F. J. TILLMAN.

CALCULATING ATTACHMENT FOR TYPE WRITING MACHINES.

APPLICATION FILED JULY 8, 1907.

913,859.

Patented Mar. 2, 1909.

11 SHEETS—SHEET 1.

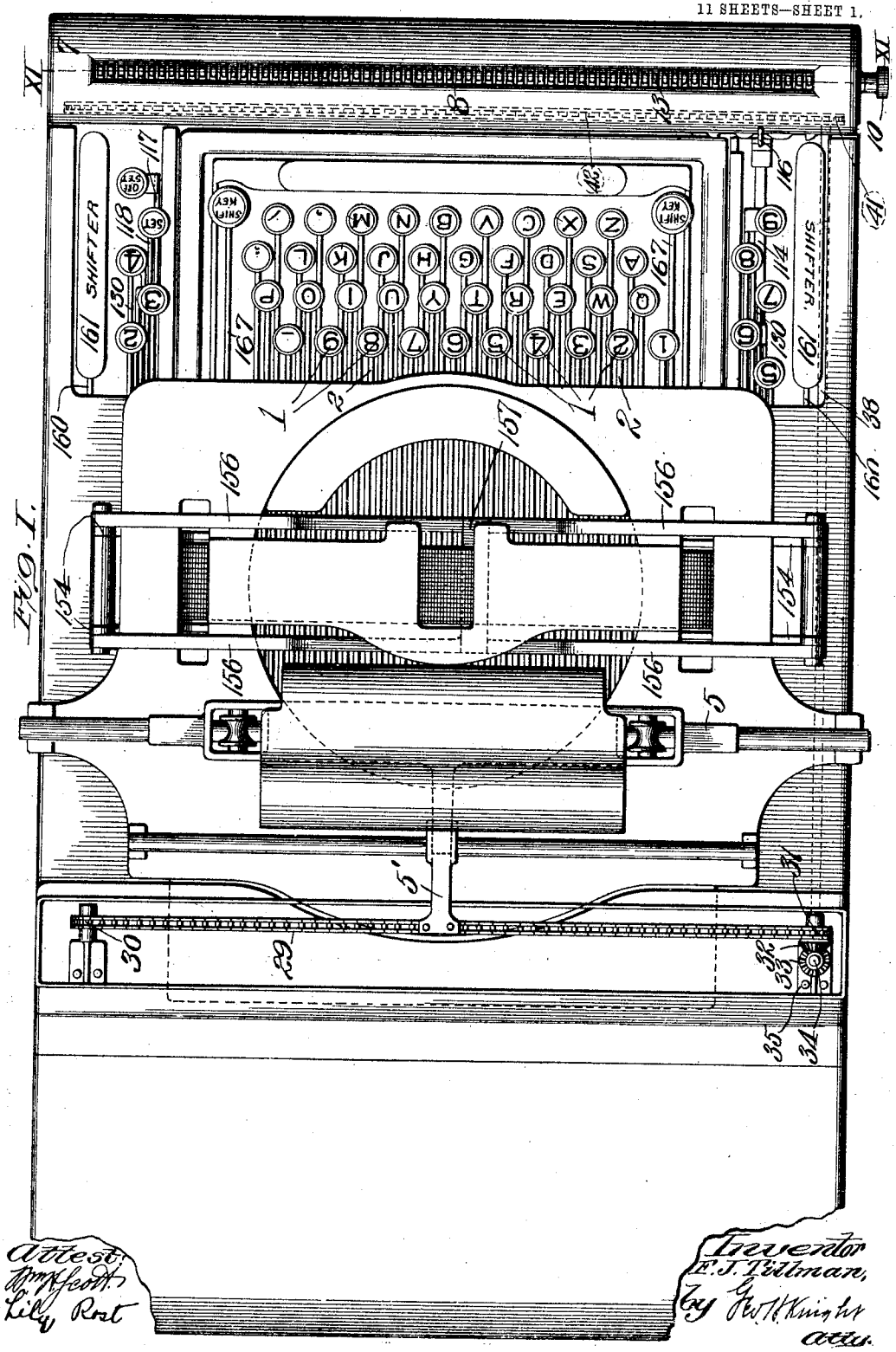

FIG. 1.

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11 SHEETS—SHEET 2.

Fig. II.

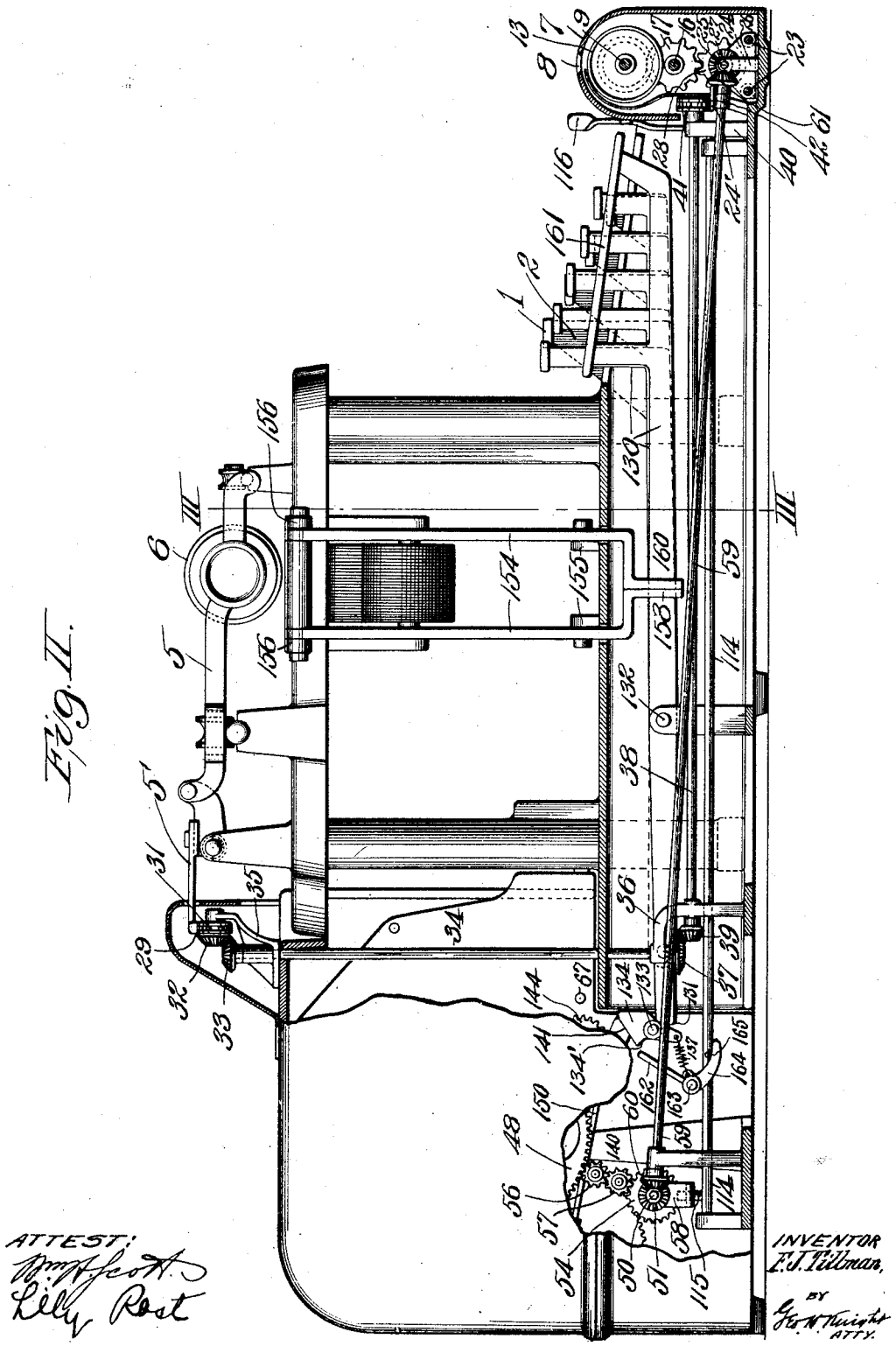

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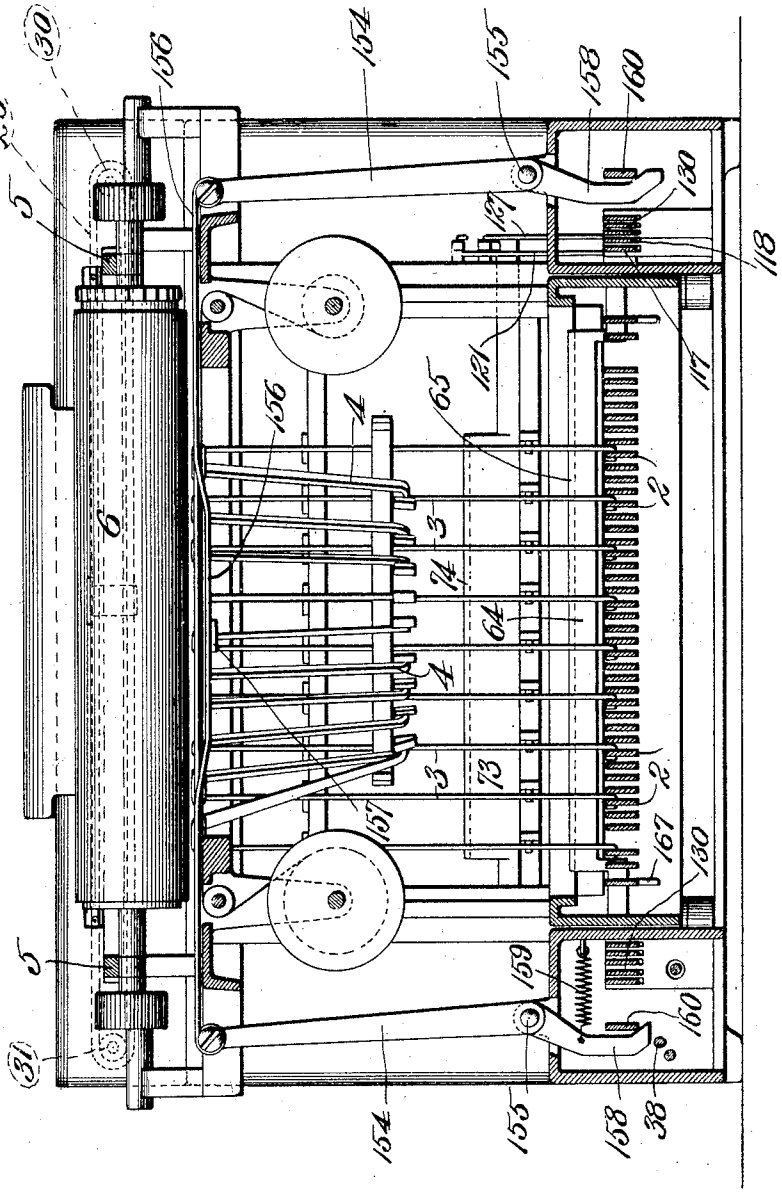
Fig. III.



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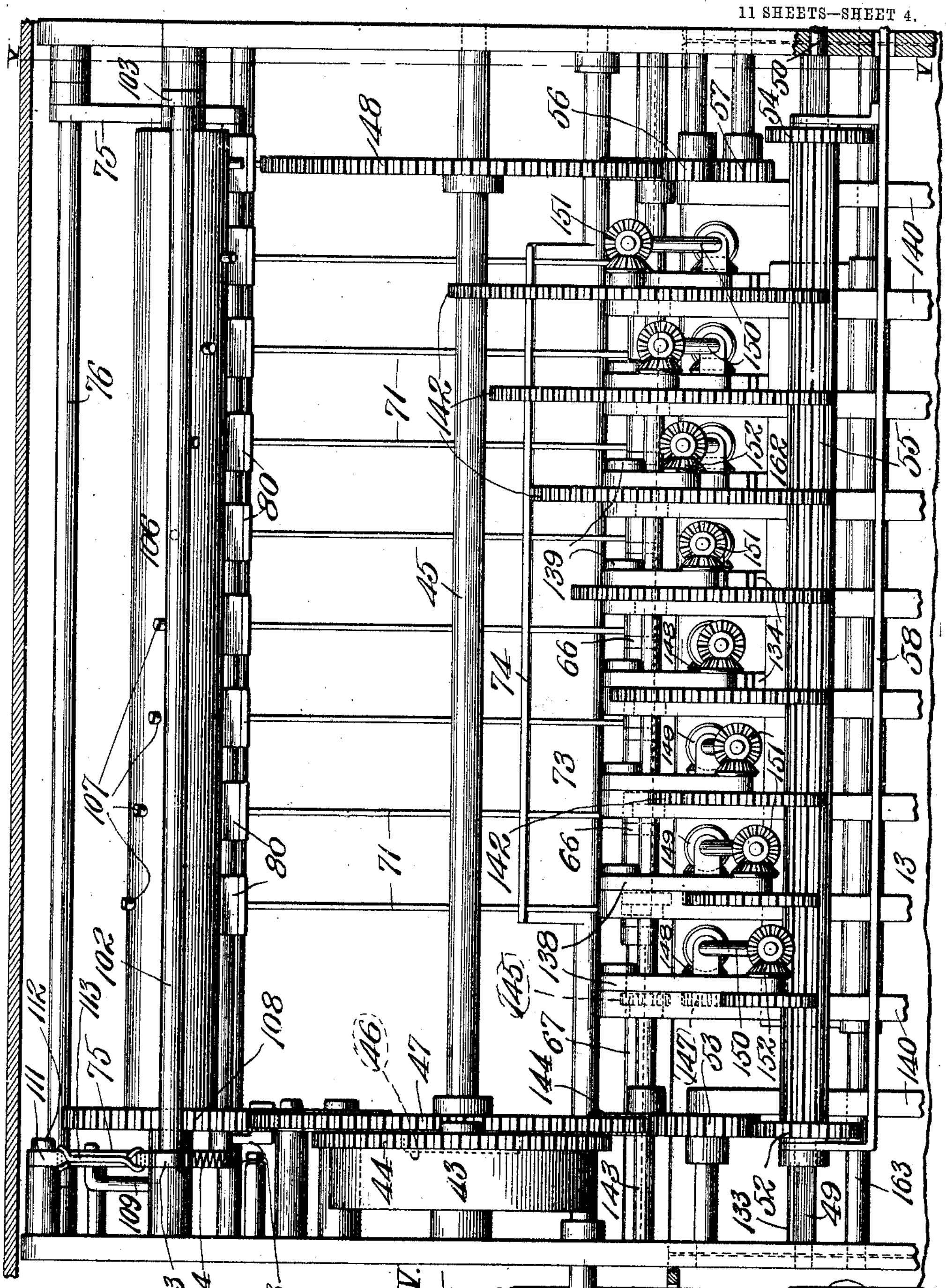

Fig. IV.

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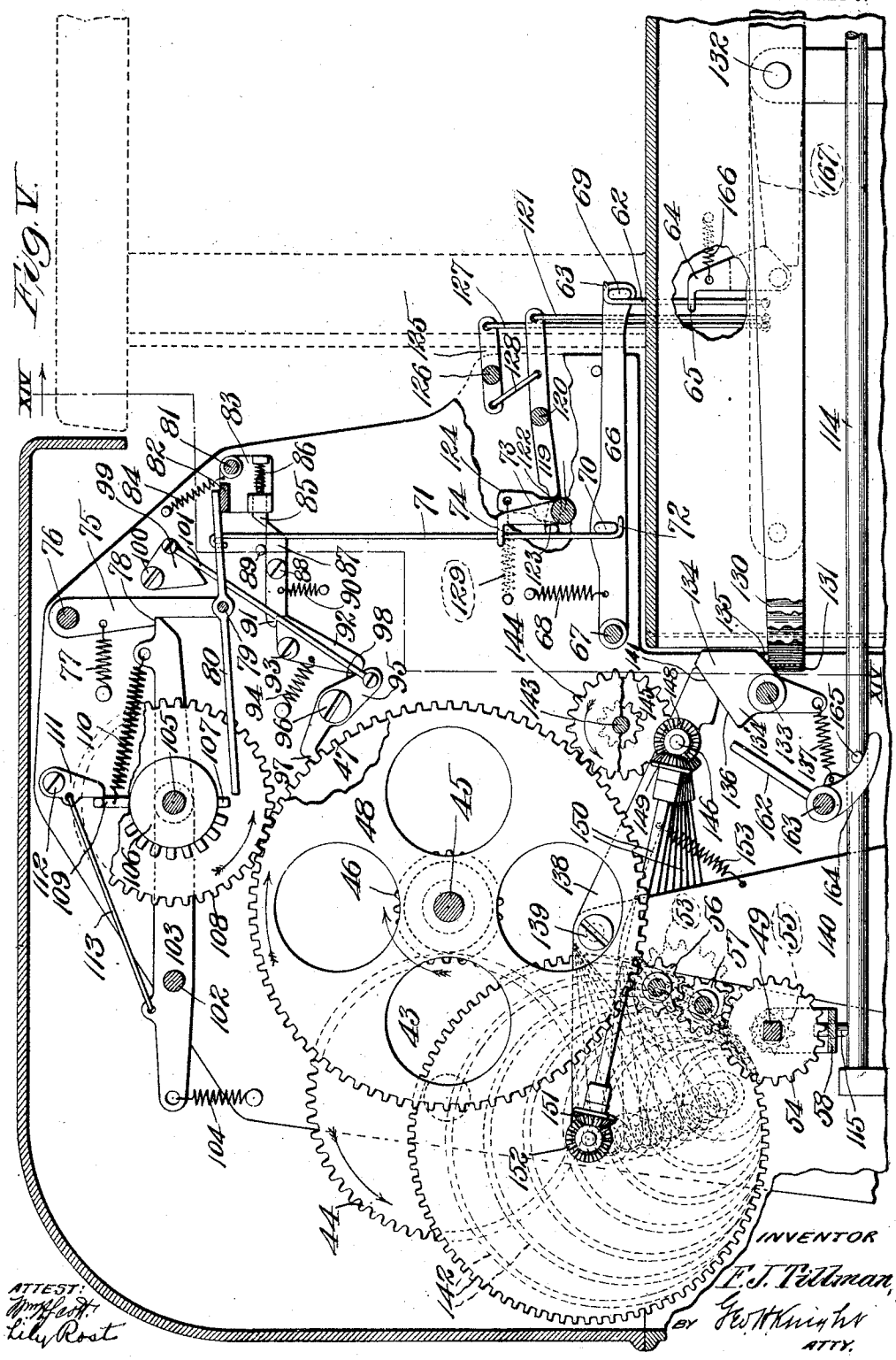
11 SHEETS—SHEET 5.

Fig. V.



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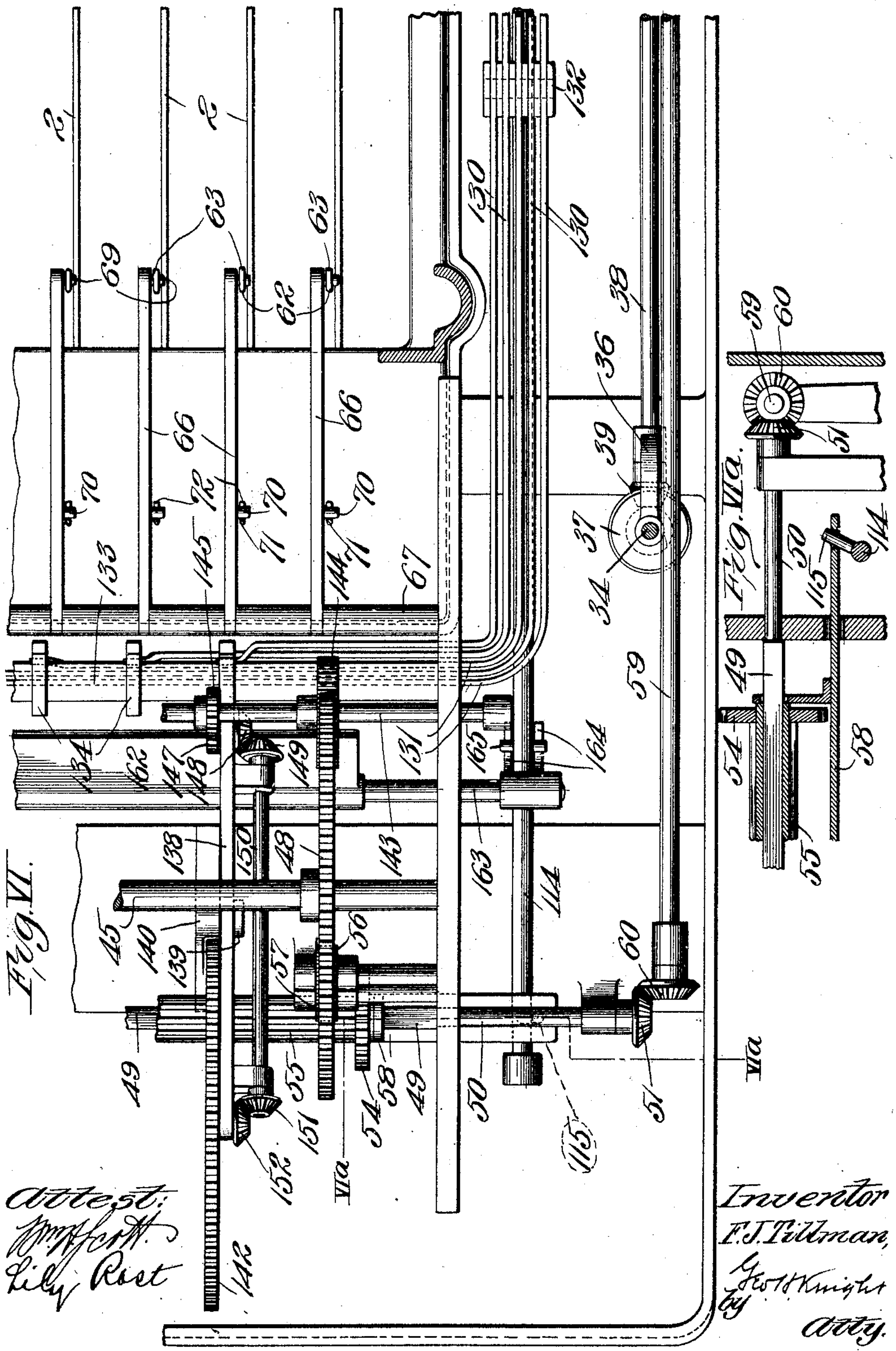

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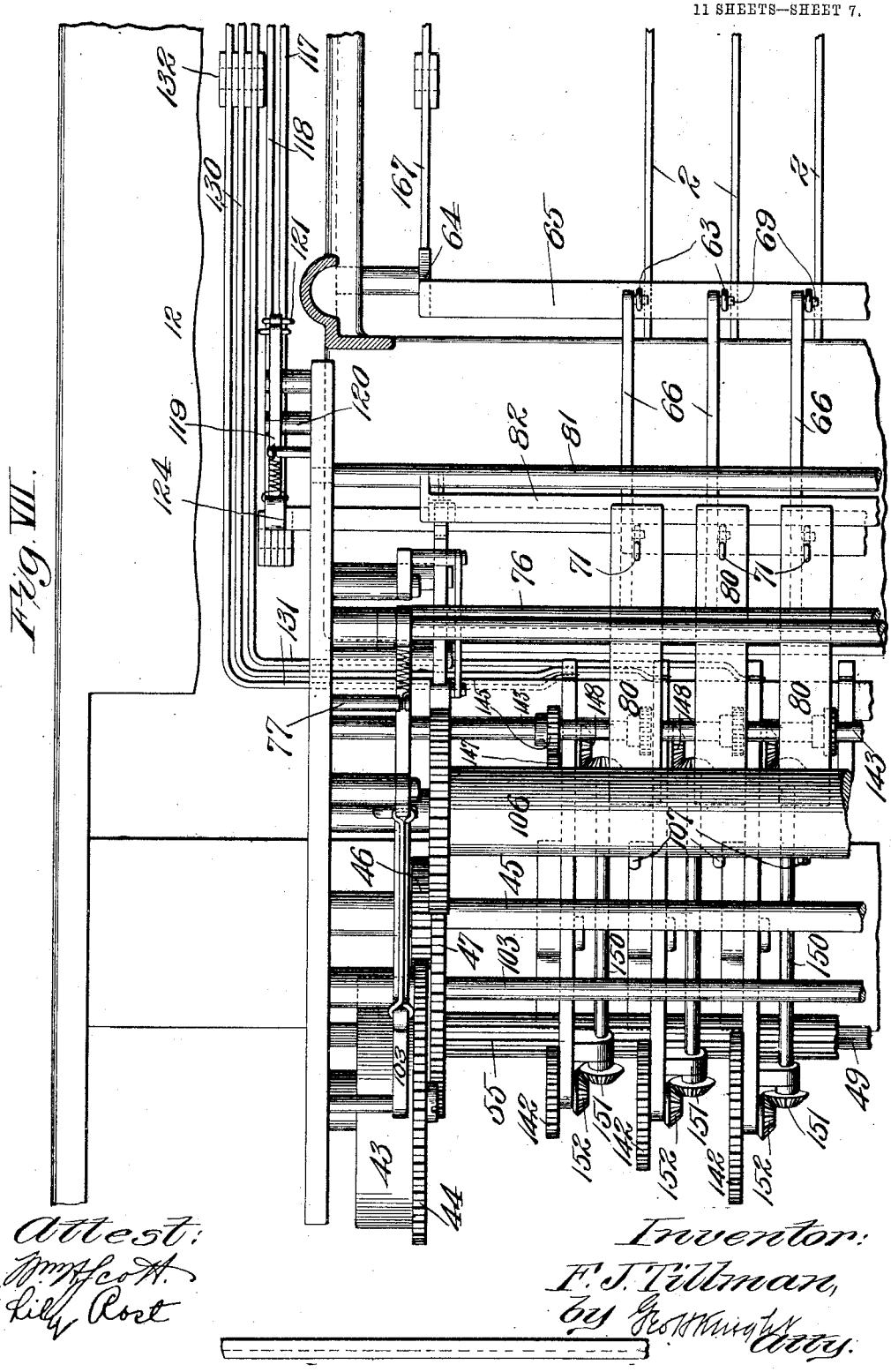
11 SHEETS—SHEET 7.

Fig. VII.



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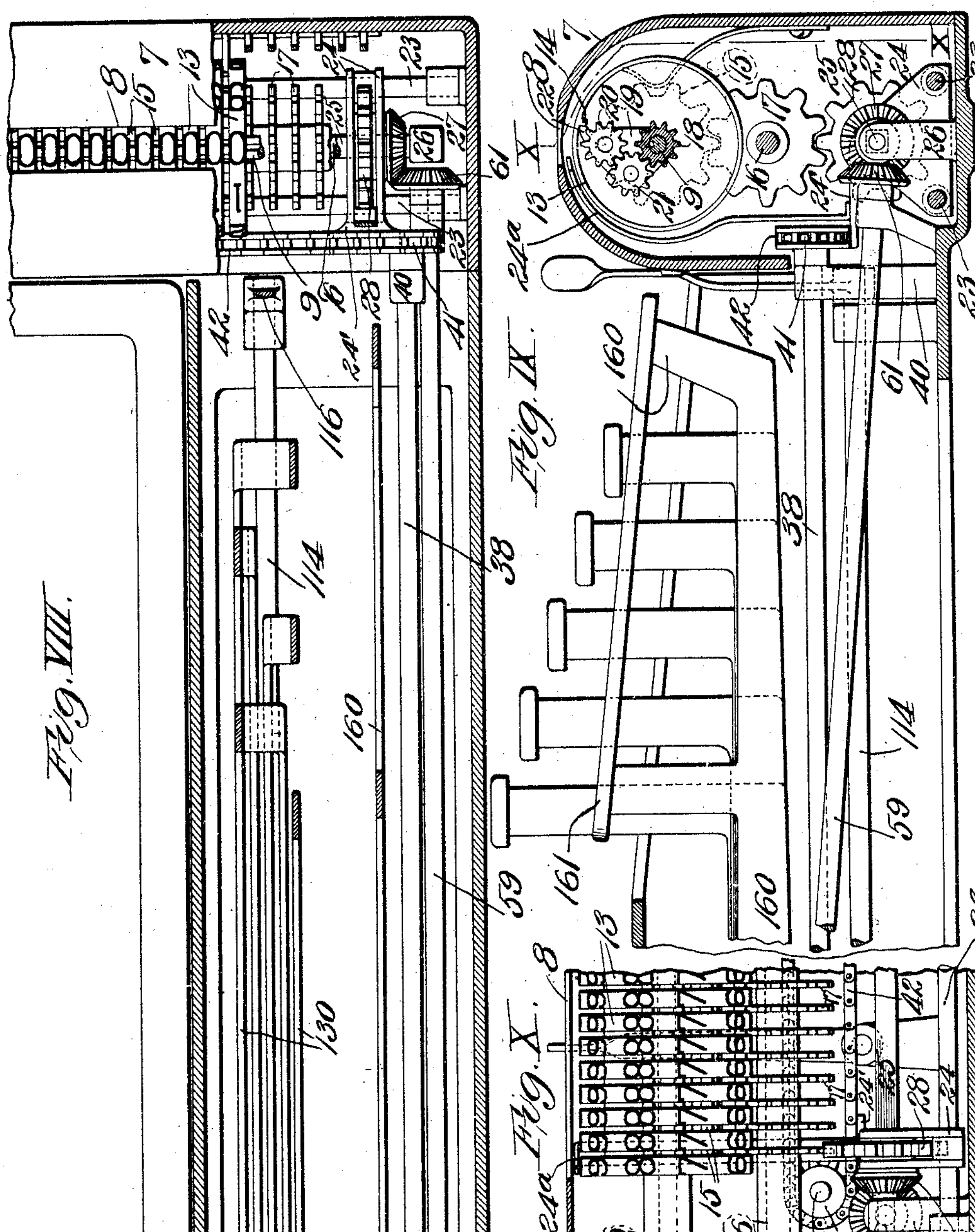
11 SHEETS—SHEET 8.



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CALCULATING ATTACHMENT FOR TYPE WRITING MACHINES.

APPLICATION FILED JULY 8, 1907.

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11 SHEETS—SHEET 9.

Fig. XI.

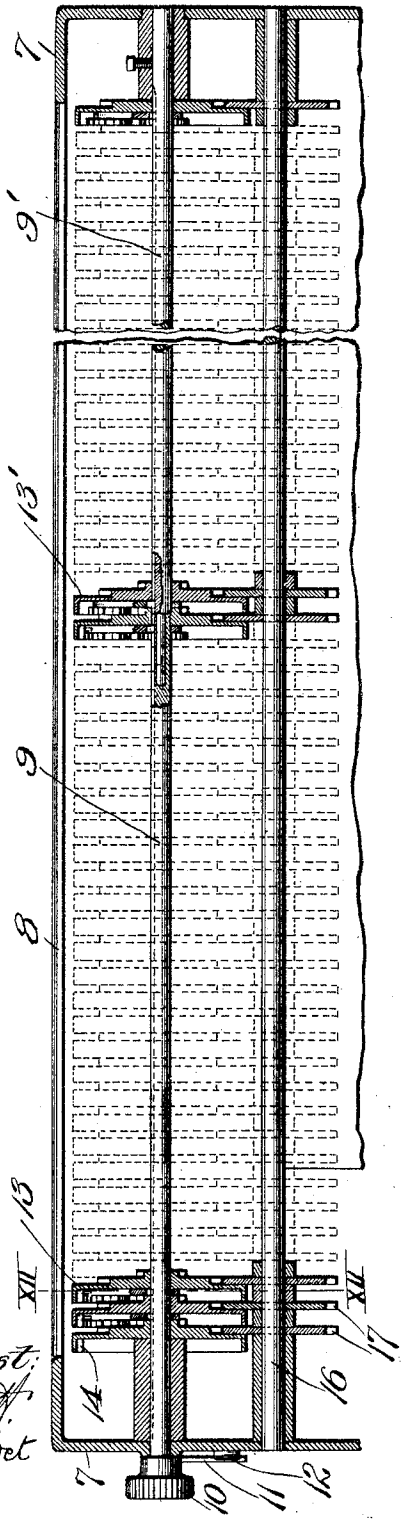


Fig. XIII

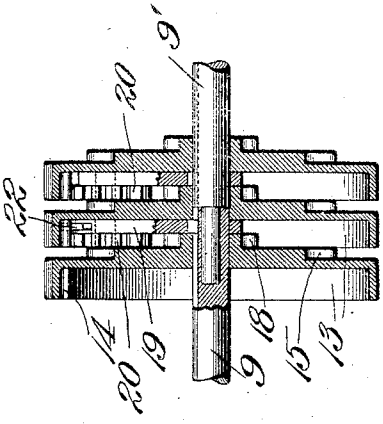
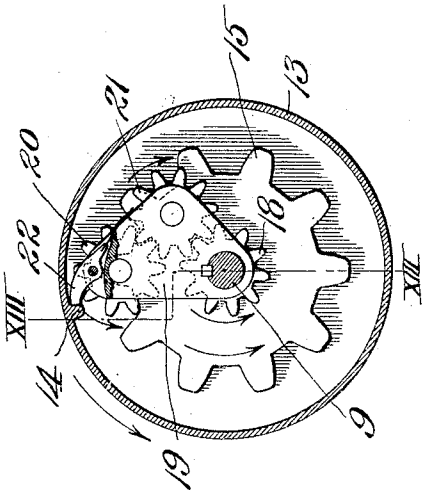


Fig. XII.



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11 SHEETS—SHEET 10.

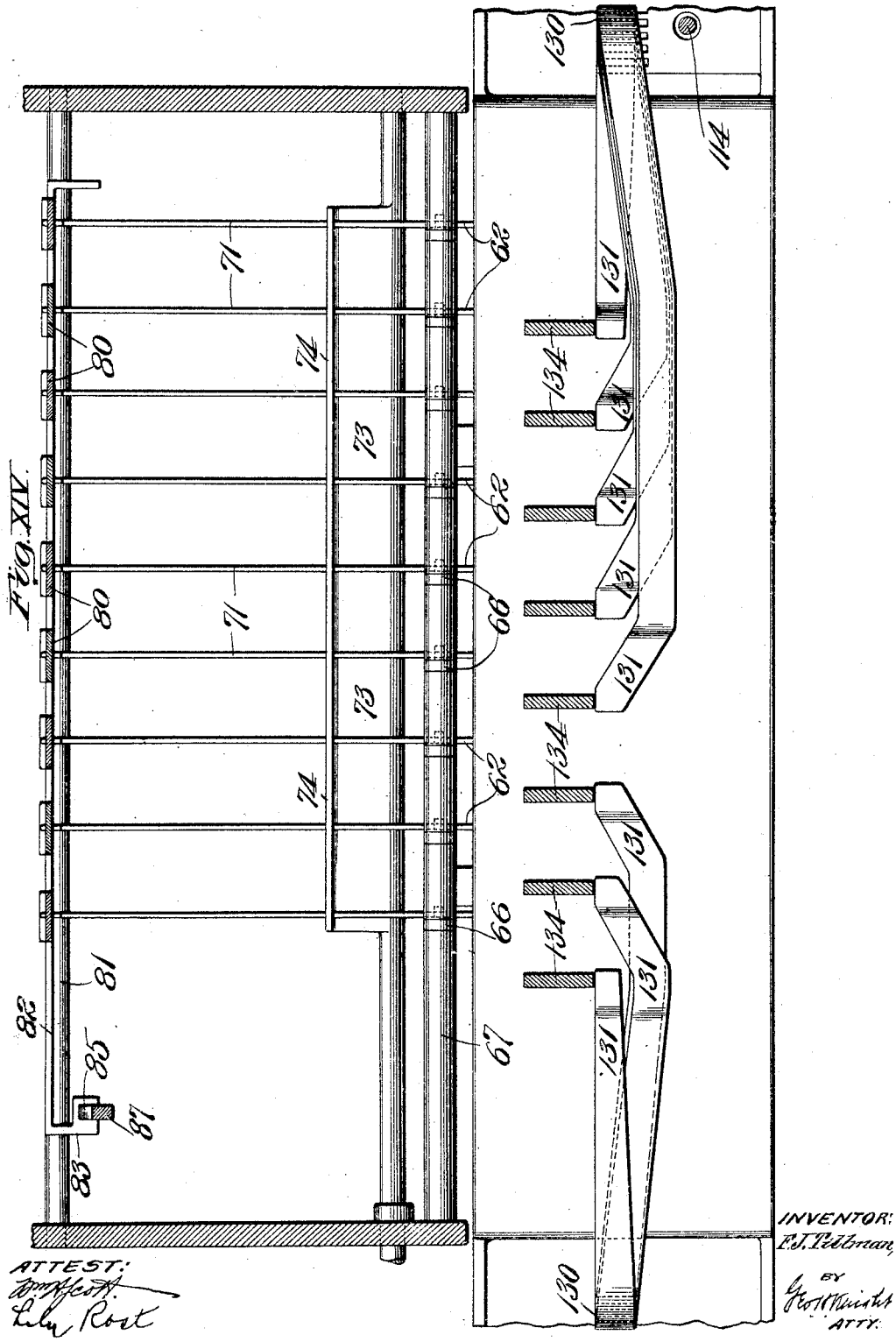

Fig. XIV.

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CALCULATING ATTACHMENT FOR TYPE WRITING MACHINES.

APPLICATION FILED JULY 8, 1907.

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11 SHEETS—SHEET 11.

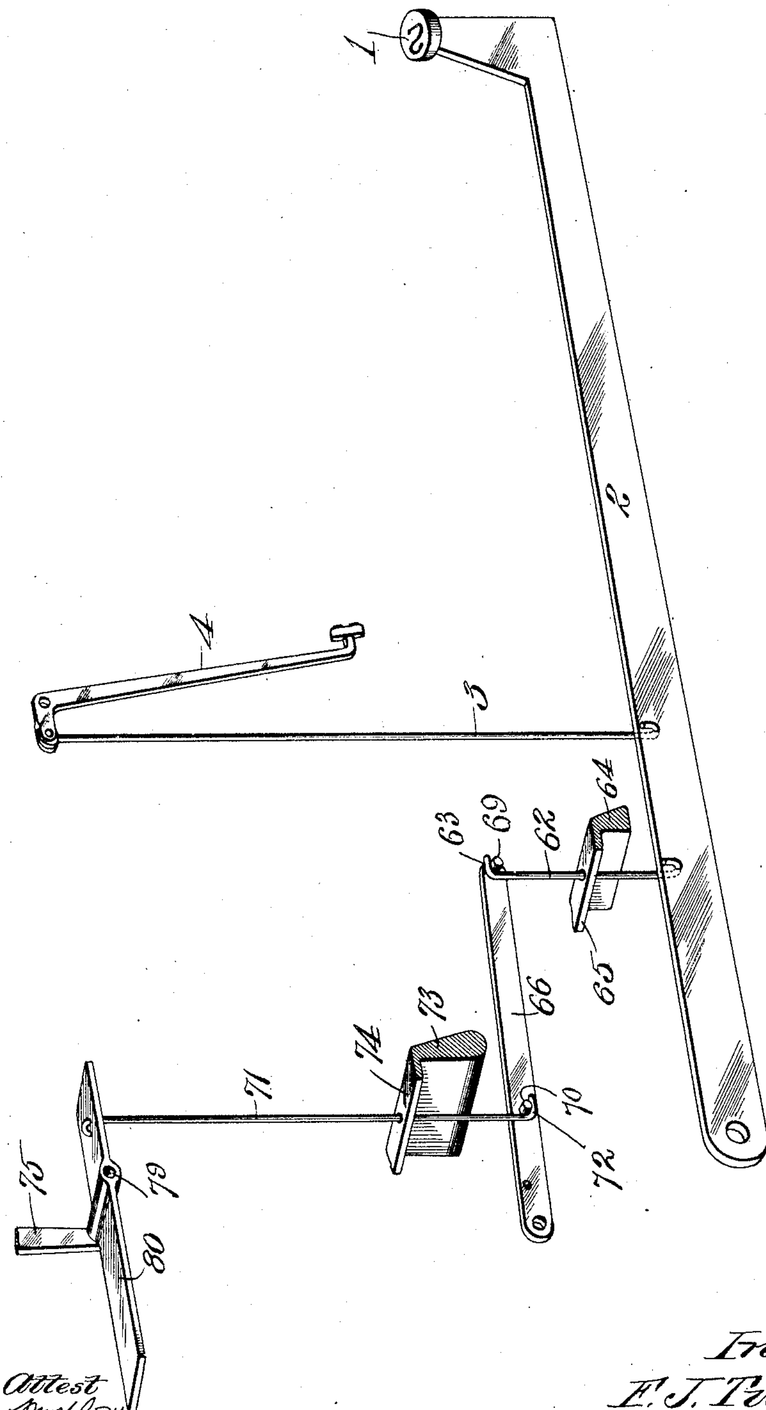

Fig. XV.

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UNITED STATES PATENT OFFICE.

FERDINAND J. TILLMAN, OF ST. LOUIS, MISSOURI.

CALCULATING ATTACHMENT FOR TYPE-WRITING MACHINES.

No. 913,859. Specification of Letters Patent. Patented March 2, 1909.

Application filed July 8, 1907. Serial No. 382,786.

To all whom it may concern:

Be it known that I, FERDINAND J. TILLMAN, a citizen of the United States of America, residing in the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Calculating Attachments for Type-Writing Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to a calculating attachment for use in connection with a typewriting machine, the invention having for its object to provide an attachment of this character which may be associated with various types of typewriters and in which the actuating means of the registering mechanism is controlled through the medium of the platen carriage of the typewriting machine.

The invention has also for its object to provide in an attachment of this character mechanism whereby addition, multiplication and subtraction may be carried out in a simple manner and in the use of which such work as the making out of bills and invoices into which the various forms of calculation specified may be readily carried out.

Another object is to produce an attachment of the character named that is controlled by the ordinary keys and key levers of a typewriting machine, thereby dispensing with complicated mechanism for this purpose.

Figure I is a top or plan view of a typewriting machine and my attachment associated therewith, the main part of the platen carriage of the typewriting machine being omitted. Fig. II is a view partly in vertical longitudinal section and partly in elevation of the typewriting machine and my attachment. Fig. III is a vertical transverse section taken on line III—III, Fig. II and looking toward the rear end of the typewriting machine and attachment. Fig. IV is a rear elevation of the calculating mechanism with the casing shown partly in vertical section. Fig. V is a vertical longitudinal section taken on line V—V, Fig. IV. Fig. VI is a plan view of the rear portion of one section of the multiplying mechanism. Fig. VI^a is a vertical section taken on line VI^a—VI^a, Fig. VI. Fig. VII is a plan view of the multiplying mechanism at the opposite side of the machine from that at which the mechanism illustrated in Fig. VI is located. Fig. VIII is a plan view of a part of the registering mechanism, members by which the registering mechanism is operated and part of the multiplying mechanism key levers. Fig. IX is a side elevation of the mechanism shown in Fig. VIII. Fig. X is a front elevation of the part of the registering mechanism shown in Figs. VIII and IX with the casing illustrated in vertical section taken on line X—X, Fig. IX. Fig. XI is a transverse section taken on line XI—XI, Fig. I through the registering mechanism, a portion of the registering wheels being shown in full lines and the remainder of said wheels being shown in dotted lines. Fig. XII is an enlarged cross section taken on line XII—XII, through one of the numeral wheels and the shaft on which the series of said wheels is mounted. Fig. XIII is a cross section taken on line XIII—XIII, Fig. XII through three of the numeral wheels. Fig. XIV is an enlarged vertical transverse section taken on line XIV—XIV, Fig. V. Fig. XV is a perspective view of one of the numeral key bars of the typewriting machine, a key lever having connection with said bar and the members by which the power members of the calculating attachment are controlled.

In the accompanying drawings the characters to be herein after used will indicate similar parts in the various views in which they appear.

The typewriting machine.—The typewriting machine with which I associate my attachment may be one of any ordinary type in which a platen carriage is employed and inasmuch as my invention does not appertain to the construction of the typewriting machine that is to be used, except as to certain members in the machine that cooperate with the mechanism of my attachment, I will not describe the general construction of any typewriting machine but confine myself in the following description to the details that are necessary for an understanding of the operation of the typewriting machine and my attachment in conjunction therewith. The typewriting machine contains the usual key board and key levers, the latter of which are connected to type bars in order that writing operations may be carried on. The key board also contains a full complement of numeral keys 1 which are mounted upon numeral key levers 2, the rear ends of which have pivotal connection with the frame of the typewriting machine and which

are spring supported in a manner common to the support of key levers in the ordinary typewriter. These key levers are illustrated in Figs. I to III inclusive and Figs. IX and XV, in which latter view one of the key levers is shown individually. Each numeral key lever 2 has united to it a connecting rod 3, see Fig. XV, that leads to a numeral type bar 4 bearing a numeral type corresponding to that on the key of the numeral key bar joined to the particular type bar.

5 is a platen carriage in which is mounted the platen 6 that serves as a backing for the type of the type bars of the machine when they are operated to print upon a sheet of paper mounted in the carriage in the usual manner. The platen carriage is designed to be operated in one direction from a suitable source of power, such as a spring as usual in typewriting machines and its movement in such direction is controlled by suitable means, such as ratchet mechanism, whereby the carriage is caused to partake of a step by step travel.

The registering mechanism.—This mechanism is located at the front end of my attachment and confined within the housing 7, see Figs. I, II and VIII to XI inclusive, that contains a sight opening 8 through which the numerals upon the numeral wheels of the registering mechanism may be viewed.

9 and 9′ designate sections of a numeral wheel shaft that are supported in the housing 7 and the inner end of one of which is stepped into the inner end of the other, as seen in Figs. XI to XIII inclusive, the section 9 being rotatably mounted and the section 9′ being preferably rigidly mounted. The shaft section 9 bears a knob 10 located exterior of the housing 7 by which the section may be rotated for a purpose to be hereinafter mentioned and the knob is provided with a detent 11 adapted to engage a stop 12 projecting from the adjacent end of the housing.

13 are numeral wheels loosely mounted upon the shaft section 9 and 13′ are numeral wheels loosely mounted upon the shaft section 9′. These wheels are arranged in succession upon the two sections of the shaft and each wheel is provided with a peripheral flange whereby the wheel is rendered a chambered one in order that it may receive certain parts of the registering mechanism to be set forth. At the interior of the peripheral flange of each of the numeral wheels 13 13′ is a lug 14. At the side of each numeral wheel opposite to that which bears the flange just mentioned and rigidly associated with the wheel is a gear wheel 15.

16 is a shaft extending parallel with the numeral wheel shaft and upon which are loosely mounted transmission gear wheels 17 that mesh with the gear wheels 15 of the numeral wheels and are adapted to be driven to impart rotation to the numeral wheels by means to be described. Each numeral wheel also has rigidly associated with it a pinion 18 that forms a part of the transfer or carrying means.

19 are pinion supporting arms rigidly secured to the numeral wheel shaft and in each of which is journaled a primary or outer transfer pinion 20 and a supplemental or inner transfer pinion 21, the former being arranged in mesh with the latter, while the latter is arranged in mesh with the transfer pinion 18 that is carried by the adjoining numeral wheel. The transfer pinion 20 is so arranged that a tooth of said pinion will always occupy a position to be struck by the lug 14 of an adjacent numeral wheel, when said wheel is rotated, and irrespective of the direction of its rotation, whereby the pinion is rotated a distance corresponding to the space between two of its teeth. The motion thus transmitted from a numeral wheel of one denomination causes a transfer from said numeral wheel to the next adjacent numeral wheel of another denomination, due to the primary transfer pinion acting in its turn to rotate the secondary transfer pinion 21 and said secondary transfer pinion acting to rotate the transfer pinion 18 that is rigidly associated with the numeral wheel of the second denomination.

The transfer parts just described provide for transfer from one to another of both of the sets of numeral wheels 13 and 13′ irrespective of whether or not the shaft section on which the wheels are mounted remains stationary or is susceptible of rotation. The shaft section 9 on which the numeral wheels 13 are mounted is rotatably mounted, however, in order that the numeral wheels 13 may be rotated independent of the numeral wheels 13′ for the purpose of resetting them to zero after they have been utilized in calculations involving addition and multiplication. To this end I provide pawls 22 carried by the arms 19 that are fixed to the shaft section 9 and which pawls revolve around said shaft section when it is rotated through the medium of its knob 10. Each pawl 22 is adapted to engage the lug 14 of the numeral wheel 13 adjacent thereto and which, when the shaft section 9 is rotated, is carried by the arm to which it is affixed, thereby causing the pawl to rotate the numeral wheel 13. Each pawl acts, as stated, upon a particular numeral wheel 13 and as a result, the numeral wheels are rotated by the pawls until all of the lugs 14 of the wheels 13 are brought into alinement and the zero signs are caused to appear collectively through the sight opening in the registering mechanism housing.

Immediately above the bottom of the registering mechanism housing are a pair of guide rods 23, see Figs. II and VIII to X

inclusive. 24 is a carriage that is slidably mounted upon said guide rods and is adapted to be moved longitudinally in the registering mechanism housing or transversely of the typewriting machine. The carriage bears a pointer 24ª that extends to the top of the housing 7 and is adapted to traverse the series of numeral wheels in view through the sight opening 8 in said housing.

25 is a non-circular shaft, the ends of which are journaled in suitable supports, such as posts 26, within the housing 7 and by which said shaft is upheld at an elevation above the guide rods and parallel with said rods. The shaft 25 has fixed to it at one end a bevel gear wheel 27 to which power is applied in a manner to be explained for the purpose of rotating said shaft.

28 is a driving wheel slidably fitted to the shaft 25 to permit of its being moved longitudinally on the shaft but the bore of which wheel is shaped to correspond to the shaft to prevent rotation of the wheel independent of the shaft. The driving wheel 28 is straddled by the carriage 24 that serves as an engaging member for said wheel to shift it upon its shaft. The driving wheel 28 is adapted to be brought into mesh with either of the transmission gear wheels 17 that engage the numeral wheels 13, 13′ whereby, when the shaft 25 and the driving wheel are rotated the numeral wheel placed in gear with the driving wheel will be rotated to a degree corresponding to that of the driving wheel and a numeral upon the periphery of the particular numeral wheel which it is desired to bring into view will appear through the sight opening in the registering mechanism housing.

The numeral wheels 13′ upon the fixed shaft section 9′ are intended more particularly for use in calculations involving subtraction. None of these wheels has associated with it a pawl 22 such as are associated with the numeral wheels 13 and which are utilized for retrograde rotation of the wheels 13 when the shaft 9 is rotated. The wheels 13′ may therefore be rotated in either direction by the driving wheels 28 and are consequently susceptible of employment in subtraction calculations as well as in addition and multiplication calculations. To restore the numeral wheels 13′ to zero it is necessary to actuate these wheels individually by imparting rotation to the driving wheel 28 in engagement with the numeral wheels, and through the medium of the numeral key mechanism and power mechanism to be hereinafter described.

Mechanism for shifting the carriage of the registering mechanism.—To provide for the carriage 24 of the registering mechanism being shifted from one transmission gear wheel 17 to the next succeeding wheel 17 in a step by step manner throughout the extent of the registering mechanism according to the step by step movement of the typewriter platen carriage I employ the following parts: 29 is an endless chain that is united to the platen carriage of the typewriter by an arm 5′ that extends rearwardly from said carriage as seen in Figs. I and II. The chain 29 is fitted to an idler 30 at one side of my attachment and it is mounted on a wheel 31 that is associated with a bevel gear wheel 32 upon a shaft mounted at the side of the attachment opposite to that at which the idler 30 is mounted. The bevel pinion 32 coöperates with a bevel pinion 33 that is fixed to a vertical shaft 34 journaled in a post 35 at its upper end which also serves as a journal member for the shaft of the wheel 31 and bevel gear wheel 32. The lower end of the shaft 34 is journaled in a post 36 projecting upwardly from the base of the frame of the attachment, see Fig. II. 37 is a bevel gear wheel fixed to the lower end of the shaft 34. 38 is a horizontal shaft journaled at its rear end in the post 36 and to the rear end of which is fixed a bevel pinion 39 that meshes with the wheel 37 of the shaft 34. The shaft 38 extends forwardly to the registering mechanism of the attachment and is journaled near its forward end in a post 40 located at the rear of the registering mechanism housing. Upon the forward end of said shaft is a toothed wheel 41. 42 is an endless chain that is operably mounted on the wheel 41 of the shaft 38 and which extends to the opposite end of the registering mechanism and passes around an idler by which it is supported at said end. The chain 42 is connected to the driving wheel carriage 24 of the registering mechanism, by an arm 24′ extending from said carriage, as seen in Figs. II, VIII and IX, whereby any movement imparted to said chain is imparted in a corresponding degree to said carriage, and it is to be noted that this movement is one of a degree similar to the type-writer platen carriage from which motion is transmitted to the registering mechanism carriage through the medium of the mechanism previously described.

The main power mechanism.—43 designates the motor of my calculating attachment, see Fig. IV, which is located in the rear portion of the attachment. This motor comprises a drum having a power spring interior thereof by which said drum is rotated when the spring is placed under tension by winding it to store power therein similarly to the main spring of a clock or other time piece.

44 is a power wheel, see Figs. IV and V, that is associated with the motor and operated thereby.

45 is a main power shaft that is rotatably mounted in suitable bearings in the frame of the calculating attachment and has fixed

thereto a pinion 46 arranged in mesh with the power wheel 44 and adapted to be driven thereby under the influence of the motor to rotate the power shaft. The power shaft also has rigidly mounted upon it, near one side of the attachment, a master wheel 47 and near the other side of the attachment a master wheel 48.

49 is a non-circular shaft journaled in the frame of the attachment and having an extension 50 that projects through the frame at one of its sides and has fixed to it a bevel wheel 51, see Figs. II, VI and VI[a].

52 is a power transmission pinion slidably and non-rotatably mounted upon the non-circular shaft 49 and adapted to be moved into and out of mesh with an intermediate transmission pinion 53 suitably supported and arranged in mesh with the master wheel 47, as seen in Fig. IV.

54 is a pinion slidably and non-rotatably mounted upon the non-circular shaft 49 near the side of the attachment opposite that at which the pinion 52 is located.

The pinions 52 and 54 are spaced apart by an elongated gear sleeve 55 that has utility in conjunction with the multiplying mechanism of my attachment to be hereinafter described and to which no further reference will at present be made. The pinion 54 is adapted to be brought into coöperation with the master wheel 48 through the medium of an upper transmission pinion 56 that meshes with said master wheel and a lower reversing transmission pinion 57 arranged to receive the pinion 54. The pinions 52 and 54 are shifted upon the shaft 49 through the medium of a shifter yoke 58 slidably fitted to the shaft and engaging said pinions, the yoke being operated in a manner to be hereinafter explained. It may be noted at this point that there being but a single intermediate transmission pinion 53 interposed between the master wheel 47 and the pinion 52, the shaft 49 is caused to rotate by said master wheel in one direction, whereas, there being two intermediate transmission wheels between the master wheel 48 and the pinion 54 when said pinion 54 is in mesh with the lowermost of said transmission pinions, the shaft 49 is rotated reversely to the direction in which it is rotated by the pinion 52.

59 is a power transmission shaft that is mounted in suitable bearings and which extends forwardly from the end of the extension 50 of the shaft 49 to the registering mechanism. This shaft bears at its rear end a bevel gear wheel 60 that meshes with the bevel gear wheel 51 on the shaft extension 50 and it has fixed to it at its forward end a bevel gear wheel 61, see Figs. II, VI, VI[a] and VIII to X inclusive. The last named bevel gear wheel meshes with the bevel gear wheel 27 fixed to the non-circular shaft 25 of the registering mechanism.

It will be seen from the foregoing description that when the pinion 52 is in gear with the master wheel 47 power is transmitted from said master wheel to the shaft 49, then to the shaft 59 and to the shaft 25 bearing the driving wheel 28, whereby said driving wheel, when in mesh with either of the transmission gear wheels 17 of the registering mechanism, causes said transmission gear wheel to impart rotation to the corresponding numeral wheel 13, the numeral wheel being at such time moved in a forward direction relative to the numerals thereon. When the pinion 52 is thrown out of gear with the master wheel 47 and the pinion 54 is thrown into gear with the master wheel 48, the mechanism just described that leads to the registering mechanism is operated reversely relative to the operation that has just been described and as a consequence, the numeral wheel that is being operated is rotated backwardly relative to the numerals thereon. In the operation of the numeral wheels in the direction first stated through the medium of the master wheel 47 and the gearing associated with it, including the pinion 52, addition is performed on the numeral wheels; whereas, when the pinion 52 is shifted out of mesh with the master wheel 47 and the pinion 54 is thrown into mesh with the master wheel 48, thereby putting the last named master wheel instead of the first named into position for coöperation with the shaft 49, the numeral wheels are rotated reversely relative to the direction of their movement in the first instance and subtraction instead of addition is performed upon the numeral wheels. In both the adding and subtracting calculations carrying action from numeral wheel to numeral wheel is accomplished through the medium of the lugs 14 of the numeral wheels that engage the outer transfer pinions 20 mounted in the shaft carried arms 19 and from which transfer pinions motion is transmitted through the inner transfer pinions 21 and therefrom to the numeral wheel pinions 18. In this connection attention is drawn to the fact that there are no pawls 22 carried by the arms 19 on the shaft section 9′ and that therefore the numeral wheels 13′ on this shaft section may be rotated in either a forward or a backward direction during carrying action.

Numeral key mechanism for controlling the power and registering mechanism.—Each numeral key lever has attached to it at a point rearward from the attachment of the type bar connecting rod 3 a vertical connecting rod 62 that is provided at its upper end with a hook 63, see Figs. V, VI, VII and XV.

64 is a horizontal rock bar extending transversely of the attachment and through a rearwardly extending flange 65 of which all of the connecting rods 62 extend loosely, the said rock bar having an office to perform in

connection with said rods that will be hereinafter mentioned.

66 is one of a series of pull levers that are pivotally mounted at their rear ends at 67, see Fig. V, and which are normally supported by lift springs 68. This pull lever is provided at its forward end with a stud 69 to which the hook at the upper end of the connecting rod 62 is loosely fitted. Intermediate of the ends of the pull lever is a stud 70.

71 is a vertical connecting rod that is provided at its lower end with a hook 72 loosely fitted to the stud 70 and which passes beneath said stud.

73 is a rock bar extending transversely of the attachment and having its ends suitably journaled in the frame of the attachment, the said bar being provided with a rearwardly extending flange 74 through which all of the connecting rods 71 complementary to the various numeral key levers pass loosely in order that said rods may operate vertically in said flange. The rock bar 73 has a function that will be hereinafter specified.

At each side of the attachment is a hanger arm 75 supported by a rod 76 that extends transversely of the attachment, the said arms being normally held rearwardly and in retracted position by retractile springs 77, see Figs. IV, V, and VI. One of the said hanger arms is provided at its rear edge with a shoulder 78.

79 is a pivot rod mounted in the lower ends of the hanger arms 75 and extending transversely of the attachment.

80 are pallets loosely mounted intermediate of their ends upon the pivot rod 79 and each comprising an arm extending forwardly from said rod and an arm extending rearwardly from said rod. The forward arm of each pallet has connected to it a connecting rod 71 corresponding to a particular numeral key lever, whereby, when said key lever is operated the particular pallet will be rocked vertically, its forward end being moved downwardly and its rear end being moved upwardly from the positions in which they are seen in Fig. V.

81 is a supporting rod mounted in the frame of the attachment and extending transversely thereof at a point in front of the forward ends of the pallets 80.

82 is a rock bar located beneath the forward arms of all of the pallets and which is connected to the supporting rod 81 by vertical arms 83, one of which has connected to it a lift or retractile spring 84, see Fig. V. In the arm of the rock shaft 82 that is located at the side of the attachment containing the master wheel 47 is a trip bolt 85 provided with a beveled point and backed by a spring 86 which normally holds the bolt projected rearwardly from the arm.

87 is a trigger pivotally mounted at 88 intermediate of its ends, and which is normally held in a horizontal position against a surmounting stop 89 by a spring 90 so that the trip bolt 85 will normally rest against the forward end of said trigger to be in position to impart a downward movement to the forward end of the trigger when the rock bar 82 is moved downwardly and an upward movement to the rear arm of the trigger at such time. In the rear arm of the trigger is a notch 91.

92 is a trip lever that is pivotally supported at 93 immediately back of the trigger 87 and which is provided with a nose at its upper end that is normally seated in the notch of said trigger, being maintained in such position under the influence of a spring 94 that is connected to the trip lever beneath its point of pivotal support.

95 is a dog pivotally mounted at 96 and having a point 97 that is normally in engagement with one of the teeth of the master wheel 47. The forward arm of this dog is provided with a cam face 98 against which the lower end of the trip lever 92 is adapted to ride when moved in the manner to be explained for the purpose of disengaging the point of the dog from said master wheel.

99 is a pull lever that is pivotally mounted at 100 and located in front of the adjacent hanger arm 75. The pull lever 99 is united to the dog 95 by a rod 101 which serves to move said lever in a rearward direction when the dog is moved to disengage it from the master wheel 47.

102 is a cross rod mounted in the frame of the attachment and which serves as a pivotal support for a pair of rocker bars 103, one of which is located at the side of the attachment containing the master wheel 47 and the other parts just previously described. The point of the forward arm of the rocker bar just mentioned normally occupies a position that causes it to engage the shoulder 78 of the hanger arm 75 seen in Fig. V, whereby the forward arm of said bar is held in a lowered position.

104 is a pull spring that is connected to the rear arm of the rocker bar 103 and which acts to elevate the forward arm of the bar when the hanger arm 75 is moved forwardly, thereby releasing the rocker from restraint as will hereinafter more fully appear.

105 is a shaft, the ends of which are journaled in the two rocker bars 103 to rotate therein. Upon this shaft is a governor barrel 106 that is of a length equal to or greater than the space occupied transversely of the attachment by the pallets 80. The governor barrel bears at its periphery a series of trip pins 107 that are stepped in a spiral manner partially around the barrel and are so disposed relative to the pallets 80, that when the rear arm of either of said pallets is elevated, the extremity of said arm will lie in the path of travel of a particular trip pin that

will coöperate with the particular pallet opposing it.

108 is a governor wheel that is fixed to the shaft 105 which carries the governor barrel 106. This governor wheel is normally arranged in mesh with the master wheel 47 when the parts are in readiness for calculation, but is adapted to be withdrawn from said master wheel upon the raising of the forward rocker arms 103 in which the shaft 105 is journaled.

109 is a retracting arm fixed to the shaft 105 and which is connected to the forward arm of the rocker bar 103 adjacent thereto by a retracting spring 110.

111 is a lever arm pivoted at 112 to the frame of the attachment adjacent to the shaft retracting arm 109 and which is united to the rear arm of the adjacent rocker bar 103 by a connecting rod 113.

The operation of the controlling mechanism is as follows: Whenever a numeral key lever 2 is actuated the corresponding pull lever 66 to which the key lever is connected is moved downwardly and, as a consequence of the attachment of said pull lever to the corresponding pallet 80, said pallet is rocked vertically to throw its rear arm into a position in front of the opposing trip pin upon the governor barrel. The forward arm of the pallet moves downwardly and as it so moves acts upon the rock bar 82 to carry it downwardly and cause its trip bolt 85 to exert pressure against the trigger 87 and throw the rear end of said trigger upwardly. Due to the movement of the trigger just stated, the trip lever 92 is released and the spring 94 attached thereto draws said trip lever rearwardly and the lower end of said lever, by riding against the cam face 98 of the dog 95, acts to so move the dog that its point is withdrawn from engagement with the master wheel 47, thereby freeing said master wheel and causing the pull lever 99 to be moved rearwardly to the adjacent hanger arm 75. It should be here stated that the several trip pins upon the governor barrel 106 are so disposed upon said barrel relative to the rear ends of the pallets 80 that said barrel may partake of a predetermined partial rotation before the trip pin engages the pallet that opposes it. There is an individual trip pin for each numeral key lever in the typewriting machine and the trip pin corresponding to each numeral key lever and the pallet connected to said lever is disposed upon the governor barrel in a position that will permit of the governor barrel rotating to a degree that will allow the governor wheel 108 and the master wheel 47 to rotate in mesh with each other to an extent to cause said master wheel to operate the registering mechanism of the attachment almost the proper amount for the calculation to be made before the particular trip pin of the governor barrel acts upon the opposing pallet 80. For the purpose of illustration it will be assumed that it is desired to add the numeral "3" upon any one of the numeral wheels of the registering mechanism that is in registration with the driving wheel 28 of said mechanism. When the master wheel 47 is freed by the disengagement of the dog 95 therefrom in the manner explained and the rear end of the pallet 80 corresponding to the numeral "3" key lever is elevated, the master wheel partakes of a degree of rotation sufficient to turn the governor wheel 108 in mesh therewith and the governor barrel in the direction indicated by the arrows, Fig. V. The master wheel and governor wheel will rotate the distance of six teeth of each wheel, or two teeth for each unit and upon this degree of rotation of the governor wheel taking place and during the engagement of the last teeth the proper trip pin will engage the opposing pallet 80 and force said pallet forwardly a distance sufficient to allow said wheels to rotate the distance of another tooth of each wheel, thereby completing the necessary degree of movement of the master wheel to permit of its actuating the registering mechanism to the desired degree and cause the calculation to appear upon the numeral wheel. The key lever that has been operated is held depressed during the operation of the parts as just described, in order that the corresponding pallet will be maintained in such position as to be struck by the approaching trip pin 107. In the forward movement of the pallet as just stated, the hanger arm 75 illustrated in Fig. V is moved forwardly, due to the pallet pivot shaft being mounted in said arm and said hanger arm is caused to act upon the pull lever 99 with the result of moving said lever forwardly and causing it to return the dog 95 into engagement with the master wheel 47 and prevent its further movement. The degree of forward movement of the hanger arm 75 just mentioned is sufficient to draw the shoulder 78 of the hanger arm from engagement with the point of the adjacent rocker bar 103, and the forward arm of said bar together with the forward arm of the mating rocker bar at the opposite side of the attachment is thrown upwardly by the action of the pull spring 104 connected to said rocker bar. Upon the upward movement of the forward arms of said rocker bars the governor wheel 108 is withdrawn from mesh with the master wheel 47 for the purpose of permitting the governor barrel to be returned to its normal position in order that its trip pins will be properly disposed as before relative to the pallets 80. The retracting spring 110 then operates to return the governor barrel, due to its connection with the retracting arm 109. This retracting spring is of greater power than the pull spring 104 connected to the rear arm of

the rocker bar 103, and it has the utility in addition to that just recited, of causing said retracting arm to operate upon the pull lever 111, whereby said pull lever is caused to exert a pull upon the connecting rod 113 and act through said connecting rod to elevate the rear arm of the rocker bar and lower the forward arm of the bar with the result of carrying the point of said bar back into engagement with the shoulder 78 of the hanger arm 75 and the governor wheel back into mesh with the master wheel. The parts are thus returned to their normal positions ready for the next calculating operation.

To provide for the operation of the shifter yoke 58 in a direction transversely of the attachment for the purpose of shifting the pinions 52 and 54 at the ends of the gear sleeve 55 and upon the shaft 49 to move the pinions into and out of coöperation with their complementary master wheels 47 and 48 I utilize a rockable shift rod 114 that is provided with a throw arm 115 which is loosely seated in the shifter yoke at one of its ends, as seen in Figs. II and V to VI[a] inclusive. The shift rod 114 is mounted in suitable posts and extends forwardly from the shifter yoke to the registering mechanism, the rod being located alongside of the typewriting machine.

116 is a hand lever at the forward end of the shift rod by which said rod may be rocked to and fro with the result of causing its throw arm to move the shifter yoke in the desired direction.

With the object in view of providing for the throwing out of the calculating mechanism connected to the several numeral key levers in order that said key levers may, when desired, be utilized in typewriting operations without calculation being performed, I utilize the following mechanism. 117 is what I term an "offset" key lever and 118 is what I term a "set" key lever. These two key levers occupy positions at one side of the typewriting machine, as seen in Fig. I. 119, see Figs. V and VII, is a main shift lever that is pivotally fitted intermediate of its ends to a stub shaft 120 projecting outwardly from the frame of the calculating attachment and the forward arm of which is united to the "offset" key lever 117 by a connecting rod 121. This shift lever is provided at its rear end with a forward cam 122 and a rear cam 123, the said cams being located at one side of the shift lever. 124 is a lever arm fixed to the rocker bar 73 at its end adjacent to the shift lever 119 and which is located between the cams of said shift lever. The lever arm is provided at its front and rear faces with cams which coöperate with the cams of said lever, whereby, when the shift lever is rocked vertically the cams will, by impingement against each other, cause a forward or rearward movement to be imparted to the lever arm and the rocker bar 73. 125 is an auxiliary shift lever that is pivotally fitted intermediate of its ends to a stub shaft 126 located adjacent to but above the stub shaft 120. The forward arm of the lever 125 is united to the "set" key lever 118 by a connecting rod 127 and the rear arm of said auxiliary lever is united to the forward arm of the main shift lever 119 by a link 128. 129 is a retracting spring connected at its forward end to the lever arm 124 and at its rear end to the frame of the attachment. When the parts are in the positions illustrated in the drawings the members that are under control of the "set" and "offset" key levers are in set positions and the calculating mechanism is in condition for service. To throw the calculating mechanism out of operation to prevent its being affected by the operation of the numeral key levers, the "offset" key lever 118 is depressed and as a result the main shift lever 119 is so moved that its rear arm moves upwardly and its forward cam 122 by riding against the forward cam face of the lever arm 124 acts to move said lever arm rearwardly, thereby carrying the rocker bar 73 in a corresponding direction and causing said rocker bar to move all of the connecting rods 71 that pass through the rocker bar in a rearward direction. The hooks 72 of said connecting rods are therefore carried away from the studs 70 of the pull levers 66 so that said pull levers may operate in conjunction with the numeral key levers without exerting any action upon the connecting rods just mentioned and the pallets 80 of the calculating mechanism to which they are attached. To restore the connecting rods 71 it is only necessary to depress the "set" key lever 117 with the result of moving the rear arm of the auxiliary shift lever 125 upwardly and creating an upward pull through the medium of the link 128 upon the forward arm of the main shift lever 119. The rear arm of the main shift lever is at this time moved downwardly and its cam 123, by riding against the rear cam face of the lever arm 124, causes said lever arm to move forwardly and the rocker bar 73 is thrown in a forward direction that causes it to return the hooks of the connecting rods 71 into operable positions beneath the studs 70 of the pull levers 66.

The multiplying mechanism.—130 designates multiplication key levers, a part of which are located at one side of the typewriting machine and the remainder of which are located at the opposite side of said machine, as seen in Fig. I. These key levers are provided with keys bearing numerals from 2 to 9 and are pivotally mounted intermediate of their ends at 132, see Figs. II, V, VI and VII, the levers having their rear portions bent transversely of the attachment at the rear of the typewriting machine into arms 131 that

extend to different degrees across the attachment, see Figs. V to VII inclusive and XIV.

133 designates a cross rod located adjacent to the arms of the key levers 130.

134 are cam levers loosely mounted upon the cross rod 133 and corresponding in number to the number of multiplication key levers. Each cam lever is provided with a forward cam face 135 against which the rear arm of the key lever corresponding thereto is adapted to ride when moved upwardly from the position illustrated in Figs. V and XIV, whereby the upper arm of the cam lever is moved rearwardly to cause it to act upon a part to be presently mentioned. Each of said cam levers has a lower arm to which is connected a retracting spring 137. At the rear of the upper arm of each cam lever is a cam face 136.

138 are carrier bars of a number corresponding to the number of multiplication key levers and cam levers 134. These carrier bars are pivotally supported at 139 in posts 140 which are arranged in a row transversely of the calculating attachment and have the carrier bars so fitted to them that the bars may be moved in an arc of a circle common to all of them. At the extremity of the forward arm of each carrier bar 138 is a cam face 141 which opposes the cam face 136 at the rear of the corresponding cam lever 134. It will be readily understood that when either of said cam levers is moved to throw its upper arm rearwardly said rear cam face 136 will operate upon the cam face 141 of the opposite carrier bar, whereby the forward arm of the carrier bar is elevated and the rear arm of said bar is lowered.

142 are toothed multiple wheels that are journaled to the rear arms of the carrier bars 138 and the size and number of teeth of which vary according to the integer of the multiplication key lever that is complementary to said wheel. For instance, the multiple wheel complementary to the multiplication key lever bearing the numeral "2" is provided with twenty teeth. The multiple wheel corresponding to the numeral "3" key lever is provided with thirty teeth while the numeral "9" wheel corresponding to the numeral "9" multiplication key lever is provided with ninety teeth. All of said multiple wheels are adapted to be moved by the cam levers 134 to the gear sleeve 55 upon the shaft 49, which contains ten teeth, and it will be seen that when either of the multiple wheels is thrown into coöperation with said sleeve and rotated in a manner to be explained, the multiple wheel in making a complete rotation will act with multiplying action upon the sleeve and said sleeve will in turn transmit the motion it receives to the shaft 49 from which motion is transmitted through the driving members leading from said shaft to the registering mechanism of the attachment to operate the numeral wheels in the last mentioned mechanism with multiplying action.

Power is communicated to the multiple wheels 142 through the medium of the following parts: 143 is an auxiliary power shaft that is journaled in the frame of the calculating attachment and occupies a position parallel with the main power shaft 45. This auxiliary power shaft has rigidly mounted upon it pinions 144 that are constantly in mesh with the master wheels 47 and 48 and which serve to operate said auxiliary shaft when the main shaft is in motion. The said auxiliary shaft also has fixed to it spur wheels 145 of a number corresponding to the number of carrier bars 138, the forward arms of which carrier bars are located beneath said spur wheels, as seen in Figs. V, VI, and VII. 146 are short shafts journaled in the forward arms of the carrier bars, and extending transversely through the bars and to opposite sides thereof. Upon each shaft 146 at one side of the corresponding carrier bar is a pinion 147 which is adapted to be moved into mesh with the surmounting spur wheel 145 when the forward arm of the carrier bar is elevated through the medium of the opposing cam lever 134. Fixed to each shaft 146 at the opposite side of the carrier bar from that occupied by the pinion 147 is a bevel gear wheel 148. The bevel wheels just mentioned coöperate with bevel pinions 149 that are fixed to shafts 150 journaled in suitable bearings carried by the carrier bars 138 and extending longitudinally of said bars. Each shaft 150 has fixed to it at its rear end a bevel gear wheel 151 that is arranged in mesh with a bevel gear wheel 152 fixed to the spindle of the corresponding multiple wheel 142. When either carrier bar 138 is moved, by reason of operation of a multiplication key lever 130 and the corresponding cam lever 134, the forward arm of the carrier bar is elevated to move the pinion 147 supported by said carrier bar into mesh with the surmounting spur wheel 145, and when the spur wheel is driven with the auxiliary power shaft on which it is mounted, motion is transmitted from said auxiliary power shaft through the gearing associated with the carrier bar to the multiple wheel carried by said carrier bar, and said multiple wheel having been lowered into mesh with the gear sleeve 55 beneath it when the forward end of the carrier bar was elevated, the motion transmitted to the multiple wheel is in turn communicated therefrom to said sleeve for the operation of the shaft 49 on which it is mounted and the operation of the registering mechanism, which coöperates with said shaft. 153 are retracting springs connected to the forward arms of the carrier bars and by which said carrier bars are returned to their normal positions after they

have been actuated to move the parts supported thereby into operating positions.

The operation of my calculating attachment in multiplying action is as follows: When it is desired to multiply one number by another the multiplication key lever bearing one of the multipliers is operated, with the result of, through the medium of the corresponding cam lever 134, moving the proper carrier bar 138 so that the multiple wheel supported thereby is moved to the gear sleeve 55 and the pinion 147 at the opposite end of said carrier bar is moved to the surmounting spur wheel 145 upon the auxiliary power shaft 143. The multiplying mechanism being now in condition for service to be actuated by power from the main power shaft 45, said power shaft is released for operation upon the multiplying mechanism together with the master wheels 47 and 48, such release being accomplished in the same manner as that carried out in the addition and subtraction operations previously described and by virtue of the actuation of one of the numeral key levers 2 of the tpye-writing machine which bears the multiplicand.

To illustrate by example the manner in which multiplication is carried out it will be assumed that it is desired to multiply "5" by "4". In performing the calculation the multiplication lever bearing the multiplier numeral "4" upon its key is first depressed for the purpose of moving the multiplication mechanism into position to coöperate with the other mechanisms of the calculating attachment. This lever operates upon the cam lever 134 that opposes the carrier bar 138 in which is mounted the multiple wheel 142 that is complementary to the multiplication key lever bearing the multiplier numeral "4". The cam lever just mentioned acts to move the forward arm of the carrier bar upwardly and the rear arm of said carrier bar downwardly, whereby the pinion 147 supported by the forward arm of the carrier bar is moved into mesh with the spur wheel 145 above it upon the auxiliary power shaft 144 and the multiple wheel at the opposite end of the carrier bar is moved into mesh with the gear sleeve 55. The numeral key lever 2 of the typewriting machine bearing the multiplicand numeral "5" is next operated and acts through the mechanism previously described to impart movement to the pallet 80 corresponding thereto, whereby the forward arm of said pallet is moved downwardly and the rear arm of the pallet is moved upwardly. The forward arm of the pallet, by acting upon the rock bar 82, depresses said rock bar and causes it to trip the trigger 87, with the result of permitting the release of the dog 95 from the master wheel 47 through the medium of the trip lever 92, whereby the two master wheels 47 and 48 are freed to rotate with the motor driven main power shaft 45. The master wheels then, due to their being geared to the auxiliary power shaft 143 by the pinions 144, serve to drive the auxiliary power shaft 143 and motion is imparted to the multiple wheel 142 through the medium of the spur wheel 145 on the auxiliary shaft, the pinion 147 supported by the previously operative carrier bar and in mesh with the particular spur wheel mentioned, and the operating members leading from the pinion just referred to to the multiple wheel. The main power shaft and the master wheels carried thereby, which have been released in the manner stated, rotate for the actuation of the multiple wheel, their rotation being continued until the dog 95 is again thrown into engagement with the master wheel 47 in the same manner as that described with reference to addition and subtraction calculations. The period of this operation is controlled by the governor barrel 106 and the governor wheel 108 that coöperates with the master wheel 47. The governor wheel 108 is provided with forty teeth arranged to mesh with the teeth of the master wheel 47 and the trip pins carried by the governor barrel 106 are disposed upon said barrel opposite to each alternate tooth of said governor wheel. As the main power shaft 45 rotates and the master wheels 47 and 48 move with it and said master wheels, by coöperation with the pinions 144, rotate said pinions and the auxiliary power shaft 143. The pinions 144 are each provided with twenty teeth and the spur wheels 145 which mesh with the pinions 147 are each provided with ten teeth.

Inasmuch as the trip pins 107 of the governor barrel 106 are disposed opposite alternate teeth of the governor wheel 108 said governor wheel and governor barrel are, in the example taken, permitted to partake of a degree of rotation that is equivalent of a distance upon said governor wheel containing ten of its teeth, or double the total of the multiplicand "5", before the trip pin of the governor barrel performs its office of actuating the opposing pallet 80 for the purpose of throwing the controlling mechanism of the attachment out of operation in the manner previously explained. Now, as the governor wheel moves a distance corresponding to ten of its teeth it acts in its movement to impart a similar degree of rotation to the master wheels 47 and 48, due to said governor wheel being in mesh with the master wheel 47. The pinions 144, with which said master wheels coöperate, each containing twenty teeth are rotated one-half of a complete rotation and the spur wheels 145 move therewith. The parts of the mechanism that are supported by the previously actuated carrier bar 138 transmit power from the spur wheel 145 to the multiple wheel supported by said carrier bar. This multiple wheel, in the ex-

ample taken, contains as previously stated, forty teeth and it is rotated one-half of a complete rotation or a degree corresponding to that of the pinion 144 and coöperating parts adjacent thereto. The multiple wheel being in mesh with the gear sleeve 55 acts, in making one-half of a rotation, to bring twenty of its teeth into coöperation with the gear sleeve 55, and consequently, said gear sleeve, which contains ten teeth, has, at this time, two complete rotations imparted to it. The shaft 49, upon which the gear sleeve is mounted, is rotated to the same extent as said sleeve, and corresponding movement is transmitted from said shaft to the shaft 59 that leads to the registering mechanism, with the result that the shaft 25 of said registering mechanism is operated two complete rotations and the driving wheel 28 on said shaft 25 is rotated correspondingly to drive the transmission gear wheel 17 in mesh with the wheel 28 and cause said wheel 17 to impart two complete rotations to a numeral wheel in the registering mechanism and bring into view upon two of said numeral wheels the number "20" or, in other words, the result of the example taken; namely, the multiplication of "5" by "4." It is to be understood that in performing the calculation explained, the transmission gear wheel 17 that is in mesh with one of the numeral wheels and is actuated by the driving wheel 28, causes said numeral wheel to partake of the two rotations mentioned and this particular numeral wheel only is driven directly by the transmission gear wheel. The next adjacent numeral wheel has rotation imparted to it from the directly operated numeral wheel through the transfer members associated with the numeral wheels and which are actuated upon each with rotation of the directly actuated numeral wheel. It will be readily understood that other examples may be performed in the same manner as that of which a detailed description has been given and irrespective of the size of the multiplicand or multiplier.

In multiplying one number by another where each number is composed of several digits, it is necessary to multiply the digits in the multiplicand individually by each digit in the multiplier, in the manner previously set forth and to return the platen carriage and the registering mechanism carriage when change is made from one digit in the multiplier to another digit therein. The method of performing such a calculation will be best understood by illustration. It will be assumed that it is desired to multiply 43 by 32 and in performing this calculation the following steps are carried out. The numeral "3" multiplication key lever 130 corresponding to the digit at the right of the multiplicand is first depressed and the numeral "2" key lever of the typewriting machine, corresponding to the digit at the right of the multiplier, is depressed, whereby the multiplying mechanism is placed in operation and the numeral "3" of the multiplicand is multiplied by the numeral "2" of the multiplier. In like manner the numeral "4" multiplication key lever, corresponding to the digit at the left of the multiplicand is next depressed, and the numeral "2" key lever of the typewriting machine, corresponding to the digit at the left of the multiplier, is again depressed to provide for the multiplication of the remaining digit of the multiplicand by the right hand digit of the multiplier. The platen carriage of the typewriting machine and the registering mechanism carriage of my attachment are then moved backwardly to a point one space less than the positions occupied by said carriages when the calculation was begun, and the digits of the multiplicand are multiplied by the digit at the left of the multiplier, viz: the digit "3", in the same manner as followed in multiplying by the right hand digit of the multiplier.

In instances where it is desired to perform a calculation in which the multiplier contains two or more numerals it is desirable to prevent impressions by the numeral types in the typewriting machine upon the paper that is being written upon, and in such instances I utilize a guard member located beneath the platen carriage of the typewriting machine and provide means for shifting this guard member into and out of the path of travel of the type bars that are actuated through the medium of the numeral key lever of the machine.

154 see Fig. III are throw levers that are pivoted at 155 to the frame of the calculating attachment and which have vertical arms extending upwardly to the top of the frame of the typewriting machine. The arms of these throw levers have pivoted to them a pair of horizontal bars 156 that extend transversely across the top of the typewriting machine and over the well occupied by the type bars of said machine. 157 is a guard plate secured to said bars 156 and adapted to occupy a position beneath the ink ribbon of the typewriting machine, the guard plate being so located with respect to the point at which the type of the type bars ascend as to be shiftable into a position to be struck by the type of the type bars when they are elevated toward the platen 6 of the machine to make an impression upon a sheet of paper placed in the typewriting machine carriage and around the platen. Each throw lever 154 is provided beneath its point of pivotal support, with a leg 158 having a cam face, the cam face of one of the legs facing toward the center of the typewriting machine and the cam face of the other leg facing outwardly relative to the machine.

159 is a draw spring that connects one of

the legs 158 to the frame of the typewriting machine and serves to return both of the throw levers to their normal positions after they have been actuated to move the bars 156 and the guard plate 157.

160 are shift key levers provided with keys 161, located alongside of the keys of the multiplication key levers 130 and located at the two sides of the typewriting machine key board. The two shift key levers are independent of each other and located adjacent to the legs 158 of the throw levers 154 so that they may, by impingement against the cam faces of said legs, act to move the throw levers in different directions. When the shift key lever at the right hand side of the attachment, as the parts are seen in Figs. I and III, is depressed the upper arm of the throw lever that is engaged by said shift key lever is moved outwardly and the guard plate 157 is carried into a position that will cause it to be struck by the type of te type bar of the typewriting machine to prevent an impression being made by such type upon the sheet of paper applied to the platen 6, and the same result is accomplished when the shift key lever at the opposite side of the machine is depressed, the upper arm of the throw lever 154 engaged by the last mentioned key lever being in this instance moved inwardly instead of outwardly.

It is sometimes desirable to prevent actuation of the multiplying mechanism in my calculating attachment, and I provide for the prevention of this mechanism by utilizing the following parts. 162 is a stop bar that extends transversely of the calculating attachment immediately at the rear of the cam levers 134 which are arranged to be actuated by the multiplication key levers to move the carrier bars 138. The stop bar 162 is supported by a rockable rod 163 which sustains the stop bar in a position that permits of its being tilted forwardly to engage shoulders 134′, see Figs. II and V, at the rear edges of the cam levers 134. The rock shaft of the stop bar has fixed to it at one end a pair of fingers 164 that straddle the shift rod 114. 165 are trip studs projecting laterally from the shift rod 114 and occupying positions above the fingers 164. When the shift rod 114 is rotated in either direction one of the trip pins 165, by bearing against the finger 164 beneath it acts to rotate the rock shaft 163 in a forward direction and carry the stop bar 162 beneath the shoulders 134′ of the entire series of cam levers 134 to hold them from movement. Under normal conditions, however, the shift rod 114 remains at rest with its trip studs extending laterally or horizontally therefrom, as seen in Fig. V and the multiplying mechanism may be operated without interference, or the shift rod may be rotated to throw the adding or subtracting mechanisms into service as previously explained.

For the purpose of adapting my calculating attachment to typewriting machines in which the type bars are provided with more than a single type, and to provide for the utilization of more than the numeral type upon the type bars that are operated by the numeral key levers of the machine I furnish means whereby the numeral key levers may be disconnected from the parts of the calculating mechanism they are united to, when the character other than a numeral and upon the same type bar as a numeral is to be impressed upon a sheet of paper in the typewriting machine carriage. The parts utilized for this purpose include the rock bar 64, through which the numeral key lever connecting rods 62 extend, and which is normally held in a forward position by a retracting spring 166 to maintain the hooks 63 of said connecting rods in engagement with the studs 69 of the pull levers 66. They also include a pair of shift levers 167 which are provided at their rear ends with cams that engage opposing cam faced wings of the rock bar 64, as seen in Fig. V. When the forward end of either of the key levers just mentioned is depressed the rock bar 64 is rotated rearwardly and the connecting rods 62 are all carried out of engagement with the studs at the forward ends of the pull levers 66, whereby the numeral key levers 2 are, when operated, prevented from actuating the governing parts of the calculating mechanism. As soon as the shift key lever that has been depressed is released the spring 166 acts to return the rock bar 64 to its normal position and the connecting rods 62 are all caused to resume their engagement with the studs at the forward ends of the pull levers 66.

I claim:

1. The combination with an ordinary typewriting machine having key levers and a platen carriage, of calculating mechanism comprising registering mechanism containing a driving member shiftably mounted and cooperable with said platen carriage, power mechanism for operating said driving member, and means operable through the medium of said key levers for controlling said power mechanism, substantially as set forth.

2. The combination with an ordinary typewriting machine having key levers, of calculating mechanism including registering mechanism, power mechanism by which said registering mechanism is operated, and governing mechanism for said power mechanism controlled by said key levers, substantially as set forth.

3. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including elements by which addition or multiplication may be performed at different times, and means whereby an element of said calculating mechanism employed for addition may be rendered inactive for calculat-

ing action and the multiplying elements of said calculating mechanism may be rendered active for calculating action.

4. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including elements by which addition or multiplication may be performed at different times, and means whereby an element of said calculating mechanism employed for multiplication may be rendered inactive for calculating action and the addition elements of said calculating mechanism may be rendered active for calculating action.

5. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including elements by which multiplication or subtraction may be performed at different times, and means whereby an element of said calculating mechanism employed for multiplication may be rendered inactive for calculating action and the subtraction elements of said calculating mechanism may be rendered active for calculating action.

6. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including elements by which multiplication or subtraction may be performed at different times, and means whereby an element of said calculating mechanism employed for subtraction may be rendered inactive for calculating action and the multiplying elements of said calculating mechanism may be rendered active for said calculating action.

7. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including elements by which addition or multiplication may be performed at different times, and means whereby an element of said calculating mechanism employed for addition may be rendered inactive for calculating action, and the multiplying elements of said calculating mechanism may be rendered active for calculating action.

8. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including elements by which addition or multiplication may be performed at different times, and means whereby an element of said calculating mechanism employed for multiplication may be rendered inactive for calculating action, and the addition elements of said calculating mechanism may be rendered active for calculating action.

9. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including elements by which multiplication or subtraction may be performed at different times, and means whereby an element of said calculating mechanism employed for multiplication may be rendered inactive for calculating action, and the subtraction elements of said calculating mechanism may be rendered active for calculating action.

10. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including elements by which multiplication or subtraction may be performed at different times, and means whereby an element of said calculating mechanism employed for subtraction may be rendered inactive for calculating action and the multiplying elements of said calculating mechanism may be rendered inactive for calculating action.

11. The combination with an ordinary typewriting machine having numeral key levers, and a shift key lever, of calculating mechanism coöperable with said numeral key levers, and means adapted to be actuated directly by said shift key lever whereby said numeral key levers are thrown out of cooperation with said calculating mechanism; said last named means comprising shiftable connecting members carried by said numeral key levers, and a rockable member adapted to be engaged by said shift key lever and by which said connecting members are thrown out of operative positions.

12. The combination with an ordinary typewriting machine having numeral key levers, and a shift key lever, of multiplying mechanism coöperable with said numeral key levers, and means adapted to be actuated by said shift key lever whereby said numeral key levers may be thrown out of coöperation with said multiplying mechanism, substantially as set forth.

13. The combination with an ordinary typewriting machine having numeral key levers, and a shift key lever, of multiplying mechanism coöperable with said numeral key levers, and means adapted to be actuated directly by said shift key lever whereby said numeral key levers may be thrown out of cooperation with said multiplying mechanism, substantially as set forth.

14. The combination with an ordinary typewriting machine having numeral key levers, and a shift key lever, of multiplying mechanism coöperable with said numeral key levers, means adapted to be actuated by said shift key lever whereby said numeral key levers may be thrown out of coöperation with said multiplying mechanism, and means whereby said multiplying mechanism may be rendered coöperable with said numeral key levers after said shift key lever is released.

15. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising registering mechanism, power mechanism for operating said registering mechanism, means cooperable with said key levers for governing said power mechanism, an offsetting key lever for breaking connection between said numeral key levers and said governing mechanism, and a setting key lever for restoring the connection between said numeral key levers and governing mechanism.

16. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising adding mechanism, power mechanism for operating said adding mechanism, power governing means coöperable with said key levers, an offsetting key lever for breaking connection between said numeral key levers and said governing mechanism and a setting key lever for restoring the connection between said numeral key levers and governing mechanism.

17. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising subtracting mechanism, power mechanism for operating said subtracting mechanism, power governing means coöperable with said key levers, an offsetting key lever for breaking connection between said numeral key levers and said governing mechanism and a setting key lever for restoring the connection between said numeral key levers and governing mechanism.

18. The combination in a calculating machine, of multiplying mechanism, numeral key levers with which said multiplying mechanism is coöperable, governing means coöperable with said key levers, an offsetting key lever for breaking connection between said numeral key levers and said governing mechanism and a setting key lever for restoring the connection between said numeral key levers and governing mechanism, substantially as set forth.

19. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising multiplying and registering mechanisms, power mechanism for operating said multiplying and registering mechanisms, power governing means coöperable with said key levers, an offsetting key lever for breaking connection between said numeral key levers and said governing mechanism and a setting key lever for restoring the connection between said numeral key levers and governing mechanism.

20. The combination in a calculating machine, of a platen carriage, registering mechanism including a series of numeral wheels, a series of transmission wheels for operating said numeral wheels, a registering mechanism carriage adapted to traverse said series of transmission wheels and coöperable with said platen carriage, a driving wheel carried by said registering mechanism carriage adapted to engage either of said transmission wheels, and power mechanism for operating said parts, substantially as set forth.

21. The combination of calculating mechanism comprising registering mechanism including numeral wheels, a guide rod adjacent to the peripheries of said wheels, a registering mechanism carriage mounted on said guide rod, a driving wheel carried by said carriage adapted to operate said numeral wheels and power mechanism for operating said driving wheel, substantially as set forth.

22. The combination with an ordinary typewriting machine having a platen carriage, of calculating mechanism comprising registering mechanism including numeral wheels, a guide rod adjacent to the peripheries of said wheels, a registering mechanism carriage mounted on said guide rod and coöperable with said platen carriage, a driving wheel carried by said carriage adapted to operate said numeral wheels, and power mechanism for operating said driving wheel, substantially as set forth.

23. The combination with an ordinary typewriting machine having key levers, and a platen carriage, of a calculating registering mechanism comprising a series of numeral wheels, a driving wheel for engagement with either of said numeral wheels and which is shiftable relative thereto, means whereby said driving wheel is moved correspondingly to the movement of said platen carriage; power mechanism for rotating said driving wheel, and means actuated by said key levers for governing said power mechanism, substantially as set forth.

24. The combination with an ordinary typewriting machine having keys levers and a platen carriage, of a calculating registering mechanism comprising a series of numeral wheels, a carriage shiftably mounted in proximity to said numeral wheels, a driving wheel mounted in said carriage and from which motion is transmitted to said numeral wheels, means by which said registering mechanism carriage is caused to partake of a movement corresponding to the movement of said typewriting machine carriage; power mechanism for rotating said driving wheel, and means controlled by said key levers for governing said power mechanism, substantially as set forth.

25. The combination with an ordinary typewriting machine having key levers and a platen carriage, of a calculating registering

mechanism comprising a series of numeral wheels, a shaft extending length-wise of said series, of numeral wheels, a driving wheel fitted to said shaft and by which said numeral wheels are driven, a carriage for shifting said driving wheel longitudinally of said shaft means whereby the carriage of the registering mechanism is moved correspondingly to the movement of the carriage, of the typewriting machine; power mechanism for rotating said driving wheel, and means actuated by said key levers for governing said power mechanism, substantially as set forth.

26. The combination in a recording calculating machine, of calculating mechanism, key levers whereby said calculating mechanism may be thrown into action, type bars coöperable with said calculating mechanism, a platen to which the type of said type bars may be moved, and a guard whereby said type may be prevented from striking said platen, substantially as set forth.

27. The combination with an ordinary typewriting machine having key levers, type bars, a platen carriage, and a platen in said carriage, of calculating mechanism coöperable with said key levers, and a guard whereby the type of said type bars may be prevented from striking said platen during the operation of said calculating mechanism.

28. The combination with an ordinary typewriting machine having key levers, a platen carriage, and a platen mounted in said carriage, of calculating mechanism coöperable with said key levers and carriage, a guard located beneath said platen, and means for shifting said guard to carry it into the path of travel and out of the path of travel of the type in said typewriting machine, substantially as set forth.

29. The combination with an ordinary typewriting machine having key levers, a platen carriage, and a platen mounted in said carriage, of calculating mechanism coöperable with said key levers and carriage, a guard located beneath said platen, and a shift key lever for shifting said guard into the path of travel and out of the path of travel of the type in said typewriting machine, substantially as set forth.

30. The combination with an ordinary typewriting machine having key levers, a platen carriage, and a platen mounted in said carriage, of calculating mechanism coöperable with said key levers and carriage, a guard located beneath said platen and movable into the path of and out of the path of travel of the type of said machine, a spring controlled rockable member to which said guard is connected, and a shift key lever for actuating said rockable member, substantially as set forth.

31. The combination with an ordinary typewriting machine having key levers, a platen carriage, and a platen mounted in said carriage, of a calculating mechanism coöperable with said key levers and carriage, a guard beneath said platen movable into and out of the path of travel of the type in said machine, a pair of rockable spring controlled members to which said guard is connected, and a pair of shift key levers arranged for engagement with said rockable members to move said guard, substantially as set forth.

32. The combination with an ordinary typewriting machine having key levers, of a calculating registering mechanism, power mechanism for operating said registering mechanism, means controlled by said key levers for governing said power mechanism, multiplying mechanism movable into and out of coöperation with said power mechanism, and means for moving said multiplying mechanism into and out of position for cooperation with said power mechanism.

33. The combination with an ordinary typewriting machine having key levers, of a calculating registering mechanism, power mechanism for operating said registering mechanism, means controlled by said key levers for governing said power mechanism, multiplying mechanism movable into and out of coöperation with said power mechanism, and key levers for moving said multiplying mechanism into and out of position for coöperation with said power mechanism, substantially as set forth.

34. The combination with an ordinary typewriting machine having key levers, of a calculating registering mechanism, power mechanism for operating said registering mechanism, means controlled by said key levers for governing said power mechanism, multiplying mechanism movable into and out of coöperation with said power mechanism, means for moving said multiplying mechanism into and out of position for cooperation with said power mechanism, and means for returning said multiplying mechanism from coöperation with said power mechanism, substantially as set forth.

35. The combination with an ordinary typewriting machine, of a calculating attachment coöperable with said machine and comprising registering mechanism, power mechanism, means controlled by the key levers of said typewriting machine for governing said power mechanism, shiftable means coöperable with said registering mechanism adapted to be placed in operation with said power mechanism, and a shifter for moving said shiftable means to cause said power mechanism to operate said registering mechanism for either adding, subtracting or multiplying action, substantially as set forth.

36. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of multiplying mechanism coöperable with said numeral key levers, and means whereby said multiplying mechanism is thrown into and out of coöperation with said numeral key levers.

37. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of a multiplying mechanism having independent members coöperable with said key levers, power mechanism for actuating the members of said multiplying mechanism, and means whereby said multiplying mechanism members are thrown into and out of coöperation with said power mechanism.

38. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said numeral key levers and including multiplying mechanism and power mechanism, and key lever actuated means whereby said multiplying mechanism is placed in coöperation with said power mechanism.

39. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising registering mechanism, power mechanism, mechanism operated by said power mechanism for actuating said registering mechanism, and a plurality of multiple wheels adapted to be moved into and out of coöperation with said mechanism for actuating said registering mechanism, and means for moving said multiple wheels into and out of coöperation with said mechanism for actuating the registering mechanism.

40. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and comprising registering mechanism, power mechanism, mechanism operated by said power mechanism for actuating said registering mechanism, and a plurality of multiple wheels adapted to be moved into and out of coöperation with said mechanism for actuating said registering mechanism, and key lever actuated means for moving said multiple wheels into and out of coöperation with said mechanism for actuating the registering mechanism.

41. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including registering mechanism and multiplying members adapted to be moved into position to operate said registering mechanism, means for moving said multiplying members into and out of operative position, and means for restraining said multiplying member moving means from movement, substantially as set forth.

42. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and including registering mechanism, and multiplying members adapted to be moved into position to operate said registering mechanism, means for moving said multiple members into and out of operative position, and means for restraining said multiple member moving means from movement.

43. The combination with an ordinary typewriting machine having numeral key levers, of a calculating attachment coöperable with said key levers and including registering mechanism, and multiplying members adapted to be moved into position to operate said registering mechanism, means for moving said multiple wheels into and out of operative position, and spring controlled means for restraining said multiple wheel moving means from movement.

44. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, and means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism, substantially as set forth.

45. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, and means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism; said last named means comprising cam levers engaging said carrier bars and key levers for actuating said cam levers, substantially as set forth.

46. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling

said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, and means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism; said last named means comprising spring controlled cam levers for engagement with said carrier bars and key levers for actuating said cam levers, substantially as set forth.

47. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, and means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism; said last named means comprising cam levers engaging said carrier bars, key levers for actuating said cam levers, and means for locking said cam levers from movement, substantially as set forth.

48. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism, cam levers engaging said carrier bars, key levers for actuating said cam levers, and means for restraining said cam levers from movements, substantially as set forth.

49. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism, multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism, cam levers engaging said carrier bars, key levers for actuating said cam lever, and means for restraining said cam levers from movement; said last named means comprising a stop bar and a shifter having engagement therewith, substantially as set forth.

50. The combination with an ordinary typewriting machine having key levers, of a calculating attachment comprising registering mechanism, power mechanism, means operable by said key levers for controlling said power mechanism multiple wheels for actuating said registering mechanism, carrier bars by which said multiple wheels are movably supported, driving means associated with said multiple wheels and adapted to be operated by said power mechanism, means for moving said carrier bars to place said multiple wheels in position to operate said registering mechanism and said driving means in engagement with said power mechanism, cam levers engaging said carrier bars, key levers for actuating said cam levers, and means for restraining said cam levers from movement; said last named means comprising a spring controlled stop bar adapted to be moved into engagement with said cam levers and a shift rod having engagement with said stop bar, substantially as set forth.

51. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including two sets of elements by which addition or multiplication may be performed at different times, and means whereby an element of one of said sets may be rendered inactive for calculating action and the elements of the other sets of elements may be rendered active for calculating action.

52. The combination in a calculating machine, of numeral key levers, calculating mechanism coöperable with said key levers and including two sets of elements by which multiplication or subtraction may be performed at different times, and means whereby an element of one of said sets may be rendered inactive for calculating action and the elements of the other set of elements may be rendered active for calculating action.

53. The combination with an ordinary typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including two sets of elements by which addition or multiplication may be performed at different times, and means whereby an element of one of said sets may be rendered inactive for calculating action and the elements of the other set of elements may be rendered active for calculating action.

54. The combination with an ordinary

typewriting machine having the usual complement of numeral key levers, of calculating mechanism coöperable with said key levers and including two sets of elements by which multiplication or subtraction may be performed at different times, and means whereby an element of one of said sets may be rendered inactive for calculating action and the elements of the other set of elements may be rendered active for calculating action.

FERDINAND J. TILLMAN.

In the presence of—
LILY ROST,
H. G. COOK.