(No Model.) 2 Sheets—Sheet 1.

I. N. LEWIS.

SPEED INDICATOR.

No. 480,107. Patented Aug. 2, 1892.

Fig. 1.

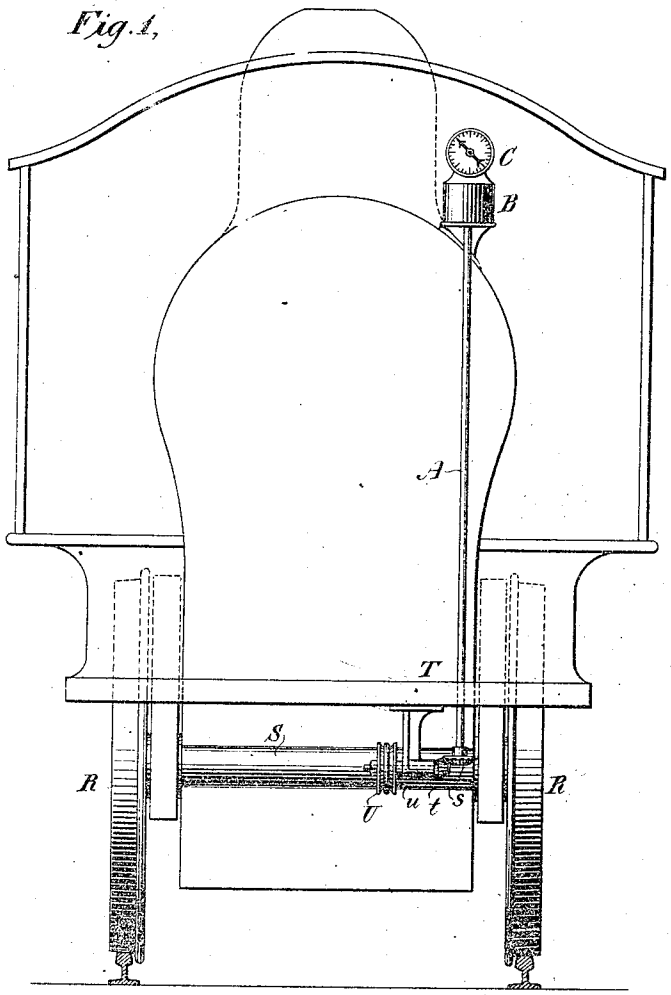


Fig. 2.

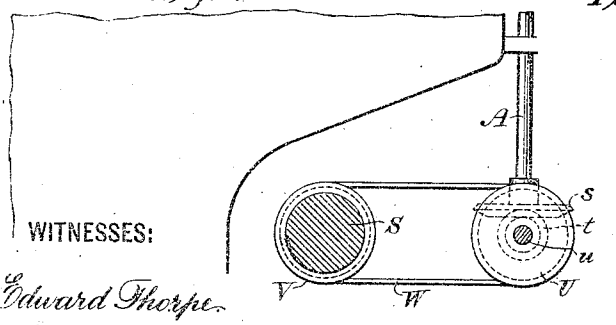


Fig. 2ª

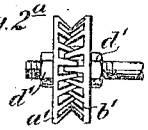


Fig. 2ᵇ

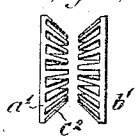
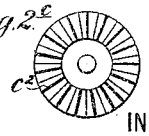


Fig. 2ᶜ



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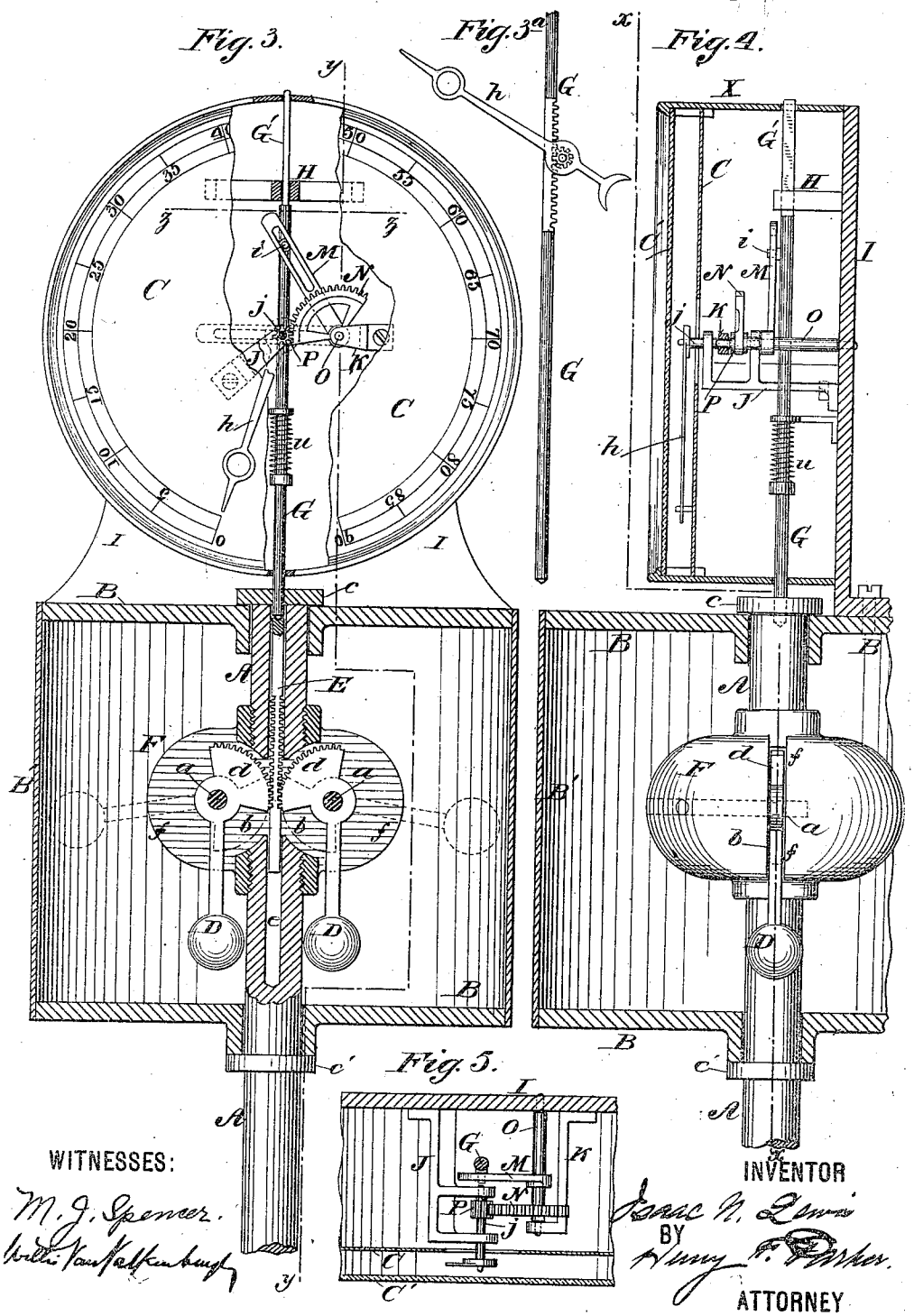
(No Model.) 2 Sheets—Sheet 2.

I. N. LEWIS.

SPEED INDICATOR.

No. 480,107. Patented Aug. 2, 1892.



UNITED STATES PATENT OFFICE.

ISAAC N. LEWIS, OF FORT SCHUYLER, NEW YORK.

SPEED-INDICATOR.

SPECIFICATION forming part of Letters Patent No. 480,107, dated August 2, 1892.

Application filed October 31, 1891. Serial No. 410,422. (No model.)

To all whom it may concern:

Be it known that I, ISAAC N. LEWIS, a citizen of the United States, residing at Fort Schuyler, in the county of Westchester, State of New York, have invented a certain new and Improved Speed-Indicator, of which the following is a specification, reference being had to the accompanying drawings, in which similar letters of reference indicate corresponding parts, and in which—

Figure 1 is a general rear elevation of a locomotive, showing the application for which my invention is especially intended; Fig. 2, an enlarged detail view representing the rear driving-axle in cross-section and the gearing for actuating the indicator therefrom. Figs. 2^a, 2^b, and 2^c represent an edge view, a detached edge view, and an interior face view, respectively, of a grooved sheave having variable circumference by which the speed of the indicator may be adjusted. Fig. 3 is an enlarged front elevation of my improved indicator, taken partly in section on the line $x\,x$, Fig. 4, showing the interior construction thereof; Fig. 3^a, a detail view of a modification; Fig. 4, a vertical section of Fig. 3, taken on the line $y\,y$; and Fig. 5, a partial horizontal section of Figs. 3 and 4, taken on the line $z\,z$.

My invention relates to speed-indicators actuated centrifugally to control the index and to produce transient indications of the speed of a revolving body. The dial bears notation of motion as referring to specific time, such as miles per hour or revolutions per minute. My invention applied to a rotary shaft is thus adapted to indicate the speed of moving railway-trains, steam-vessels, and the like, or the speed of stationary engines.

The object of my invention is to afford an automatic, direct, and accurate reading upon a uniformly-divided scale, eliminating computation, and enabling the engineer or operator to control his speed.

My invention consists in a centrifugal speed-indicator having compensating mechanism for moving the index-hand at substantially equal distances for given augmentation or decrease of speed, irrespective of the variable motions imparted to the centrifugal weights at different positions thereof. The dial may be thereby provided with an approximately uniform indicating-scale.

I will first proceed to describe the essential parts of the apparatus and subsequently describe one suitable means of attaching and operating the same in connection with a locomotive.

Referring to Figs. 3 to 5, inclusive, A represents the rotary shaft of the indicator, B the stationary frame or case in which the same is journaled, and C is the dial, which in the illustration bears notation of speed in miles per hour. D D are centrifugally-actuated weighted arms suspended from their respective pivots $a\,a$, supported upon the shaft A. $d\,d$ are toothed segments fixed to the weighted arms D D, said segments engaging tangentially with the double-toothed rack E, longitudinally movable within the shaft A, wherein a squared hole e, corresponding to the square cross-sectional shape of said rack, is provided for it to move freely. The segments $d\,d$ project into mortises $b\,b$, through which they engage with the rack E. F is a hub attached to the shaft A, revolving with it and having vertical slots $f\,f$, forming guides for the two arms D D, preserving rigidity of the latter with reference to the shaft. The shaft A is provided with a cap or shoulder c at its upper extremity, and also a collar c' for maintaining it in a proper plane of rotation. Through the upper end of the shaft A the non-rotary spindle G is inserted, resting upon the upper end of the rack E. The spindle G is retained upon said rack by its own weight, and, if necessary, by means of a suitable spring u, connected, as represented, within the dial-case. The dial mechanism within the case X is supported upon brackets H J K, attached to the plate I, rigidly mounted upon the frame B and forming the back of said case. In order to keep the spindle G from turning, its upper end G′ may be flattened, as shown, within its upper bearing H or otherwise provided with a longitudinal ridge, so as to permit its free vertical movement therein. The pin i, projecting rigidly from the non-rotary spindle G, is thereby moved in a true vertical line, and the index h of the dial C is operated by said pin i in varying ratio to the lineal motion of the latter to compensate for its variable rise and fall under given fluctuations at different speeds and produce an approximation of uniform motions of said

index-hand for said given fluctuations at all parts of the dial. The said variable distances of rise and fall of the spindle G attend the different angular positions of the weighted arms D D, as will be obvious, the lineal motion of the said shaft and pin *i* being decreased for given changes of speed, as the weighted arms approach their outermost position, as indicated by dotted lines in Fig. 3. The composition is effected by means of the following mechanism, consisting in a slotted radius-arm M, pivoted aside from the line of motion of the pin *i*, whereby when the latter is moved it acts upon said arm at variable distances or radii from its center. The arm M is secured to its pivotal shaft O, which, in order to impart a magnified motion to the index-hand, is geared to the index-shaft *j*, bearing said hand, by means of a toothed segment N, engaging with the index-pinion P. It will be seen by an inspection of Fig. 5 that the index pinion and shaft are free and independent from the vertical spindle G and so placed as to clear the path of the pin *i*, avoiding interference therewith. It will be obvious that the segment N and pinion P and separate index-shaft may be dispensed with, the index-hand *h* being placed directly upon the shaft O or upon the index-arm M; or, moreover, the said index-arm may itself be extended to form the indicator, a segmental dial being used. I also contemplate any modification of the arm M wherein its slot *m* is constructed of curvilinear or other form at variance with that illustrated for producing the desired compensation of motion. C′ represents a suitable glass plate inclosing the face of the dial C to protect the parts from dust. The frame B of the apparatus is represented of cylindrical form, inclosing, by means of its sides B′, the centrifugal mechanism, protecting that also from dust or injury. By the construction thus described a symmetrical position of the dial with reference to the rotary shaft and vertical spindle is secured. Dispensing with the compensating mechanism herein illustrated, the index-hand and its shaft may be directly geared, by means of a pinion thereon, to a rack upon the vertical spindle G, as illustrated in Fig. 3ª, a dial-scale of diminishing progression being employed in that instance to properly indicate the speed fluctuations.

Referring now to Figs. 1 to 2ᶜ, inclusive, R R represent the rear drivers of the locomotive, S the rotary axle thereof, and A the shaft, corresponding to that similarly designated in Figs. 3 and 4 or a shaft suitably geared or connected thereto. The indicator C is supported in the cab of the locomotive at any suitable position convenient to the view of the engineer, and in the position shown its shaft A is carried vertically in front of the boiler, extending directly from the indicator through an aperture in the floor T of the cab and bearing at its lower end a bevel-gear *s*, meshing with the second bevel-gear *t* upon the counter-shaft *u*, bearing a sheave U, suitably bolted to the axle S. The gears *t s* are differentially proportioned to obtain the desired speed for the indicator-shaft A, and, according to the varying diameter of the drivers of different locomotives, I may adjust the relative motion of the shaft A as may be necessary to give the proper indications by means of varying the diameter of the said gears or of the belt-sheave U with reference to the diameter of the axle S or collar V thereon upon which the belt W is carried. The belt W consists of any suitable material, preferably of round cross-section, frictionally engaging with the V-shaped grooves of the sheaves. According to the diameter of the drivers R, the sheaves U may be replaced by others of greater or less diameter to impart such speed of rotation to the centrifugal weights D D as will effect the proper indications. In order to more conveniently vary the circumference of the sheave U and to permit its adjustment from time to time as may be necessary, owing to the wear of the tires of the driving-wheels, the said sheave is constructed as illustrated in Figs. 2ª, 2ᵇ, and 2ᶜ, consisting of two truncated cones $a^2 b^2$, mortised with radiating teeth c^2 on their smaller faces, which interlock more or less, according to the adjustments of the screw-threaded nuts d^2 d^2 on the shaft *u*, thus varying the intersection of the cones and the circumference of the groove formed thereby.

It will be observed that by employing the counter-shaft *u* as a transmitting medium located laterally with reference to the axle S, interference with the action of the indicator by the vertical play of the said axle S in its bearings when the springs of the engine act is obviated.

The operation of my invention is as follows: As the shaft A rotates the weighted arms D are centrifugally actuated and receive greater or less angular motion, according to the rate of speed at which the fluctuations occur, and the toothed segments *d*, moving correspondingly, actuate the rack E, spindle G, and pin *i* with vertical change of position, accordingly depressing them by an increase of speed or lifting them by a decrease thereof. The initial acceleration from zero to ten miles per hour will, for instance, impart a greater angular change of position to the weights D D about their fulcra in opposition to gravity than will be imparted during a further acceleration of from ten to twenty miles, and so on as the rate progresses. At the same time the accompanying descent of the spindle and pin *i* will, owing to the diminishing radii of the latter's engagement with the index-arm M, produce an inverse increase of motion of the latter, as nearly equalizing and compensating for the decreasing angular motion of the centrifugal weights as practically required. When the speed is reduced, the aforesaid conditions are reversed, producing increasing motions of the index-hand *h* for given changes of speed, the decreasing motion of the arm M, compensating for the increasing angular motion of the cen-

trifugal weights, producing an approximately equal indicating movement by the hand *h* at all parts of the dial for given speed fluctuations.

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

1. In a speed-indicator, a centrifugal weight, an index, and means for imparting uniform motion to the index from the variable motion of the weight, consisting in a pivoted arm through which motion is transmitted at a radius which varies with the speed.

2. In a centrifugal speed-indicator, the combination of a rotary shaft, centrifugally-actuated weighted arms thereon, a lineally-operated indicator-spindle controlled by the said arms, a dial index-hand, and an index-arm for operating the same, fulcrumed aside from the line of movement of said indicator-spindle, having connection therewith at radial distances from its said fulcrum, which vary with the speed, substantially as and for the purposes described.

3. The combination, in a centrifugal speed-indicator, of a revolving shaft, centrifugal weights pivoted thereon bearing toothed segments, a toothed rack tangentially engaging with said segments, a non-rotary indicator-spindle supported on the said rack, a speed-indicating dial, and an index thereon operated by the said spindle.

4. The combination, in a centrifugal speed-indicator, of a rotary shaft, centrifugal weights pivotally suspended thereon, toothed segments attached to the weights, a rack in the axis of the shaft engaging tangentially with said segments, and an index operated by the rack.

5. In a centrifugal speed-indicator, the combination, with a rotary shaft, centrifugally-actuated weighted arms suspended thereon, a toothed index-operating rack, and toothed segments, engaging tangentially therewith, fixed to the said weighted arms, of an index-arm pivoted aside from the line of movement of the said rack or an extension thereof, such as the spindle G, and a projecting pin upon the said rack or its extension engaging with said arm at variable distances from its pivot, substantially as and for the purposes described.

6. The combination, in a centrifugal speed-indicator, of a rotary shaft or equivalent, weights pivoted thereon having centrifugally-imparted angular motion, an indicator-spindle operated longitudinally by said angular motion, a dial having approximately equal subdivisions representing rates of speed, a slotted index-arm pivoted aside from the spindle, a pin in the latter engaging with the slotted arm at variable distances from its pivot, a toothed segment on the axis of the arm, and an index-hand for the dial and pinion thereon engaged with by the said toothed segment.

ISAAC N. LEWIS.

Witnesses:
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M. J. SPENCER.