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PROVISIONAL SPECIFICATION.

**Adding and Subtracting Machine with a Distant Total or Difference Indicator.**

We, GUSTAV SCHWARZ, of 18, Hans Sachs Gasse, Vienna XVIII, Merchant, and RUDOLF SCHWARZ, of 96, Währingerstrasse Vienna, XVIII, Mechanist, do hereby declare the nature of this invention to be as follows:—

5 Our invention relates to that class of machines for adding numbers together or for subtracting one number from another, in which a typewriter, adapted to print the numbers, is combined with a computing machine or a subtracting machine, the succession of the figures 1, 2 . . . . . 8, 9 0 being reversed upon the registering discs of this latter.

10 The invention has for its object to provide means for the total or difference to be indicated at a place distant from that where the typewriter is operated.

15 According to our invention, the adding or subtracting machine is so constructed and arranged that, on a key of the typewriter, which comprises ten keys corresponding to the numerals 0, 1, 2 . . . . . 8, 9, being operated, as many successive makings and breakings of an electric circuit take place, as there are units contained in the number corresponding to the key. The said electric circuit contains, beside the source of electric current, as many electro-magnets, arranged in multiple arc, as the sum is to comprise places, the said electro-magnets being arranged in the locality where the sum or difference is to be indicated, and provisions being made for completing the electric circuit by the shunt containing the required electro-magnet, every time the typewriter is displaced according to the value of a figure, while the other shunts remain cut out.

20 In order to enable the typewriter to be displaced over the book into which the numbers are to be entered, according to the value of the figures and also line by line, we provide a frame to be clamped upon the book, a sliding carriage adapted to be slid along the said frame, and a second sliding carriage mounted upon the former carriage and carrying the typewriter and being movable in transverse direction.

25 The typewriter is circular and movable round a pivot. It comprises ten spring plungers carrying the type 0, 1, . . . . . 8, 9, and having their inner faces provided with projections, which, on a plunger being pressed down, abut upon a circular rail recessed at its foremost point. It will be readily understood that, when a plunger is seized and pressed down until the projection abuts upon the circular rail, and the typewriter is afterwards so rotated as to bring the seized plunger into the foremost position, the inside projection of the typewriter will drop through the recess of the rail and the type will be printed.

30 Beside the inside projections referred to, which may carry anti-friction rollers, the spring plungers of the typewriter also carry outside projections in the shape of vertical ribs, the lengths of which are to each other as the numerals to be printed by the corresponding plungers, that is to say, the length of the rib of

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the plunger carrying the type "2" is twice as long as the rib of the "1" plunger, the rib of the "3" plunger thrice as long, and so on.

When the inside projection of a plunger drops through the recess of the circular rail, the outside projection carries along—against the pull of springs—one arm of a lever, the other arm of which has the shape of a toothed sector, in gear, by means of ratchet mechanism, with a train of wheels adapted to drive a fan. On the lever moving back under the action of the springs, the train of wheels turns a ten-toothed contact wheel by as many teeth as the type of the operated plunger indicates units, and these teeth strike a contact spring, whereby an electric circuit, comprising one of the shunts into which the electro-magnets are inserted, is completed.

All the shunts have their pole pieces arranged in a series upon the longitudinally movable carriage, and the transversely movable carriage is provided with a contact spring rubbing over the said pole pieces.

Each numeral disc is in gear with a weight or spring motor for driving it, and the armature lever of the corresponding electro-magnet carries an escapement anchor, which allows the numeral disc to make a tenth of a revolution every time the armature is attracted.

The shaft of each numeral disc carries a contact arm, which, every time the said disc passes through the position in which "zero" is indicated, completes the shunt corresponding to the next higher place.

For the displacement of the transverse carriage, according to the value of the numerals, the said carriage is provided with a rack gearing with a pinion mounted on the longitudinal carriage, and to this latter is pivoted a lever having one arm made up into a toothed sector gearing with the said pinion, while the other arm is connected with a coiled spring and adapted to abut against one or the other of a number of vertically movable spring studs. As soon as a numeral is printed, the stud, against which bears the lever arm, is lowered, when the spring draws the said arm against the next stud and thereby causes the typewriter to be shifted one place.

Although we have in the foregoing statements described our adding and subtracting machine as constructed for the decimal system, it is obvious that the same can without difficulty be transformed for the addition or subtraction of English money. Such a machine would comprise a farthing dial marked 0, 1, 2, 3 and making  $\frac{1}{4}$  of a revolution every time the corresponding electro-magnet attracts its armature, a pence dial marked 0, 1, . . . . . 10, 11 and making  $\frac{1}{12}$  of a revolution under the action of its electro-magnet, a shilling dial marked 0, 1, . . . . . 18, 19 and making  $\frac{1}{20}$  of a revolution when operated, and any number of pound dials arranged according to the decimal system.

In order to enable one and the same machine to be used for both purposes, we provide two sets of numeral discs or dials, one set having the numerals marked on it in the reverse order of the other. To admit of easy interchange, the disc shafts may be made square and the discs composed of two halves connected together by a hinge and a hook.

Dated the 11th day of November 1899.

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4, South Street, Finsbury, London, Agents for the Applicants.

## COMPLETE SPECIFICATION.

**Adding and Subtracting Machine with a Distant Total or Difference Indicator.**

We, GUSTAV SCHWARZ, of 18, Hans Sachs Gasse, Vienna XVIII, Merchant, and RUDOLF SCHWARZ, of 96, Währingerstrasse Vienna XVIII, Mechanist, do

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hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Our invention relates to that class of machines for adding numbers together  
5 or for subtracting one number from another, in which a typewriter, adapted to print the numbers, is combined with a computing machine or subtracting machine, the succession of the figures 1, 2 . . . . . 8, 9 0 being reversed upon the registering discs of this latter.

The invention has for its object to provide means for the total or difference to  
10 be indicated at a place distant from that where the typewriter is operated.

According to our invention, the adding or subtracting machine is so constructed and arranged that, on a key of the typewriter, which comprises ten keys corresponding to the numerals 0, 1, 2 . . . . . 8, 9 being operated, as  
15 many successive makings and breakings of an electric circuit take place, as there are units contained in the number corresponding to the key. The said electric circuit contains, beside the source of electric current, as many electro-magnets, arranged (in multiple arc, as the sum is to comprise places, the said electro-magnets being arranged in the locality where the sum or difference is to be  
20 indicated, and provisions being made for completing the electric circuit by the shunt containing the required electro-magnet, every time the typewriter is displaced according to the place value of a figure, while the other shunts remain cut out.

The result of the attraction of an armature is that a disc along the edge of which the figure 0 to 9 are marked, is turned to an extent corresponding to one  
25 figure. In order to cause the disc corresponding to the next higher place to be turned one numeral, when a numeral disc passes from the indication 9 to 0, a normally interrupted electric connection runs from each shunt to the shunt containing the electro-magnet which corresponds to the next higher place, and while the numeral disc corresponding to the lower place passes from 9 to 0, a  
30 revolving circuit maker strikes a spring terminal and thereby closes the said electric connection.

In order to enable our invention to be fully understood we will describe the same in detail with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation, and

35 Figure 2 is a plan of the typewriter and the device for displacing it according to the place value of a figure to be printed.

Figure 3 is a section on the line 3—3, Figure 1 shewing the mechanism, by which the circuit is closed while a numeral is being printed.

Figure 4 is a horizontal section on the line 4—4 Figure 1 shewing the sliding  
40 contact piece closing the shunt of the electro-magnet concerned, every time the typewriter is shifted.

Figure 5 is an elevation illustrating how the frame carrying the typewriter is clamped upon a book for use.

Figure 6 is a front elevation, and

45 Figure 7 is a section on the line 7—7, Figure 6, of numeral discs, the weight-motors adapted to drive them, and the electro-magnets, which, by means of their armature levers control the said motors.

Figures 8 and 9 are diagrams shewing the circuit connections in the two cases  
50 respectively where the battery is inserted as a whole in the main line, and where it is inserted in portions in the shunts.

It will be seen from Figure 5, that the rectangular frame  $a, a^1, a^1$  can be clamped upon the book  $b$  in which the numbers are to be entered. For this purpose, screws  $a^2$  which pivot in the base plate  $a^3$  engage in tapped holes in the cross bars  $a^1, a^1$  of the frame.

55 A carriage  $c$  is adapted to be slid along the longitudinal bars  $a, a$  of the frame, the said carriage having secured to one of its lateral slide-bars a spring  $c^1$ , which

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carries a hemispherical knob  $c^2$ . The said knob takes into recesses  $a^4$  formed in the adjacent bar  $a$  at intervals corresponding to the interlinear spaces.

Upon the said carriage  $c$  another carriage  $c^3$  is movable in a transverse direction, this carriage  $c^3$  having secured to it the pivot  $c^4$  and the circular rail  $c^5$  for the circular typewriter. The carriage  $c^3$  supporting the typewriter is made movable in the transverse direction in order to provide for the displacement of the typewriter according to the place value of the figure to be printed. The displacements are performed by the pinion  $c^6$  mounted upon the longitudinally movable carriage  $c$  and gearing with a rack  $c^7$  screwed to the transversely movable carriage  $c^3$ . The pinion  $c^6$  is driven by the toothed sector  $c^8$  having its pivot  $c^9$  secured to an extension of the longitudinally sliding carriage  $c$ . Beyond the pivot  $c^9$  a lever arm  $c^{10}$  is rigidly connected with the toothed sector  $c^8$ , and a coiled spring  $c^{11}$  has one end fixed to the said lever arm  $c^{10}$  and the other end to a laterally projecting arm  $c^{12}$ , screwed to the carriage  $c$ . The stop pins  $c^{13}$ , which may be lowered by pressing down the corresponding keys  $c^{14}$ , keep the lever arm  $c^{10}$  in position against the pull of the spring  $c^{11}$ . When the cross carriage  $c^3$ , and consequently the lever arm  $c^{10}$  also are in their extreme left-hand positions, figures of the highest place value can be entered. As soon as the figure is printed, the first of the keys  $c^{14}$  is pressed down, whereby the first stop pin  $c^{13}$  is lowered, and the spring  $c^{11}$  is permitted to pull the arm  $c^{10}$  over the said stop pin to the next stop pin. The toothed sector  $c^8$  and the pinion  $c^6$  and rack  $c^7$  transmit this movement to the cross carriage  $c^3$  carrying the typewriter. When all the parts have arrived in the positions corresponding to the entering of units, the knob or handle  $c^{15}$  of the arm  $c^{10}$  may be taken hold of in order to push the said arm over the sloped ends of the stop pins  $c^{13}$  into the position corresponding to the entering of the next numeral. In consequence of this displacement of the arm  $c^{10}$ , the spring  $c^{11}$  is put in tension.

The annular typewriter is carried by the circular plate  $d$ , loosely mounted on the pivot  $c^4$  and having secured to it, by means of the standards  $d^1$ , a ring  $d^2$ , in which guide-holes for the plungers carrying the types are formed. To the lower surface of the plate  $d$  are secured brackets for the rollers  $d^3$  running upon the rail  $c^5$ . The type-plungers  $d^4$  are guided in square holes in the base-plate  $d$  and in the ring  $d^2$  the coiled spring  $d^5$  keeping the said plungers raised, and stop rollers  $d^6$  being pivoted to the inner faces of the plungers. On a plunger being pressed down, its stop roller  $d^6$  bears upon the outer marginal portion of the rail  $c^5$ , and when the whole typewriter is then, by means of the lowered plunger turned to the left or to the right, the type first passes over one of two, inking rollers  $d^7$ , fastened to the rail  $c^5$  by means of springs. Afterwards the stop roller  $d^6$  drops into the recess  $c^{16}$  of the rail  $c^5$  whereby the inked type is pressed upon the paper.

It has hereinbefore been stated that the plunger  $d^4$ , while being lowered, must cause as many successive makings and breakings of an electric circuit as there are units in the numeral printed by the said plunger. To this effect, all plungers except that carrying the cipher type, are provided with outwardly projecting ribs  $d^8$  of different heights. The said projecting ribs or tappets carry along, against the pull of springs  $f, f$ , a plate-shaped arm  $f^1$  of an angular lever, the other arm of which is formed by a toothed sector  $f^2$ . According to the height of the rib or tappet  $d^8$ , the lever arm  $f^1$  is moved downward a longer or shorter distance. During this movement the toothed sector  $f^2$  rotates the pinion  $f^3$  loosely mounted on its shaft and carrying upon its boss the ratchet wheel  $f^4$ , at one side, and the star-shaped contact wheel  $f^5$  provided with nine points, at the other side. While this rotary movement takes place, the springs  $f, f$  are put in tension, and the ratchet wheel  $f^4$  freely passes below the pawl  $g$  pivoted to the toothed wheel  $g^1$ , which is mounted by the side of the ratchet wheel; at the same time, a given number of the points of the contact wheel  $f^5$  slide over the upper surface of a contact spring  $h$ , which upper surface is coated with insulating material. Afterwards the toothed sector  $f^2$  and the

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pinion  $f^3$  turn in the opposite direction under the action of the springs  $f$ ,  $f$ , formerly put in tension, and the ratchet wheel  $f^4$  carries along the pawl  $g$  pivoted to the toothed wheel  $g^1$ , whereby this latter is rotated. It transmits the movement to the pinion  $g^2$ , the shaft of which also carries the toothed wheel  $g^3$  and this latter is in gear with a pinion  $g^5$  mounted on the shaft of a fly  $g^4$  for checking the rate of speed. Owing to this arrangement, the return movement takes place with a predetermined speed, moderated by the fly  $g^4$ , and during this return movement with moderated speed, the same number of points of the contact wheel  $f^5$  rubs along the conductive lower surface of the spring  $h$ , which may be connected, by means of the switch lever  $h^1$  with one pole of a source of electricity, by preference of a galvanic battery. From the teeth of the contact wheel  $f^5$ , the current flows into the carriage  $c$  and cross carriage  $c^3$  to which a contact spring  $j$  is secured. This latter bears against and rubs over a block  $k$  of insulating material inserted in the carriage  $c$ , and having as many conductive contact-pieces  $k^1, k^2, \dots$  imbedded in it as the numbers to be added may contain places. When the typewriter is displaced according to the place value of the figure to be entered the contact spring  $j$  also passes from one of the contact-blocks  $k^1, k^2, \dots$  to another. From the contact blocks or terminals  $k^1, k^2, \dots$  run as many shunts, 1, 2,  $\dots$  as there are contact-blocks and at the place where the sum or difference for the time being is to be indicated an electro-magnet I, II, III,  $\dots$  is inserted in every shunt. Beyond the electro-magnets, the shunts may unite again and the conducting wire may lead to the other pole of the source of current, as shewn in Figure 8. There may however, also be separate sources of electric current inserted in every shunt, as illustrated in the diagram Figure 9.

In front of each electro-magnet, there is mounted upon a shaft a numeral disc  $m$ , having its cylindrical face divided into ten squares marked with the Figures 1, 2,  $\dots$  9, 0. By the train of wheels  $m^1, m^2, m^3, m^4, m^5, m^6$  the shaft of the numeral disc  $m$  is driven from the shaft of the corddrum  $m^7$ . The said cord-drum is loosely mounted upon its shaft, and one of its end sheaves has secured to it a ratchet wheel  $m^8$  to which corresponds a pawl  $m^9$  pivoted to the toothed wheel  $m^6$ . For the purpose of winding up the cord  $p$ , by which the weight  $p^1$  is suspended, the hollow trunnion of the drum  $m^7$  has secured to it a bevel wheel  $q$  in gear with a bevel wheel  $q^1$  secured to a vertical shaft  $q^2$  which is provided with a crank and handle  $q^3$ .

The armature lever  $r$ , upon which the spring  $r^1$  exerts its pressure in such a direction as to tend to keep the armature  $r^2$  raised while the electro-magnet is not excited is movable upon the pivot pin  $r^3$ . The other arm of the armature lever has its free end formed like an anchor  $r^4$  similar to that used in a clock-escapement. The said escapement anchor  $r^4$  takes into a ten toothed pinion  $r^5$  fixed to the shaft of the numeral disc  $m$  and thereby keeps the train of wheels of the weight-motor locked so long as the armature  $r^2$  is not attracted. When the armature is attracted, one of the pallets or teeth of the escapement anchor  $r^4$  is withdrawn from the pinion  $r^5$  and at the same time the other tooth takes into the next space between two teeth of the pinion, whereby the shaft of the numeral disc is allowed to make  $\frac{1}{10}$ th of a revolution.

Every time a numeral disc  $m$  passes to the indication "zero" or beyond this indication, it is necessary also that the numeral disc corresponding to the next highest place should be turned to the next highest figure. In cases when the indicated sum passes from 99 to 100, or from 999 to 1000, three or four numeral discs must be turned simultaneously. To this end, every one of the shunts 1, 2 3, *etc.*, is provided with a conductive connection,  $x^1, x^2, x^3, \dots$ , to the shunt comprising the electro-magnet, which corresponds to the next highest place the said conductive connections being interrupted at one point. For closing the interruption of any of the conductive connections  $x^1, x^2, x^3, \dots$ , at the moment when a numeral disc indicates "zero," the shaft of the numeral disc  $m$  also carries a con-

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tact arm  $n$  to which corresponds a contact spring  $n^1$ . The said arm  $n$  and contact spring  $n^1$  are inserted in the electrical connections  $x^1, x^2, x^3$  etc., in the manner shewn in Figures 8 and 9.

It will be readily understood that it depends on the succession in which the numerals are caused to appear behind the holes of the box containing the discs, (i.e. 1, 2, 3 . . . . . 9, 0 or 9, 8 . . . . . 3 2 1) whether the machine will act as an adding or a subtracting machine. In order to enable one and the same machine to be used for both purposes we provide two sets of numeral discs. To admit of easy interchange the discs may be composed of two halves connected for instance by a hinge and hook or in any other well known and suitable way. 10

When the sum or difference indicated is also to be entered in the book by means of the typewriter, the circuit is first broken by means of the switch lever  $h^1$ .

The operation of the machine is as follows:—The frame  $a^1 a^2 a^3$  is first clamped upon the book in which the numbers are to be entered, in such a position that the circular typewriter, when brought into its extreme right hand position has its recess  $c^{16}$  placed over the units column of the book. As already explained, the typewriter is shifted from the left to the right by operating the keys  $c^{14}$ , whereby the corresponding stop pins  $c^{13}$  are lowered and the lever  $c^{10}$  is allowed to be drawn to the right by the coiled spring  $c^{11}$ ; the movement of the lever  $c^{10}$  being transmitted, by means of the toothed sector  $c^8$ , pinion  $c^6$ , and rack  $c^7$ , to the sliding carriage  $c^3$ , upon which the typewriter is mounted. 15 20

By holding the carriage  $c$  with both hands and pushing it forward or pulling it backward along the bars  $a$ , the typewriter is also adjusted over the line, where the first number is to be printed. The knob  $c^2$  of the spring  $c^1$  passing into one of the holes  $a$ , sufficiently locks the carriage  $c$  in position. 25

As soon as the typewriter is thus adjusted upon the book, the lever  $h^1$  is turned to the left, to close the electric circuit, and the machine is thereby made ready for operation. The contact spring  $j$  then bears upon the contact block  $k^1$ , which is the terminal of the shunt line containing the electro-magnet I, adapted to actuate the unit computer, and consequently, this electro-magnet will be energized, when the electric circuit is completed by means of the typewriter, as already explained. 30

Suppose the adding discs are in the computers and they indicate the number 5,736, and that the amount 8,715 is to be added.

The operator takes hold of the plunger marked "5," presses it downward till its roller  $d^6$  bears upon the circular rail  $e^5$ , and, by means of the said plunger, turns the typewriter to the right or to the left until the roller  $d^6$  drops into the recess  $c^{16}$ . The type at the bottom end of the plunger, which has been carried over one of the inking rollers  $d^7$ , is thereby pressed against the paper of the book and the figure "5" is printed in the units column. 35 40

While the "five" plunger is descending, its rib  $d^8$  moves the plate-shaped arm  $f^1$  of the lever  $f^1, f^2$  a distance corresponding to the height of the said rib  $d^8$ , thereby putting the coiled spring  $f$  in tension. The other arm  $f^2$  of the lever  $f^1, f^2$ , of the shape of a toothed sector, causes the loose pinion  $f^3$ , with which it meshes to turn 180° whereby five teeth or points of the ten-pointed contact wheel  $f^5$ , secured to the nave of the loose pinion, are caused successively to strike the layer of insulating material upon the upper surface of the contact spring  $h$ . At the same time, the ratchet wheel  $f^4$ , likewise secured to the boss of the loose pinion  $f^3$ , slides freely under the pawl  $g$ . 45

As soon as the plunger is released, its coiled spring  $d^5$  throws it upward whereby the springs  $f, f$  are allowed to return the lever  $f^1, f^2$  into its former position. The returning toothed sector  $f^2$  again moves the loose pinion  $f^3$  180°, but in the opposite direction, whereby the five points of the ten-pointed contact wheel  $f^5$  are caused to strike the metallic lower surface of the spring  $h$ , and the electric circuit is closed and broken five times. At the same time, the ratchet wheel  $f^4$ , by means of the pawl  $f^5$  moves the wheel  $g^1$  to which the pawl is pivoted, and the wheel  $g^1$  transmits the movement, by means of the wheels  $g^2,$  50 55

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$g^3$ ,  $g^5$ , to the fly  $g^4$ , which moderates the rapidity of succession of the makings and breakings of the electric circuit.

Every time the circuit is closed, the electro-magnet I attracts its armature  $r^2$ , and as soon as the circuit is broken again, the spring  $r^1$  moves the armature lever  $r$  in the opposite direction. At each such double oscillation of the armature lever  $r$ , the escapement anchor  $r^4$ , integral with the said lever allows the ten-toothed wheel  $r^5$  to turn, under the action of the weight  $p^1$ , one tooth, that is to say, a tenth of a revolution, so that the numeral disc  $m$ , fixed to the shaft of the ten-toothed wheel  $r^5$ , which originally presented the numeral "6" behind the glass side of the box, will successively present "7," "8," "9," "0," and "1."

While the numeral disc passes from the position "9" to the position "0," the contact arm  $n$ , which is secured to the shaft of the numeral disc, and conductively connected with the shunt 1, strikes the contact spring  $n^1$ , which is in electric connection with the shunt 2. The electro-magnet II is thereby energized, and the tens disc is caused to turn one figure, *viz.* from "3" to "4."

The units having thus been added, the operator takes hold of the thumb piece  $c^{15}$  of the lever  $c^{10}$ , and pushes the lever to the left, over the second of the bevelled pins  $c^{13}$ . The carriage  $c^3$ , carrying the typewriter, is thereby also moved to the left to such an extent that the recess  $c^{16}$  is brought over the tens column of the book, and that the spring  $j$  is caused to bear upon the contact block  $k^2$ , corresponding to the shunt 2.

Now, as there is one ten to be added the operator takes hold of the plunger marked "1," depresses it, and pushes it forward, when it will print the figures "1" in the tens column of the book, and, by means of its rib  $d^8$ , cause one completion of the circuit comprising the shunt 2. Thus, the tens computer disc  $m$  is advanced from "4" to "5" by the electro-magnet II, controlling the escapement of the computer's weight motor.

In a similar manner, the typewriter is afterwards shifted over the hundreds column of the book, and the plunger marked "7" is pressed down and pushed forward, in order to add 7 hundreds to the 7 hundreds already indicated. While the numeral disc of the hundreds computer passes from the indication "9" to "0," the contact arm  $n$ , carried by the shaft of the disc rubs over its corresponding contact spring  $n^1$  and thereby closes and breaks the shunt containing the electro-magnet IV, the effect of which is that the thousands numeral disc advances from "5" to "6."

From what has been said the procedure for adding the 8 thousands will be obvious.

It will be readily understood that the operator is not bound first to add units, afterwards tens, *etc.*, but may at pleasure begin adding at any place.

For subtracting, the numeral discs provided for this purpose are inserted, and by entering the subtrahend into the book in the manner described, the minuend indicated by the numeral discs is diminished by that amount.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In an adding or subtracting machine with distant total or difference indicator, the combination with a revoluble numeral disc of a motor adapted to rotate the same, an escapement adapted to control the motor, an electro-magnet whose armature lever carries the oscillating part of the escapement, a source of electricity included in the circuit of the electro-magnet, and means for closing and opening the circuit, substantially as and for the purpose set forth.

2. In an adding or subtracting machine with distant total or difference indicator, the combination with a series of numeral discs, arranged side by side and each having the numerals 0, 1 . . . . . 8, 9 marked on its circumference, of an individual motor for each disc, adapted to rotate the same, an escapement for each motor, adapted to control it and having its oscillating part carried by the

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armature lever of an electro-magnet, an electric circuit into separate shunts of which the electro-magnets are inserted, a contact spring adapted to be displaced over the pole ends of the shunts, a source of electricity, normally interrupted electric cross connections between the shunts, and means, controlled by the motors, for closing the interruption of a cross connection every time the corresponding numeral disc passes from "9" to "0," substantially as and for the purpose set forth. 5

3. In an adding or subtracting machine with distant total or difference indicator, the combination with a series of revoluble numeral discs, arranged side by side and each having the ten numeral figures marked on its circumference, of an individual motor for each disc, adapted to rotate the same, an individual escapement for each motor, adapted to control it and having its oscillatory part carried by the armature lever of an electro-magnet, a source of electricity from one pole of which extend branch lines containing one of the said electro-magnets each, and ending in pole studs arranged side by side, a contact spring connected with the other pole of the current generator and adapted to be caused to bear against any of the branch line pole studs, a circular revoluble typewriter, connected and moving with the said contact spring and comprising ten keys for the types 0, 1 . . . . . 8 9, a circuit closer placed in the circuit between the contact spring and the source of electricity, the said circuit closer being adapted to be operated by the keys of the typewriter in such a manner that on a key being depressed as many closings and openings take place as the figure pointed contains units, interrupted cross connections between the shunts, and circuit closers adapted to close the interruptions of the said connections and so controlled by the motors as to close the interruptions every time the corresponding numeral disc passes from "9" to "0," substantially as and for the purpose described. 10 15 20 25

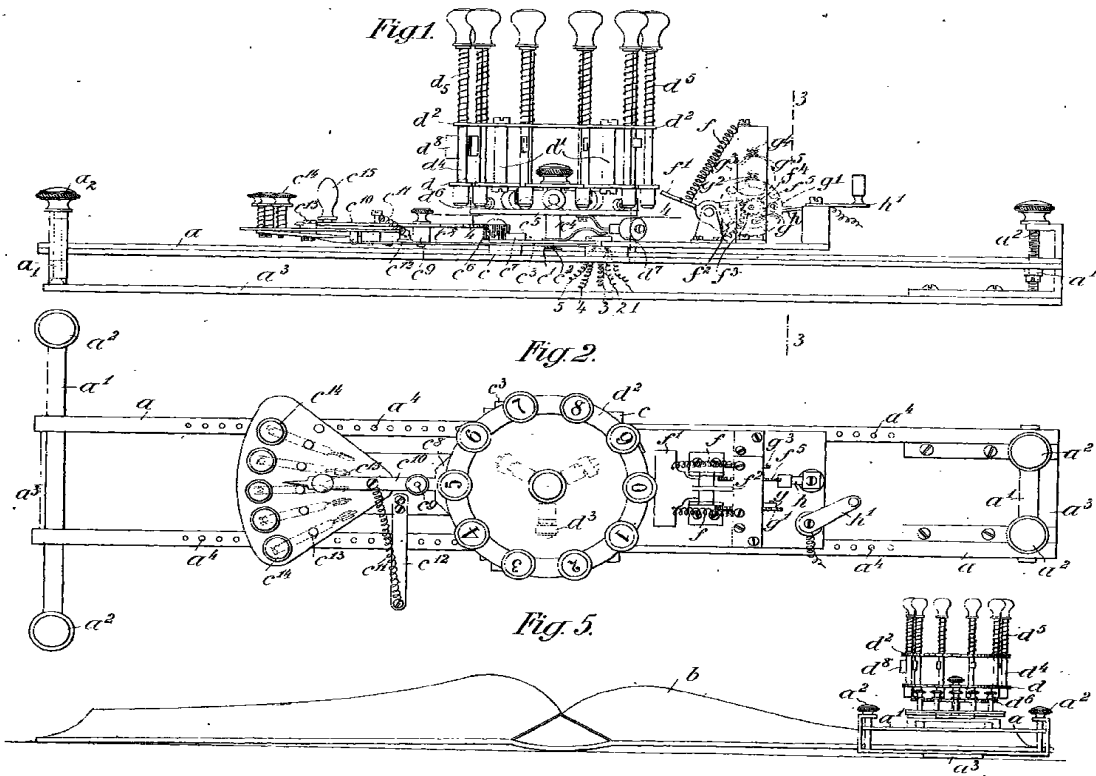
4. In an adding and subtracting machine with distant total or difference indicator, the combination with a circular revoluble typewriter comprising ten spring plungers, adapted to print the types 0, 1, . . . . . 8, 9, of a source of electricity, a contact spring connected to one pole of the current generator and having its upper surface covered with insulating material a ten-pointed contact wheel connected to the other pole of the generator and adapted to strike the contact spring with its points, a longitudinal rib formed on each type plunger except the "cipher" one, the ribs being of lengths which are to one another as 1: 2: . . . . . : 8: 9, according to the numerals to be printed by the plungers, a lever adapted to be pressed downward by the rib of a lowering type plunger, a transmitting connection between the lever and the ten-pointed contact wheel, springs adapted to be put in tension by the lowering lever, a fly for checking motion, and a ratchet mechanism adapted to drive the fly while the lever is returned by the reaction of the springs, substantially as and for the purpose described. 30 35 40

5. In an adding and subtracting machine with distant total or difference indicator, the combination with a frame, adapted to be clamped upon a book, of a carriage adapted to slide along the said frame, a carriage adapted to slide upon the former carriage in a transverse direction, a circular rail mounted upon the upper carriage, the said rail having a recess in its marginal portion in front of the carriage, a pivot arranged in the centre of the rail, a plate adapted to turn around this pivot, ten spring plungers movable in holes in the plate and carrying the types 0, 1 . . . . . 8, 9, and rollers pivoted to the plungers and adapted to roll on the rail and drop through the recess of the same, substantially as and for the purpose described. 45 50

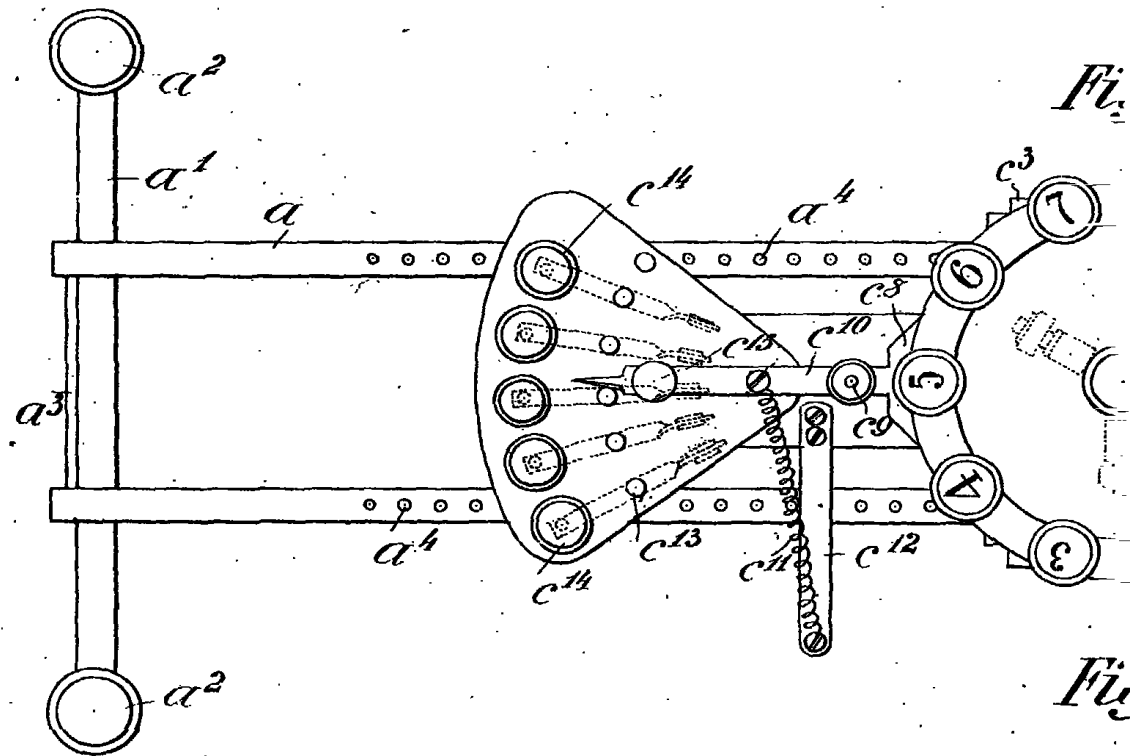
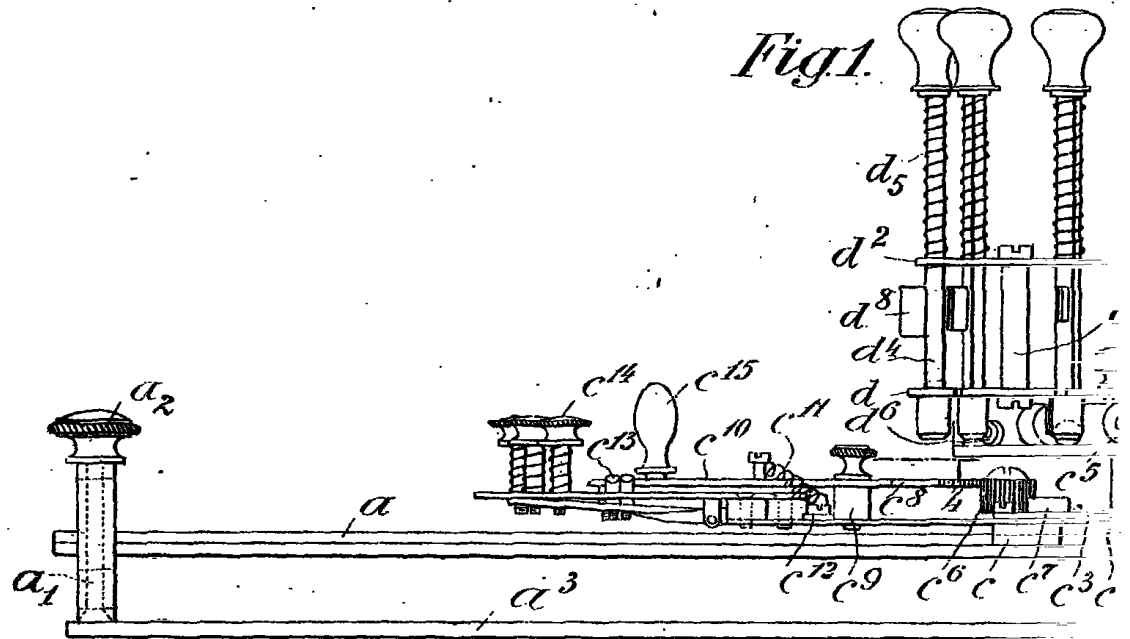
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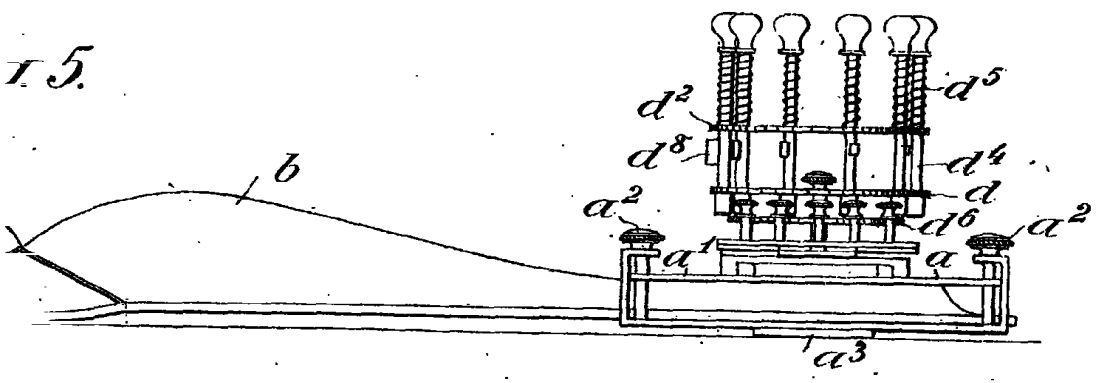
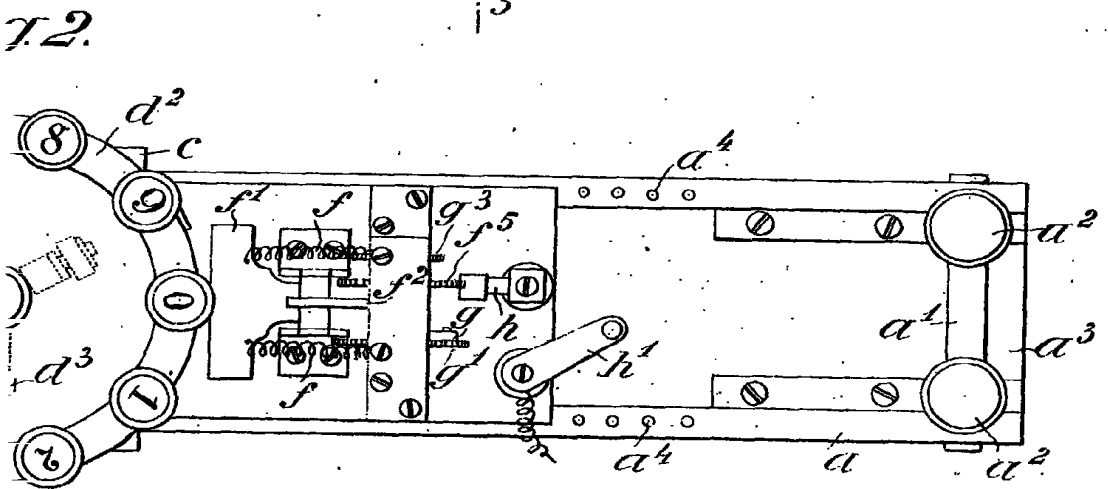
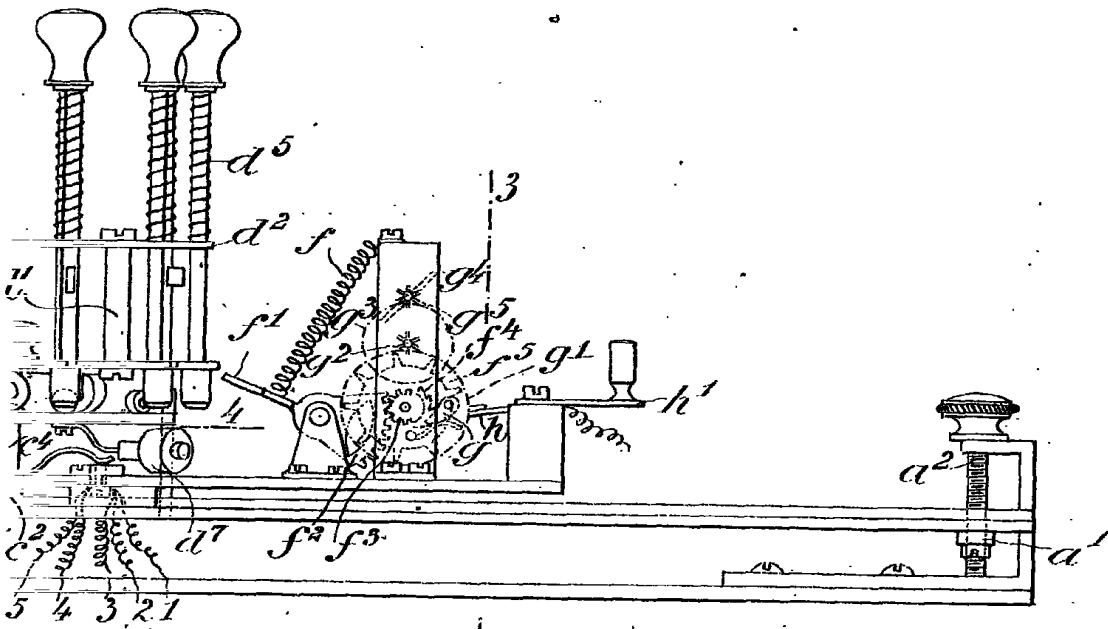
G. F. REDFERN & Co.,  
4, South Street, Finsbury, London, Agents for the Applicants.



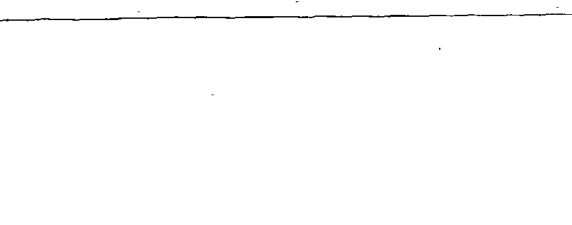
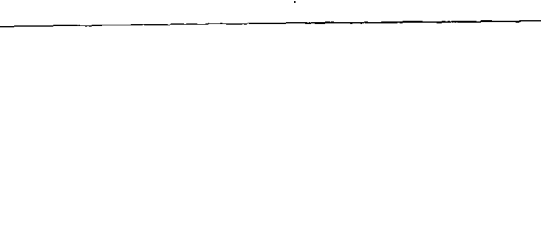
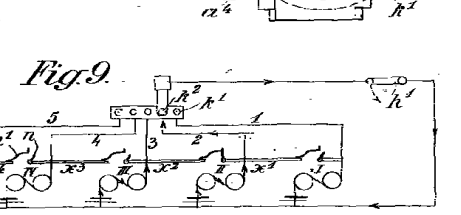
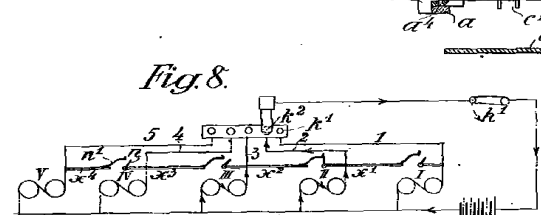
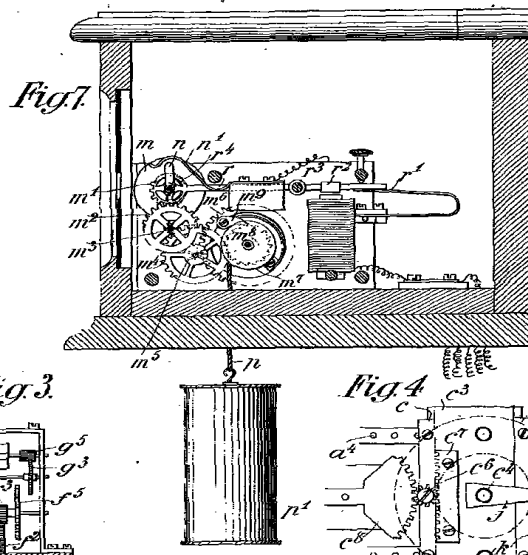
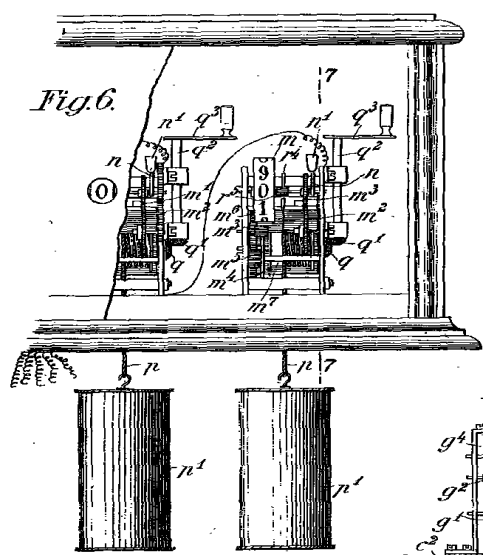


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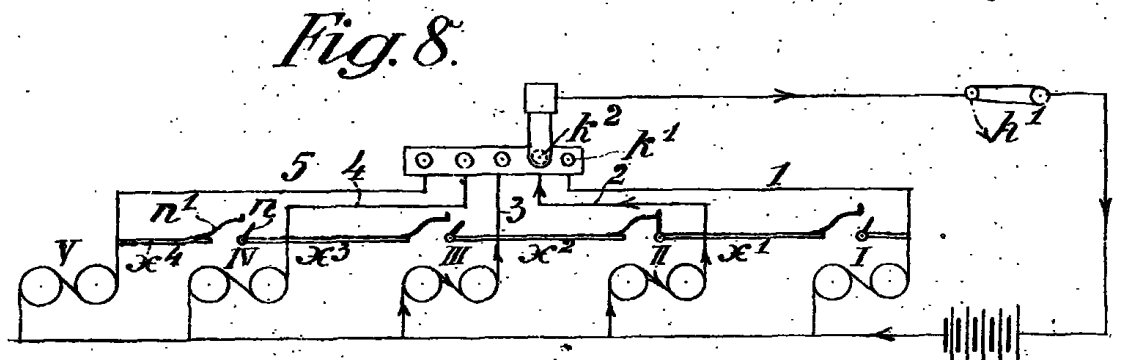
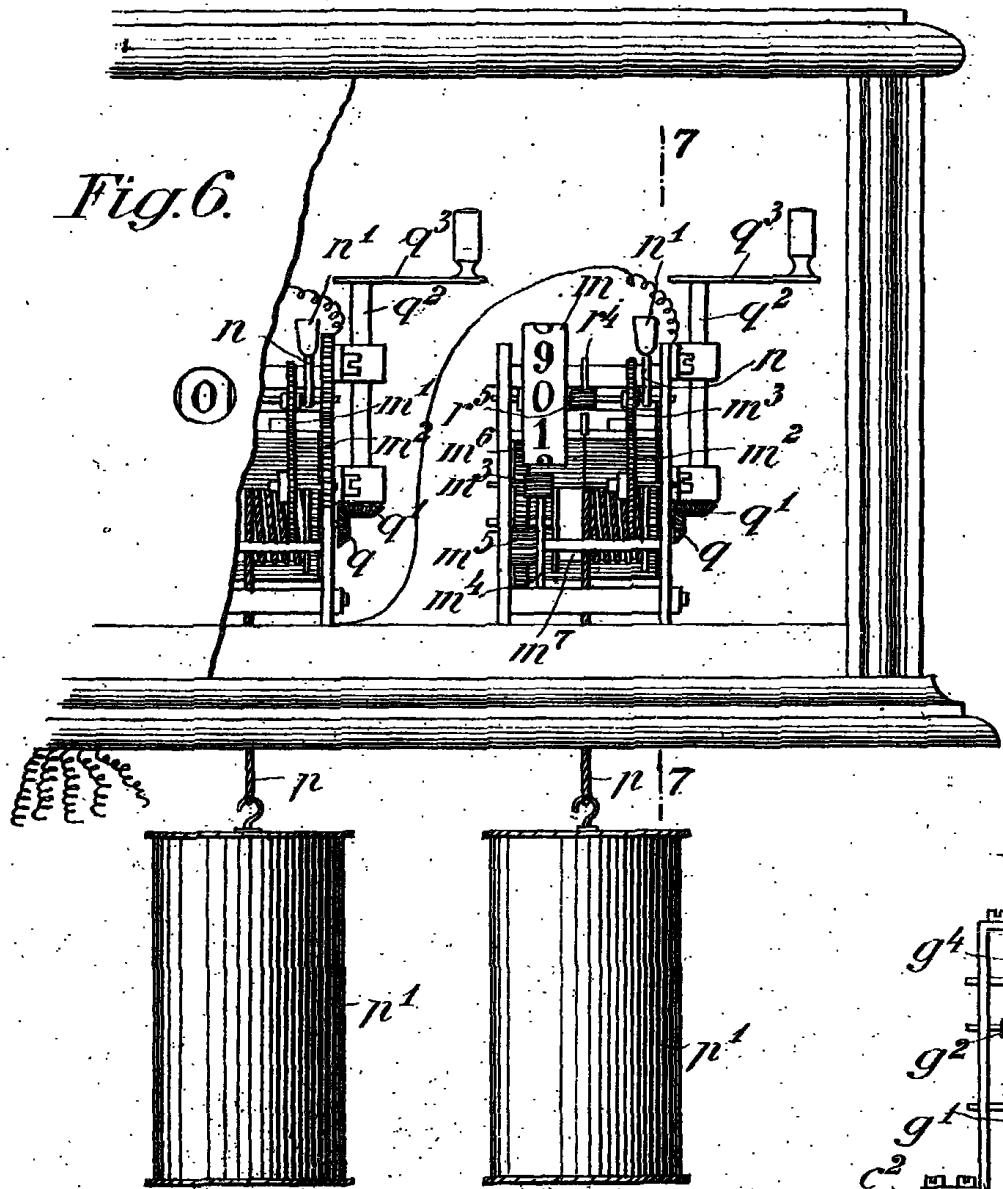


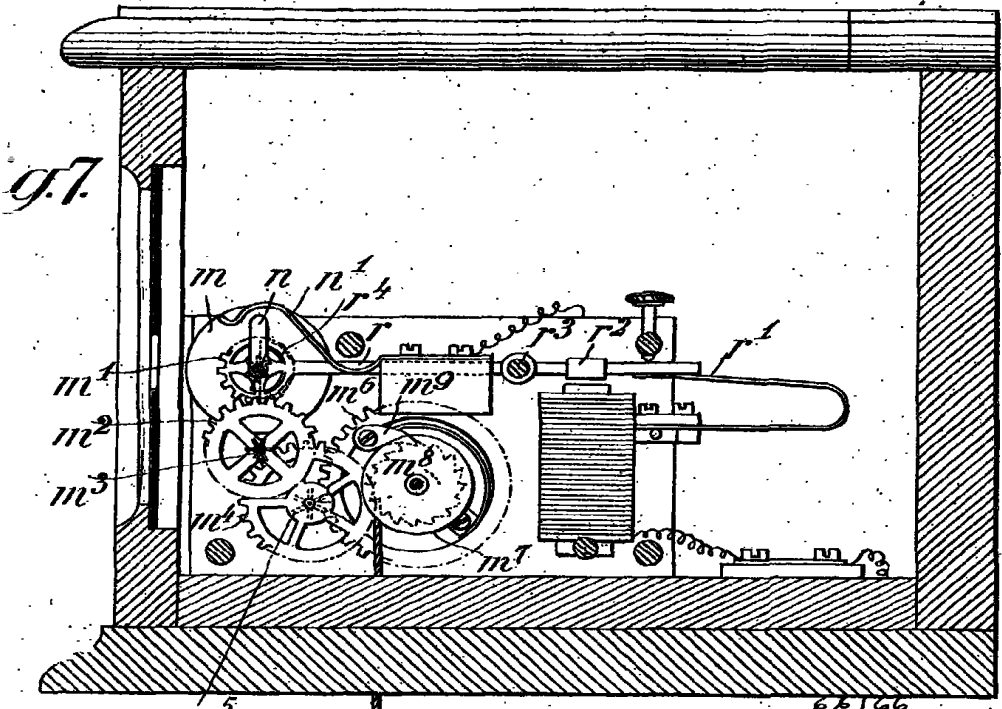


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[This Drawing is a reproduction of the Original on a reduced scale.]





g5  
g3  
f5  
3

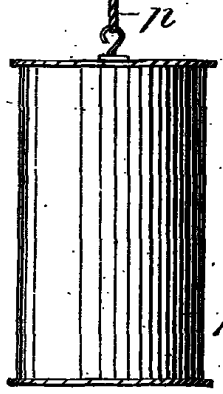


Fig. 4

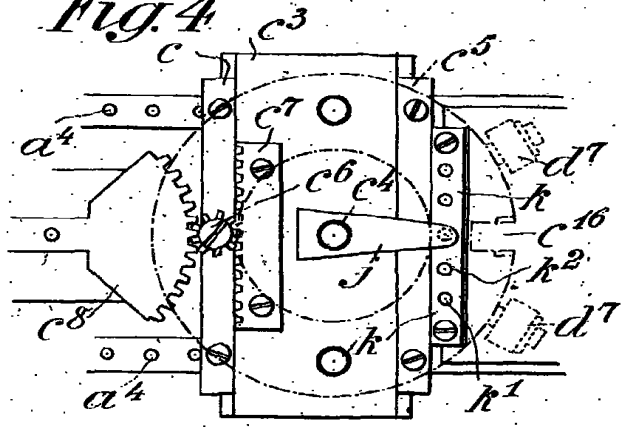
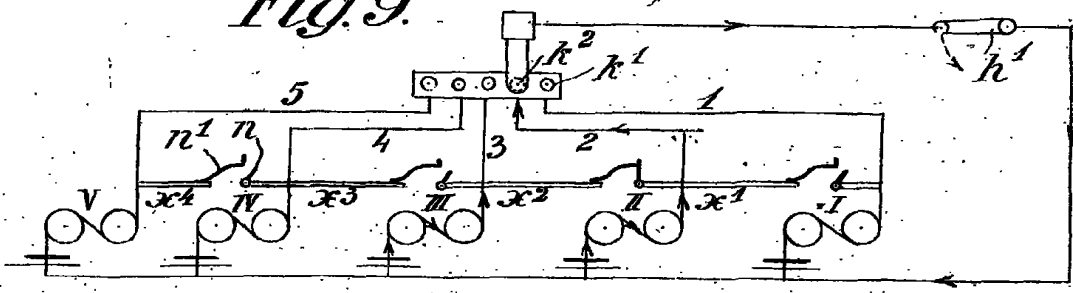


Fig. 9



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