(No Model.)

A. M. HAYNES.

RECORDING KINEMETER.

No. 367,625. Patented Aug. 2, 1887.

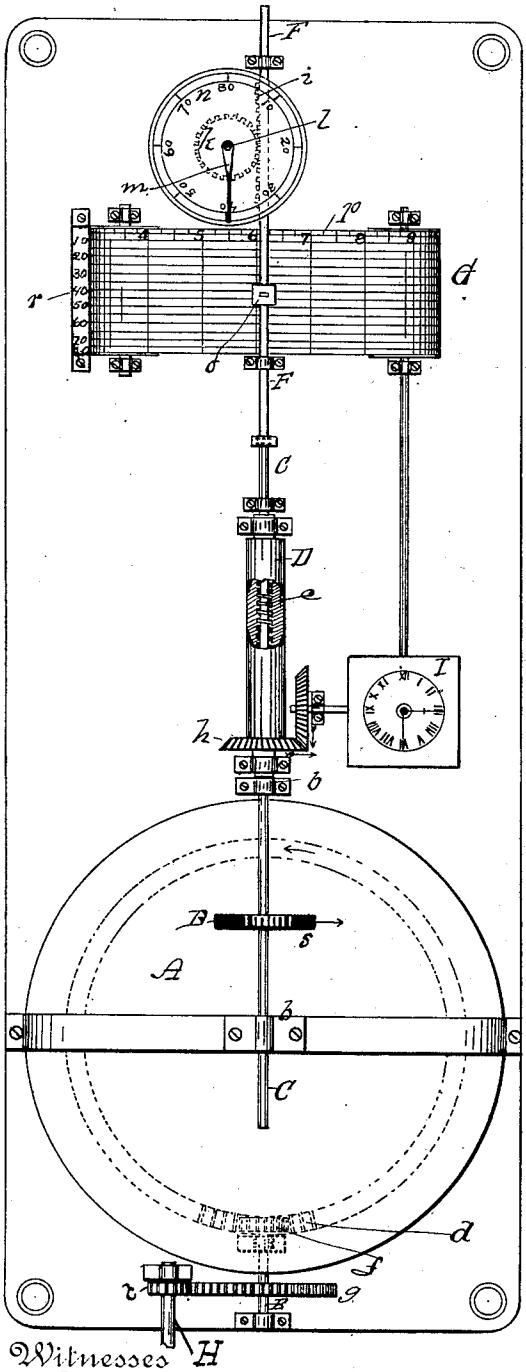

Fig. 1.

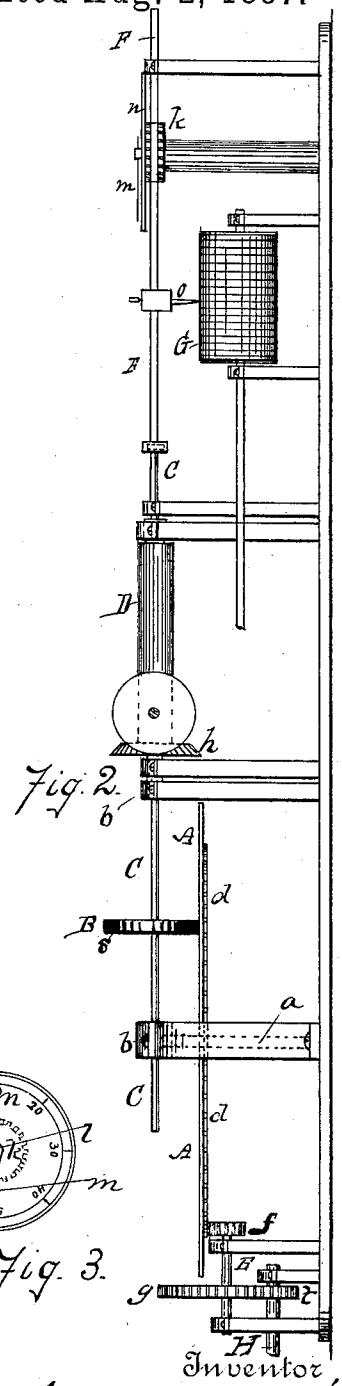

Fig. 2.

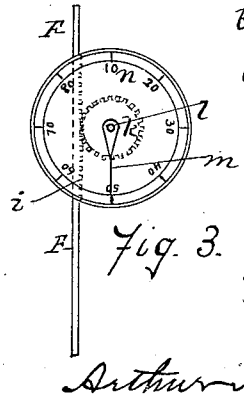

Fig. 3.

Witnesses H

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UNITED STATES PATENT OFFICE.

ARTHUR MORTON HAYNES, OF ST. PAUL, MINNESOTA.

RECORDING-KINEMETER.

SPECIFICATION forming part of Letters Patent No. 367,625, dated August 2, 1887.

Application filed October 29, 1886. Serial No. 217,504. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR MORTON HAYNES, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented an Improved Kinemeter, or Instrument for Indicating and Recording the Speed of Revolving Motion, and the Relative Speeds of Two Revolving Motions; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

The principle on which my invention is based is that of an indicating or recording movement, derived from the combination of two actuating movements, one a constant and predetermined movement and the other a variable movement proportioned to the speed of the motion which it is required to indicate or record, or both may be variable movements when the speeds are to be compared. The mechanical means by which I carry out this principle I will now describe.

Figure 1 of the accompanying drawings represents a front or top view of the essential parts of my invention, according as the apparatus is placed in a vertical or horizonal position; Fig. 2, a view thereof at right angles to that shown in Fig. 1; Fig. 3, a modification of one part of the apparatus.

Like letters designate corresponding parts in all of the figures.

As the essential foundation of an apparatus embodying my invention, I employ for producing a variable movement proportional to the varying speed of the shaft, axle, or other revolving mechanical element the speed of which is to be indicated or recorded, a revolving disk, upon the face of which a wheel or roller is caused to travel by revolving in concentric paths of various lengths of circumference thereon, and moved thereby, the wheel or roller having also a movement in the line of its axis to enable it to take different paths in traveling upon the disk.

In the drawings, A represents such a disk, revolving on its axis *a*, and B such a wheel or roller traveling in substantially concentric circles upon the face of the disk. The wheel B is caused to revolve on its axis by the contact of its periphery with the face of the disk, this periphery, preferably, being slightly yielding and elastic, as when covered with a thickness, *s*, of soft india-rubber, so as to adhere to the disk with certainty and without unnecessary pressure. The wheel or roller is mounted on and secured to a shaft, C, which not only turns in suitable bearings, *b b*, but has a free longitudinal movement therein, so that the wheel or roller may take different positions on the face of the disk anywhere between the center and periphery thereof. For producing the other motion, which, in connection with the revolving disk and wheel or roller traveling thereon, produces the resultant motion required, I prefer to employ a nut or female screw, D, rotated positively, which engages with a screw-thread, *c*, on the shaft C of the wheel or roller, and by the revolution of which the said shaft is caused to be moved endwise in one direction or the other, and therefore is made to move the wheel or roller toward or from the center of the revolving disk and cause it to travel in paths of different lengths on the face of the disk.

It may be here remarked that, as a mechanical equivalent of the construction shown and above set forth, the female screw may be upon the shaft C and the male screw be positively revolved to produce the longitudinal movement of the shaft, as specified.

The disk A and nut or screw D are to be driven, one by the shaft, axle, or revolving element the speed of which is required to be indicated or recorded, and the other by a motor having a uniform and determinate rate of speed, such as a clock-movement. As will be seen, it really makes no difference in principle which is driven by the shaft or axle and which by the clock-work.

I will describe the apparatus represented in the drawings as having the disk A driven by the shaft or axle and the nut D as driven by clock-work.

The disk A is driven in any suitable way by the shaft or axle H, whose speed is to be indicated or recorded. I have shown a circular rack or set of gear-teeth, *d*, on the back of the disk into which gears a pinion, *f*, on a transmitting-shaft, E, that has a pinion, *g*, upon it to gear with a corresponding cog-wheel, *t*, on the said revolving shaft or axle H, either directly or by intermediate gearing. Thus the speed of the disk A is always proportional

to that of the shaft, and may be at any required rate.

The nut or screw D has a cog-wheel or pinion, *h*, thereon to gear with the clock-work I, either directly or by intermediate gearing, so that the action of the nut or screw may be in the same direction as that imparted to the wheel or roller D and its shaft C. The rate of motion to be given to this nut or screw may be about the same as the average motion imparted to the said wheel or roller and shaft, and so that with an average motion the wheel or roller may travel in a circular path about midway between the center and circumference of the disk A. With such an arrangement of the parts, whenever the speed of the shaft or axle whose speed is to be indicated or recorded increases so as to rotate the wheel or roller B and its shaft C faster than the uniform speed of the nut or screw D the screw *c* of the said shaft C will travel down in the nut until the consequent shortening of the circular pathway of the wheel or roller B on the face of the disk A reduces the speed of the said wheel or roller and of its shaft to the same rate of speed as the nut, when the two will travel together as long as the same rate of speed is maintained by the revolving shaft or axle. On the other hand, if the speed of the said revolving shaft or axle decreases, the greater speed of the nut D will cause the screw *c* to travel upward therein until the wheel or roller B reaches a circular pathway on the disk A, which will give it a speed equal to that of the nut; and thus the wheel or roller B and its shaft C will continue to travel up or down whenever the speed of the revolving shaft or axle varies, and the position of the same will always bear exact relation to the speed of the said shaft or axle. It follows, therefore, that the longitudinal travel of the shaft C will, by a proper proportioning of parts and speed, move an indicator-index or a recording-marker, so as to indicate or record the speed of the primary shaft, axle, or other revolving element. Any of the known means of indicating or recording motions may be connected with the shaft C. I have shown in the drawings a sliding bar, F, connected with the said shaft. On this bar is a rack, *i*, which gears into a pinion, *k*, on the spindle *l* of an index, *m*, and in connection with the said index a circular scale, *n*, marked to indicate the number of revolutions in a minute or other unit of time at which the primary shaft, axle, or other revolving element is rotating. This sliding bar also carries a stylus or pencil or other marker, *o*, which marks upon a moving chart or tablet the relative positions of the shaft C, indicating the speed of the revolving shaft or axle at any given time. This chart or tablet is caused to move on suitable rolls or other mounting at a uniform rate by clock-work or other motor, (which may be the same as that which turns the nut D or not,) so as to indicate the divisions of current time or place by suitable scale-markings and numbers, as at *p*, thereon, while scale-marking and numbers, as at *r*, are shown on the chart or tablet, calculated to show the speed of the shaft or axle at any point of the time passed.

When the nut D is connected by gearing with the shaft, axle, or other revolving element the speed of which is required to be indicated or recorded, and the disk A is similarly connected with the clock-work or other means of uniform or variable motion, the same construction as above described may be used; but in this case the wheel or roller B and its shaft C have a motion opposite to that described above for the other arrangement—that is, when the speed of the revolving axle or shaft increases the consequent more rapid revolution of the nut D causes the screw *c* to travel upward in the nut until the wheel or roller B makes a circular pathway on the face of the disk A, which will give it an increase of speed equal to that of the nut, and when the revolving shaft or axle decreases in speed and the nut D revolves more slowly the screw *c* travels downward in the nut until the wheel or roller B reaches a shorter circular pathway, which will give it a lessened speed equal to that of the nut. A slight change only is required in the whole structure, and that is in the arrangement of the indicating and recording devices. The rack *i* will then be on the other side of the index-pinion *k*, as shown in Fig. 3, so that the scale may read in the proper direction, and the markings on the receiving chart or tablet will read upward instead of downward.

In many cases the last arrangement above described will be more convenient than the other and will be more readily apprehended, since the length of the circular pathway of the wheel or roller B will always be directly proportional to the speed of the revolving shaft or axle.

This invention is of course applicable to a great many practical uses wherever it is desirable to know the speed of shafts and axles. It is especially useful on railway-trains, not only to show the engineer at a glance the speed of the train at any moment, but by the recording of the speed along the whole route to show the effects of the various speeds on the track and the rolling-stock, of train-resistance on various grades, curves, and from the effect of the winds, &c., and to serve as a detective of and check upon careless engineers. In like manner mechanical engineers can handle and study machinery with greater intelligence and more certain deductions with it than without it.

I claim as my invention—

1. The combination of a clock-work, a revolving disk, a wheel or roller traveling in circular pathways on the face of the disk and rotated thereby, a shaft on which the wheel or roller is mounted, having a longitudinal movement in its bearings and provided with a screw-thread, and a revolving nut or screw receiving and fitting the screw-thread of the said wheel or roller shaft, the said revolving disk

and nut being connected by suitable gearing, one with the shaft, axle, or revolving element whose speed is to be indicated or recorded and the other with said clock-movement or other source of uniform motion, substantially as and for the purpose herein specified.

2. The combination of a clock-work, a revolving disk, a wheel or roller traveling in circular pathways on the face of the disk and rotated thereby, a screw-shaft on which the said roller or wheel is mounted, having a longitudinal movement in its bearings, a revolving nut or screw acting upon the screw-thread of the said shaft, the said disk and nut or screw being rotated, one by clock-work or other source of uniform motion and the other by the shaft, axle, or revolving element whose speed is to be indicated, and an index actuated by the longitudinally-moving wheel or roller shaft, substantially as and for the purpose herein set forth.

3. The combination of a revolving disk, a wheel or roller traveling in circular pathways on the face of the disk and actuated thereby, a screw-shaft on which said wheel or roller is mounted, having a longitudinal movement in its bearings, a revolving nut or screw acting upon the screw-thread of the said shaft, the said disk and nut or screw being rotated, one by clock-work or other source of uniform motion and the other by the shaft, axle, or revolving element whose speed is to be recorded, a marker actuated by the longitudinally-moving wheel or roller shaft, a clock-work, and a graduated chart or tablet on which the movements of the marker are marked, substantially as and for the purpose herein specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ARTHUR MORTON HAYNES.

Witnesses:
LOUIS FEESER, Jr.,
W. J. RODGERS.