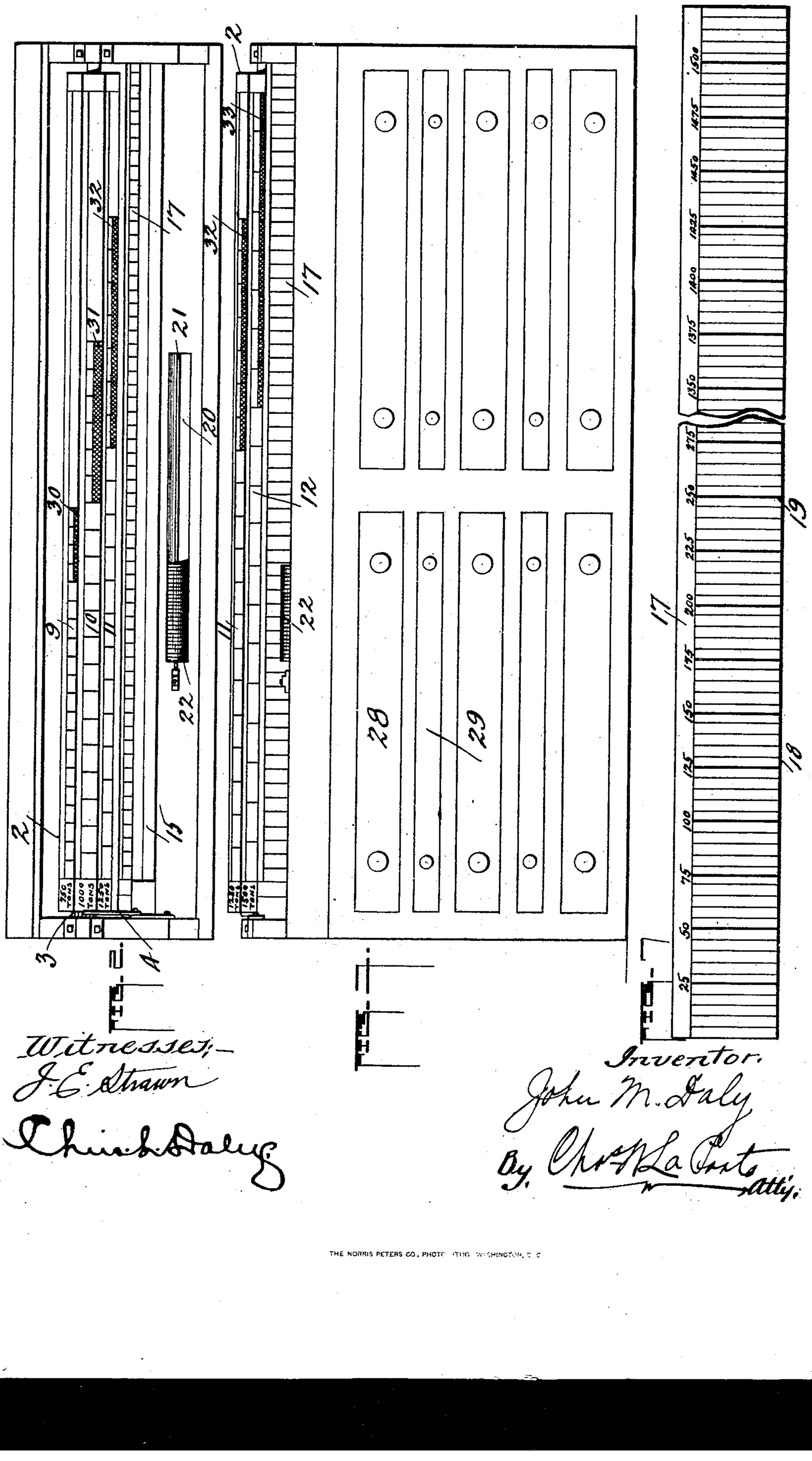
No. 715,199. Patented Dec. 2, 1902.

J. M. DALY.

SYSTEM FOR COMPUTING THE RESISTANCE OF RAILWAY TRAINS.

(Application filed Dec. 16, 1901.)

(No Model.) 3 Sheets—Sheet 1.



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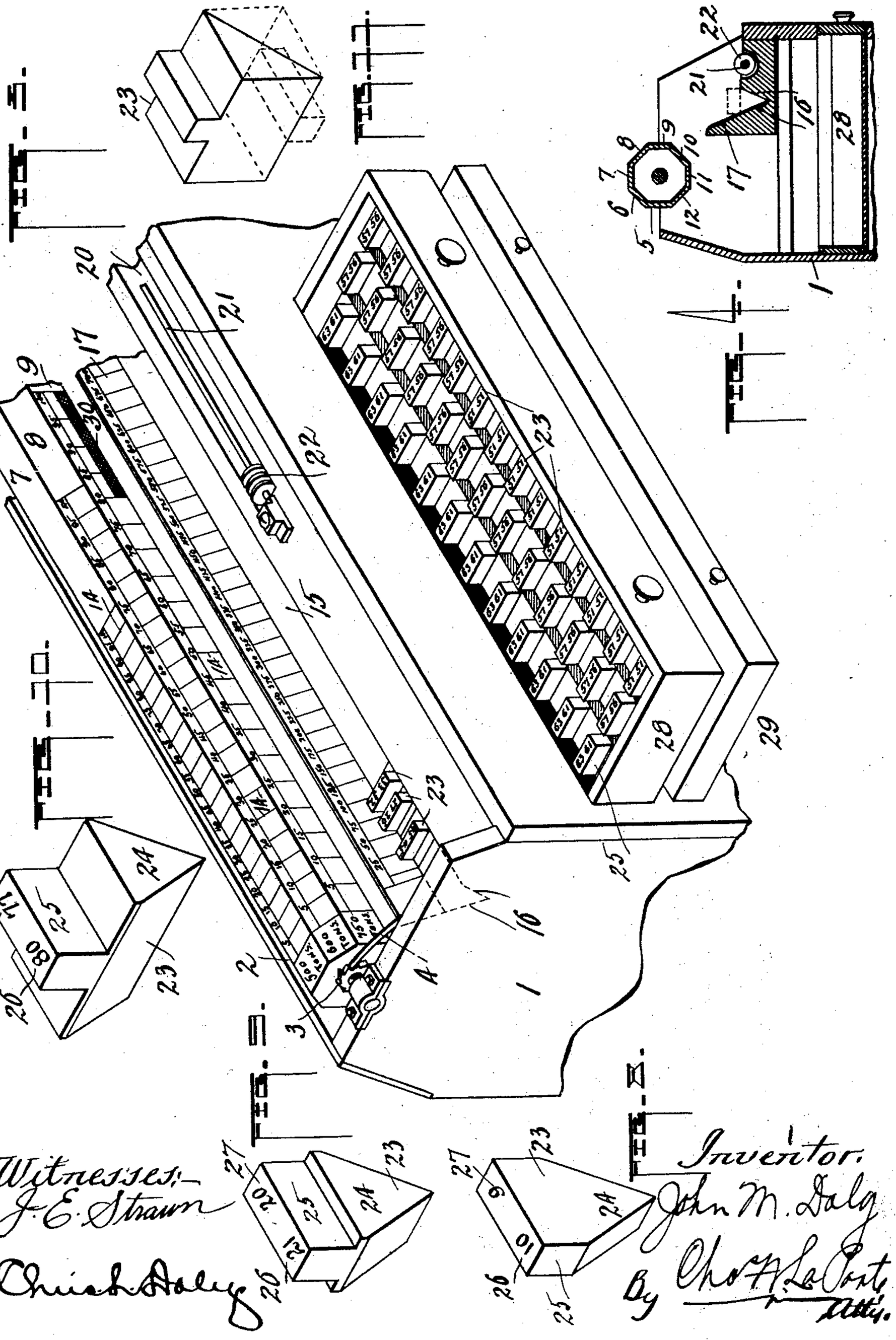

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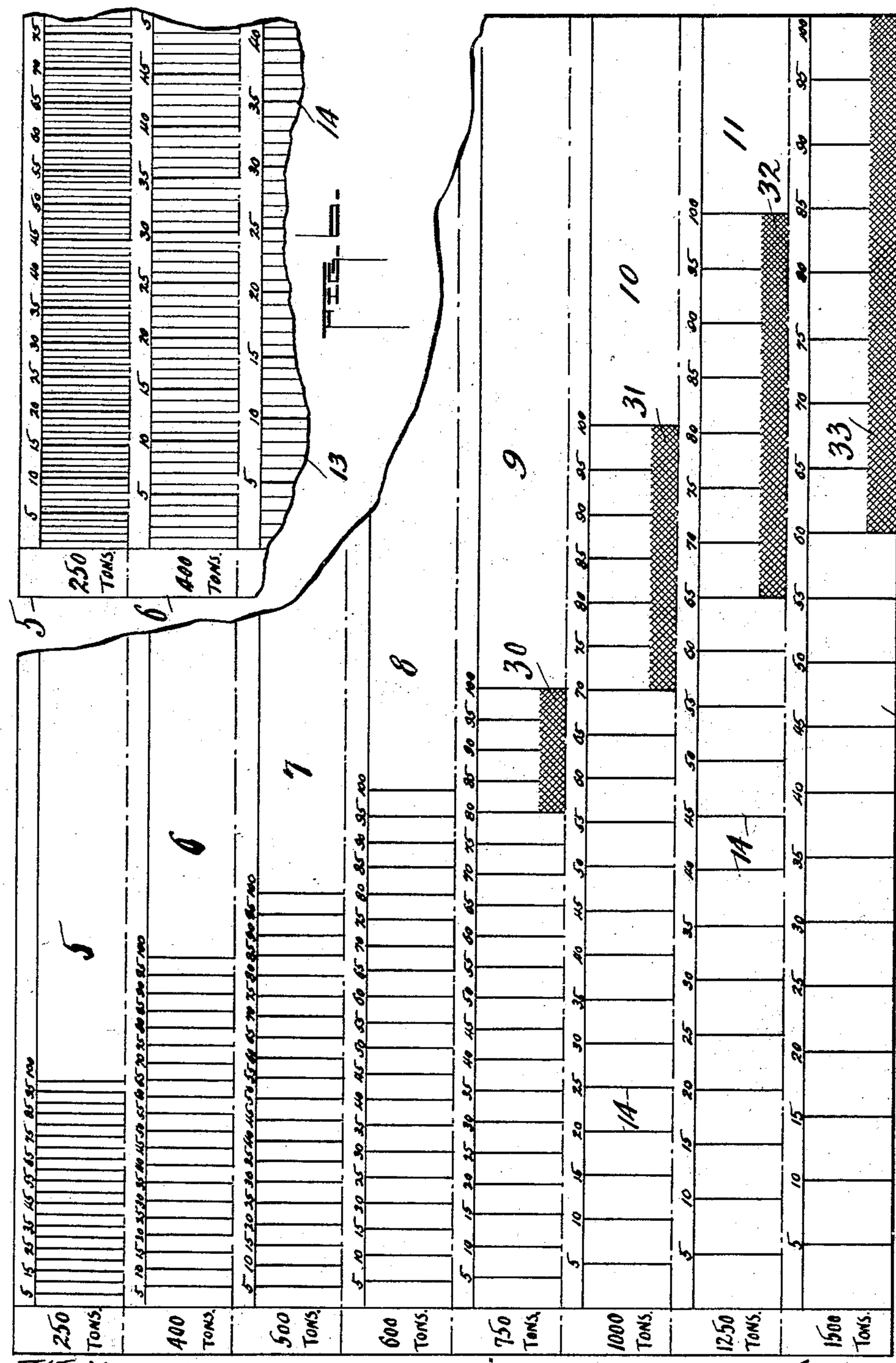
(No Model.) 3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

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SYSTEM FOR COMPUTING THE RESISTANCE OF RAILWAY TRAINS.

SPECIFICATION forming part of Letters Patent No. 715,199, dated December 2, 1902.

Application filed December 16, 1901. Serial No. 86,184. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. DALY, a citizen of the United States, residing at Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Systems for Measuring Resistance of Railway-Trains; 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 system for measuring the resistance of railway-trains.

The system used by most roads for determining the pulling tests of engines is by rating the locomotive on a tonnage basis, which consists in computing the actual weight of the cars and contents; but in my system the rating of locomotives is based on the resistance of the train to be hauled.

The method referred to as being used by most roads for determining the rating of locomotives is to switch, say, one thousand tons of cars and contents together, made up of light and heavy loads, take an engine that has been thoroughly inspected and overhauled, and make the test invariably in the day-time and under most favorable conditions. If in switching and making up the train they get the greater portion of the cars of large capacity heavily loaded and the engine succeeds in hauling them over the division in the time allowance, that decides its rating at one thousand gross tons. This same method will not hold good if the test is made again with same engine and under similar conditions if a majority of small-capacity cars light-loaded are used.

The principle upon which my system is based is to build up a train of cars all of the average gross weight hauled. For instance, the railroad has cars weighing ten tons light and others twelve, twenty, twenty-five, thirty, up to seventy tons gross, the average gross weight of cars being forty tons. Then forty-ton cars become the basing unit, and train should be made up with twenty-five cars forty gross tons each, equal to one thousand. If after testing it is found that engine used its maximum power to haul train within time limit, then one thousand gross tons stand as its rating. Now if engine hauls one thousand tons of forty-ton cars it should haul ten hundred and seventy-five tons of fifty-ton cars, eleven hundred and fifty tons sixty-ton cars, and thirteen hundred tons seventy-ton cars, as the resistance of train is reduced to that extent by reason of large-capacity and heavy-tonnage cars as compared with the rating unit of forty tons. Hence railroads using the old basis of rating engines lose at times nearly thirty-three per cent. of their power, which cannot be regained. It has been claimed by some that what tonnage an engine fails to haul under the above conditions is equally made up when empty and light-loaded cars are handled; but such cannot be the result, as an engine rating based on forty-tons unit will be found to haul one thousand tons forty-ton cars, will haul only nine hundred and twenty-five tons of thirty-ton cars, eight hundred tons of twenty-ton cars, and will only haul seven hundred tons of ten-ton cars. Now if seven hundred tons of ten-ton cars have one thousand tons resistance it is impossible for an engine correctly rated at one thousand tons of forty-ton-unit cars to haul more than seven hundred tons of ten-ton cars, and unless engine is allowed an arbitrary rating per car it cannot get train over the ruling grades without doubling and delaying itself and other trains. Some roads have made special rulings in their tonnage rules to the effect that empty cars must be rated five tons in excess of their stenciled weight. This rule while in the right direction does not obtain the end desired for the reason, first, an eight-ton empty car is rated at thirteen tons, a ten-ton empty car is rated at fifteen tons, a fifteen-ton empty car is rated at twenty tons, a twenty-ton empty car is rated at twenty-five tons; second, a ten-ton empty box-car measures thirty-seven feet, a twenty-ton empty refrigerator-car measures thirty-six feet; third, the length of cars for curvature and wheel-resistance is equal, but the fact that the weight of refrigerator-car body (ten tons) on bearings is not equal to the resistance of the empty car, the twenty-ton car should not receive equal allowance, but the ten-ton car should receive five tons allowance and the twenty-ton car three tons. Again, you have a ten-ton box-car containing two tons of merchandise. It is rated or classed as a loaded car and rated at twelve tons, whereas the

empty refrigerator-car weighs twenty tons and receives five additional tons allowance. Now the two tons of merchandise has the same effect on car-bearings as two tons of insulation, ice-box, or padding in the refrigerator-car. The wheel, flange, and length of train are the same, and why not allow the twelve-ton box-car five additional tons to equalize with the other. In other words, put twelve tons of freight into the refrigerator-car and it will not equal the hauling resistance of the twelve-ton box-car, although that is practically the basis on which they are rated. Some roads rule that when fifty per cent. of rating consists of empty cars an allowance of five tons over stenciled weight will be allowed for each additional empty car added to the train thereafter. No provision whatever is made for light-loaded cars that weigh no more than some empty cars added. Other roads rule that empty cars receive a graded allowance—for instance, a ten-ton empty car receives five tons, a fifteen-ton empty car receives three tons, and a twenty-ton empty car receives two tons. No provision is made for light-loaded cars, showing conclusively that practical operation of the present tonnage basis has developed the fact that allowance must be made for empty and light-loaded cars, while the fact that engines should haul more than their assigned rating when train consists of large-capacity cars results in a clear loss to the company. My system of determining this tonnage resistance may be more fully understood and explained by a description of a mechanical device which is employed for that purpose illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the device. Fig. 2 is a plan view. Fig. 3 is an enlarged perspective of part of the device. Fig. 4 is a cross-section through a portion of Fig. 1. Fig. 5 is a plan view, enlarged, of a percentage-scale. Fig. 6 is a section of a full-sized per-cent. scale. Fig. 7 is a plan of the tonnage-chart, and Figs. 8, 9, 10 illustrate in perspective slugs used in conjunction with said per-cent. scale and tonnage-chart. Fig. 11 illustrates in perspective a modified slug, two of which may be cut from a square, as shown in the figure.

The present device is worked out somewhat on the same lines as the device illustrated and claimed in my application bearing Serial No. 76,996 and filed September 30, 1901, wherein an indicator is employed for measuring the resistance by decreasing the intervals on tonnage-scale chart and using uniform blocks, the scale being shrunk or decreased in an average manner to provide for resistance; but in this present invention the scale, both per-cent. and tonnage charts, are uniform in order to use slugs or blocks that will measure the resistance instead of the actual tons of cars and contents.

The device comprises a case 1, of suitable dimensions, in which is journaled a polygonal-shaped revoluble roll 2, on one end of which is provided a ratchet-wheel 3, engaged by a spring-pawl 4, secured at one end to the case. The shape of the present roll is that of an octagon, upon which I arrange a per-cent. chart, with scales designated as two hundred and fifty, four hundred, five hundred, six hundred, seven hundred and fifty, one thousand, twelve hundred and fifty, and fifteen hundred tons hauling capacity, referred to as "5," "6," "7," "8," "9," "10," "11," and "12," each of said scales consisting of transverse lines 13 and 14, said lines arranged at uniform distances from each other and representing the hauling percentage of each engine from one to one hundred, and with the number of tons hauling capacity of each scale to the left of the same to indicate to what tons the same is adjusted.

15 is a trough arranged in the case in front of and adjacent to the roll 2. The same has beveled sides 16, and upon the beveled face in juxtaposition to the roll is placed a tonnage-chart comprising a uniform scale 17, with transverse lines 18 and 19, ranging from one to fifteen hundred actual tons, and with suitable characters indicating tons on the scale.

In an upper flat face of the case I have provided a groove 20, semicircular in form, extending a short distance in the case, and 21 is a rod passing through said groove, on which is carried a series of buttons or disks 22, arranged for a purpose to be described.

23 indicates slugs or blocks, which vary some in length—that is to say, a slug representing a car of ten tons, as shown in Fig. 8, is much smaller in length than that marked twenty-one tons or eighty tons. (Shown in Fig. 9 and 10.) They are each provided with beveled or wedge-shaped portions 24, with upper flat extensions 25, upon which are placed or arranged suitable characters or numerals 26 and 27, which are of opposite or varying colors—say black and red. In the case proper is provided a series of partitioned drawers 28 and a series of shelves 29. In these drawers 28 I arrange to carry the slugs 23, as is clearly shown in Fig. 3, and the shelves 29 may be used, upon which may rest the drawers when pulled or odd slugs. After testing a division and determining what the unit or average ton per car will be of an entire equipment the slugs for this division which represent cars are rated on the number of tons of average-weight cars in use. Hence if a road has two thousand twenty-five-ton cars, which are equal to fifty thousand tons hauling capacity; ten thousand thirty-ton cars, equal to three hundred thousand tons hauling capacity; forty thousand forty-ton cars, equal to one million six hundred thousand tons hauling capacity; ten thousand fifty-ton cars, equal to five hundred thousand tons hauling capacity, and five thousand sixty-ton cars, equal to thirty thousand tons hauling capac-

ity, the average will be thirty-seven tons per car of its entire equipment, and the test is made substantially as hereinbefore set out to determine the exact rating of the engine. After determining this unit you contract the larger-capacity cars over the unit and expand the slug for cars less than the unit in proportion to heavy or light tonnage. The heavier the tonnage the greater the contraction allowance is made in slugs as compared with chart, and the lighter the cars the greater is the expansion allowance made. This is further understood by supposing that a forty-five-ton car is the basing unit; so if we take ten slugs, number "45," and place them in the trough alongside of tonnage-scale they measure exactly four hundred and fifty tons; no allowance made, as forty-five tons is basing unit; but place ten slugs, number "70," in trough and the same measure about six hundred tons of resistance instead of seven hundred, and if ten blocks or slugs, number "10," are placed in trough they measure one hundred and fifty tons of resistance or fifty tons 2; in excess of actual weight—that is, if the basing unit is forty-five tons, as suggested. This of course varies according to the basing unit, but is sufficient to show method of contracting and expanding resistance. In numbering the slugs I have not numbered them in consecutive order, but have aimed to designate cars of certain capacity, and thus avoid the use of too many slugs, and by so doing make use of the buttons or disks 22, slidable on the rod 21, the slugs being numbered as "10," "15," "21," "27," "33," "38," "45," &c. The function of the disks will be more fully understood from the following: In making up trains by representation of slugs indicating cars which are placed in the case if way-bill or manifest calls for a car weighing twelve tons, by reason of there being no number "12" ton slug the operator will place a "10" block in the trough and push two buttons 22 to the opposite end of the rod 21, which indicates twelve tons and corresponds to way-bill. If the next car is a fourteen-ton car, a fifteen-ton slug is placed in the trough and one of the two disks previously moved to the right is moved to the left and the tonnage shows twenty-six. If the next car happens to be a thirty-four-ton car, a thirty-three-ton slug is placed in the case and one disk from the supply is again moved to the right and the tonnage indicated is sixty. In this way the actual tonnage is always measured and by the use of a limited amount of slugs, as is apparent. By the use of a slug bearing two distinguishable numerals the operator can measure the resistance due to weight on bearings based on gross weight of car and contents and also the increased resistance due to length of train and binding on curves, and this increased resistance is allowed for by the provision of suitable signs, as at "30," "31," "32," and "33," on the percentage-scales pertaining to the seven hundred and fifty, one thousand, twelve hundred and fifty, and fifteen hundred tons hauling capacity. Upon the slugs are the distinguishable characters or numerals referred to above, which are in opposite colors and coöperate with the per-cent. scales in measuring tonnage. The lowest number of the slug is designed to be of color corresponding to the color signs on the percentage-scales and to more clearly set out the use of the slugs in combination with the charts for measuring the tonnage resistance in trains of cars. On a one-thousand-ton train the trough adjacent to the tonnage-chart is filled with slugs in order corresponding to the tonnage called for on the way-bill or manifest, the black number of the slug being the one by which the measuring is done, until the indicating-sign of the percentage-scale is reached. All slugs placed in the case after reaching the color sign on the per-cent. scale, the measuring would be computed by the red number. Other colors may be employed for the numerals and would serve the same purpose as the red and black. The manner of employing these slugs with the additional character or numeral for measuring on the tonnage-scale this increased resistance due to length of train or curve is to suppose that a slug bearing the number "23" in black and "20" in red is placed in the case, the chart will indicate twenty-five tons. After placing a given number of these slugs in the case representing cars in train the resistance becomes greater, as has been said above, due to length of train, &c. Then is when the red numeral "20" on the slug is brought into play. Thus when reaching the sign on the per-cent. scale the twenty-three-ton slug is placed in case; but the numeral "20" is the basis of measuring, which is equal to the twenty-three tons in black plus the five tons' allowance, registering on tonnage-chart twenty-eight tons. This additional number of tons is accounted for by shoving the required number of disks 22 to the right on the rod 21. By the use of the sign on the per-cent. scales and two numbers on slugs it avoids making two distinct slugs to serve the same end, which is accomplished by the use of one slug with two numbers. In brief, the resistance due to weight on bearings based on gross weight of car and contents is measured by the black number in combination with tonnage-chart, and the increased resistance due to length of train or curves is measured on the chart after reaching color sign on the per-cent. scale by employing the opposite color number on the slug, that being the point at which the length of train or curves begins to affect the hauling capacity of engines.

In Fig. 11 the slug is shown cut from a substantially square block, forming a slug with a beveled face only on one side instead of a wedge, as in the other views. This cheapens the cost of production of slugs and only requires that trough shall correspond to their shape.

Other various changes may be made in the system as a whole and in the combination and arrangement of parts as illustrated in the device and details resorted to without affecting the principle of invention herein.

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

1. A system for measuring the hauling resistance of railway-trains, comprising a tonnage-scale to measure actual tons resistance, and combined therewith a slug bearing two distinguishable numerals, one measuring the resistance due to weight on car-bearings and the other to measure the resistance due to length of train or curves, substantially for the purposes described.

2. A system for measuring the hauling resistance of railway-trains, comprising a uniform tonnage-scale, one or more per-cent. charts, and slugs used in conjunction with said charts, bearing two distinguishable numerals, one numeral denoting the journal or bearing resistance based on gross weight of car and contents, and the other determining also the resistance due to binding on curves or length of train, substantially as described.

3. A system for measuring the hauling resistance of railway-trains, comprising a uniform tonnage-chart, a series of graduated uniform per-cent. charts, and slugs bearing two distinguishable numerals representing cars and coacting with said tonnage-chart, one number indicating tons of car to a specified point on the chart and the other for measuring the increased resistance due to length of train or curve after reaching such specified point, all substantially as specified.

4. In a system of the class described, a case, a tonnage-chart fixed in said case, a revoluble device having a plurality of sides upon which is arranged a series of percentage-charts to be intermittingly coacted with the tonnage-chart, slugs representing cars, having a detachable relation with the case in juxtaposition to the tonnage-chart and having two numbers in opposite colors, for computing the resistance in trains of cars, substantially as and for the purpose set forth.

5. A slug for the purposes set forth bearing two distinguishable numerals, substantially as described.

6. A slug for the purposes set forth bearing two numbers in opposite colors, substantially as described.

7. A slug for the purposes set forth, comprising a member bearing two distinguishable characters and having one of its faces beveled, substantially as described.

8. A slug for the purposes set forth, comprising a member having its body beveled, and a reduced extension upon which is arranged two numbers in opposite colors, substantially as described.

9. A system of the character described, comprising a case, a scale therein arranged with devices designating tonnage, the intervals corresponding to a given number of tons spaced uniform the length of the scale, a revoluble per-cent. chart to the rear of the tonnage-scale, having a series of scales of varying length to indicate the per cent. of hauling of engines, blocks or slugs bearing suitable characters and representing cars to coact with the charts for measuring and weighing resistance in trains, and a rod fixed at its ends in said case on which is carried a series of disks or buttons arranged for coöperation with said slugs, substantially for the purpose set forth.

10. In a device of the class described, the combination of a scale-chart arranged with devices designating actual tons resistance of cars, a series of slugs of varying length representing cars and bearing two arbitrarily selected and distinguishable numerals coacting with said chart for measuring the resistance in trains due to weight on bearings and length of train or curves, the numbering of each of said slugs determined from a basing unit, substantially in the manner and for the purposes set forth.

11. A system for measuring the hauling resistance of railway-trains, comprising a uniform tonnage-chart, a series of per-cent. charts adapted to the hauling capacity of differing engines, one or more of said per-cent. charts provided with a sign indicating on the tonnage-chart the point where increased resistance due to length of train or curve becomes a factor, slugs used in conjunction with said charts bearing two distinguishable numerals, one number indicating gross weight of car and contents to the sign on the per-cent chart and the other number determining the increased resistance after reaching the sign, substantially as and for the purposes set forth.

12. In a device of the class described, the combination of a tonnage-chart having devices for indicating tonnage resistance, a series of slugs or blocks with arbitrarily-selected numerals for coacting with the tonnage-chart in measuring tonnage of trains of cars, supplemental devices coöperating with the slugs whereby as the tonnage is measured by the slugs in combination with the chart these supplemental devices may be employed for registering on the chart amounts of tonnage not indicated by the numerals on the slugs, substantially as specified.

13. In a device of the class described, the combination of a case, having a runway or groove, a tonnage-chart upon one of the walls forming said groove, a revoluble per-cent. chart journaled in the case to the rear of the tonnage-chart and a ratchet-and-pawl mechanism for retaining the revoluble chart in adjusted positions, a series of slugs bearing two numerals coacting with the tonnage-chart by adjustment in the runway of the case, and receptacles in the case for retaining the slugs, substantially for the purposes set forth.

14. In a device of the class described, the

combination of a case, having a runway or groove, a chart arranged in said case consisting of lines and numerals for indicating tonnage resistance in trains of cars, a revoluble chart journaled in the case having a plurality of sides upon which is imprinted or otherwise suitably attached percentage-scales, color signs arranged on said per-cent. scales to indicate upon the tonnage-chart the point where increased resistance due to length of train or curvature becomes a factor, slugs bearing arbitrarily-selected numerals coacting with the tonnage and per-cent. charts, and receptacles for the slugs, substantially as specified.

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

JOHN M. DALY.

Witnesses:
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G. O. FORSYTH.