

No. 816,319.

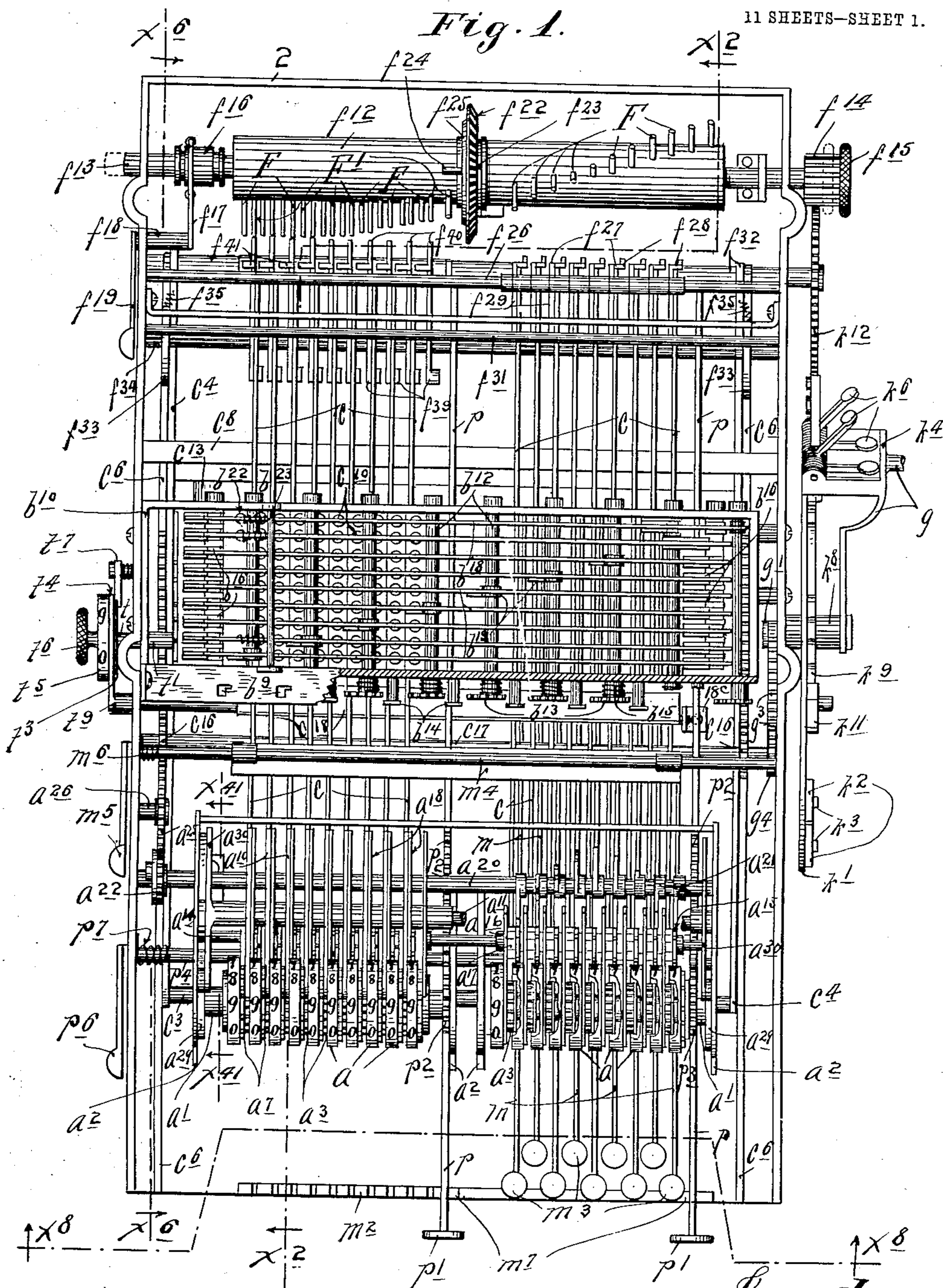
PATENTED MAR. 27, 1906.

H. HANSON.

CALCULATING MACHINE AND TYPE WRITER ATTACHMENT.

APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 1.



Witnesses.

A. H. Opsahl.

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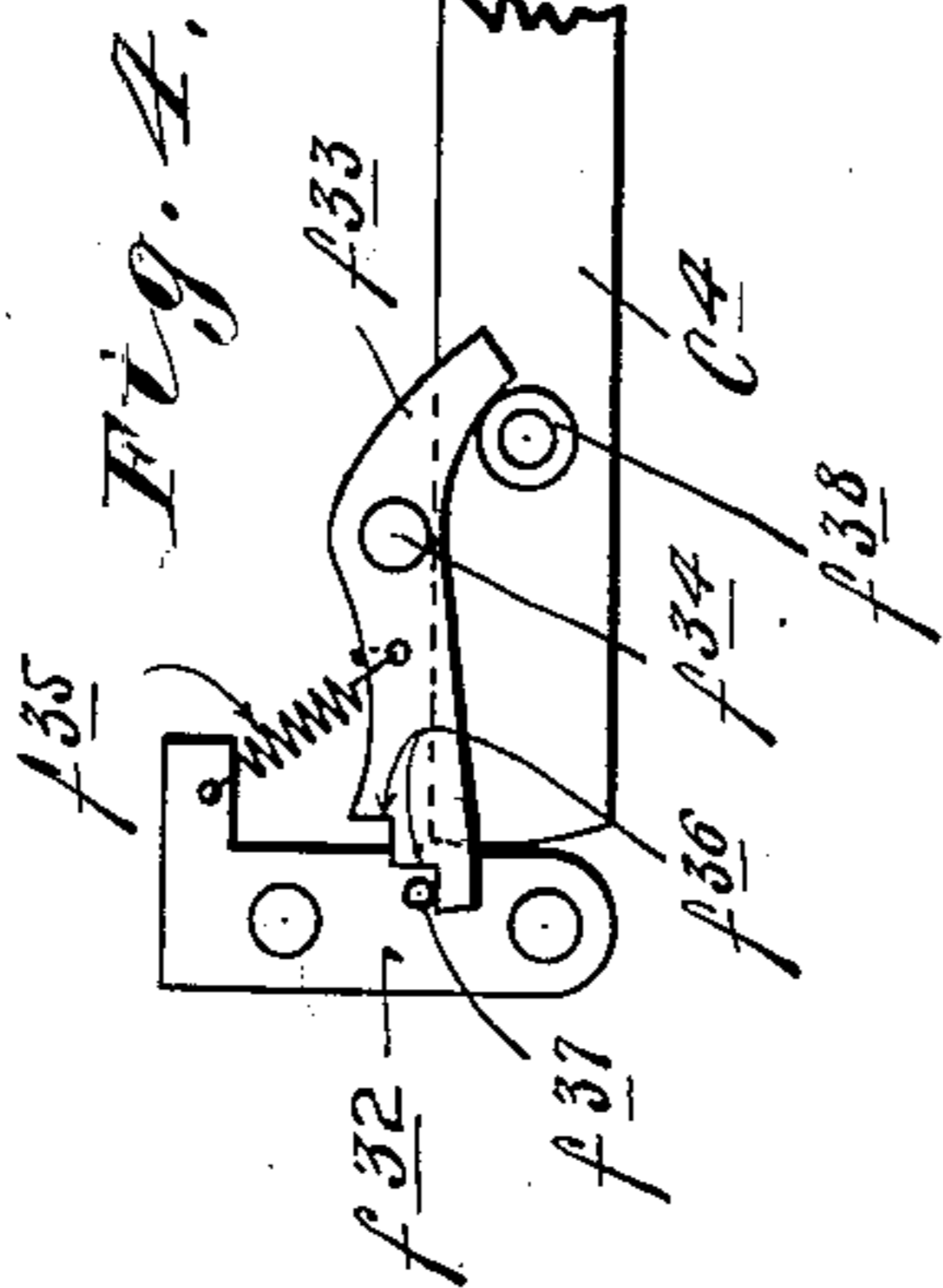
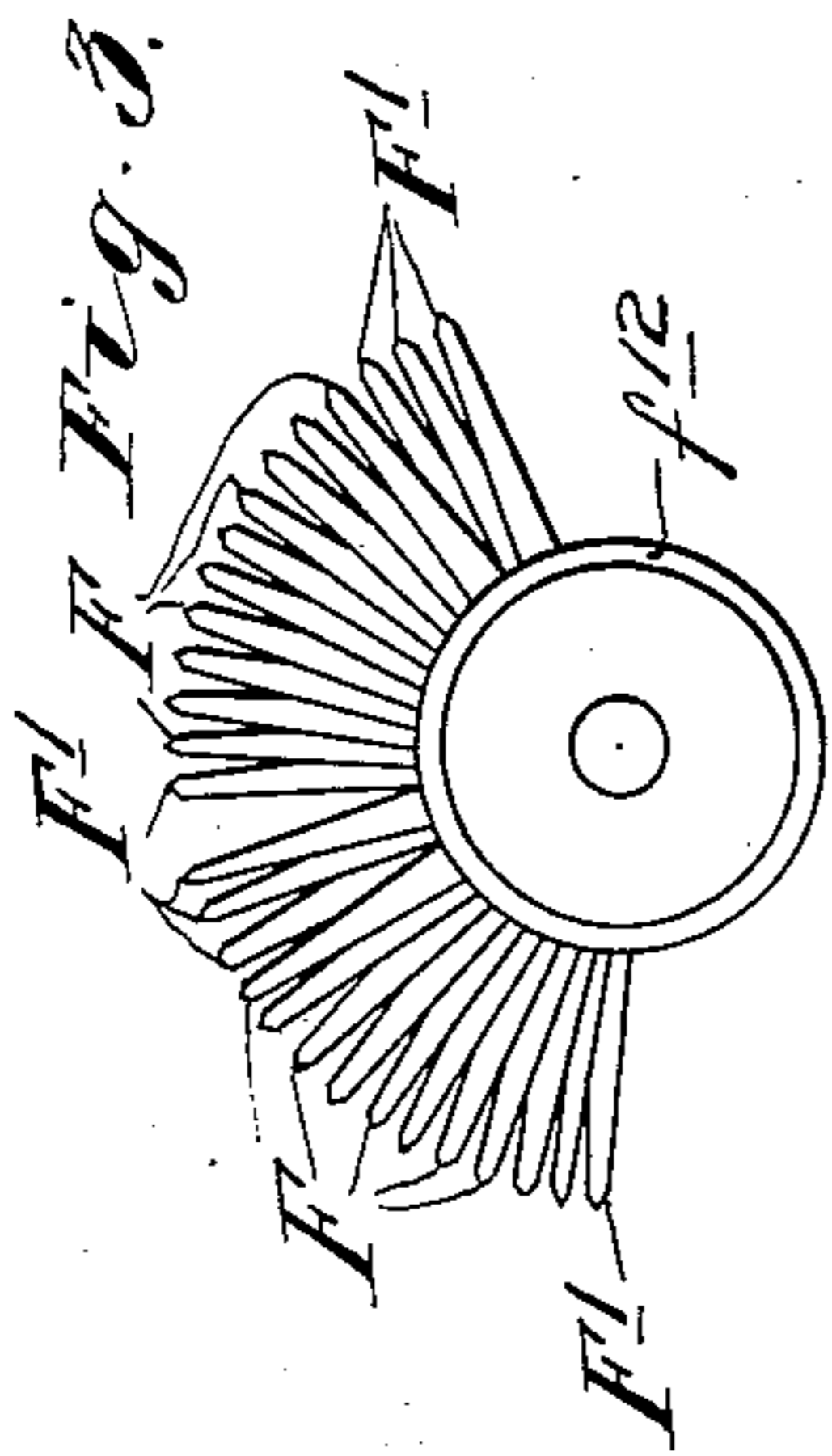
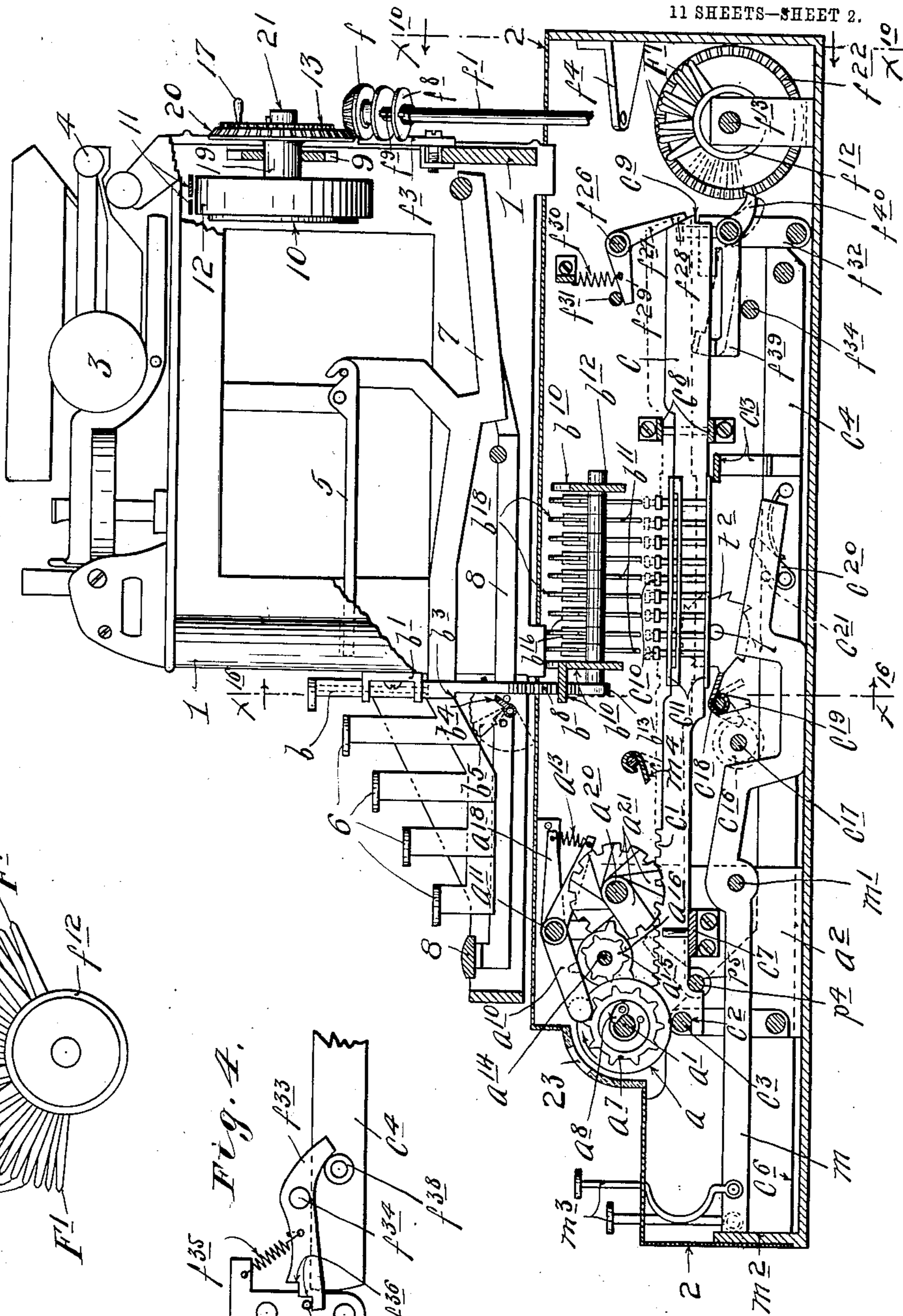
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11 SHEETS—SHEET 2.

Fig. 2.



Witnesses
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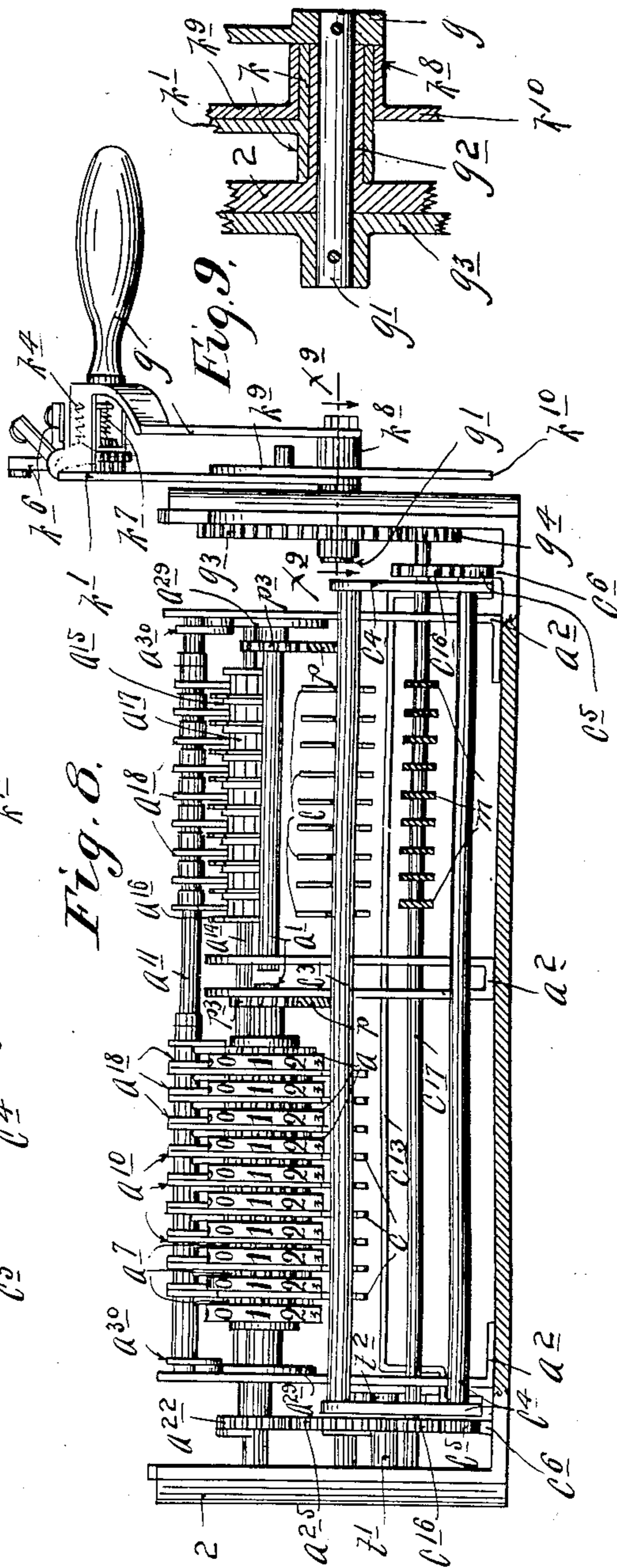
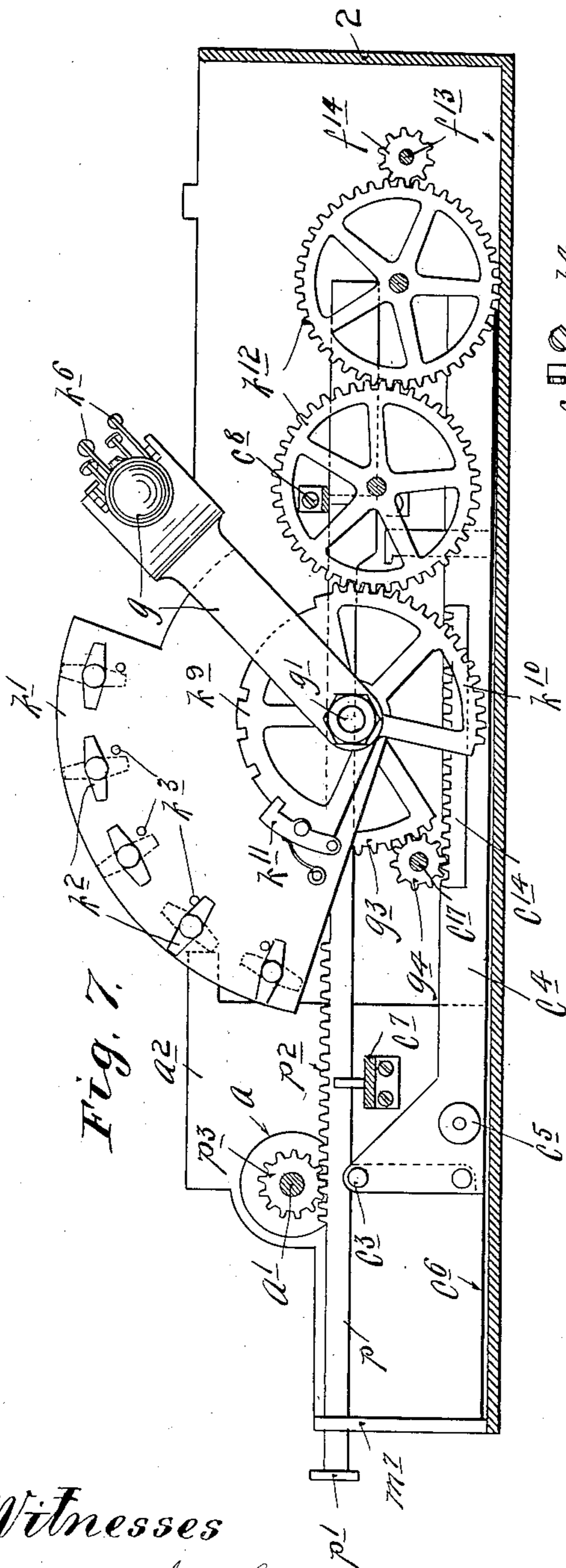
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APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 4.



Witnesses
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11 SHEETS—SHEET 5.

Fig. 10.

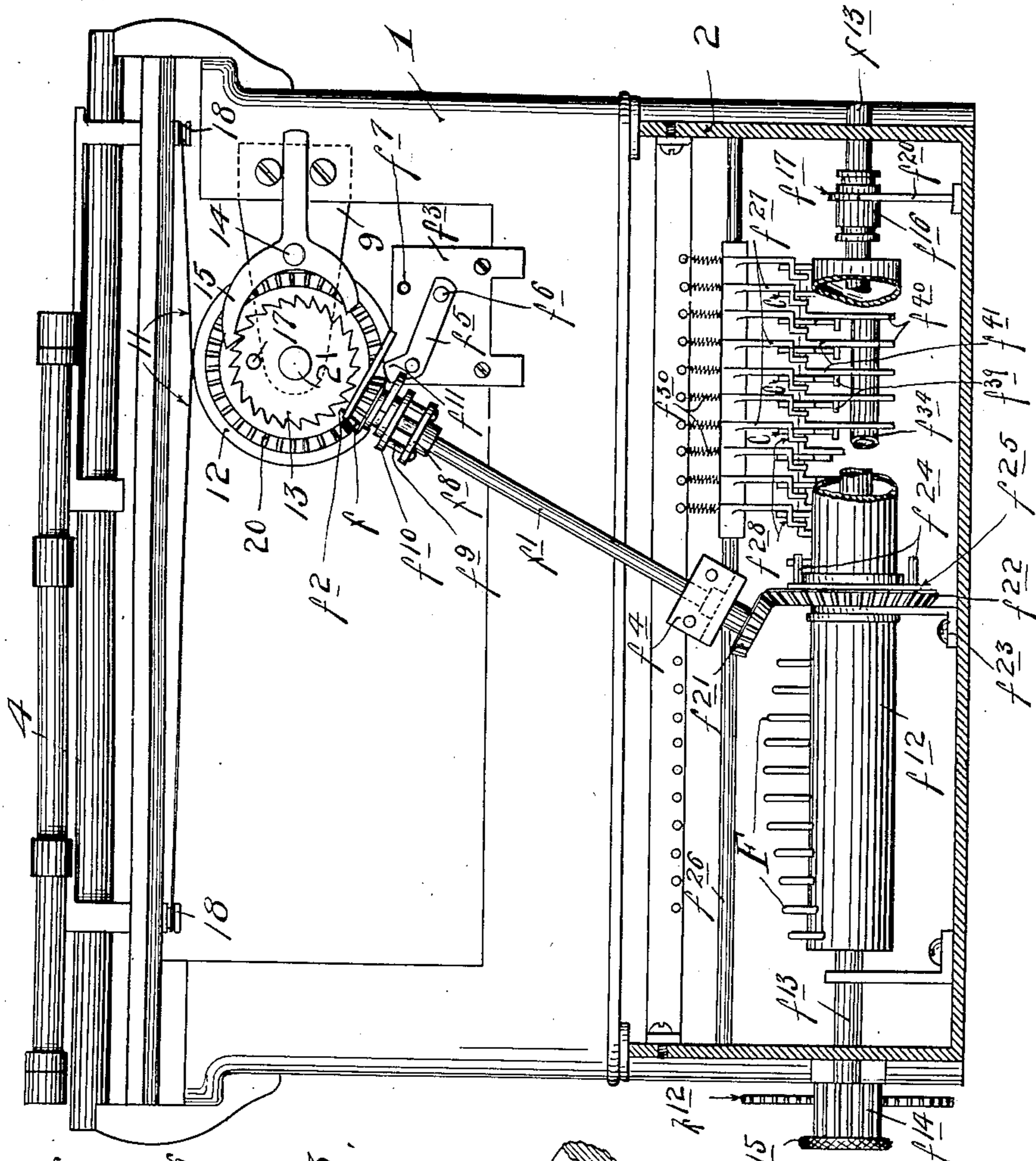


Fig. 11.

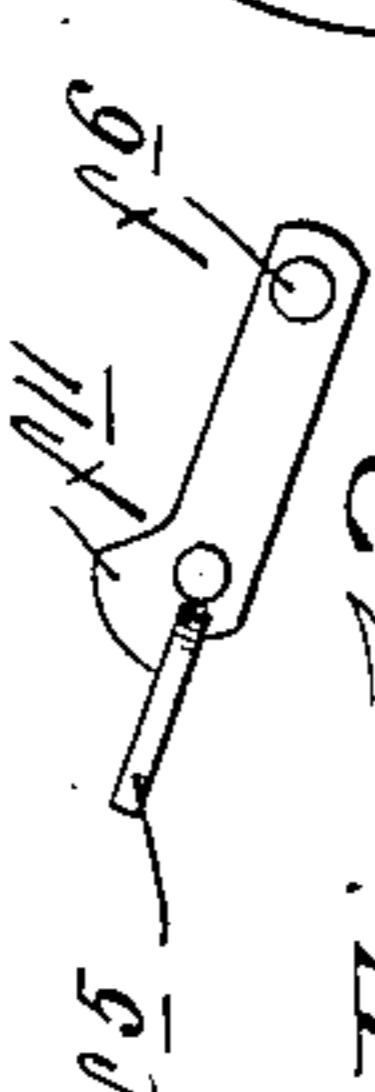


Fig. 12.

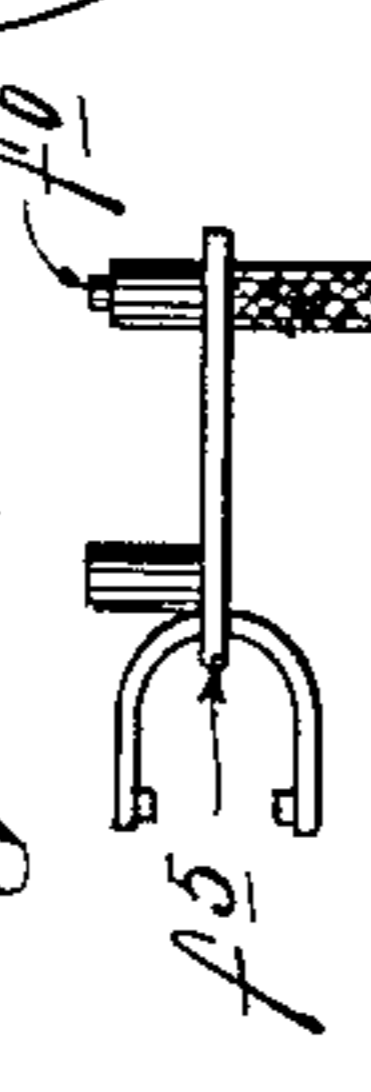
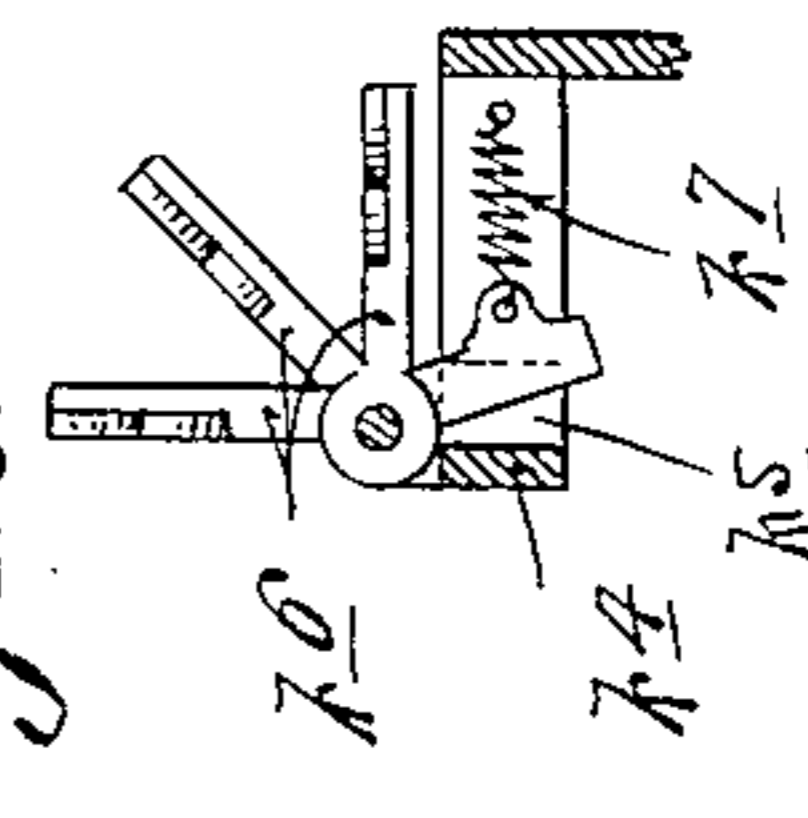


Fig. 13.



Fig. 14.



Witnesses

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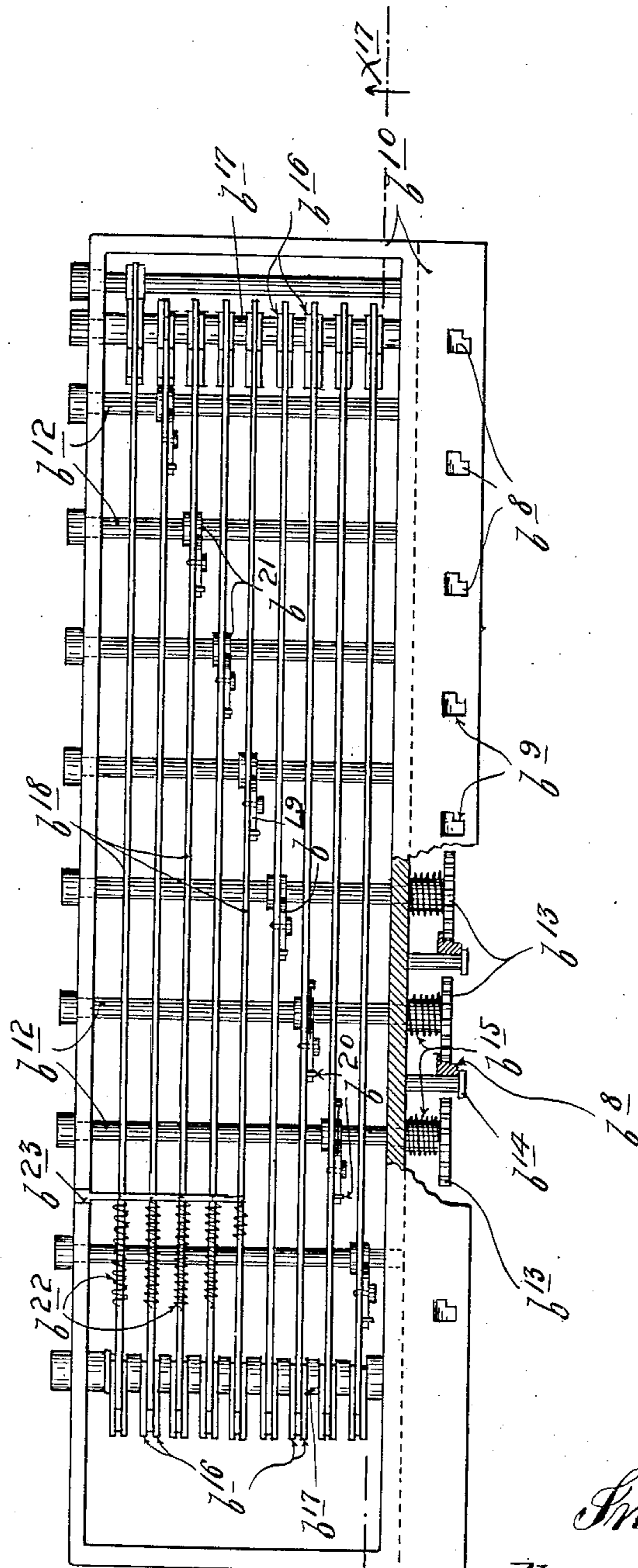
H. HANSON.

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APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 6.

Fig. 15.



Witnesses.

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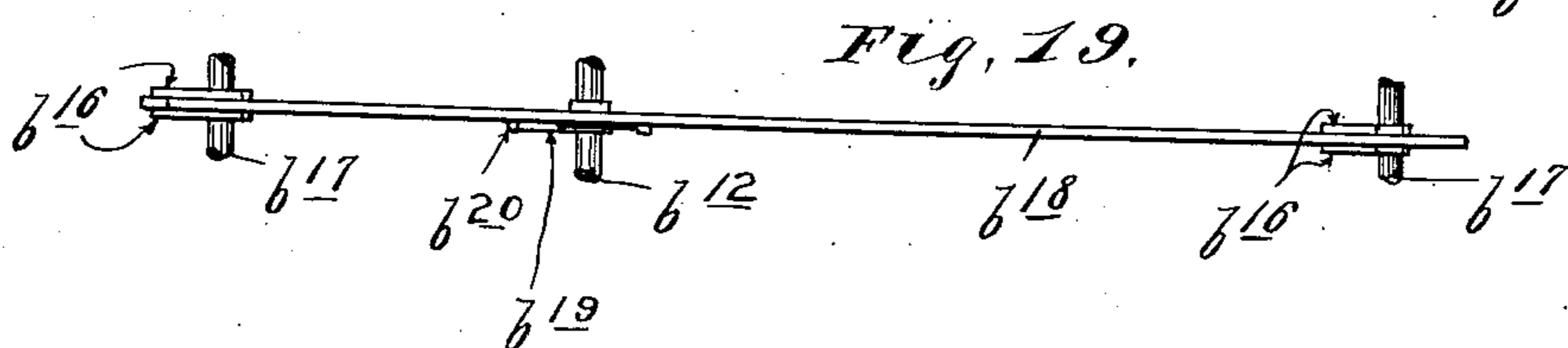
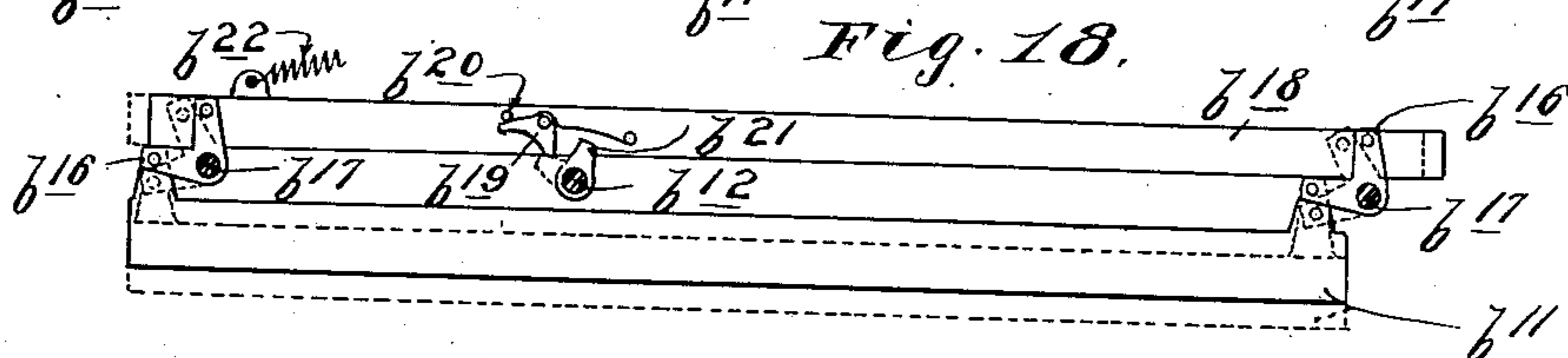
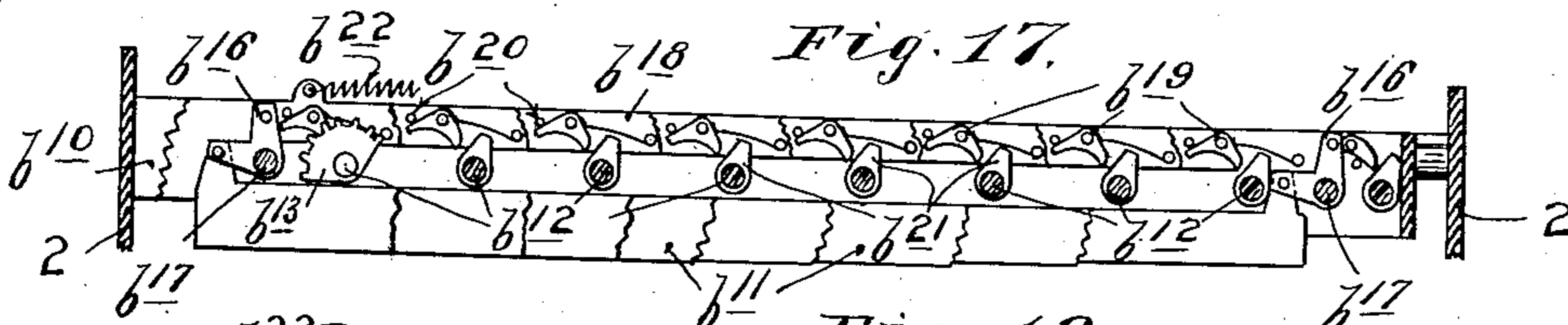
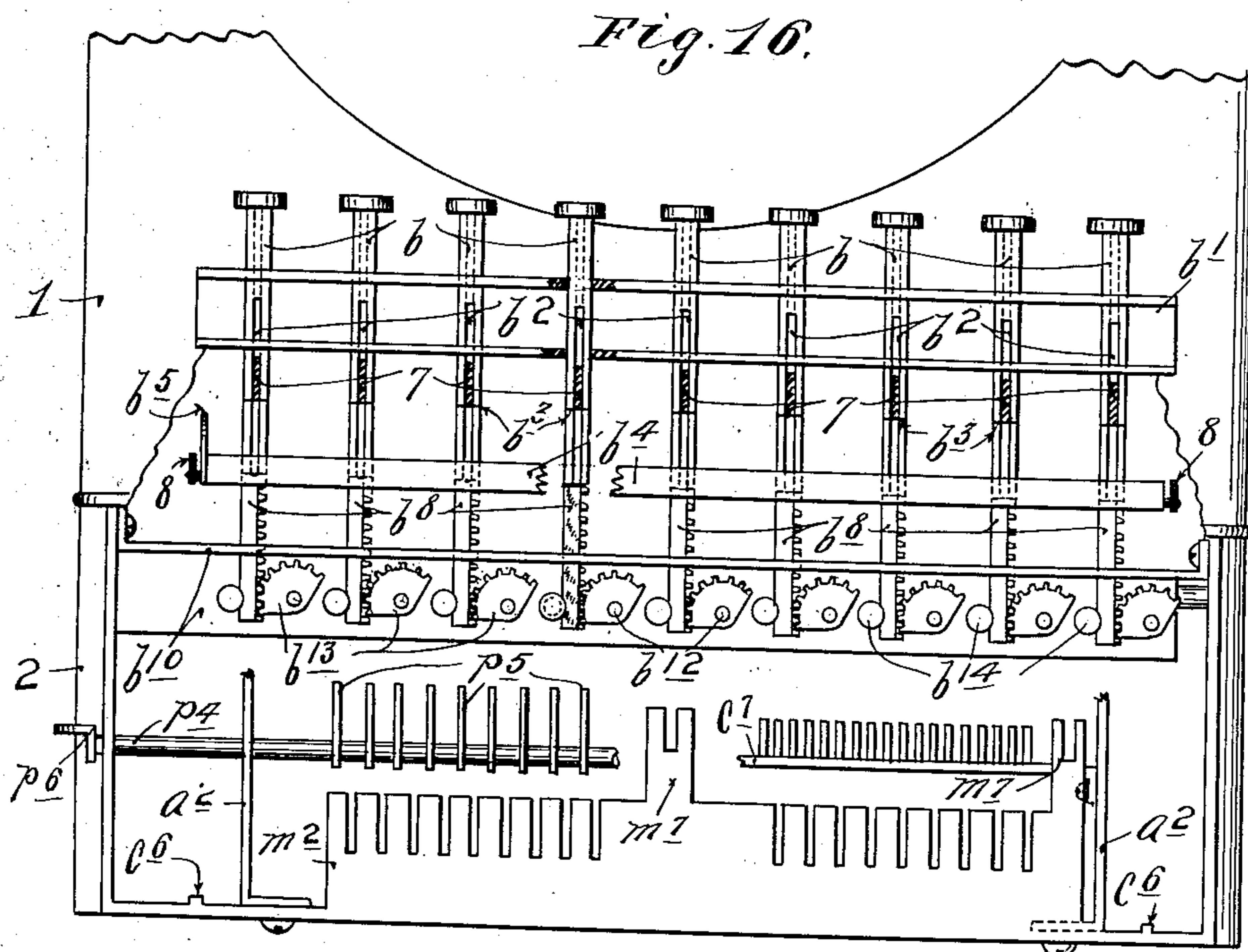
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APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 7.



Witnesses
A. H. Opsahl.
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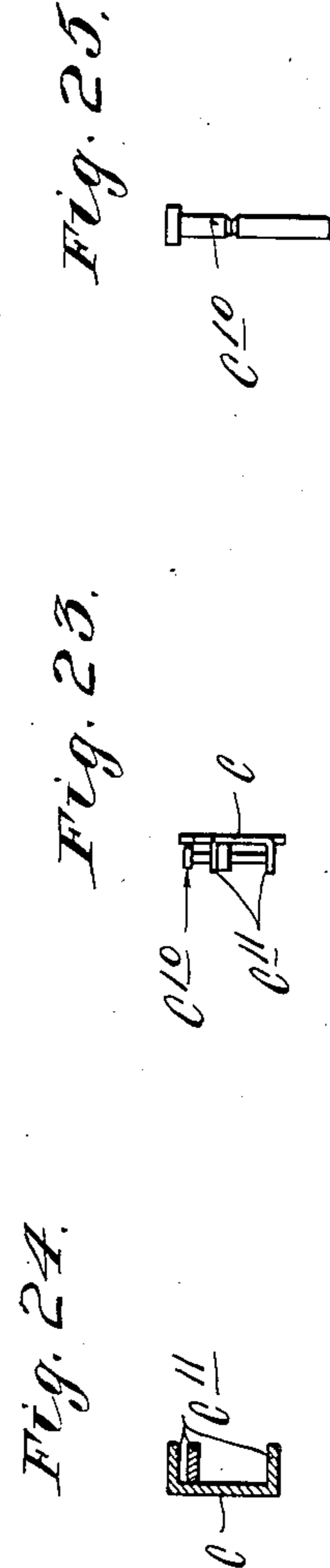
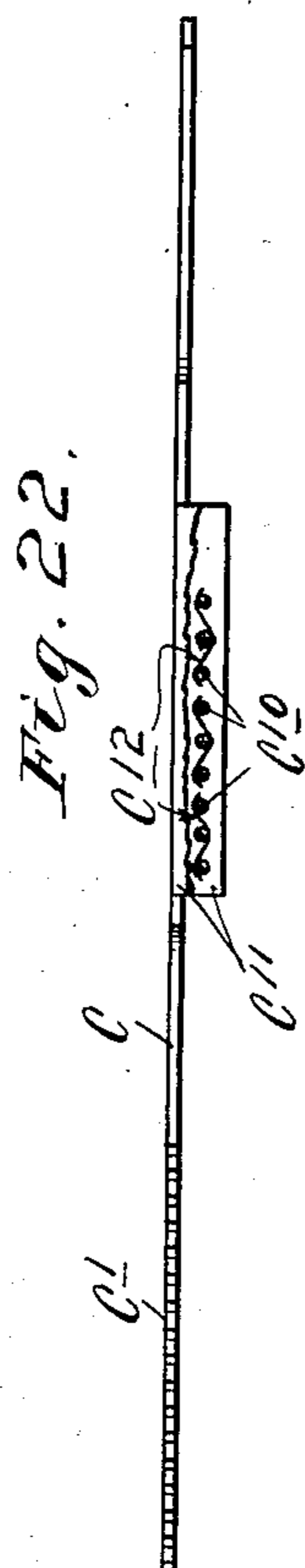
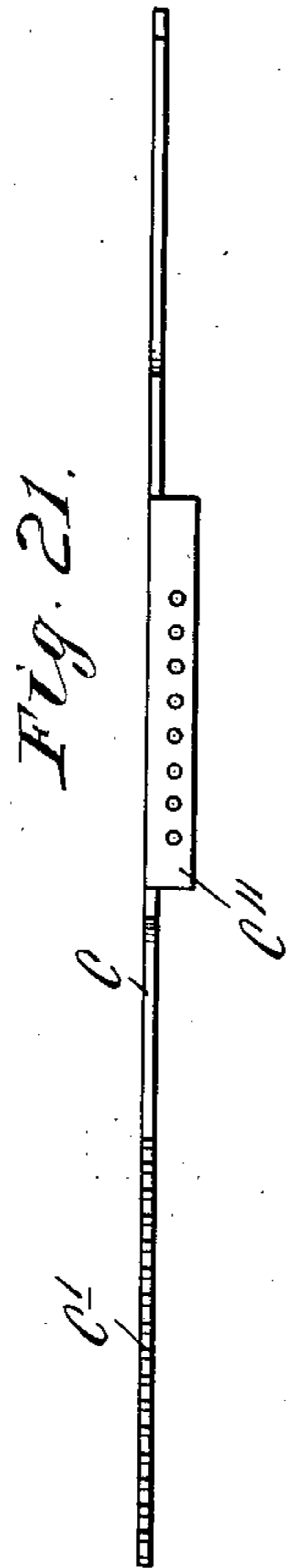
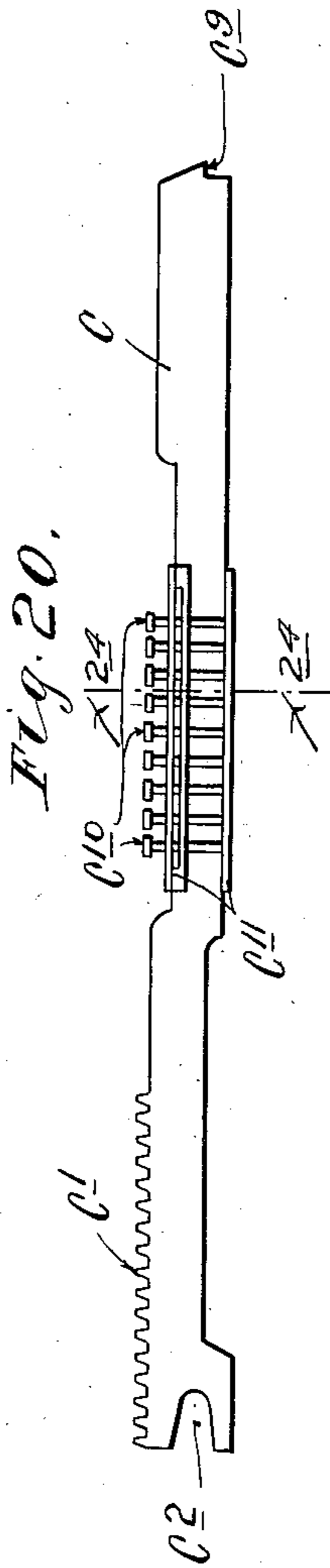
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11 SHEETS—SHEET 8.



Witnesses.
A. H. Opsahl.
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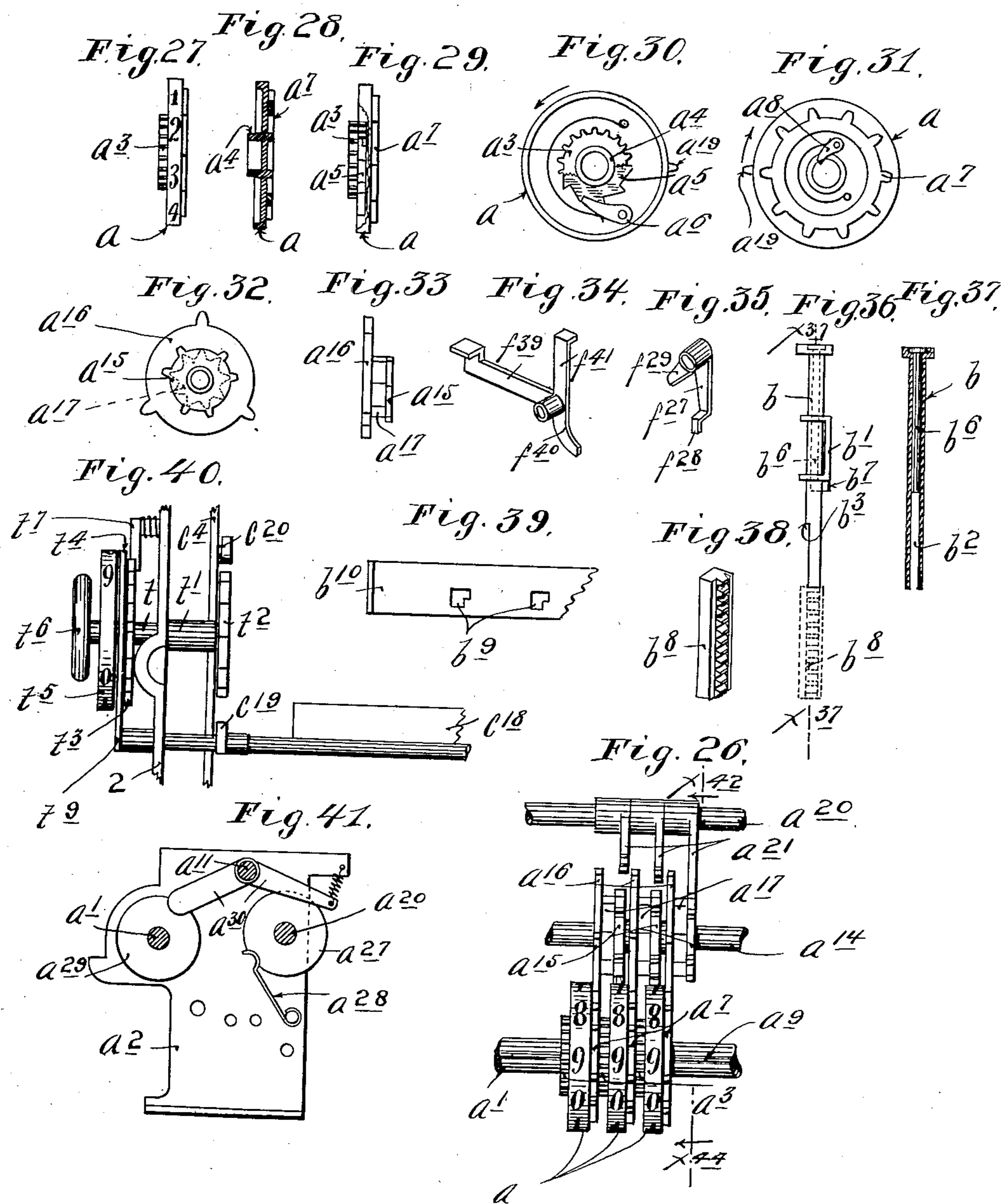
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CALCULATING MACHINE AND TYPE WRITER ATTACHMENT.

APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 9.



Witnesses.
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PATENTED MAR. 27, 1906.

H. HANSON.
CALCULATING MACHINE AND TYPE WRITER ATTACHMENT.

APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 10.

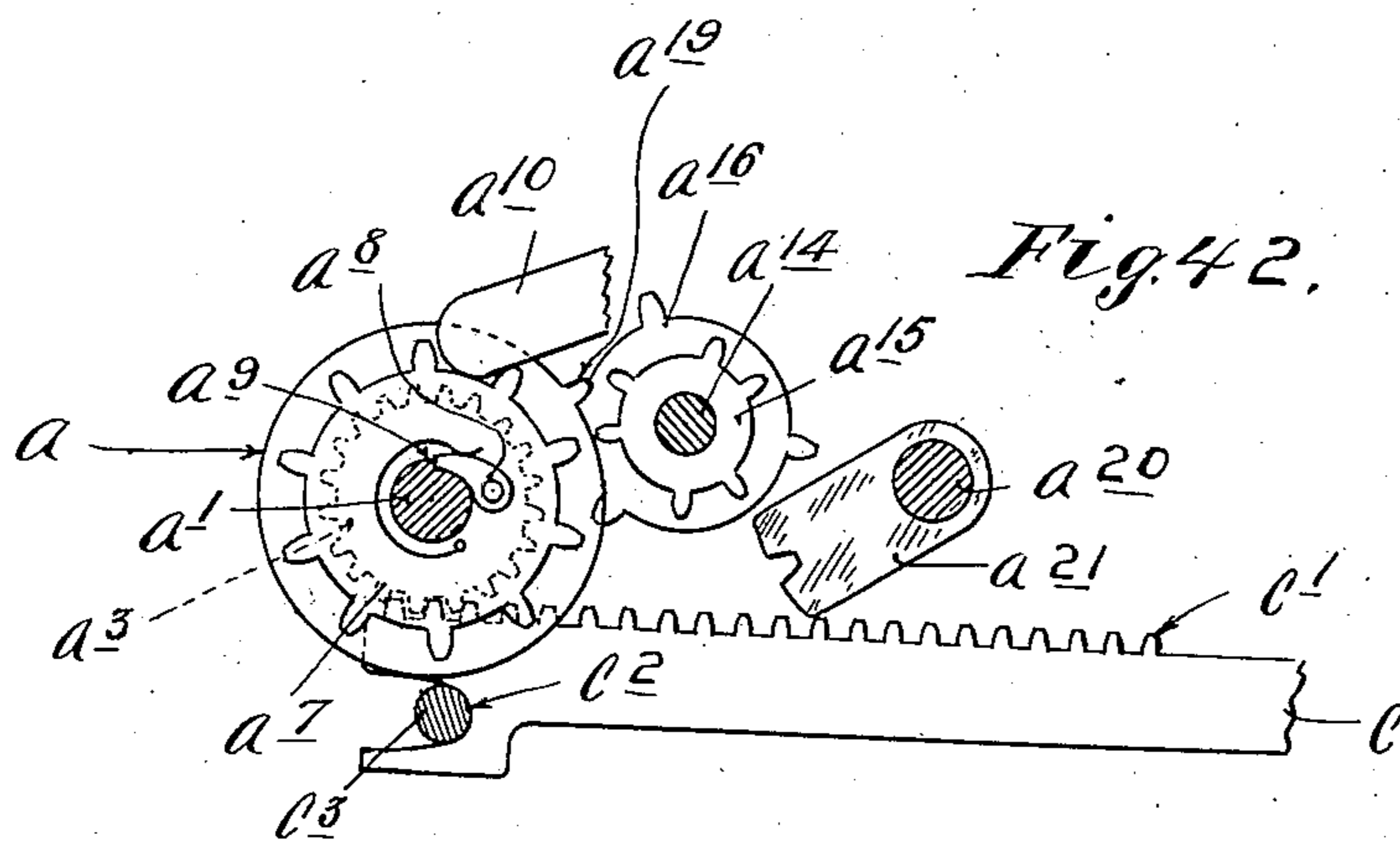


Fig. 42.

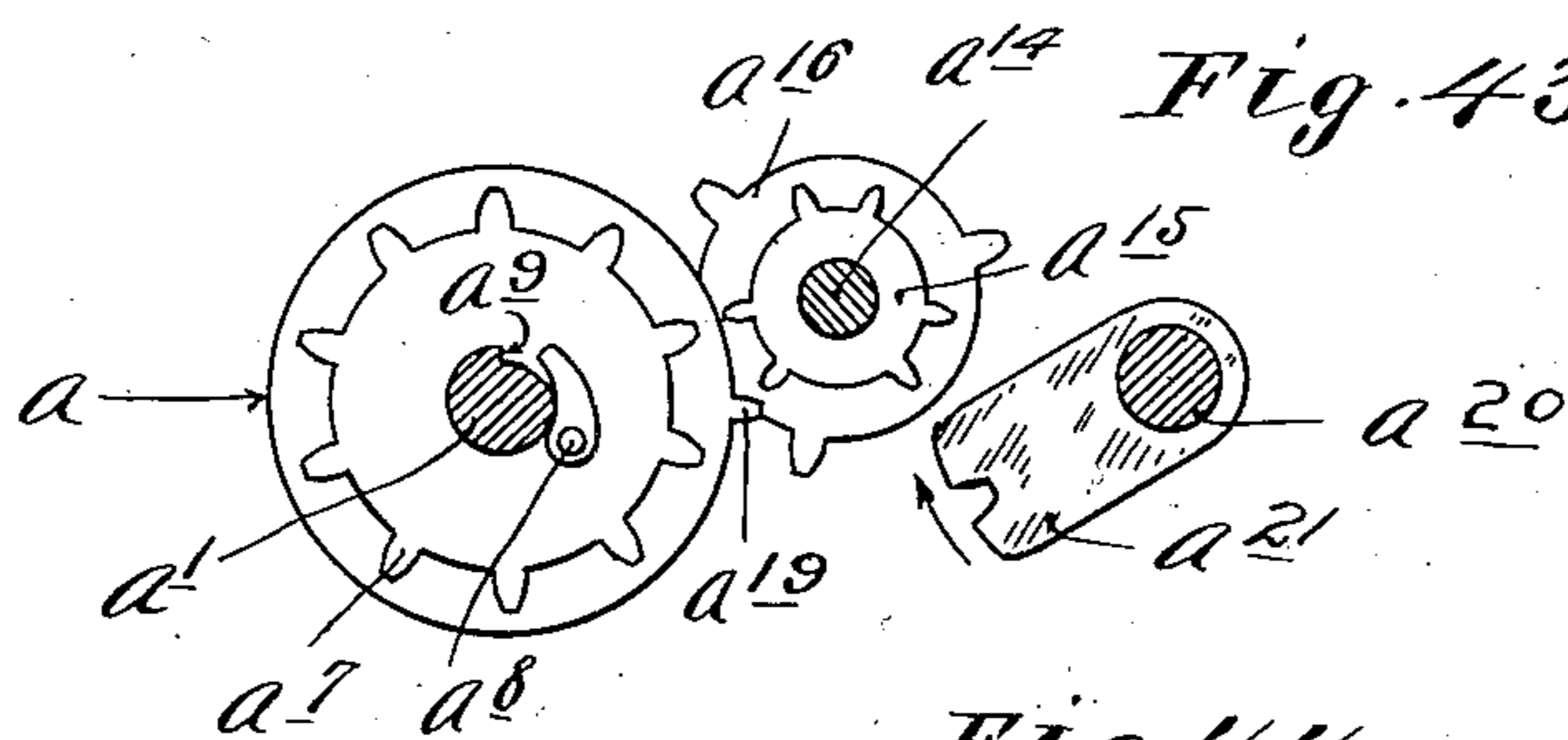


Fig. 43.

Fig. 44.

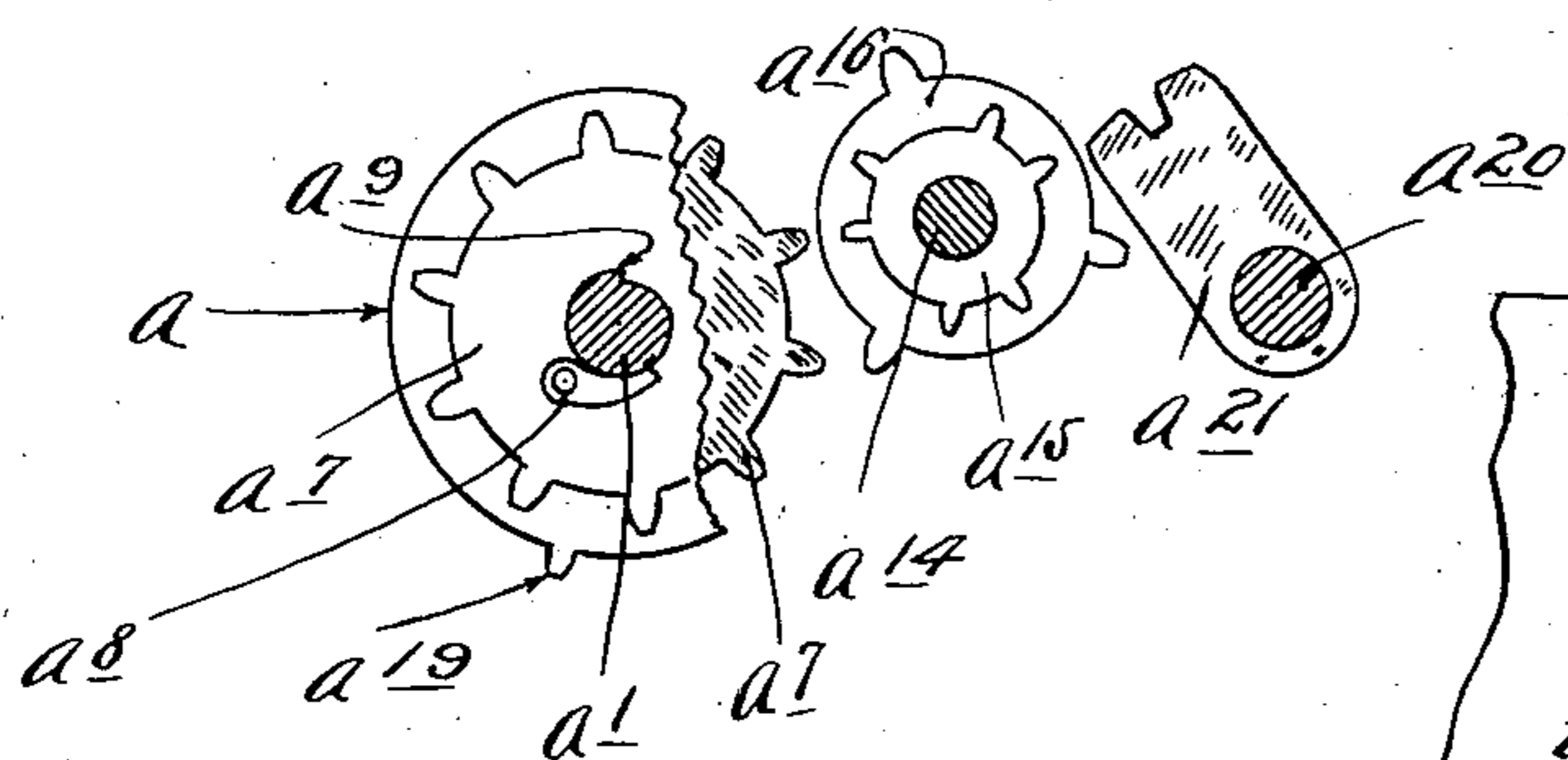


Fig. 45.

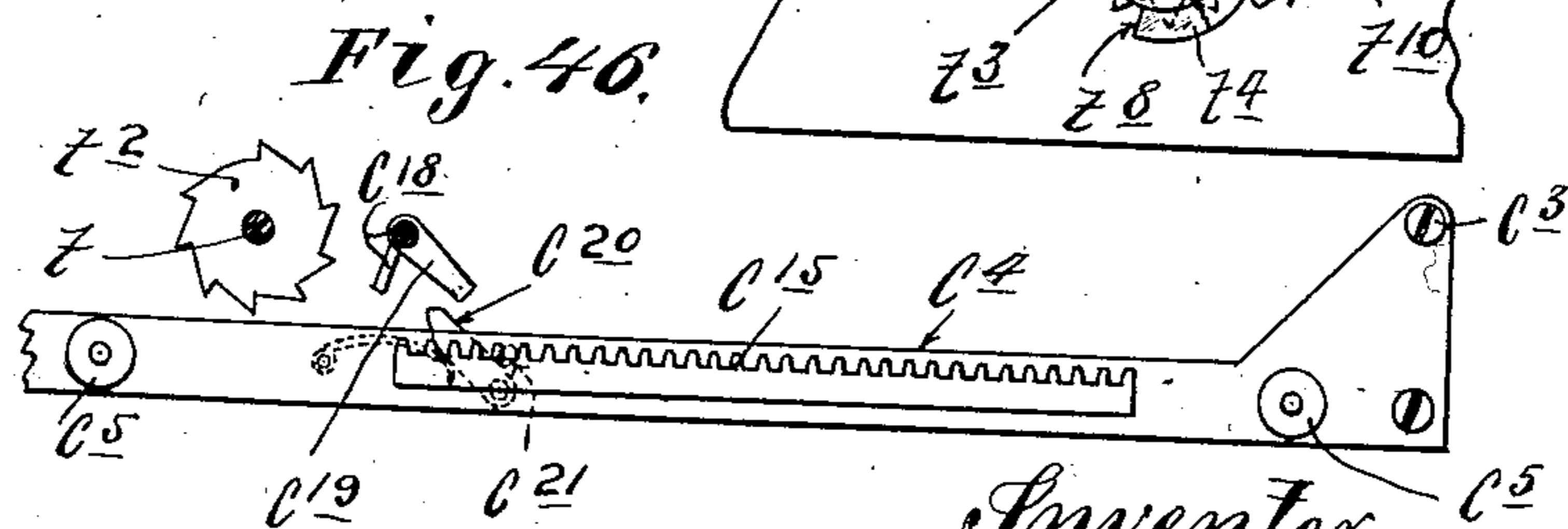


Fig. 46.

Witnesses.

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No. 816,319.

PATENTED MAR. 27, 1906.

H. HANSON.
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APPLICATION FILED JUNE 27, 1902.

11 SHEETS—SHEET 11.

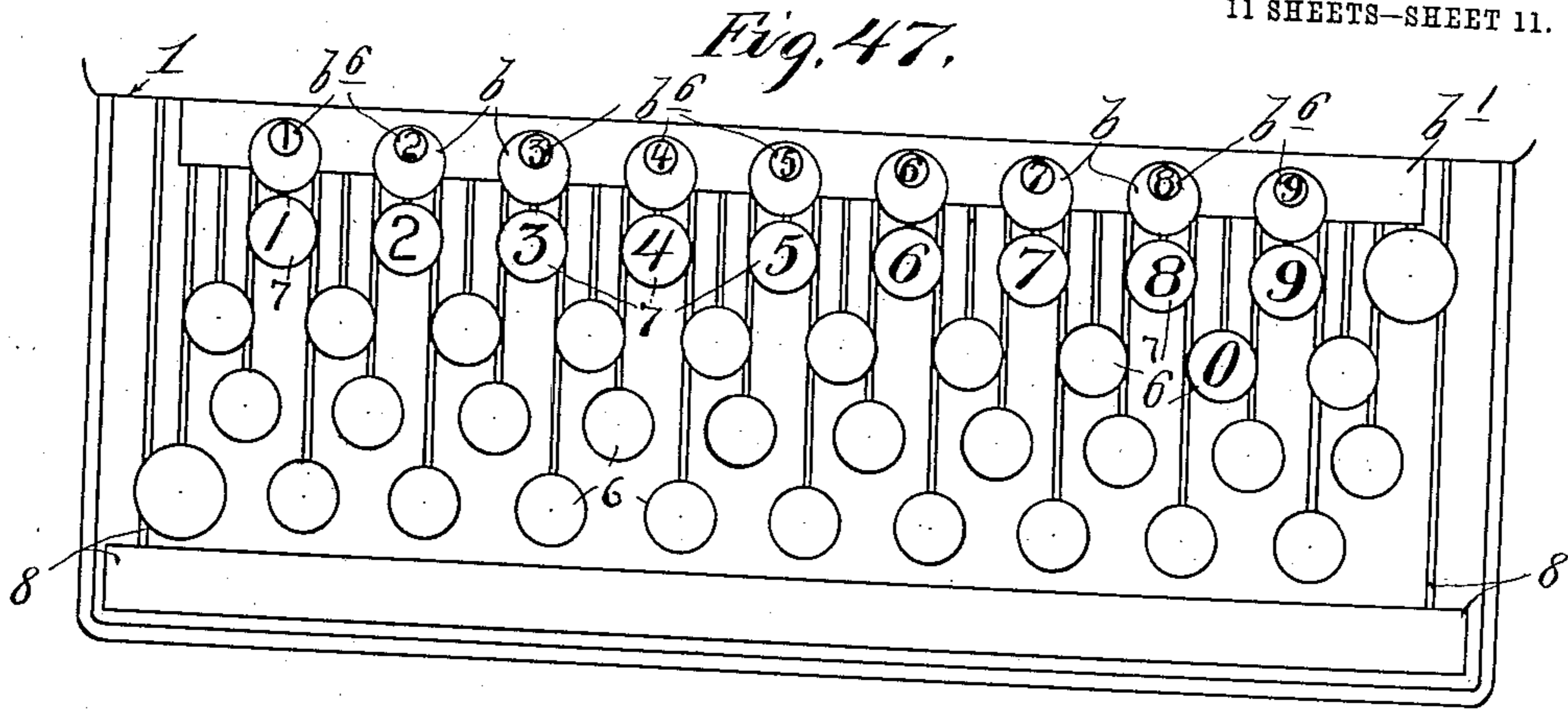
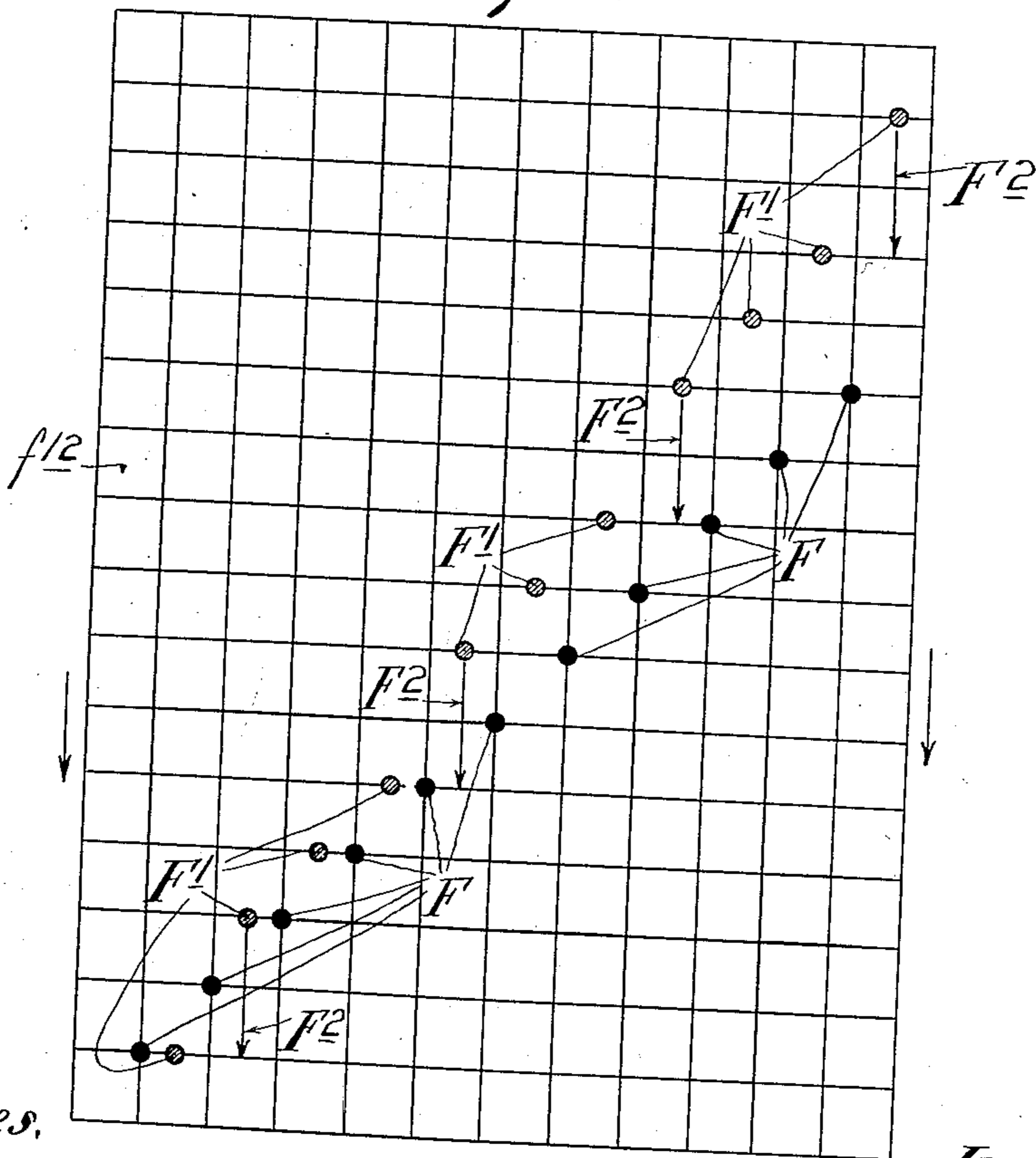


Fig. 48.



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UNITED STATES PATENT OFFICE.

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CALCULATING-MACHINE AND TYPE-WRITER ATTACHMENT.

No. 816,319.

Specification of Letters Patent.

Patented March 27, 1906.

Application filed June 27, 1902. Serial No. 113,453.

To all whom it may concern:

Be it known that I, HANS HANSON, a citizen of the United States of America, and a resident of the borough of Brooklyn, New York city, State of New York, have invented certain new and useful Improvements in Calculating-Machine and Type-Writer Attachments, of which the following is a specification.

My invention relates to calculating-machines, and especially to those which are associated with type-writing machines.

The objects of my invention may be briefly summarized as follows: First, to provide simple and efficient calculating mechanism adapted for use either in connection with or independently of printing mechanism, so that, on the one hand, the type-writer may be used independently of the calculating mechanism and, on the other hand, the calculating mechanism may be used either conjointly with or independently of the printing mechanism of the type-writer; second, to provide in a calculating-machine means whereby the adding-keys may be struck in the natural order of succession—to wit, in the order in which the numerals of a number or sum are read from the left to the right; third, to provide in connection with a type-writer or printing mechanism a calculating mechanism in which the so-called "touch" of the adding-keys is as light or approximately as light as that of the keys of a standard type-writer; fourth, to provide in a calculating-machine preliminary-representation devices which are adapted to be "set" under the action of the adding-keys and to be subsequently brought into action to operate the numeral-wheels of the register by means independent of the adding-keys; fifth, to provide means whereby errors in the setting of these preliminary-representation devices may be corrected at any time before they have been brought into action to transfer the amount on the register-wheels; sixth, to provide means whereby the so-called "adding mechanism" may be used to perform multiplication; seventh, to provide means whereby the type-writer and calculating mechanism may be used to do tabulated work; eighth, to provide means whereby a number or sum may be written "solid" thus, \$1234567, or may be separated by commas and a dollar and cent mark thus, \$1,234,567.89, and, ninth, to provide simple and efficient mechanism whereby the above-noted objects and

others, which will hereinafter appear, may be carried out.

To the above ends my invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

The following is a brief outline of the machine illustrated in the accompanying drawings and hereinafter more specifically described, which machine embodies the several features of my invention. The type-writer employed in this instance for the application of my invention is what is known as the "Underwood" type-writer. In the keyboard of the type-writer or closely associated therewith is located a row of "adding-keys," so called to distinguish them from the ordinary numeral-keys or key-levers of the type-writer. These adding-keys are made up each of two parts or sections and are so arranged that when one part of the key is struck or depressed the corresponding numeral-key lever of the type-writer will be depressed to actuate the printing mechanism of the type-writer, and the calculating mechanism will also be actuated to record the result; but when the other key-section is struck or depressed the calculating mechanism will be actuated to record the result, but the corresponding numeral-key lever of the type-writer will not be acted upon, and hence the corresponding numeral will not be printed. Nine so-called "units-bars," which are preferably extended transversely of the machine, are arranged to be depressed by the corresponding adding-keys. The register for registering the results of the computations involves a plurality of numeral or adding wheels located side by side, together with carrying mechanism of novel construction. For each numeral-wheel of the register, except the one of highest decimal order, there is a so-called "decimal-order bar," which when moved forward operates its corresponding numeral-wheel. These decimal-order bars, hereinafter for brevity called "decimal-bars," extend below and at a right angle to the nine units-bars, and each decimal-bar is provided with nine vertically-movable "units-pins," so-called, which units-pins of the several bars stand directly under the "units-bars" of corresponding unit value or numerical order. To position the units-pins so that they may be set or depressed by the depression of a units-bar under the action of an adding-key, the decimal-bars must be slightly

raised, and this is accomplished by a so-called
 "decimal-order selector" and associated de-
 vices, the best form of such selector being a
 rotary tappet-drum having spirally-arranged
 5 tappets, which acting through intermediate
 devices lift and then drop the decimal-bars
 one at a time in an order of succession from
 the left toward the right. This tappet-drum
 is driven intermittently from a motor-spring
 10 afforded by the motor-spring of the type-
 writer, and the timing of the parts is such that
 any particular decimal-bar, with its nine units-
 pins, will be in a raised position at a time
 when one of the units-bars is depressed, all
 15 these actions of course being controlled by
 the depression of an adding-key. When a
 units-pin of each decimal-bar, or of a number
 thereof, have been depressed or "set," they
 determine the amount or sum which is to be
 20 added on the wheels of the register, and hence
 taken collectively they constitute what may
 be appropriately designated as a "prelimi-
 nary-representation device." The said units-
 pins might therefore be designated as "pre-
 25 liminary representation pins." After the
 preliminary representation has been thus ef-
 fected by the depression of units-pins the deci-
 mal-bars are moved endwise by the action of
 a so-called "operating-carriage," which car-
 30 riage is moved by a hand-lever and is pro-
 vided with a so-called "driving-bar," which
 as the carriage moves forward engages the
 depressed units-pins, collects them in a trans-
 versely-lined row, and imparts movements to
 35 the decimal-bars depending on the normal
 relative positions of the depressed pins to the
 said driving-bar. Thus movements which
 are usually differential, but which will be the
 same if the same adding-key is each time
 40 struck, are imparted to the decimal-bars, and
 hence to the corresponding numeral-wheels
 of the register. The carrying of the "tens"
 from the one numeral-wheel onto the wheel of
 next higher order takes place on the return
 45 movement of the operating-carriage. Means
 is also provided whereby on the initial return
 of the operating-carriage the set or depressed
 units-pins which have then performed their
 work will be restored to normal positions.
 50 To provide for doing so-called "tabulated
 work," the registers, the groups of decimal-
 bars, and the spiral series of tappets on the
 tappet-drum are duplicated and may be fur-
 ther increased in number at will; but the
 55 same set of adding-keys and units-bars may
 be employed, it being necessary, of course,
 that the latter be sufficiently extended for ac-
 tion on all of the units-pins of the several
 groups of decimal-bars. Devices for correct-
 60 ing errors and for performing multiplication
 are also provided; but these, as well as the
 novel and peculiar disposition of the tappets
 of the tappet-drum or decimal-order selector,
 whereby so-called "solid-work" or "punctu-
 65 ated work" may be accomplished at will are

fully described in the detail description here-
after given.

It is thought that the foregoing general out-
 line of the machine will prepare the reader
 for a quick understanding of the construc- 70
 tion and operation of the machine, as here-
 inafter given.

In the detailed description of my invention
 as illustrated the following grouping of mech-
 anisms has been made, and each group of 75
 mechanism has been designated by the fol-
 lowing characters, to wit:

Type-writer and case supporting the same,
designated by numerals.

Register, including carrying mechanism, 80
designated by *a* and its powers.

Adding-keys, units-bars, and intermediate
connections, designated by *b* and its powers.

Decimal-order bars, preliminary-represen- 85
tation or units-pins, operating-carriage, and
associated parts, designated by *c* and its
powers.

Decimal-order selector or rotary tappet-
drum and associated devices, designated by
f and *F* and their powers. 90

Hand-lever and connections, designated by
g and its powers.

Tabulating mechanism, designated by *k*
and its powers.

Error-correcting devices, designated by *n* 95
and its powers.

Zero devices, designated by *p* and its
powers.

Multiplication devices, designated by *t* and
its powers. 100

My invention is illustrated in the accompa-
nying drawings, wherein like characters indi-
cate like parts throughout the several views.

Figure 1 is a plan view of the principal
 parts of the calculating mechanism, the same 105
 being uncovered, some parts being broken
 away and some parts being removed. Fig. 2
 is a view, partly in side elevation and partly in
 section, showing both the type-writer and
 the calculating mechanism, parts of the for- 110
 mer being broken away and the latter being
 sectioned on the irregular line $x^2 x^2$ of Fig. 1.
 Fig. 3 is an end view of the rotary tappet-
 drum or decimal-order selector, showing the
 complete arrangement of the tappets thereof. 115
 Fig. 4 is a detail in left side elevation show-
 ing one end of an oscillating frame, a portion
 of the operating-carriage of the calculating
 mechanism, and a latch-lever coöperating
 with said parts. Fig. 5 is a view in side ele- 120
 vation showing the forward portion of the
 case of the calculating mechanism and cer-
 tain parts mounted on the left-hand side of
 the same. Fig. 6 is a vertical section on the
 line $x^6 x^6$ of Fig. 1, a portion only of the type- 125
 writer being shown. Fig. 7 is a view princi-
 pally in right side elevation, showing the cal-
 culating mechanism, the case thereof being
 sectioned so as to expose some of the inclosed
 mechanism to view. Fig. 8 is a front elevation 130

of the calculating mechanism with some parts sectioned on the irregular line $x^8 x^8$ of Fig. 1. Fig. 9 is a detail in section on the line $x^9 x^9$ of Fig. 8. Fig. 10 is a rear elevation showing the type-writer and calculating attachment, but with the case of the latter sectioned on the line $x^{10} x^{10}$ of Fig. 2 and with some parts broken away. Figs. 11 and 12 are details, respectively, in side elevation and in plan, of the shipper-lever for operating the gear-clutch shown in Fig. 10. Fig. 13 is a perspective view showing the head or free end of the hand-operated power-lever of the machine, the tabulating-keys which are carried thereby being removed. Fig. 14 is a detail in section on the line $x^{14} x^{14}$ of Fig. 13, with the tabulating-keys shown in working positions. Fig. 15 is a plan view, with some parts broken away, of the units-bar actuating connections and the frame in which such parts are mounted. Fig. 16 is a view, partly in front elevation with some parts removed and some parts broken away and partly in section, on the line $x^{16} x^{16}$ of Fig. 2. Fig. 17 is a section on the line $x^{17} x^{17}$ of Fig. 15. Fig. 18 is a similar view to Fig. 17, but with certain of the parts shown in the former view removed. Fig. 19 is a plan view of one section of the mechanism shown in Figs. 16, 17, and 18. Fig. 20 is a side elevation showing one of the so-called "decimal-bars." Figs. 21 and 22 are plan views of the same, the latter having some parts broken away. Fig. 23 is an end elevation of the parts shown in Fig. 20. Fig. 24 is a section on the line $x^{24} x^{24}$ of Fig. 20, the so-called "units-pins" being removed therefrom. Fig. 25 shows one of the units-pins in elevation. Fig. 26 is a plan view showing in part the adding-wheels and carrying mechanism of one of the registers. Figs. 27 to 31, inclusive, are details of the adding-wheels and parts carried thereby. Figs. 32 and 33 are details of the composite carrying-wheels. Fig. 34 is a perspective view of one of the lifting and tripping levers which cooperate with the decimal-bars of the calculating mechanism. Fig. 35 is a perspective view of one of the latch-hooks which cooperate with the lifting and tripping levers in Fig. 34. Fig. 36 is an elevation of one of the adding-keys, showing also by dotted lines a loose rack which cooperates therewith. Fig. 37 is a section on the line $x^{37} x^{37}$ of Fig. 36. Fig. 38 is a perspective view of the rack shown in dotted lines in Fig. 36. Fig. 39 is a plan view of a part of the rectangular supporting-frame, best shown in Fig. 15. Fig. 40 is a plan view showing parts of the multiplying device. Fig. 41 is a section on the line $x^{41} x^{41}$ of Fig. 1. Figs. 42, 43, and 44 are sections on the line $x^{42} x^{44}$ of Fig. 26, illustrating different positions of the parts of the adding-wheels and carrying devices, some parts being broken away and others being removed. Fig. 45 is a view corresponding to Fig. 5, but

showing different positions of the parts of the multiplying device. Fig. 46 is a detail in side elevation showing a portion of the operating-carriage and certain associated parts. Fig. 47 is a diagrammatic plan of the keyboard; and Fig. 48 is a diagrammatic view of the so-called "tappet-drum" or "decimal-order selector," showing the same laid out flat.

Type-writer and case supporting the same. As already stated, I have in the present instance shown my invention as applied to an "Underwood" type-writer. The construction and operation of this type-writer is well understood and will be briefly described as follows: The numeral 1 indicates the frame of the type-writer, the base of which, it may be here stated, is mounted upon the top of a box-like case 2, which latter, as will be hereinafter noted, incloses the principal parts of the calculating mechanism. 3 indicates the impression-roller; 4, the type-writer carriage; 5, the type-bars; 6, the character-keys; 7, the numeral-key levers, which levers are yieldingly pressed upward by springs, (not shown,) and 8 the spacing-bar or bail of said type-writer, which bar or bail is also yieldingly held upward by a spring. (Not shown.) A bracket 9, Figs. 2, 6, and 10, supports the carriage-spring power device, of which 10 is the spring-barrel, 11 the tapes, 12, the tape-drum; 13, the ratchet-wheel, and 14 a fixed stud on which is pivoted the retaining-pawl 15, which holds said ratchet-wheel 13 against the tension of the motor-spring 16. The ratchet-wheel 13 is provided with a stud 17 for turning it to wind up the spring 16, and the tapes 11 are wound reversely on the drum 12, and their oppositely-extended ends are secured to lugs 18 of the type-writer carriage 4, Fig. 10, for positively moving said carriage in both directions under the action of the hand-lever of the calculating mechanism and under the action of the motor-spring of the type-writer, as will hereinafter appear. In a bearing of the bracket 9 is mounted a sleeve 19, to the inner end of which is attached a tape-drum 12, and to the outer end of which is attached a bevel-gear 20, said gear and drum being thus caused to rotate in unison. A rotary shaft 21 extends axially through and is loosely journaled in the sleeve 19 and carries at its inner end the spring-barrel 10 and at its outer end the ratchet-wheel 13. The motor-spring 16, which is within the spring-barrel 10, is at its inner end attached to the shaft 21, and at its outer end is attached to a stud 22 of the tape-drum 12. This construction provides for the adjustment of the tension of the motor-spring 16, the same as in an ordinary type-writer. The supporting-case 2 has perforations through its top-plate, which permit free movements of such of the parts of the calculating mechanism as are passed therethrough, and at its forward portion it is curved downward and reduced

in height, and at such curved portion it is provided with a glass sight-opening 23, through which, as will presently appear, the numerals on the adding-wheels of the registers are exposed to view.

Register, including carrying mechanism.—Each register involves a plurality of adding-wheels marked on their peripheries with the numerals "0" to "9," inclusive, and positioned so that these numerals will be exposed successively to view through the sight-openings 23 of the case 2, there being, as shown, ten such wheels in each group or for each register. These adding-wheels a are mounted for independent rotations in one direction on a shaft a' , which extends transversely of the machine and is journaled in vertical bearing-plates a^2 , secured to the bottom of the case 2. The said shafts a' are independent of each other, as clearly shown in Fig. 8, wherein the adding-wheels of one register are shown removed from one of the shafts. A gear a^3 is loosely mounted on the hub a^4 of each adding-wheel and receives a differential movement from its cooperating "decimal bar," as heretofore indicated and hereinafter more fully described. Between the loose gear a^3 and a web of the adding-wheel a is a ratchet-wheel a^5 , that is attached to the said gear a^3 . The adding-wheel a carries a spring-pressed pivoted pawl a^6 , which cooperates with said ratchet-wheel to turn the adding-wheel in the direction of the arrows marked on Figs. 2 and 30 when the gear a^3 is rotated by the forward or operative movement of its decimal-bar. This pawl, however, permits a reverse movement of the said gear a^3 and ratchet-wheel a^5 without causing a return movement of said adding-wheel a therewith. On the other side of the adding-wheel a is attached a wheel a^7 , having ten teeth, and pivoted to this same side of said adding-wheel is a spring-pressed pawl a^8 , which engages a shoulder a^9 of the shaft a' when the shaft is moved in the direction indicated by the arrow marked on Fig. 31, this being the movement which is accomplished by the so-called "zero devices," hereinafter described. The adding-wheels are held against accidental movement by friction-pawls a^{10} , pivoted on a transverse bearing-shaft a^{11} , supported by the bearing-plates a^2 . These pawls a^{10} are shown as provided with rollers a^{12} at their forward ends, that engage in the notches between the teeth of the wheel a^7 , carried by the corresponding adding-wheel a . The rear ends of the pawls a^{10} are connected to springs a^{13} , the other ends of which springs are attached to parts hereinafter described, as best shown in Figs. 2 and 6.

The carrying mechanism of the register is best illustrated in Figs. 2, 6, 42, 43, and 44. Parallel with and rearwardly of each adding-wheel shaft a' is a shaft a^{14} , also supported by

the brackets a^2 and having loosely mounted thereon a series of composite carrying-wheels in number one less than the number of the cooperating adding-wheels, and each consisting of three sections—to wit, a six-toothed wheel a^{15} , a three-toothed wheel a^{16} , and between these two wheels a nine-toothed star-wheel a^{17} , the three wheels being connected to rotate as if one and being frictionally held against accidental movements by a pawl a^{18} , mounted on the same shaft a^{11} on which are pivoted the pawls a^{10} heretofore described. The springs a^{13} , heretofore noted, connect the pawls a^{10} and a^{18} and yieldingly press the free ends of said pawls a^{18} against the teeth of corresponding star-wheels a^{17} , as shown in Figs. 2 and 6.

Referring to Fig. 32, it will be seen that the six-toothed wheel a^{15} is made as if every third tooth had been cut out, leaving three divisions of two teeth each. The normal positions of the carrying-wheels is best shown in Figs. 2, 26, and 42, by reference to which it will be noted that the six-toothed wheel a^{15} lies in the path of a single tooth a^{19} , carried on the periphery of the corresponding adding-wheel a . When one of the adding-wheels a is moved from its ninth to its tenth or zero position, its tooth a^{19} engages the tooth of the carrying-wheel a^{15} , which stands within its arc of movement, and will thereby shift the composite carrying-wheel from its normal position (indicated in Fig. 42) into its intermediate position, (indicated in Fig. 43,) in which position it remains for the time being. The above step movement of said carrying-wheel is a one-ninth of a complete rotation. The teeth on the wheel a^{16} were of course shifted one step with the shifting of the wheel a^{15} , but were not moved within the arc of movement of the teeth of the wheels a^7 .

Rearward of the shaft a^{14} is a shaft a^{20} , which carries radiating gear-segments or two toothed arms a^{21} , that are spaced apart laterally and set spirally on the shaft a^{20} , as best shown in Figs. 1, 2, and 26. There is one arm a^{21} for each carrying-wheel a^{15} , and the latter lie in the path thereof, so that when said carrying-wheel has been shifted from its normal position, as shown in Fig. 43, one of the advance teeth thereof will be engaged by the teeth of said arm when the shaft a^{20} is oscillated from the position shown in Fig. 43 into the position shown in Fig. 44. This movement of the said shaft a^{20} carries the toothed arm a^{21} from the position indicated in Fig. 43 into the position indicated in Fig. 44 and causing the same to act upon the wheel a^{15} and impart a further two-ninths of a complete rotation to the composite carrying-wheel, so that the carrying-wheel in Fig. 44 stands one-third of a complete rotation ahead of the carrying-wheel in Fig. 42. It should also be noted that if the toothed arms a^{21} be moved while the carrying-wheel stands

as shown in Figs. 42 and 44 it will have no action whatever on the said carrying-wheel. However, the movement of the composite carrying-wheel from the position indicated in Fig. 43 into the position indicated in Fig. 44 causes one of the teeth of the three-tooth wheel a^{16} to engage one of the teeth of the ten-toothed wheel a^7 , which belongs to the adding-wheel of the next higher denominational order and imparts a one-tenth rotation thereto, thus carrying one from the lower to the higher denominational order. It is now evident that all of those composite carrying-wheels which have not in advance of the movement of the toothed arms a^{21} been moved from normal positions by the action thereon of the tooth a^{19} of the corresponding numeral-wheel will remain in normal position and not be effected in any way by the subsequent movement of the cooperating toothed arms a^{21} . The radius of the toothed arms a^{21} should be such that the circumferential spaces between their outer ends are sufficient for each arm to complete the movement of its cooperating gear or carrying-wheel a^{15} before the next toothed arm begins action on its cooperating carrying-wheel, so that the movement of carrying from the units order to the tens order is made full and complete before the carrying from the tens order to the hundreds order is started, and so on, throughout all the orders. The circumferential distance between the first and the last toothed arms a^{21} (see Fig. 2) must be sufficient to leave an open space for the free passage of all of the teeth of the six-toothed carrying-wheels a^{15} .

The shaft a^{20} (see Figs. 1, 6, and 8) carries a loose pinion a^{22} at one end, and a spring-pressed pawl a^{23} , pivoted on said pinion, engages a shoulder a^{24} of said shaft when said pinion is rotated in the direction indicated by the arrow marked in Fig. 6, so that the toothed arms a^{21} will be positively moved under such movement of said pinion, but will not be moved under reverse movement of said pinion. The pinion a^{22} meshes with a spur-gear a^{25} , suitably journaled on a stud a^{26} , which projects inward from the left-hand side of the case 2. The gear a^{25} receives positive rotary movements in both directions under the forward and return movements of the operating-carriage and its rack c^{15} and imparts such movements to the pinion a^{22} and to its driving-pawl a^{23} . Under the forward movement of the operating-carriage the pinion a^{22} is given one complete rotation in a direction reverse from that indicated by the arrow marked on Fig. 6, and under this movement the pawl a^{23} slips over the shoulder a^{24} of the shaft a^{20} , thus leaving said shaft and its toothed arms a^{21} standing in their normal positions. Under the return movement of the operating-carriage the said pinion a^{22} is given a complete backward rotation in the

direction indicated by the arrow marked on Fig. 6, and under this movement the pawl a^{23} engages the shoulder a^{24} of the shaft a^{20} and imparts one complete rotation to the said shaft and its toothed arms a^{21} . On the shaft a^{20} near one end thereof is a disk a^{27} , (see Fig. 41,) which has a single notch that is normally engaged by the free end of a spring-retaining pawl a^{28} on one of the brackets a^2 . By this means the shaft a^{20} and its toothed arms a^{21} are held in normal positions against accidental or return movements. On the corresponding end of the shaft a' is a disk a^{29} , having a single notch that is normally engaged by the free end of a spring-pressed retaining-pawl a^{30} , which, as shown, is pivoted on the shaft a^{11} . This pawl a^{30} holds the shaft a' in normal position against accidental movements.

Adding-keys, units-bars, and intermediate connections.—The adding-keys are mounted for vertical movements, as shown, in the flanges of a channel-bar b' , which is rigidly secured to the type-writer frame 1. These keys b are centrally located over the corresponding numeral-key levers 7 of the type-writer and bear corresponding numbers on their respective heads or key finger-pieces, the said adding-keys being marked from the left toward the right with the successive numerals "1" to "9," inclusive, as shown in Fig. 47. The stems of the keys b are tubular and are slit or divided at their lower portions, as indicated at b^2 , so that they straddle the corresponding numeral-key levers 7, and are further formed with shoulders b^3 . As shown in Figs. 2 and 16, an escapement-actuating blade b^4 is pivoted at its ends and lower edge to the sides of the type-writer spacing-bail 8 in position where when thrown pivotally rearward its upper edge will be engaged by the shoulders b^3 of the keys b . At one end this blade b^4 is provided with a finger-piece b^5 , by means of which it may be turned from its normal position (indicated by full lines) into an inoperative position, (indicated by dotted lines in Fig. 2,) in which dotted-line position it will not be engaged by the said shoulders b^3 . As is evident, the depression of one of the keys b when the blade b^4 is in its operative position will depress the escapement-bail 8 and actuate the escapement mechanism of the type-writer, regardless of whether or not one of the numeral-key levers 7 is depressed. This, as will presently be noted, is an action that is necessary when the machine is manipulated to actuate the calculating mechanism without operating the printing mechanism of the type-writer.

In the upper unslotted portion of each key b is telescopically inserted a supplemental key b^6 , having at its upper end a head or finger-piece which fits a recess in the head of the key b and is of course much smaller in diameter than the latter. The numerals which in-

dicating the numerical values of the several adding-keys are preferably marked directly on the heads of the supplemental keys b^6 . The stems of the supplemental keys b^6 are provided at their lower ends with laterally-projecting lugs b^7 , which work between the split portions of the stems of the keys b to prevent the supplemental keys from turning, which engage the lower flanges of the channel-bar b^7 to limit the upward movement of both sections of the key, and which, further, afford extended surfaces for engagement with the forwardly-projecting ends of the numeral-key levers 7. The object of thus having a key within a key or, in other words, a key formed in two sections is to afford simple and efficient means for operating the adding mechanism without operating the type-bars—as, for instance, when performing multiplications, at which time it is not desirable to print all of the figures entering into the calculation, it being sufficient to print the multiplicand, the multiplier, and the product.

Loose stub-racks b^8 are positioned vertically, one just below each adding-key b , (see Figs. 2, 16, 36, and 38,) the said racks being mounted to work through seats b^9 , Fig. 29, formed in a forwardly-projecting flange of a rectangular frame b^{10} , Figs. 1, 2, 15, and 16, which frame is rigidly secured to and extends transversely across the upper central portion of the case 2. The stub-racks b^8 are for convenience in assembling the parts made separate from the keys b ; but so far as their principal function is concerned they might be rigidly secured to or formed as parts of the keys b .

The nine parallel so-called “units-bars” b^{11} are located within the rectangular frame b^{10} and extend transversely of the machine, being spaced apart from front to rear of the machine distances which represent units of movement of the numeral-wheels of the registers. (Here direct attention to Figs. 2, 5, and 15 to 19, inclusive.)

Journaled in the front and rear bars of the rectangular frame b^{10} is a series of nine shafts b^{12} , having at their forward ends gears b^{13} , (shown as segmental in form,) which gears mesh one with each of the stub-racks b^8 of the nine adding-keys b . These racks, it should be here noted, are further guided and held in mesh with said gears by headed guide-pins b^{14} , projecting from the frame b^{10} . On the forward ends of the shafts b^{12} are torsional springs b^{15} for returning said shafts, and the adding-keys connected thereto, to their normal positions after said keys have been depressed and released by the finger.

The units-bars b^{11} , just above noted, are supported from the rectangular frame b^{10} by bell-cranks b^{16} , mounted on transverse fixed rods b^{17} , also supported by said frame b^{10} . The upper arms of the bell-cranks b^{16} are

connected by tie-bars b^{18} , which extend one over each units-bar b^{11} , as best shown in Figs. 15, 17, and 18. With these supports when one of the tie-bars b^{18} is moved toward the left with respect to Figs. 17 and 18 the corresponding connecting units-bar b^{11} will be forced downward, and to accomplish such movement by the depression of the adding-keys b the following provisions are made: Each tie-bar b^{18} carries a spring-pressed pawl b^{19} , which is normally held against a stop-pin b^{20} with its free end in position to be engaged by a tappet-lug b^{21} on the corresponding rock-shaft b^{12} . By reference to Figs. 15 and 17 it will be noted that the said pawls b^{19} are located at different points on their respective bars b^{18} , so that they are brought into the proper positions with respect to the corresponding rock-shafts b^{12} . With this construction when one of the numeral-keys is depressed and the corresponding shaft b^{12} is rocked its tappet-lug b^{21} will engage the co-operating pawl b^{19} , force the corresponding tie-bar b^{18} toward the left, depress the corresponding connected units-bar b^{11} , and then pass beyond the said pawl, thus permitting said two bars b^{11} and b^{18} to be immediately returned to normal positions under the action of a spring b^{22} , which, as shown, is attached to said bar b^{18} and to a bar b^{23} , secured on the frame b^{10} . (See Figs. 1, 15, 17, and 18.) When the depressed numeral-key and corresponding rock-shaft b^{12} are subsequently returned to normal position under the action of the spring b^{15} , the pawl b^{19} will yield to permit the tappet-lug b^{21} to pass to its normal position. Furthermore, the timing of the action just above described is such that the units-bar b^{11} will receive its complete downward and operative movement and be permitted to again rise before the type-bar of the type-writer makes its imprint on the paper. This makes it impossible to print the figures on the paper through the depression of one of the adding-keys without first setting certain of the units-pins, as will presently more fully appear. The above action also prevents accidental conflict between the units-bars and other parts to be hereinafter described.

Decimal-bars, preliminary representation or units-pins, operating-carriage, and associated parts.—Extending from front to rear of the machine, below the so-called “units-bars” b^{11} , and hence at a right angle to the latter, are the independently-movable so-called “decimal-bars” c , of which there are, as shown, nine for each register—to wit, one for each adding-wheel of each register except for the register-wheel of the highest numerical order. The number of these bars c represent the number of columns of figures which may be added together. Otherwise stated, from the right toward the left they stand, successively, for the units, tens, hundreds columns,

and so on, and hence these so-called "decimal-bars" might have been designated as the "column-bars." Attention is here directed to Figs. 1, 2, 5, 20 to 25, inclusive, and Fig. 42. At their forward ends the decimal-bars c have toothed portions c' , which mesh with the gears a^3 of the respective adding-wheels a and are notched at c^2 for engagement with a fulcrum-rod c^3 of the traveling carriage c^4 , which carriage has wheels c^5 , which run over tracks c^6 on the bottom of the case 2, said carriage being thus mounted for movements from front to rear of the machine. At their forward portions the column-bars c rest on a supporting-bar c^7 , that is supported by the case 2 and is provided with vertical projections that space apart the said bars. At their rear portions said decimal-bars c rest upon the lower of a pair of transverse bars c^8 , which bars are supported by the case 2 and are provided with vertical portions which space apart the rear ends of said bars. Those portions of the bars c which normally stand rearward of the bars c^8 are of such vertical dimensions that when the said bars are drawn forward they are held against vertical movements by the bar c^8 . Normally, however, the rear portions of said decimal-bars may be raised slightly, as indicated by dotted lines in Fig. 2, for a purpose which will hereinafter appear. At their extreme rear ends the said bars c are provided with undercut shoulders c^9 for a purpose which will also hereinafter appear. Each decimal-bar c carries a series of nine vertically-movable units-pins c^{10} , mounted in laterally-turned flanges c^{11} of the said bars and frictionally held in whichever position they may be set by light springs c^{12} , interposed between the same. (See Figs. 20 to 25, inclusive.) When the decimal-bars c stand in normal position, the units-pins thereof stand under their respective units-bars b^{11} , but lie below the same such distance that the depression of any of the units-bars will not engage the respective units-pins unless the rear portion of a decimal-bar has been raised, as indicated by dotted lines in Fig. 2, in which case, however, the depression of any units-bar will force downward or set the corresponding units-pin which lies directly under the same. A transversely-extended push-bar c^{13} rigidly connects the side bars of the carriage c^4 and normally stands just rearward of the rearmost units-pin c^{10} , with its upper portion at such elevation that when the carriage is moved forward it will clear the lower ends of such of the units-pins as have not been forced downward or "set." (See Figs. 2 and 5.) On the outer surface of one side bar of the carriage c^4 is a horizontally-extended rack c^{14} , Fig. 7, and on the outer side of the other side bar of the carriage is a similar but longer rack-bar c^{15} , Fig. 6, which latter rack-bar meshes with the intermediate gear a^{25} , which

gear, as heretofore described, meshes with the pinion a^{22} on the common carrying-shaft a^{20} of the several registers. The said two rack-bars also mesh with pinions c^{16} on a transverse shaft c^{17} , which shaft is journaled in the case 2 and receives motion to reciprocate the carriage c^4 from a hand-lever hereinafter described. Such of the units-pins c^{10} of the decimal-bars c as have been pressed downward or set in one operation must be restored to normal position before starting a new line. This I accomplish as follows, (see Figs. 2, 6, and 40:) A transversely-extended pin-resetting blade c^{18} extends below the decimal-bars c and is pivotally supported by one side of the case 2 and by a fixed bracket 18^a . (See Fig. 1.) Near one end said pivoted blade is provided with a depending lug c^{19} , which stands in the path of movement of a spring-pressed actuating-pawl c^{20} , carried by one side of the traveling carriage c^4 and limited in its upward movement by a stop c^{21} . Each time the carriage c^4 moves forward the pawl c^{20} yields in passing under the lug c^{19} and then springs upward in front of the same, so that under the initial return movement of said carriage it will act upon said lug c^{19} and force the free edge of the restoring-blade upward against such of the units-pins as have been depressed, it being understood, of course, that all the depressed units-pins will by the action of the driving-bar c^{13} have been aligned or gathered in a straight row immediately above the said restoring-blade under the extreme forward movement of the said carriage and at this time have done their work.

Decimal-order selector or rotary tappet-drum and associated devices.—This group of mechanism comprises a selector, advisably in the form of a rotary drum having spirally-arranged tappets, connections between said drum and the motor-spring of the type-writer, whereby it is operated therefrom, and lifting and tripping devices whereby under the action of the said tappet-drum or selector the decimal-bars c are raised into positions to present their units-pins to any depressed units-bar one at a time from the left toward the right—to wit, in the order of succession in which the figures are struck on the numeral-keys and are printed on the paper in the type-writer. The spring-driven gear 20 (see Figs. 6 and 10) meshes with a sliding pinion f , carried by the upper end of a shaft f' , which shaft at its upper end is journaled in a projection f^2 of a bearing-bracket f^3 , rigidly secured on the rear portion of the type-writer frame 1, the lower end of said shaft being mounted in a bearing f^4 , secured to and within the case 2. (See also Fig. 2.) The bracket f^3 supports a pivoted shipper-lever f^5 , the pronged end of which engages a groove in the hub of the sliding pinion f and the other end of which carries a spring-pressed lock-pin f^6 , (see Fig. 12,) which

which is adapted to engage with either of a pair of perforations f^7 on the bracket f^3 . (See Fig. 10.) By means of this shipper-lever the pinion f can be slid in and out of mesh with the bevel-gear 20 for connecting or disconnecting at will the shaft f' for movements with the type-writer carriage, according to whether the type-writer and calculating-machine are to be operated in connection with or independently of each other, and also, as will hereinafter appear, for the purpose of changing the position of the type-writer carriage and selecting mechanism relatively to each other. As a means for causing the pinion f to rotate with the shaft f' , but permitting it to slide thereon, said shaft is shown as provided with a collar f^{18} , having perforations through which work parallel pins f^9 , carried by a collar f^{10} of the said pinion f . (See Figs. 2 and 10.) The shipper-lever f^5 is provided with a lock-flange f^{11} , which when the pinion is shifted out of mesh with the gear 20 enters a space between the teeth of said pinion and holds it in position to register exactly with the teeth of said wheel 20 when they are again connected, thus preventing jamming of the teeth and the improper connection of the gear and pinion with respect to relative positions. The said gear 20, it will be understood, is held for proper registration with the said pinion by the rack-bar and spring of the type-writer carriage mechanism. Inasmuch as the type-writer carriage can be changed to any desired position relative to the calculating mechanism, it is obvious that in making calculations the exact position of the figures on the paper in the type-writer depends on the relative position of the type-writer carriage and calculating mechanism, and by properly "timing" the type-writer carriage with respect to the selecting mechanism the groups of columns of figures may be located on the paper wherever desired, and the scale and indicator of the type-writer can be used to determine the relative position of the typewriter-carriage with respect to the selecting or actuating mechanism of the calculating-machine or attachment.

The arrangement of the selector or tappet-drum is best shown in Figs. 1, 2, 3, 6, and 10, by reference to which it will be seen that the drum-body f^{12} is secured on a transversely-extended shaft f^{13} , which is mounted to rotate in and slide through the sides of the case 2 and is provided at one projecting end with a wide-faced pinion f^{14} and a knurled head or finger-piece f^{15} . At its other end, inside of the case 2, said shaft f^{13} is provided with a collar f^{16} , having three grooves, any one of which grooves are adapted to be engaged by a spring-held detent f^{17} . The shaft of this detent f^{17} is journaled in a sleeve f^{18} on one side of the case 2 and is provided at its outer end with the finger-piece f^{19} , which when depressed raises the said detent out of engage-

ment with the groove-collar f^{16} . The said detent is normally yieldingly drawn against a stop f^{20} , which projects from the bottom of the case 2 and prevents the said detent from being drawn, by its spring, into frictional engagement with said collar f^{16} . At its lower end the shaft f' carries a bevel-pinion f^{21} , that meshes with an annular bevel-gear f^{22} , which is loosely mounted on the intermediate portion of the drum f^{12} and is held against sliding movements by a keeper-bracket f^{23} , secured to the bottom of the case 2 and engaging a groove in the hub of said gear. To cause the gear f^{22} and drum f^{12} to rotate together, but to permit the latter to slide through the former, said gear is provided with projecting pins f^{24} , that work loosely through perforations of a collar f^{25} , that is rigidly secured on the said drum.

The tappet-drum f^{12} is equipped with two double sets of tappets $F F'$, one double set for each set of calculating devices or registers and actuating mechanisms, and with the bevel-gear f^{22} conveniently located between the two double sets of tappets. The number of tappets $F F'$ is of course determined by the number of adding-wheels, there being one more of each than the number of adding-wheels in each register, so that consequently in the present instance eleven tappets F and eleven tappets F' are employed in each set. These tappets are arranged in spiral succession. The tappets F are spaced apart longitudinally with respect to the so-called "decimal-bars" c , and the tappets F' are set intermediate of the tappets F longitudinally of the drum, but are at intervals offset out of a true spiral line, this arrangement of the said tappets being clearly illustrated in the diagram view Fig. 48, in which the drum is shown as if laid out flat. This diagram view will further serve to illustrate the fact that the so-called "decimal-order selector" is not limited to a drum-like or rotary form, but, on the contrary, that the tappets are capable of any arrangement wherein they are brought into the relation indicated in the said diagram view or in other arrangements within the broad principle involved. Furthermore, the so-called "tappets" themselves may take various forms. The arrangement and function of these tappets $F F'$ will more clearly appear in the description of the operation.

Above the rear ends of the column-bars c is a transverse rod f^{26} , supported by the case 2, and on which is pivoted a series of latch-hooks f^{27} , Figs. 1, 2, 6, 10, 34, and 35, each of which hooks is bent laterally to form a shoulder f^{28} , and is further provided with a forwardly-extended stop-arm f^{29} . A spring f^{30} yieldingly holds the arm f^{29} against a fixed stop f^{31} , that limits the movement of the said hook in a forward direction. There is one of these so-called "hooks" f^{27} for each decimal-bar c , and the said hooks are so disposed with

respect thereto that any one of the said decimal-bars being in normal or rearmost position, and being slightly raised at its rear end, its shoulder c^9 will be engaged by the shoulder f^{28} of the corresponding hook and temporarily hold said bar upward, as indicated by dotted lines in Fig. 2, in which position, it will be remembered, the units-pins of the lifted bar will be so elevated that they may be engaged and set by the corresponding units-bars b^{11} which may be depressed.

Just below the rear ends of the decimal-bars c is a vertically-disposed oscillating frame f^{32} , which, as shown, is made up of a pair of end supports and a pair of transversely extended rods, the lower member of which rods pivotally connects the said oscillating frame to the sides of the case 2, as best shown in Figs. 1, 2, 4, and 6. This oscillating frame is normally held in position by latch-levers f^{33} , pivoted on a transverse rod f^{34} , supported by the sides of the case 2 and connected by springs f^{35} to the upper side portions of the oscillating frame f^{32} , as best shown in Fig. 4. The rear ends of latch-levers f^{33} are provided with upper and lower notches f^{36} , that cooperate with pins f^{37} , projecting from the end supports of the oscillating frame f^{32} . Rollers f^{38} on the sides of the carriage c^4 act upon the free ends of the latch-levers f^{33} in a manner which will presently be described. Pivoted on the upper rod of the oscillating frame f^{32} is a series of lifting-levers f^{39} , equal in number to the number of adding-wheels. Each lifting-lever f^{39} has a rearwardly-projecting tappet-arm f^{40} , normally located in the path of the cooperating tappet on the tappet-drum and adapted to be engaged thereby to depress said arm, lift said lever f^{39} , and raise the rear end of the corresponding decimal-bar c . Again, each lifting-arm f^{39} has a tripping-arm f^{41} , which at the proper time engages one of the hooks f^{27} and causes the latter to release and let fall the decimal-bar of next higher order which was just previously lifted. The transverse rod f^{34} , already described, serves as a rest for the several lifting-levers f^{39} . Each decimal-bar c has its own lifting-lever f^{39} and latch-hook f^{27} , and, as shown in Fig. 1, there is one extra lever f^{39} for tripping and letting fall the bar c of the lowest order. By reference to Fig. 34 and the other views just noted it will be seen that the free end of the lifting-arm f^{39} is turned laterally, so that it will stand directly under the corresponding decimal-bar c , and that the free end of the vertically-extended tripping-arm f^{41} is bent laterally, but in a reverse direction, so that it will engage the laterally-offset depending end f^{28} of the hook f^{27} of next higher order. (See Figs. 6 and 10.)

It will now be understood that when one of the tappets F of the rotary tappet-drum engages the tappet-arm f^{40} of the lifting-arm

f^{39} , which stands farthest toward the left, with respect to Fig. 1, it will move said lifting-lever into the position indicated by dotted lines in Fig. 2 and cause said lever to raise the decimal-bar c of the highest numerical order into a position where it will be caught and temporarily held by its cooperating hook f^{27} . Now when the second lifting-lever from the left is by the next tappet-pin acted upon as just described and caused to lift the second decimal-bar in the manner just described such movement of the said second lifting-lever will cause its tripping-arm f^{41} to operate on the hook f^{27} of higher order and cause the same to raise and drop the decimal-bar of next higher order, which latter bar was just previously lifted and caught by its hook f^{27} . Under the above action of the tappets of the "selector" or tappet-drum it is obvious that the decimal-bars from the left toward the right will in succession be raised and dropped again, and it should be remembered that the timing of the movements of the said tappet-drum, under the action of the motor-spring of the type-writer, is such that the column-bars will be in a raised position at a time when one of the units-bars b^{11} is depressed by the action of an adding-key. When the carriage c^4 moves forward, its rollers f^{38} , Figs. 4 and 6, acting on the forward ends of the latch-levers f^{33} , force downward the rear ends of said levers, so that the springs f^{35} may rock the oscillating frame f^{32} forward and carry the pins f^{37} thereof into the upper notches f^{36} of the said levers. When the frame f^{32} is thus rocked forward, the tappet-arms f^{40} of the lifting-levers f^{39} are carried forward out of the arc of movement of the tappets F of the tappet-drum, so that the said tappet-drum may, without interference, be rotated back to normal position, when the type-writer carriage is moved from the left toward the right, which movement of said type-writer carriage may be imparted by a hand-lever presently to be described. When the operating-carriage c^4 is returned to its normal position, the rear ends of its side bars strike the end supports of the oscillating frame f^{32} and force the same back to its normal position, whereupon the said frame is again locked in position by the latch-lever f^{33} , the lower notches f^{36} of which again engage with the pins f^{37} of said frame.

Hand-lever and connections.—A hand-lever g is secured to the outer end of a short shaft g' , journaled in a sleeve g^2 , secured to and projecting from the adjacent side of the case 2. At its inner end the shaft g' is provided with a segmental gear g^3 , that meshes with a pinion g^4 on the shaft c^{17} , as before described. (For the above construction see particularly Figs. 1, 7, 8, and 9.) When the hand-lever g is given a complete oscillation from its rearmost to its most forward position, motion will be transmitted through the segmental

gears g^3 , the shaft c^{17} , and the gear carried thereby, and the operating-carriage c^4 will be moved into an extreme forward position, under which movement, as already stated, the driving-bar c^{13} , acting on the depressed units-pins c^{10} , will drive the decimal-bars c forward and impart movements to the adding-wheels, dependent upon which of the units-pins have been depressed. As is further evident, under such movements of the driving-carriage, if no units-pin of any particular decimal-bar c is depressed such bar will be left standing in its normal position.

Tabulating mechanism.—Mounted on the fixed sleeve g^2 , in which the shaft g' is mounted, Figs. 1, 7, 8, and 9, is a sleeve k , to which is secured a segmental plate k' , on the outer face of which are pivoted several hand-lever-intercepting stops k^2 . These intercepting-stops k^2 are set in operative positions by turning them against stop-pins k^3 on the plate k' . At its free end the hand-lever g has a rectangular head k^4 and a notched spacing-bar k^5 , and to this head is pivoted a plurality of finger-actuated stop-keys k^6 , that are normally held in operative positions by light spring k^7 , attached to the depending portions thereof, and to a rod carried by said head k^4 , as best shown in Fig. 14. If one of the pivoted stops k^2 on the plate k' be turned into an operative position and one of the stop-keys k^6 depressed and the hand-lever g then thrown forward, the said stop k^2 and key k^6 will be thrown into engagement; but otherwise the said parts would not be brought into contact with each other. Mounted on the sleeve k is an outer and shorter sleeve k^8 , to which is secured a notched latch-segment k^9 and a segmental gear k^{10} . On the plate k' is a spring-pressed lock-pawl k^{11} , which may be engaged with any one of the several notches of the segment k^9 . By the means just described the segmental gear k^{10} is locked, so that it must move with the plate k' when the latter is moved, as above described, by the hand-lever g ; but the relative positions of the said gear k^{10} and plate k' may be changed at will by shifting the latch-segment k^9 so that the pawl k^{11} engages with other of the notches thereof. Thus a longer or shorter movement of the type-writer carriage and tappet-drum may be accomplished under a predetermined full movement of the hand-lever g , such movements being transmitted to said rotary tappet-drum and from thence to the type-writer carriage by means of connections already described and through a pair of intermeshing intermediate gears k^{12} , one of which meshes with the segmental gear k^{10} , and the other of which meshes with the wide-faced pinion f^{14} on the shaft f^{13} of the said tappet-drum. (See particularly Fig. 7.) The drawings show but six stop-keys k^6 , carried by the hand-lever g , which is as many as will be required for general purposes; but this

number may of course be increased or decreased at will.

I have shown five intercepting-stops k^2 on the segmental plate k' . The ordinary type-writer writes or prints seventy characters to the line, and for ordinary tabulating-work I have allowed fourteen spaces for each separate division of columns. Each of the stops k^2 represents one-fifth of the full move of the type-writer carriage, and hence if the first stop nearest to the hand-lever g is set in an operative position it will cause the plate k' to move the longest distance, and hence move the type-writer carriage the full length of its possible movement. If the next stop instead of the first is turned into an operative position and the lever g is given its forward movement, the said plate k' is given a one-fifth less movement, and so on to the last stop, and the type-writer carriage will of course be given movements corresponding to the movements of the said plate k' .

From the above it will be seen that the stops k^2 regulate the throw of the type-writer carriage and rotary tappet-drum as to any one of five divisions of columns, while the tabulating-keys k^6 regulate the throw thereof as to the particular column in any one of the five subdivisions to which it is desired to set the type-writer carriage. The device also permits of being used like an ordinary tabulating attachment—that is, the carriage may be returned the full distance or past any given point and the lever g remaining in its normal position and one of its tabulating-keys k^6 being depressed the latter will intercept the set-tabulating stop on the plate k' , which is moved rearward and toward it when the escapement of the type-writer is released. It may therefore be called a “double-acting tabulating device,” since it is at all times ready for action in either direction.

One object of the notched sector k^9 is to economize space. The segmental plate k' must have such radius as to afford sufficient distances between the stops k^2 to permit the keys k^6 being spaced apart sufficiently to enable them to be made strong enough for practical use, and the said plate k' being fulcrumed is limited in its movement unless the machine be raised higher, which is not deemed desirable.

Error-correcting devices.—For correcting errors I provide key-levers m , Figs. 1, 2, and 16, of which, as shown, there is one for each decimal-bar c . These levers m at their intermediate portions are pivoted on a transverse rod m' , supported by the case 2, and their free rear ends stand directly under the series of units-pins c^{10} of the corresponding decimal-bar. The forward ends of said levers m are shown as guided by a spacing-comb m^2 on the front portion of the case 2. The stems of keys m^3 work through the forward portion of the upper plate of the case 2 and are attached

one to each of the key-levers m . If a wrong units-pin should be set by mistake and the error discovered before the hand-lever g is operated, such pin can be restored to its normal position by depressing the proper key n^2 whose lever m stands below such pin set by mistake. These error-correcting devices may take various forms.

To prevent the decimal-bars c from being forced upward when one of its units-pins is restored to normal position by one of the correcting-levers m , I have provided a pivoted blade m^4 , which extends transversely across the case 2, being supported from the sides thereof just over the intermediate portions of the said decimal-bars. (Best shown in Figs. 1 and 2.) The shaft or one of the trunnions of the said blade m^4 projects, as shown, by the left-hand side of the case 2 and is provided with a finger-lever m^5 , Fig. 5, which when depressed forces the said blade m^4 down against the said decimal-bars, as shown by dotted lines in Fig. 2, against the action of a torsional spring m^6 , Fig. 1, connected at one end to the case 2 and at its other end to the shaft of said blade m^4 .

Zero devices.—For each set of numeral-wheels—that is, for each register—I provide a toothed bar or rack p , herein termed the “zero-bar,” which is mounted to slide from front to rear of the machine through the front portion of the case 2, and, as shown, is further guided by projections m^7 of the comb m^2 , Fig. 16, and by the heretofore-described guides c^8 , Figs. 6 and 7. At its forwardly-projecting end, outside of the case 2, the zero-bar is provided with a head p' , and at its intermediate portion it is provided with teeth p^2 , that mesh with a pinion p^3 on the shaft a' , on which are mounted the adding-wheels a of the corresponding register. When the zero-bar p is pulled forward to its extreme position, the pinion p^3 and the shaft a' will be given one complete rotation, and under this movement, as is evident, the shoulder a^9 of said shaft will encounter all of the pawls a^8 of the several adding-wheels and move the said adding-wheels again to normal positions in the direction indicated by the arrow marked on Fig. 2, thus picking up, as it were, the said adding-wheels and bringing them to such positions that their zero-marks will be exposed to view through the sight-opening 23. When the adding-wheels are thus restored to zero positions, their single peripheral teeth a^{19} will engage certain of the teeth of the six-toothed carrying-wheel a^{15} , Fig. 42, and hence will move the composite carrying-wheels out of their proper normal positions. As a simple and efficient device for thereafter restoring these complete carrying-wheels to proper normal positions I provide a rock-shaft p^4 , which is journaled in one side of the frame 2 and in the bracket a^2 and extends transversely of said frame and is provided

with tappet-arms p^5 , one for each composite carrying-wheel, and is further provided, as shown, at its left-hand end, with a depressible finger-lever p^6 . A torsional spring p^7 yieldingly holds the lever p^6 upward and the tappets p^5 in inoperative positions, Figs. 1, 2, 5, 6, and 16. The tappets p^5 are so disposed that when the finger-lever p^6 is depressed they will engage certain of the teeth of the three-toothed carrying-wheels a^{16} and rotate the composite carrying-wheels simultaneously to their normal positions. The shaft p^4 further serves as a stop for positively limiting the rearward movements of the decimal-bars c when the latter are moved back to normal positions by the engagement therewith of the carriage-rod c^3 under the rearward movement of the operating-carriage c^4 , Fig. 2.

Multiplication devices.—As multiplication is, in substance, continued addition of the multiplicand as many times as is denoted by the multiplier, such calculation may be performed by the proper number of movements of the hand-lever g and operating-carriage c^4 . For example, suppose “5,674” is to be multiplied by “124.” In this case the hand-lever g is operated four times for the units order of the multiplier, two times for the tens order, and once for the hundreds order, as will be more fully explained under the heading “Operation.” To make the decimal-bars c operate the proper number of times under the action of the hand-lever, the pin-lifting blade c^{18} is rendered inoperative, while the proper number of movements of the operating-carriage are given, and is then automatically rendered operative to restore to normal positions the set units-pins, so that further movement of the hand-lever and operating-carriage, should such be given, will be without effect. For the above purpose, Figs. 1, 2, 5, 6, and 40, a short shaft t is journaled in a bearing t' to the left-hand side of the case 2, parallel with the pin-lifting blade c^{18} , and a little rearward of the same. Secured to the inner end of said shaft t is a ratchet-wheel t^2 , which stands in the plane of movement of the pawl c^{20} , which is carried by the operating-carriage c^4 . The said shaft t has further secured to it a star-wheel t^3 , a cam-disk t^4 , a numeral or index wheel t^5 , and a thumb-knob t^6 . The index-disk t^5 is marked with the numerals “0” to “9,” inclusive. A spring-pressed retaining-pawl t^7 , pivoted to the case 2, coöperates with the star-wheel t^3 to yieldingly hold the shaft t and parts carried thereby in whatever position they may be set, said star-wheel, as will be understood, having ten notches, corresponding in position to the location of the numerals on the index-wheel t^5 . The cam-disk t^4 has a notch t^8 , in which engages the free end of a tappet t^9 on the projecting shaft or trunnion of the pin-lifting blade c^{18} . Normally the said tappet t^9 finds clearance within the said notch t^8 , so that the lifting-blade c^{18} will be

operated by the pawl c^{20} in the manner already described when simple addition is performed. Furthermore, a spring t^{19} , secured to the case 2 and reacting against the stop t^{11} , yieldingly holds said blade c^{18} in an operative position. (Shown in Fig. 2 and elsewhere.) When the ratchet-wheel t^2 is in normal position, (shown in Fig. 6,) the pawl c^{20} will clear the said ratchet-wheel because the said ratchet-wheel has a blank-tooth space, which at such time affords clearance for the said pawl, so that it may operate upon the tappet c^{19} of the lifting-blade c^{18} , as already described. When, however, the ratchet-wheel t^2 is turned to any one of its several other positions by the knob t^8 , to set the device in the required position for multiplication the pin-restoring blade c^{18} is held in an inoperative position by the action of the cam-disk t^4 on the tappet t^9 , the latter being then forced into the position indicated by dotted lines in Fig. 5 and by full lines in Fig. 45, and at such times the lifting-blade c^{18} and its tappet c^{19} are turned, as shown by dotted lines in Fig. 2, so that the driving-dog c^{20} will then pass clear of the said tappet c^{19} . When the ratchet-wheel t^2 is set as above described—say, for instance, at “5,” as indicated on the indicator-wheel t^5 —each forward movement of the operating-carriage c^4 will cause the driving-pawl c^{20} to engage a tooth of the ratchet-wheel t^2 and move the same one step for each such movement of the carriage. Five forward movements of the said operating-carriage c^4 will thus bring the ratchet-wheel t^2 and cam-disk t^4 back to their normal positions, so that under the fifth return movement of the said carriage the pawl c^{20} will again operate on the tappet c^{19} and cause the resetting-blades c^{18} to reset the depressed units-pins. If now any subsequent movement—that is, a sixth movement—be given to the operating-carriage, it will not move forward the decimal-bars c , and hence such movement of the said carriage will have no effect whatever on the registers. It will thus be seen that after the multiplying device has been set at the proper position, as indicated by the graduated disk t^5 , the action becomes automatic, and all the operator has to do is to pull the hand-lever g until the indicating-disk t^5 shows that it has been returned to normal position. As before stated, this result will not be affected if the hand-lever happens to be pulled more times than is necessary.

Operation.—The actions of the various groups of mechanisms and their relation to each other has already been described; but to make clear the use of the machine in performing computations, both in addition and in multiplication, the following concrete illustrations are given.

Addition: First, disconnect the type-writer and calculating mechanism by shifting the sliding pinion f out of mesh with the driving-

gear 20 and then set the type-writer carriage in such position that the figures will be printed in the desired space on the paper in the type-writer. Then connect the type-writer and calculating mechanism by sliding the said pinion f again into mesh with the said gear 20. By reference to the diagram view Fig. 48 it will be noted that the tappets F , which operate to produce “bunched” or “solid” work, are located in a continuous or unbroken diagonal row, while the tappets F' , which produce so-called “punctuated work,” are located in a broken or staggered row, with the subdivisions of said row successively offset in a given direction—to wit, circumferentially of the drum—but with the said tappets evenly spaced in a direction longitudinally of the drum, so that double spaces F^2 are left between each group of the said tappets F' . In virtue of this arrangement of the said tappets the tappet-drum is permitted to make one step of rotary movement at each space F^2 without action on the calculating mechanism, such movements taking place when a punctuation-mark, such as a comma or period, is struck on the type-writer. For example, if the figures to be added are to be printed so as to denote dollars and cents, the tappet-drum is located in proper position by setting the detent f^{17} in the middle groove of the collar f^{16} of the tappet-drum f^{12} , as shown in Figs. 1 and 10. In such position the tappets F' will engage the lifting-levers and cause them to raise the corresponding decimal-bars and unit-pins. If the line to be added is “\$1,234,567.89,” the position of the rotary selector must be such that the advance tappet F' has passed the tappet f^{40} of the lifter-lever f^{39} of highest order and lifted up the first decimal-bar c to the left, or the one that represents the million dollars denominational order, while the adding-key bearing the numeral “1” is depressed to print the numeral “1” on the type-writer and throw down the corresponding units-bar b^{11} . As soon as the adding-key is released the escape-ment of the type-writer acts, the type-writer carriage moves one step to the position for the next imprint, and the tappet-drum moves one step and brings the first double space F^2 opposite the tappet of the lifting-lever of next lower order, this having no action on the decimal-bar lifting and tripping devices, the previously-lifted decimal-bar simply being held in suspension while the punctuation-mark or comma is printed by the type-writer. The next movement of the type-writer carriage and tappet-drum, however, brings the second tappet F into engagement with the tappet-arm of the lifting-lever second from the left, or the one representing the hundred thousands of dollars denominational order, and raises the corresponding decimal-bar c while the numeral “2” is being printed on the type-writer and at the same

time tripping down the decimal-bar previously raised. The adding-keys bearing the numerals "3" and "4" are then struck on the keyboard. Then the "comma-key" is struck, and then the adding-keys bearing the numerals "5," "6," and "7" are struck in succession. Then the "period-key" is struck to produce the dollar-and-cent mark, and, finally, the adding-keys bearing the numerals "8" and "9" are struck successively, thereby completing the printing of the sum above noted, as is obvious from the foregoing statements and diagrammatic illustrations given in Fig. 48. It may be here stated that on the upstroke of the last key depressed the tenth tappet F' engages the tappet-arm of the last lifting-lever f^{39} , and the latter acts on the last hook f^{27} and trips down the last or extreme right-hand decimal-bar c . After the first line has been printed, as above described, the lever g is thrown forward, thereby throwing forward the operating-carriage and decimal-bars and causing the latter to move the numeral-wheels of the register in a manner already fully described. The units-pins, as already clearly described, are restored to normal positions under the initial return movement of the operating-carriage. If a tabulating-key k^6 was used with a view of setting the type-writer carriage and rotary selector or tappet-drum in position for the next line, we assume that both are in correct positions therefor, having been brought to such positions by means of the segmental gear k^{10} , intermediate gears k^{12} , pinion f^{14} , and oscillating plate k' , Fig. 7. Let it be assumed that the next line to be added and printed is "87,657.70." The impression-roller of the type-writer is of course first turned for spacing between the lines, and then the figures and punctuation-marks are printed from the adding-keys and character-keys, respectively, the same as the first line and in the same manner as ordinary tabulated work is done on the type-writer, the figures of each decimal or denominational order and the punctuation-marks being of course located in corresponding vertical columns. There is no adding-key bearing the numeral "0," for the reason that the ordinary character-key of the type-writer will serve the purpose of the "zero-key." If "0" or "zero" occurs in the calculation and it is not desired to print the same, the spacing-bar of the type-writer is used to cause the movement of the mechanism for positioning the various parts instead of the key bearing the numeral "0." After the second line has been printed the hand-lever is of course operated as before, and the carrying of the tens from the numeral-wheels of the register of lower order onto those of higher order will be effected in a manner already clearly described under the heading "Register, including carrying mechanism."

We will now add one more line—to wit,

"9,000,100.00." The type-writer carriage being in proper position, the numeral "9" is printed right under the "1" of the first line by striking the proper numeral-key. Then the first comma, the three "0's" or zeros, and the second comma are printed by using the type-writer keys. Under the step-by-step movement of the type-writer carriage and rotary tappet-drum the tappets of the latter act upon the lifting-levers, raise the decimal-bars in the same manner as while printing the first two lines; but as long as none of the adding-keys are operated none of the units-pins will be set, and hence such decimal-bars as have no set pins will not be moved forward under the forward movement of the operating-carriage, and hence will not move their corresponding adding-wheels. The proper adding-key is used for printing "1" in the hundreds-column. Two "0's" are then struck in succession. Then the period is next struck, and then two more "0's" are struck to complete the last line to be added. Then again the hand-lever g is moved forward and again rearward to normal position, after which the total of the three sums added will be visible on the adding-wheels at the sight-opening. If now the total is then printed by the use of the type-writer keys, the adding-wheels of the register will remain in their set positions for a comparison of the total sum printed with the total sum on the adding-wheels. The calculation as printed should then have the following appearance:

\$1,234,567.89

87,657.70

9,000,100.00

\$10,322,325.59

From this illustration it is seen that the adding mechanism can remain connected with the type-writer and the latter be operated exactly as if there was no calculating-machine attached, inasmuch as the operation of the regular type-writer keys, whether numerals or other characters are printed thereby, has no effect on the register of the calculating mechanism.

If the figures are to be printed in three-column divisions—like this, "897,564,862"—the detent f^{17} is raised and the tappet-drum is shifted axially, so that the said detent may be engaged with the inmost groove of the collar f^{16} . The effect of this is to move the tappet-drum to the left the distance of one longitudinal space between tappets F' , thus bringing the first tappet F' out of the range of the tappet-arm of the lifting-lever f^{39} , that stands at the extreme left, and causing the second tappet F' to first come in contact with the tappet-arm of the first lifting-lever. This is followed by the third and fourth tappets F' engaging the second and third lifting-levers, respectively. In this new position of the tappet-drum the

eleventh tappet F' will be in position to release and let fall the last decimal-bar c toward the right. After the type-writer carriage has been set in proper position press the adding-keys
 5 corresponding to the figures to be added, but use the ordinary keys of the type-writer for punctuation-marks, as in the first example. For calculations with figures printed as solid matter—like this, “453786”—the tappet-
 10 drum must be shifted to another position, so that the detent f^{17} will engage the outermost groove in the collar f^{16} . In this position of the tappet-drum the tappets F will be brought into position on the tappet-arms f^{40}
 15 of the lifting-levers f^{39} , and the action will be substantially as before described, except that no punctuation-marks will be struck.

The above explanations have been given with reference to but one set of calculating
 20 apparatus. With two or more sets of such devices in use the operation may or may not be the same, depending on the character of the work performed. The tappets on the several rotary drums may have their sets of
 25 tappets arranged differently, and such tappet-drum may be made in sections, with each section capable of being set in a different relative position, so that, if required, the figures can be printed in different forms by the use
 30 of different sections, and the multiplication may be performed with the one set and addition with the other. Such work is frequently required in printing bills and invoices involving both addition and multiplication.

35 Multiplication: The operation performed in multiplication has already been indicated in a general way, the same being, as before stated in substance, an addition of the multiplicand as many times as indicated by the
 40 multiplier. To more fully illustrate the use of the machine for performing multiplication, the operation of multiplying “49768” by “1083” will be followed through. First, the figures “49768” of the multiplicand are set up as in addition. Then by means of the
 45 knob t^6 , Figs. 1, 5, and 40, the ratchet-wheel t^2 and cam-disk t^4 are turned until the index-wheel t^5 is set at 3, representing the units order of the multiplier, Fig. 45. Then pull the
 50 hand-lever 3 three times and the product “149304” will appear on the adding-wheels. Then again set up the figures “49768,” but one space to the left, so that the units order will be in the tens order of the first operation,
 55 and then set the indicator-disk t^5 so that the figure “8” (the tens order of the multiplier) appears, and then operate the hand-lever g eight times. Under this action the product “3981440” (which is eighty times “49768”)
 60 will be accumulated on the adding-wheels in addition to the product of the first operation, making the total product of the two operations appear on the numeral or adding wheels, said total being “4130744.” The
 65 next order of the multiplier is the hundreds,

in which a “0” appears. Consequently there is nothing by which to multiply, and we therefore pass it by. The next and last order of the multiplier is the thousands, and hence the multiplicand is again set up, this
 70 time two spaces or decimal orders to the left from the last previous operation, including the one space for the hundreds order of the multiplier, which was passed, and one space for the thousands order, so that the unit “1”
 75 of the multiplicand will be accumulated on the thousands order of the numeral or adding wheels. The multiplier being “1,” it is not necessary to move the indicator-disk from its normal position, for in this operation the
 80 hand-lever when pulled forward and backward will operate the adding mechanism once, which is all that is required. Of course for any higher figure than “1” of the multiplier the pin-lifting or restoring-blade must
 85 be temporarily rendered inoperative by setting the indicating-disk t^5 for the multiplier, as above described. In the last operation the multiplicand “49768” was multiplied by
 90 “1000,” the product being “49768000,” and that sum was accumulated on the numeral-wheels of the register in addition to the previous accumulations, the total product now appearing on the adding-wheels being
 95 “53898744.” By not using the tabulating-keys and coöperating stops the type-writer carriage may be left standing still during the operation of the hand-lever in performing multiplication. If the work performed re-
 100 quires the several products of many multiplications to be added together, the operator prints the product of the multiplication in the column division for addition, the latter being located on the paper in the type-
 105 writer with reference to the operative position of the adding mechanism of the set used for addition, and then pulls the hand-lever, and thereby accumulates the sum on the numeral-wheels of the register, and by using the tabulating-keys the type-writer carriage
 110 may be set by the same movement in position to begin a new line. Before beginning a new line, however, the numeral-wheels must be restored to initial position in that set of the apparatus used for multiplication,
 115 this of course being accomplished by the operation of the corresponding “zero-bar,” as already described.

Multiplication can be performed with either set of tappets F or F' in operative po-
 120 sition; but it is a saving of time and less apt to confuse the operator if the tappets F be used for that purpose.

In multiplication for business purposes all of the figures entering into the calculation
 125 need not be printed on the paper in the type-writer, it being desirable rather to print only the multiplicand, the multiplier, and the product. The construction of the adding-keys b b^6 , as already described, permits this
 130

result to be readily accomplished. To operate the adding mechanism without printing, the operator places his finger on the forwardly-projecting portion of the head of the key-section *b* without touching the head of the supplemental key-sections *b*⁶ and depresses the former key-section without depressing the latter, thereby accomplishing the above result in a manner heretofore clearly set forth.

From the foregoing description and statements made it will be understood that my invention is generic in character, and hence capable of a wide range and modification.

What I claim, and desire to secure by Letters Patent of the United States of America, is as follows:

1. In combination, a register, a preliminary-representation device, key-controlled means for setting said preliminary-representation device, involving a movable denominational-order selector having a plurality of tappets arranged to be brought into action in succession, and means for subsequently bringing the "set" preliminary-representation device into action on said register.

2. In combination, a register, a plurality of decimal-order bars having a differential action on said register, of preliminary-representation pins for each such bar, key-controlled means for setting said units-pins, said means involving a selector having tappets arranged to be brought into action in succession, and means cooperating with the "set" units-pins, for subsequently moving said decimal-order bars, to actuate the register.

3. The combination with printing mechanism having numeral-keys and punctuation-keys, of a register, numeral-key-controlled means for actuating said register, to register the amount printed, said means involving a "decimal-order selector," having tappets arranged to be brought into action in succession, the said tappets being differentially spaced, at intervals, to delay the action of certain of the tappets, when a punctuation-key is struck, whereby punctuated amounts may be printed and the proper amounts accumulated on the register.

4. In combination, a register involving a series of numeral-wheels, decimal-bars actuating said numeral-wheels and having each a series of units-pins, key-controlled means for setting said units-pins, involving a "decimal-order selector" having tappets arranged to be brought into action in succession, from left toward the right, or in the natural order in which the numerals of the amount are to be read.

5. In combination, a register involving a series of numeral-wheels, a decimal-order bar actuating said adding-wheels and having each a series of units-pins or preliminary-representation pins, key-controlled means for setting the said units-pins, to effect a preliminary

representation of an amount to be registered, said means involving "decimal-order selection" having tappets arranged to be brought into action in succession, from left toward the right, and means cooperating with the "set" units-pins, for subsequently rendering said decimal-order bars operative to register the amount on the register.

6. The combination with printing mechanism having numeral-keys and punctuation-keys, of a register, numeral-key-controlled means, for controlling the action of said register, to record the amount printed, said means involving a "decimal-order selector" having a series of tappets arranged to be brought into action in succession, which series of tappets are differentially spaced, at intervals, to delay the action of certain of the tappets, when a punctuation-key is struck, the said decimal-order selector having an adjustment transversely of the line of operative movement, for the purposes set forth.

7. In combination, printing mechanism having numeral-keys and punctuation-keys, a register, numeral-key-controlled means for controlling the action of said register, to record the amount printed, said means involving a "decimal-order selector" having at least two series of tappets, the one series of tappets being uniformly spaced, and the other series of tappets being located out of line with the tappets of the former series, and being differentially spaced, at intervals, to delay the action of certain of said differentially-spaced tappets, when a punctuation-key is struck, and means whereby either of the two series of tappets may be thrown into action, at will.

8. The combination of a rotary tappet-drum, provided with one set of uniformly-spaced spirally-arranged tappets, and an intermediate set of differentially-spaced tappets, said drum being adjustable for placing either set of tappets in operative position, key-controlled step-by-step spring-power, drum-operating mechanism, a series of adding-wheels, means controlled by the keys and said tappet-drum, for determining the setting of said adding-wheels, and manually-operated mechanism for effecting the setting of said adding-wheels.

9. The combination of a register having a plurality of numeral-wheels, a rotary tappet-drum having spirally-spaced tappets, key-controlled, step-by-step spring-power tappet-drum-actuating mechanism, numeral-wheel actuating, tappet-actuated "decimal-order bars" provided with key-set "units-pins," and numeral-printing mechanism, actuated by said key-controlled, spring-power mechanism.

10. The combination of a tappet-drum, having a plurality of spirally-spaced tappets, key-controlled step-by-step spring-power tappet-drum-operating mechanism, a

series of adding-wheels, adding-wheel-actuating, tappet-actuated decimal-bars, provided with key-set "units-pins," and a manually-operated carriage, having a driving-bar for action on the "set" units-pins, for operating the adding-wheels.

11. The combination with a rotary tappet-drum, having a plurality of spirally-spaced tappets, key-controlled step-by-step spring-power tappet-drum-operating mechanism, a series of adding-wheels, a series of tappet-selected decimal-order bars, provided each with a series of units-pins, key-actuated units-pin-setting mechanism, manually-actuated mechanism operating on the "set" units-pins, to operate said adding-wheels, and type-writing mechanism subject to said spring-power mechanism and key mechanism, said type-writing mechanism having keys which operate independently of the adding mechanism.

12. The combination with a tappet-drum, having a plurality of spirally-spaced tappets, of key-controlled step-by-step spring-power tappet-drum-operating mechanism, a series of adding-wheels, a series of tappet-selected decimal-order bars, provided with units-pins, key-actuated units-pin-setting mechanism, and manually-actuated mechanism for setting the adding-wheels, by the said units-pins and decimal-bars, and for returning the latter to their normal positions.

13. The combination of a tappet-drum, having a plurality of spirally-spaced tappets, key-controlled, step-by-step, spring-power tappet-drum-operating mechanism, a series of adding-wheels, means controlled by the keys in said tappet-drum for determining the "setting" of the adding-wheels, type-writing mechanism actuated by said tappet-drum-controlling mechanism, for printing the amount to be set on the adding-wheels, manually-operated mechanism for effecting the "setting" of said adding-wheels, and means whereby said manually-operated mechanism automatically returns the type-writer carriage, and tappet-drum, to predetermined positions.

14. The combination of a tappet-drum, having a plurality of spirally-spaced circumferentially differentiated or offset tappets, key-controlled step-by-step spring-power tappet-drum-operating mechanism, a series of adding-wheels, means controlled by the keys and said tappet-drum, for determining the "setting" of the adding-wheels, type-writing mechanism actuated by said tappet-drum-controlling mechanism, for recording the "setting" of the adding-wheels, and manually-operated mechanism for effecting the "setting" of said adding-wheels, said mechanism involving means whereby the type-writer carriage and tappet-drum are returned to predetermined positions.

15. The combination of a tappet-drum

having a plurality of spirally-spaced and circumferentially-differentiated tappets, key-controlled step-by-step spring-power tappet-drum-operating mechanism, a series of adding-wheels, means controlled by the keys and said tappet-drum, for determining the "setting" of the adding-wheels, type-writing mechanism actuated by the tappet-drum-controlling keys, for recording the "setting" of the adding-wheels, manually-operated mechanism for effecting the "setting" of said wheels, and means whereby said manually-operated mechanism automatically returns the type-writer carriage and tappet-drum to predetermined positions, which predetermined positions of said carriage and drum are relatively variable.

16. The combination of a tappet-drum, having a plurality of spirally-spaced and circumferentially-differentiated tappets, key-controlled step-by-step spring-power tappet-drum-operating mechanism, a series of adding-wheels, means controlled by the keys and said tappet-drum, for determining the "setting" of the adding-wheels, manually-operated mechanism for effecting the "setting" of said wheels, and means whereby said manually-operated mechanism automatically returns the type-writer carriage and tappet-drum to any of several predetermined positions, for divisions of columns and to any column of any division, consisting of a differential coupling between the crank of the manual mechanism and the gear-train of the tappet-drum, and consisting further of differential keys on the said crank.

17. The combination with the crank of the manual apparatus, having a constant predetermined range of movement, of the tappet-drum gear-train having different ranges of movement, and the stop-carrying plate constituting a part of the coupling between said crank and said gear-train, and adjustably connected to the latter.

18. The combination of a type-writer-carriage-operating mechanism, spacing-bars of said mechanism controlling the same, the tappet-drum geared with said operating mechanism, and having a plurality of spirally-spaced tappets, a series of adding-wheels, a series of adding-keys, means controlled by the adding-keys and said tappet-drum, for determining the "setting" of the adding-wheels, and manually-operated mechanism for effecting the "setting" of the adding-wheels.

19. The combination of the type-writer-carriage-operating mechanism, spacing-bar controlling the same, type-writer keys, tappet-drum geared with said carriage-operating mechanism and having a plurality of spirally-spaced tappets, a series of adding-wheels, adding-keys, means controlled by said adding-keys and said tappet-drum, for determining the "setting" of the adding-

wheels, and manually-operated mechanism for effecting the setting of said wheels, said adding-keys adapted to operate the type-writer keys, and also to operate the adding mechanism independently of said type-writer keys, at the will of the operator.

20. The combination with a rotary tappet-drum having spirally-arranged tappets, key-controlled step-by-step impelling means for said tappet-drum, a series of adding-wheels, a series of racked bars geared with said adding-wheels, for setting them, a series of units-pins on each such bar, controlling the "setting" of the respective adding-wheels, means controlled by the keys for "setting" the respective units-pins of the respective series, means whereby said bars are placed in position for the "setting" of the units-pins under the action of said tappet-drum, and means for operating said racked bars to rotate said adding-wheels.

21. The combination of the rotary tappet-drum, having spirally-spaced tappets, key-controlled step-by-step impelling means for operating the said tappet-drum, a series of adding-wheels, a series of rack-bars geared with said adding-wheels, a series of units-pins on each rack-bar, for controlling the "setting" of the adding-wheels, means controlled by the keys for "setting" the units-pins of the several bars, means whereby said bars are placed in position for the "setting" of the units-pins under the action of said tappet-drum, means for action on the set units-pins to move said bars and operate said adding-wheels, and means for restoring the set units-pins to normal positions.

22. The combination with a rotary tappet-drum having spirally-arranged tappets, key-controlled step-by-step impelling means for operating said tappet-drum, a series of adding-wheels, a series of toothed rack-bars geared with said adding-wheels, respectively, for operating them, said bars being controlled by said tappets, a series of units-pins on each rack-bar, for differentially connecting with the bar-operating device and, respectively, controlled by the keys, and manually-actuated means for controlling said bars.

23. The combination with a type-writing machine comprising the usual key-controlled step-by-step power-operated carriage and complementary adjuncts, of a rotary tappet-drum geared with the carriage-actuating mechanism, a series of adding-wheels, a series of toothed racks geared with the said adding-wheels, respectively, for operating them, said racks being controlled by the tappets, respectively, a series of units-pins on each rack-bar, adding-key mechanism for differentially setting said pins, manually-operated rack-actuating mechanism operating on the set units-pins, and means for controlling the type-writer-carriage-operating mechanism

through the adding-keys and the type-writer spacing-bar, independently of the type-writer keys.

24. The combination with a rotary tappet-drum, a series of adding-wheels, adding-wheel-actuating and units-pin-carrying bars, key-actuated units-pin-setting mechanism, bar-lifting tappet-actuated levers, bar-retaining latch-hooks, means for simultaneously lifting up one bar preparatory to setting its pin and releasing a bar having its pin set, and means for actuating the adding-wheel-actuating bars.

25. The combination of the rotary tappet-drum, a series of adding-wheels, adding-wheel-actuating and units-pin-carrying bars, key-actuated units-pin-setting mechanism, bar-lifting tappet-actuated levers, bar-retaining latch-hooks, means for simultaneously hooking up a bar, preparatory to setting its pin and releasing the bar having its pin set, and manually-operated bar-actuating mechanism.

26. The combination with a tappet-drum and a units-pin-carrying and adding-wheel-operating bars, of bar lifting and tripping levers, a support for said levers mounted to move away from said tappet-drum, to permit unobstructed return movements of said tappet-drum, and means for thus moving said levers and their support and returning them to normal positions.

27. The combination with a tappet-drum and units-pin-carrying and adding-wheel-operating bars, of bar lifting and tripping levers, a support for said levers mounted to move away from said tappet-drum, to permit unobstructed reverse movement of the said drum, and means for thus moving said levers and their support and returning them to normal position, consisting of a pivoted latch, a spring connecting said latch to said movable lever-support, and manually-operated means operating on the said latch.

28. The combination with a tappet-drum and a series of adding-wheels, of units-pin-carrying adding-wheel-operating bars, latch-hooks cooperating with said bars, and the bar-lifting levers having tripping-arms and tappet-engaged arms.

29. The combination with a tappet-drum and adding-wheels, of units-pin-carrying tappet-operated adding-wheel-operating bars, latch-hooks cooperating with said bars, bar-lifting latch-hook-tripping levers having tappet-engaged arms, a pivoted support for said lever, a spring retracting said support, and means for returning said support to normal position.

30. The combination with a series of adding-wheels and a series of adding-wheel-operating bars each having a plurality of units-pins, of means for setting said pins, and means for restoring said pins to normal posi-

tions, after they have performed their work and before said bars have been returned to normal positions.

31. The combination with a series of adding-wheels, of rack-bars operating said adding-wheels, a plurality of units-pins carried by each rack-bar, means for setting said units-pins, and an automatically-actuated units-pin-restoring bar operating to restore to normal positions, such of said units-pins as have been set and have performed their work.

32. The combination with adding-wheels and adding-wheel-operating rack-bars, of a plurality of units-pins carried by each rack-bar, means for setting said units-pins, a pivoted units-pin-restoring bar, and an operating-carriage having a pawl operating on said restoring-bar, and having a part operating on said rack-bars.

33. The combination with adding-wheels, of rack-bars for operating said adding-wheels, units-pins carried by each rack-bar, means for setting said units-pins, a reciprocating operating carriage having a push-bar operating on the set units-pins, under the forward movement of the carriage, and a pin-restoring bar operated under the return movement of the carriage.

34. The combination with adding-wheels and adding-wheel-operating bars and units-pins carried by each bar, of means for setting said pins, an operating-carriage having a push-bar operating on the set units-pins, a pivoted units-pin-restoring bar, a pawl on said carriage for operating said restoring-bar, and means for preventing the lifting of said bars, when said units-pins are restored to normal position.

35. The combination with adding-wheels and adding-wheel-operating rack-bars provided with units-pins, of means for setting said pins, an operating-carriage operating on the set units-pins, an eccentric units-pin-restoring bar, a pawl on said carriage for operating said restoring-bar, and a pivoted bar located over said rack-bars and movable into a position to prevent lifting of the bars, when the set units-pins are returned to normal positions.

36. The combination with adding-wheels and adding-wheel-operated bars and units-pins carried by each bar, of units-pin-setting mechanism, and means for restoring to normal positions, erroneously-set pins, before they have been brought into action.

37. The combination with adding-wheels and adding-wheel-operating bars and units-pins carried by each bar, of pin-setting mechanism, and keys for restoring to normal positions erroneously-set pins.

38. The combination with adding-wheel and adding-wheel-actuating rack-bars and units-pins carried by each rack-bar of a transverse series of units-bars overlying said units-

pins, reciprocating bars and bell-cranks suspending said units-bars, key-actuated rock-shafts, tappets and pawls for actuating said reciprocating bars, means for lifting up said rack-bars, to present their units-pins to the action of said units-bars.

39. In a combined type-writer and calculating-machine, the combination with the numeral-key levers of the type-writer, of a series of adding-keys constructed each in two sections and so connected and arranged that when one of the said key-sections is struck, the calculating mechanism only will be actuated, and when the other key-section is struck both the calculating mechanism and the printing mechanism of the type-writer will be actuated.

40. The combination with a type-writer and calculating mechanism, of a series of slotted tubular key-stems, supplemental key-stems in the said tubular stems, with the numeral-key levers of the printing mechanism arranged in the slots of said key-stems and subject to the said supplemental key-stems.

41. In a combined type-writing and calculating machine, a series of two-part or divided adding-keys, the one section of which operates only on the calculating mechanism and the other section of which operates both on the calculating mechanism and on the numeral-printing mechanism of the type-writer.

42. In a combined type-writing and calculating machine, the combination with the shouldered key-stems, of the calculating mechanism, and the type-writer spacing-bar, of the bar pivoted to the members of the spacing-bar and arranged for engagement with said key-stem shoulders, or for disengagement therewith, at the will of the operator.

43. In a combined type-writer and computing-machine, the combination with printing devices, a register, preliminary-representation devices, means for setting the latter, means for repeatedly bringing said preliminary-representation devices into action on said register, of means for causing the numbers set up on the preliminary-representation devices to be printed only once during repeated actions on the register for purposes of multiplication, substantially as described.

44. In a combined type-writer and computing-machine, the combination with key-operated printing devices, a register, preliminary-representation devices, means for setting the latter, of means for repeatedly bringing said preliminary-representation devices into action on said register without actuating the printing devices, for effecting multiplication, substantially as described.

45. In a combined type-writer and computing-machine, the combination with a register, of preliminary-representation devices, means for setting the same, means for re-

peatedly bringing said preliminary-representation devices into action on said register without actuating the printing devices of the type-writer, for effecting multiplication, and a device adapted to be variably set to render said preliminary-representation devices inoperative after a predetermined number of register-actuating movements, substantially as described.

46. The combination with type-writing mechanism, a series of adding-wheels, actuating-bars therefor, units-pins carried by each bar, means for setting said pins, means co-operating with the set pins to actuate said bar, of a units-pin-restoring bar, and manually-operated means for setting the adding mechanism in position allowing repeated adding of any given number represented by the set units-pins, a variable but predetermined number of times without operating the keys or units-pin-setting mechanism, or the printing mechanism.

47. The combination with a series of adding-wheels, of actuating-bars therefor, means for actuating said bars, units-pins carried by each bar, means for setting said units-pins, the units-pin-restoring bar, the pawl carried by the bar-actuating means and operating on said restoring-bar, and means for displacing said restoring-bar, with respect to said pawl, and allowing uniform repeated operations of the adding-wheels, for multiplication.

48. The combination with adding-wheels, actuating-bars therefor, means for actuating said bars, units-pins carried by said bars, means for setting said pins, a units-pin-restoring bar, and a pawl carried by the bar-actuating means, for operating said restoring-bar, of means for displacing said restoring-bar relative to said pawl and allowing uniform repeated operations of the adding-wheels, for multiplication, and consisting of the manually-operated cam-disk and pawl for disconnecting said restoring-bar, relatively to said pawl, the ratchet-wheel normally inoperative by said lifting-pawl, an indicator-disk on the ratchet-wheel shaft, a spring for resetting said restoring-bar, and a stop-pawl mechanism for controlling the position of the ratchet-wheel and the indicator-disk.

49. The combination of the type-writer-carriage-operating mechanism, spacing-bar controlling the same, type-writer keys, a tap-pet-drum geared with said carriage-operating mechanism and having a plurality of spirally-placed tappets, a series of adding-wheels, adding-keys, means controlled by said adding-keys and said tappet-drum, for determining the setting of the adding-wheels, manually-operated mechanism for effecting the setting of said wheel, said adding-keys adapted to operate the type-writer keys, and also operate the adding mechanism independently of said type-writer keys, at the will of

the operator, and clutch mechanism of the type-writer-carriage mechanism and the tap-pet-drum driver, for uniform register of re-clutching.

50. The combination of a type-writer carriage, key-controlled spring-power mechanism, connections between the former and the latter for transmitting uniform movement, a toothed gear attached to the spring-power mechanism, a decimal-order selector, and means for connecting and disconnecting said decimal-order selector to and from said gear and for positively locking said selector against movements when disconnected.

51. The combination of a type-writer carriage, spring-power mechanism actuating the same in one direction, a tape-drum, two tapes coiled reversely around said drum and attached to the type-writer carriage, a series of adding-wheels, an operating-lever for effecting the setting of the adding-wheels, and intermediate connections between said tape-drum and said operating-lever for rewinding the spring-power mechanism and returning the carriage to any desired position.

52. The combination with a decimal-order selector, of a register, decimal-bars, keys controlling the action of said decimal-bars, spring-power mechanism controlled by the keys, means for holding one bar at a time in position so that the action of the key mechanism determines the "setting" of its corresponding adding-wheel, and means for restoring such decimal-bar to normal position simultaneously with the positioning of a bar of the next lower order, under the control of the keys, substantially as described.

53. The combination with printing mechanism and a paper-supporting carriage which has a step-by-step movement for letter-spacing, of type-lever-operating keys, a series of decimal-bars, means for bringing the decimal-bars successively under control of the keys, whereby numbers may be set up in the digital order on said bars.

54. The combination with printing mechanism and a paper-supporting carriage which has a step-by-step movement for letter-spacing, of type and type-levers operated by said keys for effecting the printing, an operating-lever having a predetermined range of movement, connections between said carriage and said lever, for automatically returning the carriage, a movable stop-carrier, and denominational selecting-keys, for arresting the movement of said carriage and carrier, at different distances from a predetermined point, substantially as described.

55. The combination with the printing mechanism and a paper-carriage which has a step-by-step movement for letter-spacing, of keys controlling the same, a register, a series of decimal-order-register-actuating bars having a movement in one direction for bringing

them under control of the keys, and having a movement in another direction for actuating said register, substantially as described.

56. The combination with printing mechanism and a paper-carriage which has a step-by-step movement for letter-spacing, of a register, a series of decimal-order-register-actuating bars, and means for restoring to normal positions said decimal-bars, after performing their work of actuating the register, substantially as described.

57. The combination with printing mechanism and a paper-supporting carriage which moves uniformly for letter-spacing, of a register, a preliminary-representation device, key-controlled means for "setting" said preliminary-representation device, a decimal-order selector, means for subsequently bringing the "set" preliminary-representation device into action on said register, and adjustable means capable of being set in advance, of the beginning of the work, in different positions, for rendering the decimal-order selector inoperative on its coacting elements, at certain predetermined but variable points, whereby a space is secured on the paper between the columns of figures, on which space punctuation-marks may be printed, if desired, without disarranging the connections which actuate the adding-wheels.

58. In an adding-machine, the combination of a series of numeral-keys, a series of parallel rock-shafts one connected to each numeral-key, a series of parallel reciprocatory bars arranged transversely across said series of rock-shafts, one of said bars being connected to each of said shafts, and adding mechanism controlled by said reciprocatory bars.

59. In a writing and adding machine, the combination with a series of numeral-keys and the printing means actuated thereby, of a series of parallel rock-shafts one connected to each numeral-key; a series of parallel reciprocatory bars arranged transversely across said series of rock-shafts, one of said bars being connected to each of said shafts; and adding mechanism controlled by said reciprocatory bars.

60. In an adding-machine, the combination of a series of numeral-keys arranged transversely across the machine; a series of rock-shafts, one connected to each numeral-key and each extending in a front-to-back direction; a series of transverse reciprocating members, one connected to each rock-shaft; and adding mechanism controlled by said transverse reciprocating members.

61. In a writing and adding machine, the combination with the series of numeral-keys arranged transversely across the machine and the printing means actuated thereby, of a series of rock-shafts one connected to each numeral-key and each extending in a front-to-

back direction, a series of reciprocatory members each of which is connected to one of said rock-shafts and extends in a direction transversely of the machine; and adding mechanism controlled by said reciprocatory members.

62. In an adding-machine, the combination of a series of numeral-keys arranged in a transverse direction across the machine, a series of rock-shafts one connected to each of said keys, said rock-shafts extending in a direction from front to rear of the machine, a series of slides one connected to each of said rock-shafts, said slides extending across said series of rock-shafts, an adding mechanism controlled by said slides and means for operating said adding mechanism.

63. In an adding-machine, the combination of a series of numeral-keys arranged transversely across the machine, a series of rock-shafts one connected to each numeral-key and each extending in a front-to-rear direction; a series of transverse reciprocating members, one connected to each rock-shaft; a transversely-arranged series of differentially-movable elements controlled by said reciprocating members; and means whereby a cooperative relation is established between said series of reciprocating members and one after another of said differentially-movable elements.

64. In a writing and adding machine, the combination with the series of numeral-keys arranged transversely across the machine, and the printing means actuated by said keys, of a series of rock-shafts, one connected to each numeral-key and each extending in a front-to-back direction; a series of transverse reciprocating members, one connected to each rock-shaft; a transversely-arranged series of differentially-movable elements; and means whereby a cooperative relation is established between said series of transverse reciprocating members and one after another of said differentially-movable elements as the keys are operated to print.

65. In a writing and adding machine, the combination with the series of numeral-keys arranged transversely across the machine and the printing means actuated by said keys, of a series of rock-shafts one connected to each numeral-key and each extending in a front-to-back direction; a series of transverse reciprocating members one connected to each rock-shaft; a transversely-arranged series of registering elements controlled by said reciprocating members to add numbers; and means for operating said registering elements.

66. In a combined type-writer and adding-machine, the combination with the series of keys arranged transversely across the machine, and the printing means actuated thereby, of an adding mechanism arranged across the front of the machine and including a se-

ries of register-wheels, a series of transverse reciprocating slides, and links connecting the several rock-shafts with the numeral-keys.

67. The combination with a type-writer, of a register, a preliminary-representation device, key-controlled means for setting said preliminary-representation device, involving a movable denominational-order selector having a plurality of tappets arranged to be brought into action, in succession, to select the denominations and means for subsequently bringing the set preliminary-representation device into action on said register, substantially as described.

68. The combination of a register having a plurality of numeral-wheels, a movable denominational-order selector having a plurality of tappets arranged to be brought into action, in succession, to select the denominations, key-controlled spring-power mechanism for operating said denominational selector, under a step-by-step action, decimal-order bars provided with units-pins adapted to be set under the coöperation of the keys and said denominational selector, and numeral-printing mechanism actuated by said key-controlled spring-power mechanism, substantially as described.

69. The combination with a movable denominational-order selector having a plurality of tappets arranged to be brought into action, in succession, for selecting the denominations, key-controlled step-by-step spring-power mechanism for operating said selector, a series of adding-wheels, means controlled by the keys and said denominational selector for determining the setting of the adding-wheels, type-writing mechanism actuated by said selector-controlled mechanism, for printing the amount to be set on the adding-wheels, manually-operated mechanism for effecting the setting of said adding-wheels, and means whereby said manually-operated mechanism automatically returns the type-writer carriage and denominational selector to predetermined positions, substantially as described.

70. In a computing-machine, the combination with key-actuated elements, of spring-held digit-selecting elements normally free or disconnected from said key-actuated elements, and intermediate connections allowing said key-actuated elements to operate said digit-selecting elements, but automatically releasing the latter from the former; and permitting the digit-selecting elements to return to normal positions in advance of the key-actuated elements, substantially as described.

71. In a computing-machine, the combination with key-actuated rock-shafts, of spring-held digit-selecting bars normally free from said shafts, and actuating connections, between said shafts and bars, allowing the shafts to actuate the bars for the selecting ac-

tion, but automatically releasing the actuated bar from its actuating-shaft and permitting the bar to return to normal position in advance of the shaft, substantially as described.

72. In a computing-machine, the combination with the key-actuated rock-shafts b^{12} and the spring-held digit-selecting bars b^{11} , with their tie-bars b^{18} and coupling bell-cranks b^{16} , of the tappets b^{21} on the shafts b^{12} , and the spring-pressed pawls b^{19} on said tie-bars b^{18} , all arranged for coöperation, substantially as described.

73. In a computing-machine, the combination with the key-actuated racks b^8 , of the spring-held rock-shafts b^{12} having the gears b^{13} engaging said racks b^8 , the spring-held digit-selecting bars b^{11} , with their tie-bars b^{18} and coupling bell-cranks b^{16} , the tappets b^{21} on said shafts b^8 , and the spring-pressed pawls b^{19} on said tie-bars b^{18} , all arranged for coöperation, substantially as described.

74. In a computing-machine, the combination with the series of register-wheels having each a tens-carrier tooth a^{19} , of the composite sets of tens-carrier wheels a^{15} , a^{16} and a^{17} , rigid with each other but loose on their common support a^{14} , a manually-operated reciprocating carriage, and the shaft a^{20} with the spirally-arranged gear-segments a^{21} , receiving motion from said carriage, and operating on the "set" sets of said composite or tens-carrier wheels, to transfer the tens, on the return motion of the carriage, substantially as described.

75. The combination of the adding-wheels a and parts carried thereby, shaft a' , toothed gear-wheels p^3 , toothed rack-bar p , shaft p^4 carrying arms p^5 and the carrying devices a^{15} , a^{16} and a^{17} on the fixed rod a^{14} .

76. The combination of one series of digit-keys operative on or common to all the denominations, escapement mechanism controlled by the keys, a rotary denominational-order selector, a register, printing devices, preliminary-representation devices, means for setting up a number on said preliminary-representation devices, means for accumulating said number on the register without actuating the printing devices, and means for repeatedly bringing said preliminary-representation devices into action on the register, for purposes of multiplication, substantially as described.

77. The combination with one series of digit-keys operative on or common to all of the denominations, numeral-printing devices having key connections arranged to print the numerals successively and in the order in which the keys are struck, key-controlled denominational-order selector, a register, means for accumulating on the register the number printed by the printing devices, and means for repeatedly accumulating said number on the register, without operating the keys more than once, for the purpose of multiplication.

78. The combination of one series of digit-keys operative on or common to all the denominations, a register, preliminary-representation devices, means for setting up a number on said preliminary-representation devices, means for repeatedly accumulating such number on the register, and mechanism adapted to be variably set in advance, for determining the number of times the preliminary-representation devices shall be operative on the register, for purposes of multiplication, substantially as described.

79. In a writing and computing machine, the combination with printing devices capable of printing any desired words or numbers, a register, preliminary-representation devices, means for setting the latter, of means for repeatedly bringing said preliminary-representation devices into action on said register without actuating the printing devices, for effecting multiplication, substantially as described.

80. In a writing and computing machine, the combination with printing devices, a register, preliminary-representation devices, means for setting the latter, of means for repeatedly bringing said preliminary-representation devices into action on said register without actuating any of the printing devices during such repetitions, for effecting multiplication, substantially as described.

81. In a writing and computing machine adapted to write any desired words or numbers, the combination with a paper-supporting carriage, a denominational-order selector supported independently of the paper-supporting carriage and having synchronous movements all the time with the longitudinal movements of said carriage, of means for varying the operative selecting position of the selector relatively to the type-writer carriage.

82. In a writing and computing machine adapted to write any desired words or numbers, the combination with a paper-supporting carriage, key-controlled carriage-driving mechanism, a denominational-order selector supported independently of the paper-supporting carriage and having synchronous movements all the time with the longitudinal movements of said carriage, of means for connecting and disconnecting the denominational-order selector from said carriage-driving mechanism at will, thereby varying the operative selecting position of the selector relatively to the carriage.

83. In a writing and computing machine adapted to write any desired words or numbers, the combination with a paper-supporting carriage, a denominational-order selector supported independently of the paper-supporting carriage, connections between said carriage and said denominational selector of such character that the movements of said two parts must necessarily be synchronous

with each other all the time, a register, preliminary-representation devices, and operating mechanism for bringing said preliminary-representation devices into action on the register.

84. The combination with a register, a movable denominational-order selector having tappets arranged to be brought into action in succession, preliminary-representation devices, means for setting the latter, devices whereby the register-wheels are automatically thrown into engagement with said preliminary-representation devices during movements of the latter in one direction and automatically disengaged therefrom during reverse movements, and means for positively moving the preliminary-representation devices in the direction of both their actuating and return movements, substantially as described.

85. The combination with a register, a movable denominational-order selector having a plurality of tappets arranged to be brought into action in succession, decimal-order bars having a differential action on the register, means for positively moving the decimal-order bars in both directions of their longitudinal motion, of devices whereby the register-wheels are automatically subjected to the action of the decimal-bars during movements of the latter in one direction and automatically released from action of said bars during reverse movements, substantially as described.

86. The combination with a movable denominational-order selector having a plurality of tappets arranged to be brought into action in succession, rack-bars having variable longitudinal travel, devices for establishing operative connections between said selector and said racks, manually-operated means for positively moving the racks in both directions of their longitudinal motion, a register having wheels engageable with the racks, and devices whereby the register-wheels are automatically actuated by the racks during movements of the latter in one direction and automatically released from action of said racks during their return movement, substantially as described.

87. The combination with a rotary tappet-drum having spirally-arranged tappets, racks having variable travel, and subject to the action of the keys and said tappet-drum, manually-operated means for positively moving the racks in both directions of their longitudinal motion, a register having wheels engageable with the racks, of devices whereby the register-wheels are automatically made subject to the action of the racks during movements of the latter in one direction but not subject thereto during reverse movements of said racks, substantially as described.

88. The combination with a movable denominational-order selector having a plural-

ity of tappets arranged to be brought into action in succession, racks carrying adjustable units-pins subject to be set by the action of the keys and said denominational-order selector, manually-operated means for positively moving the racks in both directions of their longitudinal motion, of a register having counting-wheels a to which are pivoted the spring-held pawls a^6 , and carrying the ratchet-wheels a^5 and gear-wheels a^3 in mesh with the racks c' , substantially as and for the purposes set forth.

89. A computing-machine having a movable denominational selector provided with selecting-tappets, which selector is adjustable to render its tappets operative or inoperative in respect to its selecting action.

90. A computing-machine having a rotary denominational selector provided with selecting-tappets, which selector is axially adjustable to render its tappets operative or inoperative in respect to its selecting action.

91. In a writing and computing machine, the combination of key-actuated printing devices, a rotary denominational selector, selecting by its rotary action adding mechanism controlled thereby for adding the numbers printed by the printing devices, and means for printing the total of the several numbers without actuating the register-wheels of the adding mechanism.

92. The combination with a type-writer carriage, of a computing-machine having preliminary-representation devices, a manually-operated device for transferring the preliminary representation to the register-wheels of the computer, and intermediate devices leaving said carriage and manually-operated device normally free of each other, for the purpose of actuating the computing mechanism without actuating said carriage as in multiplication, but adapted to connect said carriage and manual device at will for returning the carriage to initial position by the manipulation of the manual device.

93. In a writing and computing machine,

the combination of one series of digit-keys operative on or common to all the denominations, key-actuated printing devices, a register, a key-controlled denominational-order selector, preliminary-representation devices controlled by the keys and said selector, mechanism for bringing the preliminary-representation devices into action on the register, and means for restoring to normal positions erroneously-set preliminary-representation devices before being brought into action on the register.

94. In a combined writing and computing machine, the combination of one series of digit-keys operative on or common to all the denominations, printing devices adapted to print any desired words or numbers, a register, a key-controlled denominational-order selector, preliminary-representation devices controlled by the keys and said selector, mechanism for bringing the preliminary-representation devices into action on the register and means for restoring to normal positions erroneously-set preliminary-representation devices before being brought into action on the register.

95. The combination with adding-wheels and adding-wheel-actuating bars and units-pins carried by each bar; of units-pin-setting mechanism, and key-operated means for restoring to normal positions erroneously-set pins.

96. The combination with adding-wheels and adding-wheel-actuating bars and units-pins carried by each bar, of units-pin-setting mechanism, key-operated means for restoring to normal positions erroneously-set pins, and means movable into position to prevent lifting of said bars when the set pins are returned to normal positions.

Signed at New York this 26th day of June, 1902.

HANS HANSON.

Witnesses:

C. SEDGWICK,
J. M. HOWARD.