

N° 23,173



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Date of Application, 19th Oct., 1906—Accepted, 19th Sept., 1907

COMPLETE SPECIFICATION.

“Improvement in and relating to a Calculating Machine”

I, ALOIS SALCHER of Innsbruck, Austria Engineer do 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:—

5 The present invention relates to a calculation machine for addition and subtraction which at the same time accelerates the operations involved in multiplication and division. This machine has like known machines, toothed bars or racks, for driving, which are displaced according to the value of the numbers to be added are then coupled with the counting wheels and move the
10 latter on when they return, a transference of the tens by locking levers being used in such a manner that the racks which are operating at any time are able to be moved forward one place.

An important difference in this calculating machine for addition and subtraction is that racks are arranged double or connected in pairs instead
15 of a single rack which has only one side adapted to engage the counting wheels.

The toothed bars or racks are spring-pressed sliders which jerk forwards when released at the correct time. The setting of these sliders, which determines the stroke of the toothed bars at any time, namely the measure of rotation
20 in the direction of the addition or subtraction which in future shall be called plus and minus rotation or turning, is the first operation of the machine which is necessary. The other movements and functions of the machine, including the arbitrary switchings which are made for addition and subtraction, are derived from handling a switching slider the purpose of which is to control
25 the different movements and operations which occur in a certain order and which in its special form of construction is an essential feature of the invention.

The other devices which form parts of the present invention, particularly the device for transferring the tens which is controlled by the switching slider, will be more fully explained hereafter. The auxiliary means for placing the
30 counting or cipher disks and wheels back at the zero position are similar to known parts in similar machines.

A carriage, serving as a special auxiliary device which may be used together with the machine which is provided with setting mechanism, serves to facilitate the work of repeated addition and subtraction of the same combinations of
35 numbers in the sense of multiplication or division.

In order that the invention may be clearly understood reference is made to the accompanying drawing in which Fig. 1 is a plan of the calculating machine, which may be closed by a cover plate whereby the mechanism is invisible with the exception of the cipher disks the slide knobs and the winged
40 knobs for switching, the latter being arranged in the left hand side; the connection of two of the slide knobs with the double-toothed bar slides is represented.

Fig. 2 is a plan showing the mechanism-plate with its different devices but without the cover.

45 Fig. 3 represents the back of Fig. 2 with the devices belonging to this side, some parts being omitted.

[Price 8d.]



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Fig. 4 shows the arrangement of the arrest mechanism which fixes the toothed gear and prevents it moving at a wrong time.

Fig. 5 is an elevation, on an enlarged scale, of the arrangement of the toothed-bar slides and the rack driven carriage or sledge movable crossways which are in connection with the mechanism plate. 5

Figs. 6 and 7 and a subordinate Fig. 7^a, are part representations of the means for switching, locking and releasing the toothed-bar slides.

Fig. 8 is a part representation of the upper portion of the mechanism plate, in which the levers for transferring the tens and the locking bar belonging to them are shown. 10

Fig. 9 represents one of the rack driven axles with toothed gear, the device for adjusting the zero point, the counting disk and its details, in front and back views.

Fig. 10 is a side elevation of the switching-slide with the winged knob.

Figs. 11 and 12 are details of the device which transfers the tens. 15

Fig. 13 is a supplementary representation in elevation in which the arrangement of the controlling mechanism is shown.

Fig. 14 represents the device of the switch tongue in connection with the switching-slide, it being turned over for subtraction and partially pushed forwards. 20

Fig. 15 shows the calculating machine together with the auxiliary device for multiplication and division which is shown in

Fig. 16 by itself and uncovered.

Fig. 17 is an end elevation of the latter device as seen from the right of Fig. 15, and 25

Fig. 18 represents a detail of the same.

Figs. 19, 20 and 21 show details on an enlarged scale.

In giving a description from the operation of the machine it may be explained that the winged knob A, for switching, is arranged on the left side of the plate P (Fig. 1), and it is movable upwards and downwards by hand. The results of the addition or subtraction appear at the inspection openings x under which the counting or cipher disks a turn. The inspection openings y and the ciphered scales, the latter acting together with pointers z on the slide-knobs s , are arranged in corresponding places and serve for the representation of the summand and minuend, the slides S having to be drawn downwards correspondingly with the right hand out of the zero position (Fig. 1) until the desired ciphers appear at the openings y or are indicated by the pointers z in the order of their place value. 30 35

The turning of the cipher-disks under the openings y , which keeps step with the displacement of the slides, is effected by the racks z^1 engaging with the toothed wheels z^2 as shown in Fig. 2. 40

The key-hole shaped openings x^1 , in the cover plate P, showing the ciphers which are arranged under the openings x serve a subsidiary controlling purpose, allowing observation of the movement of the mechanism m (Fig. 13) described more fully hereafter, which may be put in gear and out of gear optionally (see k). The counting disks a are brought to zero by a knob o which is arranged on the left side and which can be set in action by the pressure of a finger, by means of the known action of pins arranged on a zero bar n operating on heart-shaped cams d (Fig. 3) arranged on the axle c of the cog-wheels. A bar l movable from the right side (Fig. 6) serves to jerk back the slides with the knobs s to the zero position shown in Fig. 1 and supposed in all other figures, after said slides have been set in any position, in so far as said bar l permits the release of the locking engagement described hereafter. 45 50

The essential parts of each of the slides, the knobs of which are designated with s are the two parallel racks or toothed bars u, v (Figs. 1 and 3). The racks of bars are both carried by a rod r which is provided with teeth and the bars u, v have rows of teeth which face one another. Between the toothed- 55

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bars u v of all the slides r , s are situated the 10-toothed wheels e , which are fixed to the axles c of the cipher wheels. When these wheels are in their normal position, or in their normal intermediate position, they do not engage with the toothed-bar slides and therefore the latter can move freely in their course which is determined by guide slots t^1 , t^2 of the mechanism plate Q. The toothed-bar slides are continually drawn by springs f . The arrangement of the slides r and s with their accessories is represented in Fig. 5.

The toothed wheels e of the counting wheels and their connection with the axle c ; cipher disks a and the heart-shaped pieces d for zero setting, are shown in Fig. 9. They are all mounted in a frame like carriage or sledge which can be moved transversely of the mechanism plate Q to the right or the left. The upper and the lower parts of the said sledge are represented by E and F respectively, and both are separated by pillars I, II III and IV. On the mechanism plate Q are short slots (see Figs 2, 3, and 8) which enable the carriage or sledge to slide freely.

The sliding of the carriage E, F entirely to the right (Fig. 1) causes the wheels e to engage with the right hand or adding toothed-bar u , and when moved to the left, to engage with the left hand or subtracting toothed-bar v . The movement of the sledge E, F to the right and the left is determined by a winged-knob A during its movement in the direction of the guiding slot situated in the left hand side, and by the working of a switch tongue H. For this purpose the said sledge has a pin V (Figs. 2, 3, 14) which yields to the pressure of the wedge-shaped switch tongue H when it slides along either on the right or the left sides, and is thus displaced correspondingly. Figs 3 and 14 show the two different positions of the switch tongue H, which with the winged knob A is movably fastened to the incised slide G, whereby on the one hand, on the preparation for addition the pin V slides to the right of the switch tongue, and on the preparation for subtraction, said pin slides to the left side of said tongue. The former position is brought about, normally, by the pressure of the spring of the switch tongue H to the side concerned, and when subtraction is to be effected, it is only necessary to give the winged knob A a slight turn to the left (see Fig. 14) whilst it is pushed upwards, whereby the switch tongue is correspondingly reversed.

Pushing the switch-slide G upwards by means of the knob A effects a series of movements, releasings and catchings, of these the devices for locking the wheels e so that they can not be moved at a wrong time, and the detent or engaging device which can be released on the double toothed-bar slides r , s are first described hereafter.

Under the carriage plates F, the locking bar c (Fig. 4) is mounted displaceable in the same direction as the carriage E, F, itself and has a set of prongs or teeth g which are able, when the bar is moved, to engage with the wheels e for detaining them in whatever position they might be at any time.

On the side of the switch-slide G two wedge-shaped slopes C^1 , C^2 are arranged at the bar c , on which a pin H^1 of the switch tongue H acts in its one or the other position (Figs. 3 and 14) when it is pushed upwards in such a manner that it compels the bar or rail O to move in the direction of the arrow (Fig. 4). This movement corresponds with the release of the locking device, the starting position shown in Fig. 4, which is brought about by the action of a spring being also the position for the engagement of the teeth g .

In order to bring the counting wheels a to the zero position by pressing the knob o , the said locking device must evidently be temporarily released, the knob o is arranged for this purpose on a driving member o^1 which is jointedly connected with the bar u on the one hand and the locking bar c at c^3 on the other hand.

Figs. 3, 6, 7, and 7^a show the device for latching and unlatching the toothed-bar slides r , s and the device is operated indirectly by the switch slide G. The tendency of the latches w , which are actuated by springs w^1 , is to engage

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the toothed-bars r and thus to hold the double racks in each position in which they are set; nevertheless a positive setting by hand pressure is made possible by shoulders of the racks at r being arranged slanting.

The springs f are unable however to push the latch upwards except after proper disengagement, the same takes place by shifting the rail W ; which is provided with holes, in the direction of the arrow (see Fig. 7) and which carries the springs w^1 , the pin like projection w^2 of the latches together with the latches w being all moved laterally. This disengagement or reengagement into the locked position is occasioned by the swing of a lever J . The swinging is caused at the right moment by the switch slide G . The said lever J is pivoted with the rail W at J^1 Fig. 6. When the switch slide G is pushed upwards the knob engages the lever J when it slides in a bent slot which is in the said lever. Also the bar l for adjusting the zero in a similar manner permits the release of the engagement of the latches at w , as projections w^2 on the latches are out of engagement when the rail W (Fig. 6) moves to the left.

For transferring the tens, a special device is employed which is controlled by the switching slide G . (Figs. 5, 8, 11 and 12). To each counting wheel a a brim like flange b is attached (Fig. 9) which is provided with a hole i at the place where the tens are transferred, at the passing of cipher 9 to 0; at this flange b , are arranged the levers h for transferring the tens for the under engagement of the lever members h^1 which are provided with noses h^2 .

The levers h , which are influenced by springs h^4 and which are pivoted on the sledge E , F , at h^x strike against stops p joined to the toothed bars which normally determine the extent of the stroke of the double racks r , s and u , v , when h^2 catches under b (Fig. 12), in such a manner that they cannot slip off at the extreme point.

The individual toothed bar slides can only reach the extreme point when the flange b , which is carried by the cipher wheel of the digits of small value, offers its hole i for the passage of the concerned levers h , h^1 so that the latter is enabled to rise to a release position with regard to the stop p . A triangular shaped switch piece j (Fig. 9) which can be turned in two directions for controlling the hole i of the flange b forms a suitable guiding surface for the pin h^2 when it slides out of the said hole and prevents it jumping over the former.

For transferring the tens it is in the first place essential that all pins h^2 are hung in the flanges b of the counting wheels (Fig. 12). For this purpose a tipping frame K able to oscillate round an upper horizontal arbor and having a rod L is used which moves the lever members h^1 from their position as shown in Fig. 11 into that according to Fig. 12 and *vice versa*. The frame K obtains its motion by the part M which is swingingly arranged and movable by a projection N in combination with the switch slide G (Fig. 10).

In order that the swinging movements of the levers h , h^1 , which transfer the tens may not be caused at a wrong time, a locking rail R is arranged the movement of which is controlled by the stroke of the switch slide. This rail R has gaps R^1 on its lower edge which allow play to the pins h^3 which are arranged on the lower ends of the lever h . This movement of the levers is not possible in the position shown in Figs. 2 and 8.

The rail R is shifted for enabling the movement of the levers by the swinging of a lever S which is pivotally attached to R at S^1 and which has its fulcrum at O . The lever S can be moved when the switch slide G is pushed forwards by the wedge at S^2 , whereby by the arrangement of an enlarged slit and a latch T , which latter abuts a stop pin T^1 and needs a special releasing when the switch lever begins to work, secures it against operation at a wrong time is procured. The last levers h , h^1 when they are swung ready for transferring the tens, are shown by dotted lines in Fig. 2.

The displaceable rail q which is under the mechanism and which can be reciprocated has the purpose of drawing downwards the toothed-bar slides r , s

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into their normal position to the starting point when the switch lever is brought back which in consequence of the transferring of the tens were sent one step too high. The rail q operates according to Fig. 3 with its lower side resting upon the knob pins as shown by dotted lines in Fig. 14 and is controlled in its movements by a hooked shaped swing bolt q^1 and by an engagement of the lower end of the switching slide G. When the switch slide G is pushed upwards by any possible turning to the right or the left of the switch tongue H, various movements occur, which are;

1) The levers h are released for movement by the moving of the rail R which is under the control of the lever S at S^2 .

2) The pins h^2 for transferring the tens are hung into position (see Figs. 11 and 12).

3) The lower rail q is moved upwards for lifting the toothed bar sliders r, s a little more than the ordinary position.

4) The engagement of the counting disks wheels e with the right or left toothed bars u, v (for addition or subtraction).

5) Disengagement of the wheels e by shifting the rail C (see Fig. 4).

6) The detents w are put out of action by shifting the rail W.

In consequence of the last mentioned occurrence, the toothed bar sliders r, s are jerked upwards and effect the plus or minus rotation of the counting wheels a and the representations of the summing or the difference of the number which is set at y . When the switch slide G is pushed upwards the switching position for subtraction (minus rotation of the cipher wheels), in order to make a difference between the normal addition is announced by a bell hammer Y being touched by the pin H^1 which is on the switch tongue H. An untimely backward swing of the said tongue is prevented by a guide until the operation is finished.

It is to be noted that the commencing idle stroke of the switch slide results from the lever S being locked by the latch T and prevented from swinging to the right (Fig. 2) and that freedom of motion for the lateral stroke at s^2 is only effected in consequence of the switch knob touching the lower end of the latch T, whereby the latter goes below the pin T^1 . When the switch slide is drawn downwards at the starting position, the above mentioned movements are repeated generally speaking in the reverse order with the exception that on account of the idle stopping just described above, after the lower rail q is depressed for the retrogression of each ten projection of the rack slide the pins h^2 which transfer the tens are drawn down out of engagement with the flange C the frame K springing backwards and then the lever h for transferring the tens is locked by means of the rail R. Thus this two events occur in variable order.

The driven counting mechanism m Fig. 13 which is not an essential part of the present invention does not require to be particularly described. The rail k is engaged and disengaged by the pins m^1 which pass through the slits of the rails k . When the counting mechanism m is in gear it participates with the turning of the counting disks a , and thus allows the control and calculation of the results of the addition and subtraction.

The ciphers are visible through the key hole shaped openings x^1 . An auxiliary arrangement, which is represented in the form shown in Figs. 15 and 18, serves to facilitate the adjustment of the slide-knobs s on a given number containing a number of digits which could be replaced after each addition or subtraction in the cipher openings y (Fig. 1).

A carriage U, which is arranged above the plate P (Fig. 15) can be moved in the direction of the stroke of the double racks by means of the lateral guiding rails $U^1 U^2$. The said carriage or sledge is provided with the slides s^1, s^2, s^3-s^8 which are provided with teeth r^1, r^2, r^3-r^8 and which allow the adjustment the cipher disks Z under the openings y^1 .

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The locking springs $j^1, j^2, j^3—j^8$ engage the toothed slides so that they are held in position against upward movement.

By means of a rail X which is able to operate against the springs with noses i^1, i^2, i^3, i^8 , the locking can be completely annuled, and for the adjustment of the rail X it is only necessary to turn the lever X^1 in the direction of the arrow as shown in Fig. 15, the projection x^2 being then displaced. When it is desired to adjust the slides $s^1, s^2—s^8$ for multiplication in a manner as that shown in Fig. 16, it is only necessary to set up the set or adjusted device U on the plate P and move it by the knob U^1 . The latch U^3 serves as a means for connection and disconnection for an eventual lateral displacement of the device U for altering the place value of the digits in relation to the slides s , it being possible to obtain a tenfold, hundred-fold *etc.* multiplicity of the ciphers being calculated as may be desired.

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

1) A calculating-machine for addition and subtraction with cipher wheels which are switched by driving toothed-bars, characterized by the toothed wheels (e) being engagably arranged to the right and the left between pairs of driving racks (u) (v) the teeth of which are arranged facing one another, in order to derive, according to the adjustment of the strokes of the racks, either the switching of the addition or the switching of subtraction.

2) A form of construction of the calculating machine as claimed in Claim 1), in which the release of the racks or slides, which tend to go with the position of the stroke from the setting position by the action of springs, is effected by the movement of a switch-slide G, characterized by a switch tongue (H) which can be adjusted directly by the handle is movably connected with the switch-slide (G), said tongue (H) allowing the counting wheels (e) to be displaced to the right or the left, said wheels (E) being arranged in a carriage, in order to cause the plus or minus rotation of said wheels (e) during the stroke of the racks.

3) A form of construction of the calculating machine as claimed in Claim 1), in which a surplus stroke of the racks enables the transference the tens, characterized by the arrangement of levers (h, h^1) which can be brought into hanging engagement with the flanges (b) of the counting wheels, said flanges being provided with gaps i , in order that said levers can swing in such a position as shown by dotted lines in Fig. 2, during their passage to the zero position, that the racks can move upwards one step in excess, a locking bar (R) preventing the movement of the levers at a wrong time, and the rack which is raised too high being drawn downwards by a rail (q).

4) A form of construction of the calculating machine as claimed in Claim 1) and with the arrangement of the switch slide as claimed in Claim 2), such that said switch slide controls not only the reversal for adding and subtracting the locking and unlocking of the counting wheels and disengaging of the racks or slides at the right time, but also the device which transfers the tens, the levers (h^1) being first hung when the switch slide begins to work, then the movement of the locking bar (R) for releasing the levers and the two operations when the switch slide goes back, the engagement of each lever and effecting the locking position of the rail (R) these two motions succeeding each other in the reverse order alternately.

5) A form of construction of the calculating machine as claimed in Claim 1) with the device according to Claim 4, characterized by the successive movements are effected by the arrangement of a lever (S) and a switch slide (G) with the aid of a latch (T).

6) In combination with the calculating machine as claimed in Claim 1), an auxiliary device for multiplication and division, which repeatedly adds and

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subtracts the same numerical value, consisting of a carriage which clasps a number of adjustable slides (s^1 , s^2 , s^3 ,— s^8) which, when pushed downwards in guides which are arranged on the plate of the calculating machine enable the simultaneous corresponding setting of the rack slides with one movement
5 of the handle.

Dated this 18th day of April, 1907.

J. A. NEES,
Agent for the Applicant.

Fig. 1.

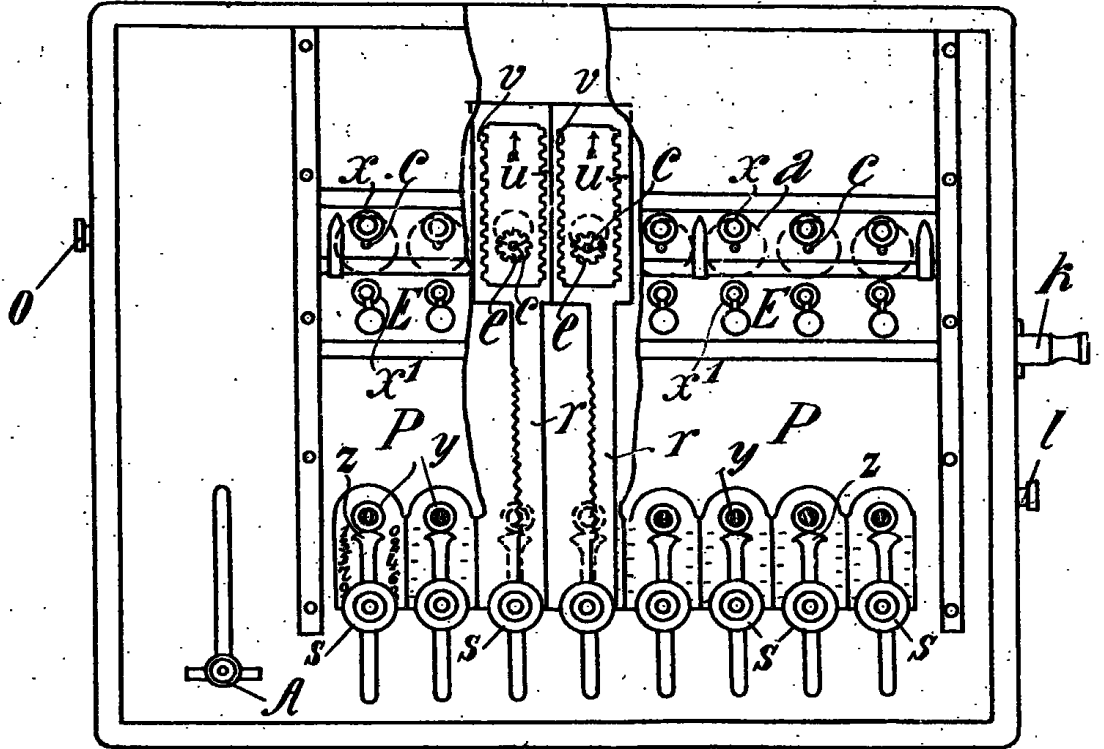
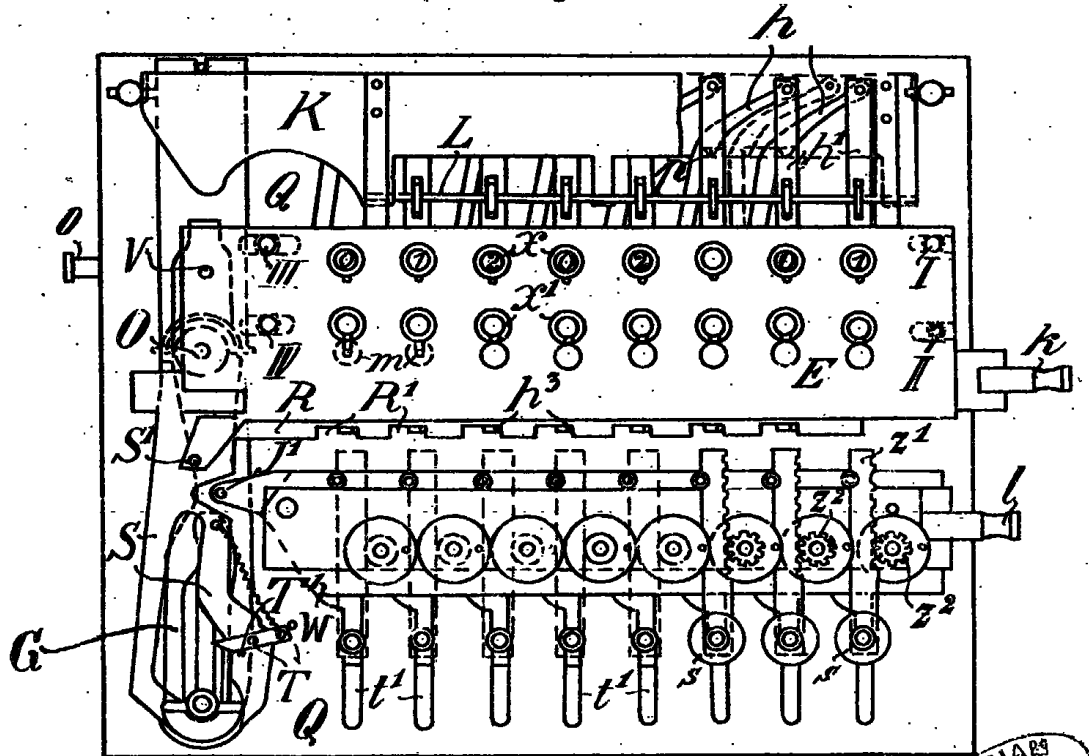
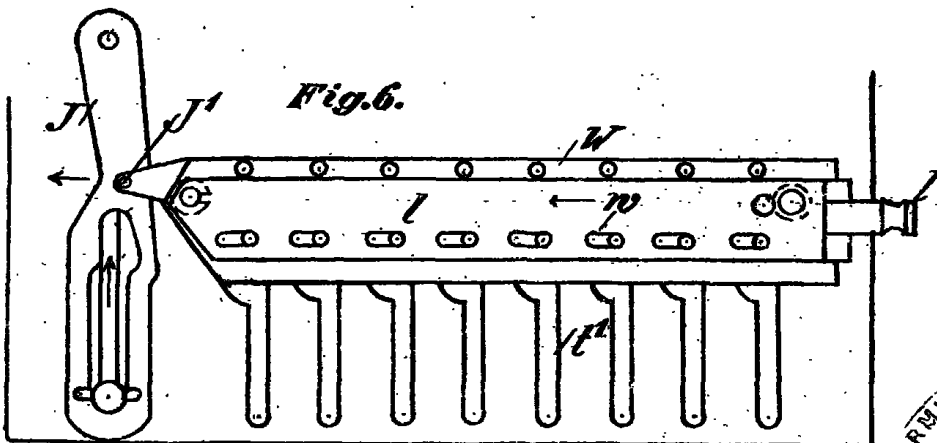
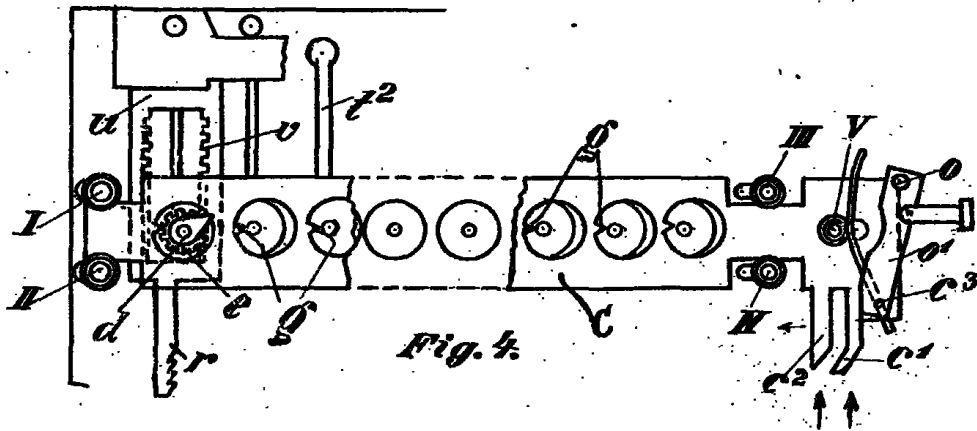
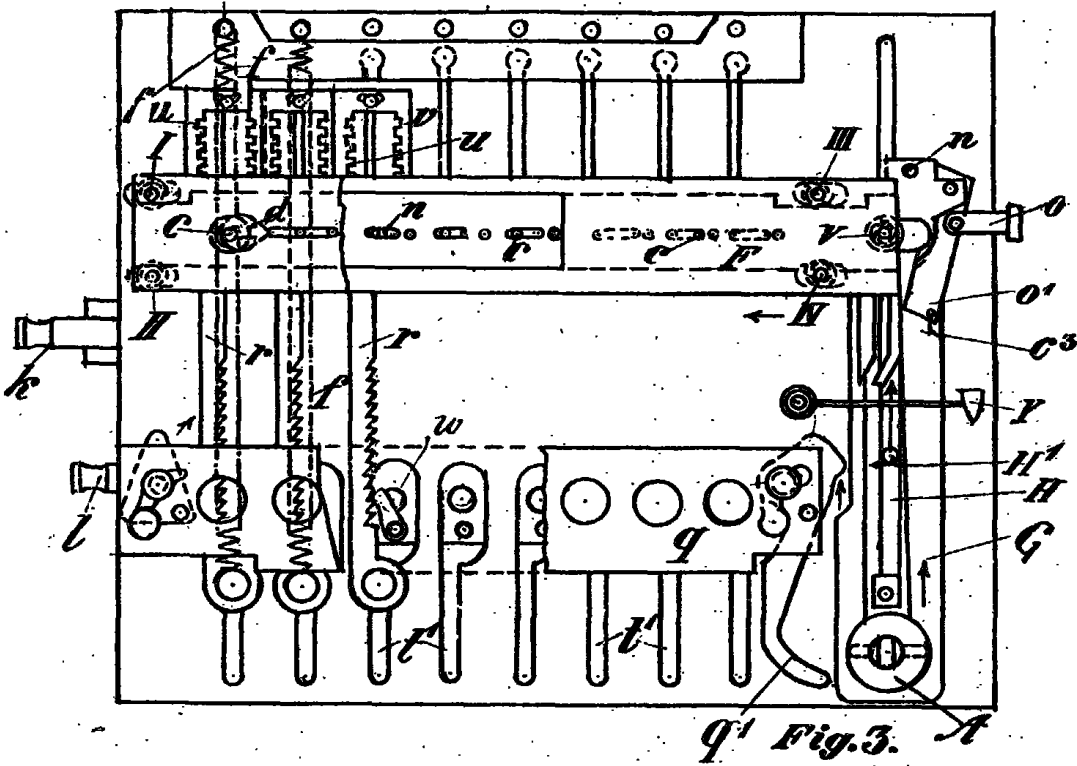


Fig. 2.



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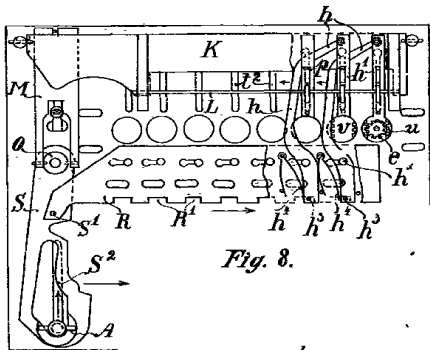


Fig. 8.



Fig. 9.

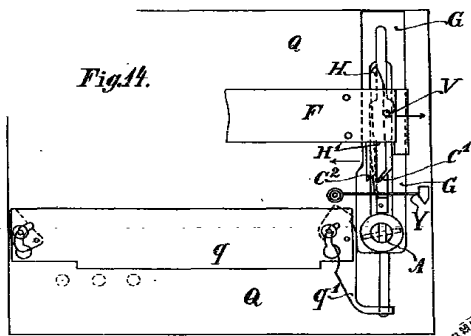


Fig. 11.

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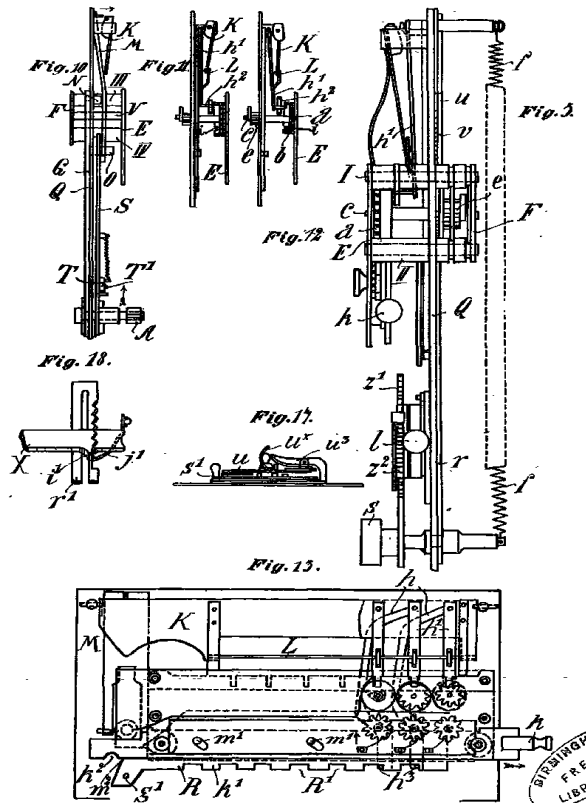


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

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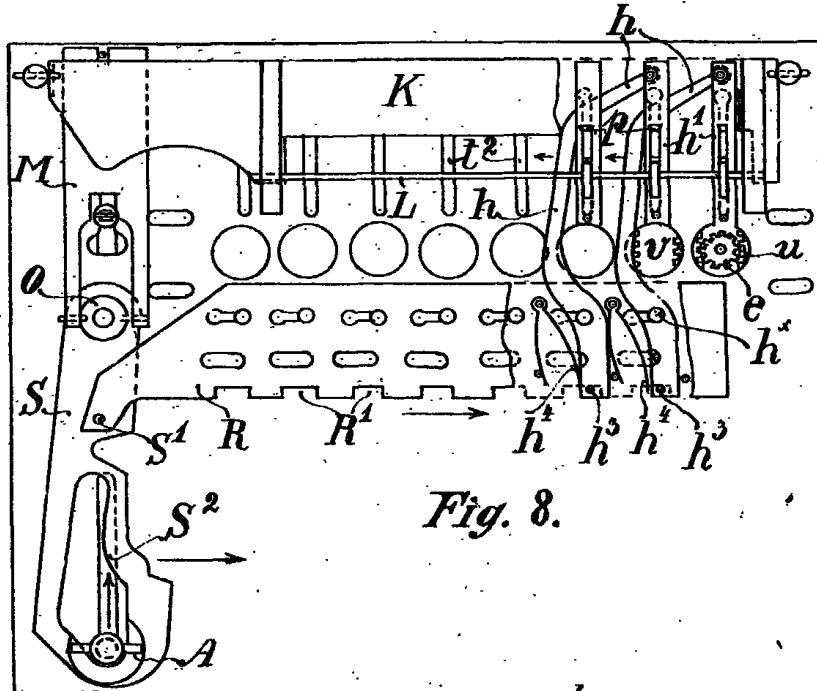


Fig. 8.

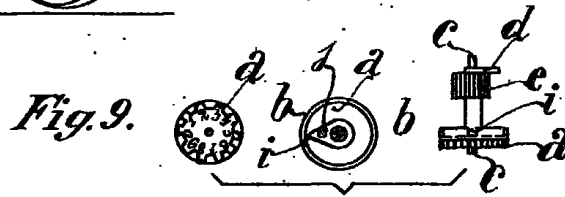


Fig. 9.

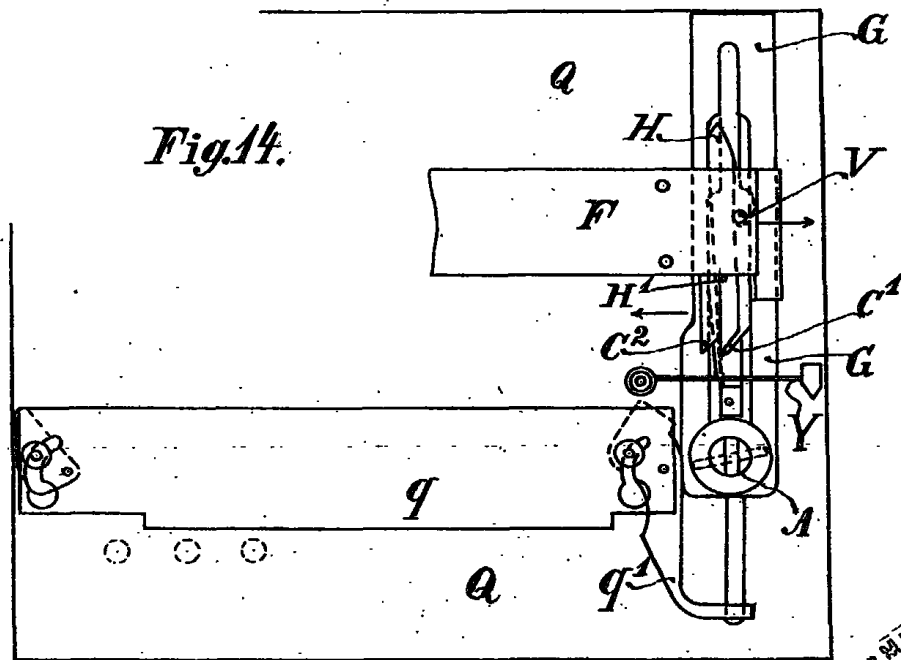


Fig. 14.

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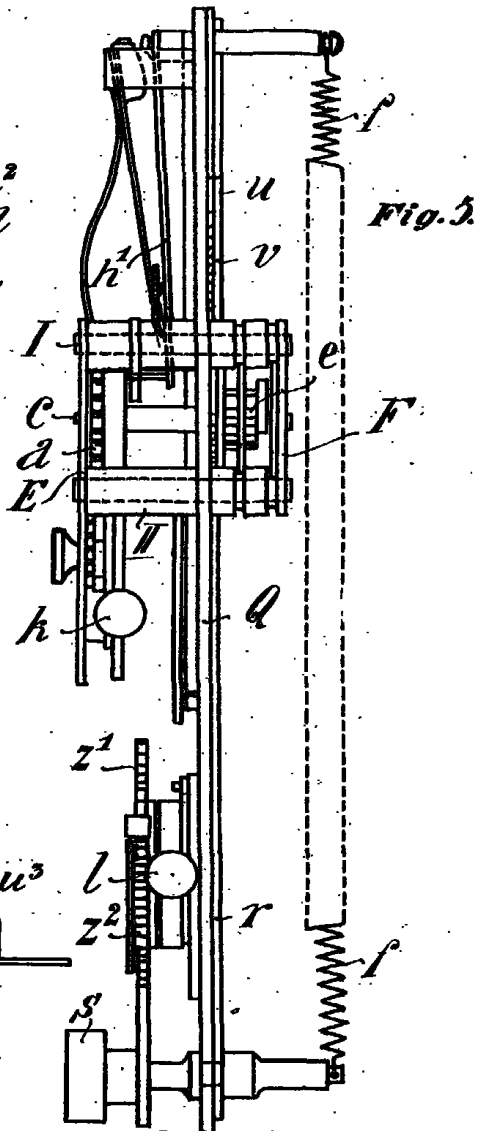
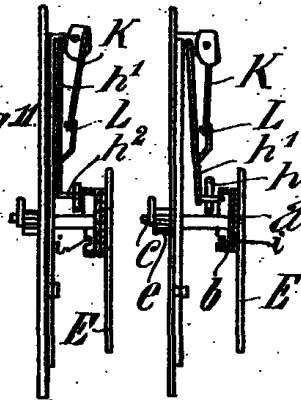
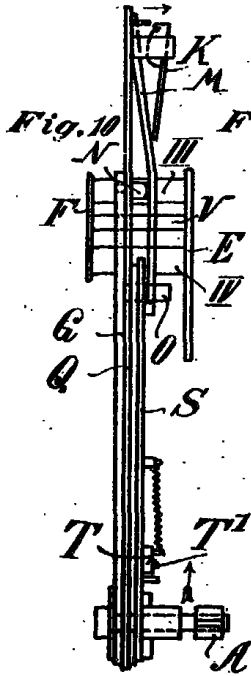


Fig. 12

Fig. 18.

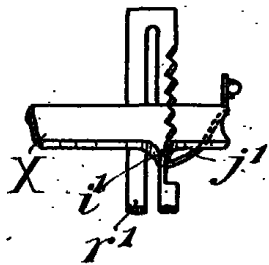
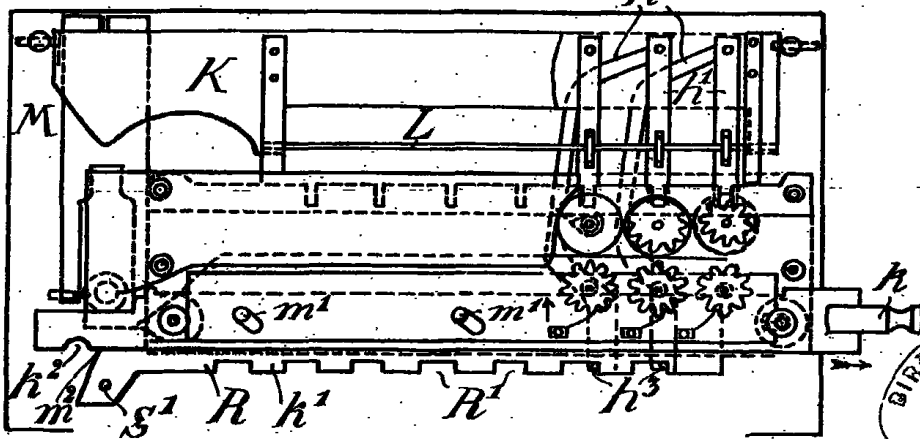
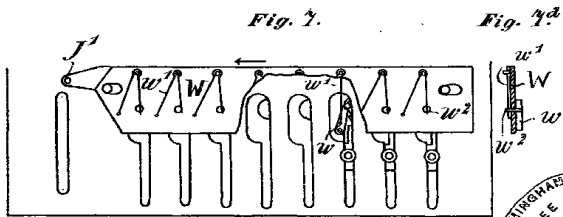
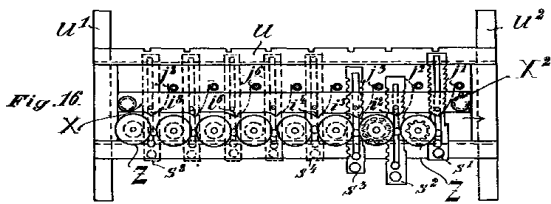
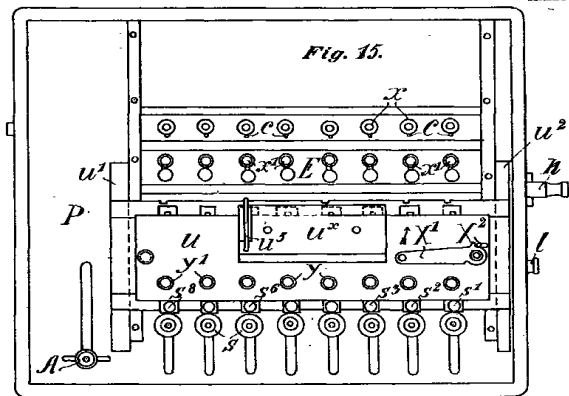


Fig. 13.



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Fig. 20.

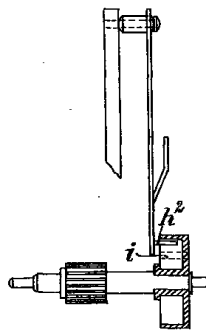
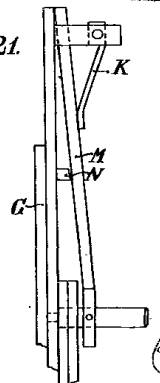


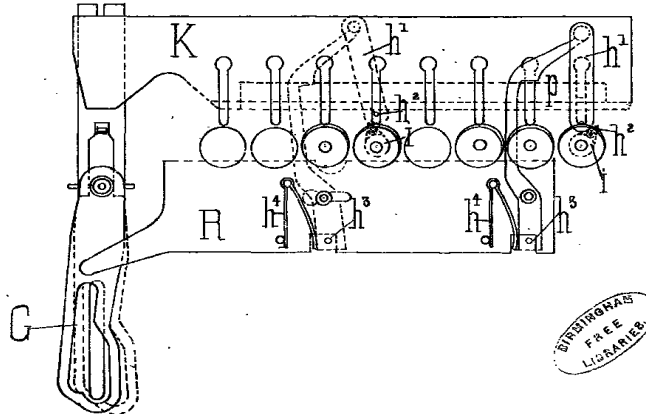
Fig. 21.



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Fig. 19.



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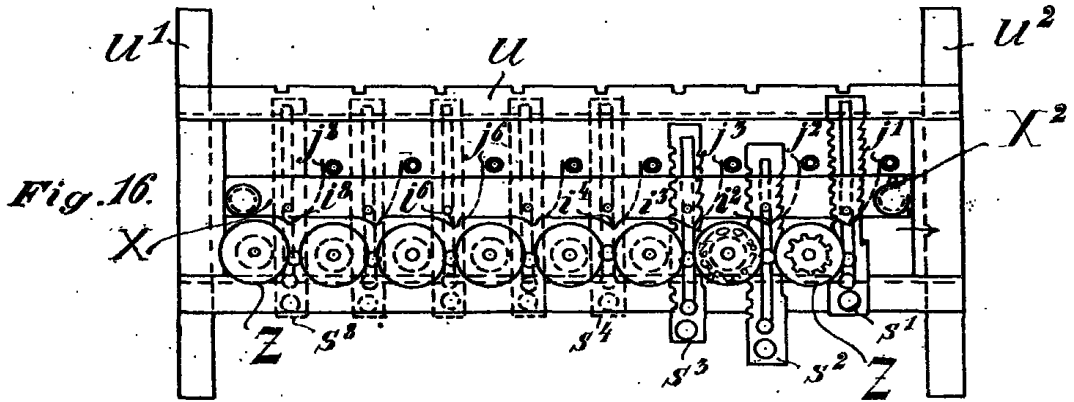
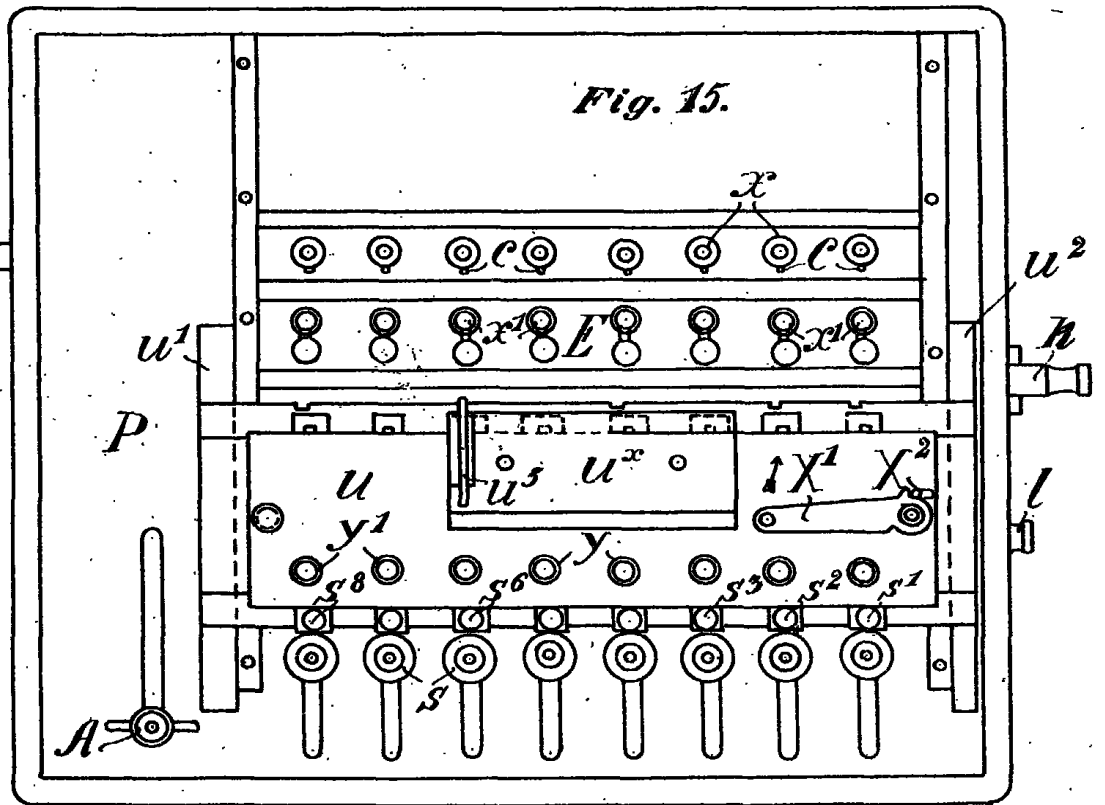
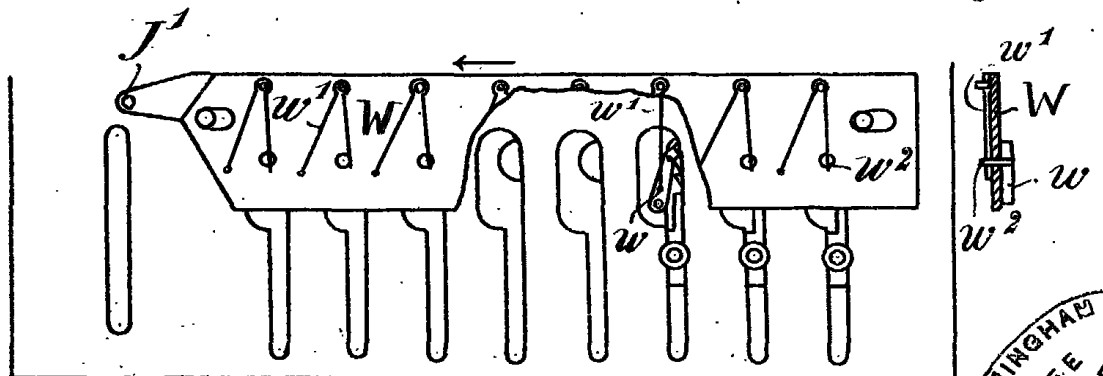


Fig. 7.

Fig. 7a.



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Fig. 20.

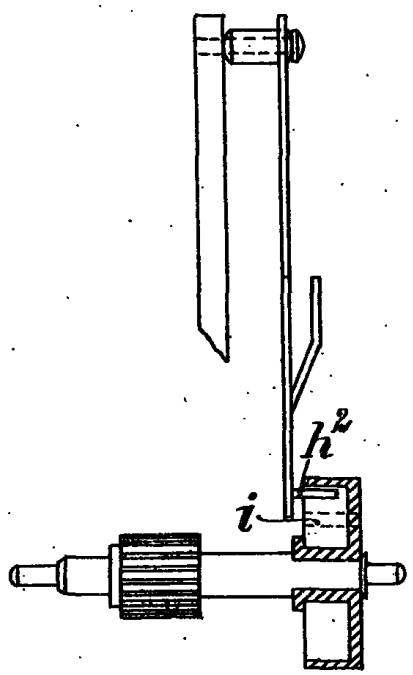
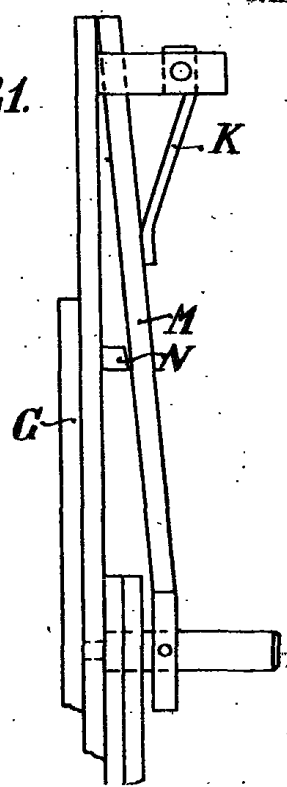
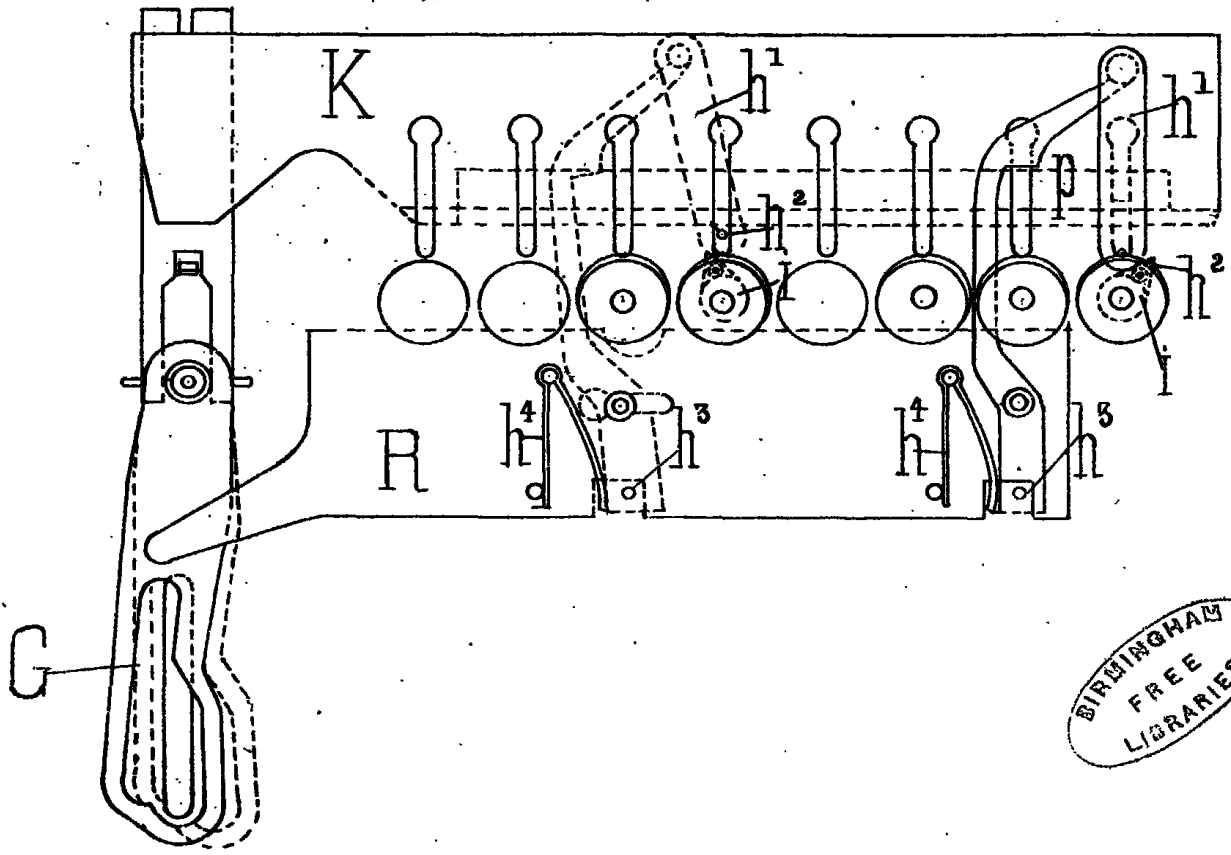


Fig. 21.



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Fig. 19.



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