

Oct. 1, 1929.

N. WHITE

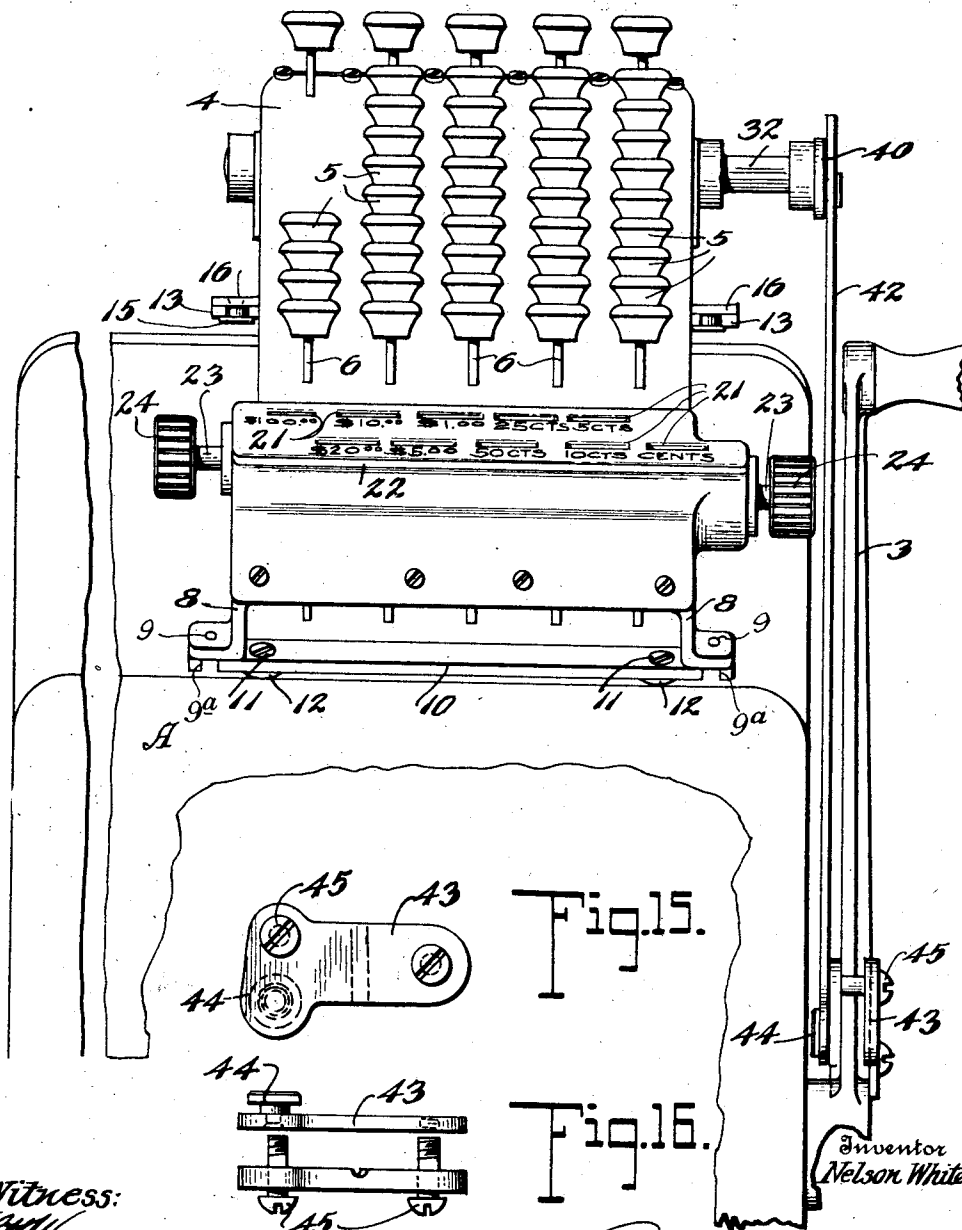
1,730,106

DENOMINATOR ATTACHMENT FOR ADDING MACHINES

Filed March 21, 1921

7 Sheets-Sheet 1

Fig. 1.



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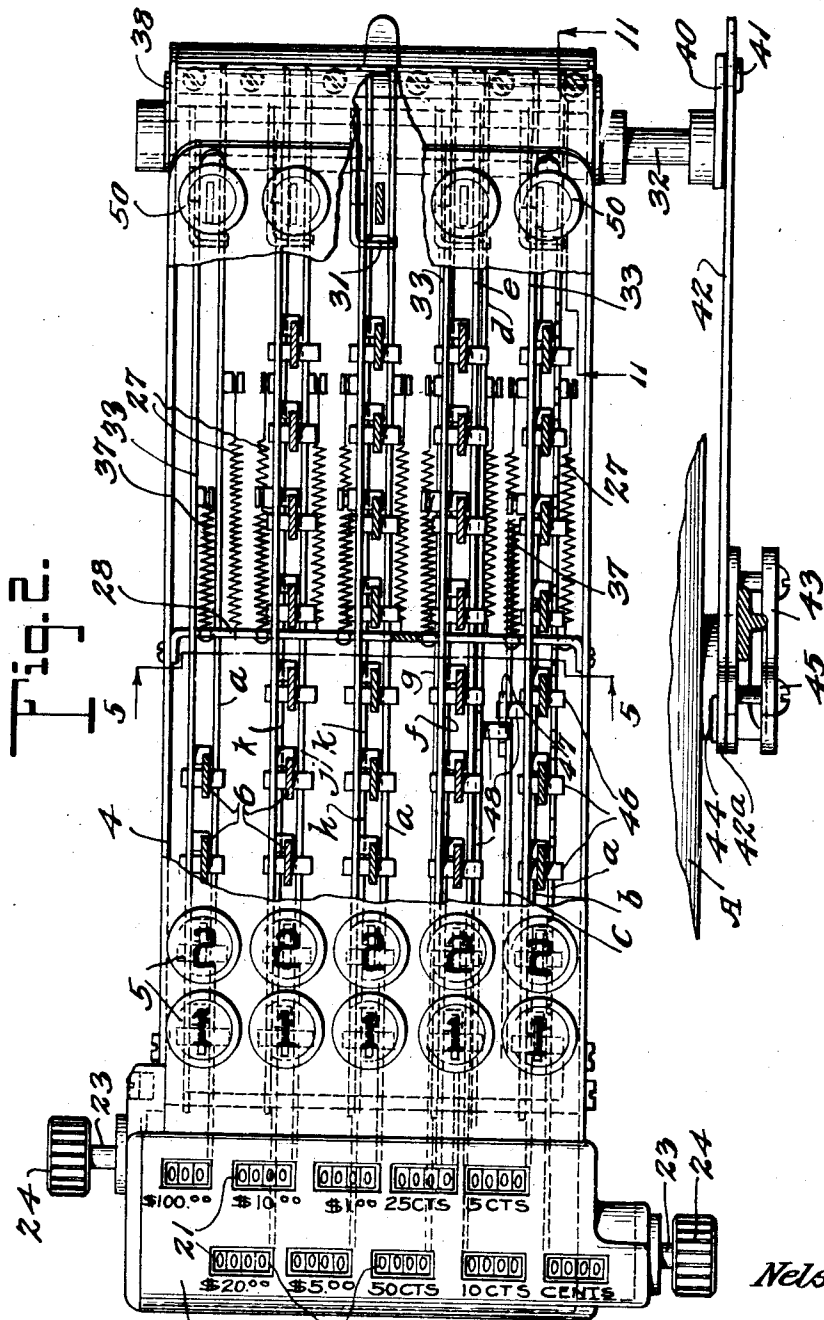
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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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7 Sheets-Sheet 2



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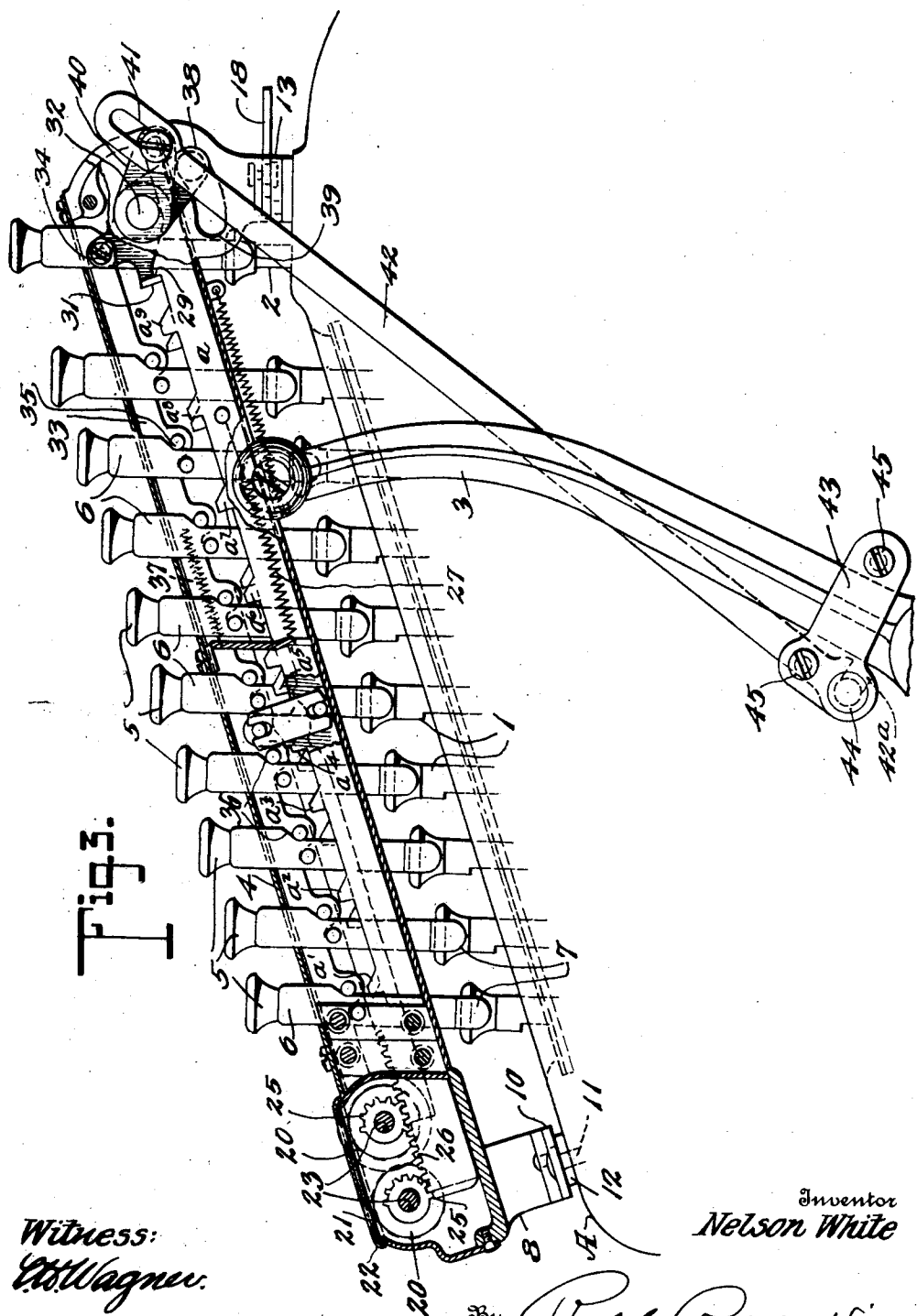
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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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7 Sheets-Sheet 4

Fig. 4.

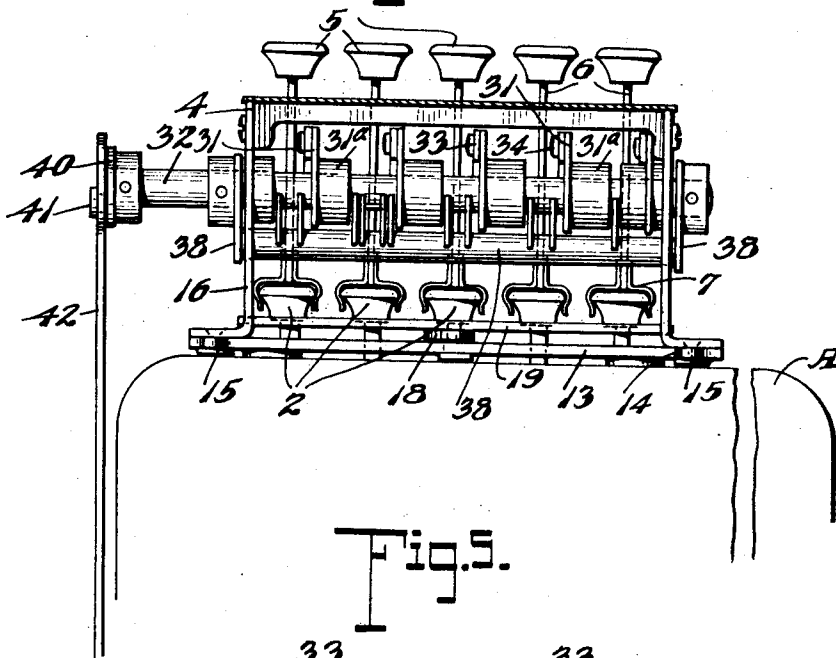


Fig. 5.

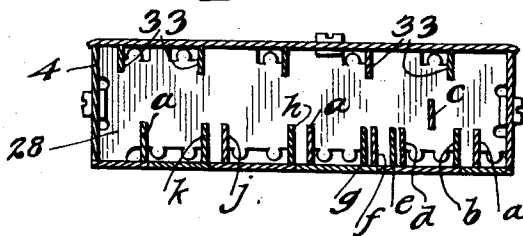
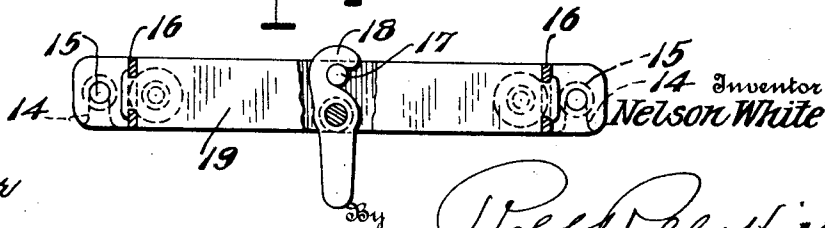


Fig. 6.



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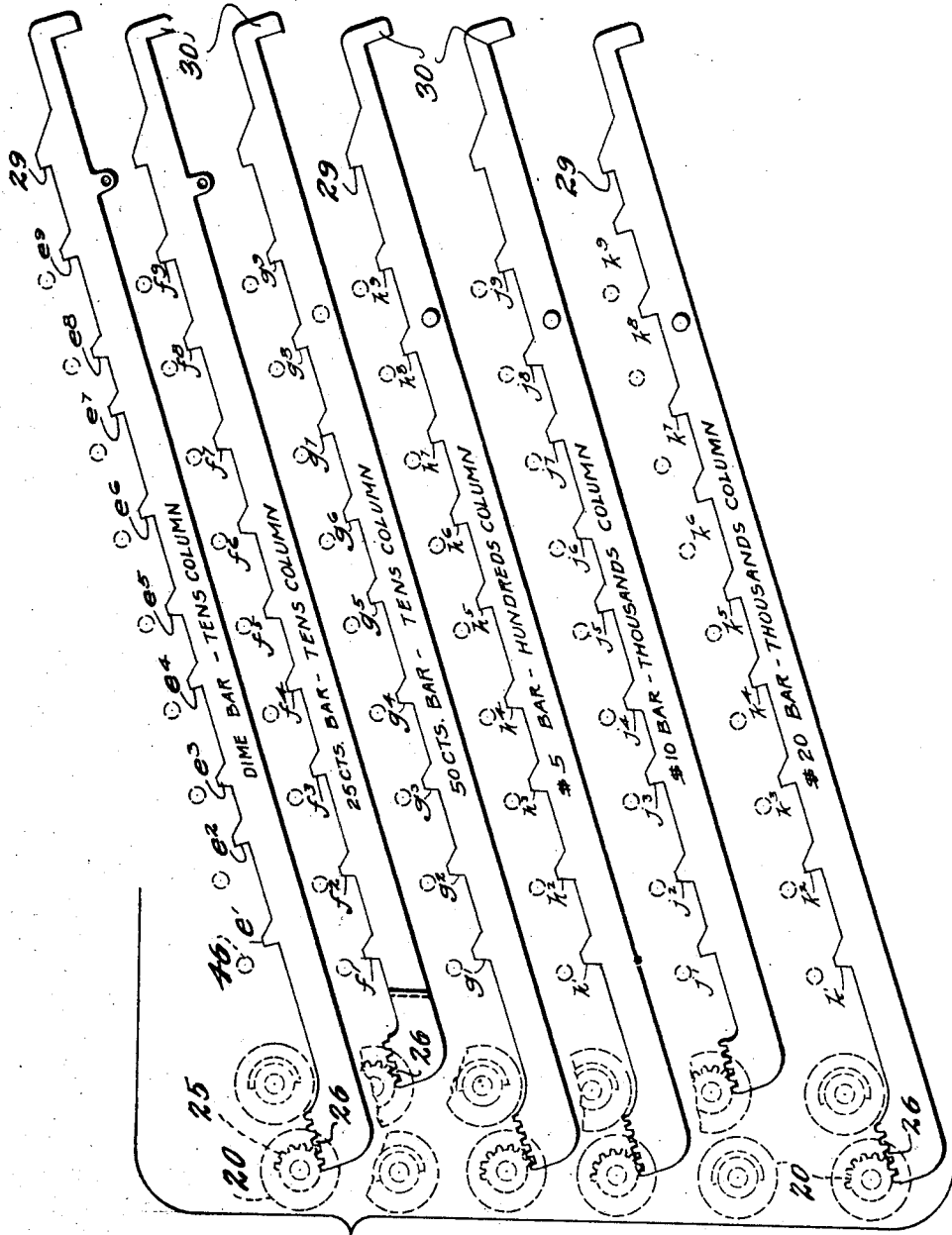
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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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7 Sheets-Sheet 5



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Fig. 7

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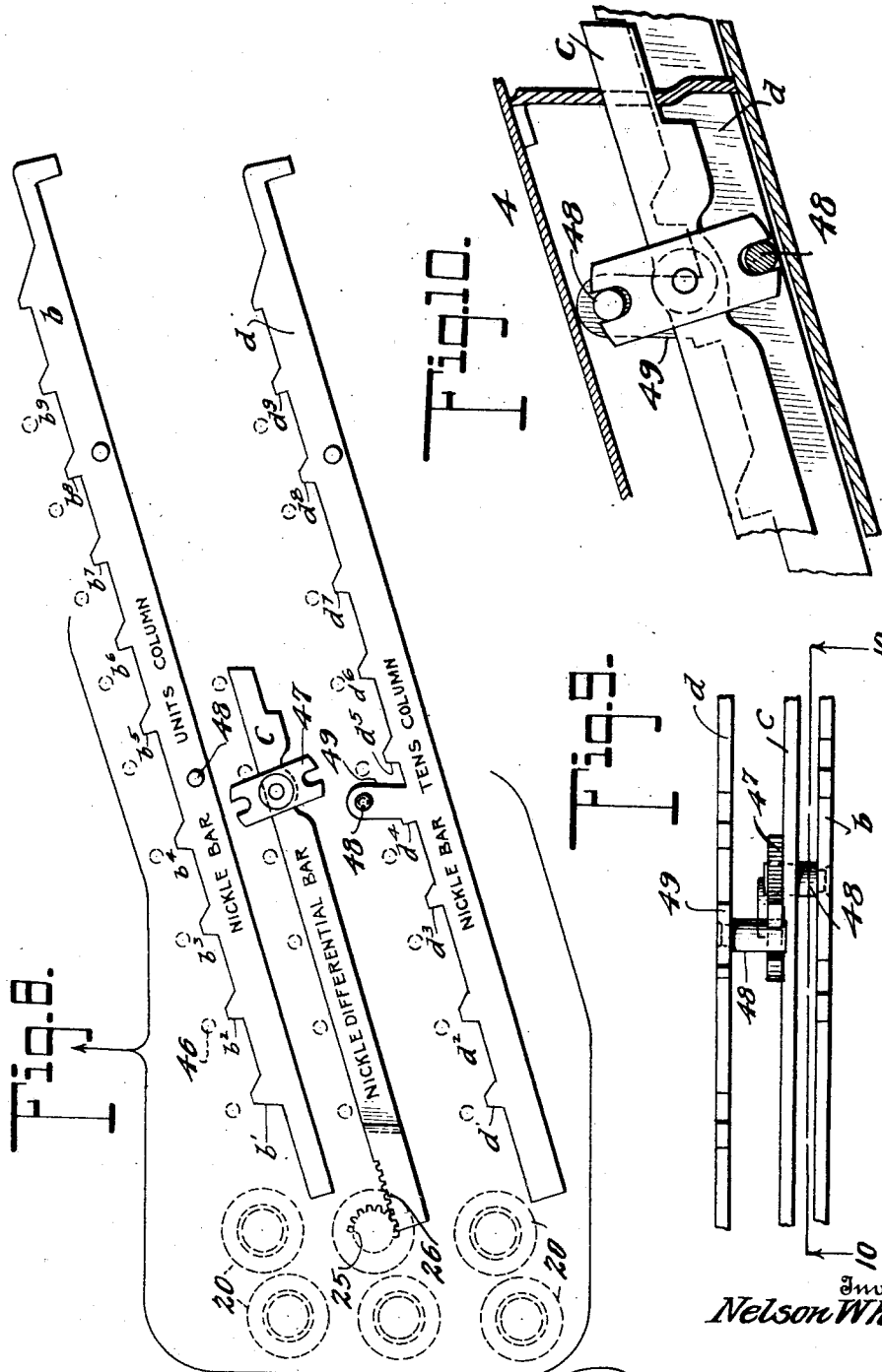
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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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7 Sheets-Sheet 6



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DENOMINATOR ATTACHMENT FOR ADDING MACHINES

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7 Sheets-Sheet 7

Fig. 12.

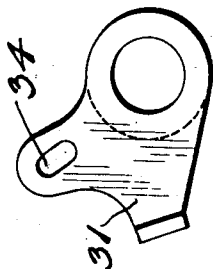


Fig. 13.

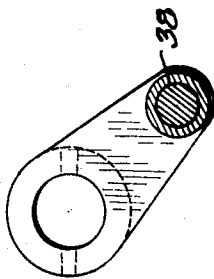


Fig. 14.

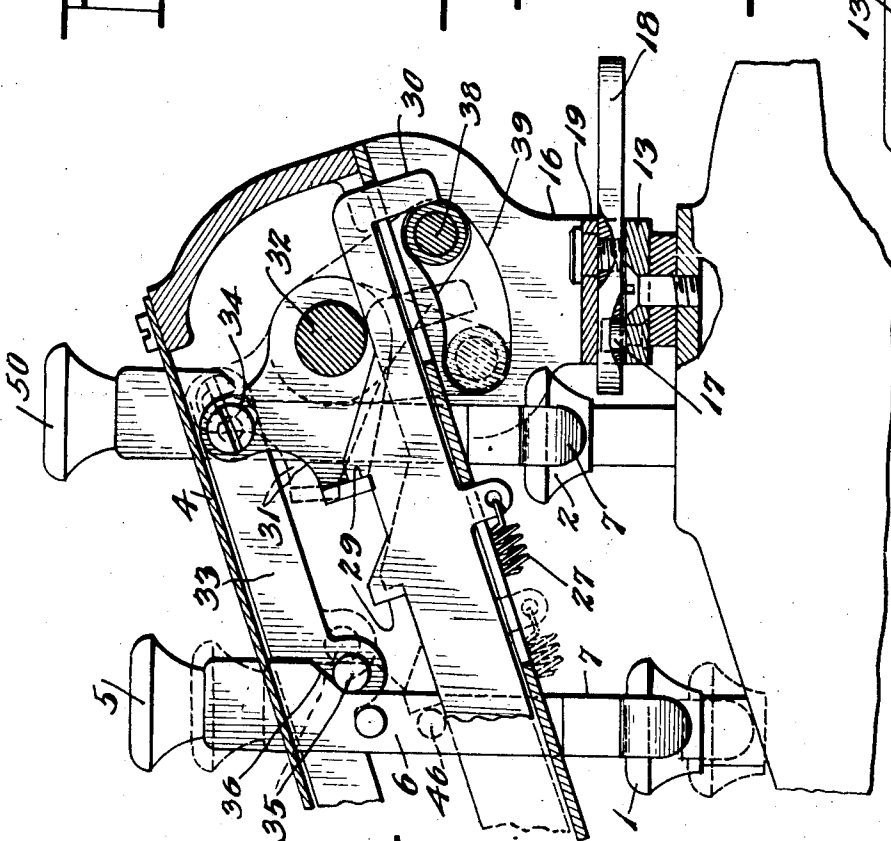
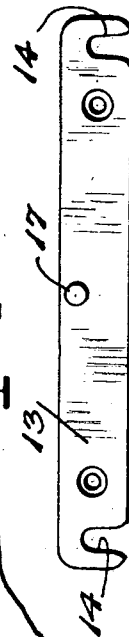


Fig. 11.

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UNITED STATES PATENT OFFICE

NELSON WHITE, OF ITHACA, NEW YORK, ASSIGNOR TO BURROUGHS ADDING MACHINE COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

DENOMINATOR ATTACHMENT FOR ADDING MACHINES

Application filed March 21, 1921. Serial No. 453,968.

When handling money it is frequently necessary not only to add and list different items, but also to break up or analyze the items into the different monetary denominations required for the payment thereof, and to add these separate denominations for the different items listed.

will operate with the necessary accuracy and precision to analyze different monetary items into the respective denominations necessary for the payment thereof, and record these denominations so that after a number of items, such as the items of a payroll have been added and listed the operator will know not only the total amount of the payroll, but also the denominations in which it must be withdrawn from the bank in order that the different amounts can be placed in the respective pay envelopes or otherwise disbursed.

The above and other features of the invention will be readily understood from the following specification together with the accompanying drawings, in which:—

Figure 1 is a front elevation of a denominator attachment constructed in accordance with the invention, showing the same in operative position upon an adding machine, all those portions of the adding machine which are not essential to the illustration of the present invention being broken away;

Figure 2 is a top plan view of the denominator attachment and a fragmentary portion of the operating handle of the adding machine, portions of the denominator attachment being broken away and shown in section to illustrate more clearly the details of construction;

Figure 3 is a side elevation of the denominator attachment and fragmentary portions of an adding machine to which it is applied, portions being broken away and shown in section;

Figure 4 is a rear view of the denominator attachment and fragmentary portions of the adding machine, portions of the attachment being removed and shown in section;

Figure 5 is a transverse sectional view on the line 5—5 of Figure 2, looking in the direction of the arrows;

Figure 6 is a detail view of the latch device provided for detachably connecting the rear end of the attachment to the back of the adding machine;

Figure 7 is a detail view of certain of the register actuating slides, the associated reg-

This is especially true when making up payrolls, or otherwise disbursing the monetary items listed, since for this purpose it is necessary to know in what denominations to draw the money from the bank, as well as the total amount of money to be withdrawn. A large amount of tedious and time consuming work is required to do this by mental calculations, and under such conditions frequent errors are unavoidable and these errors are very annoying when they happen.

The adding and listing can be readily accomplished upon any of the conventional adding and listing machines which are now in very extensive use, and I am aware that denominating machines have also been produced and used to a certain extent prior to the present invention, although these denominating machines are such complicated and expensive mechanisms as to be impractical for use except by large concerns having such a heavy payroll that the purchase of expensive special equipment for handling the same is justified. However, practically every individual or concern conducting a business involving the handling of even small amounts of money has one or more adding machines in its equipment, and the object of the present invention has been to provide an attachment which can be readily applied to a conventional adding machine and which, without interfering in any manner with the usual operation of the said machine will enable the machine to be used for the additional purpose of denominating.

Among the further objects of the invention is to provide a denominator attachment which can be easily and quickly placed in position upon an adding machine or removed therefrom without any appreciable delays or loss of time, which is comparatively simple in construction so that it can be produced and marketed at a moderate cost, and which

isters being shown diagrammatically by dotted lines;

Figure 8 is a similar view of others of the register actuating slides.

Figure 9 is an enlarged top plan view of portions of the three nickel slides or bars, showing the differential connection between the same;

Figure 10 is a side elevation of the same;

Figure 11 is an enlarged longitudinal sectional view through the upper end of the denominator attachment, taken substantially on the line 11—11 of Figure 2;

Figure 12 is a detail view of one of the locking detents for the register actuating slides;

Figure 13 is a similar view of one of the crank arms for the actuating bar;

Figure 14 is a detail view of the bar which is permanently applied to the back of the adding machine and interlocks with the latch means at the end of the denominator attachment;

Figures 15 and 16 are detail views of the clamp or bracket which is applied to the operating lever of the adding machine.

Corresponding and like parts are referred to in the following description and indicated on all of the views of the drawings by like reference characters.

The denominator attachment may be designed and constructed in such a manner as to be readily applied to any of the well known adding and listing machines which are in use. Such an adding machine has been illustrated on the drawings in a fragmentary manner, being designated in general by the reference character A. The keys 1 of the adding machine are of the usual construction and are arranged according to the decimal system. The usual special keys 2, such as the column correction, or the "error" key, "repeat" key, and the like are shown as arranged at the rear of the several banks of decimally arranged keys 1. After the mechanism of the adding and listing machine has been set in the usual manner by depressing the proper keys 1, the machine is caused to function by pulling forward upon the main actuator or operating handle 3 at the right hand side thereof. This adding and listing machine may be of any conventional and well known construction and it is not thought necessary to describe the same in further detail, since no claim to novelty is placed thereon.

The denominator attachment comprises a light frame or casing 4 which is adapted to be superposed upon the adding machine A, and which is provided with keys 5 corresponding to the decimally arranged banks of keys 1. These keys 4 are provided with stems 6 which extend through the casing 4, being slidably mounted therein, and terminate at their lower ends in spring clips 7 of

a suitable character to engage the adding machine keys 1. Any suitable means might be provided for connecting the stems 6 of the attachments to the adding machine keys, although a construction such as the spring clips 7 has the advantage of enabling the attachment to be quickly placed in position or removed therefrom without any delays or loss of time. Spring clips, such as those illustrated may be constructed to have a resilient action so that they will automatically grip the respective adding machine keys when the attachment is placed in position and become disengaged therefrom when the attachment is released and forcibly removed. Owing to the fact that the keys 5 of the attachment become interlocked with the adding machine keys when the attachment is in use, the necessity of providing separate springs and locking means for the keys of the attachment is avoided. In other words, the keys 1 of the attachment remain depressed, after being operated, as long as the corresponding keys of the adding machine remain depressed, and are returned to their original position after the adding machine has been operated and the adding machine keys returned to their original position.

The casing 4 of the attachment is adapted to be supported over the top of the adding machine A in a spaced relation thereto, and special means is provided for holding the casing rigidly in operative position and at the same time permitting of quickly applying the attachment to the adding machine or removing it therefrom. For this purpose the forward end of the casing 4 is provided with depending feet 8 and said feet carry downwardly projecting headed studs 9 which are adapted to interlock with lateral notches 9^a in the end of a transverse bar 10 which is permanently secured to the forward end of the adding machine. This bar 10 is secured to the adding machine by fastening members such as the screws 11 and is held in a spaced relation thereto by means of suitable collars or washers 12 which may be of rubber or resilient material if desired. A similar transverse bar 13, shown in detail by Figure 14, is secured to the back of the adding machine. The notches 14 in the ends of this bar are engaged by headed studs 15 carried by the depending feet 16 at the rear of the casing 4 (see Figures 4 and 11). The transverse bar 13 is also provided with a stud 17 which is adapted to be engaged by a hook or detent 18 for the purpose of positively locking the attachment in position so that there will be no possibility of the attachment being shifted out of proper engagement with the adding machine keys by the vibration and jars which are incident to the vibration of the adding machine. The locking hook 18 is shown for convenience as carried by a cross bar 19 which connects the rear feet 16 of the attachment.

With this construction it will be obvious that the attachment is handled as a unit and that it can be very quickly placed upon and locked in operative position on the adding machine, or removed therefrom, no tools of any kind being required for this purpose.

Slidably mounted within the casing 4 is a series of register actuating slides which are operatively associated with the keys so that when keys corresponding to any monetary value within the capacity of the machine are depressed, the slides will be set to analyze the amount into different smaller denominations of which it is composed, and to register these denominations upon the actuation of the adding machine. The registers 20 are shown for convenience as arranged at the forward end of the casing 4 and a separate register is provided for each monetary denomination. These registers are adapted to be read through suitably arranged sight openings 21 in a plate 22 which extends across that end of the casing in which the registers are mounted. For convenience the registers are shown as arranged in two transverse rows and carried by the transverse shafts 23, the ends of the shafts projecting from the casing and being provided with knobs 24 which can be manipulated to reset the registers and bring them back to zero position. The various registers are actuated by means of pinions 25 which engage racks 26 upon corresponding register actuating slides. The actuation of each register thus depends upon the extent of movement of the corresponding slide, and certain of the slides are arranged to have different increments of movement so that one or more coins or bills may be registered as is necessary.

The various register actuating slides are shown in detail by Figures 3, 7 and 8, and the arrangement thereof with respect to the banks of keys is shown by Figures 2 and 5. Each of these slides is connected to a tension spring 27 which is normally maintained under tension and tends to draw the slide forward to actuate the corresponding register when the slide is released. The springs 27 for all but two of the slides are arranged within the casing and attached to a transverse partition therein. The springs 27 for the other two slides are arranged under the casing, as indicated by Figure 3, and suitably attached to projections on the bottom of the casing. The rear ends of the slides are provided with shoulders 29 and depending arms or hook members 30. The shoulders 29 of the slides for each bank of keys are engaged by the nose of a detent 31, said detents being shown as carried by hubs 31^a which are loosely mounted upon a transverse shaft 32 at the rear end of the casing. The register operating slides are thus normally held in a rearwardly retracted position against the

action of the respective springs 27 by means of the detents 31.

When a key in any bank of keys is depressed the detent 31 for the register operating slides of that bank of keys is automatically moved into inoperative position. For this purpose a detent releasing slide 33 is provided for each bank of keys, the rear end of each of the said slides having a pin and slot connection 34 with the corresponding detent 31, and the slides being provided with laterally projecting pins or shoulders 35 arranged to be engaged by cam portions 36 on the stems of the keys for the attachment. Springs 37 are connected to the detent release slides 33 and normally tend to move the same forwardly into operative position. The pins 35 of the slides are then in engagement with the key stems 6 and arranged under the cams 36. When any one of the keys is depressed the cam 36 thereof engages the corresponding pin 35 and cooperates therewith to move the detent releasing slide 33 for that bank of keys rearwardly against the action of the spring 37, with the result that the corresponding detent 31 is swung upwardly and the group of register actuating slides for that particular bank of keys is released.

The lateral arms or hook members 30 of the register actuating slides are normally engaged by the cross bar of a bail 38 which is rigid with the before-mentioned shaft 32, the cross bar of the bail operating within suitably arranged segmental slots 39. A crank arm 40 which is rigidly applied to a projecting end of the shaft 32 has a pin and slot connection 41 with a link member 42 which is operatively connected to the lever or handle 3 of the adding machine A. For this purpose a bracket or clamp 43 is shown as applied to the operating lever 3 of the adding machine, said clamp being provided with a stud 44 which is detachably engaged by a hook 42^a at the end of the link member 42. The bracket 43 is shown as formed of two complementary parts which can be applied to the operating lever 3 of the adding machine from opposite sides thereof and permanently clamped in position thereon by the screws 45. However, the hooked end 42^a of the link 42 has a detachable engagement with the stud 44 so that these parts can be quickly connected or disconnected when placing the attachment in position upon the adding machine or removing it therefrom. When the operating lever 3 is swung forwardly to actuate the adding machine A in the customary manner, the motion thereof is transmitted through the link 42 and crank arm 40 to the shaft 32, with the result that the said shaft and the bail 38 carried thereby are rocked. The arrangement is such that the bail 38 is swung forwardly, and any of the register operating slides which have been released by the detents 31 can then move forwardly under the

action of the tension springs 27. Suitable stops are provided and controlled by the keys for governing the extent of movement of each of the slides, so that the corresponding registers will be properly operated. Upon the return movement of the main operating lever 3 the bail 38 is swung rearwardly and engages the hooks or arms 30 of any of the register operating slides that have been moved forwardly, with the result that all such register operating slides are returned to their original positions. Upon the completion of the adding and listing operation, the keys 1 of the adding machine are released and returned to their original positions, in a manner which is well known, and the keys of the attachment will be returned to their original positions at the same time, with the result that the detents 31 will be in position to engage the shoulders 29 of the register operating slides which are reset or returned to their original positions by the action of the links 42. The pin and slot connection between the upper end of the link 42 and the crank arm 40 provides for a limited amount of play between the parts and enables the main operating lever 3 of the adding machine to have the necessary greater amplitude of movement than the bail 38.

The unit bank of keys is provided with register operating slides *a* and *b*, one of which is arranged upon each side of the stems for the keys (see Figures 2 and 5). The tens bank of keys is provided with four register operating slides *d*, *e*, *f*, and *g*, two of which are arranged on each side of the key stems. A differential nickel bar *c* is arranged between the unit bank of keys and the tens bank of keys, being operatively connected, as will be hereinafter described, to the slides *b* and *d*. The hundreds bank of keys is similarly provided with slides *a* and *h*, the thousands bank of keys with the slides *j* and *k*, and the ten thousands bank of keys with a slide *a*. The three said slides *a* are identical in construction, and the slide *a* for the pennies or units bank or column is shown by Figure 3. The upper edge of the slide *a* is provided with a series of stops a^1 , a^2 , a^3 , a^4 , a^5 , a^6 , a^7 , a^8 and a^9 , which are adapted to engage cooperating stop pins 46 on the stems of the respective keys for the purpose of properly governing the amplitude of movement of the slide when it is released. This is the pennies slide and the rack 26 thereof operates the register 20 for cents or pennies. The before-mentioned stop shoulders on the slide are arranged with respect to the pins 46 of the keys so that the slide will have different increments of movement after being released, depending upon the key which has been depressed. For instance, the stop shoulder a^1 will permit the slide *a* to have one increment of movement before engaging the pin 46 of the one cent key in the cents or units

column or bank of keys. If the two cent key is depressed, the stop a^2 is so arranged that the slide will have two increments of movement before it engages the pin 46 of the depressed key. Similarly, the stop a^3 will permit three increments of movement when the three cent key is depressed and the stop a^4 will permit four increments of movement when the four cent key is depressed. The penny or cents register 20 will thus register one, two, three or four pennies, depending upon the value of the key which is depressed. When the five cents key is depressed, there will be a five cent piece or nickel registered instead of five pennies and no movement of the cents slide *a* is desired. Accordingly, the stop shoulder a^5 thereof is so arranged that it is engaged by the stop pin 46 of the five cents key as soon as the said key is depressed. The registration of the nickel instead of five pennies is taken care of by the slide *b*, in a manner which will be hereinafter described. The stop shoulders a^6 , a^7 , a^8 and a^9 have the same relation to the pins 46 of the corresponding keys as the shoulders a^1 , a^2 , a^3 , and a^4 have to the one, two, three and four cents keys. This is due to the fact that the same number of pennies are involved and should be registered. Of course, for the six, seven, eight and nine cents keys a nickel or five cent piece will be registered in addition to the pennies.

There are three nickel slides or bars, said bars being illustrated in detail by Figure 8. The bar or slide *b* is associated with the units column of keys and the bar or slide *d* is associated with the tens column of keys, the bar *c* being arranged at an intermediate position and elevated slightly above the other bars, as is illustrated more clearly by Figure 5. The intermediate nickel bar *c* is termed a differential bar and the forward end thereof is provided with the rack 26 which engages the pinion 25 of the nickel or five cents register 20. Neither of the nickel bars or slides *b* or *d* is provided with a rack or has any direct connection with the register 20, although the three nickel bars or slides are operatively connected in such a manner that if either of the slides *b* or *d* is permitted to move forwardly one step or increment, the differential bar or slide *c* will cause a single nickel or five cent piece to be registered while if both of the bars *b* and *d* move forwardly one step or increment at the same time, the differential bar *c* will be advanced two steps so that two nickels or five cent pieces will be registered. For this purpose the differential bar or slide *c* carries an upright lever 47 which is pivoted thereto at an intermediate point in its length, the opposite extremities of the lever being slotted to receive the pins 48 which project laterally from the slides *b* and *d*, the slide *d* being provided with an upstanding arm 49 which carries the pin 48. The pin 48 of the nickel

bar *b* of the units column thus engages the lower end of the lever 47 while the pin 48 of the nickel bar *d* for the tens column engages the upper end of the lever 47. It will thus be obvious that if either one of the nickel slides *b* or *d* is permitted to move forwardly one step, the nickel differential slide *c* will receive a single increment of movement, while if both of the nickel bars or slides *b* and *d* are permitted to move forwardly at the same time the nickel differential bar *c* will receive two increments of movement. The nickel bar *b* is provided with the stops *b*¹, *b*², *b*³, *b*⁴, *b*⁵, *b*⁶, *b*⁷, *b*⁸ and *b*⁹ which correspond to the keys of the units column. The stops *b*¹ to *b*⁴ are arranged to be engaged by the stop pins 46 of the keys as soon as the keys are depressed, so that when any one of the corresponding keys is operated there will be no actuation of the nickel register. The stop shoulders *b*⁵ to *b*⁹ inclusive are arranged so that the bar *b* will be advanced one step forward and cause a single nickel to be registered if any one of the corresponding keys is actuated.

The stop pins 46 of the keys 5 of the units column or bank cooperate with the stop shoulders of the two slides or bars *a* and *b* so that for any value from one cent to nine cents the penny and nickel registers 20 will be actuated according to the number of pennies and nickels which are necessary to make up the value of the depressed key. For the values of one cent to four cents the nickel slide *b* is not actuated although the penny slide *a* receives different increments of movement corresponding to the value of the depressed key so that there is a proper actuation of the penny register 20. When the five cents key is depressed the penny slide *a* is locked against movement while the nickel slide *b* is permitted to move forward to actuate the nickel register owing to the fact that the shoulder *b*⁵ thereof does not engage the stop pin 46 of the key until after the nickel slide has had an increment of movement. When any one of the keys from six cents to nine cents is depressed, the nickel bar *b* is permitted to move forward to register one nickel, while the penny slide *a* is permitted to move forward different increments, depending upon the number of pennies which may be required in addition to the nickel to make up the value of the depressed key all as previously described. All of the values from one cent to nine cents are thus taken care of by the slides *a* and *b* of the units column of keys.

The tens column of keys, as previously mentioned, is provided with the four register operating slides or bars *d*, *e*, *f*, and *g*, two of which are arranged on each side of the key stems. The bar *d*, as previously mentioned serves to actuate the nickel register, being provided with the shoulders *d*¹, *d*², *d*³, *d*⁴,

*d*⁵, *d*⁶, *d*⁷, *d*⁸ and *d*⁹. The shoulders *d*¹, *d*², *d*³, *d*⁶, and *d*⁷ are arranged to engage and cooperate with the stops of the corresponding keys to lock the bar *d* against movement when any one of the said keys is depressed, while the stops *d*³, *d*⁴, *d*⁸ and *d*⁹ are properly spaced from the vertical paths of the stops of the corresponding keys to permit a forward movement of the nickel bar to register a nickel when one of the corresponding keys is depressed.

The bar or slide *e* controls the dime or ten cents register and is provided with the stops *e*¹, *e*², *e*³, *e*⁴, *e*⁵, *e*⁶, *e*⁷, *e*⁸, and *e*⁹. The stops *e*¹, *e*⁴, *e*⁶, and *e*⁹ are properly spaced from the vertical paths of the stops of the corresponding keys to permit a single increment of forward movement to register a single dime when one of the corresponding keys is depressed. The stops *e*² and *e*⁷ are properly spaced from the vertical paths of the stops of the corresponding keys to permit two increments of forward movement when one of the corresponding keys is depressed, thereby providing for the registration of two dimes. The stop shoulders *e*³, *e*⁵, and *e*⁸ are arranged to engage the stop pin of the dime bar or slide *e* and lock the same against movement when one of the corresponding keys is depressed.

The actuating bar or slide *f* for the quarter or twenty five cents register 20 is similarly provided with the stop shoulders *f*¹, *f*², *f*³, *f*⁴, *f*⁵, *f*⁶, *f*⁷, *f*⁸, and *f*⁹. The stops *f*¹, *f*², *f*⁵, *f*⁶, and *f*⁷ are arranged to engage the stop pins 46 of the keys and lock the bar against movement when one of the corresponding keys is depressed, while the stops *f*³, *f*⁴, *f*⁸, and *f*⁹ are each properly spaced from the paths of the corresponding stop pins 46 to permit a forward movement of the bar or slide *f* to register a single quarter or twenty-five cent piece when one of the corresponding keys is depressed. Similarly, the actuating bar or slide *g* for the fifty cents or half dollar register 20 is provided with stops *g*¹, *g*², *g*³, *g*⁴, *g*⁵, *g*⁶, *g*⁷, *g*⁸ and *g*⁹, of which the stops *g*¹ to *g*⁴ are arranged to lock the bar or slide against movement when one of the corresponding keys is depressed, while the stops *g*⁵ to *g*⁹ inclusive are each properly spaced from the vertical paths of the stop pins 46 of the corresponding keys to permit a forward movement of the bar or slide *g* to register a single half dollar or fifty cent piece on the fifty cents register when one of the corresponding keys is depressed.

The four register actuating bars or slides *d*, *e*, *f*, and *g* are all controlled by the stop pins 46 of tens column of keys 5, and the arrangement is such that when any one of these tens keys is depressed the mechanism is set to analyze the value into the different smaller denominations of which it is comprised and to register the proper number of the different denominations on the corresponding reg-

isters 20 upon the actuation of the adding machine A. For instance, when the "1" key of the tens column is depressed, all of the slides or bars are locked against movement with the exception of the dime bar or slide *e*, which is permitted to move forward one increment and register one dime on the dime or ten cents register 20 when the adding machine is actuated. If one of the keys of the units column is depressed in conjunction with the "1" key of the tens column, the proper number of pennies and nickels to complete the total value of the two depressed keys will be registered, the bars or slides of the units column being controlled and actuated as previously described. Should the "2" key of the tens column be depressed, all of the register actuating slides would be locked except the dime slide *e*, which would be permitted to have two increments of forward movement to register two dimes upon the actuation of the machine. If the "3" key of the tens column is depressed, the dimes slide *e* and fifty cents slide *g* will both be locked against movement while the twenty-five cents slide *f* and nickel slide *d* will each be permitted to have a single increment of forward movement to register one quarter and one nickel on the appropriate registers 20. If the "4" key of the tens column is depressed, the fifty cents slide *g* will be locked against movement while each of the slides *d*, *e* and *f* will be permitted to have a single increment of forward movement and actuate the corresponding registers 20 to register one quarter, one dime and one nickel. If the "5" key of the tens column is depressed, all of the slides will be locked against movement with the exception of the fifty cents slide *g*, which will be permitted to have a forward movement to register a single half dollar or fifty cent piece on the proper register 20. Similarly, the depression of the "6" key of the tens column will set the mechanism to register one half dollar and one dime, the depression of the "7" key of the tens column will set the mechanism to register one half dollar and two dimes; the depression of the "8" key of the tens column will set the mechanism to register one fifty cent piece, one quarter, and one nickel; depression of the "9" key of the tens column will set the mechanism to register one fifty cent piece, one quarter, one dime and one nickel.

When certain keys of the units column are operated in combination with certain keys of the tens column, it is necessary to provide for a double increment of movement for the nickel differential bar *c* so that two nickels will be registered on the five cents register 20. For instance, if the sum of thirty-five cents is set up on the keyboard, the depression of the "3" key of the tens column will set the mechanism to provide for the registration of one quarter and one nickel, while the depression of the "5" key of the units column

will provide for the registration of a second nickel. Owing to the fact that the nickel slide *b* of the units column moves forwardly simultaneously with the nickel slide *d* of the tens column, a double increment of movement will be imparted to the nickel differential bar slide *c* with the result that one quarter and two nickels will be registered. In an analogous manner two nickels are registered when forty-five cents, eighty-five cents, or ninety-five cents is set up on the keyboard. When twenty-five cents is set up on the keyboard, two dimes and one nickel are registered.

Of the two slides *a* and *h* provided for the hundreds column, the slide *a* is identical with the slide *a* of the units column, since the registration of dollars for the values from one dollar to nine dollars is controlled in an identical manner with that of the registration of cents from one cent to nine cents. The actuating bar or slide *h* controls the five dollars register 20 and is provided with the stop shoulders *h*¹, *h*², *h*³, *h*⁴, *h*⁵, *h*⁶, *h*⁷, *h*⁸, and *h*⁹, arranged as shown in detail by Figure 7. The stops *h*¹ to *h*⁴ inclusive lock the slide *h* against forward movement when one of the corresponding keys is depressed, while the stops *h*⁵ to *h*⁹ inclusive permit one increment of forward movement for the purpose of registering one five dollars on the five dollars register 20 when one of the corresponding keys is depressed. Thus, for values of one dollar to four dollars, the five dollar bar *h* is locked against movement while the dollars bar or slide *a* is permitted to have different increments of forward movement, depending upon the value of the depressed key; when the five dollars key is depressed the dollars slide or bar *a* is locked against movement while the five dollars bar or slide *h* is permitted to move forwardly and register one five dollars. For values from six dollars to nine dollars the five dollars bar *h* is permitted to move to register one five dollars, while the dollars bar *a* is permitted to have different increments of movement depending on the number of one dollars which are required in addition to the five dollars to complete the value of the depressed key.

For the thousands column there is a ten dollars bar or slide *j* and a twenty dollar bar or slide *k*, said slides being shown in detail by Figure 7. The bar *j* is provided with the stop shoulders *j*¹, *j*², *j*³, *j*⁴, *j*⁵, *j*⁶, *j*⁷, *j*⁸, and *j*⁹, of which the stops *j*¹, *j*², *j*³, *j*⁴, and *j*⁵ are each arranged to permit a forward movement of the bar to register one ten dollars on the ten dollars register 20, while the stops *j*⁶, *j*⁷, *j*⁸, and *j*⁹ are each arranged to lock the ten dollars bar or slide *j* against movement. The twenty dollars bar or slide *k* is likewise provided with the stops *k*¹, *k*², *k*³, *k*⁴, *k*⁵, *k*⁶, *k*⁷, *k*⁸, and *k*⁹. The stop *k*¹ locks the twenty dollars slide *k* against movement when the corresponding

key is depressed. The stop k^2 permits one increment of forward movement to register one twenty dollars on the twenty dollars register, as does also the stop k^3 . The stops k^4 and k^5 each permit two increments of forward movement to register two twenty dollars, the stops k^6 and k^7 each permit three increments of movement to register three twenty dollars, and the stops k^8 and k^9 each permit four increments of forward movement to register four twenty dollars. It will thus be obvious that when any one of the keys of the thousands column is depressed, the value of the key will be analyzed into the different twenty dollar and ten dollar denominations and the correct number of the two denominations corresponding to the value of the key registered on the appropriate registers 20.

The ten thousands column of keys is provided with a single slide or bar a which controls the actuation of the one hundred dollars register 20, the arrangement of the stops on this slide being identical with that of the other two slides a of the hundreds and units columns respectively. In the present construction the ten thousands column is only shown as utilizing four keys. It will be understood, however, that I am merely describing one possible embodiment of the invention in detail for illustrative purposes, and that the specification and drawings are to be considered in an illustrative sense and not in a restrictive sense. The capacity of the machine can be readily enlarged or decreased, as may be found necessary or desirable. Furthermore, the arrangement of the cooperating stops and the inter-relation of these operating slides or bars of different columns of keys can be varied to denominate in different ways, the essential consideration being that each of the various items which are set up on the adding machine be analyzed into the different monetary values or denominations of which it is composed so that when the operator takes his final result from the machine, he will know all of the different items and the total value of the items, and in addition thereto the different denominations and the total number of each of the different denominations which must be drawn from the bank or otherwise secured in order that the different items on the list may be placed in pay envelopes or otherwise disbursed.

The complete cycle of operation of the denominator attachment when any item is set up on the keyboard, is as follows:—If the value \$297.85 is set up on the keyboard, one key in each column or bank of keys will be depressed, with the result that all of the detent releasing bars 33 will be moved rearwardly by the action of the cams 36 on the pins 35, and all of the detents 31 swung upwardly away from the shoulders 29 of the register actuating bars or slides. All of the said bars or slides

are thus released, although they are initially held against movement by the resetting bar or bail 38. Upon the forward swing of the main operating lever 3 of the adding machine the resetting bar or bail 38 is moved forwardly so that all of the register actuating bars or slides are free to move under the action of the tension springs 27, with the exception of those slides which are locked against movement by the cooperating stops on the slides and stems 6 of the keys. For the particular value of \$297.85, which has been taken as an example, the bar or slide a of the ten thousands column will have two forward increments of movement and register two one hundred dollars on the one hundred dollars register 20. The slides or bars j and k of the thousands column will move forwardly, in the manner previously indicated to register four twenty dollars on the twenty dollars register 20 and one ten dollars on the ten dollars register 20. The slides or bars h and a of the hundreds column will register one five dollars on the five dollars register and two dollars on the dollars register. The slides of the tens column will register once each on the fifty cents register, the twenty-five cents register and the five cents register, the ten cent bar or slide e being locked against movement. The slide b of the units column will cause an additional nickel to be registered on the nickel register, while the slide a will be locked against movement so that no pennies will be registered. The \$297.85 item is thus analyzed into the different denominations of which it is composed, and the operator knows at a glance what denominations of money and the number of each denomination which must be withdrawn from the bank in order that this item can be paid. Upon the return movement of the main operating lever 3, the resetting rod or bail 38 engages the hooked ends 30 of those register actuating bars which were previously moved forwardly, with the result that all of the said bars are reset or returned to their original positions. In the meantime the adding machine keys are released in the usual manner so that all of the keys are returned to their normal positions and the detents 31 permitted to engage the shoulders 29 of the register actuating slides. This completes the operation of adding, listing and denominating, the adding and listing being done by the adding machine mechanism in the well known manner. The different items are charged into the machine successively and the cycle of operation for each item is identical with that just described. The registers 20 are preferably in the form of accumulators so that the denominations for each of the items which are charged into the machine will be automatically added to the denominations already registered for the items previously charged into the machine. The attachment is provided with keys 50 corresponding to the special keys

2 of the adding machine, so that these special keys can be operated with the attachment in position. When it is desired to get the total or subtotal for the items which have been charged into the machine, the proper special key is depressed and the main operating lever 3 actuated in the usual manner. No one of the detents 31 of the attachment will be released, so that there will be no movement of any of the register actuating slides and no actuation of any of the denominator registers. The adding machine, however, will give the total or sub-total, so that the operator will have a list of the items and also the total value of all of the different items. This, however, is not sufficient to enable the total value of the money to be drawn from the bank in proper denominations to pay or disburse the different items, and where a denominator device or machine is not available, tedious mental calculations are frequently necessary for ascertaining how the money should be drawn from the bank. These difficult calculations are avoided by the use of the denominator attachment which operates automatically to analyze the items into the different denominations and to register the denominations upon suitable registers. When the operator gets his total from the adding machine, he has merely to consult the registers on the denominating attachment to know the exact denominations and the exact amount of each denomination in which the money must be drawn from the bank. This is determined with accuracy and precision, so that the possibility of error is avoided as well as the tediousness of a mental computation. Owing to the facility and ease with which the attachment can be applied to an adding machine or removed therefrom, the adding machine can be used without the attachment for the usual routine work where a denominator is not necessary and would be superfluous. Ordinarily, the denominator attachment would merely be applied to the adding machine on certain days of the week or month when a payroll or the like is to be made up. The adding machine is thus temporarily enabled to denominate in addition to its usual adding and listing functions, and the expense incident to providing a complete denominating machine in addition to the adding machine is thereby avoided. As previously explained, the denominating machines which are now available are complicated and expensive mechanisms, and since their use is restricted very largely to the making up of payrolls, they are idle much of the time, and can only be afforded by large concerns having heavy payrolls. An attachment of the present character is thought to supply an existing need for a denominating machine which can be produced at a moderate cost and placed within the reach of the many concerns which have need for such a device but do not feel justified in purchasing the costly ma-

chines heretofore available for that purpose. With the present attachment the owner uses his adding machine perhaps six days a week as an adding machine per se and merely places the denominator attachment on the machine on Saturdays or on the 1st and 15th days of the month when making up his payroll. Owing to the simplicity of the attachment it can be produced at a very small fraction of the cost of the complete denominator machines.

I do not, of course, desire to be limited to the precise constructions, arrangements and operations herein referred to, as there are many modifications possible which would obviously come within the scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A calculating device of the character described including a keyboard having the keys arranged in columns, a series of registers, register actuating slides of which certain of the slides are associated with the columns of the keys, one of the slides being operatively connected with the slides of different columns of keys so that it will receive one amplitude of movement when one of the said slides is operated and a different amplitude of movement if both of the said slides are actuated, and cooperating means upon the keys and those slides associated with the keys for permitting differential movements of the slides.

2. A calculating device of the character described, including a keyboard having at least two columns of keys, a register, a slide associated with each of the two columns of keys, means controlled by the keys for permitting movements of the slides for the respective columns of keys, and a third slide operatively connected with the register and operatively connected with the two before-mentioned slides so that it has one amplitude of movement when either of the mentioned slides is operated independently of each other and a different amplitude of movement when the two first-mentioned slides are operated at the same time.

3. A calculating device of the character described, including a keyboard having at least two columns of keys, of a slide associated with each of the two columns of keys, means controlled by the keys of each column for governing the actuation of the corresponding slide, a register, a register actuating slide, and a lever operatively connecting the register actuating slide with the two before-mentioned slides, whereby the register actuating slide will receive one amplitude of movement when either one of the first-mentioned slides is moved independently of each other, and a different amplitude of movement

when the two first-mentioned slides are actuated at the same time.

4. A calculating machine of the character described, including a keyboard having at least two columns of keys, slides associated with the said two columns of keys, means controlled by the keys for governing the movements of the said slides, a register, a register actuating slide, a lever carried by the register actuating slide and loosely engaging the before-mentioned slides whereby the said register actuating slide will have one amplitude of movement when either one of the first-mentioned slides is actuated independently of the other slide, and another amplitude of movement when the two first-mentioned slides are actuated at the same time.

5. A calculating machine of the character described, including a keyboard having at least two columns of keys, slides associated with the said columns of keys, means controlled by the keys for governing the movements of the said slides according to the value of the keys that are manipulated, a register, a register actuating slide, and an upright lever carried by the register actuating slide and pivotally connected thereto at an intermediate point in its length, the first mentioned slides being provided with lateral pins which loosely engage the ends of the lever whereby the said register actuating slide will have one amplitude of movement when either one of the first-mentioned slides is actuated independently of the other slide, and another amplitude of movement when the two first-mentioned slides are actuated at the same time.

6. A denominator including a keyboard having a unit column of keys and a tens column of keys, a nickel register, a register actuating slide, independent slides associated with the two columns of keys, means controlled by the keys for governing the movements of the said independent slides according to the value of the manipulated keys, and an operative connection between the register actuating slide and the independent slides whereby the register actuating slide will receive one increment of movement when either one of the independent slides is actuated independently of the other slide, and a double increment of movement when the two independent slides are actuated at the same time.

7. A denominator including a keyboard having a units column of keys and a tens column of keys, a penny slide and a nickel slide associated with the units column of keys, dime, quarter and half dollar slides and a second nickel slide associated with the tens column of keys, corresponding denomination registers arranged to be actuated by the corresponding slides, and means controlled by the keys for permitting differential movements of selected slides to actuate the registers according to the denominations of which the

amount set up on the keyboard is composed.

8. A denominator including a keyboard having a units column of keys and a tens column of keys, a penny slide and a nickel slide associated with the units column of keys, a nickel slide, dime slide, quarter slide, and half dollar slide associated with the tens column of keys, corresponding denomination registers, a differential nickel slide controlling the nickel register, an operative connection between the differential nickel slide and the nickel slides of the units and tens column whereby the differential slide receives one increment of movement when one only of the nickel slides is actuated and receives a double increment of movement when both of the nickel slides are actuated at the same time, and means controlled by the keys for permitting differential movements of selected slides to actuate the denomination registers according to the denominations of which the amount set up on the keyboard is composed.

In testimony whereof I affix my signature.

NELSON WHITE.