Dec. 8, 1953 H. P. LUHN 2,661,896

SERIAL NUMBERING MACHINE

Filed April 18, 1950 2 Sheets-Sheet 1

Fig. 1.

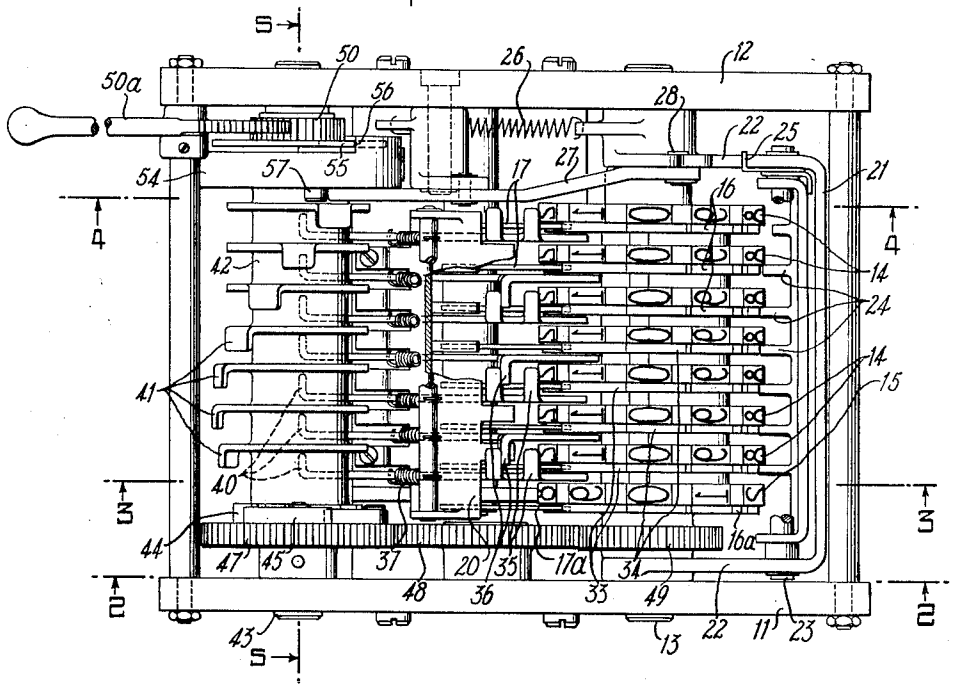
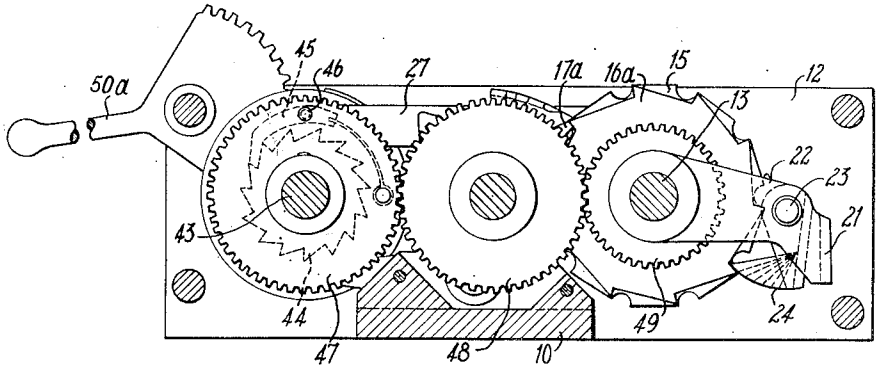


Fig. 2.



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Dec. 8, 1953 H. P. LUHN 2,661,896

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Filed April 18, 1950 2 Sheets-Sheet 2

Fig. 3.

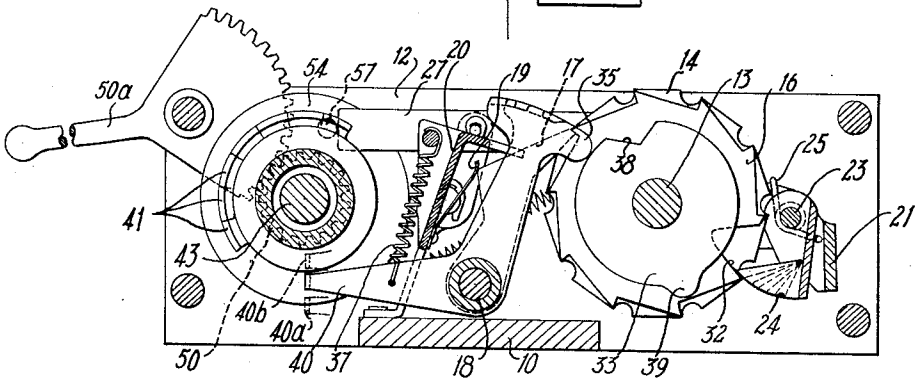


Fig. 5.

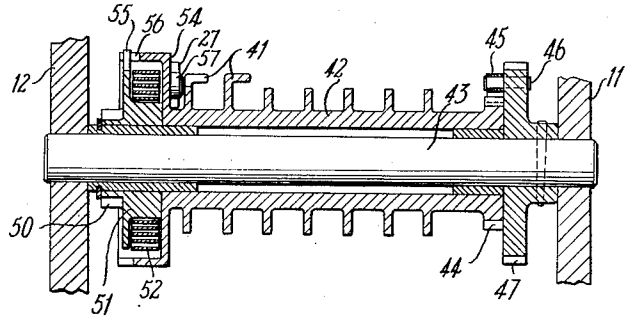
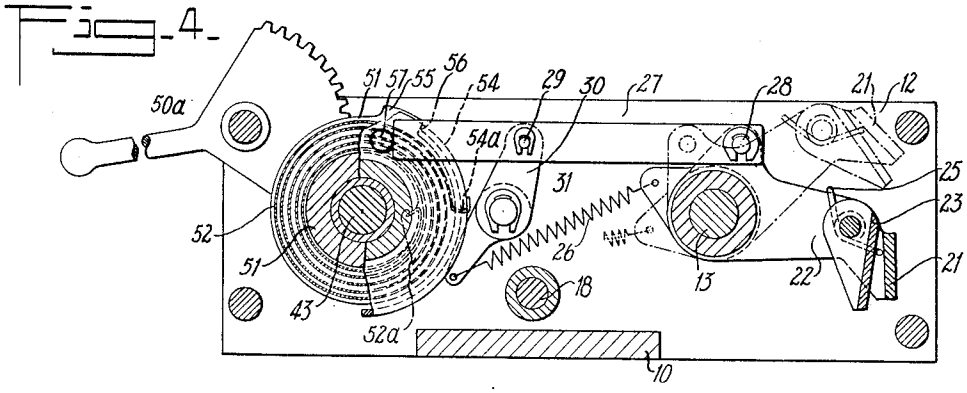


Fig. 4.



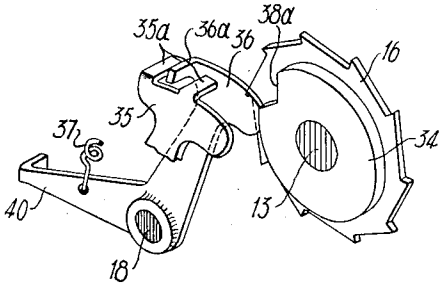


Fig. 6.

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UNITED STATES PATENT OFFICE

2,661,896

SERIAL NUMBERING MACHINE

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Application April 18, 1950, Serial No. 156,692

12 Claims. (Cl. 235—1)

1

This invention relates to numbering machines of the type wherein a row of numeric printing wheels is operated to present successive numbers to a recording position for serial numbering purposes.

The principal object of the invention is to provide an additional numeric printing wheel adjacent to the normal units position wheel and to provide positioning mechanism to set such wheel to print a code or check value in accordance with the arrangement of digits in the serial number set up.

The apparatus of the invention finds utility in a checking system for multidigit numbers to insure that in their transmission or other manner of handling the digits comprising the number have not become altered or transposed.

The particular system to which the invention is directed is one in which a single key digit is appended to the original or true number, and the value of this key digit is selected so that upon cross addition of all the digits of the number plus the key digit, in accordance with a rule of substitution, the result will be zero (with tens cast out in the process).

In accordance with the rule mentioned, the units and alternate higher denomination digits of the original number are replaced by so-called "substitute" digits, prior to the cross addition, according to the following table:

Original digit	0	1	2	3	4	5	6	7	8	9
Substitute digit	0	2	4	6	8	1	3	5	7	9

Taking a number, such as 257348, for example, and making the substitution, we have:

Original number	2	5	7	3	4	8
Substitute number	2	1	7	6	4	7

Cross adding the digits of the substitute number with tens cast out, the tens complement of the resulting digit is the "key" digit to be appended to the original number. Thus, the cross addition with tens cast out is 7, whose tens complement is the key digit 3, so that the original number with its key 3 may be recorded as 2573483.

From the foregoing, it will be apparent that upon cross addition of the digits of the original number with substitutions made as before and the key digit included in the addition, the result will be zero. If the result is other than zero, it is an indication of an error in arrangement of the digits of the original number. Thus, if through error the number were written as 2673483, cross addition according to the rules laid down will result in

Original number	2	6	7	3	4	8	3
Substitute number	2	3	7	6	4	7	3

2+3+7+6+4+7+3=2 (with tens cast out)

2

Or, if two adjacent digits were transposed as

Original number	5	2	7	3	4	8	3
Substitute number	5	4	7	6	4	7	3

5+4+7+6+4+7+3=6 (with tens cast out).

It is, therefore, an object of the invention to provide a mechanism operable in conjunction with a numbering machine for automatically selecting the appropriate key digit for each successive serial number for printing thereof along with the original number.

Specifically, an object of the invention is to select the key digits as set forth in the following partial table of numbers from 0 to the columnar capacity of the numbering machine, wherein (inspection will show) each key digit is the tens complement of the sum of the cross addition of the digits of the original number with substitution made as explained and tens cast out.

Number	Key	Number	Key	Number	Key
0	0	27	3	300	4
1	8	28	1	301	2
2	6	29	9		
3	4	30	7	497	8
4	2	31	5	498	6
5	9	32	3	499	4
6	7	33	1	500	9
7	5	34	9	501	7
8	3	35	6		
9	1	36	4	9997	8
10	9	37	2	9998	6
11	7	38	0	9999	4
12	5	39	8	10000	8
13	3	40	6	10001	6
14	1				
15	8	97	6	49997	0
16	6	98	4	49998	8
17	4	99	2	49999	6
18	2	100	8	50000	9
19	0	101	6	50001	7
20	8				
21	6	294	9	999997	0
22	4	295	6	999998	8
23	2	296	4	999999	6
24	0	297	2	1000000	8
25	7	298	0	1000001	6
26	5	299	8		

A specific object of the invention is to provide a mechanism for setting up consecutive numbers each accompanied by the appropriate key digit. In carrying out the objects of the invention, a line of print wheels is provided and through pawl and ratchet mechanism of the so-called deep-tooth type the wheels are progressively stepped to present the next successive number for each operation of the device. Feeler mechanism is coordinated with the number representing wheels and through this mechanism an additional wheel adjacent to the units wheel of the number is adjusted to display the required key digit.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which

disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view of the device.

Fig. 2 is a sectional elevation taken on lines 2—2 of Fig. 1.

Fig. 3 is a sectional elevation taken on lines 3—3 of Fig. 1.

Fig. 4 is a sectional elevation taken on lines 4—4 of Fig. 1.

Fig. 5 is a section taken on lines 5—5 of Fig. 1.

Fig. 6 is a perspective of the feeler device for one denominational order.

Referring to the drawings, 10 represents a base plate integral with side plates 11 and 12 between which an axle 13 is supported. Freely rotatable on axle 13 are seven number wheels 14, each with ten digital characters 0 to 9 spaced about its periphery and arranged so that, as the wheel is stepped in a clockwise direction as viewed in Fig. 3, the digits will be presented to a printing line extending across the top of the wheel, in the order 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Also mounted freely on axle 13 is the key digit wheel 15 having the ten digital characters 0 to 9 spaced about its periphery and arranged so that, as the wheel 15 is stepped in a clockwise direction as viewed in Fig. 2, the digits will be presented to the printing line in the order 0, 9, 8, 7, 6, 5, 4, 3, 2, 1.

The manner in which the serial number wheels 14 are advanced will now be explained. Integral with each wheel 14 is a ten-tooth ratchet 16 (Fig. 3) engaged by a detent 17 freely pivoted on a cross rod 18 and biased against the ratchet by a leaf spring 19 which is attached to an angular plate 20.

A bail 21 with its side arms 22 freely pivoted on shaft 13 has pivoted thereto at 23 a pawl structure comprising seven pawls 24 of graduated extent, each lying in the plane of a ratchet 16. Spring 25 urges the pawl structure against ratchets 16 and a spring 26 (Fig. 4) connected to the hub of bail arm 22 biases the bail in a counterclockwise direction.

The bail 21 may be oscillated by means of a link 27 connected at 28 to a bail arm 22 and at 29 to a lever 30 pivoted at 31. Spring 26 is anchored to lever 30. When link 27 is moved to the left, spring 26 will rock bail 21 through an angle of one ratchet tooth spacing to the dotted line position of Fig. 4 and, upon return of link 27 with the wheels 14 all set at 0, the pawl 14 of the units order wheel will advance this wheel from its 0 to its 1 position. Upon a second reciprocation of link 27, the wheel will be advanced from 1 to 2 and so on. When it reaches its 9 position, the deep notch 32 (see Fig. 3) in the units ratchet will allow the pawl structure to rock slightly clockwise and enable the tens order pawl 24 to engage the tens ratchet 16, so that upon the next reciprocation both the units and tens wheels 14 will be advanced from 09 to 10. By this well known means, the wheels 14 are stepped through the successive values with the presence of 9's to the right enabling a one-step advance of the next higher order wheel.

For the purpose of the present invention, each wheel 14 has integral therewith a cam which for the units and alternate orders is designated 33 (Fig. 3) and for the tens and alternate orders is designated 34 (Fig. 6). Cams 33 cooperate with bell crank followers 35 and cams 34 cooperate with bell crank followers 36, which are biased clockwise against the cams by springs 37.

Cams 33 each have a notch 38 (Fig. 3) located so that, when the related wheel stands in its 9 printing position, the notch is aligned with its follower 35 and the latter will be rocked clockwise into the notch. Each cam 33 has also a rise 39 so located that, when the related wheel 14 stands in its 4 printing position, the rise is aligned with its follower 35 and the latter will be rocked counterclockwise from its normal position. The followers 35 accordingly have three positions, a normal or central position with the related wheel in its 0, 1, 2, 3, 5, 6, 7 or 8 setting, a clockwise position with the wheel in its 9 setting and a counterclockwise position with the wheel in its 4 setting.

Cams 34 have a notch 38a (Fig. 6) in the same relative location as cams 33, but do not have the rise, so that the related levers 36 have only two positions, a normal position for all digits except 9 and a clockwise position for the digit 9.

Each of the seven bell crank followers 35 and 36 has a lateral extension 40 (Figs. 1 and 3) which in normal position extends across the path of one of a series of spirally arranged stops 41, all of which are integral with a sleeve 42 free on a shaft 43 (see Fig. 5).

The sleeve 42 has secured thereto at one end a ratchet 44 (Figs. 2 and 5) cooperating with a spring biased pawl 45 pivoted at 46 to a gear 47 adjacent to and coaxial with sleeve 42. This gear 47 through idler 48 drives a gear 49 which is integral with the key digit wheel 15 on shaft 13 (see also Fig. 1). This wheel has a ratchet 16a integral therewith for cooperation with a detenting arm 17a of the same construction as for the number wheel 14 to prevent retrograde or counterclockwise turning of the wheel.

The ratio between gears 47 and 49 is such that a 24° rotation of gear 47 will advance wheel 15 an angle of 36° or one digital step. The ratchet 44 has 15 teeth so that a one-tooth advance of the pawl 45 will advance the wheel 15 one digital step, a two-tooth advance of pawl 45 will advance wheel 15 two steps, and so on.

From the partial table given hereinabove, it will be noted that, when the number wheels stand at 0 (zeros to the left are omitted for the sake of simplicity), the key wheel is also at 0. Advance of the number wheel to 1 is accompanied by advance of the key wheel to 8, which is a two-step advance of the latter. Subsequently, advance of the number wheel from 1 to 2 is accompanied by advance of the key wheel from 8 to 6, which is another two-step advance. As pointed out hereinbefore, both wheels turn in the same direction but, since the digits are arranged in reverse order (see Fig. 1), the key wheel numbers descend in value two digits for each one digit advance of the number wheel. This may be termed the basic condition which is modified to bring about an additional step or steps of advance of the key wheel for the following conditions.

Whenever the number wheel 14 in the units order advances from 4 to 5 (regardless of the setting in higher orders), the key wheel 15 is advanced one additional step for a total advance of three steps to lower the setting thereof by 3. In the table this is illustrated where the number wheels change from 4 to 5; 14 to 15; 24 to 25; 34 to 35; and 294 to 295.

Whenever the number wheels 14 in the two lowest orders advance from 99 to 00, the key wheel 15 is advanced two additional steps for a

total of four. See the table where the change is denoted at 99 to 100; 299 to 300.

Whenever the number wheels 14 in the three lowest orders advance from 499 to 500, the key wheel 15 is advanced three additional steps for a total of five.

Whenever the number wheels 14 in the four lowest orders advance from 9999 to 0000, the key wheel 15 is advanced four additional steps for a total of six.

Whenever the number wheels 14 in the five lowest orders advance from 49999 to 50000, the key wheel 15 is advanced five additional steps for a total of seven.

Whenever the number wheels 14 in the six lowest orders advance from 999999 to000000, the key wheel 15 is advanced six additional steps for a total of eight.

The operating mechanism for bringing these various extents of advance about is as follows. A gear 50 (Figs. 3 and 5) freely mounted on shaft 43 is rocked through any suitable means, such as a handle 50*a* geared thereto, in a counterclockwise direction for about three-quarters of a revolution. This gear has secured integral therewith a disk 51 to which the inner end of a coil spring 52 is secured at 52*a* (Fig. 4). The outer end of the spring is secured to a shell 54 at 54*a* integral with sleeve 42 (see Fig. 5), so that as gear 50 is turned counterclockwise as viewed in Fig. 4, carrying with it disk 51, the shell 54 and sleeve 42 will be drawn in the same direction through spring 52 and the stops 41 will turn until intercepted by an extension 40 of one of the bell cranks 35 or 36.

The stops 41 are normally positioned so that the units order stop is two steps or 48° from the units order extension 40 (see Fig. 3), and the succeeding stops are spaced each an additional single step of 24° away from the extensions related to the next lower ordered stops.

In Fig. 4, when disk 51 is rocked counterclockwise, a tooth 55 thereon moves away from a coacting edge 56 on the side of shell 54. This shell accordingly follows tooth 56 carrying with it the sleeve 42 under the influence of spring 52 and, when the sleeve is interrupted, shell 54 will stop therewith, while disk 51 continues through its full stroke, spring 52 yielding to permit such action.

The shell 54 has a pin 57 therein (Figs. 1, 4 and 5) normally abutting slide 27 to hold the same in the position of Fig. 4, so that when the shell and sleeve are rotated by spring 52, pin 57 moves therewith, freeing slide 27 for advance under the influence of spring 26 to rock the bail 21 to its dotted line position, in which the pawls 24 are positioned to engage the next ratchet tooth and advance the wheels one unit upon restoration of the bail. This occurs upon return of gear 50 and disk 51 which first through tooth 55 engages edge 56 to restore shell 54, and the latter carries with it the pin 57 to engage and restore slide 27 and bail 21. For the sake of simplicity in disclosure, it is assumed that the parts are normally retained in their normal position of Fig. 4 through frictional resistance of the connections.

Referring to Fig. 2, the two-step advance of sleeve 42 has caused two teeth of ratchet 44 to pass pawl 45 in a counterclockwise direction. Upon return of the gear 54, tooth 55 will return therewith and, when it engages edge 56, it will rock sleeve 42 and ratchet 44 two steps in a clockwise direction to drive pawl 45 and connected gear 47 a like amount. This through gears 48 and 49 will turn the key wheel 15 two steps to advance the setting from 0, through 9, to the 8 position.

This movement occurs while slide 27 is being restored so that the number wheels 14 are advanced one step from 0 to 1 while key wheel 15 is concurrently advanced two steps from 0 to 8, with detents 17 and 17*a* holding the wheels in advanced positions.

On the next operation of oscillating gear 50, the action is repeated, that is, sleeve 42 is rotated two steps to bring the units order stop 41 against the units order extension 40, and upon the return stroke wheels 14 advance to represent 2, while wheel 15 is advanced to represent 6.

In the same manner the next two operations of gear 50 will advance wheel 14 to represent 3 and 4 in succession, and wheel 15 will advance to 4 and 2, respectively.

When the units order wheel 14 stands in its 4 position, the higher portion or lobe 39 (Fig. 3) thereon engages and rocks the related lever 35 counterclockwise, so its extension 40 is held in dotted line position designated 40*a*, out of the path of the units order stop 41. Now, upon counterclockwise turning of sleeve 42, it will turn until the tens stop 41 engages the tens extension 40 after a three step advance, causing three teeth of ratchet 44 to advance past pawl 45 and upon the return stroke turning of gears 47, 48 and 49 will result in a three step advance of wheel 15 from 2, through 1, and 0 to 9.

It will be noted in Fig. 6 that lever 35 related to the units order has a pair of fingers 35*a* extending toward the tens lever 36, and the latter has a single finger 36*a* extending in the opposite direction and lying between the fingers 35*a*. With the construction as shown, lever 35 is free to rock counterclockwise upon a 4 setting of the units wheel 14, but is held by finger 36*a* against rocking clockwise into its notch 38 (see Fig. 3), when the units order stands at 9. Accordingly, with the units order at 9 and the tens order at any digit other than 9, the units order lever 40 will be held in its full line position of Fig. 3 to effect only a two-step advance of sleeve 42, and as the wheels 14 advance from, say, 09 to 10, the key wheel advances two steps from its 1 to its 9 setting (see the above table).

Thus, as the wheels 14 progress from 0 to 99 unit by unit, there is an accompanying two-step advance of wheel 15 for each unit except in cases where the units order goes from 4 to 5 when the advance of wheel 15 is three steps.

With the wheels 14 standing at 99, the notches 38 and 38*a* of the units and tens order wheels will be in position to enable related levers 35 and 36 to rock together in a clockwise direction, to bring both extensions 40 thereof to the dotted line position 40*b* of Fig. 3. Accordingly, the stops 41 in these two orders will not be intercepted and sleeve 42 will advance four steps until stop 41 of the hundreds order strikes extension 40 of the hundreds order, which is in full line positions, with a resulting four step advance of wheel 15 as wheels 14 advance from 99 to 100. The advance of wheel 15 will be from its 2 (see table), through its 1, 0 and 9 to its 8 position.

The action between levers 35 and 36 of the units and tens orders is duplicated between levers 35 and 36 of the hundreds and thousands orders, the tens of thousands and hundreds of thousands orders, and so on, so that for each of such pairs the lower ordered lever 35 will rock counterclockwise when its setting goes from 4 to

5 and both will rock clockwise when both go from 9 to 0, it being noted that the shift of lever 35 in higher orders is only effective to provide an extra step of advance of wheel 15 when all lower orders stand at 9 and 9's in paired orders are effective to provide two extra steps only when all lower orders also stand at 9.

Thus, with wheels 14 standing at 9999, for example, the four lowest extensions 40 are in their ineffective positions 40b, so that the fifth step 41 is effective to terminate rotation of sleeve 42 after six steps of advance.

The several different extents of advance may be tabulated as follows for the capacity of the device illustrated.

Advance of wheel 14	Advance of wheel 15			
	Basic	Additional		Total
*xxxxx*4 to *xxxxx*5	2	+ 1	=	3
*xxxx*99 to *xxxx*00	2	+ 2	=	4
*xxx*499 to *xxx*500	2	+ 3	=	5
*xx*9999 to *xx*0000	2	+ 4	=	6
*x*49999 to *x*50000	2	+ 5	=	7
999999 to 000000	2	+ 6	=	8

In the above *x* represents any digit and the advance between any other numbers is the two step advance only.

The apparatus has been described as a numbering device starting with 0 and, when operated, as explained, each succeeding number will be set up with its proper accompanying key digit in accordance with the system disclosed.

Where it is desired to start a series of numbers at some other number, it is apparent that wheels 14 may be manually adjusted to represent such number, the corresponding key digit derived mathematically and wheel 15 set to such digit. From such point on, successive numbers will have their related key digits automatically set up.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a numbering apparatus having a line of denominationally ordered numbering wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel coaxial with said line of numbering wheels and having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a two-position advance of the key wheel, and means controlled jointly by the units and tens order numbering wheel for causing an additional one-position advance of the key wheel when said two numbering wheels represent fixed predetermined values.

2. In a numbering apparatus having a line of denominationally ordered numbering wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the

arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a two-position advance of the key wheel, the digit representing positions of said key wheel being regressive so that each succeeding digit representing position is one unit lower in value, and means controlled jointly by the units and tens order numbering wheels for causing an additional one-position advance of the key wheel when said two numbering wheels represent fixed predetermined values.

3. In a numbering apparatus having a line of denominationally ordered numbering wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a two-position advance of the key wheel, and means controlled jointly by the units and tens order numbering wheels for causing an additional one-position advance of the key wheel when the units order of the numbering wheels advances from 4 to 5.

4. In a numbering apparatus having a line of denominationally ordered numbering wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit of advance of the numbering wheels for causing a two-position advance of the key wheel, means controlled by the numbering wheels for causing an additional one-position advance of the key wheel when the units order of the numbering wheels advances from 4 to 5 and further means controlled jointly by the units, tens and hundreds order numbering wheels for causing an additional two-position advance of the key wheel when the units and tens orders of the numbering wheels advance from 99 to 00.

5. In a numbering apparatus having a line of denominationally ordered numbering wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a two-position advance of the key wheel, means controlled by the numbering wheels for causing an additional one-position advance of the key wheel when the units order of the numbering wheels advances from 4 to 5, further means controlled by the numbering wheels for causing an additional two-position advance of the key wheel when the units and tens orders of the numbering wheels advance from 99 to 00 and further means controlled jointly by the units, tens, hundreds and thousands order numbering wheels for causing an additional three-position advance of the key wheel when the three lowest orders of the numbering wheels advance from 499 to 500.

6. In a numbering apparatus having a line of denominationally ordered numbering wheels,

with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a two-position advance of the key wheel, means controlled by the numbering wheels for causing an additional one-position advance of the key wheel when the units order of the numbering wheels advances from 4 to 5, further means controlled by the numbering wheels for causing an additional two-position advance of the key wheel when the units and tens order of the numbering wheels advance from 99 to 00, further means controlled by the numbering wheels for causing an additional three-position advance of the key wheel when the three lowest orders of the numbering wheels advance from 499 to 500 and further means controlled jointly by the units, tens, hundreds, thousands, and ten thousands order numbering wheels for causing an additional four-position advance of the key wheel when the four lowest orders of the numbering wheels advance from 9999 to 0000.

7. In a numbering apparatus, a numbering wheel having ten digit representing positions, a key wheel having ten digit representing positions, both wheels being initially set in their 0 representing positions, means for advancing the numbering wheel to successively represent the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9, means for effecting an advance of the key wheel for each advance of the numbering wheel, and means controlled by the numbering wheel, depending on the position thereof, for controlling the extent of advance of the key wheel to successively represent the digits 8, 6, 4, 2, 9, 7, 5, 3 and 1, respectively.

8. In a numbering apparatus, a first numbering device settable to represent any of the digits, a second numbering device also settable to represent any of the digits, both devices normally represent the 0 digit, means for causing the first numbering device to represent in succession the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9, means controlled by the first device, depending on the setting thereof, and operative concurrently with said last named means for causing the second numbering device to represent in succession the digits 8, 6, 4, 2, 9, 7, 5, 3 and 1, respectively.

9. In a numbering apparatus, a plurality of denominationally ordered number representing elements with each element being arranged to represent any of the ten digits 0 to 9, mechanism for causing said elements to represent in succession the values of the arithmetic progression whose difference is unity, a further digit representing element, means controlled by the units representing element and effective as successive numbers are represented on the first named elements for representing successively lower digits on the said further element with a difference of 2 between successive digits, and means controlled jointly by a pair of adjoining numbering elements or by a series of adjoining numbering elements of successively ascending orders for effecting an additional fixed advance or fixed advances in the representation of said further element depending upon the position of said pair or said

series of adjoining numbering elements, respectively.

10. In a numbering apparatus having a line of denominational order number wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel coaxial with said line of numbering wheels and having a plurality of digit representing positions, means controlled by the units numbering wheel and normally effective for each unit of advance of said numbering wheel for causing a predetermined advance of the key wheel, and means controlled jointly by a pair of adjoining numbering wheels or a series of adjoining numbering wheels of successively ascending orders for effecting an additional fixed advance or fixed advances in the representation of said key wheel depending on the position of said pair or said series of adjoining numbering wheels, respectively.

11. In a numbering apparatus having a line of denominational order number wheels, with each wheel having digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having a plurality of digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a certain advance of the key wheel, and means controlled jointly by a pair of adjoining numbering wheels or a series of adjoining numbering wheels of successively ascending orders for effecting a fixed change of advance or advances in the representation of said key wheel depending on the position of said pair or said series of adjoining numbering wheels, respectively.

12. In a numbering apparatus having a line of denominational order number wheels, with each wheel having ten digit representing positions, mechanism for causing advance of said wheels to successively represent the values of the arithmetic progression whose difference is unity, a key wheel having ten digit representing positions, means controlled by the units numbering wheel and normally effective for each unit advance of the numbering wheels for causing a fixed advance of the key wheel, means controlled jointly by a pair of adjoining numbering wheels or a series of adjoining numbering wheels of successively ascending orders for causing an additional fixed advance or fixed advances of the key wheel when certain of the numbering wheels advance from 4 to 5, and further means controlled jointly by a pair of adjoining numbering wheels or a series of adjoining numbering wheels of successively ascending orders for causing an additional fixed advance or fixed advances of the key wheel when certain of the numbering wheels advance from 9 to 0.

HANS P. LUHN.

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