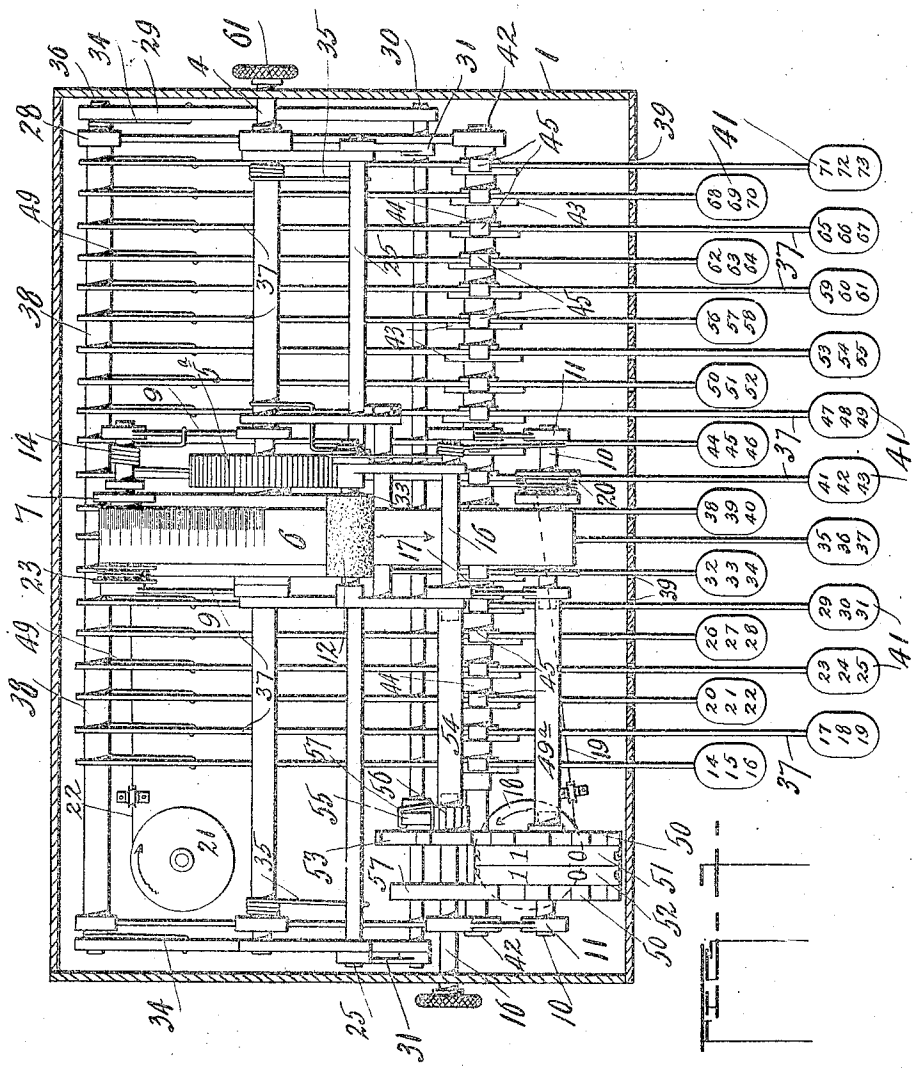
J. M. DALY.

COMPUTING MACHINE.

APPLICATION FILED APR. 11, 1904.

939,221. Patented Nov. 9, 1909.

5 SHEETS—SHEET 1.



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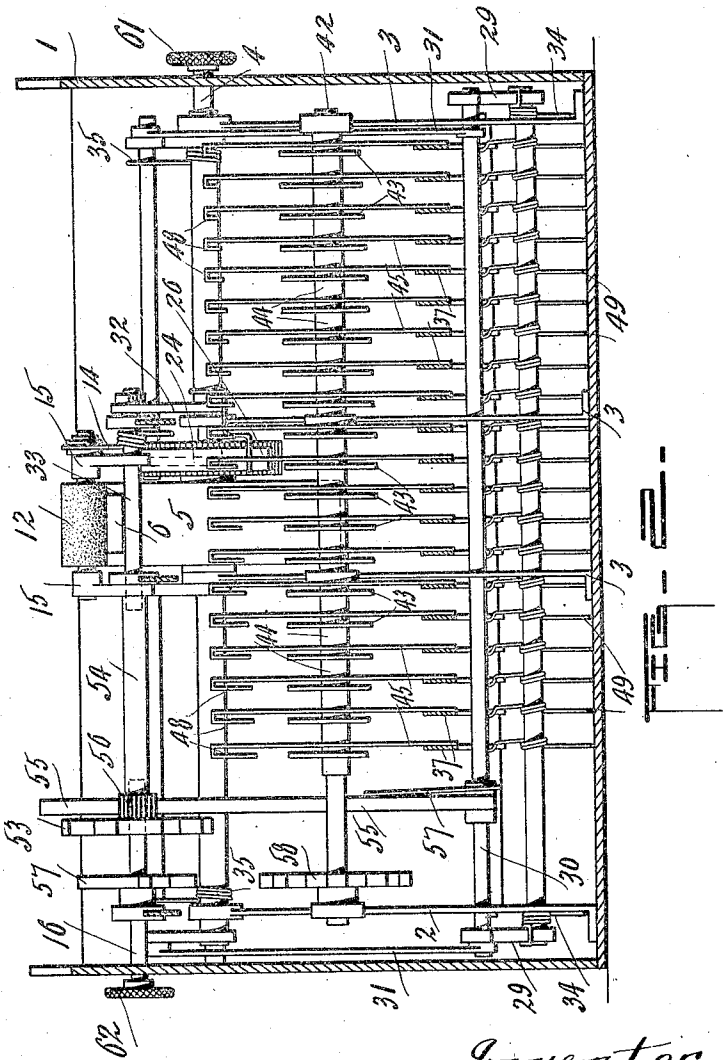

Fig. 2.

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5 SHEETS—SHEET 3.

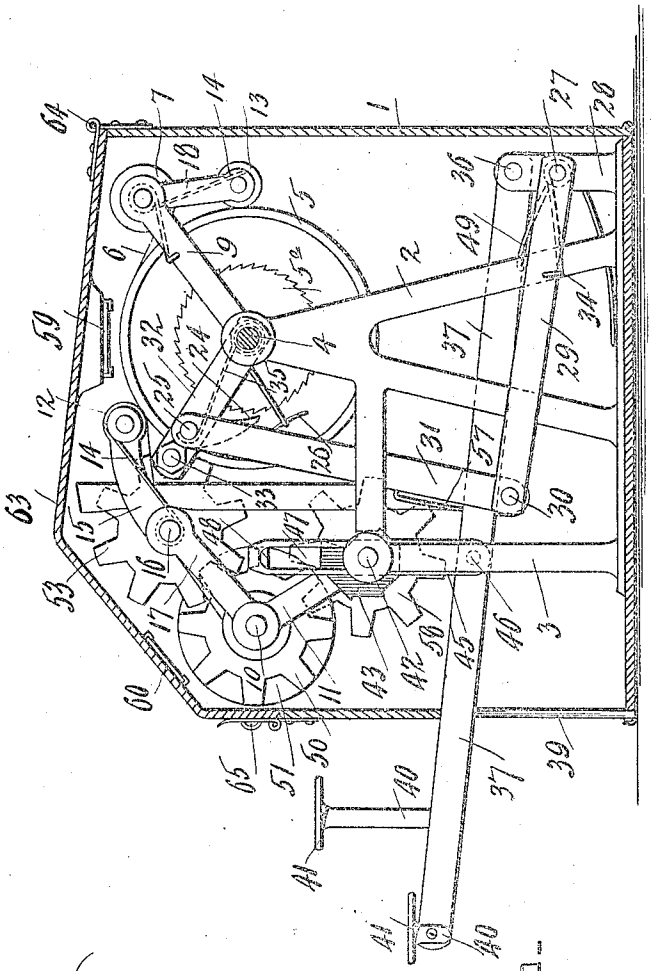

FIG. 3.

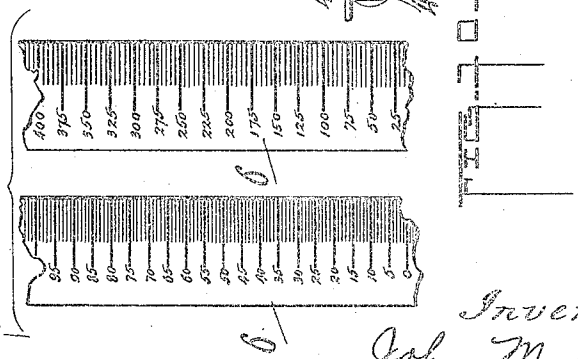

FIG. 7.

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5 SHEETS—SHEET 4.

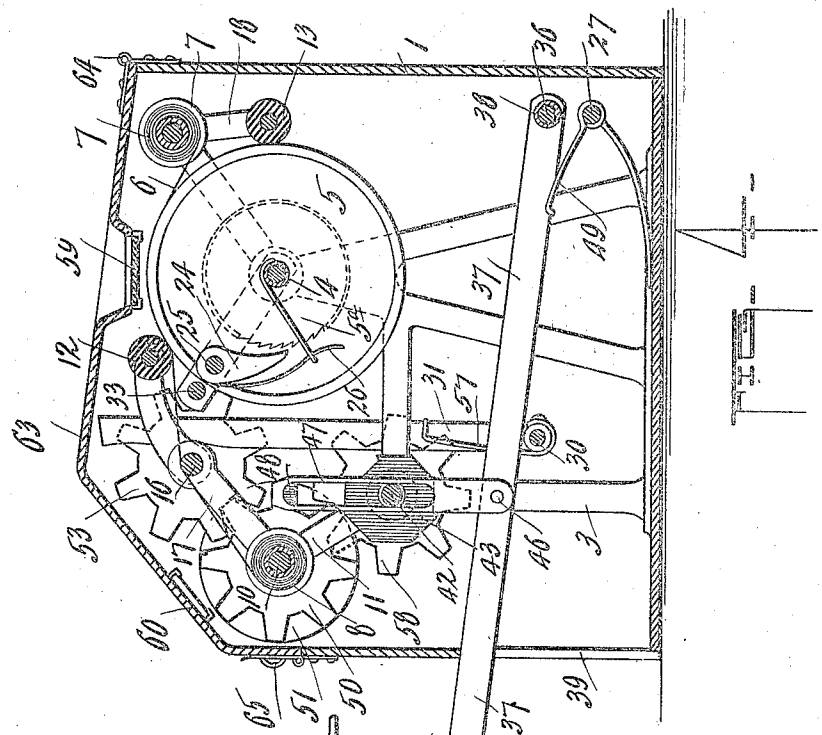

FIG. 4.

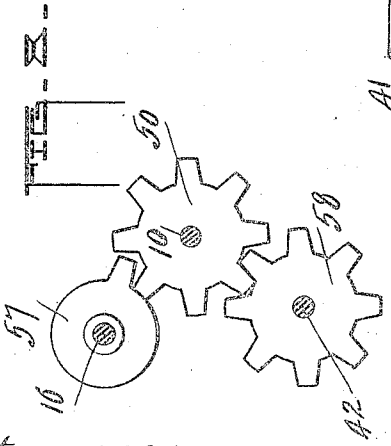

FIG. 8.

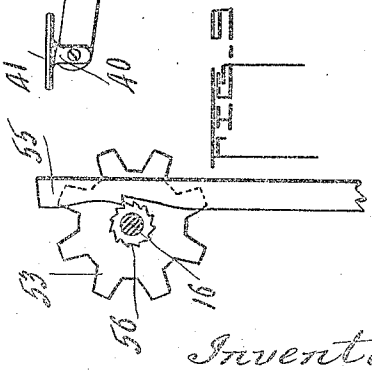

FIG. 9.

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APPLICATION FILED APR. 11, 1904.

939,221.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 5.

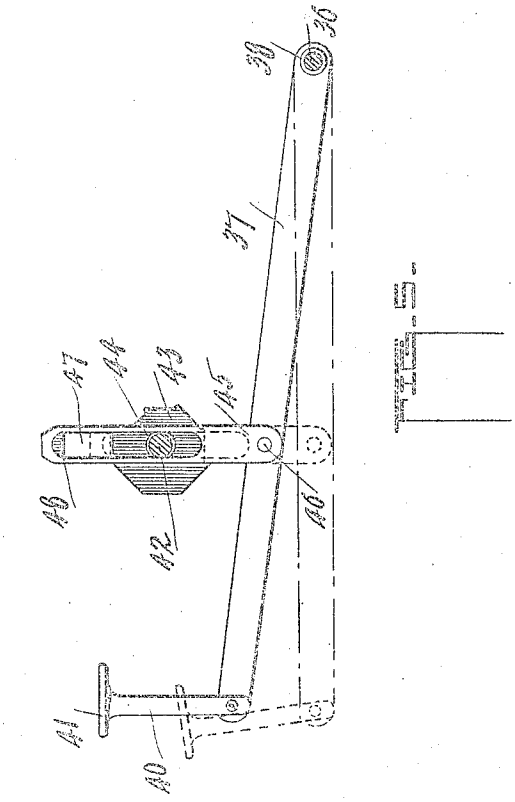


FIG. 5.

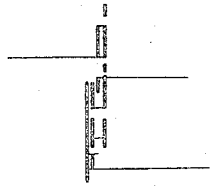
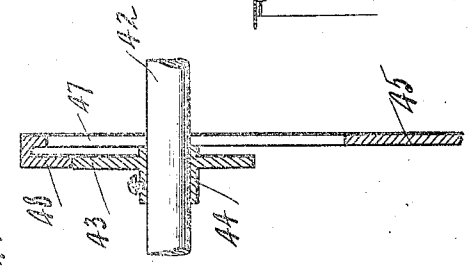


FIG. 6.



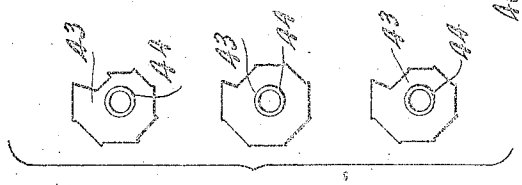


FIG. 7.

FIG. 8.

Witnesses:-

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UNITED STATES PATENT OFFICE.

JOHN M. DALY, OF CHICAGO, ILLINOIS.

COMPUTING-MACHINE.

939,221. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed April 11, 1904. Serial No. 202,553.

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 has for its object the equation of train tonnage or for computing the tonnage resistance in railway trains, the object being to reduce or adjust the loading of engines from an actual weight to a drawbar pull.

Attention is called to several patents issued to me on December 2nd 1902, two of which are numbered 715,199 and 715,201 which illustrate and describe a "system for computing the tonnage resistance of railway trains," and while the results to be obtained by the present invention are somewhat similar to the patents referred to, the method of and the construction of the mechanism are vastly different.

The method in vogue on railroads for making up trains or loading engines prior to about 1897, was to place a given number of loaded and empty cars in train, reducing empty cars to a loaded car basis. On some roads they considered two (2) empty cars equal to one (1) loaded car, hence an engine rated at twenty-five (25) loads would haul twenty (20) loads and ten (10) empty cars. On other roads they used a basis of three (3) empty cars equal to two (2) loaded cars, others five (5) empty cars equal to three (3) loads, etc. At that time this method was reasonably accurate, as cars were of almost uniform capacity and weight, viz., fifteen (15) and twenty (20) ton capacity. With the introduction of large engines, and the reduction of grades about 1897, came the large capacity car of fifty (50) ton capacity, against the standard fifteen (15) and twenty (20) ton capacity cars, making it impractical to rate and load engines on the car-haul basis. The gross-tonnage car and contents plan was next tried, this plan has on several roads proved a failure and frequently results in overloading the engine, thereby causing delay to train and creating additional chances for accidents. The manifest or way-bill that accompanies loaded cars shows the tare, net and gross weight of car and contents. Empty cars have the tare weight stenciled on body of car and from this source yardmaster or yard-men switch together and build up trains on the tonnage basis.

The gross tonnage plan is not a correct basis, for the reason, that it does not recognize or provide for the additional power required to haul a ton of car as compared to a ton of contents, although all experts concede that the same engine can haul a greater gross tonnage of large capacity heavy loaded cars than it can haul in small capacity light loaded cars, for the reason there are elements of friction due to the number of cars used in taking care of a given tonnage of contents. For example: an engine rated at twenty-one hundred (2100) gross tons is attached to train composed of thirty (30), seventy (70) ton cars equal to twenty-one hundred tons, will have no difficulty in hauling such a train, in fact it should have six hundred or seven hundred tons more. On the next trip over the same grade the same engine has twenty-one hundred (2100) gross tons of fifteen (15) ton cars, it cannot possibly haul it. Again on another trip over the same grade the same engine has twenty-one hundred (2100) tons of forty (40) gross tons in fifty-three (53) cars, it is able to haul the train in the allotted time. Each standard freight car has eight (8) wheels, eight (8) journals and measures about forty (40) feet in length over all. Hence when twenty-one hundred (2100) tons is in seventy (70) gross ton cars we have only thirty (30) cars, two hundred and forty (240) wheels and journals and twelve hundred (1200) feet of train. In forty (40) ton cars we have fifty-three (53) cars, four hundred and twenty-four (424) wheels and journals and twenty-one hundred and twenty (2120) feet of train and if in fifteen (15) ton cars, we have one hundred and forty (140) cars, eleven hundred and twenty (1120) wheels and journals and fifty-six hundred (5600) feet of train. With seventy (70) gross ton cars, we have friction on two hundred and forty (240) journals and at wheel to rail on two hundred and forty (240) wheels; we have twelve hundred (1200) feet of surface for wind resistance; we have the benefit of momentum when one half the train passes

over the summit of grade to help over an adjacent grade again; we have only twelve hundred (1200) feet of train to bind in one (1) or two (2) curves at one time, which is also a train resistance feature.

The same engine hauling fifteen (15) ton cars has forty (40) to fifty (50) per cent. greater resistance or draw-bar pull; this has been practically demonstrated on a number of roads and is a matter of record. This ratio does not exist to the same per cent. on heavy grades where the rating is five hundred (500) to one thousand (1000) gross tons as where the grades are light and engines are rated at fifteen hundred (1500) to twenty-five hundred (2500) tons, for the reason, that the smaller the rating the less cars are required and the less friction, wind resistance and resistance due to distance of weight from power.

Having shown the fact that a ton of car has a greater draw-bar pull than a ton of contents, I wish now to show that the draw-bar pull or train resistance will vary on heavy and light cars according to their location in train or distance from the engine. For example: in switching together and making up a train at the starting point they place fifty (50) light fifteen (15) ton cars next to engine and twenty (20) heavy seventy (70) ton cars at rear of train next to the caboose, we have a total gross tonnage of twenty-one hundred and fifty (2150) tons. The weight of the seventy (70) ton cars at the rear of train will prevent engine from getting the advantage of momentum on down grades until after two thirds of the entire train has passed over the summit of grade; again, when the heavy cars are placed at the rear of train near caboose and light cars placed at head end near the engine, the heavy cars at rear draw hard and tend toward straightening out train in curves creating additional friction of wheel flange to rail, the reverse effect is felt when the heavy cars are hauled near the engine. Hence in order to equalize, adjust and load an engine on an equated tonnage or draw-bar pull basis, it is necessary to not only provide for the difference in the resistance between light and heavy cars, but, to also provide for the difference in the resistance or draw-bar pull due to location of each weight of car in the train and the distance of the weight from the engine.

In order to provide for the difference in resistance of light and heavy gross weight cars, my plan is, to test the engines with train composed of cars all of one gross weight, say forty (40) gross tons each. After arriving at a proper rating on forty (40) ton cars, determine the resistance of fifteen (15), twenty (20), twenty-five (25) ton, etc., at different locations in train. For example, on a rating of two-thousand (2000) tons, fifty (50) cars of forty (40) tons each, we place fifteen (15) cars of fifteen (15) tons each next the engine and forty (40) cars of forty (40) tons each next the caboose, we have a total of eighteen hundred and twenty-five (1825) tons or one hundred and seventy-five (175) tons less than rating, although the draw-bar pull on both trains is the same; again, put the forty (40) cars of forty (40) tons each next the engine and the fifteen (15) cars of fifteen (15) tons each next the caboose and the engine can haul seventy-five (75) additional tons or a total of nineteen hundred (1900) tons. In the first case, when light cars were next the engine we conceded twelve (12) additional tons per car to the engine for increased resistance of a fifteen (15) to a forty (40) ton car, also for the additional resistance due to heavy cars at rear end. In the second case, with the light cars at rear, we reduce that feature of the concession and allow the engine six (6) tons per car on the fifteen (15) light cars for difference in weight compared to forty (40) ton car, no concession made for light cars ahead. When cars of greater weight than the testing unit are used, the effect is the reverse. For instance, a train rated at two thousand (2000) tons has forty (40) cars of forty (40) gross tons each next to engine, it should haul nine (9) cars of seventy (70) tons each equal to twenty-two hundred and thirty (2230) tons on a rating of two thousand (2000) tons, based on forty (40) ton testing unit. If the seventy (70) ton cars are placed next to the engine it should haul one (1) additional seventy (70) ton car or a total of twenty-three hundred (2300) tons on a rating of two thousand (2000) tons. Again when an engine is tested on basis of forty (40) ton cars and rated at, say, sixteen hundred (1600) tons, no concession is made for any car of forty (40) gross tons put in train between the first and fortieth car, as the engine demonstrated its capacity to haul full rating of such cars up to a limit of forty (40) cars; however, when a forty (40) gross ton car is placed in train at the rear of forty other cars on a sixteen hundred (1600) ton rating, it must receive an additional allowance according to its location behind the fortieth (40th) car, due to length of train resistance and also to the resistance due to placing cars of less than forty (40) tons ahead of the fortieth (40th) car.

The invention has for its further object, a machine for equating the draw-bar pull of cars of different gross weight at different locations in train, preferably, from the actual weight of car and contents as shown on the manifest or way-bill that accompanies each car; by means of a suitable registering device or display, having a series of keys for operating the same, which said keys have an invariable movement for a predetermined

number of strokes, and a variable stroke at predetermined intervals. The keys of the machine are provided with numerals representing cars of a certain gross tonnage. And in the arrangement of the keys I have provided that each key shall represent three different weights of cars. The object being, that if an operator presses down the key numbered 14, 15, 16, ten (10) consecutive times it registers on the registering device one hundred seventy (170) tons, instead of one hundred fifty (150) tons; two tons allowed each car on account of their representing tons less than the testing unit. Press the same key ten (10) additional times and the registering device will record one hundred eighty (180) tons or three tons per car additional, one ton more being allowed for length of train or distance from the power. Press the same key ten (10) additional times and it registers on the recording device two hundred (200) tons or two additional tons, which is allowed for the increase distance from the power; this ratio on the basis that the engine is rated at sixteen hundred (1600) to two thousand (2000) tons. If the engine is rated at seven hundred (700) to twelve hundred (1200) tons the allowance in each instance would be less; but if rated two thousand (2000) to twenty five hundred (2500) tons, a greater allowance per car would be made. Again, if after the placing of the thirty (30) light cars in the train, such as indicated by the key, you add five (5) cars of forty (40) tons each, to record this additional tonnage you would press the forty (40) ton key five times, which will register on the recorder an even two hundred (200) tons, which is in addition to that previously registered or recorded by pressing the key first mentioned, no allowance is made for the testing unit car. The next five (5) cars added to the train, if of seventy ton cars the (70) ton key is pressed and at each pressure of the seventy (70) ton key there will be registered on the recorder sixty two (62) tons making a total of 310 tons. The seventy ton key if the car is placed at the point referred to in the train there is recorded sixty two (62) tons instead of seventy (70) tons, that being the draw-bar pull as compared to a forty (40) ton testing unit. We now have forty (40) cars in the train which is rated at sixteen hundred (1600) tons of forty (40) ton unit cars. If you add ten (10) more forty (40) ton cars which will place them forty first (41) to fiftieth (50) cars from the engine by pressing the key number forty ten times it will register on the recording device four hundred ten tons (410) tons or one extra ton per car for distance from power, nothing for light weight as it is the test unit.

In order to provide for the different draw-bar pull of same weight of car at different locations in the train I provide a registering device that is actuated by a series of independently movable keys, each of said keys having a given stroke for a predetermined number of strokes and the stroke of each and all of the keys adapted to be lengthened at predetermined intervals and so retained for a given number of strokes. The devices are so arranged and combined that the adjustment for the increase length of stroke of each key is automatic and the stroke of all the keys are automatically adjusted simultaneously after pressing any one key a predetermined number of strokes or by pressing a series of different keys amounting in the aggregate to the number of strokes for which any one key is adjusted. The adjustment of the keys may be such that the increase in their stroke may be after five successive strokes on one key or upon five different keys or adjusted to suit any number of strokes as may be desired and as required for different ratings.

In order that the invention may be more fully understood reference is had to the accompanying drawings forming a part of this specification, in which;

Figure 1 is a plan view, with the casing in section, showing a tonnage computing machine embodying my improvements; Fig. 2 is an elevation in section, parts removed, showing my improved machine in front elevation; Fig. 3 is an elevation of one end of my machine, with the casing shown in section; Fig. 4 is a vertical sectional elevation through a point approximately the center of my machine, to illustrate certain points; Fig. 5 is a detached view of a key, showing its stroke in dotted lines, also showing a stop member with which it co-acts; Fig. 6 shows enlarged, a sectional view of a stop member on its shaft, also a member carried by the key co-acting with the stop member, the said carrying member being in position when the key is depressed; Fig. 7 shows three different forms of stop members with which the keys co-act; Fig. 8 is an elevation from one side showing gearing for a certain tallying device; Fig. 9 shows an elevation from one side of means for actuating the tallying device; Fig. 10 shows two detached portions of different forms of a tape or scale for registering or recording the tonnage resistance in a train.

Like numerals of reference indicate corresponding parts throughout the figures.

In the drawings 1 indicates a casing which may be of suitable form and in which the operative parts of my device are contained. The device may be portable as shown in the drawings or otherwise as may be desired and of a size most convenient. In the casing is carried the standards 2 and 3 supported upon the base of the casing and suit-

ably connected together and for the purpose for which they are intended, I have provided several sets of such standards. In the standards 2 there is journaled a shaft 4 and on the shaft 4 is carried the wheel 5 and the ratchet wheel 6. Over the wheel 5 there is adapted to be passed a registering tape or registering scale 6 which is fed from the reel 7 to the reel 8. The reel 7 is journaled in the arms 9 which extend up from and may form a part of the standards 2. The reel 8 is supported on a shaft 10 extending longitudinally and parallel with the shaft 4 and the same is journaled in the brackets 11 which extend up from and form a part of certain standards 3. To insure the tape or scale being fed uniformly from the reel 7 to the reel 8 I provide for frictionally feeding the said tape or scale, which is accomplished by the rollers 12 and 13, the former bearing upon the surface of the tape and impinging the same against the surface of the wheel 5; the roller 13 bearing against the surface of the wheel 5 as shown and frictionally holding the same during its rotation, both the rollers 12 and 13 are yieldingly held by means of the springs 14. The roller 12 is carried in the swingably supported arms 15 carried by a shaft 16 extending parallel with the shaft 10 which in turn is supported by arms 17 forming a part of the brackets 10. The roller 13 is supported by arms 18 which are swingably carried on the shaft which supports the reel 7. In the movement of the wheel 5 the tape or scale 6 is unwound from the reel 7 and wound upon the reel 8, for the purpose of registering the tons of resistance indicated by the operation of certain keys to be described. The winding of the tape on the reel 7 is assisted by a spring drum 18^a from which a tape or cable 19 is fed and one end attached to and adapted to be wound on a reel 20 carried by the shaft 10. In rewinding the tape or scale 6 on the reel 7 the same is assisted by a spring drum 21 from which a tape or cable 22 is fed one end of which is attached to and wound upon a drum 23 attached to or carried by the shaft supporting the reel 7.

The wheel 5 is adapted to be actuated through the tape 6 and pawl 24 carried by a rod 25, which said rod is mounted in a link frame which will be described. The pawl 24 being yieldingly held to its work by means of the springs 26; the pawl being so disposed that in its normal position it is free of the ratchets on the wheel 6 to permit the latter to be turned in opposite directions without necessity of having to disengage the pawl, the purpose of which will be described.

The link frame to which attention was called comprises a shaft 27 extending longitudinally in the frame and journaled in the standards 28 at opposite ends thereof and attached to the ends of the shaft 27 is shown the bars 29 extending forwardly and connecting the free ends of the bars 29 is shown a rod 30. Extending up from and attached to the opposite ends of the rod 30 are shown the link bars 31 and connected to the upper end of the link bars 31 is the outer end of the rods 25, the inner end of the rods 25 connected in a link bar 32 which extend from the shaft 4 which support the inner ends thereof out and beyond the rods 25 and their ends are connected by the short rod 33. The arrangement here shown has been made necessary on account of the construction of the wheel 5 and the arrangement of the link bars 31, 32, and the rods 25; but this arrangement may be modified and rearranged as desired. The link frame consisting of the bars 29, 31, 32 also the rods 25 and 31 is held normally in a raised position, and yieldingly held in such position by means of the springs 34 carried by the shaft 27 and bearing against the under side of the bars 29, also the springs 35 carried by the shaft 4 and bearing against the under side of the rods 25 as shown.

36 indicates a shaft or rod, its opposite ends journaled in the upper ends of the standards 28, and 37 denote a series of key-bars having their inner ends pivoted on the shaft 36 and the bars separated by the spacing collars 38 carried on the shaft 37; the bars 37 extend forwardly inclined slightly upwardly and pass above the rod 30, with the lower edges of the bars 37 lying in close proximity to the upper face of the rod 30. The bars 37 pass out of the casing 1 through the slots 39 in which the key-bars are adapted to have vertical movement and the key-bars are alternately short and long to economize in space, and are provided on their outer extremities with the short arms 40 to which is attached a key or button 41, upon the face of which is adapted to be placed certain numerals representing cars of certain tons, as called for by the way-bills or manifest, which will be further described.

42 denotes a longitudinally disposed shaft which is journaled in the upper ends of the standards 3, and upon said shaft is carried a series of stop members 43, in practice one for each of the key-bars 37. The said stop members are provided with irregular peripheries, to be further described, and have the extended hub portion 44, to provide a suitable bearing therefor on the shaft 42. The stop members are so arranged on the shaft that they are alternately disposed with vertically movable bars or arms 45, which at their lower ends are pivotally attached to the key-bars as at 46, and are further provided with the elongated slots 47 in their body through which the shaft 42 extends and to adapt the bars 45 to have an extended movement across the axis of the shaft which is occasioned by the depression of the key-

bars 77, to which the bars 45 are attached. Each of the bars 45 is provided with the depending ears or lips 48, which overlie the peripheral edges of the stop members 43, and are adapted to engage or abut with the stop members 43, when the keys are depressed, serving to limit the stroke of the keys. The arms 45, as shown in the drawings are preferably of uniform length, while the lips or depending ears 48 of the succeeding arms 45 are shorter than those on the preceding bars 45, the purpose of which will also be described. The key-bars are adapted to be normally held in a raised position, with the lips 48 of the bars 45 in their extreme raised position above the stop members described, accomplished by means of spring arms 49 bearing upwardly against the lower edge of the key-bars 37, with a coil of the spring, coiled around the shaft 27. These spring arms serve also, to return the key-bars to their normal position after each depression when the hand or finger of the operator is released therefrom.

Referring again to the key-bars 37, attention is directed to Fig. 1 which shows in plan the buttons or keys 41; these keys are provided with suitable numerals and are adapted to register the tonnage in cars ranging from fourteen (14) tons to seventy-three (73) tons. It will be observed, as was stated above, that each of the keys provided with three numerals. The first key, beginning with the left hand side of the machine, represents a car weighing fourteen (14), fifteen (15) or sixteen (16) tons, respectively, and each succeeding key thereafter represents cars three tons more than the preceding keys. This arrangement is made for the purpose of economizing in space and the registering device is conformed thereto, but it is not intended to put a limit on the number of keys nor what tons in cars each key shall represent; for the reason, that a machine may be so constructed that a fifteen (15) ton car will be represented by one key and a sixteen (16) ton car by another key. There is no limit to this arrangement and the device here shown is to illustrate how in practice the device may be made.

Referring now to the stop members which I have indicated as 43, it will be observed from the drawings and especially Figs. 3, 4, 5, and 7, that the irregular faces thereof vary on nearly all of the stop members. In Fig. 3 which represents an end view from one side of the machine, the stop member there shown may be taken to indicate a seventy (70) or a seventy-one (71) ton stop member, while in Figs. 4 and 5, the stop member may be taken as indicating a forty (40) ton stop member, and in Fig. 7, three different stop members are shown which may be taken as reprtsenting fifteen (15), thirty-five (35) and forty-five (45) ton stop members respectively. The machine in this case, may be taken as being based on a sixteen hundred (1600) ton rating, the unit of which is a forty (40) ton car; therefore, all of the stop members would be adjusted to this rating; and the depending lips or ears 48 of the bars 45 are in length to correspond to the stop members with which they co-act. In other words, taking for example a forty (40) ton stop member and the position in which it is shown in Figs. 4 and 5; if a forty (40) ton car were placed in a train in the first forty (40) cars, the stroke of a forty (40) ton key-bar would be only sufficient to move the registering tape 6 to record forty (40) tons, the depression of the key being determined by the distance between the upper squared face of the forty (40) ton stop member as shown in the figures, and the lower edge of the ear or lip 48 of the bar 45 co-acting with such forty (40) ton stop member and attached to the forty (40) ton key-bar.

In computing the tonnage resistance of the cars as they are added to the train, I have provided as was intimated in the fore part of the specification, to allow so much resistance for cars of different weights and in series; so that in making up a train if ten cars of fifteen (15) tons each are placed in the train next the engine, each car will register on the recording device seventeen (17) tons respectively or in the main one hundred and seventy (170) tons. At this juncture, mechanism would be brought into play for automatically changing the position of the fifteen (15) ton stop member and in fact all the stop members simultaneously, so that by placing ten (10) additional fifteen (15) ton cars in the train, the movement of the fifteen (15) ton key-bar and its bar 45 would move so as to register on the recording device eighteen (18) tons for each depression of the key-bar or one ton additional for each of the ten (10) cars added to the train, amounting to one hundred and eighty (180) tons. For example, take the seventy (70) ton key-bar, and if in making up the train, we should place ten (10) seventy (70) ton cars next the engine, the depression of the seventy (70) tons key-bar ten (10) times would register on the recording device six hundred (600) tons or sixty (60) tons for each car, the reasons for which have been heretofore stated. Or if in placing a sixty (60) ton car next the engine, a depression of the sixty (60) ton key-bar would record fifty-five (55) tons; or a depression of a forty-eight (48) ton key-bar, the same will record approximately forty-six (46) tons; the depression of a thirty-six (36) ton key-bar will record approximately thirty-seven (37) tons; the depression of a twenty-seven (27) ton key-bar will record approximately twenty-nine (29) tons. In other words, the tonnage of cars

below the unit is expanded and that above the unit contracted, and the nearer the car comes to the testing unit, the less variation in the resistance. The stop members are so made and the lips 48 of the bars 45 so adjusted with reference to the distance of travel to the face of the stop member, that in no matter what position a car is placed in the train, the pressure upon a key-bar representing such a car will equate on the register its proper resistance. In the machine here shown, each of the stop members is provided with eight (8) irregular faces which are adapted to limit and regulate the distance of travel of each of the key-bars as they are depressed. The examples above given with reference to the placing of certain cars in a train were equated as though each stop member had ten irregular faces, rather than eight, and I wish it to be understood that in computing the resistance the machine may be adjusted by the placing of stop members which will equate in series of eight cars more or less. Each stop member is made to suit the requirements of its office and each lip 48 of the bars 45 are made in lengths to have a stroke which will equate the proper resistance in a car whether the same is in the first series of eight, or wherever else it might be placed in the train or whatever tons are represented by such a car as it appears on the way bills or manifest. And devices are provided which will be described for changing the position of not only one but of all the stop members at predetermined intervals, or after each eight cars have been placed in the train, if the machine is so made and the shape of the stop member is to conform to cars in series of eight. This mechanism which will be described, is also adapted to serve as a tallying device for registering the number of cars placed in a train. It will be noticed from the drawings that the peripheral edges of the stop members as you leave those representing the unit of forty (40) tons and upon opposite sides thereof, are more and more irregular, that is to say, the off-sets become greater. While the stop members which represent the unit of forty (40) tons are provided with a series of contact faces which are similar the remainder of the contact faces are more and more depressed. This is to accommodate the placing of a given number of forty (40) ton cars in the train, and when placing a forty (40) ton car after the train has reached a certain length, the face of the forty (40) ton stop members is provided with a series of increasing irregular portions to properly compute the resistance in the forty (40) ton car when placed in the train as stated.

The shaft which has been referred to as 10 is here shown in two parts and connected by the sleeve 49ª. At or near the outer end, the shaft 10 carries a pair of gear wheels 50 and a pair of unit wheels 51 and 52. The gear wheels 50 will have teeth in number to correspond to the acting faces of the cams. As was stated, the cams in the present application are provided with eight portions, therefore the wheels 50 are each provided with eight teeth. This will also be true of the unit wheels which will register with every depression of a key-bar 37. This is accomplished by means of a gear wheel 53 corresponding to the gears 50 and is carried on the outer end of the shaft 16; this shaft like the shaft 10 is in two parts and is connected by sleeve 54. To operate the gear 53 for transmitting power to one of the gears 50 with each depression of the key, I have provided a ratchet bar 55, the lower end of which is carried by the rod 30 forming one of the elements of the link-frame. The upper end of the ratchet bar has a toothed portion adapted to engage with a ratchet wheel 56 carried by the shaft 16, and may be integral with the wheel 53, if desirable. A spring 57 attached to the shaft 30 and bearing against the rear of the ratchet bar 55, serves to hold the same in position for engagement with a tooth of the ratchet wheel 56; so that with each depression of a key-bar 37, the tooth of the ratchet bar will impart a partial rotation to the shaft 16 by engagement with a tooth of the ratchet wheel and cause the wheel 53 to move one of the wheels 50 the space of a tooth and register the same on the unit or tallying wheel 51. With every complete revolution of the wheel 51, it is adapted to move the unit wheel 52 the space of one tooth, for the purpose which is clearly apparent and well known with this form of tallying device. I accomplish this by securing a segmental gear 57ª having one tooth on the shaft 16, the tooth of which is adapted to intermesh with the teeth of the gear wheel 50, adjacent to the unit wheel 52. And as was stated above, the actuation of the tallying device is also employed for the purpose of imparting a partial rotation to the shaft 42 which carries the stop members after a given number of strokes have been applied to any one key-bar or a series of such key-bars in succession. This is accomplished by a gear wheel 58, in all respects similar to the wheels 50 and 53, and is secured on the shaft 42 and intermeshes with one of the wheels 50, best seen in Figs. 3, 4 and 8.

The registering tape or scale 6 is provided with suitable signs or marks and numerals to indicate degrees of tonnage which are adapted to pass beneath a sight opening 59 in the upper face of the casing 1. The form of the registering tape may be as shown in either one of the views as illustrated in Fig.

10, or of any other suitable form. The tallying wheels 51 and 52, like the tape, pass beneath a sight opening indicated as 60, so that in the operation of the machine, an operator can determine at once the number of tons resistance registered upon the registering device, and the number of cars placed in the train as registered by the tallying device. Both the tonnage registering tape and the tallying wheels may be adjusted or reversed from the outside of the machine. To reverse the tape or to move it backward a suitable distance, a hand wheel 61 has been provided secured upon the outer end of the shaft 4 as seen in the figures and the arrangement of the ratchet teeth 24 described as being normally held away from the teeth of the ratchet wheel 6, will permit of the reverse movement just described, and the pawl 24 is so disposed that a preliminary depression must be given to the key-bars 37 before the pawl engages with the teeth of the ratchet wheel. This preliminary movement of the key-bars is made without affecting the position of any of the parts by leaving a sufficient amount of space between the shaft or bar 30 and the lower face of the key-bars 37 when they are in their normal position. It is adapted to have the pawls 34 with three engaging points, one shorter than the other so as to provide their ready engagement with any one tooth of the ratchet wheel 6 as the link-frame is depressed. The means for reversing the tallying device is similar to the tonnage registering mechanism and is accomplished by means of a hand wheel 62 on the outer end of the shaft 16, and upon the outside of the device which is also the case with the hand wheel 61.

In the present device, the arrangement of the irregular acting faces of the stop members is to provide for making up trains of cars from the power rearward or when switching in cars at points remote from the power. The reverse of this may be accomplished by reversing the arrangement of the stop members and provide for picking up cars next to the engine or power to save backing engine and cars into side tracks, and further, will save equating cars in train when more are added. This and many forms of arranging and equating with the devices here shown, may be provided, and I do not wish to be confined to the specific structure as herein shown.

I have provided the casing with a cover 63 hinged at 64 and adapted to be locked at 65. The same may be swung backward to expose to view the operative parts of the apparatus and give access thereto.

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 described, a key, mechanism for limiting the stroke of said key, and means for automatically changing the position of said limiting mechanism after a predetermined number of strokes of said key, and thereby change the distance of stroke of said key.

2. In a device of the character described, registering mechanism, a key for operating said mechanism, mechanism for limiting the stroke of said key, and means for automatically changing the position of said limiting mechanism after a predetermined number of strokes of said key, and thereby change the distance of stroke of said key.

3. In a device of the character described, the combination of a plurality of numbering wheels, a plurality of keys each adapted when operated to actuate said numbering wheels, mechanism for limiting the stroke of each of said keys, and means for automatically changing the position of said limiting mechanism after a predetermined number of strokes of said keys, and thereby change the distance of stroke of said keys, said limiting mechanism being so arranged as to cause the numbering wheels to register and display a greater amount each time the position of said limiting mechanism is changed.

4. In a device of the character described, registering mechanism, keys for operating said mechanism, limiting means for said keys, mechanism for automatically changing the limiting means, and mechanism operated by the keys for controlling the change of said limiting means.

5. In a device of the character described, a key, means for regulating the length of stroke of said key when said key is being depressed, and means for automatically changing said regulating means, thereby allowing said key to be depressed a greater distance with each change of said regulating means.

6. In a device of the character described, a series of keys, each succeeding key independently movable, and capable of being moved a greater distance than the preceding key, limiting means for each key, and means for automatically changing the position of all of said limiting means after a given number of strokes of one or several keys.

7. In a device of the character described, a shaft, a stop member on said shaft, its periphery provided with a series of irregular portions, a key-bar, and means attached to the key-bar and adapted to coact with the several irregular faces of the stop member during the successive operation of said key-bar for the purpose of limiting the length of the stroke of said key-bar.

8. In combination, registering mechanism, a series of key-bars adapted to actuate such mechanism, means for limiting the movement of the key-bars, and mechanism

for automatically changing said limiting means, whereby said key-bars may have an invariable stroke prior to each change of the limiting means and a variable stroke with each change of said limiting means.

9. Mechanism for registering the tonnage resistance in trains of cars, comprising a movable tape having thereon certain signs and numerals indicating tons, a series of key-bars, one or more numerals on each key-bar, limiting means for said key-bars, and means for automatically changing the position of said limiting means after a predetermined number of strokes of any one or several of said keys.

10. Mechanism for registering the tonnage resistance in trains of cars, comprising a registering tape, a revoluble device for moving the tape, a plurality of keys, each of which are adapted to actuate said revoluble device, limiting means for each of said keys, and mechanism operated by the keys for changing the position of said limiting means, whereby with each change of said limiting means, the stroke of each key when depressed will be different than it was before such change of said limiting means.

11. In a device of the character described, an oscillatory key-bar, a bar attached to said key-bar and having a depending lip, limiting means co-acting with the lip of said key-bar, and means operated by the key-bar for changing the position of the limiting means.

12. In a device of the character described, a shaft, a stop member carried on said shaft and having a series of irregular acting portions, a key-bar, a member attached to said key-bar and movable across the axis of the shaft, said member provided with means adapted to co-act with the acting portions of the stop member.

13. The combination of a key-bar, a stop-member provided with a series of irregular acting portions coöperating with said key-bar to limit the length of stroke of said key-bar, and means for automatically moving the stop-member, after a predetermined number of strokes of said key-bar.

14. In a device of the character described, the combination with a key-bar, of a stop-member provided with a series of uniform acting portions and a series of graduated acting portions, and means connected with said key-bar coöperating with the acting portions of said stop-member.

15. In a device of the character specified, a shaft, a series of stop-members carried on said shaft, the periphery of succeeding stop-members having graduated portions, a series of key-bars corresponding in number to the number of stop-members, and a series of bars carried by said keys provided with portions adapted to co-act with the stop-members, and graduated for the purposes specified.

16. In a device of the character specified, tonnage registering mechanism, a car tallying device, a link frame and connections between the link frame, the tonnage registering and tallying devices, a plurality of key-bars adapted to actuate the link frame and thereby impart movement to the tonnage and tallying devices, and limiting means for each of said key-bars, which said limiting means is automatically operated after a predetermined number of strokes of any one or several of said keys, whereby each of said key-bars are adapted to have an invariable stroke for a predetermined number of strokes, and a variable stroke at predetermined intervals.

17. A device for registering the tonnage resistance in trains of cars, comprising a casing having sight openings, tonnage registering mechanism disposed beneath one of said sight openings, a tallying device disposed beneath the other of said sight openings, a plurality of depressible key-bars extending through the casing and provided with buttons on their outer ends, upon which are arranged certain characters, a link frame, connections between the link frame, the tonnage registering and the tallying devices, the link frame so disposed with reference to said key-bars as to be actuated by the depression of any one of said key-bars, limiting means for each of said key-bars, and means for automatically changing the position of said limiting means.

18. In a device of the character specified, registering mechanism, a key for operating said registering mechanism, limiting means for said key, and means operated by said key for automatically changing the position of said limiting means, for adding on the registering mechanism with each change of the limiting means, an amount different from what is called for by the key, and also an amount different from that registered prior to each change of said limiting means.

19. In a device of the character specified, registering mechanism, a plurality of keys for operating said mechanism, each provided with one or more numerals, the operation of certain of said keys adding to and being displayed by said mechanism, an amount different to that indicated by the numerals on such keys.

20. In a device of the character described, registering mechanism, a key for operating said mechanism and provided with one or more numerals, said key when given a full stroke capable of being depressed an invariable distance for a predetermined number of strokes, means for automatically changing the distance the key may be moved, whereby after a predetermined number of full strokes of said key, the distance of its stroke is varied, the operation of the key adding on the registering mechanism synchro-

nously with each change of stroke, amounts at variance to the numerals appearing on said key.

21. In a device of the character specified, registering mechanism, a key-bar for operating said mechanism and provided with one or more numerals, a shaft, a member carried by said shaft and provided with a series of uniform and irregular acting portions, means carried by said key which will engage with the aforesaid member with each full stroke of the key, means for automatically operating the said shaft to shift the position of the member thereon after a predetermined number of strokes of said key for changing the distance which the key may be moved, and thereby cause said key to operate the registering mechanism to add variable amounts.

22. In a device of the character described, adding mechanism, a key for operating said mechanism, and means operated by the key for automatically varying the stroke of the key.

23. In a device of the character described, adding mechanism, a key for operating said mechanism, one or more numerals on said key, and means operated by the key for automatically varying its stroke, to change the amount to be added by said mechanism with each change in stroke of said key.

24. In a device of the character described, a plurality of keys, numerals on each key representing an actual weight of a car and contents, a registering device, mechanism controlled by said keys for operating the registering device, said mechanism when operated, causing the registering device to add and display an arbitrarily selected amount, and at variance to the numerals displayed on the key.

25. In a device of the character described, a plurality of keys, each succeeding key from one side capable of being depressed a greater distance than its preceding key, one or more characters on each key arranged in numerical order, means for limiting the stroke of each key, and means for changing all of the limiting means so as to increase the distance of stroke which may be given to all the keys.

26. A tonnage equating device, comprising a suitable register, a plurality of keys, each of which are provided with characters in numerical arrangement to denote the gross weight of different cars, and means controlled by the keys for imparting movement to the register, with each operation of said keys, to display on the register the resistance of a car in lieu of the gross weight thereof.

27. A tonnage equating device, comprising a register, a car tallying device, a plurality of keys for actuating said register, the actuation of a key also adapted to impart motion to the tallying device, one or more characters on the keys in numerical arrangement to denote the gross weight of cars, mechanism actuated by the keys for imparting movement to the register, and to cause said register to display the resistance of a car in lieu of the gross weight thereof.

28. In a device of the character described, a registering device for automatically equating the draw-bar pull of cars of different gross weight at different locations in a train, of a series of keys, characters on each key for denoting the gross-weight of different cars, mechanism interposed between the keys and registering device and operated by said keys to actuate said register, and means for automatically changing the position of said interposed mechanism after a predetermined number of operations of one or more keys.

29. In a device of the character described, a member having a series of irregular faces, a key, said key during a given number of strokes adapted to have engagement with one of the faces of said member and after a predetermined number of strokes adapted to successively engage the successive faces of said member, and means for automatically changing the position of said member.

30. In a device of the character described, a member having one or more uniform faces and one or more irregular faces, a key, said key during a given number of strokes adapted to have engagement with one of the faces of said member, and after a predetermined number of strokes adapted to successively engage the successive faces of said member, and means for automatically changing the position of said member.

31. In a device of the character described, a registering device, a lever, means engaged by the lever for limiting its stroke when depressed, so that the stroke may be made invariable for a predetermined number of strokes, means for automatically changing the position of the limiting means, so that the stroke of the lever as it is successively depressed, may be made variable for a predetermined number of strokes, a ratchet and pawl mechanism for moving the register, and connections between the ratchet and pawl mechanism and said key.

32. In a device of the character described, the combination of an intermittently revoluble shaft, a series of members having a series of irregular faces, secured on said shaft, levers in operative engagement with said members and the irregular faces thereof, and means actuated by one of said levers after a predetermined number of strokes of one or several of said levers for partially rotating said shaft and the members thereon.

33. In a device of the character described, the combination of a registering device, a car-tallying device provided with a series of characters in numerical arrangement, a series of levers each of which have a stroke

at variance with its preceding lever, when said levers are fully depressed, means for actuating said registering device by either of said levers, a ratchet mechanism for actuating the tallying device, and means controlled by any one of said keys for actuating such ratchet mechanism and thereby the tallying device upon the stroke of any one of said keys.

34. In a device of the character described, the combination of a registering device, a car-tallying device coöperating therewith, a series of keys, numbers on each of said keys, means operated by any one of said keys for adding to and displaying on said register an amount at variance to and different from the numbers on said keys, a ratchet mechanism controlling said tallying device, a reciprocally supported bar having a dog adapted to have engagement with said ratchet mechanism, and means controlled by any one of said keys for moving said reciprocally supported bar.

35. In a device of the character described, a member having a series of graduated off-sets, a key, and means connected with said key adapted to have engagement with each of the off-sets of the member, in succession and after a predetermined number of strokes of said key.

36. In a device of the character described, a member having a series of graduated off-sets, a key, means connected with said key adapted to have engagement with each off-set of the member for a predetermined number of strokes, and means operating after a predetermined number of strokes of said key for advancing successively the off-sets of the member.

37. In a device of the character described, a registering device, a key having a suitable numeral, and adapted to operate said registering device, means for limiting the stroke of said key, thereby governing the movement of the registering device, so that for a predetermined number of strokes of the key the registering device will register an amount corresponding to the numeral on the key, and means for automatically changing the position of the limiting means, so that the stroke of the key may be increased and operate to cause said registering device to add an amount different to what is called for by said key.

38. In a device of the character described, a key, means for limiting the movement of said key for a predetermined number of strokes, and means for automatically changing said limiting means, so that said key may have a different movement, after a predetermined number of strokes.

39. In a device of the character described, registering mechanism, a key for actuating said mechanism, means for limiting the movement of said key for a predetermined number of strokes, and means for automatically changing said limiting means, so that said key may have a different movement, after a predetermined number of strokes.

40. In a device of the character described, the combination of a key-bar, and a stop member co-acting with said key-bar, said member being provided with a plurality of irregular faces to limit and to permit a difference in movement of said key-bar after a predetermined number of strokes of said key-bar.

41. In a device of the character described, the combination of a key-bar, and a movable member co-acting with said key-bar, said member being provided with a plurality of irregular faces to limit and to permit a difference in movement of said key-bar after a predetermined number of strokes of said key-bar.

42. In a device of the character described, the combination with a key-bar, of a revoluble stop member provided with a series of uniform acting portions and a series of graduated and depressed acting portions, and means connected with said key-bar cooperating with the acting portions of said stop member.

43. In a device of the character described, registering mechanism, a key, means for limiting the key stroke, so that said key may have an invariable stroke for a predetermined number of strokes, and with each stroke operate said mechanism, and means for automatically changing said limiting means, so that said key may also have a different stroke, after a predetermined number of strokes, and to operate such registering mechanism with each variable stroke.

44. In a device of the character described, a key, means for limiting the key stroke, so that said key may have an invariable stroke for a predetermined number of successive strokes, and means for automatically changing said limiting means, so that said key may also have a different stroke after a predetermined number of strokes, the stroke of the key increasing at each variation.

45. In a device of the character described, the combination of a series of keys each having independent movement, means for limiting the key stroke, so that said keys may have an invariable stroke for a predetermined number of strokes, and means operated by said keys for automatically changing said limiting means, so that said keys may also have a different stroke after a predetermined number of strokes, said keys arranged so as to have their strokes varied simultaneously, and any one of said keys after a predetermined number of strokes of any one or all of said keys, adapted to operate to change said limiting means.

46. In a device of the character described, the combination of a series of keys each hav-

ing independent movement, means for limiting the key stroke, so that said keys may have an invariable stroke for a predetermined number of strokes, and means operated by said keys for automatically changing the position of said limiting means, so that said keys may also have a different stroke after a predetermined number of strokes, certain of said key limiting means arranged to have their positions simultaneously changed after a predetermined number of strokes of certain of said keys, and certain other of said key limiting means arranged to have their positions changed after a predetermined number of strokes of certain other of said keys, but only after a predetermined number of changes in the aforesaid key limiting means.

47. In a device of the character specified, registering mechanism, a key for operating said mechanism and provided with one or more numerals, the operation of the key at all times adding on the registering mechanism an amount at variance to and different from the numerals appearing on the key.

48. In a device of the character described, registering mechanism, a key for operating the said mechanism and provided with one or more numerals, the operation of the key adding on the registering mechanism an amount at variance to and different from the original amount, the difference in the two amounts equaling a number at variance to and different from the numerals appearing on the key.

49. In a device of the character described, registering mechanism, a key for operating said mechanism and provided with one or more numerals, means for limiting the key stroke, so that said key for a predetermined number of strokes will add on the registering mechanism an amount equal to that called for on the key, and means operated by said key for automatically changing the position of said limiting means so that at predetermined intervals said key when operated will add on such mechanism an amount at variance with the numerals appearing on the key.

50. In a device of the character specified, registering mechanism, a key for operating said mechanism provided with one or more numerals, the operation of the key adding to the registering mechanism an amount at variance to and different from the numerals on the key, the amount added being less than that called for by said key.

51. In a device of the character specified, registering mechanism, a key for operating said mechanism and provided with one or more numerals, the operation of the key adding to the registering mechanism an amount at variance to and different from the numerals on the key, the amount added being more than that called for by the said key, and means for automatically changing the distance which the key may be moved, so that after a predetermined number of strokes of said key, said key when operated will increase the amount previously added to said mechanism.

52. In a machine for equating train tonnage, registering devices, mechanism for operating said devices, and means based on a unit of rating coöperating with said mechanism.

53. In a machine for equating train tonnage, registering devices, mechanism for operating said devices, and means based on a unit of rating interposed between said registering devices and said operating mechanism for limiting the movement of the latter.

54. In a machine for equating train tonnage, registering devices, means based on a unit of rating and representing gross weight of different cars, coöperating with the registering devices, and mechanism for operating the registering devices, coöperating with the rating means, whereby with each operation of the registering devices, said devices will display the resistance of a car in lieu of its gross weight, and to indicate amounts equal to the unit, amounts greater than certain weights of cars less than the unit, and amounts less than certain weights of cars greater than the unit.

55. In a computing machine, in combination, registering means, a plurality of movable members operatively connected with the registering means and having associated therewith designating characters serving as a guide in the operating of the registering means, and means for limiting the movement of said members, said limiting means being so arranged that the registering means when operated by certain of the members in accordance with the characters associated therewith, will register an amount equal to said designating characters, and when operated by certain other of said members in accordance with the characters associated therewith, will register an amount greater, than said designating characters, and when operated by certain other of said members in accordance with the characters associated therewith, will register an amount less, than said designating characters.

56. In a computing machine, in combination, registering means, a plurality of movable members operatively connected with the registering means and having associated therewith designating characters serving as a guide in the operating of the registering means, means for limiting the movement of said members, said limiting means being so arranged that the registering means when operated by certain of the members in accordance with the characters associated therewith, will register an amount equal to said designating characters, and when op-

erated by certain other of said members in accordance with the characters associated therewith, will register an amount greater, than said designating characters, and when operated by certain other of said members in accordance with the characters associated therewith, will register an amount less, than said designating characters, and mechanism for tallying each operation of said movable members.

57. A device for reducing gross tons and cars and contents to tons of draw-bar pull, comprising adding devices, means for adding on said 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 adding devices, thereby causing said devices 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 the train.

58. A device for reducing gross tons and cars and contents to tons of draw-bar pull, comprising adding devices, means for adding on said 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 adding devices, thereby causing said devices 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 the train, and means for tallying each movement of the adding devices.

59. In a device of the character specified, the combination of a suitable arrangement of numerals representing gross tons of cars and contents, registering mechanism, means associated with said numerals for actuating said registering mechanism whereby the said mechanism is caused to add amounts at variance to that called for by the numerals aforesaid, being equal to the draw bar pull of cars and contents, and means for increasing the allowance made to each gross weight of car and contents at predetermined intervals.

60. In a device of the character specified, the combination of a suitable arrangement of numerals representing gross tons of cars and contents, registering mechanism, means associated with said numerals for actuating said registering mechanism whereby the said mechanism is caused to add amounts at variance to that called for by the numerals aforesaid, being equal to the draw bar pull of cars and contents, and means for automatically increasing the allowance made to each gross weight of car and contents at predetermined intervals.

61. In a device of the character specified, the combination of a suitable arrangement of numerals representing gross tons of cars and contents, registering mechanism, means associated with said numerals for actuating said registering mechanism whereby the said mechanism is caused to add amounts at variance to that called for by the numerals aforesaid, being equal to the draw-bar pull of cars and contents, means for increasing the allowance made to each gross weight of car and contents at predetermined intervals, and means for tallying each movement of said registering mechanism.

62. In a computing machine, in combination, registering means, a plurality of movable members operatively connected with the registering means and having associated therewith designating characters serving as a guide in the operating of the registering means, and means for limiting the movement of said members, said limiting means being so arranged that the registering means when operated by certain of the members in accordance with the characters associated therewith, will register an amount equal to said designating characters, and when operated by certain other of said members in accordance with the characters associated therewith, will register an amount greater than said designating characters.

63. In a computing machine, in combination, registering means, a plurality of movable members operatively connected with the registering means and having associated therewith designating characters serving as a guide in the operating of the registering means, and means for limiting the movement of said members, said limiting means being so arranged that the registering means when operated by certain of the members in accordance with the characters associated therewith, will register an amount equal to said designating characters, and when operated by certain other of said members in accordance with the characters associated therewith, will register an amount less than said designating characters.

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

JOHN M. DALY

Witnesses:
G. M. Wood,
Julius I. Iverson.