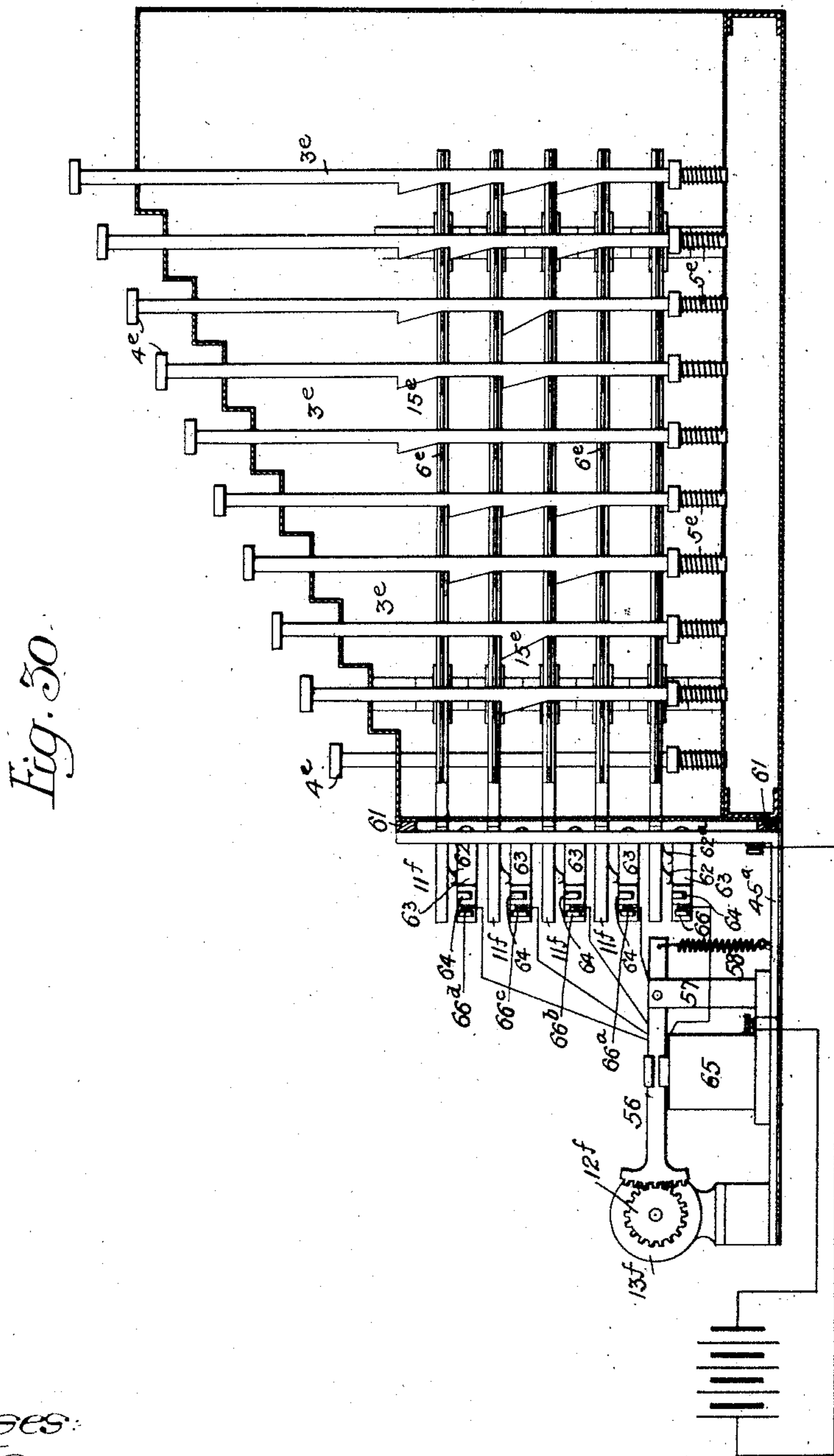
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Patented Dec. 20, 1910.

13 SHEETS—SHEET 10.



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CALCULATING OR COMPUTING MACHINE.

APPLICATION FILED MAR. 8, 1906. RENEWED MAY 20, 1910.

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13 SHEETS—SHEET 11.

Fig. 31.

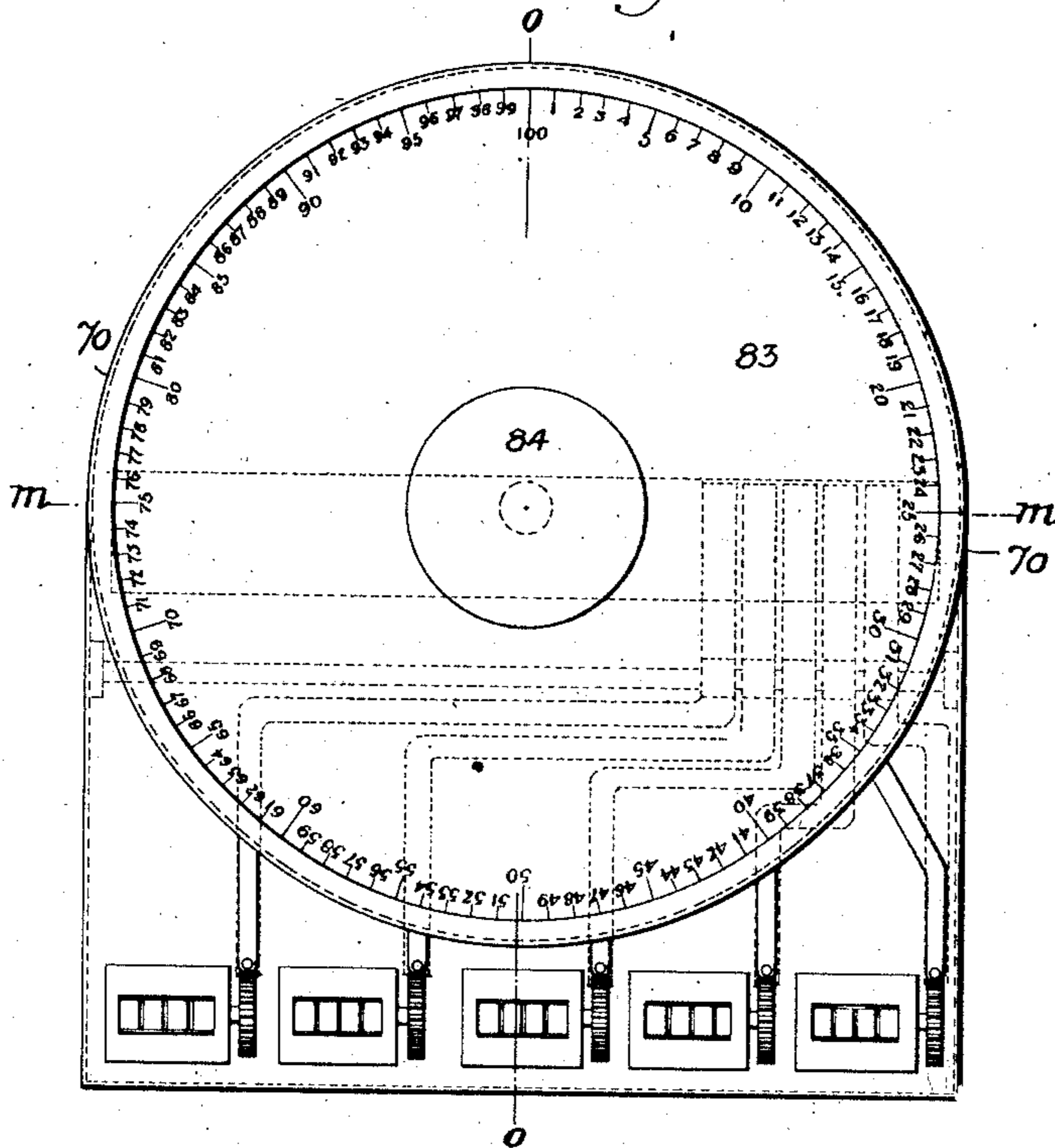
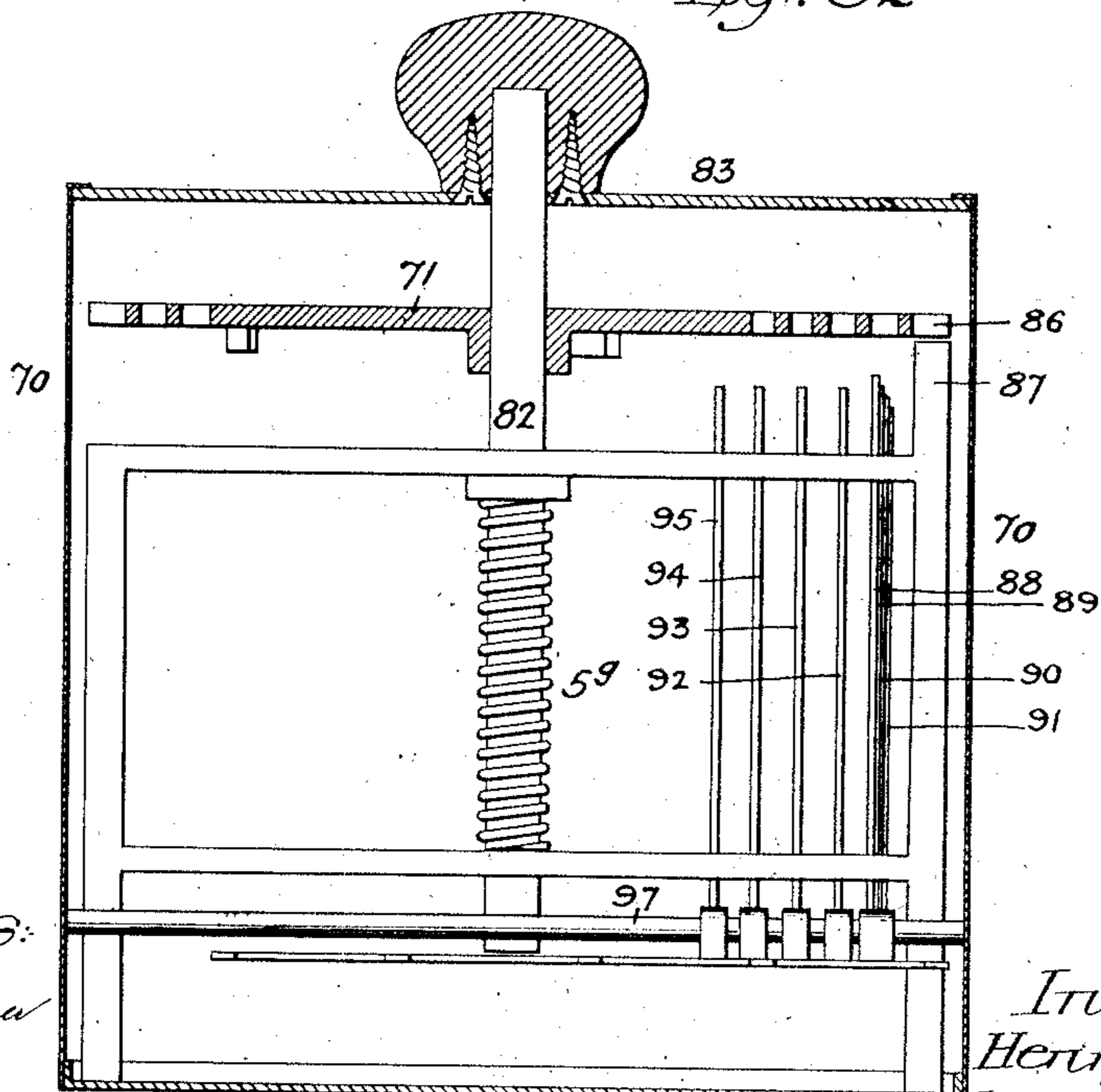


Fig. 32.



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13 SHEETS—SHEET 12

Fig. 33.

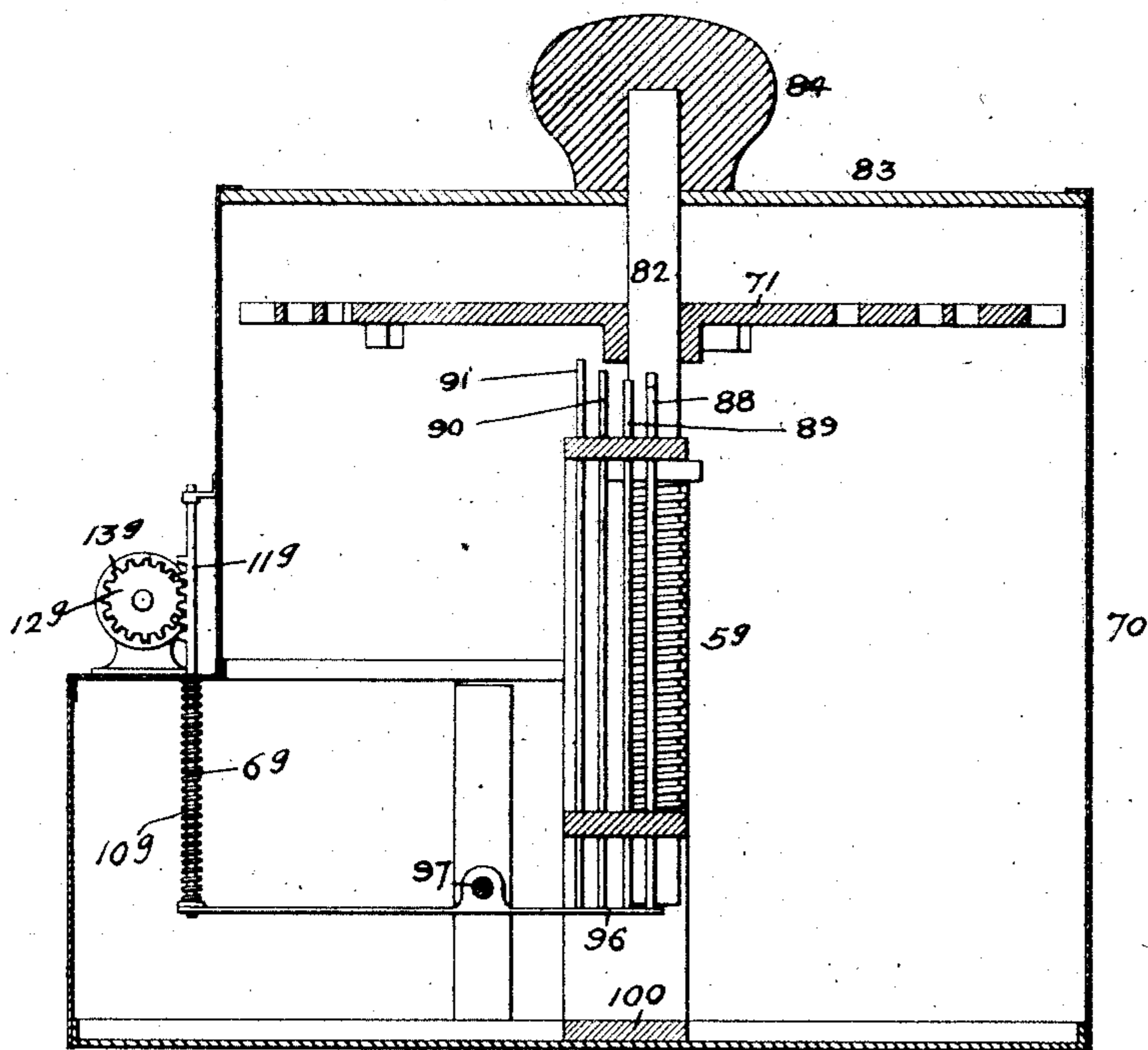


Fig. 34.

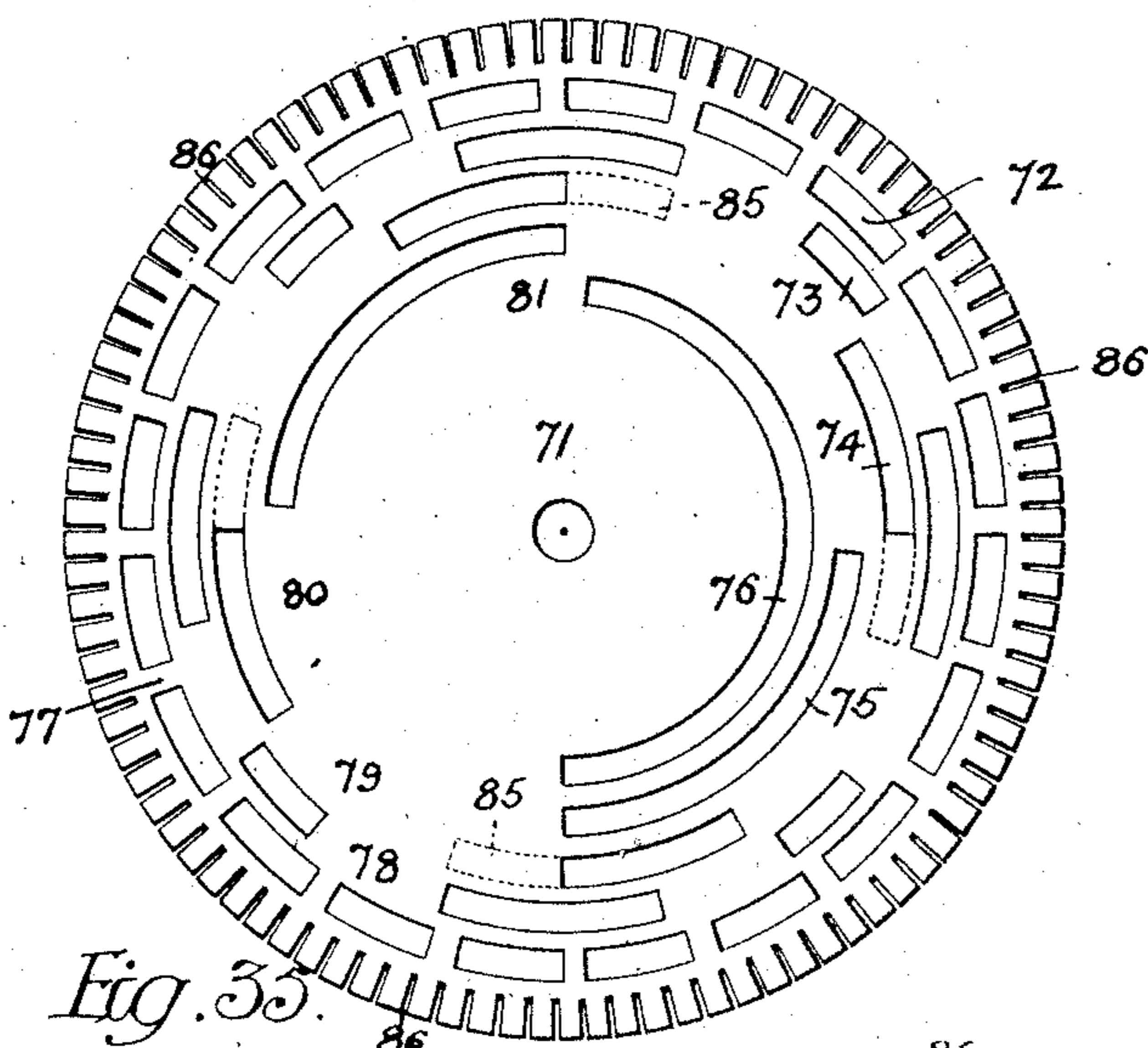
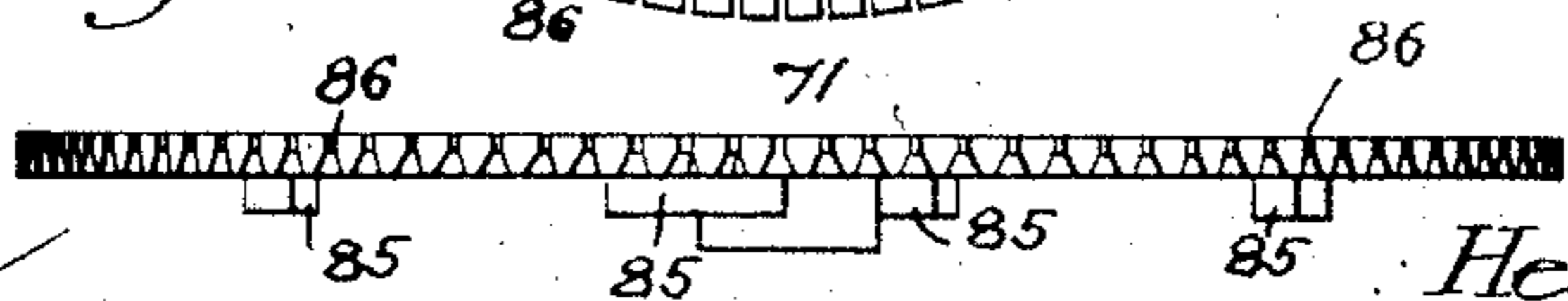


Fig. 35.



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979,391.

H. R. GRIFFEN, DEC'D.
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CALCULATING OR COMPUTING MACHINE.
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Patented Dec. 20, 1910.

13 SHEETS—SHEET 13.

Fig. 36.

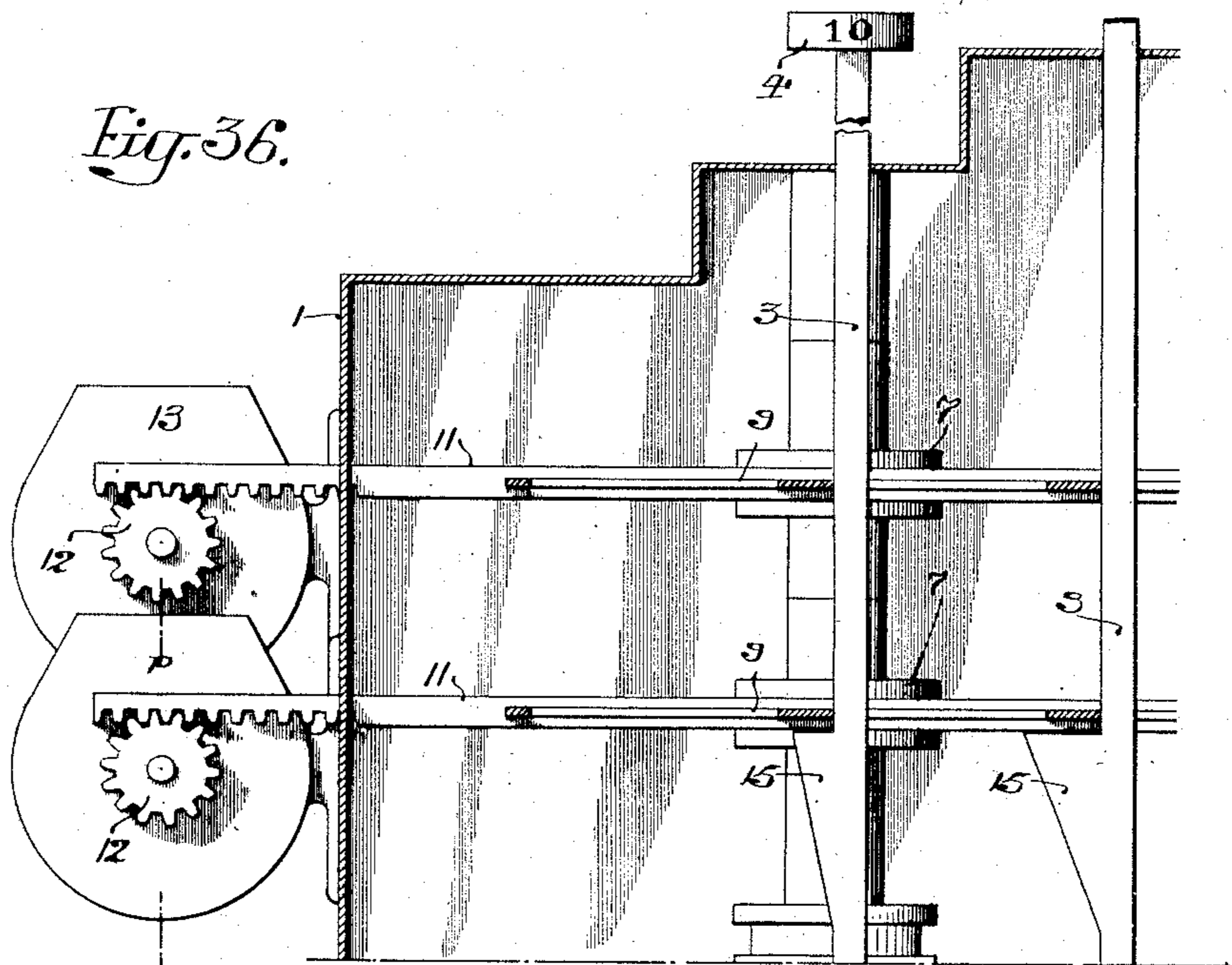


Fig. 38.

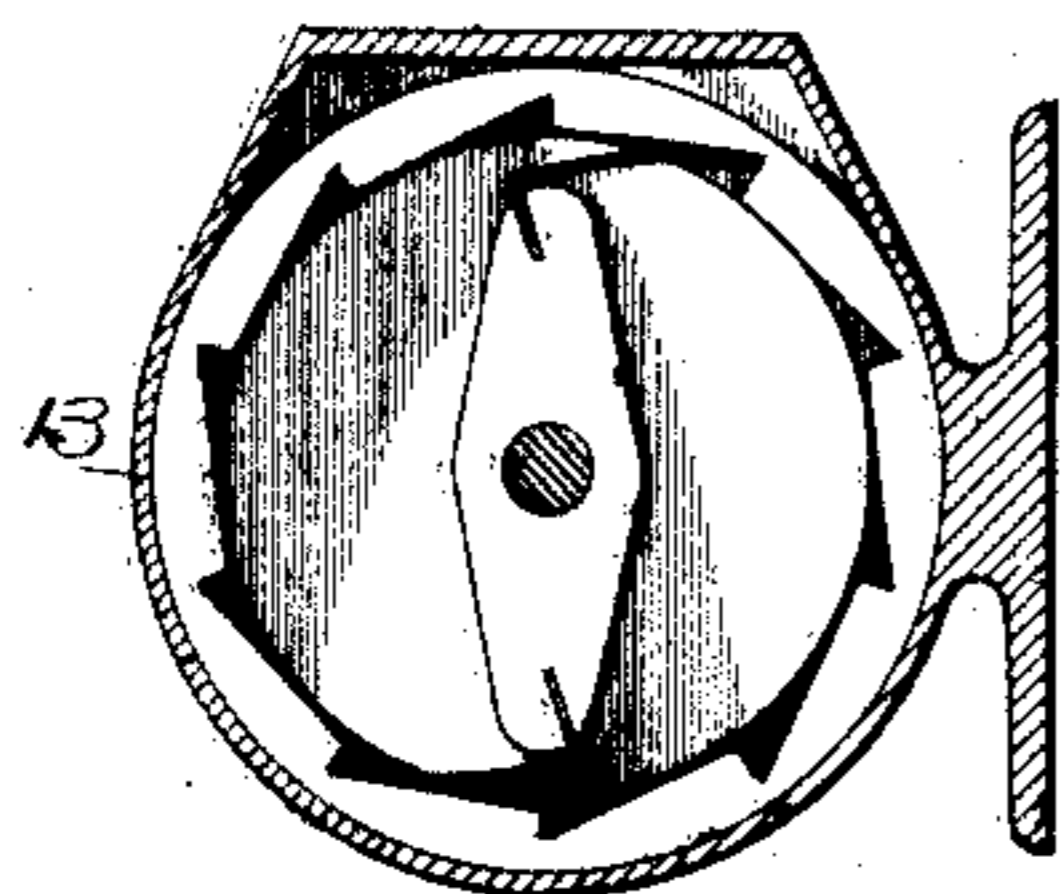


Fig. 37.

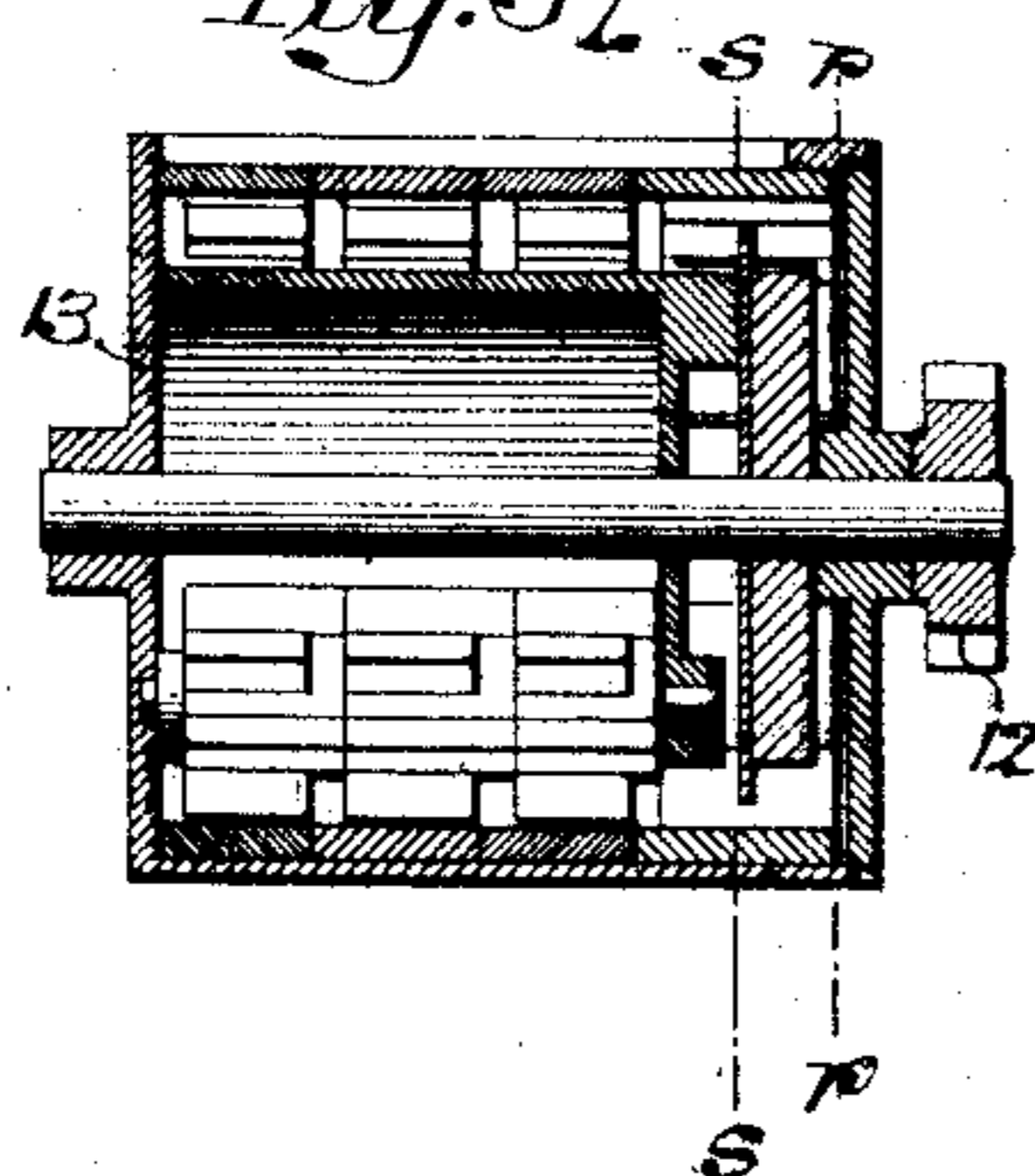


Fig. 39.

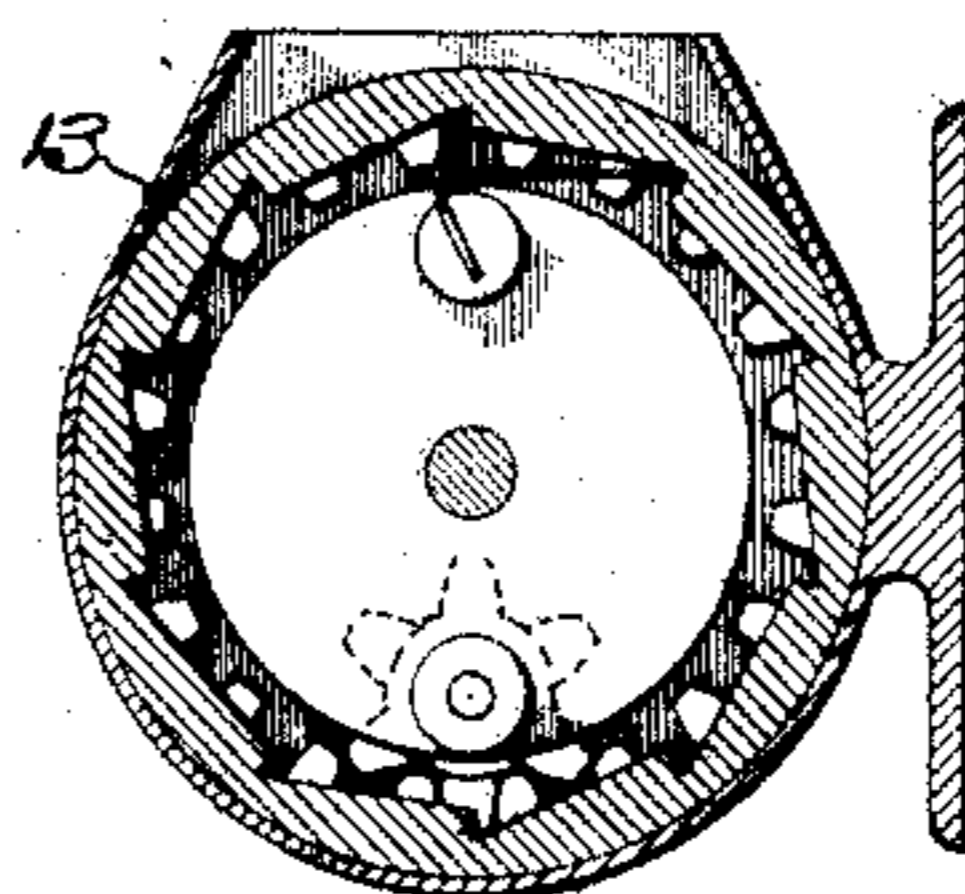
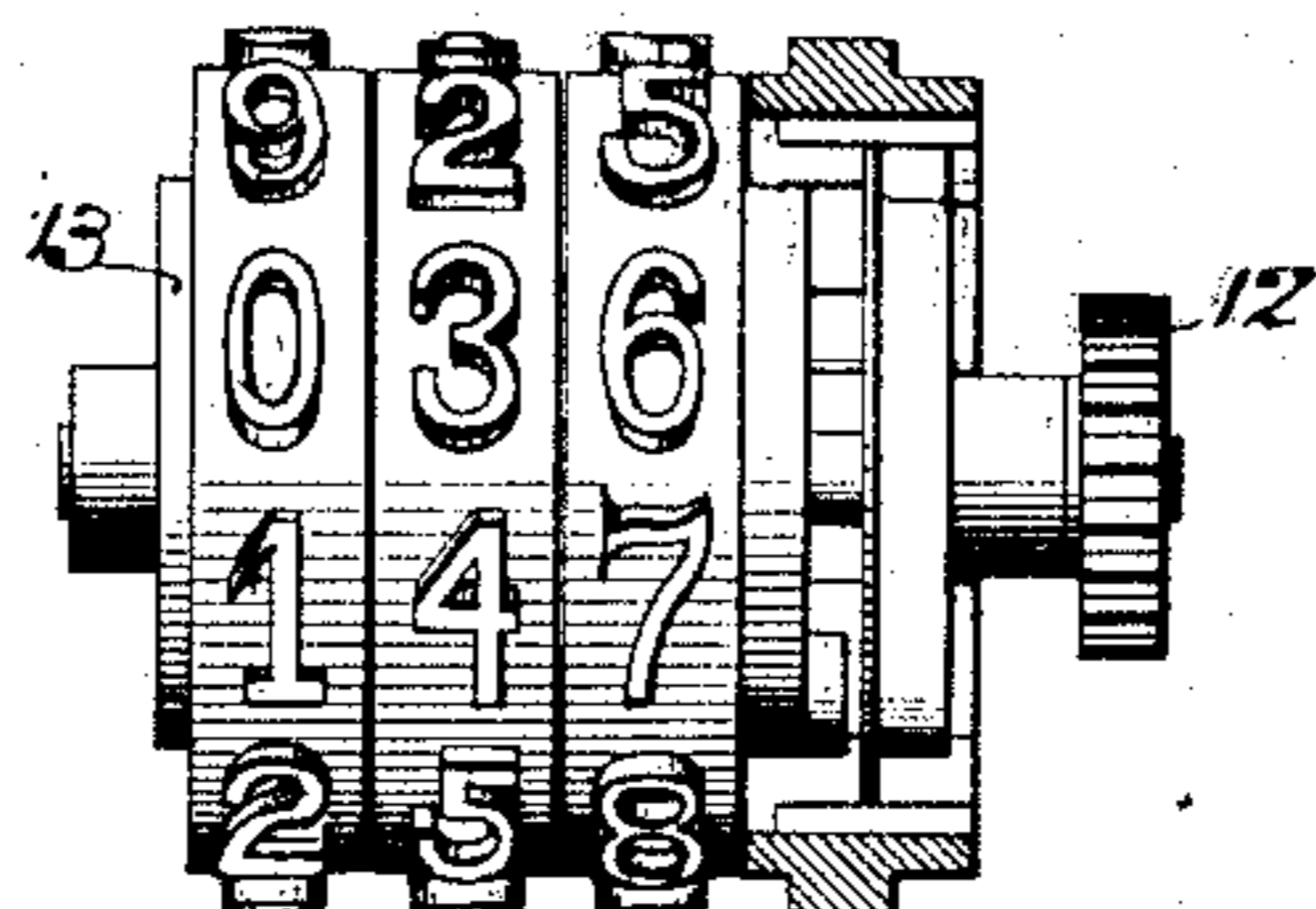


Fig. 40.



Witnesses

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Walter A. Burrows

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Henry R. Griffen.

by His Attorneys:

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UNITED STATES PATENT OFFICE.

HENRY R. GRIFFEN, OF PHOENIXVILLE, PENNSYLVANIA; CATHERINE S. GRIFFEN
ADMINISTRATRIX OF SAID HENRY R. GRIFFEN, DECEASED.

CALCULATING OR COMPUTING MACHINE.

979,391.

Specification of Letters Patent.

Patented Dec. 20, 1910.

Application filed March 8, 1906, Serial No. 304,969. Renewed May 20, 1910. Serial No. 562,527.

To all whom it may concern:

Be it known that I, HENRY R. GRIFFEN, a citizen of the United States, and a resident of Phoenixville, Chester county, Pennsylvania, have invented Improvements in Calculating or Computing Machines, of which the following is a specification.

The object of my invention is to provide a machine or instrumentality for automatically registering or recording the different denominations of coin and paper money necessary to make up any given amount, such, for instance, as the various sums to be paid employees in large establishments.

An instrument or machine embodying my invention is particularly applicable for use in making up pay-rolls, although it may be employed for other purposes where it is desired to know the least number of pieces of money, whether bank notes or other forms of paper money or coins of the various denominations, required to make up a large number of sums of varying amounts.

My invention may be embodied in apparatus of varied form, having manually operated parts which control mechanism to effect the registration of the necessary pieces of money, or these keys may operate switches controlling an electric circuit designed to move the registering mechanism.

In the accompanying drawings, I have shown a number of instrumentalities for carrying my invention into effect, in which:

Figure 1, is a front elevation, partly in section, of one form of denomination calculator made in accordance with my invention; Fig. 2, is a sectional view of the same taken on the line *a—*a**, Fig. 1; Fig. 3, is a sectional plan view of the right-hand side of the machine, taken on the line *b—*b**, Fig. 1; Figs. 4 to 13, inclusive, are diagrammatic views illustrating a portion of the mechanism of the machine shown in Figs. 1, 2 and 3; Figs. 14, 15 and 16, are views of a modified form of structure in which the operating rods are actuated by rocking mechanism; Fig. 17, is a perspective view of a machine embodying my invention, in which I employ fewer keys than that shown in the machine of Figs. 1, 2 and 3; Figs. 18, 19, 20, 21, 22, 23, 24 and 25, are detail views of the same; Fig. 26, is a plan view of an electrically operated calculator; Fig. 27, is a cross-sectional view of the same taken on the line *h—*h**, Fig. 26; Fig. 28, is a sectional eleva-

tion taken on the line *j—*j**, Fig. 26; Fig. 29, is a detached sectional view taken on the line *k—*k**, Fig. 26; Fig. 30, is a sectional view of a modified form of an electrically operated device; Fig. 31, is a plan view of a keyless machine embodying my invention; Fig. 32, is a sectional elevation of the same, taken on the line *m—*m**, Fig. 31; Fig. 33, is a sectional elevation in section of the same taken on the line *o—*o**, Fig. 31; Fig. 34, is a plan view of an apertured plate employed in connection with this form of machine; Fig. 35, is an end elevation of said plate structure; Fig. 36, is an enlarged view of a portion of the structure shown in Fig. 2, illustrating in greater detail one of the registers or recorders employed with my calculating machine; Fig. 37, is an elevation of one of the registers or recorders, partly in section on the line *p—*p**, Fig. 36; Figs. 38 and 39, are transverse sectional views on the lines *r—*r** and *s—*s**, respectively, of Fig. 37, and Fig. 40, is a view similar to Fig. 37, showing a form of recording register which may be employed in connection with my improved calculating machine.

In Figs. 1, 2 and 3, of the drawings herewith, 1 represents a casing having a stepped top 2, through which project vertically movable operating rods or bars 3 having keys or buttons 4 whereby they may be readily actuated by the fingers of the operator; such rods being normally upheld by springs 5. The casing 1 is duplex in form, having ninety-nine keys at the right-hand side for use in calculating the number of coins required, and ninety-nine keys at the left-hand side for use in calculating the number of pieces of paper currency required in making up the various amounts. Within the casing are a series of slidable members 6 supported at their edges by rollers 7, which edges are preferably stiffened by members 8 adapted to the grooves of said rollers. These slides may be in the form of solid plates, having rows of apertures 9 in both directions, ten each way, making one hundred in all, although I may employ grids 6^a formed of a series of rods 9^a spaced apart equidistantly and secured to the members 8, and such structure is shown in Fig. 14. These slides or grids are held in the normally retracted position by means of springs 10, and are provided at their forward ends with rack bars 11 disposed in engagement with pin-

ions 12 of registering or recording devices 13 of any suitable character, of which there is one for each slide.

The vertical rods 3 are disposed in the 5 apertures 9 of the slidable members or between the rods of the grids, and the keys 4 on each side of the machine contain figures from one to ninety-nine, inclusive. Each of said bars carries one or more cams 15, as 10 may be desired, of varying width, which cams coact with the slidable members 6 or the grids 6^a, so that by pressing any one of the keys, one or more of said slides will be moved, and the fact of such movement, and 15 its extent, will be recorded by the respective registering devices.

Each of the five slidable members 6 on the right-hand side of the machine represent one of the coins to be used in making 20 up the desired amounts, and each of the slides on the left-hand side represent one of the denominations of paper money. The slides on the right-hand side, starting from the bottom, represent, respectively, a penny, 25 a nickel, a dime, a quarter-dollar, and a half-dollar. Those on the left-hand side, starting from the bottom, represent, respectively, a one-dollar note, a two-dollar note, a five-dollar note, a ten-dollar note, and a 30 twenty-dollar note. If desired, a sixth slidable member or grid may be added to this side of the machine at the top, for fifty-dollar bills, and certain of the rods 3 will be provided with cams to actuate the same as 35 desired.

As noted, each of the rods 3 carry means for displacing the slides so that such movement can be registered. With reference to the right-hand side of the machine, the rod 40 3 attached to the one-cent key is provided with a cam 15 of the smallest size, as shown in Fig. 4, so arranged that when said key is pushed down the slidable member 6 controlling the registration of pennies will be 45 moved forward one space to register one unit on its recording device, and when the pressure of the finger is removed, said key will be returned to the original position by its spring 5. The two-cent rod is provided with a cam twice the width of the one-cent rod, which serves to move the penny slide twice as far, or a distance sufficient to cause the rack rod to move the pinion and register two units, and so on for the three- 55 and four-cent keys. The rod from the five-cent key is provided with a cam of the smallest size to engage the slidable member controlling the registration of nickels, and when pressed down it will cause such member to move a sufficient distance to register a 60 single nickel. From six to nine cents, inclusive, the respective keys are supplied with cams to move the slidable members controlling the registration of nickels, and 65 with corresponding cams to make the re-

spective movements of the slidable member controlling the registration of pennies. The ten-cent key is provided with a cam opposite the slidable member controlling the registration of dimes and moves the same one 70 space, and so on throughout the rest of the machine; the several diagram views, Figs. 4 to 12, inclusive, being taken on the lines of the several keys and showing the cams carried by each rod containing the indicated amounts. Fig. 13 shows the first row 75 of rods on the dollar side of the machine. The left-hand side of the machine is constructed and operated in precisely the same manner, the one-dollar key moving the slid- 80 able member controlling the registration of the number of single dollar bills desired, the two-dollar key moving the slidable member controlling the registration of the number of two-dollar bills desired, the three-dollar 85 key moving the slidable members controlling the registration of both the one- and two-dollar bills, all of such members being moved one space. The four-dollar key effects sufficient movement of the slidable 90 member controlling registration of two-dollar bills to indicate two units, and the five-dollar key moves the slidable member controlling registration of five-dollar bills one unit; each slide through its rack rod 11 communicating motion to the corresponding 95 registering device and recording the motions made and consequently the number of bills required.

To illustrate the operation of my improved machine, what is the fewest number 100 of bills and coins that will be required to make up the several amounts, \$18.74, \$39.42, and \$11.16? The purpose of this machine is to automatically calculate this desired in- 105 formation. This is done by pressing first the key "18" on the dollar side, and the key "74" on the cent side; then the key "39" on the dollar side, and the key "42" on the cent side, then the key "11" on the 110 dollar side and the key "16" on the cent side, all of which operations will be recorded on the several registers, which will then indicate as follows: The first register on the dollar side, representing the twenty-dollar 115 bills will show the unit 1; the second register on the dollar side, representing the ten-dollar bills will show the unit 3; the third register on the dollar side, representing the five-dollar bills will show the unit 2; the 120 fourth register on the dollar side, representing the two-dollar bills will show the unit 3; the fifth register on the dollar side, representing the one-dollar bills will show the unit 2. The first register on the cent 125 side, representing the fifty-cent pieces will show the unit 1; the second register on the cent side, representing the twenty-five cent pieces will show the unit 1; the third register on the cent side, representing dimes will 130

show the unit 4; the fourth register on the cent side, representing nickels will show the unit 2, and the fifth register on the cent side, representing pennies will show the unit 7; indicating to the user that, in order to pay the several sums, \$18.74, \$39.42 and \$11.16, with the fewest pieces of money, one-twenty dollar bill; three-ten dollar bills; two-five dollar bills; three-two dollar bills; two-one dollar bills; one-fifty cent piece; one-twenty five cent piece; four-dimes; two-nickels, and seven-pennies, will be required.

In the foregoing example, it is not desired to ascertain the fewest pieces of money in the total sum, but in the several sums aggregating such total whereby each of the smaller sums may be paid with the fewest pieces of money, and in this connection it is to be noted that neither the registers nor the recorders (if used) will show the amount of money under consideration. On the cent side of the machine, the cent register will indicate the number of pennies required in any given amount, or in the payment of any given centum amounts; the next register will indicate the number of five cent pieces; the next the number of dimes; the next the number of twenty-five cent pieces or quarters, and the next the number of fifty cent pieces or half dollars. On the dollar side, the same condition will exist; the first register indicating the number of one dollar bills, and consequently the same read off will be dollars; the next will indicate the number of two dollar bills, and in order to know the sum of money, it is necessary to multiply the amount indicated by 2; the third indicates the number of five dollar bills, and in order to ascertain the money involved, it is necessary to multiply the numbers on the register by 5; the next indicates the number of ten dollar bills involved, and to find out the sum of money, it will be necessary to multiply such number by 10, while the last register will show the number of twenty dollar bills involved, and to ascertain the amount of money, it will be necessary to multiply such number by 20. Each register, therefore, is termed a "unit" register or accumulator; that is to say, it registers certain units of value. The penny is a unit; the five cent piece is a unit; the dime is a unit; the twenty-five cent piece is a unit, and the fifty cent piece is a unit, and such units will be indicated upon the different registers as such; the object of the whole invention being to provide mechanism that will separate the amounts represented on the indicators or keys into units representing the fewest pieces of money in said amounts. The aggregate of the units of the various registers, recorders or accumulators will show the number of pieces of money necessary to pay

off the various sums indicated by the various keys pressed. This calculation is recorded by the instrument without any thought upon the part of the operator, except to depress the keys indicating the amounts expressed in the account, or pay roll, of which the number of bills and coins are to be determined.

Although I have shown and described a series of slidable members for communicating the motion of the vertically moving rods to registering mechanism, I do not wish to be limited to such actuating mechanism, as the necessary motion may be communicated through rock shafts, by rotating slides, or by any form of transmitting mechanism in use. Instead of employing the cams for effecting the movement of the slidable members, I may employ a direct connection, or use a lever forming a direct connection between the keys.

In Figs. 14, 15 and 16, I show portions of a form of instrument in which the rack bars 11 for transmitting movement to the recorders are carried by rods 6^a which are actuated by levers 17 fixed to cross bars 18, such cross bars also having arms 19 to be moved by projections 15^a carried by the rods 3 of the keys. The levers 17 and the arms 19 are fixed to the cross bars and the latter are arranged to rock in their bearings. In order to provide for the registry of more than one coin, as will be desired to record the necessary amounts, the projections 15^a carried by the rods are disposed correspondingly nearer the levers, so that the full depression of the keys will, in some instances, effect a greater movement of the levers and in consequence a greater movement of the rack bars. The general arrangement of the machine in all other respects is the same as that shown in Figs. 1, 2, 3, with the slidable members for actuating the recording mechanism; the cross bars 18 being arranged in tiers above each other. At the tiers where no coins of the particular value would ever be needed in making up any amounts, the bars 18 may be omitted.

Instead of a machine having ninety-nine keys on the "dollar" and "cent" side, totaling one hundred and ninety-eight keys in all, I show in Figs. 17, to 25, inclusive, the details of a machine in which only thirty-eight keys are employed. Fig. 17, is a perspective view of this thirty-eight-keyed machine.

Fig. 18, is a plan view of the slidable member 6^b controlling the registration of units representing pennies of such thirty-eight-keyed machine, in which twenty keys are provided for the denominations less than one dollar, and eighteen keys for denominations of one dollar and over. This slidable member is provided with openings 20, through which the rods 3^b controlled by keys

4^b pass; which rods, with the aid of cams 15^b, similar in all respects to those illustrated in connection with the other machine hereinabove described, effect the movement of such member. The cams of these rods 3^b act directly against the partitions 21 between the openings 20 of this member. This slidable member controlling the registration of pennies is operated directly, because in all amounts ending with "one," "two," "three" or "four," the corresponding number of pennies is required.

Fig. 19, is a side elevation of the unit rods on the cent side of the machine, showing also a sectional view of the penny slide. I provide cams 15^b on the rods of keys "five," "six," "seven," "eight" and "nine", for engagement with the slidable member controlling the registration of quarter-dollar coins, because one of such coins is needed with all sums ranging from "twenty-five" to "twenty-nine" cents, and from "seventy-five" to "seventy-nine" cents. This slidable member cannot be operated directly by either rod of the "two" or the "seven" key in the tens column on the cent side of the machine, on account of not needing one of these coins with sums ranging from "twenty" to "twenty-four" cents, or from "seventy" to "seventy-four" cents. I provide cams for engagement with the slidable member controlling the registration of dimes on all of the unit keys, because dimes are needed with all sums ranging from "thirty-five" to "forty-four" cents, and from "eighty-five" to "ninety-four" cents. The registration of dimes is required with all the units. I also provide cams for engagement with the slidable member controlling the registration of two dimes on all the unit rods, because two dimes are needed with all sums ranging from "twenty" to "twenty-four" cents, "forty-five" to "forty-nine" cents, "seventy" to "seventy-four" cents, and "ninety-five" to "ninety-nine" cents. Two dimes are also needed with all the units. I provide cams for engagement with the slidable member controlling the registration of nickels on all of the keys of the unit column, because nickels are needed with all sums ranging from "five" to "nine" cents, "fifteen" to "nineteen" cents, "thirty" to "thirty-four" cents, "forty" to "forty-four" cents, "fifty-five" to "fifty-nine" cents, "sixty-five" to "sixty-nine" cents, "eighty" to "eighty-four" cents, and "ninety" to "ninety-four" cents. Nickels, therefore, are also needed with all of these units.

In Fig. 20, I have shown a plan view of the slidable member controlling the registration of nickels. The slidable member is provided with centrally disposed bars 25 and 26 mounted on both sides of the same, to which bars are pivoted arms 27 and 28

respectively. These arms extend laterally from said bars 25 and 26, and are coupled by bars 29, to which springs 30 are attached to hold the structure in the normal position. The arms do not touch the rods near to which they are disposed, so that if the "nine" key in the unit column was depressed, for example, it would simply rock the arms 27 on the upper side of the slidable member forcing the same on the "tens" side against the rods of the keys on that side just as it reached the end of its motion, without giving the slidable member any forward movement. In the same way, if the "naught" key on the unit side was depressed, it would simply rock the arms 28 on the under side of the slidable member. If the "six" key on the "tens" side was depressed, it would rock the arms 27 in a direction opposite to that produced by the "nine" key in "unit" column, and if the "four" key on the "tens" side were to be depressed, it would rock the arms 28 in the opposite direction to the movement produced by the "naught" key in the "unit" column. If keys "naught", "ten", "fifty" or "sixty" in "tens" column be depressed with keys "five", "six", "seven", "eight" or "nine" in the "unit" column, the cams on said keys would prevent the rocking movement of the arms 27, and a forward movement of the slidable member would result; effecting the registration of one unit of the device for recording the nickels. By depressing keys "naught", "ten", "fifty" or "sixty" in the "tens" column with keys "naught", "one", "two", "three" or "four" in the "unit" column, there would be no forward motion of the slidable member, but simply a rocking movement of the arms 27, since there are no arms to be opposed by cams on the rods of keys "naught", "one", "two", "three" and "four". In the same manner, when keys "thirty", "forty", "eighty" or "ninety" in the "tens" column are depressed, together with keys "naught", "one", "two", "three" or "four" on the unit side, a forward movement of the slidable member would result through the locking of the arms 28, and depression of keys "thirty", "forty", "eighty" or "ninety" in the "tens" column with keys "five", "six", "seven", "eight" or "nine" in the "unit" column would simply impart rocking movement to the arms 28. That this is correct will be quite evident, as a nickel is needed with the sums of "five", "six", "seven", "eight", "nine", "fifteen", "sixteen", "seventeen", "eighteen", "nineteen", "thirty", "thirty-one", "thirty-two", "thirty-three", "thirty-four", "forty", "forty-one", "forty-two", "forty-three", "forty-four", "fifty-five", "fifty-six", "fifty-seven", "fifty-eight", "fifty-nine",

"sixty-five", "sixty-six", "sixty-seven", "sixty-eight", "sixty-nine", "eighty", "eighty-one", "eighty-two", "eighty-three", "eighty-four", "ninety", "ninety-one", "ninety-two", "ninety-three" and "ninety-four" cents.

Fig. 21, is a side elevation of the "tens" rods 3^c on the cent side of the structure for moving the slidable members controlling the registration of the various coins, showing also a sectional view of the nickel slidable member. The keys for the sums of "fifty", "sixty", "seventy", "eighty" and "ninety" cents, act directly on the slidable member controlling the registration of fifty-cent pieces. The slidable member for registering twenty-five cent coins is moved by cams on the rods of the keys for the sums of "thirty", "forty", "eighty" and "ninety" cents, which act directly on said slidable member and by cams on the rods of the keys for the sums of "twenty" and "seventy" cents to act in combination with the rods of the keys for the sums of "five", "six", "seven", "eight" and "nine" cents in the "unit" column, as will be pointed out hereinafter. The rods of the keys for the sums of "ten" and "sixty" cents are also provided with cams which act directly upon the slidable member controlling the registration of dimes, and the rods of the keys for the sums of "thirty", "forty", "eighty" and "ninety" cents, have cams for operating the said slidable member, which act in combination with the cams for said member on the unit side of the machine. The rods of the keys for the sums of "twenty", "forty", "seventy" and "ninety" cents have cams for acting upon the slidable member controlling the registration of two dimes, which only act in combination with cams on the rods in the unit column for engagement with said slidable member. The rods of the keys for the sums of "naught", "ten", "thirty", "forty", "fifty", "sixty", "eighty" and "ninety" cents, have cams for acting upon the slidable member controlling the registration of nickels, which act only in combination with rods in the unit column having cams for engagement with the corresponding slidable member; the rods for the sums "twenty" and "seventy" having no cams in the "tens" column, because there is no use for a nickel in any sums ranging from "twenty" to "twenty-nine" cents, or from "seventy" to "seventy-nine" cents.

The slidable member for effecting the registration of dimes will be equipped with four sets of swinging or rocking arms 35, 36, 37 and 38, of the same character as the arms 27 and 28 employed in connection with the slidable member for effecting registration of the nickels; two of said sets of arms being on the upper side of said slidable member and two on the under side. These arms are

arranged for such coaction of the parts as will insure the registration of a dime for all sums ranging from "thirty-five" to "forty-four" cents and from "eighty-five" to "ninety-four" cents, and of two dimes for all sums ranging from "twenty" to "twenty-four" cents, from "forty-five" to "forty-nine" cents, from "seventy" to "seventy-four" cents and from "ninety-five" to "ninety-nine" cents. For sums from "ten" to "nineteen" cents and from "sixty" to "sixty-nine" cents, the operation of the dime slidable member will be imparted directly by one of the operating rods.

In Figs. 22 to 25, inclusive, I have illustrated the details of the dime slide of the 38-keyed machine. Fig. 22, is a plan; Fig. 25, an end elevation; Fig. 23, a side elevation, showing the "unit" key rods, and Fig. 24, a section on line *g-g* of Fig. 22, showing the tens key rods. The arms 35, 36, 37 and 38 are secured in precisely the same manner as they are secured to the slidable member controlling the registration of nickels. The arms 35 are disposed just in front of the "thirty" and "eighty" keys on the tens side, and just in front of the "five", "six", "seven", "eight" and "nine" keys on the units side. The arms 36 are disposed just in front of the "forty" and "ninety" keys on the tens side, and just in front of the "naught", "one", "two", "three" and "four" keys on the units side. Below the dime slidable member and at a sufficient distance therefrom to permit of the operation of the cams on the several keys, the swinging arms 37 and 38 are mounted. The arms 37 are disposed just in front of the "forty" and "ninety" keys on the tens side, and in front of the "five", "six", "seven", "eight" and "nine" keys on the units side, and the arms 38 are disposed just in front of "twenty" and "seventy" keys on the tens side and in front of the "naught", "one", "two", "three" and "four" keys on the units side. These arms are so located in relation to the key rods as to allow plenty of room to swing without coming in contact with said rods. On the dime slidable member, a wall 39 is disposed in front of the "ten" and "sixty" keys on the tens side. Each set of arms is provided with suitable springs in the same manner as the slidable member shown in Fig. 18; such springs being attached at their opposite ends to the slidable member. These springs are very light and weak, not of sufficient resistance to cause any tendency of the slidable member to move forward against the resistance of recorders and the much heavier spring controlling the position of the slide. The purpose of these light springs is to cause the members to return to their normal position when rocked or swung through the operation of a combination of keys which

would produce such motion, and to prevent the possibility of these members coming to rest with any of their arms in contact with the key rods so as to be violently rotated when the key with which they might be in contact is depressed. I provide guides 40 for the arms 37 and 38 on the under side of the machine. These guides are fastened to the slidable member and are provided with slots 41 in which said arms 37 and 38 may move horizontally, but these slots prevent any vertical movement and relieve said arms from the torsional strain of the vertical component of the thrust of said key rods.

The operation of the dime slide is as follows: If the "naught" key on tens side is depressed with any key on unit side, it will simply cause the arms 35 and 37 or 36 and 38 to swing from right to left. If keys "ten" and "sixty" are depressed, the slidable member would be moved forward one unit of distance by direct action on the wall 39, and the keys on units side would simply swing the arms 35, 36, 37 and 38, as before. If the "twenty" and "seventy" keys are depressed with keys "five", "six", "seven", "eight" or "nine", the arms 35 and 37 will be caused to rotate, but is pressed with keys "naught", "one", "two", "three" or "four", a forward movement of the slidable member through two units of distance will be effected and two dimes will be recorded; this action being effected through the arms 38 at the same time the cams on the keys "naught", "one", "two", "three" or "four" at the dime level would swing the arms 36. Without the necessity of going through a full description of the action of all the keys it is sufficient to say that swinging will take place where the arms in front of the cams on keys used are not on the same member, and a forward motion of slide will take place where the arms in front of the two keys depressed are on the same member; such motion being in proportion to pitch of the cams. The "naught" and "fifty" keys will not give a dime with any of the units; the "ten" and "sixty" keys will give a dime by direct action no matter what units are pressed; the "twenty" and "seventy" keys will give two dimes with "naught", "one", "two", "three" or "four" keys; the "thirty" and "eighty" keys will give one dime with "five", "six", "seven", "eight" or "nine" keys, and the "forty" and "ninety" keys will give one dime with "naught", "one", "two", "three" or "four" keys and two dimes with "five", "six", "seven", "eight" or "nine" keys.

On the slidable member controlling the registration of twenty-five cent pieces, there will be one set of arms for engagement by the rods of keys "twenty" and "seventy"

on the tens side, and keys "five", "six", "seven", "eight" and "nine" on the unit side; in order that a twenty-five-cent coin will be registered for all sums from "twenty-five" to "twenty-nine" cents and from "seventy-five" to "seventy-nine" cents. Such coins as are needed with sums ranging from "thirty" to "forty-nine" cents and from "eighty" to "ninety-nine" cents will be registered directly by the action of the rods upon said slidable member. The half-dollar coins or fifty cent pieces are all obtained by direct action of the rods upon the slidable member controlling the registration of such coins.

I have only described the arrangement and action of the "cent" side of the thirty-eight-keyed machine, but it will be understood that the slidable members of the "dollar" side are constructed and operated in the same manner as the slidable members of the "cent" side.

In Figs. 26 to 30, inclusive, I have shown a machine arranged to operate by the use of electric current, the contacts being made directly by the key rods 3^e. In the casing of the machine a plate 45 formed of conducting material is mounted on insulating strips 46 of wood or other suitable material. This plate is provided with a binding post 47 and is perforated at 48 to guide the end of the key rods 3^e. Alternating layers of conducting and non-conducting material 49 and 50, respectively, are disposed within the casing, the layers of conducting material being positioned in the same manner and taking the place of the slidable members. The top and bottom pieces 50 of non-conducting material extend beyond the others to form means for fastening the structure to the casing of the machine; for instance by the screws 51. The members 49 may either be continuous perforated plates of the form shown in plan, Fig. 26, or they may be short sections connected by wires or other contact means. What is desired is an electric conductor extending over the whole space occupied by the key board. The members 49 are extended at one end as shown, and are provided with binding posts 51, 51^a, 51^b, 51^c and 51^d. The arrangement is such that the members 49 and 50 form vertical walls of alternate strips of conducting and non-conducting material, and between these walls the key rods 3^e pass. These key rods are supplied with springs 5^e at their lower ends resting on the plate 45. The springs serve the double purpose of returning the keys to normal position when released after being depressed, and of supplying a permanent electric connection between the plate 45 and the key rods 3^e, which latter must be conductors. The rods 3^e are supplied with contacts 52 as shown in Figs. 27 and 29; Fig. 27, being a section just in front

of the line of keys controlling the registry of nickels, and Fig. 29, a section of part just in front of the naught line of keys. Fig. 29, shows just sufficient parts to illustrate the arrangement of contacts. Magnets 55, 55^a, 55^b, 55^c and 55^d, for the several layers of conducting material controlling the recording of the cams with corresponding registering mechanism are shown, which magnets are fully described hereinafter.

The plate 45 is connected at one side to a suitable battery or other source of electric current, the other side of battery being connected to one pole of the several magnets. The binding post 51 is connected with the other pole of magnet 55; binding post 51^a with magnet 55^a; binding post 51^b with magnet 55^b, and so on. The circuit therefore is complete except for the gaps between the contacts 52 and the conducting plates 49, and when any key is depressed so as to form contact, such contact formed with the conducting plate 49 will actuate magnet 55; with conducting plate 49^a will actuate magnet 55^a, and so on. The contacts, except where pennies and two dimes are wanted, are all placed at the same distance above the center of the conducting plate with which they are to form contact, and this distance is equal to the vertical distance through which the keys may be depressed. Therefore, except for pennies and two dimes, the contacts will all pass to center of conducting plates and return, thus making and breaking circuit once and therefore causing recorders to record one unit. The contacts designed to yield two dimes are placed at a distance above the conductors 49^b, so that the depression of the key will cause contact to pass clear across and beyond 49^b, thus making and breaking the current once in the descent and once in the ascent. The one-penny key, see Fig. 27, has one contact placed the full distance of movement of keys above center of conductor 49; the two-penny key has one contact placed as for two dimes, only being above conductor 49 instead of conductor 49^b; the three-penny key has two contacts, one placed at the distance of movement of keys above center of conductor 49^a and the other close to conductor 49, so that the lower one will reach and cross conductor 49^a before the upper one reaches it; then the upper one will reach. There will therefore be three makes and breaks of current and a record of three units. The four-penny key has two contacts both so close to conductor 49^a that they will both completely cross it and yet far enough apart so that the first one will be beyond it before the second one reaches it. This will make four breaks of the current; two on the descent and two on the ascent.

The arrangement of the key rods is fully shown in Figs. 26, 27 and 28. The "ten"

key rods bear one contact at the proper distance of movement above conductor 49^b, the "twenty" key rods bear one contact at less than the distance of movement above conductor 49^b, the "thirty" key rods bear one contact at distance of movement above conductor 49^c, and another at distance of movement above conductor 49^a. The "forty" key rods bear one at proper distance above conductors 49^c, 49^b and 49^a, the "fifty" key rods bear one at proper distance above conductor 49^a. The "five" key rod bears one contact at proper distance above conductor 49^a, the "fifteen" key rod has contacts at proper distance above conductors 49^b and 49^a, the "twenty-five" key rod has contact at proper distance above conductor 49^c, the "thirty-five" key rod has contacts at proper distance above conductors 49^c and 49^b, the "forty-five" key rod has one contact at proper distance above conductor 49^c and one at less than distance of movement above conductor 49^b. Above "fifty", the key rods bear the same contacts as below "fifty", with the "fifty" contact added. That is to say, key rod "fifty-five" is the same as key rod "five" with "fifty" added; key rods "eleven", "twelve", "thirteen" and "fourteen" the same as key rods "ten" with "one", "two", "three" or "four" pennies added, and so on throughout the numbers. The conductors and sections of insulating material are preferably formed into a solid pile by any suitable fastening means. The contacts made by the key rods 3^e with the layers of conducting material 49, 49^a &c., energize the magnets 55, 55^a &c. Armatures 56, 56^a &c., are pivotally mounted in frames 57 above these magnets, said armatures carrying segmental rack sections 11^e which mesh with pinions 12^e of the registering or recording devices 13^e. After the circuit is broken, releasing the armatures, they are returned to the normal position by means of springs 58.

In Fig. 30, I have illustrated a form of machine having slidable members which effect the operation of the recorders by an electric current; the circuit being made and broken by spring contacts carried by the slidable members and said members being identical with the arrangement of the machine shown in Figs. 1, 2 and 3. One view only is shown as it illustrates in detail the electrical arrangement; the mechanical parts being the same as the other machine. A metallic plate 45^a is insulated from the mechanical portion of machine by strips of insulating material 61. The racks 11 of the machine shown in Figs. 1, 2 and 3, are replaced by the extensions 11^f carrying contacts 62. These extensions may be insulated from the balance of machine by any means forming a connection between them and the slidable members 6^f. Attached to the plate 45^a at a convenient point above or below the

extensions 11^f are the insulating pieces 63, and inserted into and flush with surface of the same are the narrow electric conductors 64. Riveted or otherwise secured to the extensions 11^f are the spring contacts 62 so placed that one motion of slide will cause them to advance sufficiently to engage conductors 64, but not to move beyond it. On the one-cent slidable member are two contacts 62 and 62^a. Contact 62 is so placed that motion equaling one unit of distance of the one-cent slide will cause it to engage the conductor 64 but not pass beyond, while a movement of two units of distance will cause it to pass beyond conductor 64. Contact 62^a is so placed that a movement of three units of distance will cause it to engage the conductor 64, while a movement of four units of distance will cause it to pass beyond said conductor. The metallic plate 45^a is connected with one pole of a suitable battery or other source of electric current, the other side of same battery or current being connected with one pole of each of the five magnets 65, 65^a, &c., controlling the recorders for the different denominations. The conductors 64 carrying the binding posts 66, 66^a, 66^b, 66^c and 66^d are connected to the other pole of same magnets; post 66 to magnet 65, and so on. The armatures 56 of the magnets are pivotally mounted in a frame 57, said armatures carrying at one end segmental rack sections meshing with gear wheel 12^f of the recording device 13^f. At the opposite ends of said armatures are springs 58 of sufficient power to return said armatures to original position when released from the pull of the magnets when the circuit is broken. The action of this machine is as follows:—The plate 45^a being connected with one side of a battery, each extension 11^f and the contacts 62 are connected with that side of battery. The other side of the battery is connected to one pole of each of the five magnets, and the conductors 64 are connected to the other pole of same magnets. The circuit is complete, except for gap between contacts 62 and conductors 64. When any slidable member is moved forward and makes contact, that magnet, the circuit of which is completed by such contact, will act, depressing its armature and pulling the respective recorder a sufficient distance to record one unit. On the return of the slide to its original position, the circuit will be broken, and the spring 38 at the back end of armature lever will return rack to its original position.

The slidable member controlling the registration of dimes sometimes moved two units of distance to record two dimes, and in this case the contact 62 of the extension 11^f will cross the conductor 64 and pass onto the hard rubber surface beyond. The circuit will, therefore, be made and broken on the forward movement of the slidable member

and will be again made and broken on return movement of said member. This will cause two movements of the armature and the recording of two dimes. The slidable member controlling the registration of pennies is equipped with two contacts, which are arranged as previously described, and on a motion of one unit of distance will make and break circuit once, making a record of one penny. A motion of two units of distance will make and break circuit twice, recording two pennies. A motion of three units of distance will make and break circuit three times and record three pennies, and motion of four units of distance will make and break circuit four times and record four pennies. The "dollar" side of the electrically operated machines (not shown) is of the same general arrangement as the "cent" side, the only difference being in the arrangement of the contacts and cams.

In Figs. 31, 32, 33 and 34, I show a form of denomination calculator that may be operated without keys. The instrument comprises a casing 70 carrying the mechanism, an important element of which consists of a plate 71, apertured at 72, 73, 74, 75 and 76, for the blanks, and provided with engaging portions 77, 78, 79, 80 and 81, respectively, for the registration of pennies, nickels, dimes, quarter- and half-dollars needed to make up the various amounts. The plate 71 is carried by a shaft 82 supported by suitable means within the casing 70, and a spring 5^s is provided to insure the return of said plate after it has been depressed. Above the plate 71 and firmly secured to the shaft 82 is another plate 83, provided with an operating knob 84 firmly secured thereto. The marginal edge of the plate 83 is divided into one hundred equal divisions, marked from naught to ninety-nine. The shaft 82 together with the plates 71 and 83 can freely rotate within the casing 70, while at the same time, these elements are capable of a direct downward or sliding motion when pressed from above. After such action, they will be returned to their normal position by the spring 5^s when the pressure from above is released. In addition to the operative portions 77, 78, *et seq.*, of the plate 71 between the several apertures 72, 73, *et seq.*, said plate is provided with projecting portions 85 on the under side of the same in line with the operative portions 79 of said plate controlling the registrations of the dimes, such projections being employed when it is desired to register two dimes, and engaging the rod controlling the registration of dimes in advance of the regular operative portion 79 of the plate so as to move the dime rod through double the distance it would move if acted upon by the portion 79 of said plate. The projections 85

are arranged for a distance equal to five spaces on the scale, and will effect the registration of two dimes for all sums from "twenty" to "twenty-four"; from "forty-five" to "forty-nine"; from "seventy" to "seventy-four", and from "ninety-five" to "ninety-nine".

The edge of the plate 71 is provided with one hundred teeth or recesses 86, such teeth tapering from nothing on the under side of plate to base of the same at top, and an engaging piece 87 is provided, carried by the casing and comprising a tapered tooth which serves to guide the plate 71 when it is depressed, and insure that the proper amount desired to be designated will be operated by such plate. The parts are beveled or tapered as noted so that there will be no need of accurate adjustment in the operation of the apparatus. A positioning of the denomination plate within slightly less than half a space of the mark will be sufficient to insure proper registry. Underneath the plate 71 and supported in the same casing, are the rods 88, 89, 90, 91, 92, 93, 94 and 95, controlling the registration of one, two, three or four pennies, and the nickels, dimes, quarter- and half-dollars necessary. These rods rest on levers 96 loosely fitted on a shaft 97, upon which they may rotate, but are held in place laterally by collars 98 or other devices. The rods are properly adjusted as to length, and the shaft 97 is firmly secured to the framework or casing of the instrument. At the other end of the levers 96 are rods 6^s resting upon said levers and having springs 10^s to restore them to their normal position, such springs engaging fixed collars 99 on said rods 6^s. The upper ends of the rods 6^s are provided with racks 11^s engaging pinions 12^s of the recording devices 13^s. The distance between the lower end of the shaft 82 and the bottom plate 100 of the casing is sufficient to allow the proper downward motion to said shaft and the plate 71.

The action of the machine is very simple: The knob 84 is grasped in the hand and the plates 71 and 83 rotated until the number desired on the scale at the margin of said plate 83 is opposite the point on the casing in line with the operating rods, then downward pressure is given the knob 84. The plate 71 will then be disposed so that the apertured portions will come opposite the rods controlling the denominations not desired, with the solid portions of the plate opposite the rods controlling the denominations required. When the downward movement is given, therefore, the plate 71 will miss the rods controlling the denominations not required and will push certain of the rods, and through the latter the levers, and so on to the recording device for the denominations required. In practice, the rods controlling the registration of quarter- and

half-dollars would probably be on the opposite side of the machine from that shown to avoid the long bend or angle in the levers leading to the recorders. The dollar side of the machine (not shown) is of the same general arrangement, the apertures of the plate corresponding to plate 71 being simply varied to suit the different requirements met in the dollar side of such a machine.

I have shown an arrangement for computing the number of bills necessary, in which a twenty-dollar bill is the highest denoted. In large pay-rolls, particularly in cases where payments are made once a month, it may be desirable to employ bills of larger denominations, such as fifty and one hundred dollars. For the purpose of taking care of these denominations, devices within the scope of my invention may be added.

Any suitable form of registering or recording device may be employed in connection with my improved machine, such for instance as I have illustrated at 13 in Figs. 36 to 40, both inclusive, or that shown in Patent No. 634,073, dated Oct. 3, 1899, properly modified to insure the indication of one unit for every tooth of the actuating wheel. These registering or recording structures are arranged to accumulate and indicate the movement of the actuating pinion which is engaged by a rack bar 11; such pinion 12 being so connected to the shaft or spindle carrying the wheels forming the registering or recording pile as to run free when the rack bar 11 is retracted.

In several of the claims, reference is made to "selective manipulative elements," and by this term I desire to broadly designate the various keys and other members designed to be actuated manually in order that the sums represented by the numbers on said "keys" or "selective manipulative elements" may be automatically divided into the kind and quantity of pieces of money making up the amount represented by said numbers. Such term is also designed to include the portion actually manually operated and the coacting mechanism between the same and the registers or recorders which indicate the result of the operation or operations of such "elements."

I claim:

1. In a calculating machine, the combination of a plurality of selective manipulative elements marked to represent any combination of numbers within the capacity of the machine, and a plurality of unit registers or accumulators each for indicating the units of the stated numbers in denominations of money, each of said selective manipulative elements being operable to cause an accumulation of units upon one or more of said unit registers or accumulators and automatically dividing and selecting the de-

nominations and the quantity of pieces of money in the sum represented by the operated selective manipulative element.

2. In a calculating machine, the combination of a plurality of selective manipulative elements marked to represent any combination of numbers within the capacity of the machine, a plurality of unit registers or accumulators each for indicating separate portions of the stated numbers in denominations of money, and coacting operative mechanism between the selective manipulative elements and the unit registers, each of said selective manipulative elements when operated causing an accumulation of units upon one or more of said unit registers or accumulators and automatically dividing and selecting the denominations and the quantity of pieces of money in the sum represented by the operated selective manipulative element.

3. A calculating machine comprising indicators, selective manipulative means marked to represent any combination of numbers within the capacity of said machine, and connections between the latter and said indicators whereby upon the operation of the manipulative means to indicate any amount within the capacity of the machine they will automatically select and operate the proper indicators to show the denominations and the number of coins it will take to make up said amount.

4. A calculating or computing machine, comprising a series of independent and independently cumulative registers or recorders, a slidable selective member, pinions carried by said registers or recorders, and actuating means for said pinions controlled by said slidable member to effect the operation of the registers or recorders, said slidable member being apertured to form a selective element.

5. A calculating or computing machine, comprising a series of independent and independently cumulative registers or recorders, a series of slidable selective members, pinions carried by said registers or recorders, racks carried by said slidable members for engagement with said pinions to effect the operation of the registers or recorders, said slidable members having apertures, vertically moving rods passing through said apertures, and cams carried by said rods for engagement with the walls of said apertures whereby said slidable members may be moved by depressing said rods.

6. A calculating or computing machine,

comprising a series of registers or recorders, a series of slidable members, pinions carried by said registers or recorders, racks carried by said slidable members for engagement with said pinions to effect the operation of the registers or recorders, said slidable members having apertures, vertically moving rods passing through said apertures, a series of cams carried by each of said rods for engagement with the walls of said apertures whereby said slidable members may be moved by depressing said rods, and denomination keys carried by said rods.

7. A calculating or computing machine, comprising a series of registers or recorders, a series of slidable members having means for actuating said registers or recorders, a series of vertically moving rods, and cams carried by said rods for engagement with the slidable members whereby one or more of the same may be operated by the depression of one of said rods.

8. A calculating or computing machine, comprising a series of registers or recorders, a series of slidable members, pinions on said registers or recorders, racks carried by said slidable members, said slidable members having openings, vertically moving rods adapted to said openings, and a series of cams carried by each of said rods for engagement with the walls of said openings whereby said slidable members may be operated, some singly and others in unison, by the depression of the rods.

9. A calculating or computing machine, comprising a series of registers or recorders, a series of slidable elements for actuating said registers or recorders, a series of keys representing the units of any sum, a series of keys representing the tens of said sums, and means carried by said slidable members for causing the coaction of said keys for the movement of the slidable members when the sum contains both tens and units, the slidable members being so constructed and combined with said keys as to automatically separate any amount expressed thereby into its predetermined parts or units of value, the number of which is indicated upon the respective registers or recorders.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

HENRY R. GRIFFEN.

Witnesses:

MURRAY C. BOYER,
JOS. H. KLEIN.