No. 733,947. PATENTED JULY 21, 1903.

A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 1.

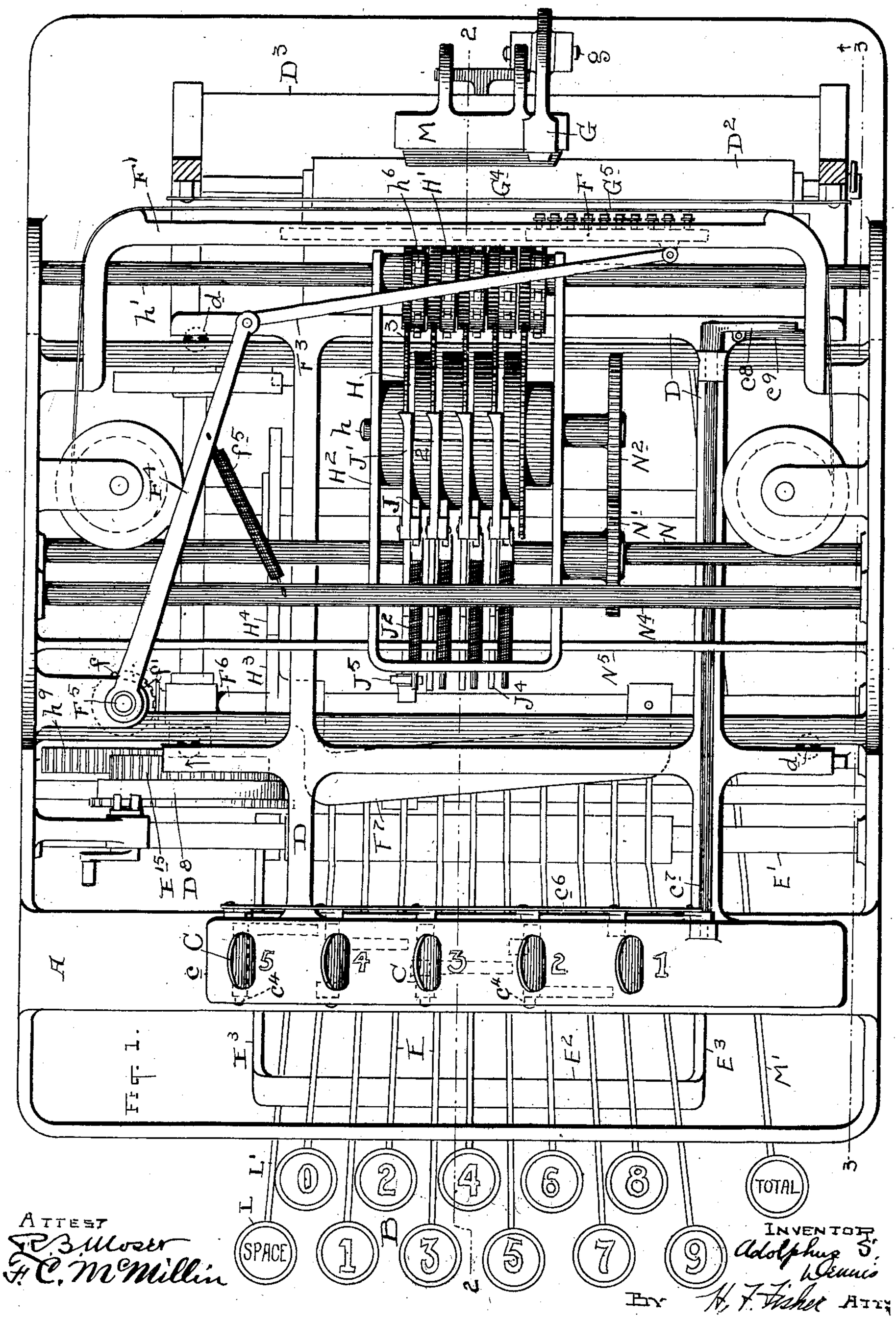


Fig. 1.

Attest
F. B. Moser
F. C. McMillin

Inventor
Adolphus S. Dennis
By H. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 2.

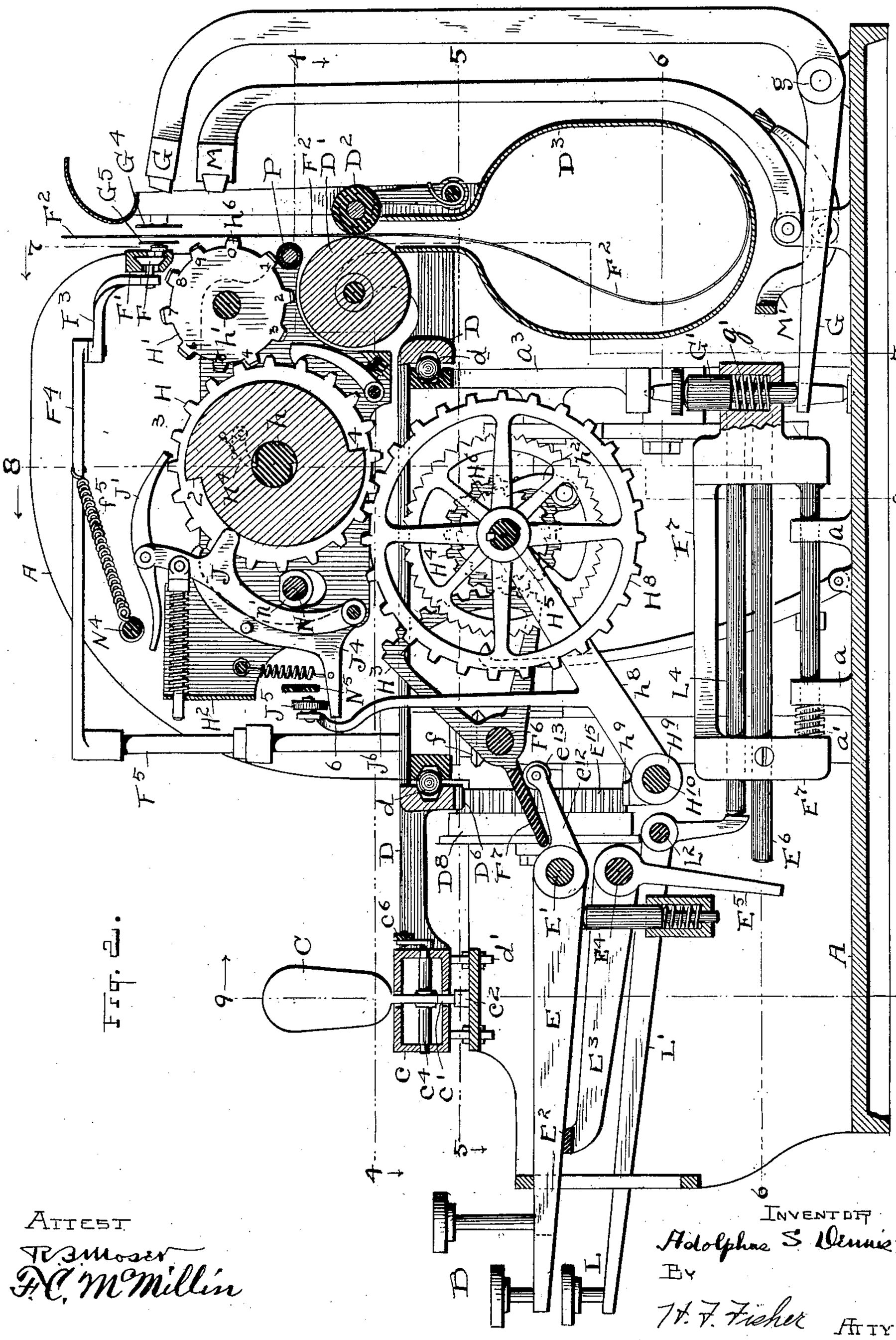


FIG. 2.

Attest
R. F. Moser
F. C. McMillin

Inventor
Adolphus S. Dennis,
By
W. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 3.

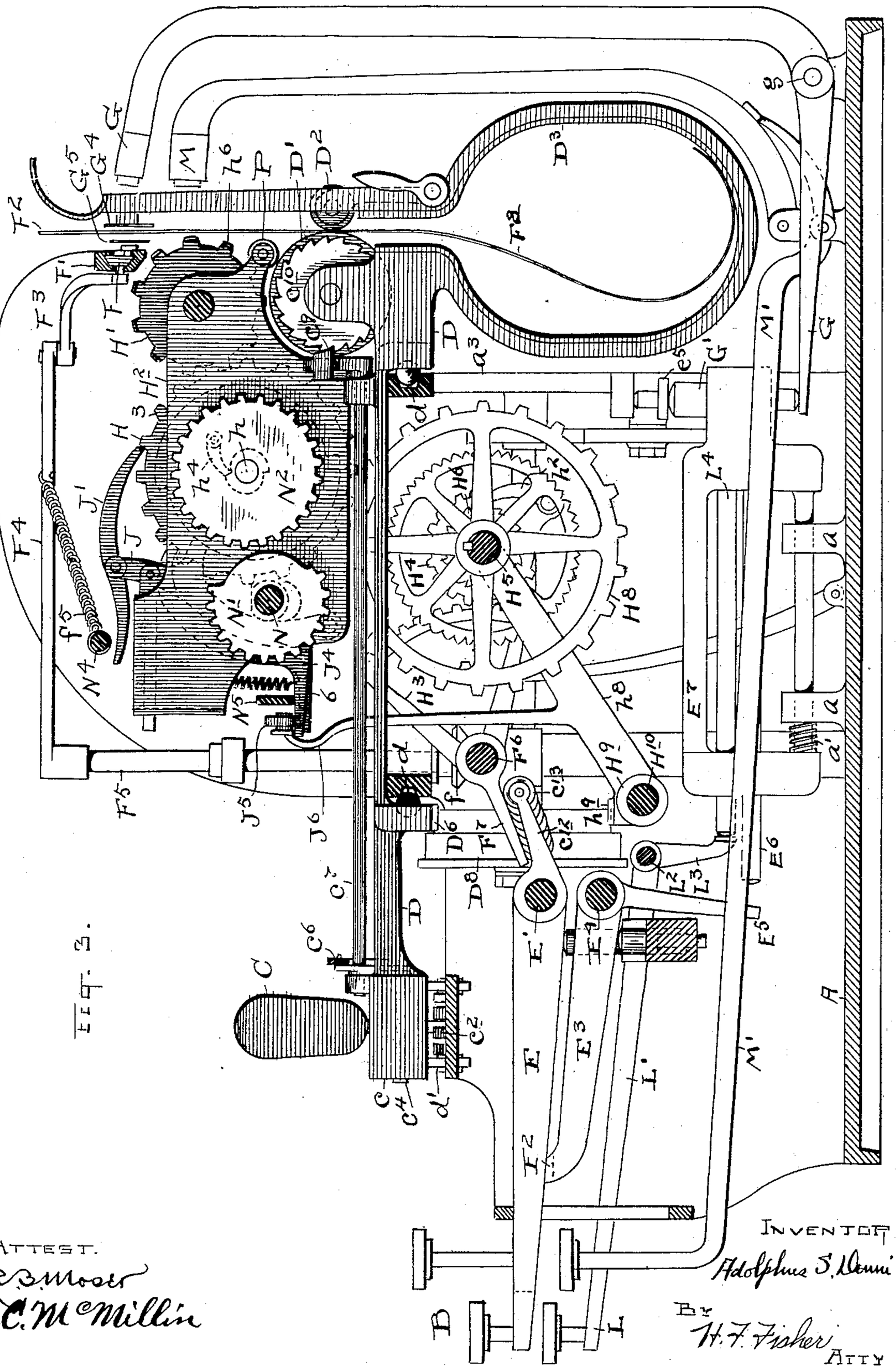


FIG. 3.

ATTEST.

R. B. Moore

F. C. McMillin

INVENTOR

Adolphus S. Dennis

By H. F. Fisher ATTY

No. 733,947. PATENTED JULY 21, 1903.

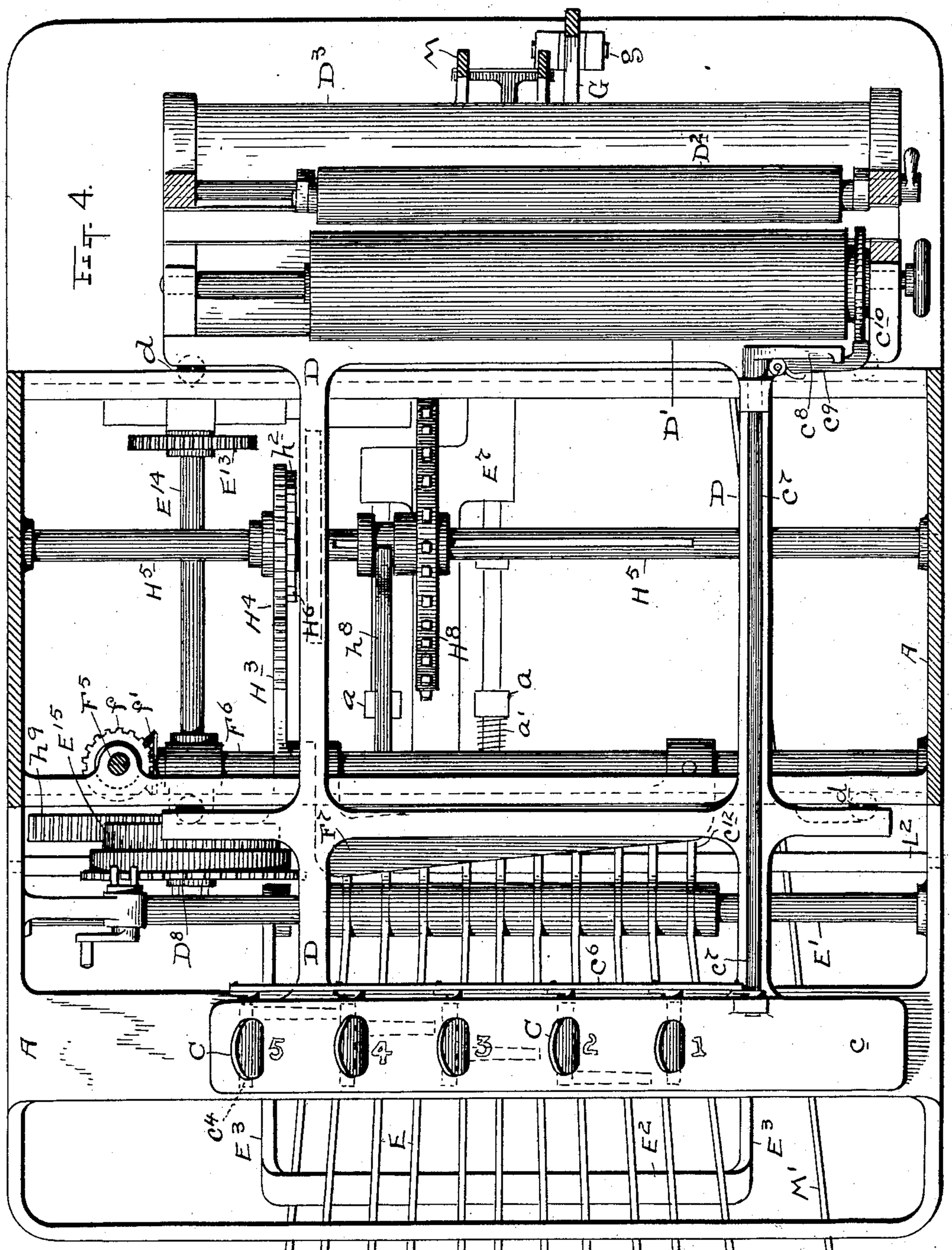
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 4.

FIG. 4.



ATTEST.
R. B. Moore
F. C. McMillin

INVENTOR
Adolphus S. Dennis
By W. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

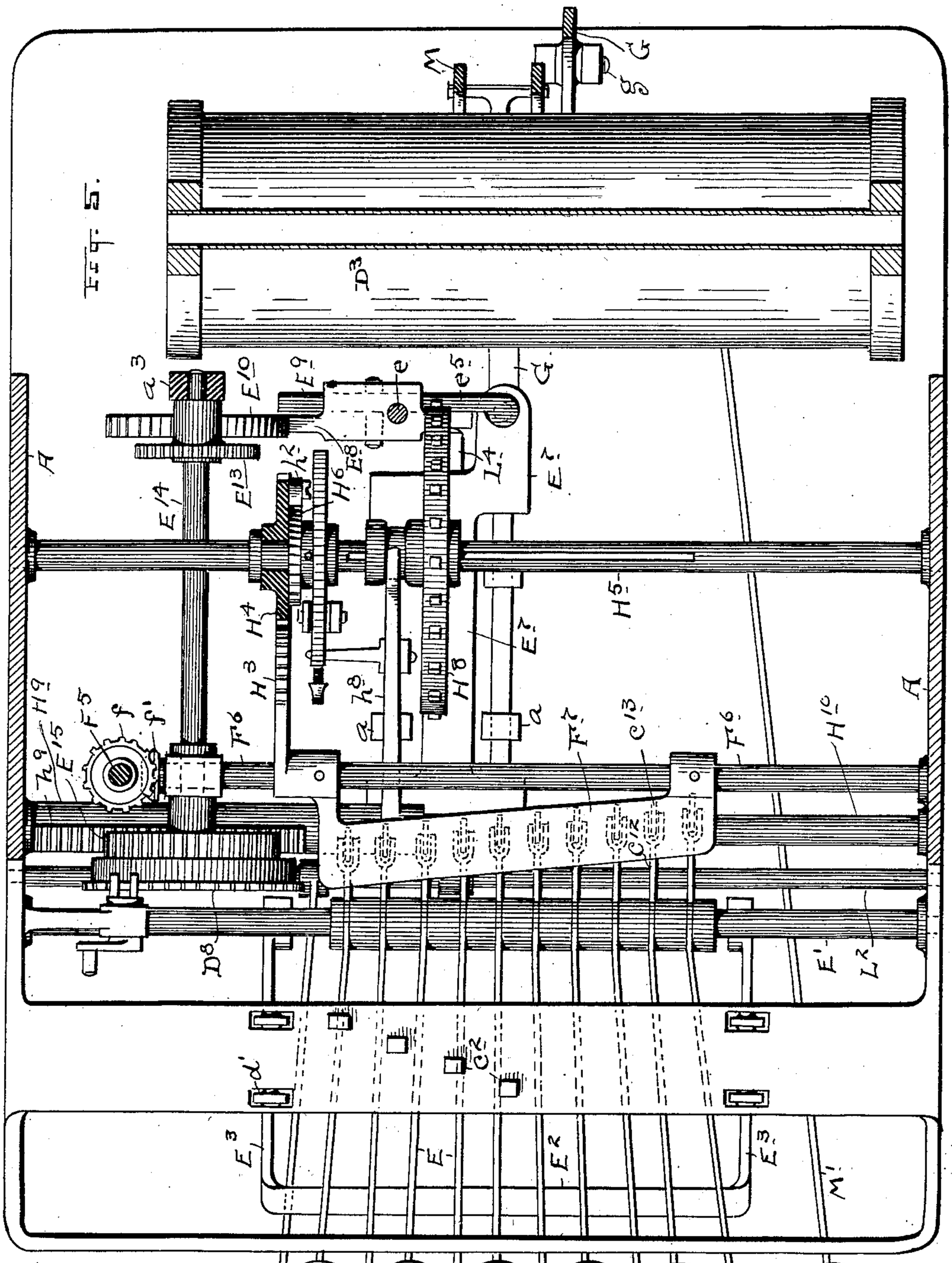
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 5.

Fig. 5.



Attest
R. B. Moser
F. C. McMillin

Inventor
Adolphus S. Dennis
By W. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

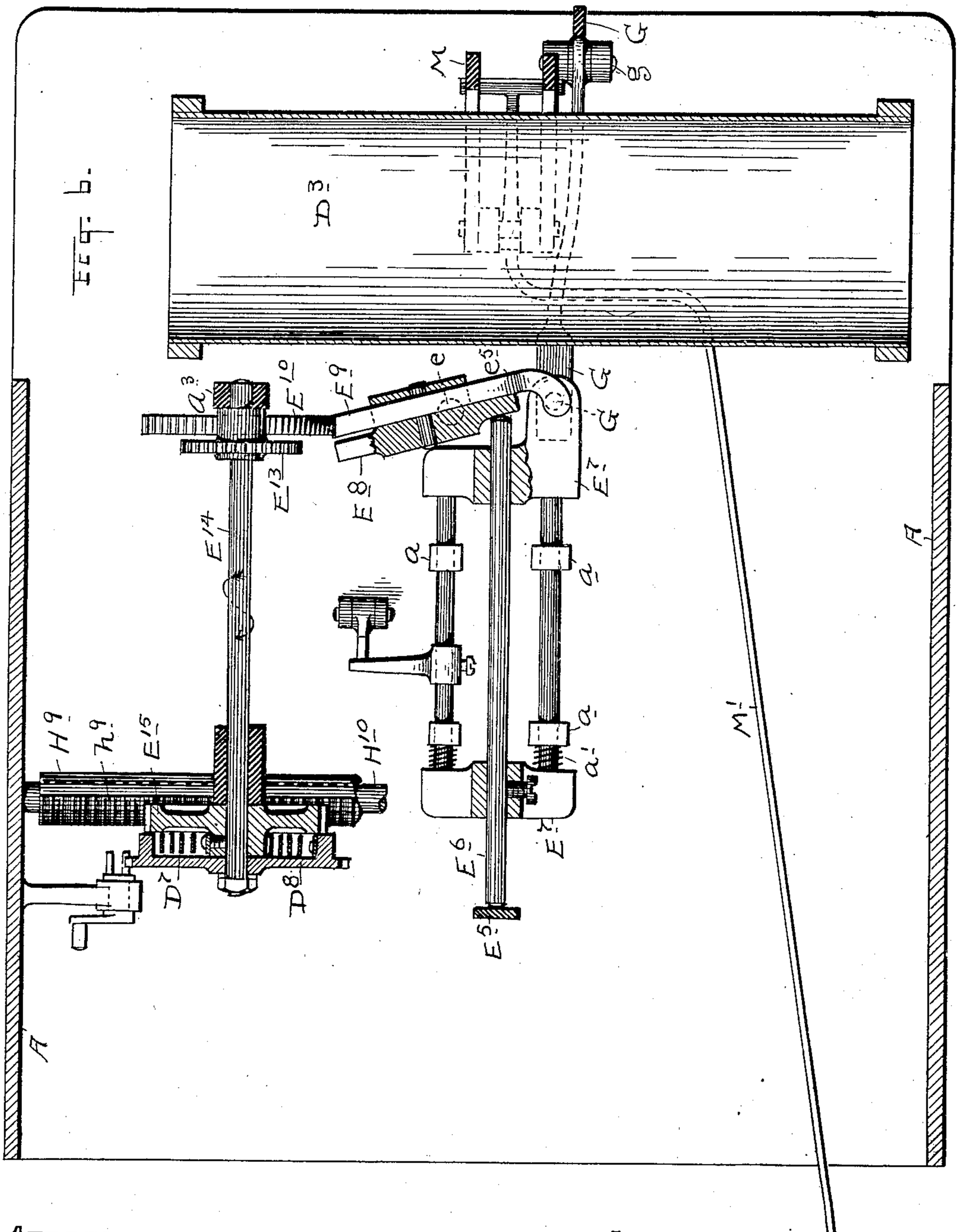
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 6.

Fig. 6.



Attest

P. B. Moore

F. C. McMillin

Inventor

Adolphus S. Dennis

By H. F. Fisher Atty

TOTAL

No. 733,947. PATENTED JULY 21, 1903.

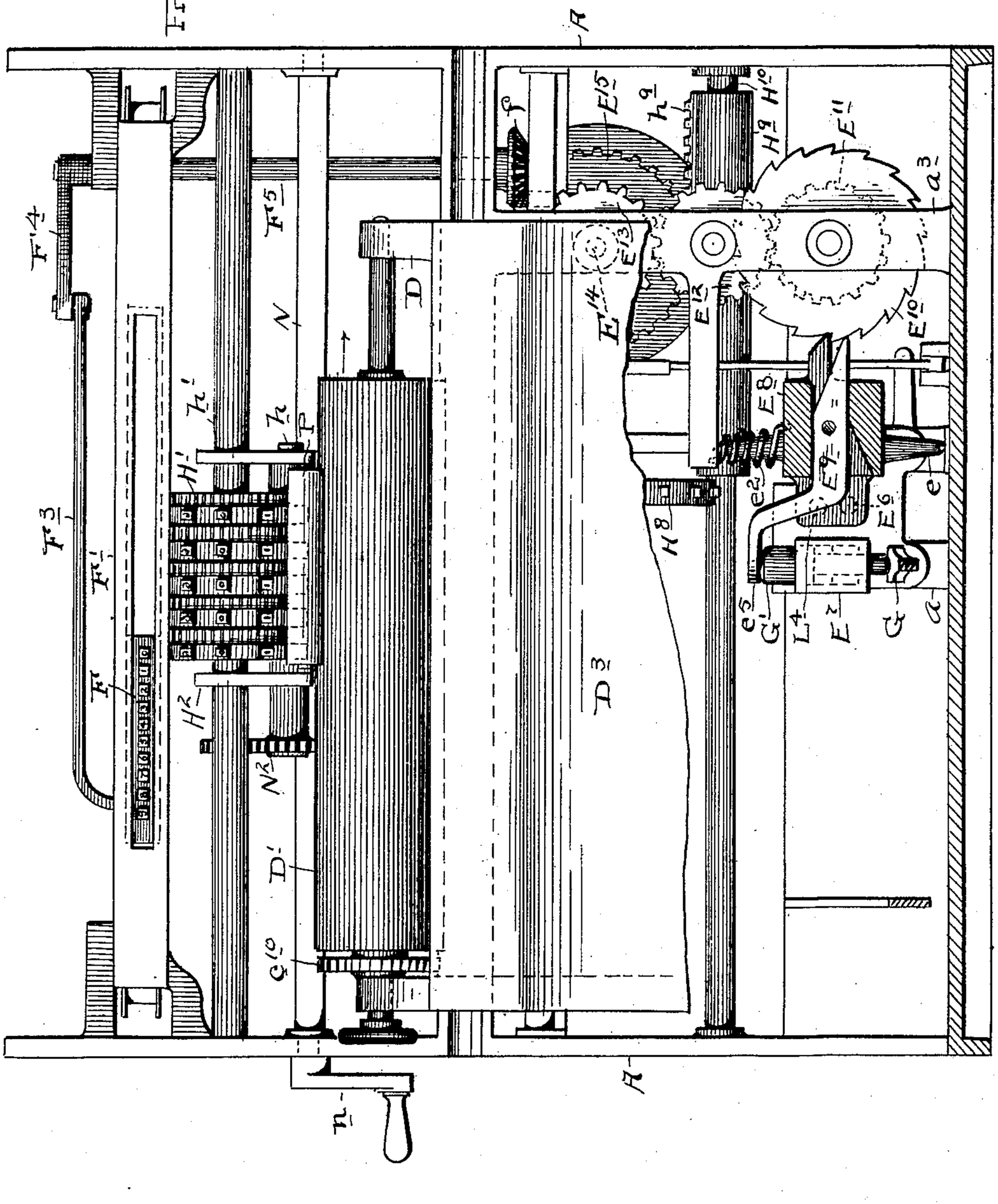
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 7.

Fig. 7.



Attest.
R. Sherer
F. C. McMillin

Inventor
Adolphus S. Dennis
By H. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

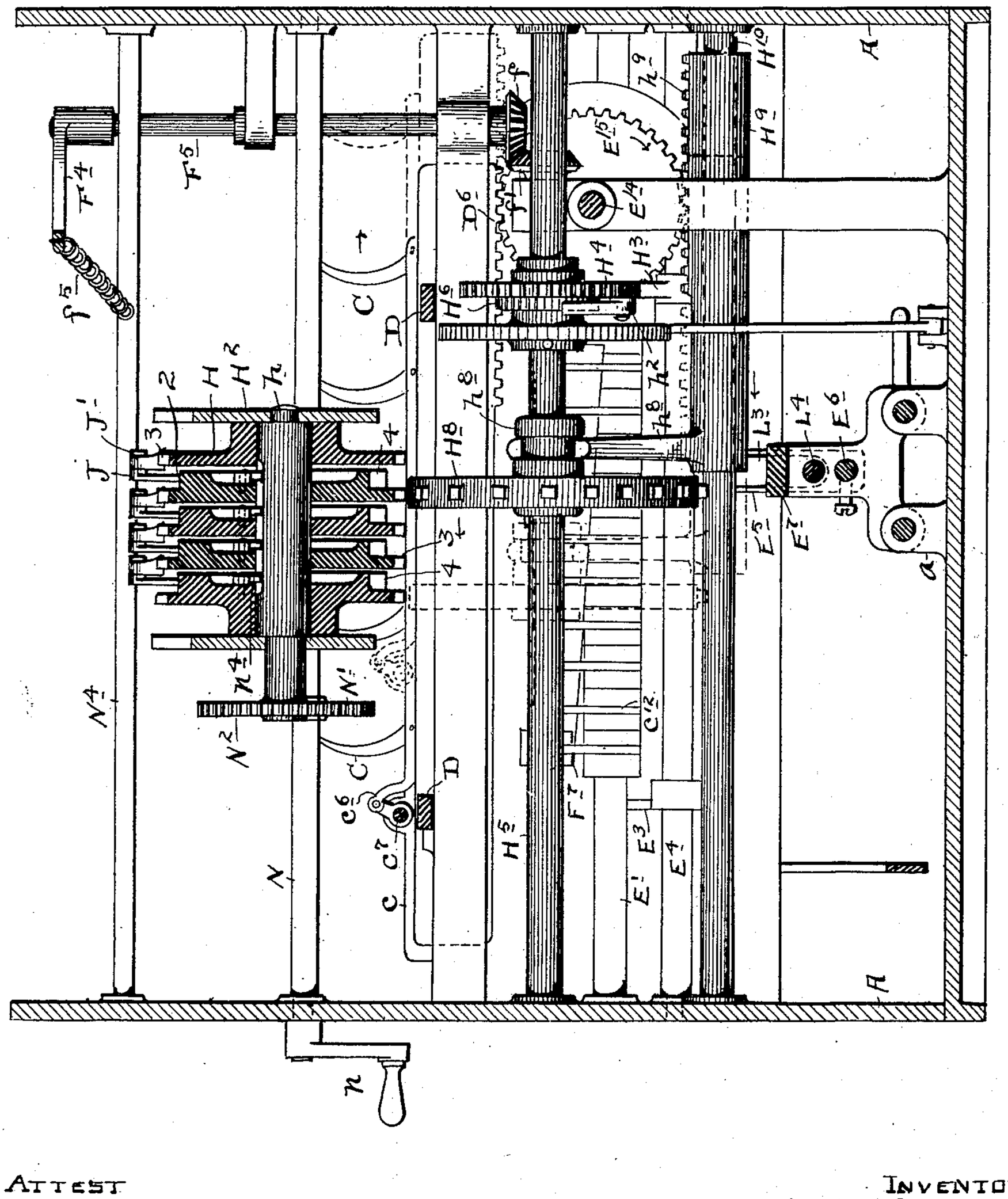
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 8.

Fig. 8.



Attest
R. Blosser
F. C. McMillin

Inventor
Adolphus S. Dennis.
By H. F. Fisher Atty

No. 733,947. PATENTED JULY 21, 1903.

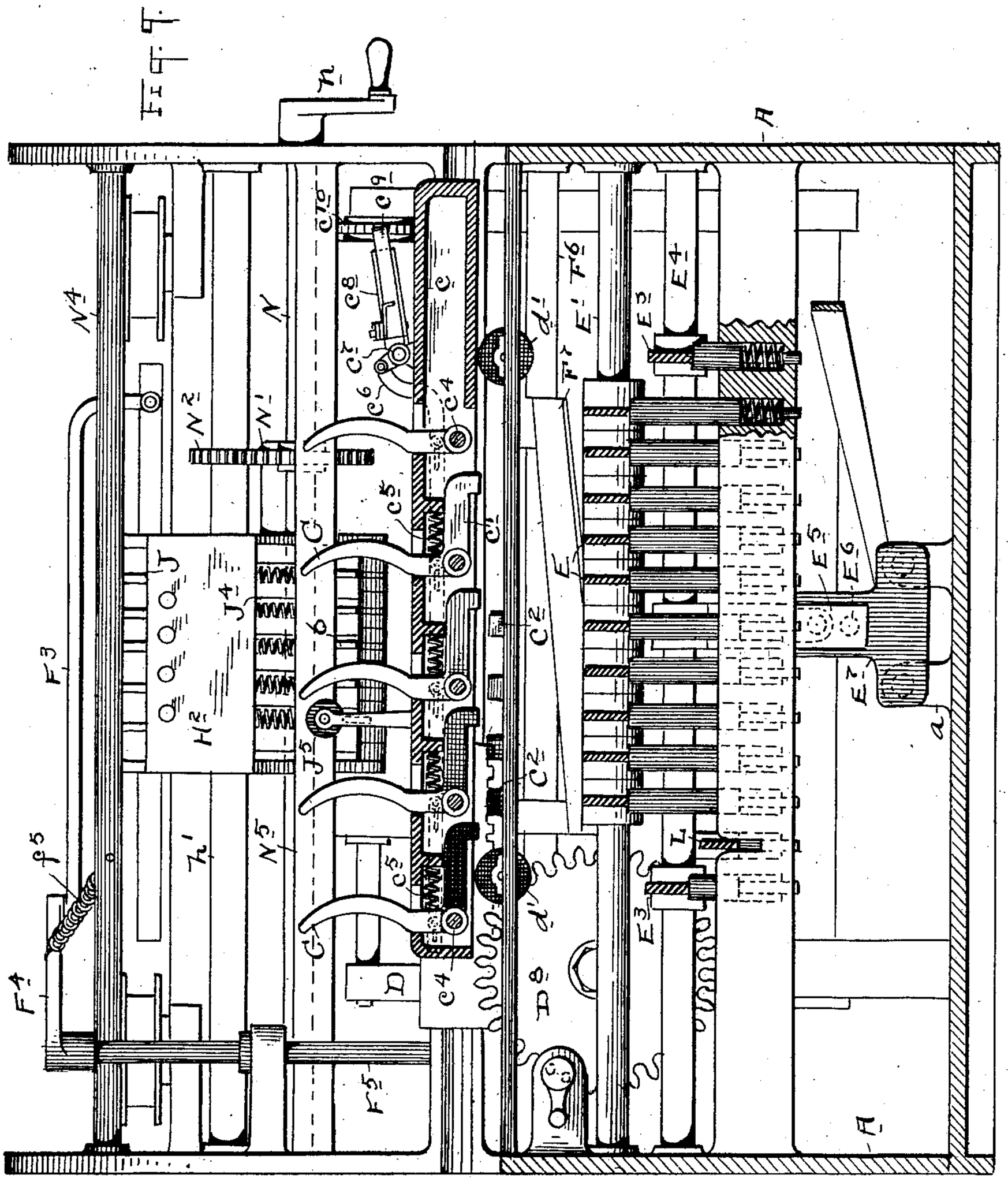
A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 9.

FIG. 9.



ATTEST

R. B. Moore

F. C. McMillin

INVENTOR

Adolphus S. Dennis

BY H. F. Fisher ATTY

No. 733,947. PATENTED JULY 21, 1903.

A. S. DENNIS.

ADDING AND RECORDING MACHINE.

APPLICATION FILED MAR. 25, 1898.

NO MODEL. 10 SHEETS—SHEET 10.

Fig. 10.

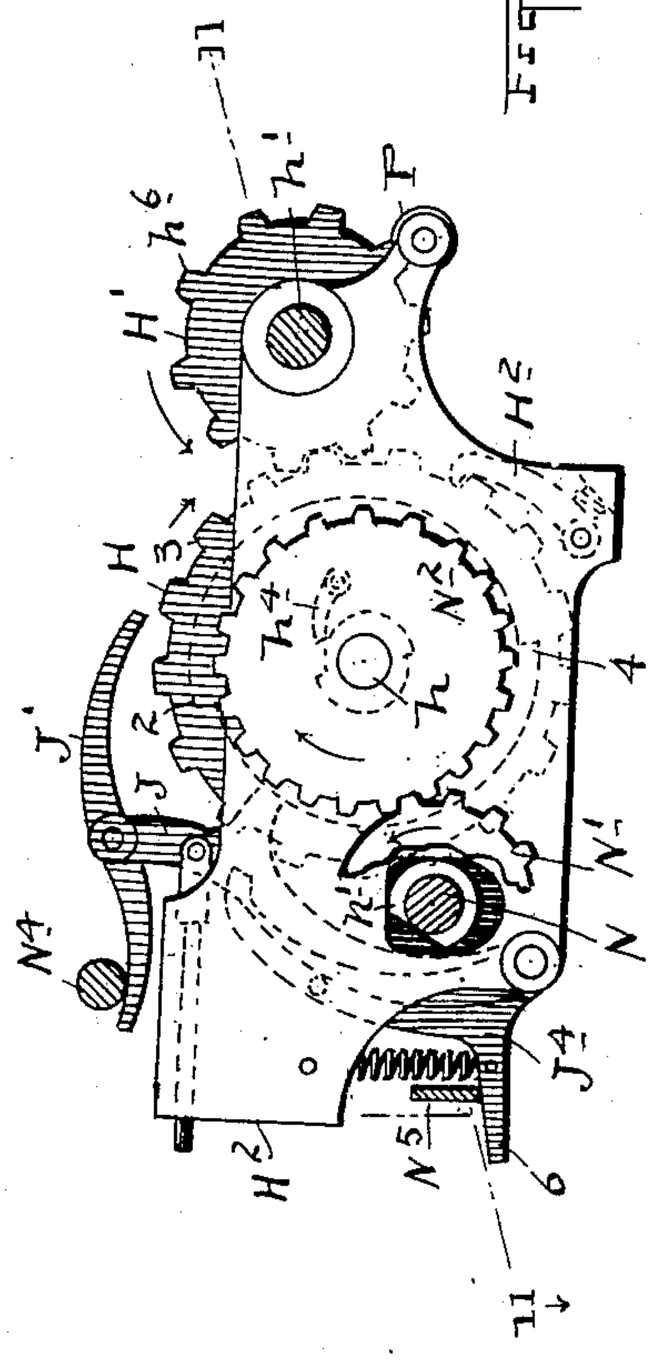
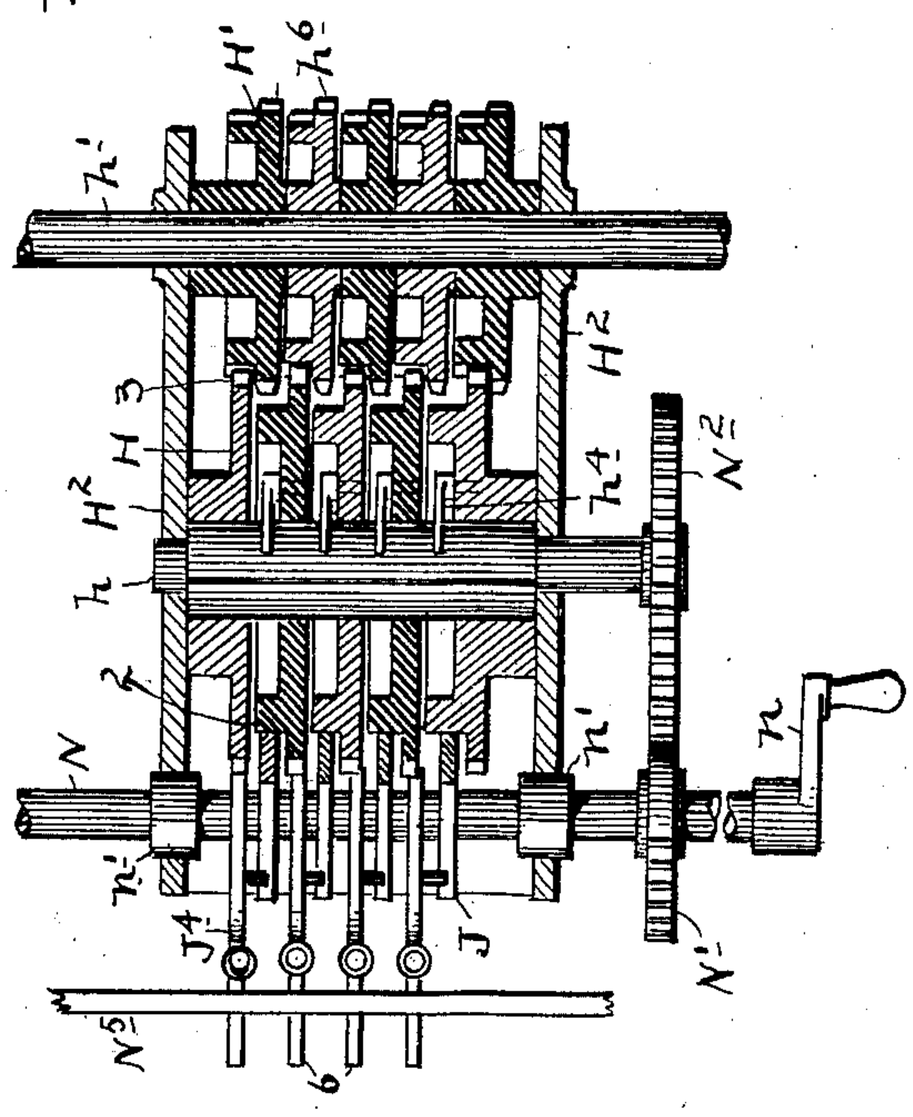


Fig. 11.



Attest
R. B. Moser
F. C. McMillin

Inventor
Adolphus S. Dennis

By H. F. Fisher Atty

No. 733,947. Patented July 21, 1903.

UNITED STATES PATENT OFFICE.

ADOLPHUS S. DENNIS, OF CLEVELAND, OHIO, ASSIGNOR TO THE BANKERS ADDING & RECORDING MACHINE COMPANY, OF CLEVELAND, OHIO, A CORPORATION.

ADDING AND RECORDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 733,947, dated July 21, 1903.

Application filed March 25, 1898. Serial No. 675,063. (No model.)

To all whom it may concern:

Be it known that I, ADOLPHUS S. DENNIS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Adding and Recording Machines; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in adding and recording machines; and the invention consists in a machine in which there are two distinct and separate ultimate results reached through operations carried forward at the same time by associated and coöperating mechanisms, said mechanisms being part way in two independent lines and one line designed more especially to print the items to be added in successive lines and columns as they would be set down by pen or pencil and the other line of mechanism designed to faithfully add up all the items as rapidly as they are printed and keep the total or sum thereof ready to be printed off in full in a single line by a single stroke or depression of the totalizing-key. This sum or total may be struck off at any time, as may be desired, whether all the items have as yet been set down or not—that is, the total of any number of items from two up may be accurately printed off in an instant at any time, because the total or sum of the items is made by the machine as the recording of the items progresses and is ready to be stated in print the moment the last item has been set down, and this is true whether the answer be in units or millions or any other number. Now keeping in view the foregoing objects, which are the essential objects of the machine, reference to the accompanying drawings may be had for illustration of the mechanism to carry the same into effect.

Figure 1 is a plan view of the machine in which all the parts are supposed to be in their normal position. Fig. 2 is a central sectional elevation of the machine, front to rear, on line 2 2, Fig. 1. Fig. 3 is practically a side elevation of the machine, the near side of the main frame being removed and the view looking in from line 3 3, Fig. 1. Fig. 4 is a plan section on line 4 4, Fig. 2, the adding and recording mechanism above this line all being removed. Fig. 5 is a plan section on line 5 5, Fig. 2, corresponding to Fig. 4, but still lower down, and thus revealing parts not seen in Fig. 4. Fig. 6 is a plan sectional view on line 6 6, Fig. 2, which is on a still lower plane than either Figs. 4 or 5 and intended more especially to disclose the escapement mechanism for governing the movements of the carriage. Fig. 7 is a rear elevation of the machine, partly in section and on a line corresponding substantially to line 7 7, Fig. 2. Fig. 8 is a transverse sectional elevation of the machine on a line corresponding substantially to line 8 8, Fig. 2, looking forward and showing especially the rack mechanism for moving the carriage and the column-line gear in opposite directions and a vertical section of the adding-wheels. Fig. 9 is a transverse sectional elevation of the machine on line 9 9, Fig. 2, looking rearward and disclosing especially the spacing and column-defining levers and associated parts. Fig. 10 is a detail showing the adding-wheels and the printing-wheels of the adding mechanism in side elevation and an elevation of the pivoted frame carrying the adding-wheels and certain locking mechanism, as hereinafter more fully described. Fig. 11 is a plan view of the parts disclosed in Fig. 10 and looking down from horizontal line 11 11, crossing said figure.

In the foregoing views, A represents the main frame of the machine, upon which all the other parts are directly or indirectly supported; but since the style or construction of the frame is not really material and any suitable frame may be substituted for what is shown I have only outlined the frame here and there for convenience in interpreting the drawings.

B represents the keys constituting the keyboard, and said board is not necessarily unlike the keyboard of an ordinary type-writer, but in this instance comprising only ten keys, which carry the nine numerals or digits "1," "2," "3," &c., and a cipher, making ten all told. These do not include the totalizing

and the spacing keys shown, but have to do exclusively with recording, writing, or printing the several items to be added together and the operation of the adding mechanism, as will hereinafter plainly appear.

C represents a series of short column-determining levers which are supported on the front of carriage D and serve to fix the column in which the first figure of any given item is to be printed. Five levers are here shown for as many columns; but there might be as many more as there are columns of figures to be added, say, into the billions. It will be noticed in Figs. 1 and 4 that there are numerals "1," "2," "3," &c., in the spaces between the levers C on the surface of the oblong box or casing *c*, in which said levers are pivoted, and said numerals indicate the successive columns, beginning in this special machine to count from the right or units point toward the left to higher denominations. Hence if the item to be printed be "20" the thumb will be laid in the "2" space, and the lever to the right, which always is the lever for any number, will be moved laterally, so as to depress its own short arm *c'*. This will cause said arm to engage the lug c^2 on the top of said casing and stop the carriage D in its return movement to the right, so as to begin printing in the tens-column, thus bringing the figure "2" of the item "20" in the second column, where it belongs, and the "0" at the next depression of a key in its column. Each one of the levers C is therefore intended to set the carriage to print any item from "1" up and each for its own column, running from left to right and finishing in the units-column. For convenience said levers are substantially L shape and are pivoted at their angles in the casing *c* on cross-rods c^4, small spiral springs c^5 serving to hold them normally out of engaging position. From the foregoing it will be understood that these levers C are used every time a line is to be printed and to move the carriage to position to print a new line. Then having fixed the place or column of beginning they are not again used until another item is to be printed, and each time the beginning-point is determined by the number of figures or characters in the item to be copied, whether one or more. The levers C have, however, still another function besides the one already described, and this relates to the feed mechanism on which the record or print of the machine is made. In Figs. 1 and 4 it will be seen that each pivot-rod c^4 on which a lever is rigidly fixed has an inner crank extremity operatively engaged with a bar or rod c^6. This bar has in turn a crank connection with the rod c^7 and serves to rotate said rod. The rod c^7 has a crank-arm c^8, on which is pivoted a spring-pressed dog or pawl c^9, and the said dog or pawl engages a ratchet c^{10} on the paper-roll D'. Now following this line of mechanism through to said roll D' it will be seen that each time any one of the levers C is operated it will communicate action through this mechanism to roll D' and carry the paper sheet which comes between this roll and outer roll D^2, Fig. 2, forward just far enough to provide for another line of figures or items to be printed below those already printed thereon. The levers C, therefore, both fix the column in which the printing of each line is to be begun and feed the paper forward to receive the line. Both rolls D' and D^2 are carried on the rear end of carriage-frame D, and the paper is fed upward between them and by them past the totalizing-wheels to means for printing the items or lines to be added. The carriage D has a back-and-forth transverse movement and is fed forward step by step as the printing of the items occurs under impulse from the keys B, as is common in type-writing machines. The said carriage occupies a horizontal position about midway of the machine, extending from front to rear, and of the outline most plainly seen in plan, Fig. 4. For ease and quietness of movement the carriage is provided with antifriction ball-bearings *d*, front and rear, Fig. 1, and rollers *d'* at the extreme front; but any preferred construction and arrangement of bearings to ease the travel of the carriage may be adopted. The column-spacing levers C are supported on the front of said carriage and the paper-rolls D' and D^2 on the rear thereof, and the means to operate the carriage and other mechanism is carried thereby, including the pocket or holder D^3 for the paper, Figs. 2, 5, and 7. This holder extends across the rear of the frame and has a comparatively narrow neck at the top, Fig. 5, through which the paper is drawn between the rolls D' and D^2. A roll or other means might be used to carry the paper in lieu of the holder D^3 shown. Other mechanism directly associated with carriage D or supported thereon is the escapement or feed mechanism therefor, whereby the carriage is caused to travel forward step by step a sufficient distance to successively print the work. This mechanism proceeds primarily from the key-levers E, pivoted on the cross shaft or rod E', Fig. 2. As any one of these several levers is depressed it bears upon a cross bar or piece E^2, supported at its ends on arms E^3, rigid with shaft or rod E^4 and forming together a frame. This frame rotates shaft E^4, carrying the arm E^5, and said arm bears against rod E^6 each time a key-lever is depressed. The rod E^6 is adjustably fixed in a sliding frame E^7, having its support in lugs or projections *a*, standing up from the base of main frame A, and springs *a'* or their equivalent at some suitable point cause said frame to move back to starting position after each actuation by arm E^5. Now referring to Fig. 6, we see the escapement mechanism for the carriage comprising two dogs E^8 and E^9. The dog E^8 has a head with side trunnions *e*, Fig. 7, on which it swings, and in this dog or head is pivoted the dog E^9, provided, as seen in Fig. 6, with a lat-

eral extension e^5 for purposes hereinafter described. The rod E^6 bears against the dog E^8 below its pivot and causes it to vibrate out of engagement with ratchet-wheel E^{10} when the carriage is to be released and to bring the dog E^9 into engaging position with said wheel by the same operation, and as the exchange of engagements is effected the said ratchet-wheel is caused to travel forward one notch or tooth, and this works a corresponding movement in the forward feed of the carriage, for which said escapement was made. The limited pivot movement of dog E^9 in dog E^8, Fig. 7, enables this limited rotation to occur. Then as the frame E^7 is liberated from pressure by arm E^5 and springs a' carry it back to normal position the dog E^8 is rotated back to engaging position again by springs e^2 on its trunnions or other sufficient means. In no case is either dog fully released from wheel E^{10} before the other takes engaging position, thus always keeping the escapement-wheel within control of said dogs. The ratchet-wheel E^{10} is supported by the side of gear E^{11} on a short shaft on post a^3 of the main frame A, and gear E^{11} meshes with gear E^{12} next above on the same post, and this in turn engages gear E^{13}, Fig. 6, on shaft E^{14} still higher up, Fig. 7. The shaft E^{14} extends toward the front of the machine, as seen in plan, Fig. 1, and carries the large gear-wheel E^{15}, which itself is engaged with the rack D^6 on the carriage-frame D. A convolute spring D^7 in a rotatably-adjustable housing D^8 is fixed to said housing and shaft E^{14} at its respective ends and furnishes the power for promptly moving the carriage D forward whenever it is liberated by the escapement mechanism before described. Control of this forward movement of the carriage is therefore obtained and held by the train of mechanism proceeding from the key-levers C, and the distance of each forward movement of the carriage as a result of a key depression is limited mechanically and is uniform in and for all the said several primary keys C.

F represents the type-bar at the rear and top of the machine, Fig. 7, from which the printing of the items occurs, and said bar is constructed and arranged to slide transversely of the machine in a longitudinal slot in supporting bar or strip F'. (Seen also in Figs. 1 and 3.) On the front or face of the said type-bar are consecutively arranged numbers or characters corresponding to those on the keyboard, and the intervening mechanism between key-lever and type-bar is designed to always bring the figure or character thereon corresponding to the one on the key depressed before the hammer G to make the desired imprint on the paper sheet F^2. Incident to this movement, but through a different line of mechanism, is the actuation of the said hammer, as hereinafter seen. Now keeping in mind the location and direction of movement of the type-bar F and the fact that it has varied distances to travel, according as one character or another is called for, we first have the long link or rod F^3, Fig. 1, which connects said bar with the operating-lever F^4, supported on the top of rock-shaft F^5, Fig. 3. Rotary motion is imparted to the vertical shaft F^5 by means of bevel-gear f thereon meshing with and driven by a like gear f' on shaft F^6. (See Figs. 4, 5, and 8.) This movement does not work a complete rotation of shaft F^5, and hence segmental gears or other means to afford a rocking rotation of said shaft would suffice. The shaft F^6 is supported in suitable bearings on the main frame and has affixed thereto the plate F^7, Fig. 5, extending forward from said shaft and serving to give a rocking movement to the same. Then to set in operation the whole train of mechanism just described and extending from the type-bar F to the key-levers C, I provide each of said levers with an arm c^{12} and a roller c^{13} in the extremity of the arm to bear against said plate. The normal position of plate and arm is seen in Fig. 2, and when a key-lever is depressed to print the said arm necessarily raises the plate F^7, and thus rotates shaft F^6 and through it gives motion at last to the type-bar. Obviously the measure of rotation imparted to shaft F^6 will measure the extent of movement of type-bar F, and since I want different lengths or distances of movement of the type-bar as one or another character is to be printed therefrom I determine each and all the movements by the varying lengths of the rear arms c^{12} of the key-levers shown, Fig. 5. The key-levers being all depressed equal distances it follows that one of the shorter arms c^{12} will describe a shorter arc than one of the longer ones, and hence give less movement to the plate F^7. Then of course the travel of the type-bar will be shortened proportionately, and the shorter arms are used for the shorter movements and the longer arms for the longer movements of said bar. In operation the type-bar stands normally with the cipher opposite the hammer G, the spring f^5 on arm F' keeping it there. Then if, say, key "1" be struck the figure "1" on the type-bar will come into printing position, and if key "9" be struck the figure "9" will come into printing position, and so on, and there is no chance here for a mistake, because the intervening mechanism is positive at all points and the right figure on the type-bar must of necessity and unavoidably respond, and none other can. There is therefore no chance whatever for an error to be made by the machine in printing an item or in adding it, and if any mistake occurs it must be in or by the operator in striking the wrong key. Now recurring to the means for operating hammer G, Figs. 2 and 7, it will be seen that the said hammer is pivoted at g on the base of the machine and has an arm extending forward from its pivot to a point beneath the spring-pressed bolt G'. This bolt is supported in a

projection at the rear of frame E^7 and has a reduced part surrounded by a spring g', which extends through said projection and bears against the top end of the arm of lever G. The outer extremity e^5 of the dog E^9 bears upon the upper end of bolt G', and the inner extremity at the other side of its pivot in dog E^8 is normally held in line but out of engaging position with the teeth in ratchet-wheel E^{10}. When dog E^8 is caused to release ratchet-wheel E^{10} through the action of rod E^6 to the position as seen in Fig. 6, the inner extremity of dog E^9 is carried in line with the ratchet-tooth and forced upward thereby a distance of one tooth, which movement imparts a prompt and decisive downward movement to end e^5 and bolt G', and thus throws the hammer G with the requisite stroke against the type-bar, or, rather, against the impression-strip G^4 of flexible material, which comes between said hammer and bar and outside the paper, the inking-ribbon G^5 being of course between paper and bar. Thus it occurs that every time that the ratchet-wheel E^{10} is permitted by the escapement mechanism to rotate and is caught by dog E^9 there is an actuation of the hammer G and an impression from the type-bar, and this occurs with each depression of any one of the several key-levers, as already described. It also follows that after each of said key-levers is released from the pressure of the operator's finger all of said parts are immediately restored to their original position, hammer G dropping away from the type by gravity when dog E^9 and rod E^6 are returned by their respective springs. Sometimes, however, it is desirable to cause the machine to do spacing and not to print, and in such cases a movement of the carriage can be obtained for as much space as may be desired by depressing the spacing-key L, having lever L', Figs. 2 and 3. This lever is pivoted on its own support L^2 and is rigid with short arm L^3, which bears against and operates the sliding rod L^4 in frame E^7. At its rear end this rod bears against the lower portion of the head of dog E^8 the same as rod E^6, but with the difference that rod L^4 is not rigid with frame E^7, but has a free sliding movement therein. Hence when the rod E^6 is pressed in action it carries frame E^7 with it, and the dog E^9 keeps in working relation with bolt G', which operates the hammer by reason of both said parts traveling back together; but since rod L^4 does not actuate the frame E^7, but only slides therein, the dog E^9 is carried away from the hammer-controlling bolt G' when the spacing-key alone is depressed, and thus the carriage is caused to travel step by step alone until as much space is obtained as may be desired.

It remains now to describe what may be specifically termed the "adding" or "totalizing and recording" mechanism. This mechanism is comprised in two sets of wheels H and H' and the associated parts, Figs. 2, 3, 4, and 8. H represents the "adding-wheel," so called, because all the adding that is done by the machine is in one sense accomplished by these wheels, although there is no mark of a figure or character upon them, and H' represents the total-recording or type wheels, because they each carry on their periphery in regular succession the characters found on the keyboard and running in this instance "0," "1," "2," "3," &c., and from them the totals are taken. Each and all wheels H' have the same characters in the same order, and when said wheels are at zero or starting-point they all sustain the same relation to the starting-point and all the naughts are in a transverse line in printing position. There is one wheel H' for each wheel H, and both sets of wheels are free on their shafts to rotate independently, and each wheel H is geared with a corresponding wheel H'. Hence if any one of the wheels H is rotated it will rotate its companion H' in the other set; but only one pair of wheels H H' is rotated at any single operation of a key-lever, and all such movements are independent and separate. The wheels H are carried on a short shaft h in frame H^2, Figs. 10 and 11, and wheels H' on shaft h', extending across the machine. Frame H^2 is pivoted on the shaft h' for purposes hereinafter described. Now referring to Figs. 2 and 5 the means for imparting rotation to wheels H may be readily traced. For this purpose there is first a segment H^3, fixed to rotate with shaft F^6, and in this instance is shown as made in the same piece with plate F^7, though this is not necessary. Operated by this segment is the gear H^4, free to turn on shaft H^5 and carrying a pawl h^2, which engages a ratchet-wheel H^6, fixed upon shaft H^5. The gear H^4 when actuated by segment H^3 is therefore idle on its return movement and locked with ratchet H^6 in its forward or active movement, thus imparting a corresponding rotary movement to the shaft H^5. These movements of the shaft H^5 vary in degree or extent of rotation according as one or another of the key-levers E is operated and a longer or shorter arm c^{12} thereon is brought into action. One of the effects of the difference in the lengths of arm c^{12} has already been explained, and a similar effect is now imparted to the shaft H^5 and the mechanism actuated therefrom, so that the smaller numerals have the shorter movement and the higher numerals the longer movement. This will be understood by referring to Fig. 2, where the figures on the face of projections h^6 of the type-wheels H' are for convenience in this description shown in the same relation on the side of the wheel H'. Suppose, for example, that figure "2" is to be rotated up to printing position, now occupied by "0." Evidently only a short distance is to be traveled; but suppose figure "9" is to be brought to printing position. In that case almost a complete rotation of wheel H' must be had. Hence a long lever-arm c^{12} is needed to effect this longer movement and rotation,

and all the said arms c^{12} and the parts running thence to said wheels H′ are constructed and arranged to give just the right movement to each of said several wheels, governed by the size of the figure; but a short arm or a long arm has the same effect on each wheel whether it be in units-column or in a higher column, and the size of the figure and not its columns determines the degree of rotation—that is, the figure "9" requires the same rotation in units-column as in any higher column. Now returning to the actuating mechanism for shaft H^5, Fig. 8, and having seen by what means and for what purpose more or less rotation is imparted to the shaft we find on it a relatively large toothed wheel H^8, which is engaged by means of a spline or feather to travel or rotate therewith, but free to slide on said shaft to take any position to which it may be momentarily moved by means of the lever-arm h^8, which engages the hub of said wheel. This arm, as seen in rear elevation, Fig. 8, is rigid with the sliding sleeve H^9 on cross-shaft H^{10} and carries a rack h^9, which in turn is engaged by gear-wheel E^{15}, meshing with rack D^6 on the sliding carriage D. Hence both racks D^6 and H^{11} will move in unison and exactly equal distances, but in opposite directions. Going back now to the series of short levers C, said levers have been described as serving to fix the column in which the printing and the adding are to begin, whether it be units, tens, hundreds, or some higher column, and this being done it is understood that the machine then moves on step by step under operation from the key-levers to print the item and make the addition at the same time.

The wheel H^8, just above described, is the determining member of the machine so far as the adding mechanism proper is concerned in fixing the column in which the first figure of every item, large or small, is to be added, the printing from the type-bar F of course occurring in the same or corresponding column. For example, in Fig. 8 wheel H^8 is opposite the thousands or fourth column adding-wheel H, and this indicates that the first figure to be printed from the type-bar F and the first to be added alike will be in the thousands-column. This is the starting-point in this item, and the machine prints and adds next in the hundreds-column, and then in the tens and last of all in the units column. Now in order to trace how the adding referred to occurs see the adding-wheels H, Figs. 2 and 11 especially, where it will be observed that each of said wheels has two cams 2 and 4 on its side, and all the said cams are exactly alike and on corresponding sides of all the wheels. Each wheel H has twenty teeth 3, ten for each cam, which mesh with ten gear-teeth on the sides of wheels H′, and there are ten printing teeth or projections h^6 on each wheel H′ opposite the gear-teeth thereon. Hence half a revolution of a wheel H works a full revolution of a wheel H′, and as the passing of each ten teeth 3 adds one to the next higher column, as we shall see, it very properly sweeps wheel H′ around one complete turn, which is the equivalent of ten points. Each of the ten teeth 3 on wheel H represents ten in the addition and marks the travel of pivoted arm J from the bottom of one cam over the summit thereof into the bottom of the next cam. In this operation the said arm J has been thrown back by the cam far enough to cause the pawl or dog J′ carried thereby to drop back the distance of one tooth 3 on the next higher wheel H, it being understood that the arm J which corresponds to any one of wheels H has its dog arranged to engage the wheel H next higher numerically, so that if, say, ten units be added by units-wheel H the arm J traveling on the said wheel will cause its pawl J′ to drop back, engage, and carry forward the tens-wheel H one point or tooth. This will cause the tens-wheel H′, with which it meshes, to move forward one point also and show up "1" at the place to print in lieu of the cipher. As another ten is added by the units-wheel H the same operation is repeated by the next cam thereon, and so on indefinitely, all the several wheels H being equipped in like manner and all operating alike themselves as well as upon the wheels H′, with which they are geared, and adding their tens to the next higher column in like manner whatever column they may be in. The forward movement of arm J and its pawl is in this case effected by means of spring J^2, all that is needed being sufficient force to rotate one pair of meshing wheels H and H′, and this is easily done. In case it be desired to temporarily lock each wheel H against rotation after each operation thereof a dog J^4 can be used for this purpose. Each wheel has its own dog, and all said dogs are shown here as pivoted by the side of arms J and are in engagement with their respective wheels except as they are momentarily withdrawn or raised by means of roller J^5 on the arms J^6, projecting upward from the wheel-lever h^8. This arrangement causes the wheel or roller J^5 to ride back and forth over or across the lower projections 6 of the dogs J^4 and always to stop on and depress the projection of the dog whose wheel is then next to be rotated. The next movement another dog is lifted out of engagement the same way, while the last dog drops into engagement again, and so on, the other dogs of course all being in locking position when the wheel J^5 has passed on in either direction.

Let us suppose now that two items are to be recorded and added together by the machine—viz., "824" and "598," the total of which is fourteen hundred and twenty-two. To print the first item, the machine will of course be set by the third lever C, because it begins in the hundreds-column, and the carriage being thus set and all other things in proper position the next thing in order is to strike the key bearing the first figure of the

first item, which is "8." This will record or print "8" on the item-sheet from the type-bar F and at the same time rotate the adding-wheel H, which is in hundreds position, forward eight points and turn the hundreds-wheel H′ to bring "8" to printing position. The figures following are each successively recorded on the item-sheet and added in like manner on both wheels H and H′ in the tens and units columns, and if the total record were now struck off without going further it would be just the same as that printed on the item-sheet—viz., "824." The item "598" is next to be recorded or printed on the item-sheet and added to the first item. Here again we begin in the hundreds or third column from the right of columns, and by means of the third lever C we make the requisite movement and stop the carriage in the right place. The key bearing the figure "5" is then struck, and "5" is at once printed on the item-sheet and added to "8" already run up in the hundreds-column, making a total of thirteen. This carries the hundreds-wheel H three points past the first cam on its side and through the dog J′ of the dog J, for that wheel moves the next higher or thousands wheel H forward one point, thus totalizing "1" in the thousands-column and "3" in the hundreds-column. Then "9" in the tens-column of the second item is set down on the item-sheet and at the same time is added to "2" in the tens-wheel, making eleven in said wheel. This leaves one over in this column, which is added to the next higher or hundreds column, where the last preceding addition left "3." Adding one to this "3" makes "4" now in the hundreds-column and leaves "1" in the tens wheel or column, the same figure always in all cases being carried forward to the wheel H′. Next "8" of the second item is printed on the item-sheet and added to "4" of the first item on the units-wheel H and H′. This makes twelve, or one, ten, and two units. The one is therefore carried over into the tens-wheels, and added to the one already in said wheels makes "2" in the tens-column wheels and leaves two units in the units-column wheels. Both items are now set down on the item-sheet, and the total or sum of both is in the wheels H and H′ and on being printed off is found to be "1422." These figures have by the foregoing operation been carried into a transverse line on the four several wheels H′, from which the total is printed by one stroke of the hammer M, and said hammer has width enough to extend across all the said wheels and strike off the total at one blow. Said hammer is operated by a key of its own on the long lever M′ and pivoted as shown in Figs. 2 and 3 or in some equivalent way. After a total has been struck off and new work is to be done all the totalizing-wheels should be brought back to zero or starting-place. To do this in a convenient and speedy manner, I provide means for rotating the said wheels H and H′ in reverse directions, consisting of transverse shaft N, carrying a ragged gear N′, Figs. 1, 3, and 11, and a crank n on shaft N, which serves to turn said wheels as far as needed, it being understood that said wheels have varying distances to rotate back, according to which figure is exposed to print. Ordinarily the vacant portion of the wheel N′ is exposed to the gear N^2 on shaft h, which carries the adding-wheels H, so as not to make engagement with wheel N^2 except when such engagement is wanted. The shaft N passes through frame H^2, carrying said wheels H, Fig. 11, and has cams n' engaging in openings in the sides of said frame to so far raise the frame when the wheels H are to be rotated back that the engaging dogs J^4 and pawls J′ will be liberated, as seen in Fig. 10, wherein frame H^2 is shown as raised in this manner. In this operation the stationary cross-rod N^4 causes the lifting of pawls J′ from wheels H, and cross-bar N^5 in like manner causes disengagement of the dogs J^4, and a small pawl h^4, Fig. 10, for each hub of the wheels H stops all said wheels at the same place relatively and all the wheels H′ at zero.

If in the adding of units the sum runs into hundreds or thousands or higher, the proper wheels H and H′ will be turned as each ten is to be added to any of the higher columns, and the same is true if the addition be in any of the higher columns inclusive of units.

The hammer G for the type-bar F is arranged to strike over or above the hammer M, and the wheels H′ are in substantially the same vertical plane at the printing-point as the type-bar, but beneath the same. Hence they are in place to print the answer or total of the items beneath the items, which are printed higher up in the machine and are carried upward as each item is set down.

The ink-roller P serves to ink the type on totalizing-wheels H′.

What I claim as new, and desire to secure by Letters Patent, is—

1. In adding-machines, a series of adding and totalizing wheels arranged in pairs and constructed to carry the tens to the next higher pair of wheels in the series, and having said totalizing-wheels constructed with printing characters, and means to print the total sum added from said totalizing-wheels, in combination with a sliding item type-bar and means to print the items from said bar, said adding and totalizing wheels and type-bar having joint operative connecting parts whereby each item when printed is at the same time recorded upon said adding and totalizing wheel, substantially as described.

2. In adding-machines, a series of adding and totalizing wheels operatively paired, printing characters on said totalizing-wheels, and a single actuating and determining wheel for said adding-wheels constructed to be brought into working engagement with each adding-wheel in the series in succession, in combination with a movable item-printing

type-bar and a set of keys having operative mechanism leading to both said actuating-wheel and type-bar, and whereby each item is printed separately, and at the same time added upon the totalizing-wheels, substantially as described.

3. In adding-machines a series of adding and totalizing wheels arranged in pairs and geared together, a single actuating and determining wheel constructed to engage and operate each adding-wheel in succession, and means to set said single wheel in engaging position with any one of said adding-wheels, in combination with a sliding type-bar and mechanism to carry the same back and forth different distances according to the item to be printed, and a set of key-levers to operate the determining-wheel and said type-bar, substantially as described.

4. In adding-machines, a set of totalizing-wheels mounted side by side, and having printed characters thereon, and a hammer to print the total sum added upon said wheels, in combination with a sliding type-bar having connected means to operate said bar varying distances, a printing-hammer for said bar, and a set of operating key-levers having operative connections leading to both said totalizing-wheels and said type-bar for joint movement for each item selected, substantially as described.

5. In adding-machines, a set of wheels constructed each with cams on their sides to add up to ten and to carry one over to the next higher column, a set of totalizing and printing wheels actuated thereby, a pivoted arm actuated by said cams and carrying a dog to engage the next higher wheel, a locking-dog for each cam-wheel normally in engagement therewith, and means to disengage each dog from the next higher wheel when said wheel is actuated by the pivoted arm, substantially as described.

6. The adding-wheels having each a series of teeth about its periphery and all said wheels independently mounted on the same shaft and constructed to carry one over to the next higher wheel for every ten added, and totalizing printing-wheels in mesh with said adding-wheels, in combination with a separately-mounted type-bar for printing the items, and separate hammers for said totalizing-wheels and said type-bar, a pivoted dog to be released by the lower dog-arm, a set of key-levers representing the digits and cipher, and a separate train of mechanism leading from said keys to the adding-wheels and said type-bar and whereby both the total and the item selected are recorded, substantially as described.

7. In an adding-machine, a set of totalizing printing-wheels mounted side by side, a sliding item-printing type-bar mounted immediately above said wheels, separate printing-hammers opposite said wheels and bar, a movable carriage to support the paper upon which the items and total are to be printed, a set of key-levers and means connecting said type-bar, said totalizing-wheels and said type-bar hammer for joint action upon the depression of any one of said key-levers, substantially as described.

8. In an adding-machine, a set of totalizing-wheels having printing characters on their edges, a sliding type-bar with printing characters thereon, said wheels and type-bar mounted in close relation and having the face of the type characters on each in a parallel plane when brought to printing position, a separate hammer opposite said wheels and bar, means to actuate said type-bar varying distances, means to add the items selected upon the totalizing-wheels, and means to operate said hammer, substantially as described.

9. In an adding-machine, a set of key-levers representing the digits and cipher, an item-printing type-bar mounted to slide, a set of totalizing-wheels mounted in line beneath said bar, printing characters on said bar and wheels, printing-hammers opposite said bar and wheels, a movable carriage adapted to carry the paper between said hammers and said wheels and bar, and means to move both the type-bar and the totalizing-wheels to printing position by the depression of any one of said key-levers, substantially as described.

10. A series of adding-wheels and a series of totalizing-wheels in mesh therewith, the wheels of both series being independent on their respective shafts and rotatably in pairs of one in each series, in combination with a determining-wheel movable to engage any one of said adding-wheels at a time, a pivoted arm for each adding-wheel and a dog thereon to engage the next higher wheel in the same series, a spring to press said arm forward, locking-dogs for said adding-wheels, and means operatively connected with said movable determining-wheel to engage and release said dogs, substantially as described.

11. The adding-wheels in series and separately mounted, a single actuating-wheel for all said adding-wheels and means to rotate said actuating-wheel greater or less distances as larger or smaller sums are to be added, said means comprising a sliding sleeve and rack thereon and an arm to move said actuating-wheel, a spring-controlled gear meshing with said rack, and escapement mechanism for controlling said gear, substantially as described.

12. The adding-wheels and the totalizing-wheels engaged in pairs and each pair independent of the others, a slidable actuating-wheel to engage any of the adding-wheels at the will of the operator, the movable carriage and rack thereon, a sliding sleeve having a rack and arm to move said slidable actuating-wheel, a spring-operated gear meshing with and operating both said carriage and sleeve-

rack, and escapement mechanism for said gear having key-lever operating and controlling connections, substantially as described.

13. In an adding-machine, a sliding carriage, and a series of independently-rotatable adding-wheels, in combination with a shaft and a single sliding drive-wheel thereon for all the adding-wheels, means connected with said carriage to slide said drive-wheel on its shaft to starting-place, and separate means to rotate said wheel and shaft varying distances, comprising a set of key-levers, a rocking plate engaged by said levers, and pawl-and-ratchet mechanism connecting said plate and the drive-wheel shaft, substantially as described.

14. The adding-wheels, and the totalizing-wheels having printing characters on their periphery, in combination with the means to print the items consisting of a straight sliding type-bar and a pivoted hammer, fixed laterally, a series of key-levers, and mechanism intermediate of said key-levers and the type-bar and hammer to move the same to operative position, substantially as described.

15. The type-bar and the frame in which it slides lengthwise, the key-levers, and operating mechanism connecting said parts to operate said bar varying distances at a time, in combination with a pivoted hammer to strike the impressions from said bar, and actuating mechanism therefor connected with the said key-levers, substantially as described.

16. The straight sliding type-bar and the mechanism to carry the same back and forth different distances according to the denomination to be printed, said mechanism comprising an upright shaft and an arm thereon linked to said bar and means to rotate said shaft, in combination with the key-levers and the hammer actuated through said levers, substantially as described.

17. The carriage arranged to slide laterally in the machine and constructed to carry the paper on which the items are to be printed, a series of levers to fix the column in which the printing of each item is to be begun, and a determining-wheel set by said lever, in combination with the key-levers and adding and totalizing wheels actuated therefrom and operatively connected with said determining-wheel, substantially as described.

18. The carriage, the series of levers to fix the carriage at starting position according to the column in which printing of an item is to begin and separate stops for each of said levers, and a determining-wheel for the adding-wheels controlled through said levers, in combination with the key-levers and escapement mechanism for the carriage operated thereby, substantially as described.

19. In an adding-machine, the carriage and means to set the carriage according to the column in which the printing is to begin, and escapement mechanism for the carriage, in combination with a transversely-sliding type-bar, a hammer therefor on a fixed pivot, a series of totalizing-wheels side by side and a separate hammer therefor, having separate actuating mechanism, substantially as described.

20. The carriage and means thereon for holding and feeding the paper printed on, and escapement mechanism for the carriage, in combination with a series of adding-wheels and a series of totalizing-wheels geared together in pairs, and having characters on their periphery from which the printing is done, a sliding type-bar to print the items and separate hammers for the type-bar and totalizing-wheels, substantially as described.

21. The carriage and the means thereon to carry and feed the paper printed on, the adding and the totalizing wheels revolving within fixed limits, the transversely-sliding type-bar and two printing-hammers on fixed pivots to strike off the items and the totals from the said totalizing-wheels, substantially as described.

22. In an adding-machine, a series of totalizing-wheels and a series of adding-wheels operatively connected with the totalizing-wheels in pairs, and characters on the peripheries of the totalizing-wheels, means to move all said wheels to zero or starting-point, locking-dogs for each adding-wheel, and a cam-shaft to actuate said dogs in or out of engagement with said wheels, substantially as described.

23. In an adding-machine, the adding-wheels and the totalizing-wheels geared together in pairs, the mechanism to actuate said wheels in pairs and means to temporarily lock the wheels not operated comprising a pivotal spring-pressed dog for each wheel, and the supporting-frame therefor, and the cam-shaft for changing the position of said dogs upon said frame, substantially as described.

24. The series of adding-wheels and totalizing-wheels connected in pairs and a sliding wheel to engage and rotate one of said pairs at a time, in combination with a sliding type-bar to print the items and a hammer therefor on a fixed pivot, and the key-levers through which all said actuations are effected, substantially as described.

Witness my hand to the foregoing specification this 14th day of March, 1898.

ADOLPHUS S. DENNIS.

Witnesses:
H. E. MUDRA,
R. B. MOSER.