

E. H. PALMER.
 CALCULATING MACHINE.
 APPLICATION FILED SEPT. 27, 1905.

969,801.

Patented Sept. 13, 1910.

4 SHEETS—SHEET 1.

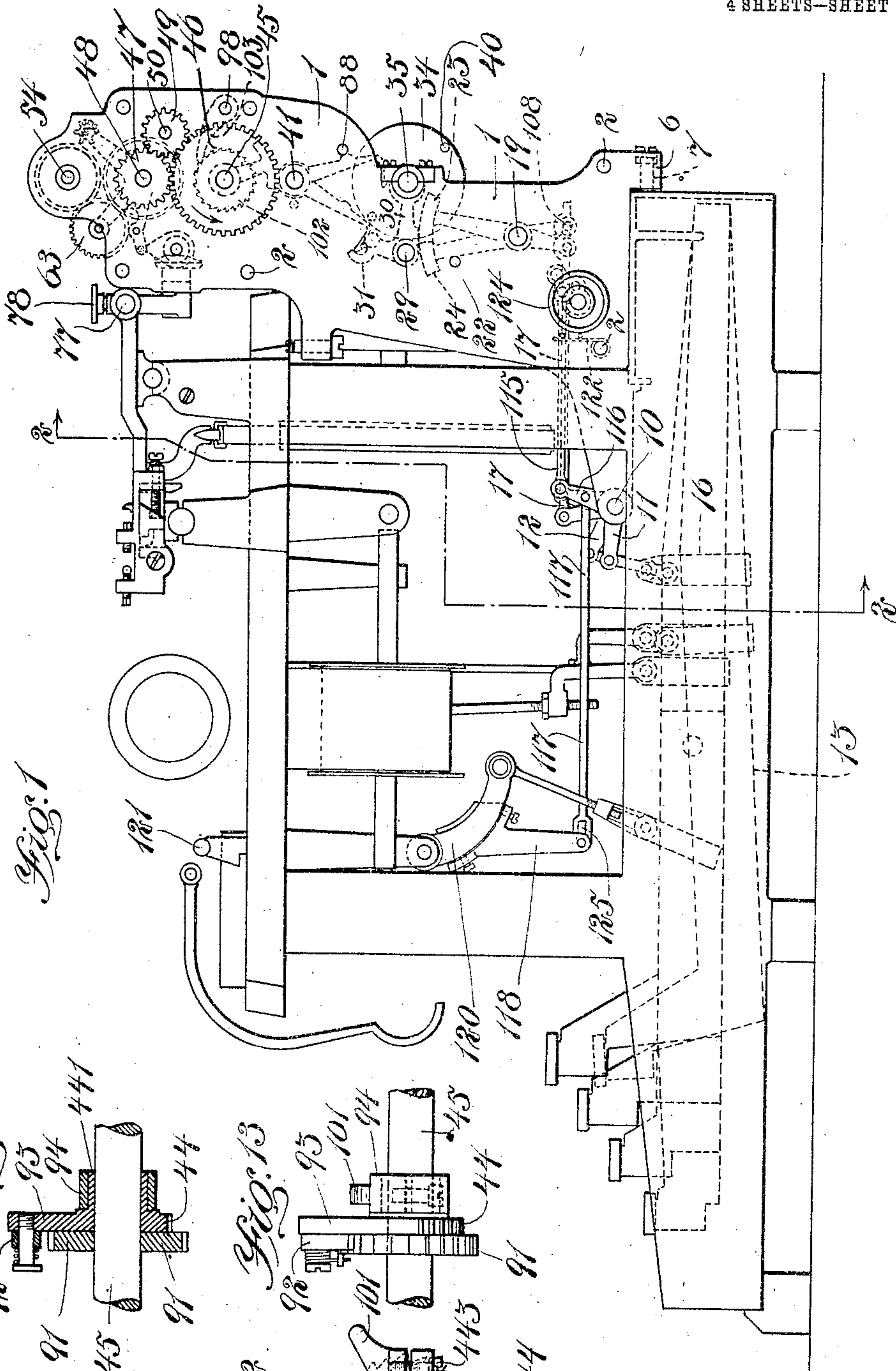


Fig. 1

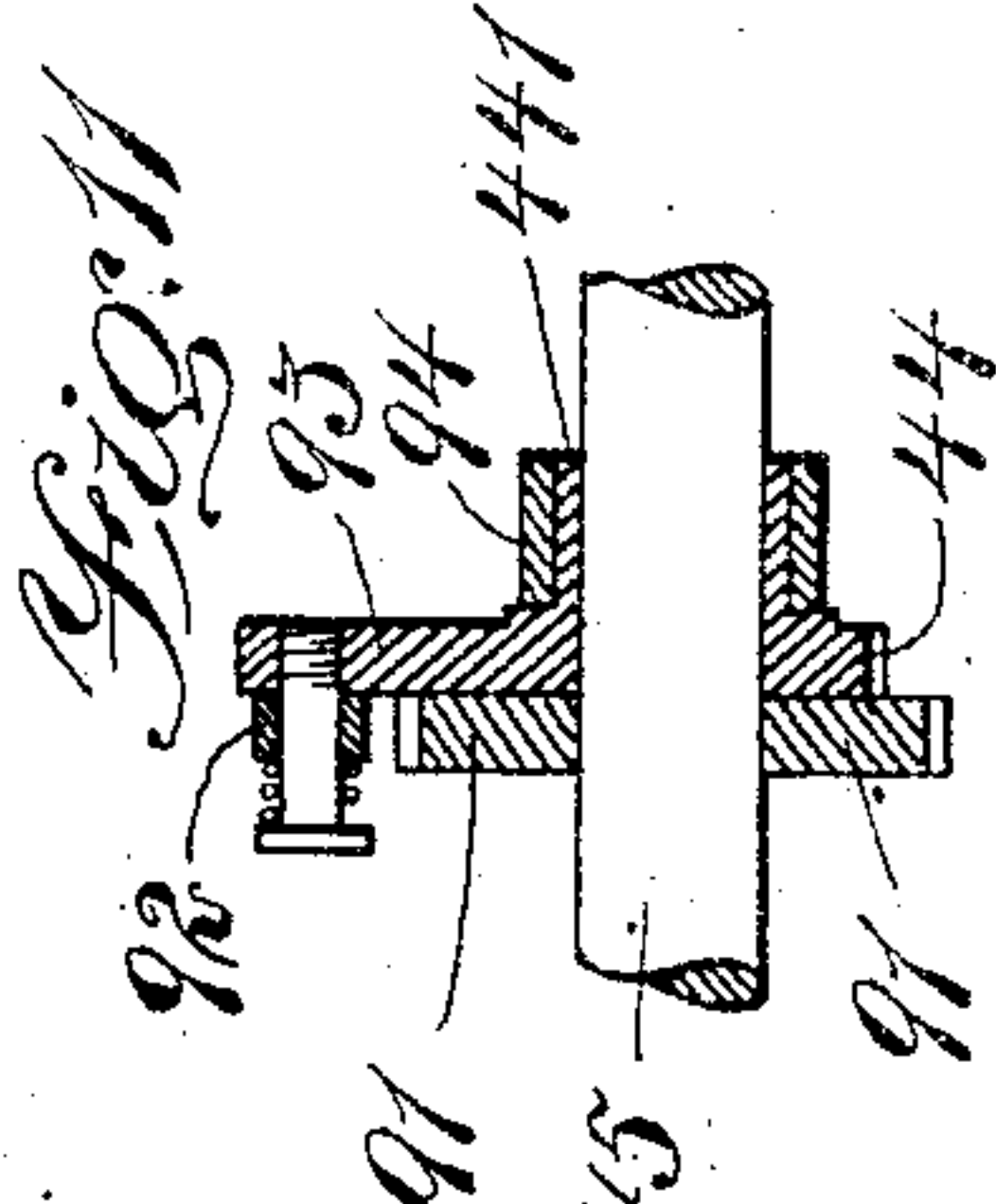


Fig. 11

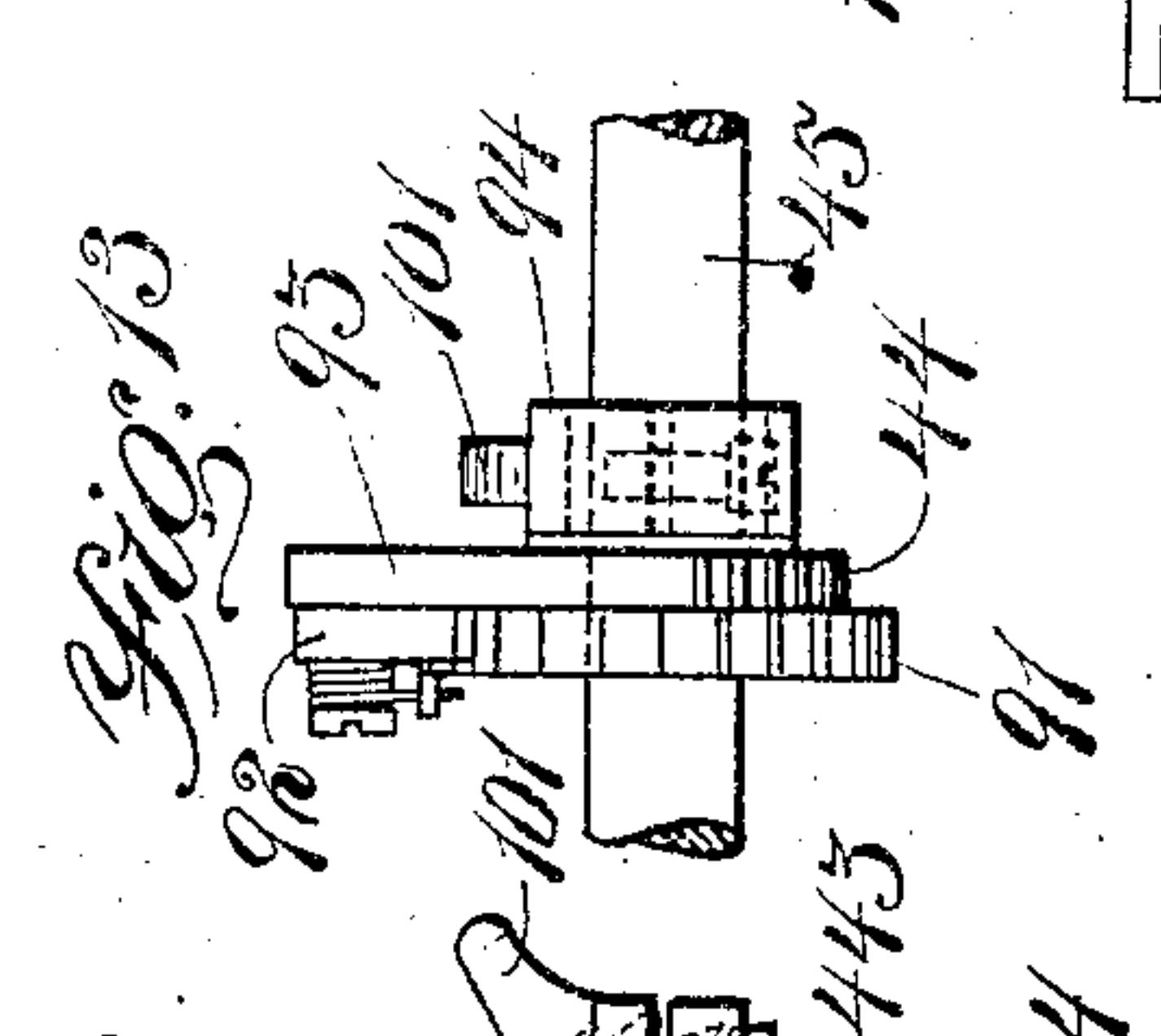


Fig. 13

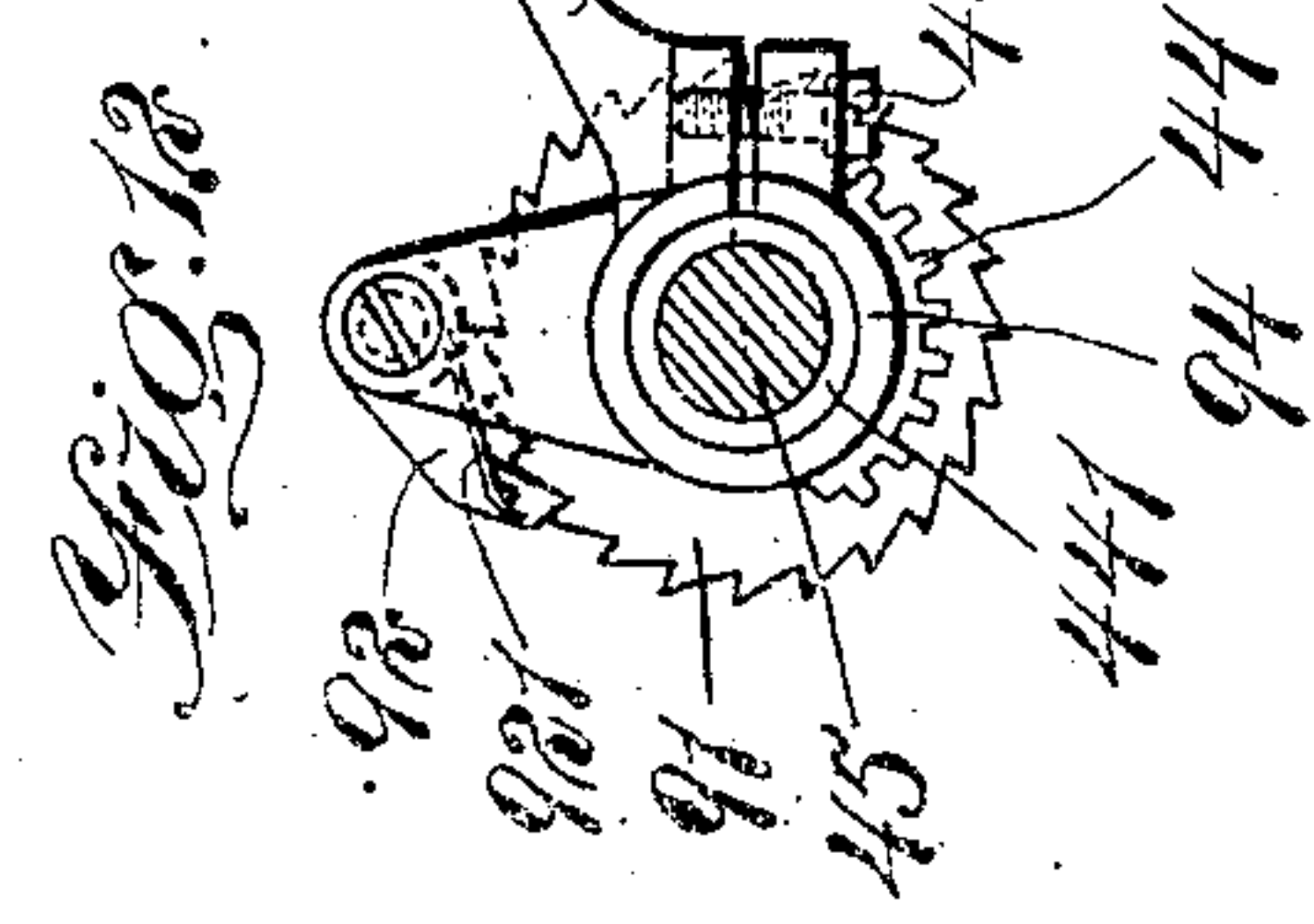


Fig. 12

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4 SHEETS—SHEET 2.

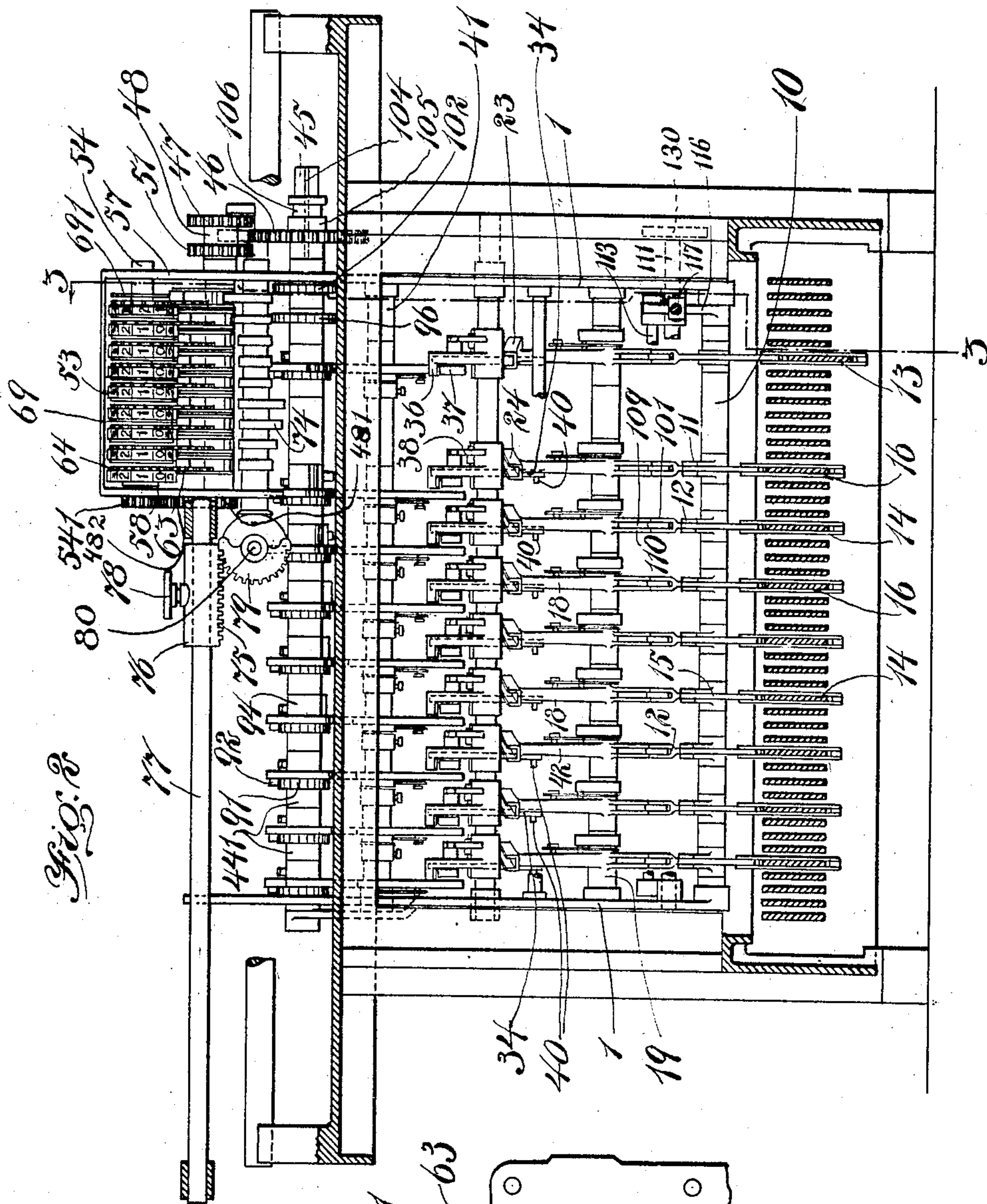


Fig. 13

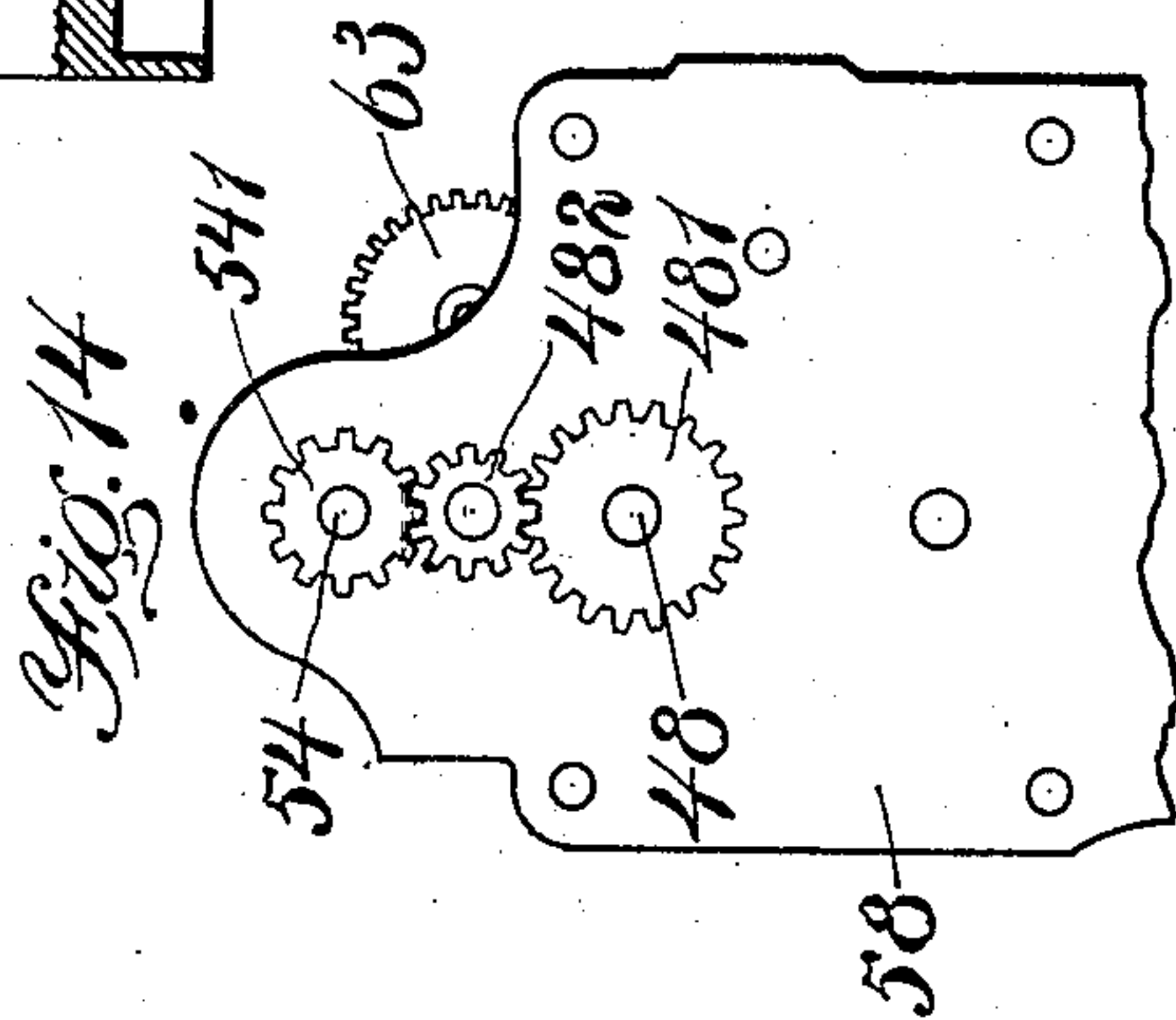


Fig. 14

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4 SHEETS—SHEET 3.

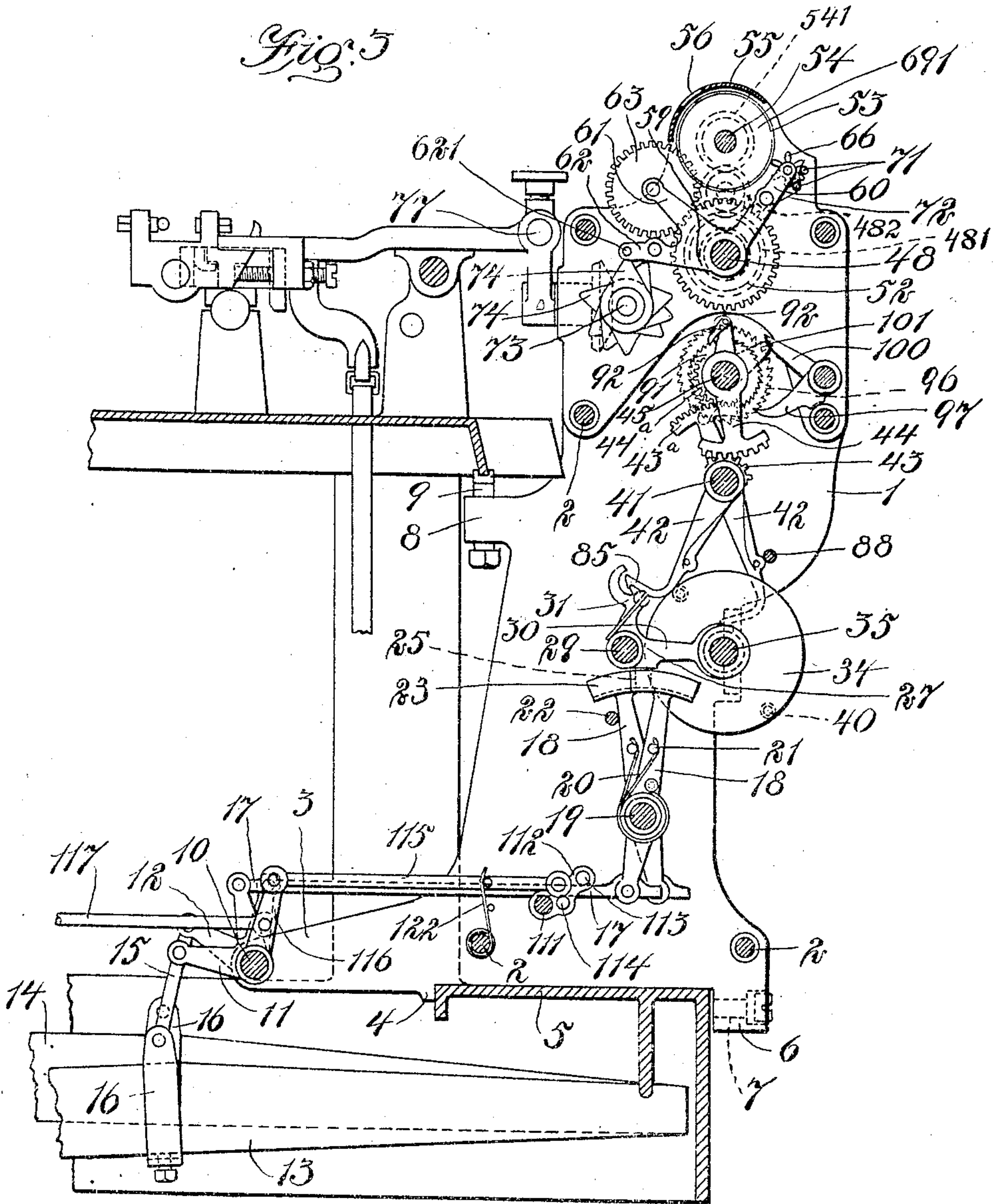
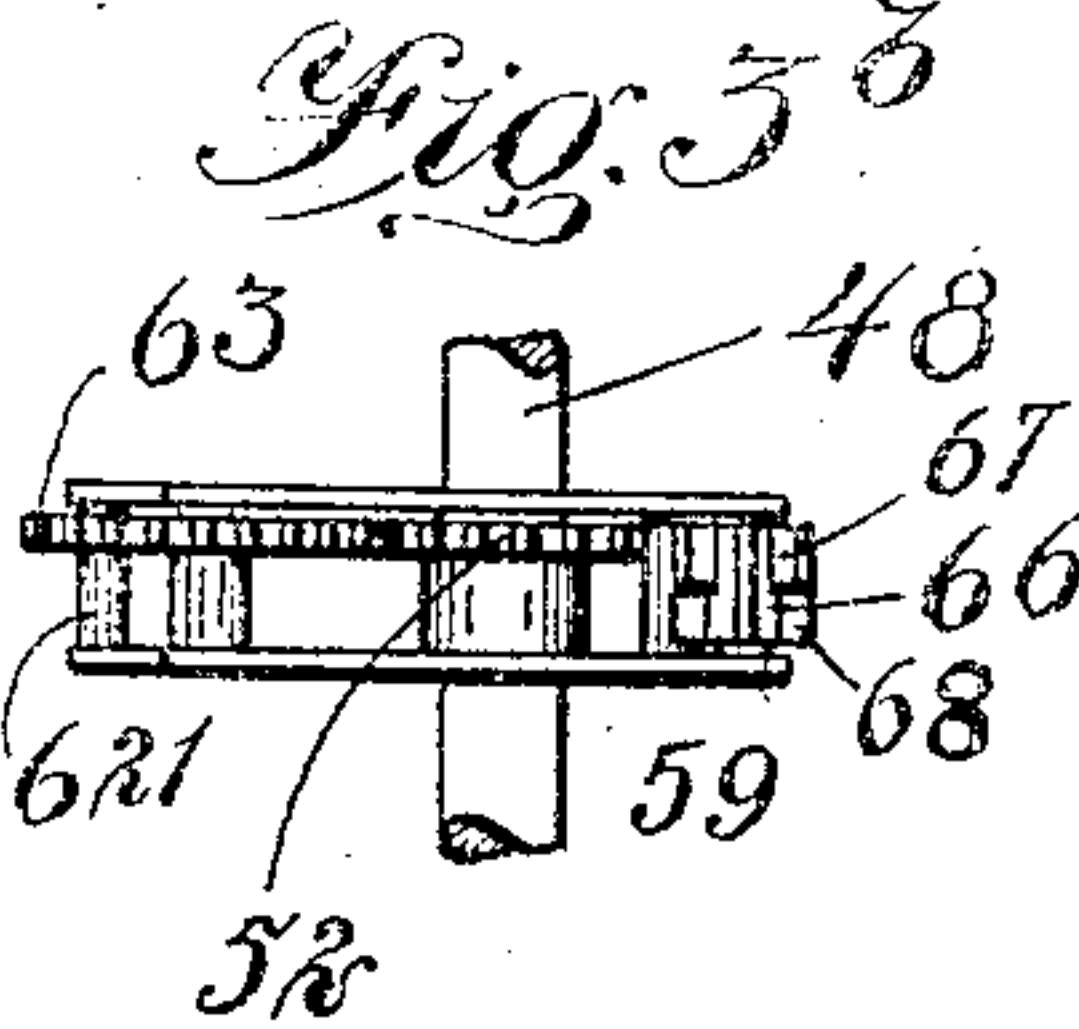


Fig. 5^a

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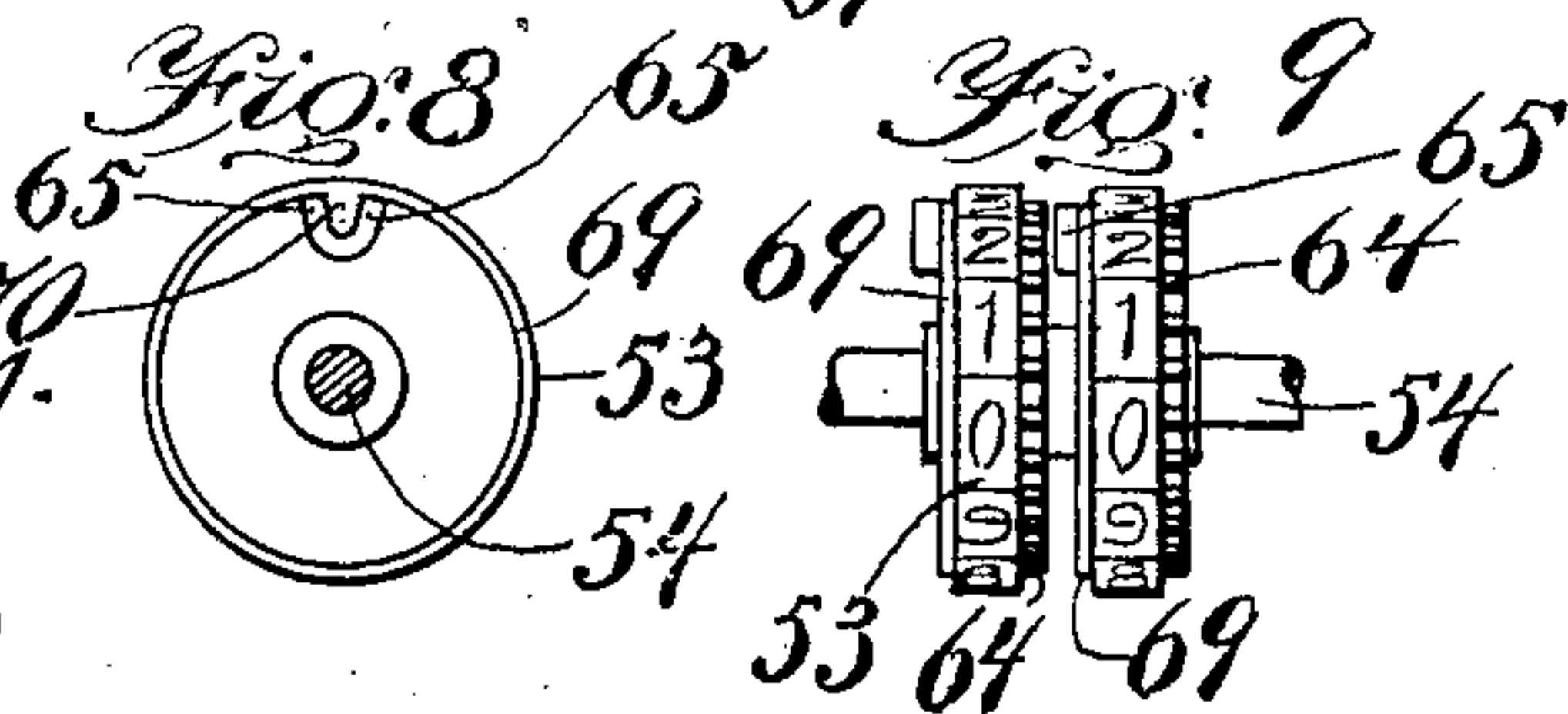
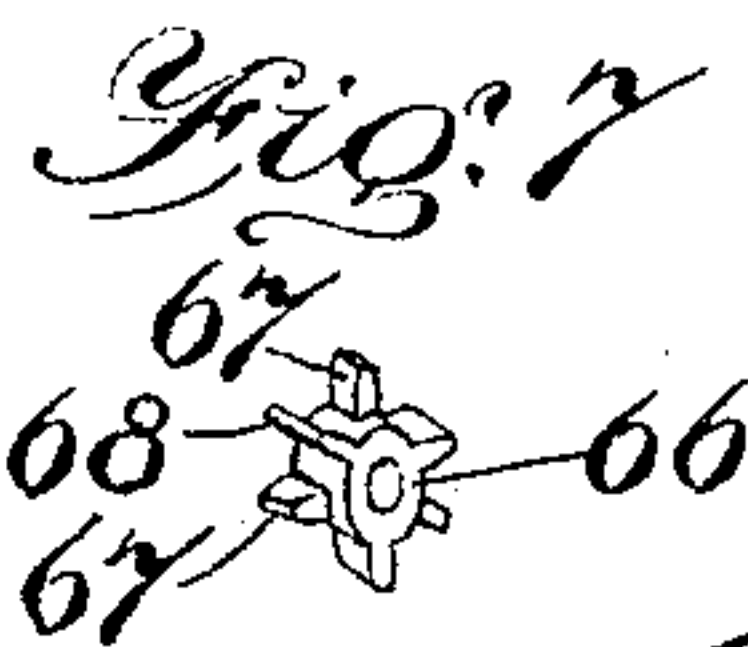
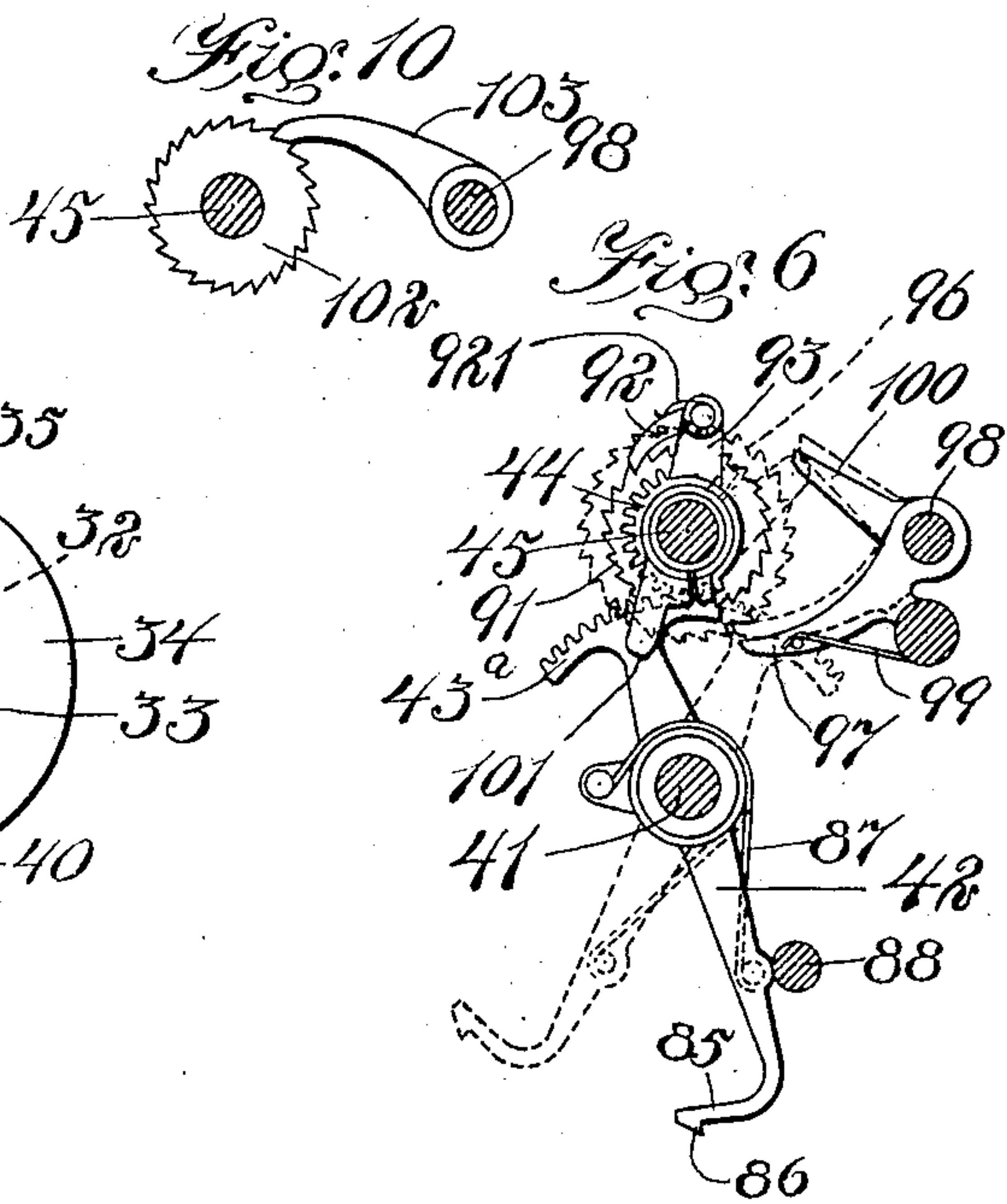
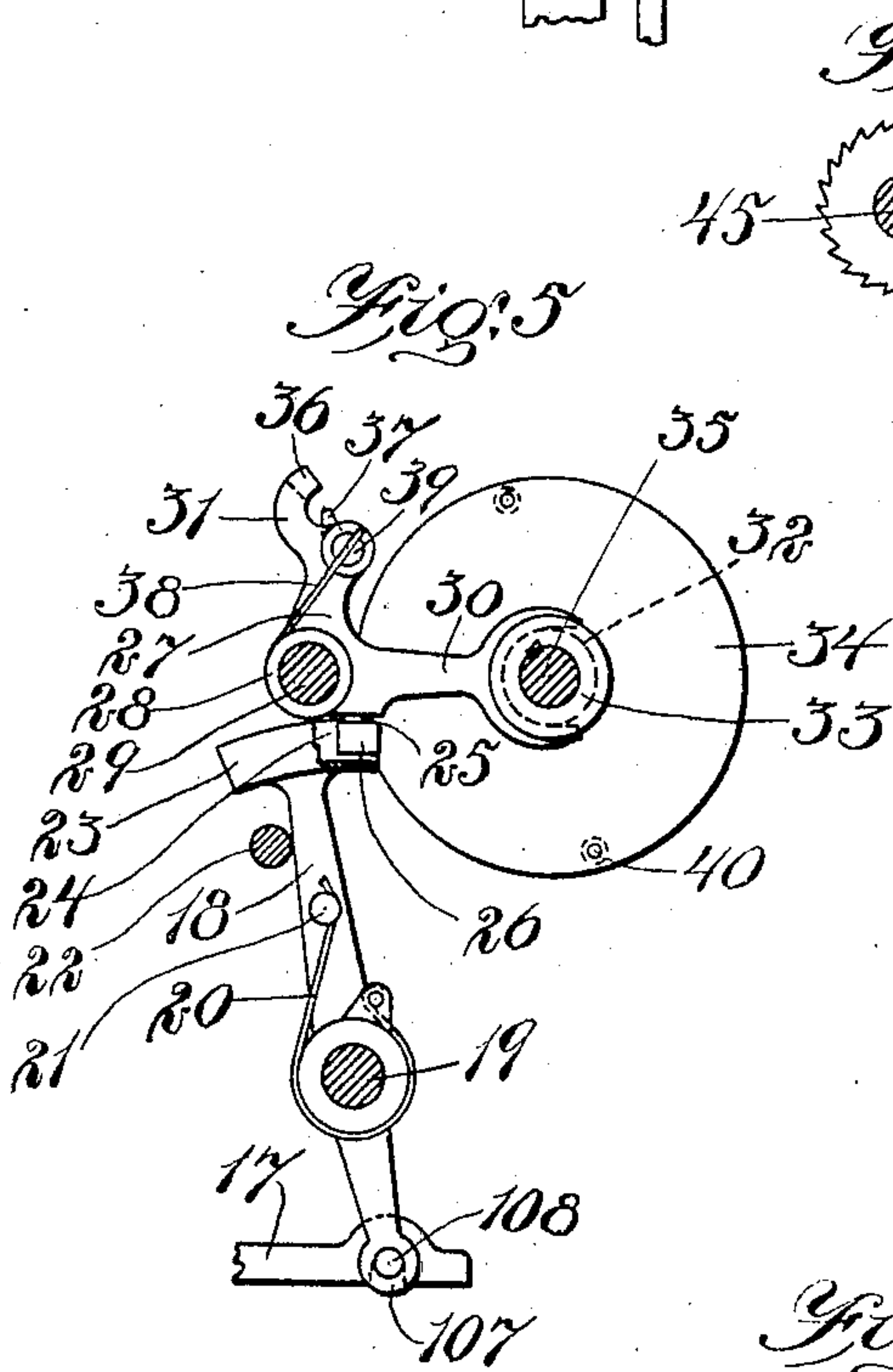
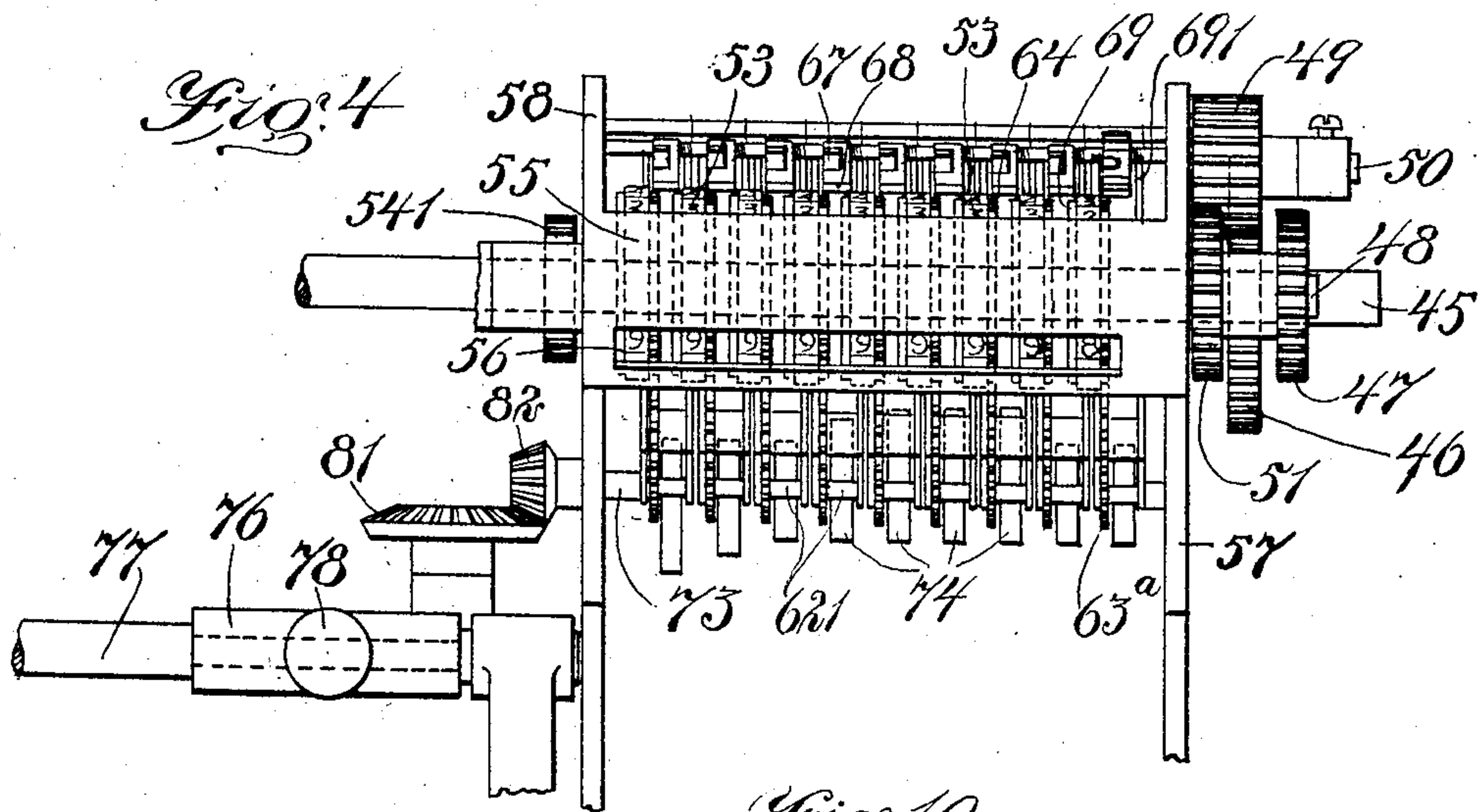
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

EDWARD H. PALMER, OF READING, MASSACHUSETTS.

CALCULATING-MACHINE.

969,801.

Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed September 27, 1905. Serial No. 280,307.

To all whom it may concern:

Be it known that I, EDWARD H. PALMER, of Reading, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

This invention relates to manually-operated calculating machines and particularly to mechanism adapted to be connected to any of the well-known types of typewriting machines and to be operated by the number keys of the latter, although the machine is adapted to be constructed for independent use.

The objects are to provide a machine or mechanism capable of ready attachment to and disengagement from a typewriting machine without any reconstruction or rearrangement of the latter, and which is adapted to register and exhibit the results of the addition or subtraction of a series of numbers simultaneously with the printing or writing of such numbers on a sheet of paper held by the carriage of the typewriting machine.

Further objects are to secure accuracy in the results; uniformity in the effort required for indicating or registering each number in the calculating mechanism regardless of the size or amount of such number, and in the amount of depression of the keys required for this result; simplicity of construction; capability of rapid operation so that the numbers may be registered and added or subtracted by the mechanism as rapidly as they can be written by the most expert typewriter operator; capability of actual reversal of the number-bearing disks or wheels so that subtraction may be directly performed and mistakes automatically corrected, and provision for readily disconnecting the calculating mechanism from the number keys without actually removing the same from the typewriting machine, and for automatic disconnection of the same by operation of the shift key when the upper case letters or symbols operated by the same keys as the numbers are written.

Of the accompanying drawings,—Figure 1 represents an embodiment of the invention as applied to a typewriting machine of the type known as the "Remington, No. 7," sufficient of the typewriting machine being shown to indicate the manner of connecting the calculating mechanism thereto. Fig. 2

represents a front elevation of the calculating mechanism, a portion of the typewriting machine also being shown in section on line 2—2 of Fig. 1. Fig. 3 represents a view similar to Fig. 1, on an enlarged scale, some of the parts being shown in section, the section being taken on line 3—3 of Fig. 2. Fig. 3^a and Fig. 3^b represent respectively a front elevation, and a plan view of the number-carrying mechanism. Fig. 4 represents a plan view of a portion of the same. Figs. 5 and 6 represent views showing in elevation details of the mechanism. Fig. 7 represents a perspective view of one of the connecting pinions which communicate motion from one of the number disks to the adjacent left-hand ones. Fig. 8 represents an elevation of the left-hand side of one of the number disks. Fig. 9 represents in elevation, two adjacent number disks. Fig. 10 represents an elevation of the pawl and ratchet device preventing retraction of the main shaft. Figs. 11, 12 and 13 represent respectively an axial section, and elevations as seen from the front and right of the machine, of one of the devices for communicating motion to the main shaft proportioned to the number indicated. Fig. 14 represents a detail view from the left of Fig. 2, showing the upper or auxiliary frame and the connections for rotating the shaft on which all of the number wheels or indicators are loosely mounted.

The same reference characters indicate the same parts in all the figures.

This calculating mechanism may be applied to any typewriting machine by making slight adaptations and modifications in the frame and connections suitable for the particular machine from the construction and arrangement here shown, which is particularly adapted to the "Remington No. 7", but in any case essentials of the mechanism are the same. In the embodiment here shown, the apparatus comprises main side frame plates 1 1 connected together by suitable transverse rods 2 and various shafts hereinafter described, which support parts of the mechanism. This mechanism and frame plates are compactly and securely held together, constituting a separate independent device which may be operated independently, and has also capabilities of attachment to the frame of a typewriting machine. The lower portions of the frame plates 1 are widened and have

forwardly-projecting arms 3, also downwardly-projecting lugs 4 adapted to engage the forward edge of the table projection 5 of a typewriting machine, and also having lugs 6 arranged to project downward at the rear of this table. In the projections 6 are adjustable set-screws 7 adapted to be screwed up against the rear of the table 5 to clamp the calculating mechanism to the machine. There are also formed upon the side plates projections 8 carrying set-screws 9 arranged to engage the upper part of the typewriting machine. By means of these projections and screws the calculating mechanism may be firmly and securely attached to the typewriter in a way which also permits ready disconnection therefrom.

Mounted in the forward ends of the arms 3 is a transverse rod or shaft 10 on which are pivotally mounted bell-crank levers 11 12, there being nine of such levers, each of which is adapted to be connected to one of the key levers 13 14 of the type-writing machine. The connection is made by means of links 15 each of which is connected at one end to one of the bell-cranks, while its other end is pivoted to a collar 16 detachably clamped upon one of the key levers. The upwardly-projecting arm of each of the bell-cranks has pivoted to it a connecting rod 17 which is engaged with a lever 18 pivoted upon a transverse shaft 19, the ends of which are held in the side plates of the frame. Mounted upon this shaft 19 are springs 20 each of which engages a pin 21 on one of the levers 18, tending to hold these levers in the position designated by 18^a, with one of its arms bearing against a cross rod 22, but when the key levers are depressed to strike a numeral on the paper carried by the typewriter carriage, the key levers then being in the position occupied by 13, the bell cranks are turned in left-hand rotation and the levers 18 moved in the opposite direction of rotation, carrying their upper arms to the right.

Each of the levers 18 carries on its upper end an inclined guideway or cam portion 23, containing a cam groove 24, (Fig. 2) into which projects a stud 25 having a trundle roll 26 carried by a member 27 having a collar portion 28 embracing the transverse rod or shaft 29, the ends of which are fixed in the side plates 1 of the frame. This member 27 is provided with two rigid arms 30 31, the former of which carries a two-armed fork extending into a groove 32 formed in a hub 33 of a disk 34, which has a feather-and-slot connection with a rotatable shaft 35, mounted in bearings in the frame. The feather-and-slot connection as is obvious, causes the disk 34 to rotate with shaft 35 but permits it to be moved longitudinally upon the shaft. The arm 31 carries

a laterally-extending projection 36 on its end and also a pivoted pawl or tooth 37 located adjacent the projection 36 but separated therefrom by a small space. A spring 38 carried by the pivot 39 of the pawl bears against the hub or collar portion 28 of the member 27 and tends to hold the pawl in the position shown in Fig. 5.

The shaft 35 is kept continuously rotating by any suitable motor, as an electric motor, which may be connected with the shaft in any manner desired or by a spring, compressed air, or any other desired means, and the disks 34 continuously rotate with the shaft. Each of the disks carries one or more pins or studs 40 projecting therefrom laterally toward the left in Fig. 2.

Pivotally supported upon a fixed shaft 41 above the shaft 35 are arms 42 of which there are nine, corresponding in number to each of the other parts described. The arms 42 carry connected to them gear segments 43 of varying sizes which mesh with gear segments 44 mounted on the shaft 45 which runs from side to side of the calculating mechanism frame. The segments or disks 44 are loose on shaft 45 and each carries a projecting arm 93 (Figs. 12 and 13) to which is pivoted a pawl 92. Beside each of said arms is a ratchet wheel 91 fixed to the shaft, with the teeth of which the pawl 92 engages. A spring 921 is provided for holding the pawl in mesh with the ratchet. When one of the number keys is operated rotary motion of an amount proportional to the numeral on such key is given by the mechanism above described, to the shaft, and therefrom such motion is communicated to the registering and indicating mechanism located above the same and connected to the frame members. Integrally formed with the segments 44 are sleeves 441 upon which are externally mounted split collars 94 adapted to be clamped in any position of adjustment by clamping screws 443. Each of these collars carries a projecting arm or lug 101 adjustable therewith for a purpose hereinafter described.

The shaft 45 has a single connection by which its motion may be communicated to each of the number-bearing wheels or index elements, of which there may be any number desired. This connection consists of a gear 46 (Figs. 1, 2 and 4) splined upon the shaft 45 so that it is compelled to rotate with the shaft but is free to move thereon, and is adapted to mesh either with a pinion 47 fixed to a shaft 48 or with an idler 49 on a stud 50 which meshes with a second gear 51 fixed to the same shaft as that upon which the gear 47 is mounted. The shaft 48 has fixed upon it gears 52 of which there are as many as there are number wheels 53 upon the shaft 54 and of these there may be as many as are desired, the number being limited

ed only by the size of the typewriting machine, which would of course permit more number wheels than would be required in ordinary use. In the embodiment of the invention illustrated there are nine number wheels of which the two at the right of Figs. 2 and 4 may be used to designate hundredths and tenths, or cents, the third one from the right designating units, the next tens, the next hundreds, the next three indicating units, tens and hundreds of thousands respectively, and the one at the extreme left indicating millions. The number wheels are inclosed in a casing or covering 55 in which is formed a slot 56 of sufficient width to show one of the numerals on each disk, this slot serving as an indicator by which the amount represented by the amount showing on the disks may be read.

The shaft 54 bearing the number disks and shaft 48 are mounted in an auxiliary frame having side plates 57 58 and suitably connected to the main frame.

Upon the shaft 48 are pivotally mounted holders 59 (Fig. 3) equal in number to the disks and gears 52, each of which has three arms 60 61 62. The arm 61 carries pivoted to it a pinion 63 constantly in mesh with the gear 52 and mounted in the same plane with a toothed portion or pinion 64 formed or connected on the right-hand side of one of the number disks, each of the number disks being so provided. On its left-hand face, each of the number disks except the extreme left-hand one, carries two teeth 65 projecting laterally into close proximity to the next adjacent disk (Figs. 8 and 9). The arms 60 of the holders 59 carry pinions 66 which may be called "carrying wheels," shown in detail in Fig. 7. These pinions have an even number of teeth and each alternate tooth 67 is formed with less than the width of the other teeth 68. As the pinions appear in Figs. 4 and 7, the teeth 67 project from the left side of the hub, the right-hand portions of these teeth being removed. The number of teeth of the pinions is preferably six and they are so spaced that two adjacent teeth of full width may rest upon the periphery of the annular shoulder 69 formed at the left of each of the number disks, while the tooth 67 midway between projects into a space between two of the teeth on the portion 64 of the next left-hand disk and extends laterally into the space between the number wheels and in the path of motion of teeth 65. These teeth are mounted upon the number disks in such a position that when during the operation of addition the numeral "9," or during the operation of subtraction, the figure "0" of any disk is adjacent the indicator slot, one of the teeth 65 comes into position to engage that tooth 67 of the small pinion which is in engagement with the toothed portion 64 of the

next left-hand disk. As the first number wheel is then rotated one space the teeth 65 turn the pinion 66 by an amount sufficient to move the second disk, that is, the one at the left, through one space to present the next number carried by it at the indicator. The teeth 68 of full width carried by pinions 66 bearing against the periphery of the annular portion 69 prevent the pinion from turning as the right-hand number disk is rotated except when one of the teeth 65 engages a tooth 67, when the notch 70 left between teeth 65 permits one of the wide teeth 68 to enter and so allows the pinion to rotate and move the number wheel at the left.

At the right of the number wheels is a smooth-surfaced disk 691 (Figs. 2 and 4) located in the same position relatively to the right-hand wheel that the shoulder 69 of any wheel bears with respect to the next adjacent wheel to the left. This disk serves to hold two of the wide teeth 68 on the right-hand carrying wheel when that carrying wheel is in mesh with the right-hand number wheel and locks the number wheel in the same manner as the other number wheels are locked by their respective carrying wheels, except when released by withdrawal of the carrying wheel, and the driving connections are put in gear for turning said number wheel through actuation of a number key, by means to be described. This construction and arrangement of carrying wheels, which are also locks for the number wheels, is an important feature of the machine, as it avoids the necessity of detents for preventing overthrow of the number wheels, thereby relieving them of friction, and permits all of them to be turned at once with so little resistance, and at the same time with so exact a motion, that any number of such wheels may be used without limit. This is a result not achieved in a practical manner by any other machine and one which has long been sought by banking houses and other concerns dealing in large sums.

The pinions 66 are carried by the arms 60 so as to engage two adjacent number wheels and the distance between these pinions and the pinion 63 is such that when the holder 59 is rotated to bring either pinion into engagement with the number disks, the other is moved out of engagement therewith. When it is the pinion 66 which is moved away from the disks, one of its outer teeth is engaged between two transverse pins 71 (Fig. 3) as soon as its inner tooth leaves its engagement with the number wheels to hold it in proper position so that it may enter in proper engagement with the teeth of the disks as soon as it is allowed to move toward them again. A spring 72 is mounted upon the rods 71 and bears upon a portion of arm 60, tending normally to retain

the holder with the pinion 66 engaging the number disks and the pinion 63 out of engagement therewith. As the holder pivots upon shaft 48, pinion 63 always remains in mesh with gear 52. Mechanism consisting of a shaft 73 carrying adjustable cams 74 is provided for moving the holders at the proper time to bring the pinions 63 into mesh one at a time with the number-bearing disks, and at the same time to move the corresponding carrying pinions 66 out of engagement with the number wheels as the carriage is advanced preparatory to the actuation of the number keys, so that when the carriage is in position to receive the impression of a figure in its proper place in a number, the appropriate number wheel will be connected up to give the proper value to that figure in the result being calculated.

The shaft 73 is operated by the typewriter carriage through an adjustable rack 75 (Figs. 2 and 4) formed upon a sleeve 76 which is mounted movably on a cross-bar 77 carried at the rear of the typewriter carriage and adapted to be clamped in any position by a set-screw 78. The rack is arranged to mesh with a gear segment 79 on a cross shaft 80, which shaft on its other end carries a bevel gear 81 meshing with a bevel gear 82 on the end of shaft 73. During a portion of the travel of the typewriter carriage, the rack 75 is separated from gear segment 79, but when it comes into engagement with the gear segment, it rotates the same step by step as the carriage is moved, while the keys are operated and the shaft 73 is correspondingly rotated. It will be observed that the cams 74 carried by this shaft are equal in number to the holders 59, and that they are spaced laterally so that each comes in the plane of one of the holders and in position to strike a pin 621 on the holder. They are also adjusted rotarily in a generally helical line about the shaft so that the projections of no two are in alignment. The shape of each cam is the same and is clearly shown in Fig. 3. Each cam is cylindrical throughout the greater portion of its extent but is formed with a single comparatively abrupt projection. The cams being arranged on the shaft in the manner above described, as the shaft is rotated, it is evident that they will come into engagement successively with the arms 62 of the holders 59, the left-hand cam coming into contact first with the left-hand holder, thereby moving its pinion 63 into engagement with the disk arranged to indicate numbers in the millions column. It will be observed that the calculating mechanism is not rendered operative until a cam causes one of the number wheels to be thrown into gear and that this only takes place when the rack 75 engages and turns the gear 79. Consequently the point on the sheet at which

numbers to be added or subtracted may be written is determined by the location of the rack. Usually as in making out bills, etc., the numbers to be added are written at the right of the sheet, and the rack will then be placed correspondingly on the right-hand portion of the cross-bar, but it may be desirable to calculate numbers written at the extreme left, and for this purpose the cross-bar is made of sufficient extent that the rack may be set far enough to the left for the first impression, at the number "1" space of the machine, to be capable of actuating any of the number wheels. Preferably the cams are arranged so that spaces may be left in the written record between the millions and thousands, the thousands and hundreds and the units or dollars and tenths or cents so that a period may be put in the last space and commas in the other spaces if desired, so that also the calculating mechanism will not be operated while the typewriter carriage is passing over such space. Such an arrangement as that referred to is shown in Fig. 3, where the cam projecting to the left and to which the numeral 74 is applied, is adapted to actuate the millions disk and between this cam and the next one below it and to the left is a space equal to the distance moved by the cam projection while the typewriter carriage is moving two spaces. The next three cams are adapted to operate the hundred thousands, ten thousands and thousands disks respectively, and they are spaced at equal distances apart, this distance corresponding to the amounts moved at each step of the carriage so that when a number is struck and impressed upon the paper the calculating mechanism having been thrown into gear by the preceding movement of the carriage, is simultaneously operated. Between the thousands cam and the hundreds cam is another space of extra width so that after a space or a comma has been made in the writing, the next actuation of a number key will operate the proper number-indicating disk. Finally between the cam for throwing into gear the units or dollars disk and those for connecting up the tenths and hundredths, or cents disks, is left another space for allowing the insertion of the usual period.

While it is necessary that the spaces between the cam projections should be multiples of the distance moved with each step of the carriage, the precise arrangement described is not necessary, since the cams might be arranged with greater spaces after the millions, the thousands and the units than those referred to here, or there might also be left greater spaces between each two numerals of the number.

Between the first cam 74^a and the last cam 74 of the series, in rotary arrangement as seen in Fig. 3, is left a space which comes

beneath the line of the engaging pins 621 when the rack is out of gear with the segment and the cam shaft is in a position of rest, to the end that there may be no actuation of any number wheel if the number keys are operated while the rack is thus disconnected.

It is obvious that variations in the dimensions and locations of the rack 75, and also in the number of such racks used, may be made without departing from the spirit of the invention, and that more or fewer number wheels than shown, within the limit of the number of spaces or steps of the paper carriage travel may be employed.

Again, by omitting one or more of the cams so that certain of the number wheels are never connected up and never operated, parallel columns may be added or subtracted and the results of each separately indicated on the corresponding independent groups of number wheels.

The manner in which the depression of a number key causes the calculating mechanism to operate will now be described:— When a number key is depressed, one of the levers 18 is moved in right-handed rotation about the pivot shaft 19, thereby moving its upper arm and the cam portion supported thereon from left to right, as seen in Figs. 1 and 3. As the cam portion is inclined from right to left as seen in Fig. 2, its movement just described causes the member 27 through the engagement of stud 25 with the walls of the cam, to be moved to the left, sliding on shaft 29. This movement also through the medium of arm 30 and the fork formed thereon carries one of the disks 34 to the left, bringing it into such position that as it is rotated one of its pins 40 will strike and move an arm 42. Normally the arms 42 hang in planes slightly to the left of the respective disks and members 27, but when the latter are moved to the left by actuation of levers 18 as described, the studs 40 are carried into the planes of the respective arms 42 as are also the projections 36 and pawls 37. The proportions of the parts are such that the studs 40 move the arms 42 far enough so that their laterally-projecting end portions 85 are carried to the projections 36, which arrest their further motion while the studs 40 slide tangentially off from the ends of the arms. In the movement of an arm by engagement with one of the pins, a latch projection 86 (Fig. 6) carried at the lower part of projection 85 displaces the pawl 37, which being restored to its previous position by the spring 38, engages in rear of the latch 86 and prevents retraction of the arm 42 until the member 27 has been moved to the right into its inoperative position by the elevation of the number key. When this movement takes place, pawl 37 is moved laterally out of en-

gagement with latch 86, leaving the arm free to be restored by a spring 87 into normal retracted position where it bears against a transverse rod 88. When the parts 36 37 are in their inoperative position out of engagement with arm 42, they are located closely adjacent the arm so that in being moved into this position they do not release their engagement with the latch on the arm until they have reached almost the limit of their movement and the number key has become elevated to almost its normal position. This prevents actuation of the calculating mechanism by premature striking of the key a second time after it has once been depressed and before it has become elevated sufficiently to allow shifting of the carriage a space for permitting the writing of a second numeral, and also for connecting another number wheel with the operating mechanism by means of the rack.

The number-bearing keys of the typewriter machine are all depressed an equal and invariable amount without regard to the number written by them, and as the arms 42 are all of equal length and identical form, while all of the studs 40 are at the same distance from the axis of shaft 35, it follows that the segments on shaft 41 are also rotated through the same amount for each number. However, it is necessary that the number wheels or counters 53 should be turned varying amounts to correspond with the size of the number written, that is, a number wheel should be turned one space for the numeral one and so on up to nine spaces when the key bearing the numeral "9" is struck. For accomplishing this result, I provide mechanisms for turning the shaft 45 greater or less amounts, depending on the key which is struck, these mechanisms consisting of gear segments of different pitch and radii. The arm which is moved when the number one key is struck carries a gear segment of very short radius meshing with one carried by shaft 45 of long radius so that a comparatively small amount of rotation is given to shaft 45, which motion is communicated to the number wheels through the gearing previously described, while the arm which is operated when the number nine key is depressed carries a gear segment of greater radius, meshing with one of comparatively small radius on shaft 45, so proportioned that the latter shaft is turned through an angle nine times as great as that through which it is turned by the number one mechanism. The intermediate number connections are composed of gear segments on the shaft 41 regularly increasing in radius from 1 to 9, and meshing with cooperating segments on shaft 45, which are correspondingly and successively decreased in radial and circumferential extent. It will be understood from the foregoing that

each separate number or digit imparts an amount of movement corresponding to its value, to the number disks, through connections which include a driving member (arm 5 42 and segment 43) and a follower 44; that these driving members are given a motion of rotation which is uniform for all, whatever the numbers represented by them; and that drivers and followers are variously 10 proportioned so that varying amounts of rotation, corresponding to the values of the several numbers, are given to shaft 45 and thence to any one of the number wheels. Thereby the construction may be made the 15 simplest possible, troublesome adjustments avoided, and certainty of action and accuracy of result secured.

In the Remington typewriting machines, in one type of machine the lower case letter 20 "l" is used for the numeral one, while in another form of machine a separate number key is provided, but in either case the key which is used for writing "l" is at the extreme right of the machine relatively to 25 the other number keys, while the number two key is at the extreme left, the remaining keys being arranged in order up to the number nine key, which is adjacent the number one key on the left. In Figs. 3 and 6, the 30 gear segments 43 44 are operated by the number one key, while the segments 43^a 44^a are operated by the number nine key and illustrate the extremes in the proportions of these parts, the other segments being 35 in rear of segments 43^a 44^a, as seen in Fig. 3, and therefore not appearing in that figure. Fig. 6 shows only the mechanism governed by the number nine key.

Any suitable method and arrangement of 40 gearing may be employed for causing shaft 45 to be turned exact multiples of the amount of rotation given to it through the number one key, for the subsequent keys, but I have found the most convenient and ef- 45 fective arrangement to be to have the segments on shaft 45 which are operated through the number one and number two keys as portions of forty-eight toothed gears, 50 while the other segments are all portions of gears which if complete would each have twenty-four teeth, although the radii of these segments and their pitches are different. The movement given by studs 40 to 55 each arm 42 is such as to move each of the members on shaft 41 through one-eighth of a revolution and gear 43 is so proportioned that it moves segment 44 and shaft 45 through one-twenty-fourth of a revolution. The other arms and segments move shaft 45 60 through successively-increasing twenty-fourths of a revolution until segment 43^a; when rotated by the same amount, moves shaft 45 through nine twenty-fourths of a revolution, thereby producing at the count- 65 ers or number wheels nine times the motion

given them when operated by the number one key.

Each of the segments 44 44^a etc., is loose on shaft 45 but adjacent each is a ratchet-wheel 91 which is fast to the shaft and is 70 engaged by a pawl 92 carried by an arm 93 connected to the segment as previously described. It will thus be seen that the mechanism controlled by the key levers is adapted to move shaft 45 by successive increments 75 in one direction only. The hubs of gear segments 44 are properly spaced on shaft 45 by the collars 94.

In order to check the rotation of shaft 45 and prevent it from being carried too far 80 by its momentum, I provide a ratchet-wheel 96 fast on shaft 45 and mounted adjacent to it a pawl 97 fast on a transverse shaft 98 and normally held out of engagement with one of the teeth of the ratchet by a spring 85 99, (see Fig. 2 and dotted lines in Figs. 3 and 6). Also fast to shaft 98 are arms 100 extending toward shaft 45 and spaced to correspond with the members 44. Each of the latter carries an arm or stud 101 as 90 previously described, projecting outwardly therefrom in position to engage one of the arms 100 after the segment has been rotated a certain amount. These projections are arranged at varying angles with a fixed 95 line so that they will engage the arms 100 after varying amounts of rotation, and each projection is so arranged that it will engage its respective arm 100 and move pawl 97 100 into locking engagement with ratchet 96 at the time when the gear segment to which it belongs has been turned exactly the right amount to move the number disks proportionately to the number to be registered. 105 Another ratchet-wheel 102 (Fig. 10) is mounted fast upon shaft 45 having teeth engaged by a pawl 103 pivoted on shaft 98, preventing retraction of shaft 45, and permitting its rotation only in the direction in which it is impelled by the ratchets 91 and 110 segments 44.

From the foregoing it will be understood that when any number key is depressed, shaft 45 is turned through an amount proportionate to the number indicated by the 115 key and is locked in said position as long as the key remains depressed. Its motion is then communicated through gear 46 and either the train consisting of gears 49 and 51 or the gear 47 to shaft 48. When gear 120 46 is in the position shown in Figs. 2 and 4, it drives shaft 48 through idler 49 and pinion 51 in a forward direction or that direction in which successive numbers are added by the mechanism but when gear 46 125 is in engagement directly with gear 47, it drives shaft 48 in the opposite direction. To permit of such motion the gear is slid- ingly mounted on the shaft 45 and held in 130 rotative engagement therewith by a spline

104. It has its hub 105 formed with a groove 106 or other means by which a suitable shifting lever or connection may be engaged to move it from engagement with one of the gears 47 49 to engagement with the other. From shaft 48 movement is communicated to the number wheels by the selective mechanism already described, so that depression of any one of the keys may be made to actuate any one of the number wheels, depending on the position of the typewriter carriage, and consequently of that particular cam 74 which may be in engagement with one of the holders 59. By reason of the construction which causes the carrying wheel between a disk and its right-hand neighbor to be moved out of engagement at the time that any one of the driving pinions 63 is engaged with the disk, the addition may be begun with the extreme left-hand figure of the number to be written, since the particular number disk spaced to correspond with this figure (whether it be the extreme left hand, or "million" disk, or another) is connected through its pinion 63 with the mechanism operated by the number key by means of the appropriate cam 74 raising the holder 59, thereby throwing such pinion into gear with the disk and simultaneously throwing out the carrying wheel connecting this disk with the number disks at the right. Thereby this particular disk is free to be revolved in either direction without affecting the disks to the right and is consequently virtually the same as the first wheel in any train of registering wheels. The same is true of each succeeding wheel to the right as the writing progresses, for the carriage in its movement from right to left operates the cams and thus successively removes the direct connection of the operating mechanism with the number wheel at the left last engaged, at the same time moving its carrying wheel into engagement with it and the disk to the right, and connects the remaining number disks, one after another, with the driving mechanism while disconnecting the carrying wheels for the several respective disks. Thus whatever number wheel for the moment is connected to the operating mechanism is a first wheel, and all those at the left thereof are connected with it by the carrying wheels, whereby whenever the number wheel being actuated has brought its nine in addition, or zero in subtraction, opposite the indicator slot, the next actuation of the disk will cause the one at the left to be moved, while those at the right will not be disturbed at all, since the carrying wheel connected to them has been moved out of engagement. Thus, successive figures forming part of a number may be added by actuating the proper number wheel, beginning with one at the left and operating successive ones at the right, and the results al-

ready indicated by those at the left will be corrected by the carrying mechanism while the wheels at the right will be unaffected until the last one has been actuated. As the carrying mechanism previously described operates equally for movement of a number wheel in either direction, this mechanism provides for performing the operation of subtraction as well as addition. To perform subtraction the gear 46 is simply shifted into engagement with pinion 47, whereupon the direction of rotation of the disks when engaged by their appropriate driving pinion 63 is reversed. The operation thereupon is the same as in addition except that the difference between two numbers instead of their sum is indicated and only those wheels at the left of any number wheel being actuated are affected while those at the right remain stationary. This also enables the operator to correct mistakes for if a wrong numeral has been accidentally struck, the error can be quickly corrected by temporarily shifting the gear 46 into reversing position, operating the same key lever again to reverse the number wheel and bring it to its previous position, then erasing the incorrect impression on the paper and making the correct impression and addition. This same reversal for subtraction provides for the quick return of any or all of the number wheels to zero, when the result indicated by the number wheels will be written on the paper simultaneously with the return of these wheels to the zero position. This also affords a check on the work, for if the result has not been correctly written the inaccuracy will be indicated, since those wheels from which the result has been copied correctly will be at the zero position, while the ones from which the indication is incorrectly taken will occupy some other positions, from which the amount of the error can be readily determined and easily corrected.

Usually typewriting machines have on the same type-blocks and keys with the numerals also other symbols which are struck when the carriage is displaced by the shift key, and in order that the calculating mechanism may not be disturbed when the shift key is depressed to permit the other symbols on the number keys to be written, I have provided connections attached to the carriage-shaft mechanism for disconnecting the calculating mechanism from the keys. To this end the links 17 which communicate motion from the bell-cranks 11 12 to the arms 18 are detachably engaged with the latter arms by means of notches or open slots 107, (Fig. 5) each of which is arranged to engage with a pin 108 on the lower end of one of the arms 18. As may be seen from Fig. 2, the lower arms of the levers 18 are each formed with a central opening 109 and two side bars 110 into which opening and between

which bars the ends of the several links 17 are retained and guided. Fast on a shaft 111 at opposite sides of the frame are plates 112, (Fig. 3) each of which supports an end of each of the cross rods 113 114 extending from side to side of the apparatus, the first being above the links 17 while the second is below them, each being closely adjacent thereto. The link 115 is pivoted to one of the plates 112 and at its other end connected to a rocker 116 pivoted to the cross bar 10, which rocker by means of a link 117 is connected to a projecting arm 118 (Fig. 1) adjustably and detachably secured to the lever 120 to which is also connected the transverse shift rail 121 which moves the carriage into position to receive impressions from the upper case symbols carried by the type blocks. When the shift key is depressed lever 120 and arm 118 are moved to the left or toward the front, turning shaft 111 in left-hand rotation and bringing the rod 114 to bear on the under sides of the links 17, raising their notched ends out of engagement with the pins 108. When the shift key is released, spring 122, engaging a projection on link 115 moves the latter toward the rear and rotates plates 112 and shaft 111 in the opposite direction, bringing rod 113 to bear on the upper sides of links 17 and causing the latter again to engage the pins 108. In order that the links may be permanently disconnected by hand if desired, the shaft 111 is extended out through one side of the frame and is provided with an external hand-engaging member 124 which may be turned to bring rod 114 into position vertically above the shaft. A slot 125 in link 117 at the point of connection of the latter with arm 118 permits such movement without shifting the typewriter carriage.

Several of the indicators or number wheels 53 are simultaneously shifted, as when adding any number such as "6" to a number such as "99,999". The action will result in the shifting of these wheels so as to show "100,005". As the movement from one number wheel to another must be through the carrying means or devices 66, there is a slight lost motion through said carrying devices which prevents the numerals of the wheels 53 showing in perfect alinement. To overcome this objection, and to preserve the alinement of the indicators or number wheels, in spite of the liability of lost motion due to the carrying devices, I provide means for rotating the shaft 54 preferably at a speed somewhat greater than, and in the same direction as, the movement of the number wheels on said shaft when the number wheels are actuated. As has been explained, no number wheel is rotated excepting when the shaft 48 is actuated. A convenient means for transmitting

motion from the shaft 48 to the shaft 54 may comprise pinions 541 and 481 secured on the shafts 54 and 48 respectively, as indicated in Fig. 14. An intermediate pinion 482 connects the pinions 541 and 481 so that the shaft 54 will be rotated whenever the shaft 48 is actuated, and in the same direction of rotation as that of the shaft 48 and that of the number wheels. As indicated in Fig. 14, the respective sizes of the pinions 541 and 481 are such that the shaft 54 will be rotated at a higher speed than the shaft 48. Therefore, whenever a carrying takes place from one numeral wheel or disk to the next, the shaft 54 is rotated in the same direction as the number wheel or wheels and faster than they so that instead of there being a frictional retarding movement of the number wheels, such friction as may exist between the number wheels and the shaft 54 will tend to advance the number wheels as far as permitted by the carrying devices.

The number wheels 53 constitute computing indicators which are movable relatively to each other upon the shaft 54. The pinions 66 constitute the means which carry from one wheel 53 to another, and they also serve as locks which prevent any movement of a number wheel beyond the point to which it is intended that it shall be shifted. In the embodiment of the invention illustrated, each pinion 66 is mounted upon an arm 60 of a holder 59 and when said holder is oscillated, in the manner that has been described, the said carrying devices and lock 66 are shifted so that the connection between the two adjacent indicators or number wheels 53 is broken. But for this break of the connection it would be impossible to reverse the movement of the number wheels or indicators when it is desired to effect a subtraction in order to correct an erroneous addition.

From the foregoing it will be seen that I have provided a calculating machine, including in its construction a plurality of number-bearing members movable to present a number adjacent an indicator. In the particular embodiment of the invention illustrated in the accompanying drawings, said number-bearing members comprise the wheels 53, any number of any wheel being adapted to be brought to position to show through the slot 56, which constitutes the indicator. Also, in this particular embodiment of the invention, I have provided a plurality of manually controlled operating members 27, the manual control for said members 27 being through the key levers and the levers 11, links 17 and levers 18. Each of these members 27, when operated as described, causes the registration of a different number by a member or wheel 53 through the connection described from the shaft 35 to the shaft 48. The shaft 48 con-

stitutes a single driven member, since said member is driven through the connections from the shaft 35 and the gears 52 of said shaft 48 are, of course, controlled as to their operation by the said manually controlled members 27. The pinions 63, each of which is carried by an arm 61 of the holder 59, constitute connections between the driven member 48 and its gears, and the number-bearing members 53.

It will also be understood, that, in the embodiment of the invention illustrated, there is an independent normally inoperative connection between each of the manually controlled members and each of the number wheels, because the connection between each pinion 63 and the toothed portion of the respective number-bearing wheels is normally broken so as to be inoperative for the purpose of transmitting movement to a number wheel. Therefore, when the reversing device hereinbefore described is thrown into or out of gear, the normally inoperative connection referred to is also reversed in its movement when actuated.

I claim:—

1. A calculating machine having an indicator, a plurality of number-bearing members, movable to present a number adjacent the indicator, a single driven member, a plurality of manually-operated members controlling the action of said driven member, each adapted for operation to cause the registration of a different number, and a plurality of separate connections each connectible with the driven member and one of the number-bearing members and movable transversely of the driven member to make the connection.

2. A calculating machine having an indicator, a plurality of number-bearing members, movable to present a number adjacent the indicator, an independently-driven member; a plurality of manually-operated members controlling the action of said driven member, each adapted for operation to cause the registration of a different number, a plurality of separate connections normally out of connection with said number-bearing members, each movable transversely of the driven member to make connection between said driven member and one of said number-bearing members, and means for throwing in said connections successively.

3. A calculating machine having a plurality of number wheels, a plurality of manually-controlled members, each adapted to be operated to cause the registration of a different number, a plurality of similar independent connecting members between said manually-controlled members and each of the number wheels movable transversely of the axes of the latter into and out of operative connection, and carrying connections separate from said first connections between

each of said number wheels and the next adjacent wheel, each constructed and arranged so as normally to lock the next number wheel at the left against all movement.

4. A calculating machine having a plurality of number wheels, a plurality of manually-controlled members, each adapted to be operated to cause the registration of a different number, a plurality of similar independent, normally inoperative, connections between said manually-controlled members and each of the number wheels, connections between each of said number wheels and the next adjacent wheel, and means for throwing into operative position the connection between the manually-controlled members and one of said number wheels and simultaneously throwing out the connection between said wheel and the wheel at the right thereof.

5. A calculating machine having a plurality of number wheels, a plurality of manually-controlled members, each adapted to be operated to cause the registration of a different number, a single driven member, a plurality of independent normally inoperative connections engaged with said driven member and adapted to be engaged one with each of the number wheels, a reversing device adapted to be thrown into and out of gear for changing the direction of movement of said driven member, connections between each of said number wheels and the next adjacent wheel, and means for throwing into operative position the connection between the manually-controlled members and one of said number wheels and simultaneously throwing out the connection between said wheel and the wheel at the right thereof, whereby said number wheel may be moved in either direction.

6. A calculating machine having a plurality of number wheels, a plurality of manually-controlled members, each adapted to be operated to cause the registration of a different number, a single driven member, a plurality of independent normally inoperative connections engaged with said driven member and adapted to be engaged one with each of the number wheels, connections between each of said number wheels and the next adjacent wheel, and means for throwing into operative position one at a time the connections between said manually-controlled members and the number wheels and simultaneously throwing out the connection between the number wheel being operatively connected and the wheel at the right thereof, whereby each of said wheels may be operated independently.

7. A calculating machine having a plurality of number wheels, a plurality of manually-controlled members, each adapted to be operated to cause the registration of a different number, independent normally in-

operative connections between said manually-controlled members and each of the number wheels, said connections including a member adapted to be thrown into and out of gear for changing the direction of movement of said wheels, carrying connections between each of said number wheels and the next adjacent wheel, and means for throwing into operative position one at a time the connections between said manually-controlled members and the number wheels and simultaneously throwing out the carrying connection between the number wheel being operatively connected and the wheel at the right thereof, whereby each of said wheels may be operated independently in either direction.

8. A calculating machine comprising a series of number wheels, a single shaft, separate and independent driving means for each of said number wheels intermediate said shaft and number wheels, whereby the wheels may be operated by rotation of the shaft, said driving means being normally out of engagement, connections between adjacent number wheels and normally in engagement therewith, and means arranged to throw into operative engagement the driving means between the shaft and one of said number wheels and simultaneously disconnect the connection between said number wheel and the adjacent wheel at the right thereof.

9. A calculating machine comprising a series of number wheels, a single shaft, driving means intermediate said shaft and each of said number wheels, whereby the wheels may be operated by rotation of the shaft, said driving means being normally out of engagement and movable into and out of engagement perpendicularly to the axis of said shaft, connections between adjacent number wheels and normally in engagement therewith, and means arranged to throw into operative engagement the driving means between the shaft and one of said number wheels, the connection between such number wheel and the next adjacent wheel at the right thereof being connected to said driving means in such manner as to be moved out of engagement with the number wheel while the driving means is placed in operative position.

10. A calculating machine comprising a series of number wheels, a shaft adjacent said wheels, means connected to turn said shaft proportionately to the amounts of numbers to be indicated, a holder, an intermediate driving connection carried by said holder adapted to be interposed in engagement with said shaft and one of the number wheels, and a carrying connection mounted on said holder adapted to be engaged with said number wheel and an adjacent number wheel, said holder and connections being ar-

ranged to throw one connection out of engagement with a number wheel when the other is engaged therewith.

11. A calculating machine comprising a series of number wheels, a shaft adjacent said wheels, means connected to turn said shaft proportionately to the amounts of numbers to be indicated, a holder, an intermediate driving connection carried by said holder adapted to be interposed in engagement with said shaft and one of the number wheels, and a carrying connection mounted on said holder adapted to be engaged with said number wheel and the next adjacent number wheel of lower order, said holder and connections being constructed and relatively arranged so that, when the holder is actuated to bring one of said connections into engagement with a number wheel, the other connection is moved out of engagement with the wheel.

12. A calculating machine comprising a series of number wheels, a shaft adjacent said wheels, means for turning said shaft proportionately to the amounts of the numbers to be indicated, a holder carrying an intermediate driving connection adapted to be interposed in engagement with said shaft and one of the number wheels, and a second holder carrying an intermediate driving connection adapted to be placed in engagement with said shaft and another number wheel, a connection carried by said second member arranged to engage said last-named number wheel and an adjacent number wheel, and means for moving said driving connections successively into operative position.

13. A calculating machine comprising a series of number wheels, a shaft adjacent said wheels, means for turning said shaft proportionately to the amounts of the numbers to be indicated, a holder carrying an intermediate driving connection adapted to be interposed in engagement with said shaft and one of the number wheels, and a second holder carrying an intermediate driving connection adapted to be placed in engagement with said shaft and another number wheel, a connection carried by said second member arranged to engage said last-named number wheel and an adjacent number wheel, yielding means tending to hold said driving connections out of operative position, and means for moving said driving connections successively into operative position.

14. In a calculating machine, a plurality of disks bearing each a series of numbers and each having a toothed portion, a shaft having a plurality of gears, holders movably mounted adjacent the number-bearing disks, a pinion pivoted to each of said holders, each pinion being in mesh with one of said gears and adapted to engage the toothed portion of one of said disks, and connectors carried

by said holders and arranged each to engage portions of two adjacent disks.

15. In a calculating machine, a plurality of disks bearing each a series of numbers and each having a toothed portion, a shaft having a plurality of gears, holders movably mounted adjacent the number-bearing disks, pinions pivoted each to one of said holders in the same plane with one of said gears and the toothed portion of one of said disks and adapted to be brought in mesh therewith, connectors carried by said holders and arranged each to engage portions of two adjacent disks, springs tending to hold said pinions out of, and said connectors in, engagement with said disks, and mechanism for moving the pinions and connectors in opposition to the springs.

16. In a calculating machine, a plurality of disks bearing each a series of numbers and each having a toothed portion, a shaft having a plurality of gears, holders movably mounted adjacent the number-bearing disks, a pinion pivoted to each of said holders each pinion being in the same plane with one of said gears and the toothed portion of one of said disks and adapted to be brought in mesh therewith, connectors carried by said holders and arranged each to engage portions of two adjacent disks, means engaged with said holders tending to hold them in position with said pinions out of, and said connectors in, engagement, and mechanism for moving the pinions and connectors in opposition to said holding means.

17. In a calculating machine, a plurality of disks bearing each a series of numbers and each having a toothed portion, a shaft having a plurality of gears, holders pivotally mounted on said shaft, each of said holders carrying a pinion in the same plane with one of said gears and the toothed portion of one of said disks and mounted for movement to bring the pinion into meshing engagement therewith, yielding means tending to retain said holders with their pinions disconnected from said disks, and mechanism for moving the holders to bring the pinions into engagement with the disks.

18. In a calculating machine, a plurality of disks bearing each a series of numbers and each having a toothed portion, a shaft having a plurality of gears, holders pivotally mounted on said shaft, each of said holders carrying a pinion in the same plane with one of said gears and the toothed portion of one of said disks meshing with one of the gears, carrying wheels mounted on said holders each arranged to engage two adjacent number disks and adapted to transmit motion from one to the other, yielding means tending to retain said holders with their pinions disconnected from said disks and the carrying wheels engaged therewith, and mechanism for moving the holders to bring the

pinions into engagement with the disks and to move the carrying wheels out of engagement therewith.

19. In combination with the carriage of a typewriting machine, a calculating attachment for typewriting machines comprising a plurality of number-bearing disks, a shaft, a plurality of intermediate driving connections movable independently into and out of operative engagement with the shaft and disks, and mechanism adapted to be operated by the typewriter carriage for placing said several connections successively in such operative engagement.

20. In combination with the carriage of a typewriting machine, a calculating attachment for typewriting machines comprising a plurality of number-bearing disks, a shaft, a plurality of intermediate driving connections movable independently into and out of operative engagement with the shaft and disks, and mechanism adapted to be operated by the typewriter carriage for placing said several connections successively in such operative engagement, said mechanism being formed and arranged to permit movement of the carriage between successive actuations of said intermediate connections without actuating the same.

21. In a calculating apparatus, a plurality of number-bearing disks, mechanism for turning said disks, said mechanism including driving connections adapted to be moved into and out of engagement with the several disks, a cam shaft, and cams mounted thereon and arranged to engage and move said connections successively into engagement with said disks.

22. In a calculating apparatus, a plurality of number-bearing disks, a driving shaft connected for actuation by amounts proportionate to the numbers to be calculated, a plurality of connections equal in number to the disks arranged for movement to complete and interrupt an operative driving connection between the disks and shaft, a cam shaft, and cams mounted thereon, there being one cam arranged to engage each one of said connections to move the same into operative engagement.

23. In a calculating apparatus, a plurality of number-bearing disks, a driving shaft connected for actuation by amounts proportionate to the numbers to be calculated, a plurality of connections equal in number to the disks arranged for movement to complete and interrupt an operative driving connection between the disks and shaft, a cam shaft, and cams mounted with capabilities of angular adjustment thereon, there being one cam arranged to engage each one of said connections to move the same into operative engagement.

24. In a calculating attachment for a typewriting machine having a carriage, a

plurality of number-bearing disks, a driving shaft connected for actuation by amounts proportionate to the numbers to be calculated, a plurality of connections
 5 equal in number to the disks arranged for movement to complete and interrupt an operative driving connection between the disks and shaft, a cam shaft, cams mounted thereon, there being one cam arranged to engage
 10 each one of said connections to move the same into operative engagement, and means adapted to be carried by the carriage of the typewriting machine to connect with and rotate said shaft on movement of said
 15 carriage.

25. In a calculating attachment adapted for connection with a typewriting machine having a carriage, a plurality of number-bearing disks, a driving shaft connected for
 20 actuation by amounts proportionate to the numbers to be calculated, a plurality of connections equal in number to the disks arranged for movement to complete and interrupt an operative connection between the
 25 disks and shaft, a cam shaft, cams mounted thereon, there being one cam arranged to engage each one of said connections to move the same into operative engagement, gearing in engagement with said shaft, and a
 30 toothed member adapted to be carried by the carriage of the typewriting machine to mesh with and operate said gearing.

26. In combination with a typewriting machine and the carriage thereof, a calculating attachment comprising a plurality of
 35 number-bearing disks, a driving shaft connected for actuation by amounts proportional to the numbers to be calculated, a plurality of connections equal in number to the disks arranged to be moved into and
 40 out of operative engagement with the disks and shaft, a cam shaft, cams mounted thereon, there being one cam arranged to engage each one of said connections to move the
 45 same into operative engagement, gearing in engagement with said shaft, and a toothed member connected to and moved by said carriage and adjustably mounted to mesh with and operate said gearing.

27. A calculating machine comprising a plurality of manually-operated members, each adapted to be actuated to cause indication of a different number, a shaft, driving
 50 means for said shaft including an independent actuator controlled by the manually-operated members and a driving and a cooperating following member for each number to be indicated, all of said driving members
 55 being arranged for a uniform amount of travel and said following members being of different proportions, whereby varying amounts of motion corresponding to the values of the several numbers are given
 60 them, and number-bearing index elements operated by said following members.
 65

28. A calculating machine comprising a plurality of manually-operated members, each adapted to be actuated to cause indication of a different number, a shaft, driving
 70 means for said shaft independently actuated under the control of the manually-operated members and including a driving and a cooperating following member for each number to be indicated, all of said driving
 75 members being arranged for a uniform amount of rotary motion and said several driving and following members being of different proportions, whereby varying amounts of rotary motion corresponding to the values of the several numbers are given
 80 them, and number-bearing index elements operated by said following members.

29. A calculating apparatus comprising number-bearing disks, manually controlled
 85 mechanism for causing indication of the numbers to be calculated, and mechanism arranged to turn said number disks independently actuated under the control of said manually-controlled members, said
 90 mechanism including drivers having all the same amount of travel and being of different proportions for turning the disks variable amounts according to the numbers indicated by said manually-operated members.

30. A calculating apparatus comprising
 95 a plurality of manually-operated members, each adapted to be operated to cause the indication of a different number, a shaft, driving means for said shaft independently actuated under the control of the manually-
 100 operated members and including members all having the same amount of angular movement and of different proportions for causing rotation of said shaft through amounts proportionate to the numbers in-
 105 dicated by said respective manually-controlled members, number disks, and movable connections adapted to be interposed between said shaft and each of said number wheels independently.
 110

31. In a calculating apparatus comprising a plurality of members each adapted to be manually operated to cause the indication of a different number, a shaft, and a plu-
 115 rality of intermediate driving members independently actuated each under the control of one of said manually-operated members to move said shaft, said driving members all having a uniform amount of travel, and being of varying radii constructed so
 120 that each may produce an amount of motion in said shaft proportional to the number of its particular manually-controlled operating member.

32. In a calculating apparatus, a plu-
 125 rality of members each adapted to be manually operated to cause the indication of a different number, a shaft, a plurality of intermediate driving members for moving said shaft, and continuously-moving members
 130

each under the control of one of said manually-operated members and arranged to be moved thereby into and out of operative connection with one of said intermediate driving members for operating the same and thereby the shaft, the several intermediate members being proportioned to drive the shaft through varying distances.

33. In a calculating apparatus comprising a plurality of members each adapted to be manually operated to cause the indication of a different number, a shaft, a plurality of intermediate driving members, continuously-moving devices controlled by the manually-operated members for actuating the driving members to move said shaft, said driving members all being arranged to move through the same angle and being of varying radii constructed so that each may produce an amount of motion in said shaft proportional to the number of its particular manually-controlled operating member, and locking means operated by each of said intermediate driving members to engage said shaft and arrest movement thereof at the end of the movements of the driving members.

34. In a calculating apparatus, a plurality of members each adapted to be manually operated to cause the indication of a different number, a shaft, a plurality of intermediate driving members for moving said shaft, continuously-moving members each under the control of one of said manually-operated members and arranged to be moved thereby into and out of operative connection with one of said intermediate driving members for operating the same and thereby the shaft, the several intermediate members being proportioned to drive the shaft through varying distances, and locking means operated by each of said intermediate driving members to engage said shaft and arrest movement thereof at the end of the movements of the driving members.

35. In a calculating apparatus, nine members each adapted to be manually operated to cause the indication of a different number, the numbers running from one to nine, a shaft, a plurality of intermediate driving members for moving said shaft, and continuously-moving members each under the control of one of said manually-operated members and arranged to be moved thereby into and out of operative connection with one of said intermediate driving members for operating the same and thereby the shaft, the several intermediate members being proportioned to drive the shaft through varying distances according to the numbers indicated by the manually-operated members.

36. In a calculating machine, members each adapted to be manually operated to

cause the indication and calculation of a separate number, the numbers running from one to nine, a shaft, gear segments connected to rotate said shaft in one direction, said segments being of varying radii and equal in number to the aforesaid members, intermeshing-gear segments mounted adjacent said first segments and varying inversely in radius, and mechanism controlled by the manually-operated members for separately driving said last-named segments.

37. In a calculating machine, members each adapted to be manually operated to cause the indication and calculation of a separate number, the numbers running from one to nine, a shaft, intermediate driving members equal in number to the manually-operated members connected to turn said shaft in one direction, continuously-driven means normally out of engagement with said intermediate members and adapted to be moved into operative connection therewith by the manually-operated members to actuate the intermediate members and thereby the shaft, the intermediate members including gear trains of varying values proportioned to the numbers indicated by the respective manually-operated members through which their operation is controlled, whereby the shaft may be turned proportionately to the value of the number indicated by any one of the respective manually-operated members.

38. In a calculating apparatus, a shaft, driving means therefor including independent gear trains of varying values, a continuously-moving shiftable member located adjacent each of said driving means, and a plurality of manually-operated members, each having a connection with one of said continuously-moving members for shifting the same into operative engagement with the respective adjacent shaft-driving means, the manually-operated members being arranged to be moved an invariable amount for registering different numbers, and said gear trains being proportioned to cause varying amounts of motion in said shaft corresponding to the numbers represented by the several manually-operated members.

39. In a calculating apparatus, a shaft, driving means therefor including independent gear trains of varying values, a continuously-moving shiftable member located adjacent each of said driving means, a plurality of manually-operated members, each having a connection with one of said continuously-moving members for shifting the same into operative engagement with the respective adjacent shaft-driving members and each of said connections including an arresting device arranged to engage and hold a portion of the shaft-driving means engaged by its respective continuously-mov-

ing member until the manually operated means has been returned to inoperative position.

40. In a calculating apparatus, a shaft, 5 toothed segments of varying lengths loosely mounted thereon, a one-way acting driving connection between each of said segments and the shaft, a second shaft parallel to the 10 first shaft, levers loosely mounted thereon, each lever having a toothed arm engaged with one of the segments, the said lever arms being of lengths varying inversely to the 15 lengths of the segments, a plurality of manually-operated members adapted to be actuated by an invariable amount to cause the registration of different numbers, and mechanism controlled by said manually-operated 20 members for moving said levers equal amounts to cause variable amounts of rotation of said first shaft.

41. In a calculating apparatus, a shaft, toothed segments of varying lengths loosely 25 mounted thereon, a one-way acting driving connection between each of said segments and the shaft, a second shaft parallel to the first shaft, levers loosely mounted thereon, each lever having a toothed arm engaged with one of the segments, the said lever arms 30 being of lengths varying inversely to the lengths of the segments, a plurality of manually-operated members adapted to be actuated by an invariable amount to cause the registration of different numbers, mechanism controlled by said manually-operated 35 members for moving said levers equal amounts to cause variable amounts of rotation of said first shaft, a ratchet mounted on said first shaft, a pawl mounted adjacent the ratchet, a plurality of arms connected 40 to said pawl, and means connected to each of said segments arranged to engage one of said pawl-connected arms at the conclusion of the driving movements of the respective segments to lock the pawl with said ratchet. 45

42. In a calculating apparatus, a shaft, toothed segments of varying lengths loosely 50 mounted thereon, a one-way acting driving connection between each of said segments and the shaft, a second shaft parallel to the first shaft, levers loosely mounted thereon, each lever having a toothed arm engaged with one of the segments, the said lever arms 55 being of lengths varying inversely to the radial lengths of the segments, a plurality of manually-operated members adapted to be actuated by an invariable amount to cause the registration of different numbers, mechanism controlled by said manually-operated 60 members for moving said levers equal amounts to cause variable amounts of rotation of said first shaft, a ratchet mounted on said first shaft, a pawl mounted adjacent the ratchet, a plurality of arms connected to 65 said pawl, means connected to each of said segments arranged to engage one of said

pawl-connected arms at the conclusion of the driving movements of the respective segments to lock the pawl with said ratchet, and means connected to said first shaft to resist reverse movement thereof. 70

43. In a calculating apparatus, a continuously-rotatable shaft, disks having a rotatable and longitudinally-slidable engagement therewith, pivoted levers, one being 75 adjacent each disk, pins projecting from the disks toward the respective levers and normally out of engagement therewith, laterally-movable members engaged with said disks, a stop and a locking device carried 80 by each of said members, a plurality of manually-operated members each connected to one of said laterally-movable members and constructed to shift the same laterally when operated and thereby move the stop 85 and locking device carried thereby and one of the disks and its pins into position to engage portions of one of said levers.

44. In a calculating machine, a plurality of levers adapted to be manually operated 90 for causing the indication of different numbers, laterally-inclined cam members connected to said levers, laterally-movable driving means engaged with said cam members, and calculating mechanism adjacent said 95 driving means and normally out of connection therewith, said driving means being arranged to be moved laterally into engagement with said calculating mechanism upon actuation of the levers.

45. In combination with the number keys 100 and carriage shift mechanism of a typewriting machine, a calculating attachment for typewriting machines comprising calculating mechanism, links adapted to be operatively connected to said number keys and 105 detachably engaged with portions of the calculating mechanism, and means adapted to be connected to the shift mechanism of the typewriting machine and operated thereby 110 for disengaging the links from the calculating mechanism.

46. In combination with the number keys of a typewriting machine, a calculating attachment for typewriting machines 115 comprising calculating mechanism having controlling levers, each of said controlling levers provided with a laterally-extending engaging portion, a plurality of links each having at one end an operative connection with one of said number 120 keys and at its other end a notch adapted to engage said laterally-extending portion of one of said controlling levers, and a disengaging device for said links comprising a bar extending under the links, and a 125 holder therefor movable to raise the bar so as to engage the links and lift their notched ends out of connection with the levers.

47. In combination with the number keys, carriage, and carriage-shift mechanism 130

ism of a typewriting machine, a calculating attachment for typewriting machines comprising calculating mechanism having controlling levers, each of said controlling levers provided with a laterally-extending engaging portion, a plurality of links each having at one end an operative connection adapted to be engaged with one of the number keys and at its other end a notch adapted to engage said laterally-extending portion of one of said controlling levers, a disengaging device for said links arranged to engage the links and lift their notched ends out of connection with the levers, and an operating connection for said device adapted to be engaged with the carriage shift mechanism.

48. A calculating machine having a plurality of number-bearing wheels, a shaft on which said wheels are freely mounted, means for carrying from one wheel to another, means for actuating each of the wheels independently and means for rotating said shaft in the same direction as that of a wheel whenever a wheel is actuated.

49. A calculating machine having a plurality of number-bearing wheels, a shaft on which said wheels are freely mounted, means for carrying from one wheel to another, and means for rotating said shaft in the same direction as, and at a higher speed than, the direction of movement of any number wheel when the latter is actuated.

50. In a calculating apparatus, a train of movable computing indicators including means for carrying from one to another, said carrying means being movable to and from carrying position, and actuators for said indicators movable simultaneously with said carrying means from and to actuating position.

51. In a calculating apparatus, a train of movable computing indicators including means for carrying from one to another, and an individual actuator for each indicator, said carrying means and indicators being relatively movable to and from carrying position, and said actuators and indicators relatively movable simultaneously therewith from and toward actuating position, whereby the carrying connections between the indicators may be broken when the actuating connection with one of them is made.

52. In a calculating apparatus, a train of movable computing indicators including combined carrying devices and locks between said indicators, separate actuators for the several indicators and means whereby the connection between the actuators may be made and at the same time that between the indicators and combined carrying devices and locks may be broken.

53. In a calculating apparatus, a plurality of members, each actuatable manually to cause indication of numbers, a shaft, a plurality of intermediate driving connections for moving said shaft distances proportional to the numbers to be calculated, and drivers adjacent, but out of contact with the driving connections there being one driver for each of said connections, one of said connections being brought into relation for actuation by one of the drivers whenever a manual member is actuated.

In testimony whereof I have affixed my signature, in presence of two witnesses.

EDWARD H. PALMER.

Witnesses:

C. F. BROWN,
A. C. RATIGAN.