J. M. DALY.

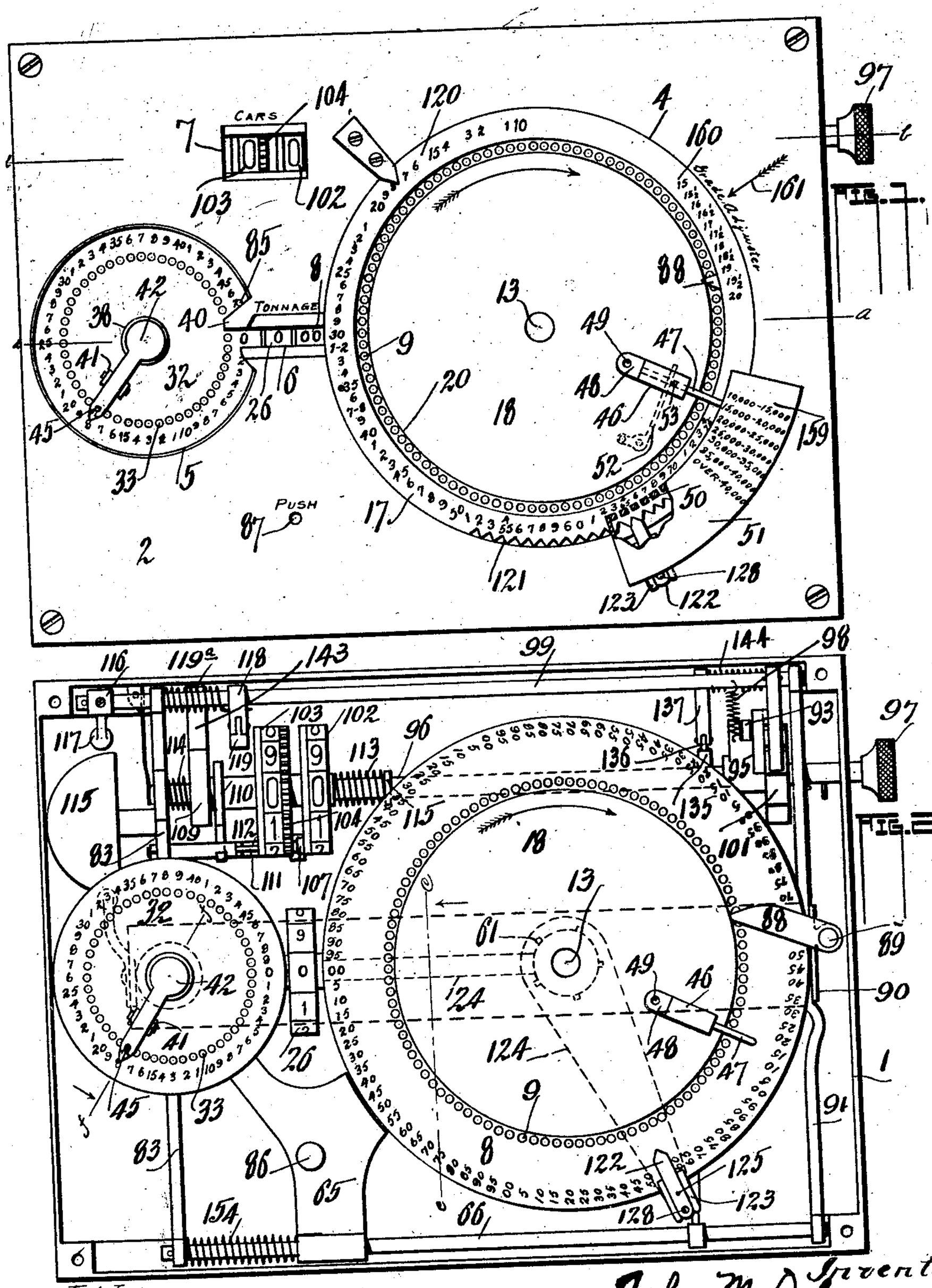
COMPUTING MACHINE.

APPLICATION FILED MAY 19, 1906.

994,821.

Patented June 13, 1911.

4 SHEETS—SHEET 1.



Witnesses:-
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Chas. H. Daly.

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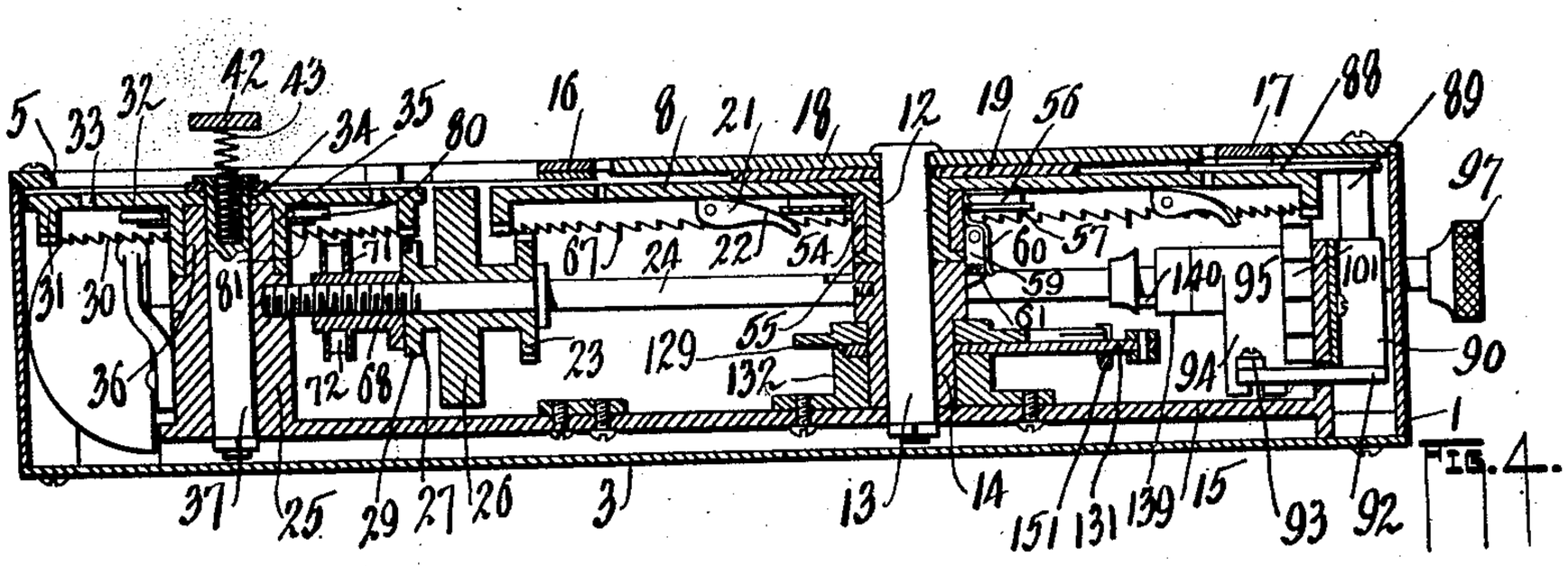

FIG. 4.

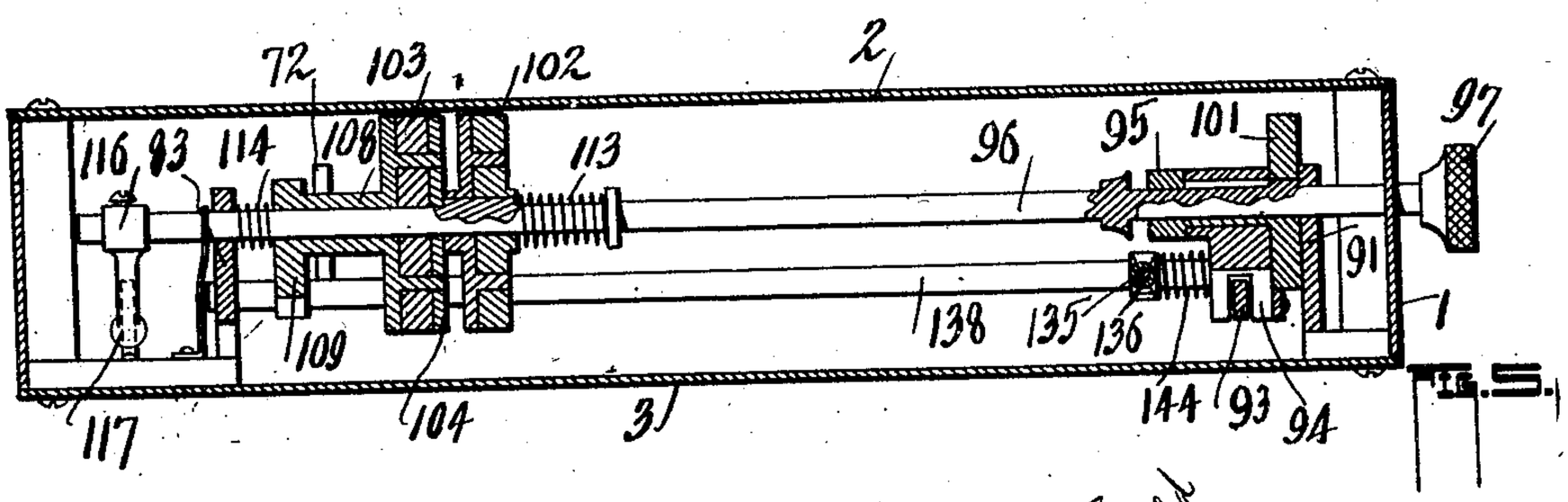

FIG. 5.

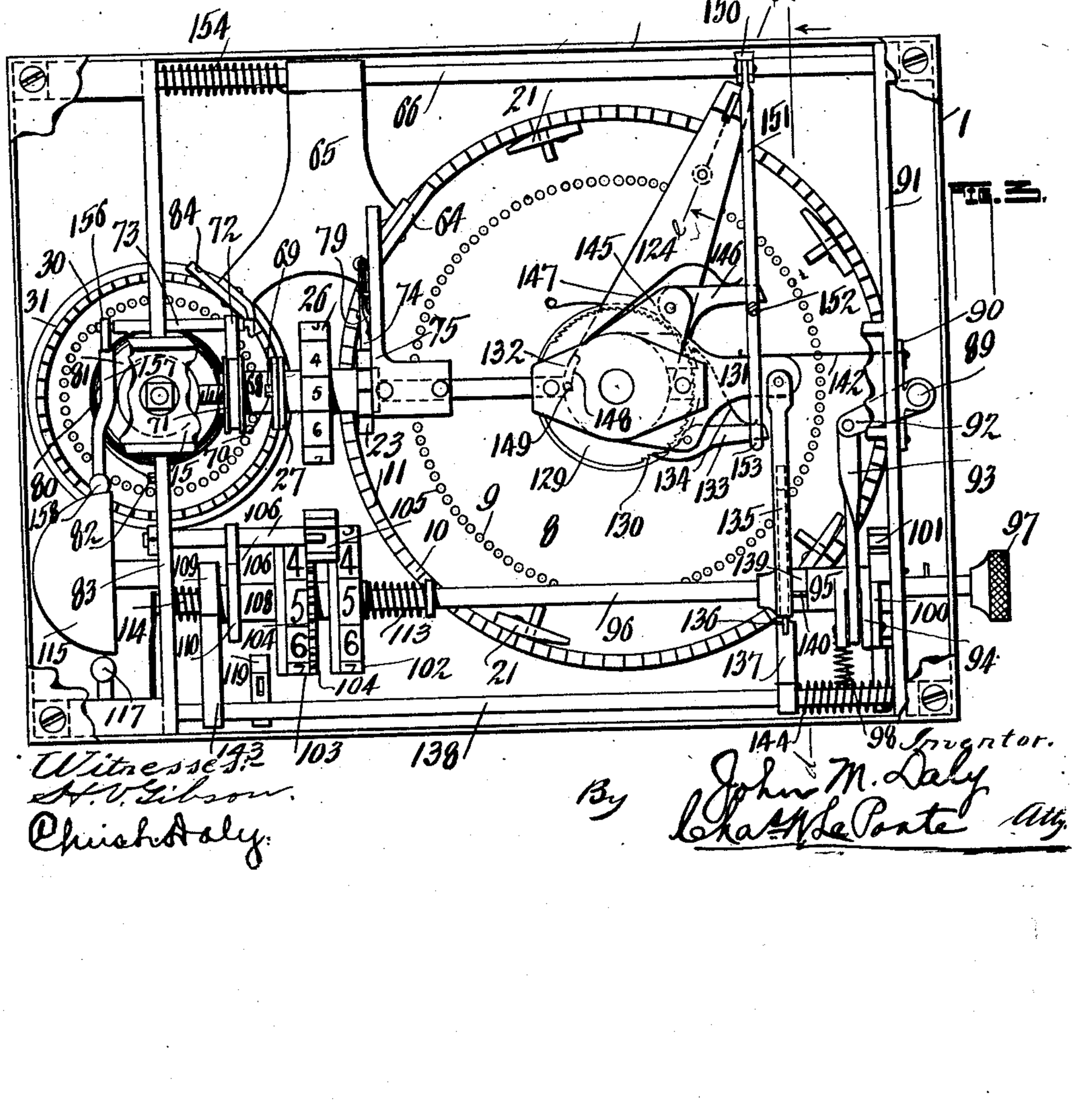

FIG. 6.

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4 SHEETS—SHEET 3.

FIG. 6.

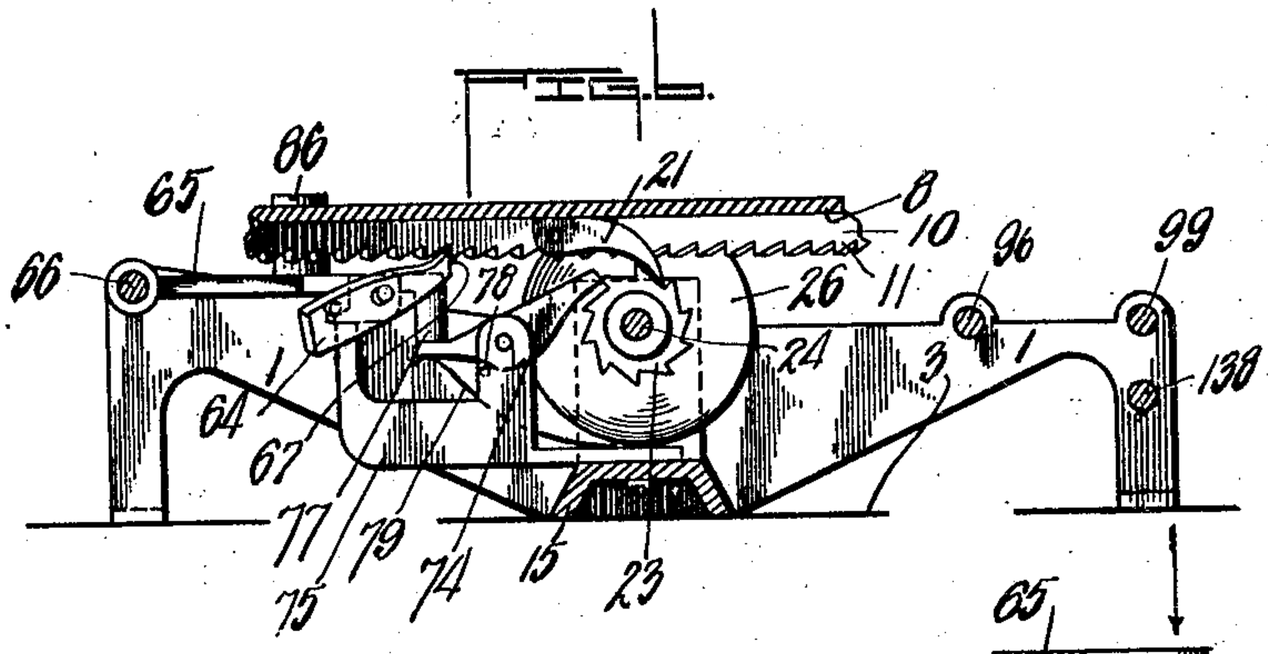
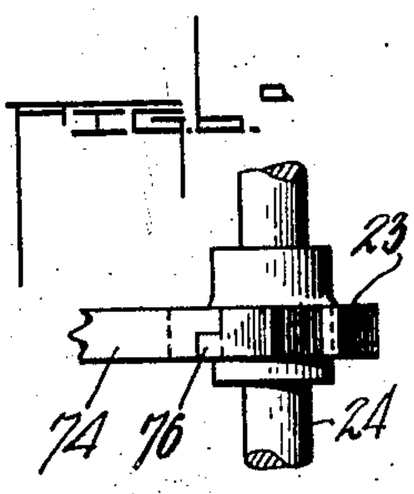


FIG. 6a.



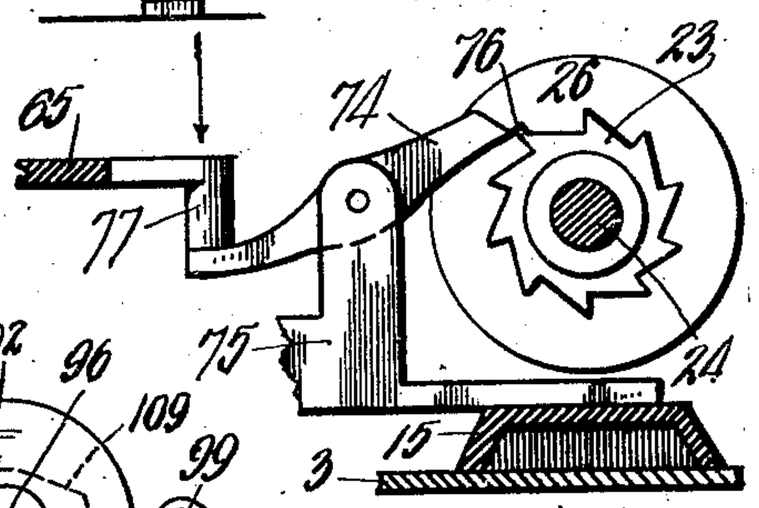


FIG. 6b.

FIG. 7.

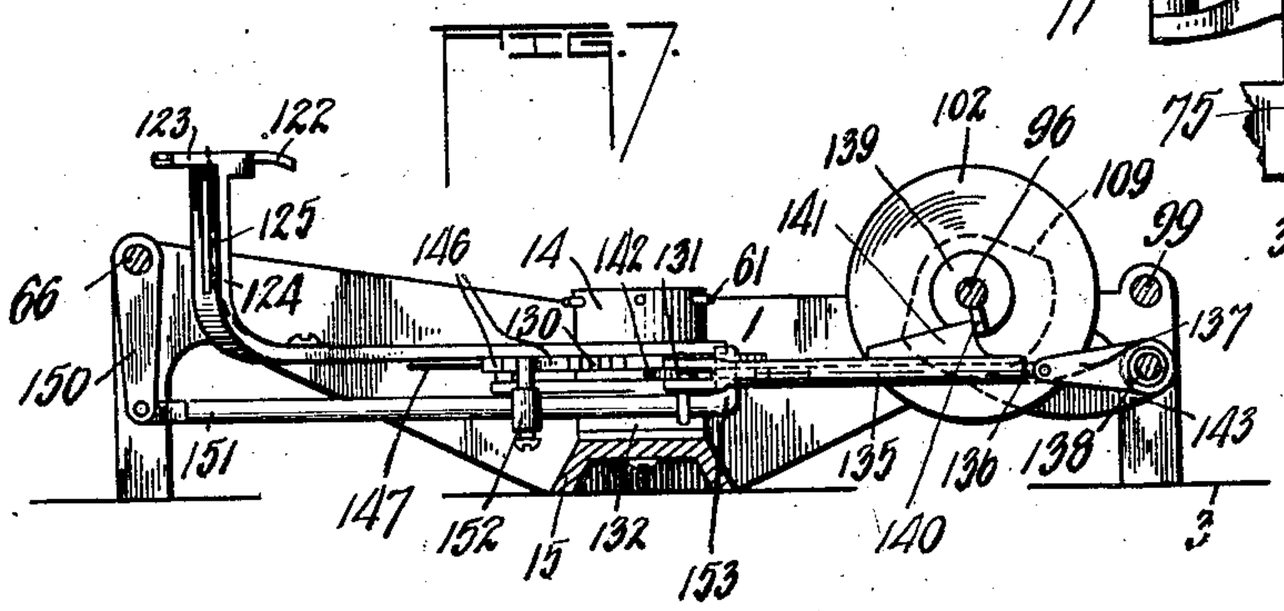


FIG. 8.

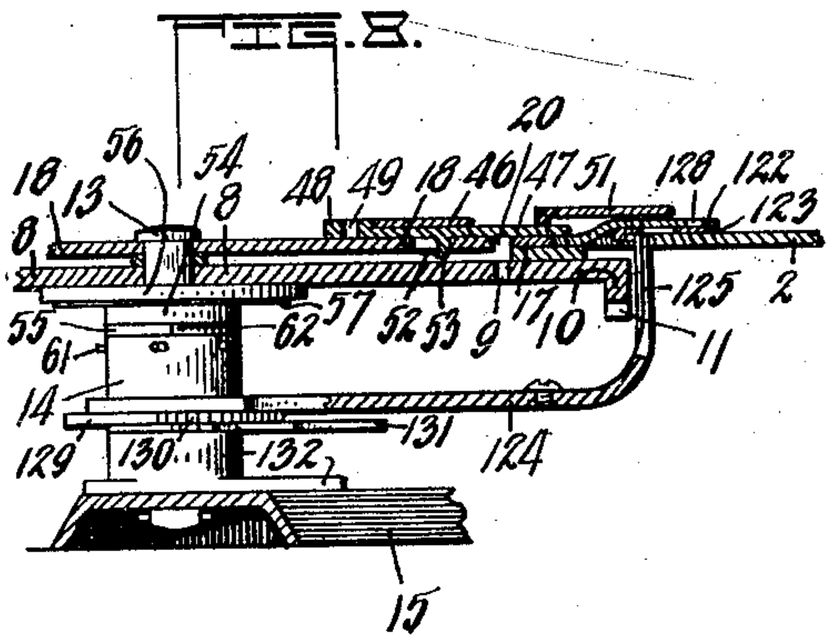
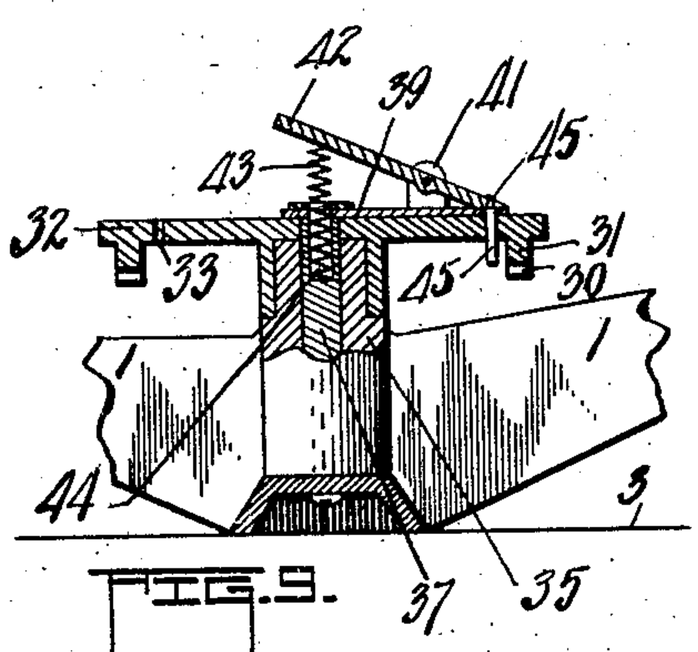


FIG. 9.



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4 SHEETS—SHEET 4.

FIG. 10.

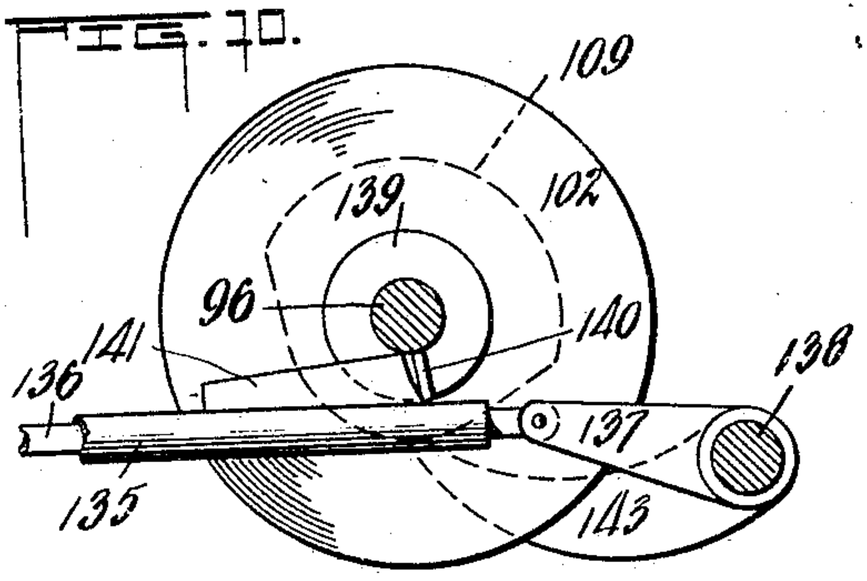


FIG. 11.

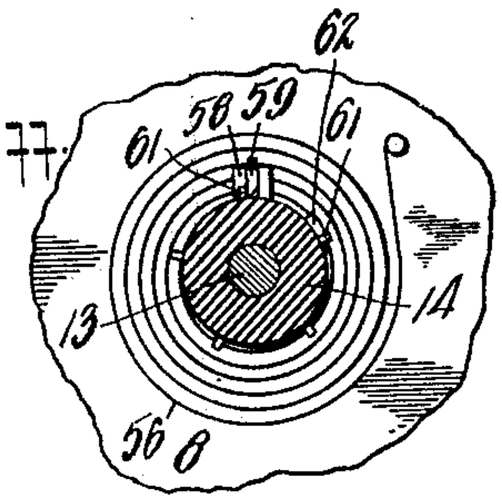


FIG. 12.

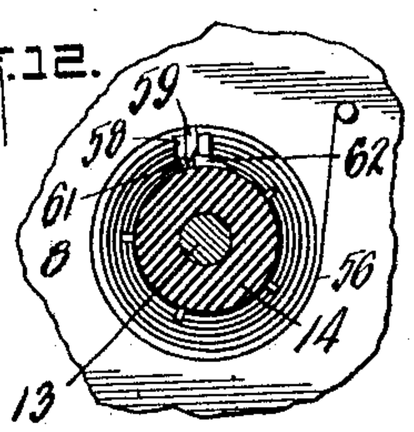


FIG. 15.b

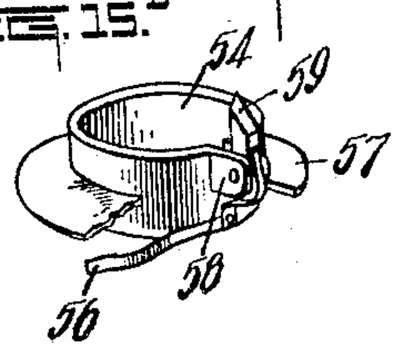


FIG. 13.

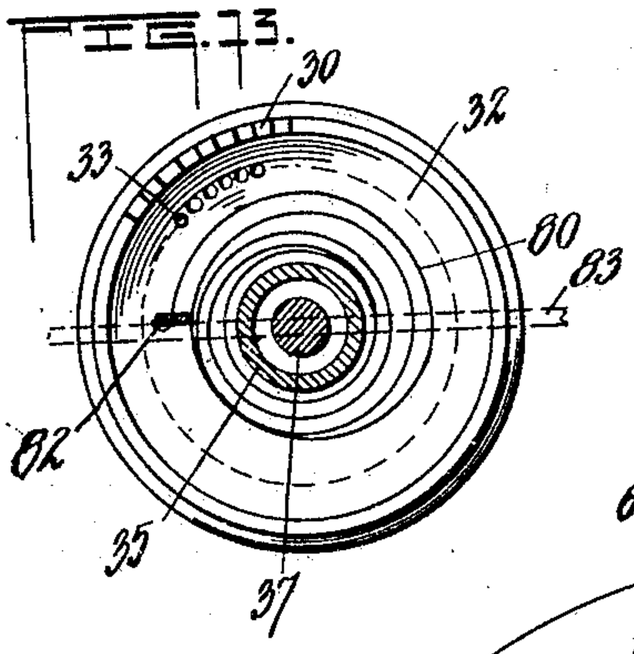


FIG. 15.a

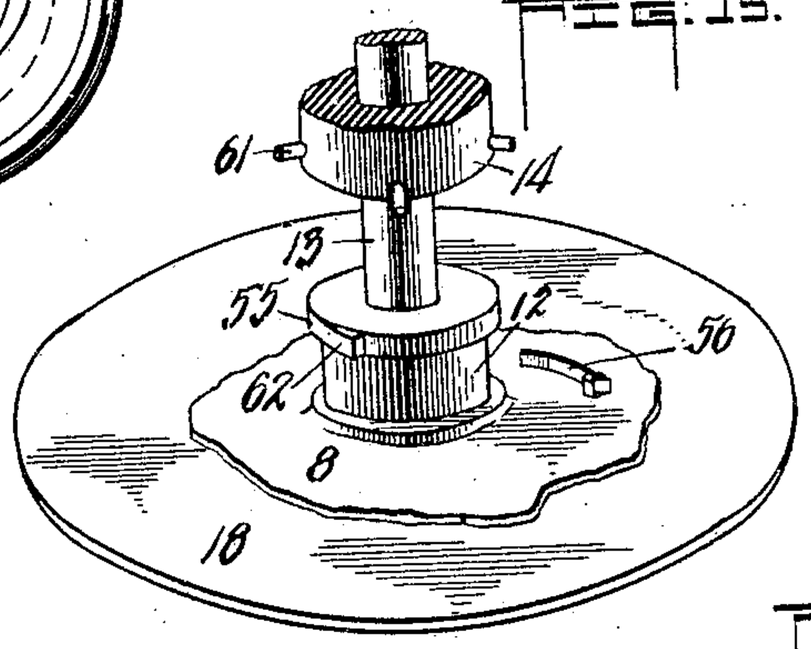


FIG. 15.

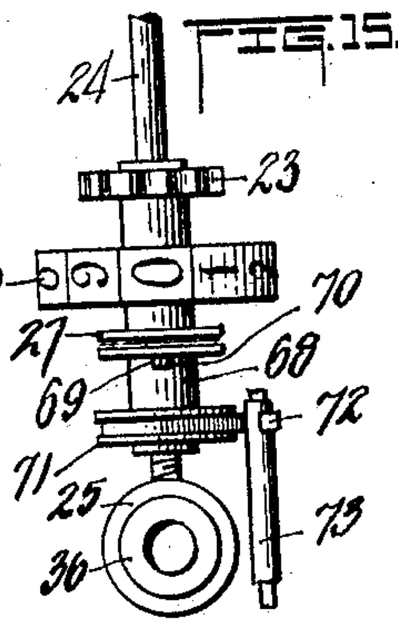


FIG. 14.

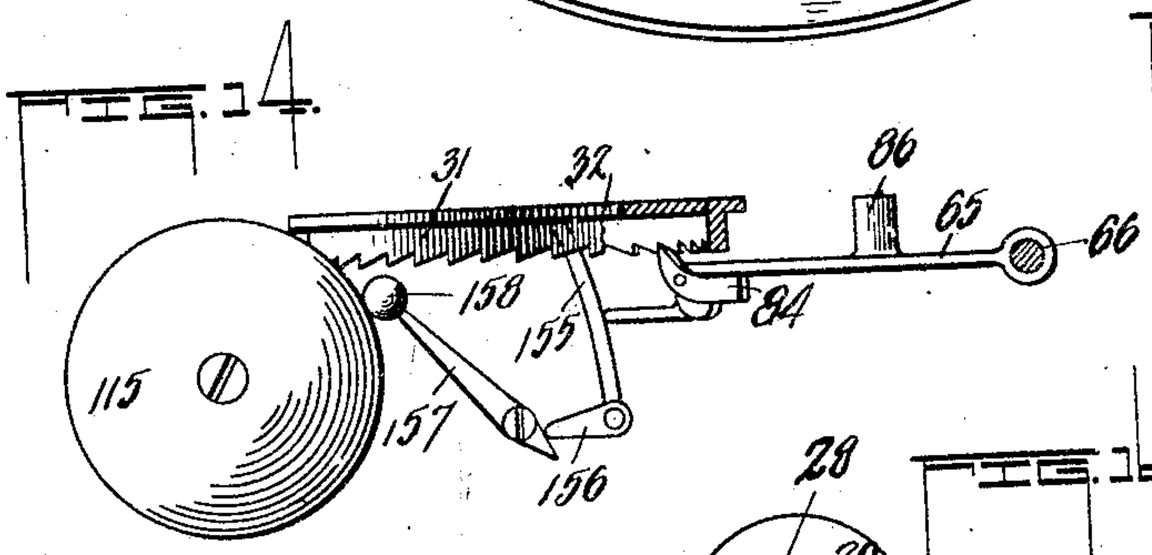


FIG. 15.c

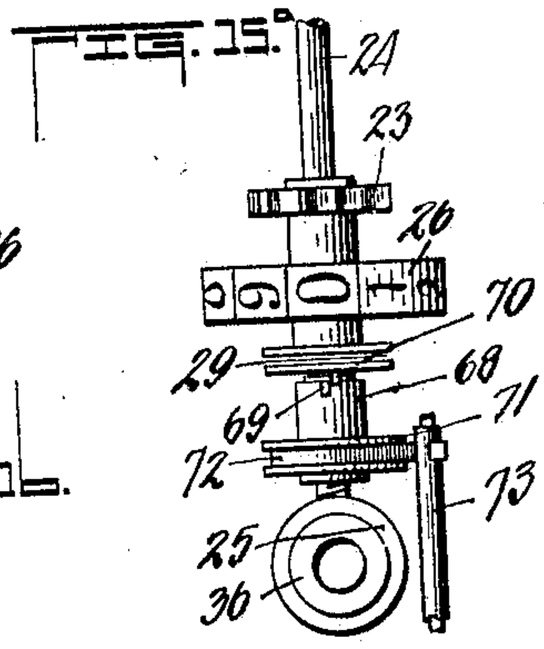
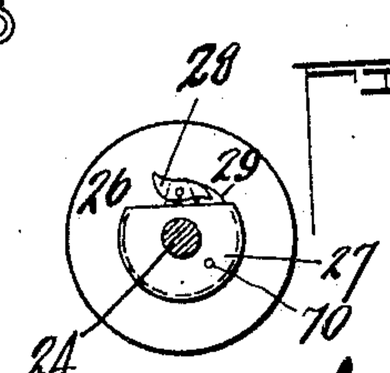


FIG. 15.b



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UNITED STATES PATENT OFFICE.

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COMPUTING-MACHINE.

994,821.

Specification of Letters Patent. **Patented June 13, 1911.**

Application filed May 19, 1906. Serial No. 317,720.

To all whom it may concern:

Be it known that I, JOHN M. DALY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Computing-Machines; and I do hereby 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.

This invention has reference to a computing machine and relates particularly to a device for reducing gross tons of cars and contents into pounds of draw-bar pull, and for automatically adding and displaying on said register the total of said reduction.

One of the objects which I have in view in reducing gross tons of cars and contents into pounds of draw-bar, is to compute and to automatically cause the register to indicate an amount at variance to and different from that called for by the number equal to the gross tons of cars and contents appearing on the scale which is used in making said computation.

The invention has for its further object to construct a computing machine of the kind referred to in which the allowance made to each gross weight of car and contents will be automatically increased at predetermined intervals, thereby causing said machine to compute and register for the same gross weight of car and contents a different amount, said allowance to be made depending on the location of said car and contents in a train.

The results to be obtained by the present device is in some respects similar to that aimed at in machines upon which patents have already been granted to me and by others upon which applications for patent are now pending. The patents referred to are numbered 715,197, 715,199 and 715,201, dated Dec. 2, 1902; also Patents Nos. 939,221, 939,222 and 939,479 dated Nov. 9, 1909. The applications for patent to which reference has been made were filed on April 11th 1904, and Jan. 4th, 1906 and bearing Serial Nos. 202,552, 274,342.

For a further and full description of the invention herein and the merits thereof, and also to acquire a knowledge of the details of construction of the means for effecting the result, reference is had to the following description and drawings hereto attached.

While the essential and characteristic features of the invention are susceptible of modification, still the preferred embodiment of the invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a top plan view of my improved computing machine; Fig. 2 is a top plan of the device shown in Fig. 1, with the top casing removed to show the arrangement of the working parts of the device beneath; Fig. 3 is a bottom plan view of the machine, with the lower casing removed, showing the reverse side of parts seen in Fig. 2 and other operative parts co-acting therewith; Fig. 4 is a vertical longitudinal cross section as the same would appear on the line *a*—*a* of Fig. 1; Fig. 5 is a vertical longitudinal cross section as the same would appear on the line *b*—*b* of Fig. 1; Fig. 6 is a sectional detail in elevation taken on the line *c*—*c* of Fig. 2; Fig. 6ª is a detail in plan of pawl and ratchet wheel disclosed in the center of Fig. 6; Fig. 6ᵇ is a detail in elevation of parts seen in Fig. 6ª, with additional parts not shown in said figure; Fig. 7 is a transverse sectional detail in elevation of certain operative parts of the device as the same would appear on the line *d*—*d* of Fig. 3, with the casing omitted; Fig. 8 is an enlarged vertical cross section as the same would appear on the line *e*—*e* of Fig. 3. Fig. 9 is a cross section as the same would appear on the line *f*—*f* of Fig. 2; Fig. 10 is an enlarged detail view of the parts illustrated to the right of Fig. 7, but showing such parts in a different position from that shown in Fig. 7; Figs. 11 and 12 are bottom plan views of the central portion of the disk provided with the perforations shown in Figs. 1, 2 and 3 and also show spring controlled means in connection with the disk whereby at the will of the operator the disk may be automatically returned to "0"; Fig. 13 is a bottom plan view of the numbering wheel shown at the left of Fig. 2, and a spring coöperating therewith; Fig. 14 is an enlarged detail in elevation of certain parts disposed at the left of Figs. 2 and 3; Figs. 15 and 15ª show twc different views in plan of the numbering wheel associated with the operating disk and parts coöperating therewith; Fig. 15ᵇ is a detail perspective view of a collar and parts thereof carried by

the bearing of the operating disk; Fig. 15ᶜ is a perspective view of certain of the parts disposed on the center post or stem for the operating plate, said parts shown in a reverse position or up side down; Fig. 16 is an elevation of the numbering wheel shown at the left of Fig. 3 and all parts connected therewith adapted to coöperate with the perforated disk also shown to the left of Fig. 3.

For several years past, railroad officials have been experimenting, to determine the best method of loading locomotives, in order to prevent overloading, stalling, and delaying them, and at the same time to insure having the engines haul the maximum number of gross tons of car and contents they should haul. Expert mechanical men have devised certain formula for arriving at the total weight of car and contents an engine should haul, by both practical and dynamometer car tests as follows;—Take the weight of engine on drivers, the size of cylinder, the size of driver wheels, the steam pressure, and by mathematics determine about what its tractive power in pounds is on a level. To determine the gross tons an engine can haul over certain grades and curves another formula has been adopted as follows:—For each degree of curve, allow one-half pound of draw-bar pull, and for each foot of grade to the mile allow .386 pounds of draw-bar pull. For example, take an engine and place a dynamometer car next to the tender, then couple one hundred and fifty (150) cars of forty (40) gross tons each behind the dynamometer car and engine uses its maximum power to move the train on a level exerting and recording on dynamometer chart twenty thousand (20,000) pounds, which indicates its tractive power. Twenty thousand (20,000) pounds divided by one hundred fifty (150) cars equals one hundred thirty-three (133) pounds per forty (40) ton car; one hundred thirty-three (133) pounds divided by forty (40) tons equals three (3) pounds per ton draw-bar pull on level. Now on a thirty (30) foot grade having a four (4) degree curve we must add one-half pound, per degree of curve equal to two (2) pounds for four (4) degree curve, on grades .386 for each foot of rise thirty (30) by .386 equaling eleven and one half pounds ($11\frac{1}{2}$). Wheel friction at three (3) pounds, curve at two (2) pounds and grade at eleven and one half ($11\frac{1}{2}$) pounds, equaling sixteen and one half ($16\frac{1}{2}$) pounds, hence, an engine can haul over this grade in forty (40) ton cars twenty thousand (20,000) pounds. Twenty thousand (20,000) pounds divided by sixteen and one half ($16\frac{1}{2}$) equals twelve hundred and twelve (1212) pounds.

The pounds of draw-bar pull per ton of gross weight of car will vary according to the gross weight of each car. For example, on a level a ten (10) ton car has seven (7) pounds per ton, a total of seventy (70) pounds; a forty (40) ton car has three (3) pounds per ton, a total of one hundred and twenty (120) pounds and a seventy (70) ton car has two pounds (2) per ton, making a total of one hundred and forty (140) pounds. Hence, an engine with twenty thousand (20,000) pounds tractive power can haul two hundred and eighty five (285) ten (10) ton cars, equal to 2850 gross tons; on forty (40) ton cars an engine can haul one hundred and sixty six (166) cars of one hundred and twenty (120) pounds each which is equal to 6640 gross tons; and on seventy (70) gross ton cars an engine can haul one hundred and forty three (143) cars of one hundred and forty (140) pounds each, equal to 10010 tons. In each instance the draw-bar pull on the engine is twenty thousand (20,000) pounds. This applies only to a level, any curve or grade creates additional draw-bar pull per ton and reduces the gross tons to be hauled.

It being the custom to haul ten and fifteen ton cars in trains together with seventy (70) ton cars, and by reason of this large variation in the resistance per ton in draw-bar pull of each weight of car, an intelligent adjustment must be provided. Printed charts can be distributed and placed in the hands of switchmen, yardmasters, conductors, and others whose duty it is to see that engines are properly loaded, but they must use the way-bill or manifest that accompanies the car showing the gross weight of each car and contents in connection with such chart or scale. For example, in building up a train if the first car is ten tons, they enter the ten tons on report opposite the car number, then refer to the chart, and find its draw-bar pull over the grade and curve to be equal to eleven pounds per ton; the next car if a forty (40) ton car, is equal to two hundred and seventy (270) pounds and the next a seventy (70) ton car equal to four hundred and seven (407) pounds, they must continue to adjust each car until the total draw-bar pull is equal to the rating, twenty thousand (20,000) pounds. If they do not stop when twenty thousand pounds is reached they must refigure or deduct the surplus, and as the average yardmaster, switchman or conductor is not an expert in mathematics, and as they are required to take a check of their train from the cars out in the yard it is not practicable for them to always compute correctly the gross tons of car, to say nothing of adding correctly the total pounds of draw-bar pull, which is much more difficult. The pounds of draw-bar pull shown in the last instance, viz., a ten ton car equaling one hundred and ten pounds, a forty ton car equaling two hundred and seventy pounds and a seventy ton car equal-

ing four hundred and seven pounds, applies to a very light grade of about eight (8) feet to the mile and a two degree curve, and for a train the average weight of cars being about forty (40) tons which would keep the length of train down to a reasonable limit. If the average weight of cars is twenty (20) tons each, then additional allowance must be made, this allowance I provide for as every ten (10) cars are added to the train, all of which will be more fully explained.

In order to provide a device for quickly and accurately reducing from gross tons to pounds of draw-bar pull, I have perfected a computing device that not only reduces gross tons to pounds of draw-bar pull, but also computes into one total the resistance in pounds of all cars in the train, and which automatically makes increased allowance per ton as the length of train increases or decreases by reason of large number of light or small number of heavy cars. It also registers the total number of cars in the train when complete.

The device referred to comprises a rectangular casing 1 which forms the side and end walls adapted to have attached thereto the top 2 and bottom 3, all of which inclose the working parts to be hereinafter more fully described. The top 2 has the annular cut out portions 4 and 5 and the slot 6 communicating therewith, and said top is further provided with the sight opening 7, for a purpose to be described.

8 denotes an annulus plate or disk provided with a series of perforations or holes 9 arranged in a circumferential row disposed a suitable distance inwardly from the edge of the said disk. Said disk is provided with a depending annular flange 10 which is provided with ratchet teeth 11. It is preferable to provide the disk 8 with one hundred (100) perforations or holes and a corresponding number of ratchet teeth, however, it may be found convenient as well as practicable to provide the disk with more or less holes or ratchet teeth. The disk 8 has a central depending tubular extension 12 forming a bearing for the disk on a stud or spindle 13 journaled in a vertically disposed bearing 14, which passes through a longitudinal brace or frame part 15 disposed a short distance above the bottom 3 of the casing, see Fig. 4, and the disk 8 is located in the casing below the annular opening 4 and that portion of the upper face of the disk from the perforations 9 to the outer edge thereof, is hidden from view beneath the top of the casing 2, except where the disk rotates beneath the slot 6. On the upper face of the disk 8 and adjacent to the outer edge thereof arranged in a circumferential line, are provided a series of characters, preferably numerals, which represent pounds of draw-bar pull, preferably arranged in units of 5. As will be seen, the said numerals are arranged in several series beginning with "00" and ending with "95". While I have shown the numerals of the disk 8 arranged in units of 5, I do not want to be confined to arranging the numerals in units of 5, as it may be found desirable to employ the numerals in units of 1, 10 or 20, but simply as a matter of convenience in illustrating the device and the manner of reducing gross tons of cars and contents into pounds of draw-bar pull, I have shown the numerals arranged in units of 5. Where the annular cut out portion 4 is provided in the top of the casing 2 I form a ledge or off set 16, approximately one-half depth of the thickness of the top of the casing, and this ledge or off set is adapted to accommodate a ring or band 17, retained on the off set 16 so as to be movable thereon, in a manner hereinafter more fully described.

Covering the central portion of the disk 8 within the circle described by the perforations 9, is a top or cap plate 18, which is preferably connected with the upper end of the stud or spindle 13. The top plate 18 is separated from the upper face of the disk 8 by means of a suitable sized disk 19 interposed between the top plate and disk so as to allow for the interposition of certain operative parts which overlie and operate above a portion of the top of the disk 8 and the perforations 9 therein as the disk is rotated. The arrangement of the top plate 18 and the inner edge of the off set 16 of the top of the casing, as well as the ring 17 provides a circumferential channel or groove 20 between the same and beneath which the perforations 9 of the disk 8 are disposed. With this arrangement a pin or pointer may be inserted into any one of the perforations 9 of the disk 8, through the groove or channel 20 above specified, best seen in Figs. 1 and 4. To the inner face of the flange 10 depending from the disk 8 I pivot at intervals the pawls 21, the free ends of which are adapted to be held projecting downwardly by means of the flat springs 22 secured to the under face of the disk and engaging the said pawls. These pawls are preferably spaced at every twentieth tooth on the ratchet of the disk or beneath the one hundredth mark indicated by "00". These pawls are adapted to successively engage with each successive ratchet tooth of a ratchet wheel 23 carried on a longitudinally disposed shaft or rod 24, one end of which is secured in the central bearing 14 and the outer end thereof is secured in a vertical standard or bearing 25, projecting upwardly from the part 15, as seen in Fig. 4. The ratchet wheel 23 just referred to is preferably provided with ten ratchet teeth and the said ratchet wheel is connected with or forms a part of a numbering wheel indi-

cated as 26 and provided with numerals on its periphery, ranging from "0" to "9". Connected with or forming a part of the numbering wheel 26 just referred to is a disk or plate 27, best seen in Figs. 3, 4 and 16 and this disk or plate has pivotally connected thereto a pawl 28, the free end of which is held upright by means of a spring 29 which partially encircles the disk or plate 27 and has one end secured thereto and the opposite end engaging the pawl, somewhat as seen in Fig. 16.

The pawl just referred to as being pivoted to the plate or disk 27 is adapted during each rotation of the numbering wheel 20 and the ratchet wheel 23 to successively engage with a series of ratchet teeth 30 formed in the lower edge of the depending flange 31 of a disk 32. The disk 32 is in most respects similar to the disk referred to as 8, being provided with the depending flange and ratchet teeth as specified, although the disk 32 is much smaller than the disk 8, and like the disk 8 is provided with a series of perforations or holes 33 arranged in a circumferential row disposed a suitable distance inwardly from the edge of the said disk. It is preferable to provide the disk 32 with a series of fifty holes and a corresponding number of ratchet teeth, however, it may be found convenient as well as practicable, as was suggested in the use of the disk 8 to provide the disk 32 with more or less holes or ratchet teeth. The disk 32 is provided with a central opening and a tubular bearing adapted to be seated on the reduced upper extension 36 of the standard 25 heretofore referred to and extending through the standard 25 is a stud or spindle 37 which passes through the opening 34 in the disk 32 and is provided with a plunger 38 overlying an arm or pointer 39 which is adjustably carried on the upper outer end of the stud or spindle 37 beneath the plunger 38 as shown in Figs. 2 and 4. And arranged on the upper outer face of the disk 32 I have arranged a series of characters, preferably numerals as shown from "0" to "49" and these numerals are disposed between the outer edge of the said disks and the holes or perforations 33 therein, so that as the disk is rotated through the engagement of the pawl 28 on the plate 27 with the ratchet teeth thereof, the numerals will pass beneath the slotted opening 6 for the purpose of coöperating with the numerals on the numbering wheel 26 and the numerals on the disk 8, whereby to properly register or indicate the pounds of draw-bar pull as the disk 8 is operated for the purpose of actuating the said parts. The disk 32 is disposed centrally beneath the annular opening 5 in the top 2 of the device 8 and projecting partially across the upper face of the said disk and the path of the numerals and perforations therein is a lug or stop 40 of the top of the casing 2, see Fig. 1, and the said lug or stop will be engaged by the arm or pointer 39, referred to as being carried on the upper end of the stud or spindle 37. The arm or pointer 39 extends radially from the center of the disk 32 and has its outer end disposed so as to describe a circle about the circumferential row of numerals arranged on the upper face thereof, as seen in Figs. 1, 2 and 9, and extending up from the said arm or pointer and its opposite sides is shown a pair of ears 41 to which and between which is pivotally connected a finger 42, the rear end of which is adapted to be normally held in a raised position, as seen in Fig. 9, by means of the spring 43 seated in a tubular opening 44 in the extreme upper end of the stud or spindle 37. Raising the rear end of the finger 42 positions the forward end thereof in contact with and above the outer end of the arm or plunger 39 and said finger 42 has connected therewith a plunger 45 which passes through an opening in the outer end of the arm or plunger 39 and is adapted to be inserted into any one of the perforations or holes 33 in the disk 32 as may be desired.

To adjust and change the position of the arm or plunger 39 and the finger 42, the operator will press down upon the rear free end of the finger 42 which will elevate or lift the front end thereof and in so doing, will lift the plunger 45 out of the perforation or hole 33 in the disk 32 and adapt the arm or pointer 39 in the finger 42 to be adjusted on the upper face of the disk. The plunger 45 projects down through the perforations 33 in the disk 32, as seen in Fig. 9, for a purpose to be described, and when raising the plunger by depressing the finger, the movement of the plunger while it is such as to release it from the perforations or holes in the disk, will not lift it out of the perforations in the arm or plunger 39.

Referring again to the top or cap plate 18, the upper face of the same is provided with a boss 46 through which is carried and adapted to have movement, an elongated pin 47 provided with a head 48 having a perforation 49, the head forming a shoulder which abuts with the inner edge of the boss 46 as shown in Figs. 1 and 2. The pin 47 overlies and crosses the outer edge of the plate 18, the circumferential groove 20 formed between the outer edge of the plate 18 and the inner edge of the band 16 and partially crossing the band 16 is adapted to be inserted into any one of a series of perforations indicated as 50 which are formed in the concave face of an off set 51 of the top 2 of the casing, best seen in Figs. 1 and 8. The pin 47 is adapted to be held projected forwardly to prevent the same from being accidentally disengaged from the per-

foration 50 from which it is inserted by the operator, and for this purpose a flat spring 52 is provided pivoted to the under side of the plate 18 and the said spring bears against a stud 53 depending from the pin 47 which projects through a slotted opening 54 in the plate 18. An operator desiring to adjust the position of the pin 47, which also changes the position of the plate 18, inserts a pin or metal pencil in the perforation 49 in the head 48 of the pin 47, draws the same toward the center of the plate 18 and releases the pin 47 from the perforation in the off set 51, and then oscillating the plate 18 so as to bring the pin in front of the perforation 50 of the off set 51 in which it is desired to insert the same, he releases the pin 47 and the spring 52 acting against the stud 53, as above described, will force the pin into its proper perforation and retain the same in that position until it is again desired to readjust the position of the pin.

The devices just above described, act in conjunction with certain features of the device to be more fully explained, for adjusting the same to engines of different ratings and the pin referred to as 47 serves as a stop member against which a finger or metal needle engages when the same has been inserted into a hole or perforation 9 of the disk 8 for partially rotating the same in computing gross tons of cars and contents and reducing the same into pounds of draw-bar pull, all of which will be more fully explained.

I will now proceed to describe the devices in connection with the disk 8, the disk 32, and the numbering wheel 26, whereby they may be simultaneously and automatically returned to their normal or initial positions, which will place all of the parts mentioned at "0."

Encircling the depending hub or tubular bearing 12 of the disk 8 is shown a collar 54 loosely carried thereon, the hub or bearing of the disk provided with a lower flange 55, see Fig. 4, which retains the collar 54 in working position thereon. To this collar is connected one end of a flat coil spring 56, the opposite end of which is secured to the under face of the disk 8 and for retaining the said spring in working position, I have provided the disk or plate 57 which is secured to the collar 54 between which and the under face of the disk 8 the spring 56 is located. Pivotally connected to a pair of ears 58 on the upper face of the collar 54 is shown a small pawl 59 which depends alongside of the said collar and the free end of the said pawl is held against the lower portion of the hub or bearing 12 of the disk 8 and the upper end of the bearing 14 above described, by means of the spring 60 as shown in Fig. 4. It is adapted that the pawl 59 shall engage successively a series of laterally projecting pins 61 secured to the upper end of the bearing 14, there being preferably (5) five pins and in the operation of the disk 8 it is intended to wind up the spring 56 sufficiently to return the said disk to "00", whenever it is desired. To do this, I provide the lower flange 55 of the hub or bearing 12 of the disk 8 with a cam portion 62, which, after one-fifth rotation of the disk 8 the cam portion 62 will engage with a beveled face 63 of the pawl 59 and swinging it outwardly will cause it to be disengaged from the pin 61 with which it engages and allow the spring 56 to relax, which will permit the collar 54 to advance the distance between the pin with which it was engaging and the preceding pin. The spring 60 upon the release of the pawl, forces it again to the position shown in Fig. 4, so that it may be in position to abut with the preceding pin 61, and so that as the disk 8 is again partially rotated it will again partially wind up the spring until the cam 62 referred to, again disengages the pawl from the pin 61. Thus, it will be seen there is always sufficient tension on the spring 56 to hold the disk and adapt it to be returned to its normal or initial position whenever it is so desired, and in a manner to be more fully described. In Fig. 11, a detail view has been made showing the pawl 59 engaging a pin 61 and the disk 8 being rotated, and winding up the spring 56; in Fig. 12, being a view similar to Fig. 11, the disk 8 has rotated into a position where the cam portion 62 has engaged, and has just about released the pawl 59 from the finger 61. Upon the release of the pawl, it will be seen that the spring will relax, forces the collar 54 forward, where the pawl 59 will engage with the preceding pin 61 and stop the collar. The disk 8 is held against any backward movement by means of a pawl 64 which engages with the ratchet teeth 11 on the flange 10 of the said disk. This pawl is pivotally connected with a cradle 65 which is carried on a rod 66. At five different points on the depending flange 10 of the disk 8, I have provided a ratchet tooth 11, with an extended tooth portion 67, see Figs. 4 and 6. These extended tooth portions 67 are of such a length that when the cradle 65 is depressed, in a manner to be described, the pawl 64 is moved out of the way of every ratchet tooth of the disk 8, with the exception of those teeth provided with the extensions 67; thus when the disk has been moved and the spring 56 partially wound up, it will be seen upon depressing the cradle 65 and releasing the pawl 64 from the ratchet teeth of the said disk, the disk will return a predetermined distance or until one of the tooth extensions 67 engages with the end of the pawl 64, which engagement will stop the movement of the disk at its normal

or initial position, which is that position shown in Figs. 1 and 2. The pawl 64 is intended to be heavy at one end so as to cause the opposite end to be projected into the path of the ratchet teeth 11.

It was previously explained that as the disk 8 was rotated the pawls 21 thereof would engage successively with the ratchet teeth of the wheel 23 for the purpose of imparting movement to the numbering wheel 26 carried on the shaft 24 and that with each rotation of the numbering wheel 26, movement would be imparted to the disk 32 through the engagement of the pawl 28 on the plate 27 with the ratchet teeth of said last mentioned disk. Means has been provided for holding the ratchet wheel 23 and numbering wheel 26 to their work and in connection therewith means has also been provided whereby as the pawl 64 is released from the teeth of the disk 8 to permit it to return to its initial position, to also permit the numbering wheel 26 to return to its initial position. This means consists of a sleeve 68 which has a threaded engagement as shown in Fig. 4, with the stationary shaft 24 and on the sleeve 68 is provided a small stud or pin 69 which is adapted to be engaged by a stud or pin 70 projecting outwardly from the disk or plate 27. With this construction it will be seen that as the numbering wheel 26 and the disk or plate 27 are rotated, the stud or pin 70 engaging the stud or pin 69 will impart rotary movement to the sleeve 68 and it having a threaded engagement as shown, will be projected longitudinally thereon until the stud 69 disengages itself through such movement from the stud 70. The sleeve 68 is provided with a pair of annular flanges 71 which are spaced apart as shown forming a channel between the same in which is coiled a flat spring 72 attached at one end to the sleeve and the outer end to a tubular bar 73, best seen in Fig. 3. With the provision of this spring it will be seen that as the sleeve is rotated through action of the numbering wheel 26, it will tend to coil up the spring and when the sleeve with its stud 69, is released from the stud 70, the relax of the spring will cause the sleeve to rotate in the opposite direction and return it to its normal or initial position, with the stud 69 abutting with the stud 70.

There is provided a pawl 74 which is fulcrumed to a support 75 secured to the brace 15. This pawl is adapted to engage with the teeth of the ratchet wheel 23 and hold it to its work on the shaft 24 as the same is rotated through the engagement of the pawls 21 on the disk 8 during the rotation of the latter. The teeth of the wheel 23 are approximately of the same length with the exception of one tooth which is provided with an extended portion 76, so that when the pawl 74 is released from the ratchet wheel 23, and the spring 72 acting to return the sleeve 68 and also the numbering wheel 26 and the ratchet wheel 23 in engagement with the sleeve 68 through the studs 69 and 70, the tooth having the extension 76 will engage with the end of the pawl 74 and stop the return movement of the numbering wheel and ratchet wheel at which time the parts have returned to their normal or initial positions, which is at "0", corresponding to the return movement of the disk 8. To provide for returning the numbering wheel 26 to "0" simultaneously with the return of the disk 8 to "0", I provide the cradle 65 with the depending extension 77 which is adapted when the cradle is depressed to release the pawl 64 from the ratchet teeth of the disk 8 to engage with the rear extension of the pawl 74 to release it from the ratchet wheel 23; it being understood that the cradle 65 will have a predetermined movement before it engages with the pawl 74 and in raising the pawl 74 it will clear the teeth of the ratchet wheel 23 with the exception of the extension 76 of one tooth thereof, as provided, so as to prevent the ratchet wheel from returning only so far through the action of the spring 72, so that when the extension 76 of one of the teeth thereof engages with the pawl 74, the parts will be at "0". To insure that the pawl 74 will only have a limited movement, I have provided a stud 78 projecting outwardly from the support 75 and beneath the rear portion of the pawl, so that as the rear end thereof is depressed through the engagement therewith of the extension 77 of the cradle 65 the pawl can only move so far and prevent the opposite end thereof from being out of the path of the tooth extension 76 of the ratchet wheel 23 when it is returned in the manner specified, and upon the release of the cradle, a spring which is indicated as 79, having one end secured to the support 75 and its opposite end engaging with the the rear portion of the pawl 74 serves to return it to its normal position, best seen in Fig. 6.

The return of the disk 32 is controlled through the action of the cradle 65 as well as a spring suitably connected with the said disk. The spring referred to is indicated as 80 and is coiled about the hub or tubular bearing 35 of the disk and between the lower face of the disk and a flange 81 connected with the hub 32, to which one end of the said spring is attached and the opposite end thereof is secured to a post or upright 82 extending up from a cross brace 83 which projects transversely from the brace 15. As the disk 32 is rotated through the action of the pawl 28 heretofore described, having engagement with the ratche teeth of the said disk, it will be seen that the spring 80 will be wound

up. This disk is held against return movement by a pawl 84 which is pivotally connected with the forward end of the cradle 65, upon the opposite side to which the pawl 64 is attached and said pawl 84 is weighted at one end so as to hold the opposite end in the path of the ratchet teeth of the disk 32 to adapt it to engage the same. Thus, it will be seen that when the cradle 65 is depressed for the purpose of releasing the disk 8 and numbering wheel 26, it will also release the disk 32 by disengaging the pawl 84 from the tooth thereof, allowing the spring 80 to relax and return the disk 32 to its normal or initial position, which is at "0". To insure the said disk 32 stopping at "0" I have provided projecting out of the upper face thereof a small stud or pin 85, see Fig. 1, which is adapted to engage with the off set or lug 40 provided on the top 2 of the casing, somewhat as seen in Fig. 1, which said view illustrates the two disks and numbering wheel at "0". To allow the operator to depress the cradle 65 for the purpose hereinbefore stated, I provide the cradle with an upwardly projecting stud or button 86, which is located directly beneath a perforation or opening 87 in the top of the casing 2, as seen in Fig. 1, whereby the operator may, by the use of a pointer or metal pencil which is inserted through the perforation 87 engage the button 86 depressing the cradle, resulting in the release of the disks and numbering wheel, when they will return to their normal positions.

In the operation of the disk 8, through the insertion of a pointer in any of the perforations 9, and rotating the said disk until the pointer engages with the stem 47, the said pointer engages with the inner end of a short lever 88, which is carried on the upper end of a spindle 89 journaled in a bracket 90 secured to a cross brace or frame 91 connected with the longitudinal brace 15. The short lever 88 is preferably disposed in a horizontal position and extends partially over the disk 8 with the inner end thereof lying beneath and just beyond the edge of the top or cap plate 18, as seen in Figs. 1 and 2. The position of the inner end of the said short lever being such that a pointer inserted into one of the perforations 9 of the disk 8 for operating the same, will engage with the end of the short lever, and partially rotate the spindle 89 to which it is attached. On the lower end of the spindle 89 is carried a short lever 92, see Figs. 3 and 4, which projects inwardly beneath the disk 8 and has pivotally connected with the inner end thereof a lever or reach bar 93 which extends over to one side of the casing and has connected therewith or attached thereto an arm 94 secured to a sleeve 95 that is loosely carried on a shaft 96 extending longitudinally through the casing, having a bearing in the cross brace 83 and 91, with one end of the said shaft projecting from without the end of the casing as shown in Figs. 1, 2 and 3 and with a knob 97 secured on the upper end thereof. To the arm 94 is connected one end of a spindle 98, the opposite end of which is preferably secured to a rod 99 extending longitudinally through the casing, parallel with the shaft 96 and also connected with the arm 94 is a pawl 100 which is adapted to successively engage with the teeth of a ten tooth ratchet wheel 101 secured on the shaft 96; so that as the pointer moves the short lever 88 it will oscillate the spindle 89 and move the short lever 92 secured on the lower end thereof, will move the pawl 100 through the connection therewith of the lever 93 and arm 94, and move the ratchet wheel 101 the distance of one tooth and impart a partial rotation to the shaft 96 for the purpose of actuating certain car numbering devices which will now be described; said car numbering devices being actuated to register each movement of the disk 8. The car numbering devices which have just been referred to consist of numbering wheels 102 and 103 carried by the shaft 96 and disposed in the casing beneath the sight opening 7 in the top thereof, see Fig. 1. The former has a spline and groove connection with said shaft to adapt the shaft to be projected longitudinally in the casing by the operator pressing against the knob 97. The numbering wheel 103 is loose on the shaft 96 and is provided with a gear 104 adapted to be engaged by a pinion 105 on a stationary shaft or stud 106 which is operated during each complete revolution of the numbering wheel 102 through and by means of a tooth 107, see Fig. 2, which intermittently meshes with the pinión 105 for imparting the proper movement to the numbering wheel 103. The last mentioned numbering wheel is provided with an elongated hub portion 108 on the upper end of which is secured a cam 109 and secured to the said hub portion 108 is a flat coil spring 110, the outer end of which is coiled around the stationary shaft or stud 106.

When the numbering wheels are in their initial positions at "0", a pin indicated as 111 secured to the numbering wheel 103 engages and rests upon a short vertical extension 112, projecting upwardly from the stationary shaft 106, retaining the parts in this position, but as the numbering wheels are rotated in the manner specified, the pin 111 moves away from the extension 112 and also winds up the spring 110, thus, when the operator desires to return the numbering wheels to "0" he presses the knob 97 inwardly which projects the shaft 96 and causes the numbering wheel 103 to disengage itself from the pinion 105 and

allows the spring 110 to relax and return the numbering wheel 103 to its original or initial position, with the pin 111 engaging and resting upon the upright 112, and the operator to return the numbering wheel 102 to a position corresponding to that of 103 needs only to rotate the shaft 96 and place the numbering wheel 102 in the position shown in Fig. 2, which said figure shows both of the numbering wheels at "0". To insert the return of the shaft 96 to its original position after the return of the numbering wheels in the manner specified, I have provided the coil spring 113 on the shaft 96, the former bearing between the hub of the wheel 102 and a collar 115 on the shaft 96 and the latter bearing between the cross brace 83 in which one end of the shaft 96 is journaled and the cam 109 on the said shaft. The car numbering devices which have just been referred to are in all respects similar to the car numbering devices, which have been shown and described in the last application filed by me and bearing Serial Number 294,662.

In connection with the car numbering devices, I have provided an alarm to indicate to the operator that a predetermined number of cars have been placed in the train, which it is understood to be the train length. This alarm consists of a bell 115 supported by the cross brace 83 and an arm indicated as 116, carried on the longitudinally disposed shaft 99 and having a knob 117 on its free end adapted to engage and strike the bell 115. The means of operating the shaft 99 for the purpose of causing the ringing of the bell 115 consists of an arm 118 carried by the said shaft which has pivotally attached thereto a pawl 119. In the rotation of the numbering wheel 103, when the pin 111 attached thereto engages and moves the arm 118, it will rock the shaft 99 so as to move the knob of the arm 116 from the bell 115, and in the further movement of the said numbering wheel 103, the pawl 119 being pivoted to the arm 118 will move off of the pin, allowing the arm 116 to fall and cause the knob thereof to engage with the bell 115; the pin 111 engaging with the arm 118 acts against the coil spring 119^a on the shaft 99 which serves to return the shaft after it has been moved through the engagement of the pin 111 with the arm 118. Pivoting the pawl 119 on the arm 118, allows the pin 111 of the numbering wheel 103 when the said wheel is returned to its normal position to pass the the pawl which swings out of the way to adapt the said wheel with its pin to return to its original position. The pin 111 may be attached to the wheel 103 at any desirable point, but I prefer particularly in the machine illustrated, to attach the pin to the said wheel at a point where the pin will engage and move the arm 118 to ring the bell 115 after 59 cars have been placed in the train and at a time when the 60th has been added thereto, thus placing the car limit at 60 cars.

The ring or band 17 which has been briefly referred to, forms a part of that mechanism which automatically increases the allowance made to each gross weight of car and contents at predetermined intervals, said allowance to be made depending on the location of said car and contents in a train. This band 17 has been referred to as being movably supported on a ledge or offset 16 and is provided on the upper face thereof with a scale or chart 120 arranged with a series of characters, preferably numerals which are the tonnage numbers and represent gross tons of cars and contents. These numbers may be arranged in any suitable manner, and the said scale or chart may be contracted and expanded or not as desired and the said numbers are adapted to be arranged opposite certain of the perforations or openings 9, provided in the disk 8 whereby when the operator is reducing gross tons of cars and contents into pounds of draw-bar pull, he will take from the way-bill or manifest the amount called for in gross tons of car and contents, and by the use of a pointer inserted in a perforation in the disk 8 opposite to a number corresponding to that called for on the said way-bill or manifest and in rotating the said disk, will through the mechanism described, register on the disk 8, the numbering wheel 26 and disk 32, the pounds of draw-bar pull in the car. It is adapted to move this ring or band 17 to the left at predetermined intervals and to a predetermined distance, said distance varying after the band has been moved a predetermined number of times. The outer edge of the said band is serrated for a portion of its length or provided with a series of teeth indicated as 121 and engaging with the said teeth is a short arm 122 slidably carried on a shelf portion 123 of the upper end of an arm 124. The short arm 122 is yieldingly held in engagement with the teeth or serrations 121 of the band 17 by means of a spring 125, see Fig. 8, which is attached to the arm 24 and extending up through a slotted portion 126 thereof and also a slot 127 in the shelf portion 123 engages or is connected with the short arm 122, and to adapt the said short arm to be disengaged from the serrations or teeth of the band 17, I provide a perforation 128 in the outer end of the said short arm into which the operator may insert a pointer or metal pencil, and moving the short arm downwardly disengages the same from the band, the release of the pointer from the short arm allows the spring 125 to return

the same to its initial position to engage with the serrations or teeth of the band, if it is so desired. The arm 124 is revolubly carried on the standard or upright 14, hereinbefore referred to, and has connected therewith or made a part thereof, a disk 129, a portion of the periphery of which is provided with a series of ratchet teeth 130, preferably 50 teeth, although any number desirable for the purpose intended may be provided.

131 denotes a plate which is journaled on the upright 14 beneath the disk 129 of the arm 124 and said plate is supported upon a bearing 132 supported by a longitudinal cross brace 15. This plate has pivotally connected therewith a pawl 133 adapted to normally engage with the teeth of the disk 129 through and by means of the spring 134 secured at one end to the said plate and the opposite end bearing against an extension of the said pawl. The plate referred to has an extension to which is pivotally connected the inner end of an elongated tubular rod 135 into which is telescoped and has movement a rod 136 connected with an arm 137 carried by a longitudinally disposed rock shaft or rod 138. With each complete rotation of the shaft 96 which operates the car numbering wheels 102 and 103 it is intended to reciprocate the tubular rod 135 for imparting movement to the plate 131. It is understood that when the shaft 96 makes a complete rotation that 10 cars have been placed in a train and it is after the first ten cars have been added that it is intended to operate the band 17, and move it the distance of one tooth through and by means of the arm 124 and the devices connected therewith, for the purpose of changing the position of the band 17 and the tonnage numerals thereon to provide for the increased allowance made to each gross weight of car and contents added in the second ten cars placed in the train. The movement of the arm 124 is repeated after each complete rotation of the wheel 102 and after each tenth car has been added to the train for the purpose of moving the band 17 the distance of one tooth, until after the 40th car has been placed in the train when it is intended that the ring or band 17 shall be moved the distance of two teeth after each complete rotation of the wheel 102 or the placing of each ten cars thereafter in the train. On the shaft 96 is carried a disk 139 which is provided with a pin or tooth 140 that is adapted when the numbering wheel 102 is moving the distance between "9" and "0" thereon, to engage with the lug 141, see Fig. 7, on the tubular rod 135 and projecting the same inwardly so as to move the pawl 133 the distance of one ratchet tooth on the disk 129, when the pin 140 disengages itself from the lug 141 and the plate 131 together with the pawl 133 which is connected thereto, is returned to its original position by means of the spring 142 which engages with the extension of the plate 131 and is fastened at its opposite end to the cross brace 91, see Fig. 3. This movement of projecting the tubular rod 135 to move the pawl 133 and its returning the said parts, by means of the spring 142, moves the arm 124 and the band 17 with which it is connected, through the short arm 122, the distance of one tooth of the serrations or teeth 121 in the band. The operation just described is repeated as was stated, with each revolution of the numbering wheel 102 or the shaft 96 until after 40 cars have been placed in the train when the movement of the band 17 will be the distance of two of its teeth. I accomplish this through the cam 109 on the shaft 96 and a pawl 143 carried on the rock shaft or rod 138 which has its free end held in engagement with the said cam, by means of a coil spring 144 which is coiled about the rock-shaft or rod 138 and has one end attached thereto or to the arm 137 secured thereon and the opposite end attached to the cross brace 91. In Fig. 7, the cam 109 is shown in the position where the pawl 143 is disposed, which movement has rocked the shaft 138 and also the position of the lug 141 on the rod 135, so that in the rotation of the shaft 96, the finger 140 of the disk 139 can only move the rod 135 a distance such as to permit the pawl 133 to move ahead a ratchet tooth on the disk 129, therefore only move the ring or band 17 the distance of one of its serrations or teeth. But as the shaft 96 continues in its rotations, it brings the cam 109 thereon into a position which will permit the spring 144 to move the arm 137 and its connection with the rod 135 closer to the shaft 96 so that the pin 140 of the disk 139 will move the lug 141 and in turning the rod 145 and pawl 133 a sufficient distance to permit the said pawl to pass over two of the ratchet teeth of the disk 129 and in its return impart sufficient motion to the arm 124 as to move the ring or band 17 the distance of two of its serrations or teeth instead of one, as previously explained. The tendency of the spring 144 is to elevate the arm 137 and its connection with the rod 135, cause the free end of the pawl 123 to ride on the surface of the cam 109, so that as the cam is rotated, it will depress the said pawl and change the movement of the rod 135 and the pawl 133 as just described. The bearing 132 above referred to is provided with an arm extension 145 to which is pivotally connected a pawl 146 adapted to engage with the ratchet teeth of the disk 129 and serves to prevent the said disk and arm 124 from moving backwardly when the plate 131 and the pawl 133 are advanced one or more teeth for moving the ring or band 17 in the man-

ner described; and the said pawl 146 is properly held in engagement with the teeth of the disk 129 by means of the spring 147, see Fig. 3.

If it is desirable the plate 131 may be so constructed that it has a limited movement, which will prevent the arm 124 and the ring or band 17 from moving only a given distance, the same would be accomplished either by limiting the disk 129 to a given number of teeth or provide the plate 131 with a slot 148, see Fig. 3, in which operates a pin 149 projecting up from the bearing 132, or if desired both a limited number of teeth and the pin 149 may be employed. It is adapted through the cradle 65 and the rod 66 to release the pawls 133 and 146 from the teeth of the disk 129 whereby the arm 124 may be returned to its normal position together with the ring or band 17 or upon the release of the pawls as specified from the disk, the operator may release the short arm 122 from the said band 17 and return the arm to the position shown in Fig. 1. This I accomplish by attaching to the rod 66 a depending lever 150 to the lower end of which is pivotally connected a rod or reach 151 provided with the pin 152 adapted to engage with an extended portion of the pawl 146 and looping the outer end of said rod or reach at 153 around the rear extension of the pawl 133. Thus, it will be seen that when the operator depresses the cradle 65, in the manner herebefore specified, he will shift the lever 150 so as to reciprocate the rod or reach 151 and through the parts 152 and 153 above specified, disengage the pawls 133 and 146 from the teeth of the disk 129 to permit free and easy movement to the arm 124. For the purpose of retaining the forward end of the cradle 65 in an elevated position to cause the pawls 64 and 84 to engage with the ratchet teeth of the disks 8 and 32 and also to retain the rod or reach 151 in the position shown in Fig. 3, I have provided a coil spring on the rod 66, one end of which engages with the cradle 65 and the opposite end connected with the cross brace 83, see Fig. 3.

Referring to the off set 51 on the top 2 of the casing, which is best seen in Figs. 1 and 8, the said off set provides an opening in the top of the casing beneath the same, up through which is inserted the short arm 122 connected with the arm 124 which has attached thereto the disk 129. The inner end of the short arm 122 as was explained is adapted to engage with the serrations or teeth 121 of the ring or band 17 and the outer end thereof overlies and rests upon the portion 123 of the arm 124 which is also projected up through the opening in the casing formed by the off set 51, which places the outer end of the short arm 122 outside of the upper edge of the off set 51, whereby an operator is enabled to insert a pointer into the perforation 128 of said short arm for the purpose of releasing the same, from the ring or band 17, as was described.

In addition to the alarm to call to the attention of the operator that his train limit has been reached, it is also provided to ring the said alarm when the disk 32 has rotated into a position to cause the pointer 39 to engage with the off set or lug 40 on the top 2 of the casing. When the pointer 39 engages the off set 40 an engine has been loaded to its full capacity and he is not only advised that such is the case by the sound of the alarm, but the device becomes locked through such engagement of the pointer 39 as specified. The sounding of the alarm, when the pointer 39 engages the off set 40 is accomplished through the plunger 45, see Fig. 9, which is adapted to engage with the upper end of a lever 155 fulcrumed on the part 73 and which has attached thereto a short lever 156, and said short lever engages with the lower end of a lever 157 which is pivoted to the upright 25 and provided on its outer end with a knob 158 adapted to hit the bell 115. Disk 32 rotating through the action of the disk 8 and parts described, it will be seen operates to raise the knob 158 of the lever 157, and when the said lever 157 is released the alarm is sounded by the contact of the knob 158, in the dropping of the lever, all of which it is believed will be understood.

As engines of different weight and dimensions have different tractive power, I provide in the device an adjustable feature to adjust the draw bar pull on different classes of engines, and as grades and curves vary I also provide to compensate for such grades and curves. The means for adjusting the draw-bar pull when employing different classes of engines consist of the adjustable finger 47 carried by the plate 18 which is used in connection with the off set 51 on the top 2 of the casing on which, as shown in Fig. 1 is provided a scale or chart indicated generally as 159. Said scale or chart 159 is made up of the numerals "10,000–15,000"; "15,000–20,000"; "20,000–25,000"; "25,000–30,000"; 30,000–35,000"; "35,000–40,000", etc. The numerals "10,000–15,000", provide for the adjustment of the device to an engine rated at anything between "10,000 and 15,000"; and likewise the next numerals "15,000–20,000" provides for the adjustment of a device rated at anything between "15,000 and 20,000", the remaining numerals being provided for substantially for the same purpose as those just above mentioned and the said numerals as they have been mentioned in their order are placed on the off set above the openings

or perforations 50 in the concave face of said off set. As shown in Fig. 1, the device is set for reducing gross tons of cars and contents to pounds of draw-bar pull in connection with an engine rated at, say, "18,000", as the finger 47 of the plate 18 is inserted in the perforation 50 of the off set 51 which is disposed below the numerals "15,000–20,000." In this connection attention is called to the pointer 39 employed in connection with the plunger 45 and the disk 32 which coöperates with the finger 47 when adjusting the device to engines of different capacity; that is to say, when adjusting the finger 47, as shown in Fig. 1 to the rate of "18,000" as was suggested, the plunger 45 of the pointer 39 is inserted into the perforation or hole 33 which is opposite the numeral or character 18 on the disk 32. This provides for the locking of the device when the pointer 39 engages with the off set or lug 40 of the top 2 of the casing indicating that the engine has received its full tonnage in cars; unless when loading the engine with cars the operator would reach his train length of sixty (60) cars before the pointer 39 engaged with the off set or lug 40 when the alarm would be sounded.

In order to compensate for grades and curves, as above suggested, I employ in connection with the chart or scale 120 and the ring or band 17 on which the same is provided, a scale or chart which is indicated as 160, see Fig. 1, suitably attached to the upper face of said ring or band 17. Said scale or chart 160 consists of suitable numerals and represents pounds of draw-bar pull for different degrees of curve and grade and the same coöperates with an arrow, or pointer 161 suitably attached to the top 2 of the casing as shown in Fig. 1.

As an example of adjusting the machine to a division of road where the grades and curves vary in opposite directions from a certain point, attention is called to the following: We will say that we have a division of road from "A" to "K" and trains are made up at stations "A", "D" and "K." We will assume that a machine is placed at station "D" to compute the draw-bar pull in trains east bound to "A" and west bound to "K", the grade east to "A" from "D" is twenty-five feet to the mile, and no curves, and west to "K" from "D" it is thirty-feet to the mile and a four degree curve. The draw-bar pull in both directions from "D" has been worked out and found to be 16½ pounds per ton east to "A" from "D" and 20 pounds per ton west to "K" from "D." The operator will place a pointer in the perforation of the short arm 22 and withdraw the same from engagement with the serrations or teeth of the band 17 and he will then adjust the said band until the arrow 161 on the top 2 of the casing points to "sixteen and one-half" (16½) on the chart or scale 160. Now, if in the operation of the machine a pointer is placed in the perforation or hole 9 in the disk 8 opposite the numeral "10" on the ring or band 17 and the disk 8 is moved in the direction of the arrow indicated on the top plate 18, of Fig. 1, until the said pointer engaged with the finger 47 which is inserted in the perforation 50 of the off set 51 which represents the rating of an engine "15,000 to 20,000." The device through the operation of the said disk 8 will impart movement to the numbering wheel 26 and in the manner hereinbefore specified, and register "165" pounds, the numbers indicating such appearing beneath the opening or slot 6 in the top 2 of the casing. This computation is based on a train which is moving east to "A" from "D." If the train is to move west to "K" from "D" where the resistance is twenty (20) pounds per ton, the operator will insert the pointer in the perforation of the short arm 22, as was previously explained, and withdrawing the short arm from the ring or band 17 he will move the band to the left until the arrow 161 points twenty on the chart or scale 160 and locking the parts in such position. It will thus be seen that the ten (10) ton car will register 200 pounds, and cars of their weight in proportion. This mode of adjusting compensates for different grades, curves, and ratings with one and the same machine.

By examining Fig. 1 it will be seen that when the band 17 is adjusted to 16½ pounds per ton, there are 33 holes or perforations of the disk 8 between the finger 47 and the tonnage numeral on the band 17 indicating a car of ten (10) tons; each of said perforations representing five (5) it will be seen that when the said disk 8 is moved the distance of 33 holes, which are multiplied by five the device will register 165 pounds. Now, when the band 17 is adjusted so that the numeral 20 of the chart 160 is opposite the arrow 161 the distance between the finger 47 and the tonnage numeral 10 has been increased 7 perforations or holes on the disk 8; thus when it is moved six additional distance of 7 perforations, making forty (40) in all, that the device will register two hundred (200) pounds.

An engine with only "10,000 to 15,000" tractive power, hauls less cars and tons than an engine with "20,000 to 25,000" pounds or more; hence its train length when fully loaded will be short. To adjust for engines of different capacity, all that is necessary for the operator who handles the device is to get the engine number. The general custom

among railroads is to number all machines of the same size and capacity in consecutive order, for example:

Engines 1 to 100,		draw-bar pull	--	12,000	lbs.
" 101 " 150,	"	"	--	13,000	"
" 201 " 260,	"	"	--	15,000	"
" 301 " 375,	"	"	--	17,000	"
" 401 " 440,	"	"	--	18,000	"
" 501 " 650,	"	"	--	22,000	"

The engine number given to the man in charge to prepare train, is Number 433; this being 18,000 pounds, he inserts the pointer into the perforation in the shoulder 48 of the finger 47 and adjusts the said finger to the perforation 50 in the off set 51 beneath the numerals "15,000 to 20,000," of the scale or chart 159, substantially as is seen in Fig. 1, this being the rate as shown. This adjustment allows five pounds per car more than for engines with "10,000 to 15,000" pounds, and twenty-five pounds per car less than is allowed for engines with "35,000 to 40,000" pounds, as was previously explained. The greater the capacity of engines the greater number of cars will be hauled and the greater number of cars the greater the resistance per ton, hence the necessity for the adjustment as shown. To make a further allowance to engine when a train is composed of an unusual number of light cars, I provide, as was previously described, to automatically increase this allowance five pounds per car for the 10th car; five more pounds per car, making (10) ten after the 20th car, an additional five pounds per car after the 30th car, and ten pounds per car after the 40th car, making twenty-five pounds more after the 40th car is added to the train. A ten ton car next the engine as shown, registers 65 pounds, the same car if outside the 41st car from the engine will register 190 pounds. It was previously explained that when the 40th car was reached, the band 17 was released the distance of two of its serrations or teeth 121, allowing it to move that distance to the left. This same ten ton car, after the 51st car from the engine will register 200 pounds instead of 195. It is understood that ten pounds per car allowance made to the 40th car is also allowed to the 50th, 60th, 70th, etc. In other words, five additional pounds per car is allowed every ten cars up to the 40th car, at the 40th, 50th, 60th, 70th and 80th car, this allowance is doubled and ten pounds per car instead of five is automatically allowed. The mechanism for providing such allowance having been described, and all of which it is believed will be understood.

The spacing or placing of the tonnage numerals on the band as shown in the drawings represents a very light grade and curvature and will vary as the curves and grades increase, so that on a heavy grade and sharp curve the draw-bar pull on a seventy (70) ton car may increase from 410 to 1500 pounds and to permit of taking car of such variations, I reserve the right to change the unit numbers as was suggested from "5" to "10," "20," "30" or "20," "40" and "60" in order to keep the devices down to a very small size and very compact.

In order to permit the same machine to adjust the draw-bar pull of cars over different grades and curves I reserve the right to change the location of the numbers representing the tons of cars, by stamping, printing or otherwise attaching them at different locations on the band, but substantially the same numbers as appear or more, will appear in consecutive order on the said band. This may be found necessary by reason of the variation in the bands of draw-bar pull per ton of cars over the different degrees of grades and through curves of different degrees. For example, attach an engine to a train of cars of 40 gross tons each on a level tangent and exert its tractive power, which we find to be "30,000" pounds and it moves 50 cars of 40 tons each equal to 2000 pounds, 50 cars divided into 30,000 pounds gives 600 pounds draw-bar pull per pound and 600 pounds divided by 40 tons gives 1.5 pounds per ton resistance due to wheel friction on a 40 gross ton car. This ratio increases per ton of cars of less than 40 gross tons and decreases per ton on cars of more than 40 gross tons. This variation caused by grade and curvature makes it necessary to provide a machine with numbers adjusted on the band to fit each district according to the grade and curves, or to provide for changing the location of numbers on the same to adapt it to be moved to the right or left before compiling the draw-bar pull. For example, with a machine located at station "D" and train move to "A" east, and west to "K" and on the east end the grade is found to be 30 feet and four degrees curves, and on west end the grade is found to be 28 feet and a four degree curve, a 40 ton car going east to "A" has 600 pounds of draw-bar pull and the same car going west to "K" has only 572 pounds of draw-bar pull. Now, in order to make the same machine compute accurately the draw-bar pull on trains moving in each direction, it is arranged that the band may be set six spaces or the distance of six serrations or teeth, right, instead of to the left, before compiling the draw-bar pull on trains moving west, which then causes the 40 ton car to register 30 pounds less on account of the reduced resistance due to reduced grade from 30 ft. to 28 feet to the mile.

Having thus fully described my invention, what I claim and desire to secure by Letters Patent of the United States, is:—

1. In a device of the character specified,

in combination, a member carrying a scale consisting of characters representing gross-tons of cars and contents, registering mechanism, and means for actuating said mechanism, whereby the said mechanism is caused to add and indicate an amount at variance to that called for by the character on said scale, being equal in pounds of draw-bar pull of the car and contents.

2. In a device of the character specified, in combination, a member carrying a scale consisting of a suitable arrangement of numerals representing gross-tons of car and contents, registering mechanism, and means associated with said scale for actuating said registering mechanism, whereby when said register actuating means is operated from points opposite certain of the numerals on the scale, said mechanism is caused to register and to indicate an amount at variance to that called for by the number on said scale, being equal in pounds of draw-bar pull to the draw-bar pull of the car and contents.

3. In a device of the character specified, in combination, a member carrying a scale consisting of a suitable arrangement of numerals representing gross-tons of car and contents, registering mechanism, means associated with said scale for actuating said registering mechanism, whereby when said register actuating means is operated from points opposite certain of the numerals on the scale, said mechanism is caused to register and to indicate an amount at variance to that called for by the number on said scale, being equal in pounds of draw-bar pull to the draw-bar pull of the car and contents, and means for tallying each movement of the registering mechanism.

4. In a device of the character specified, in combination, a member carrying a scale consisting of a suitable arrangement of numerals representing gross-tons of car and contents, registering mechanism, means associated with said scale for actuating said registering mechanism, whereby when said register actuating means is operated from points opposite certain of the numerals on the scale, said mechanism is caused to register and to indicate an amount at variance to that called for by the number on the scale, being equal in pounds of draw-bar pull to the draw-bar pull of the car and contents, and means for increasing the allowance made to each gross weight of car and contents at predetermined intervals.

5. In a device of the character specified, in combination, a member carrying a scale consisting of a suitable arrangement of numerals representing gross-tons of car and contents, registering mechanism, means associated with said scale for actuating said registering mechanism, whereby when said register actuating means is operated from points opposite certain of the numerals on the scale, said mechanism is caused to register and to indicate an amount at variance to that called for by the number on the scale, being equal in pounds of draw-bar pull to the draw-bar pull of the car and contents, means for tallying each movement of the registering mechanism, and means for increasing the allowance made to each gross weight of car and contents at predetermined intervals.

6. In a device of the character specified, in combination, a member carrying a scale consisting of numerals representing gross-tons of car and contents, registering mechanism, means for actuating said mechanism, whereby the said mechanism is caused to register and to indicate an amount at variance to that called for by the numeral on the scale, equal in pounds of draw-bar pull to the gross-tons of car and contents, and means for automatically increasing the allowance made to each gross weight of car and contents at predetermined intervals.

7. A device for reducing gross-tons of cars and contents to pounds of draw bar pull, comprising a registering device, means for adding and indicating on said registering device the total of said reduction, and means for increasing the allowance made to each gross weight of car and contents after a predetermined number of operations of said registering device, thereby causing said device to compute and register for the same gross weight of car and contents different amounts, said allowance to be made depending on the location of said car and contents in a train.

8. A device for reducing gross-tons of cars and contents to pounds of draw-bar pull, comprising a registering device, means for adding and indicating on said registering device the total of said reduction, means for increasing the allowance made to each gross weight of car and contents after a predetermined number of operations of said registering device, thereby causing said device to compute and register for the same gross weight of car and contents different amounts, said allowance to be made depending on the location of said car and contents in a train, and means for tallying each movement of the registering device.

9. In a device for reducing gross-tons of cars and contents into pounds of draw-bar pull, in combination, registering mechanism, a member carrying a scale consisting of numerals representing gross-tons of cars and contents, means for actuating the said mechanism, whereby the said mechanism is caused to register and to indicate an amount at variance to that called for by the number on the scale, means coöperating with said scale to adapt the device to reduce the gross-tons of cars and contents into pounds of

draw-bar pull in connection with engines of different sizes and capacity, and means for adjusting the scale to adapt the said device to variations in degree of grades and curves.

10. In a device of the character specified, in combination, a member containing a scale consisting of numerals representing gross-tons of cars and contents, a disk rotatably mounted beneath said member and having an annular row of numerals visible at a suitable point outside the confines of said scale, a numbering wheel rotating in a plane different to that of the disk and arranged so that its numbers will coincide at intervals with the numerals on the disk, means for automatically changing the position of the scale at predetermined intervals, and operable connections between the disk and numbering wheel to adapt the actuation of the numbering wheel to a predetermined movement of the disk.

11. In a device of the character specified, in combination, a member containing a scale consisting of numerals representing gross tons of cars and contents, a disk rotatably mounted beneath said member and having an annular row of numerals visible at a suitable point outside the confines of said scale, a numbering wheel rotating in a plane different to that of the disk, and arranged so that its numbers will coincide at intervals with the numerals on the disk, means for automatically changing the position of the scale at predetermined intervals, and operable connections between the disk and numbering wheel to adapt the actuation of the numbering wheel with each one-fifth revolution of said disk.

12. In a device of the character specified, in combination, a member containing a scale consisting of numerals representing gross-tons of cars and contents, a disk rotatably mounted beneath said member and having an annular row of numerals visible at a suitable point outside the confines of said scale, a numbering wheel rotating in a plane different to that of the disk and arranged so that its numbers will coincide at intervals with the numerals on the disk, a second disk rotating in the same plane with said first mentioned disk and having an annular row of numerals adapted to coöperate with the numbering wheel and first mentioned disk, operable connections between the first mentioned disk and numbering wheel, to adapt the actuation of the said wheel after a predetermined movement of the disk, and operable connections between said numbering wheel and last mentioned disk.

13. In a device of the character specified, in combination, a movable member containing a scale consisting of numerals representing gross-tons of cars and contents, a register, and means associated with said scale and operatively connected with said register, said means when operated from certain points on said scale causing said register to operate and indicate the pounds of draw-bar pull in lieu of the cross-tons of car and contents represented by the numeral from which point on the scale said register operating means is actuated.

14. In a device of the character specified, a movable member containing a scale consisting of numerals representing gross-tons of cars and contents, a register, means cooperating with said scale, and operatively connected with said register, said scale serving as a guide to the operation of the register operating means, the operation of said means from certain points opposite the scale indicating by the register the pounds of draw-bar pull in lieu of the gross tons of car and contents represented by the numeral on the scale, and means for moving the said member and scale to increase the allowance made to each gross weight of car and contents at predetermined intervals.

15. In a device of the character specified, a movable member containing a scale consisting of numerals representing gross-tons of cars and contents, a register, means cooperating with said scale, and operatively connected with said register, said scale serving as a guide to the operation of the register operating means, the operation of said means from certain points opposite the scale indicating by the register the pounds of draw-bar pull in lieu of the gross-tons of car and contents represented by the numeral on the scale, and mechanism connected with said scale member for automatically moving the same at predetermined intervals to increase the allowance made to each gross-weight of car and contents.

16. In a device of the character specified, an adjustable member containing a scale consisting of numerals representing gross-tons of cars and contents, means for adjusting said member and scale, a register, means coöperating with said scale and operatively connected with said register, the scale serving as a guide to the operation of the register operating means, the operation of said means from certain points opposite the scale indicating by the register the pounds of draw-bar pull in lieu of the gross-tons of car and contents represented by the numeral on the scale, and a chart also carried on said member to adapt the device to the variations in degree of grade and curve through the adjustment of said member.

17. In a device of the character specified, an adjustable member containing a scale consisting of numerals representing gross-tons of cars and contents, means for adjusting said member and scale, a register, means coöperating with said scale and operatively connected with said register, the scale serv-

ing as a guide to the operation of the register operating means, the operation of said means from certain points opposite the scale indicating by the register the pounds of draw-bar pull in lieu of the gross-tons of car and contents represented by the numeral on the scale, a chart also carried on said member to adapt the device to the variations in degree of grade and curve through the adjustment of said member, and means adjustably supported in proximity to the register operating means and coöperating therewith for regulating the device for use in connection with engines of different sizes and capacity.

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

JOHN M. DALY.

Witnesses:
WILLIAM G. THOMSON,
BARTO. A. BLOOMFIELD.