D. DAVIS, Jr. & E. WRIGHT.

ROTARY-MEASURE.

No. 182,177. Patented Sept. 12, 1876.

Fig.1.

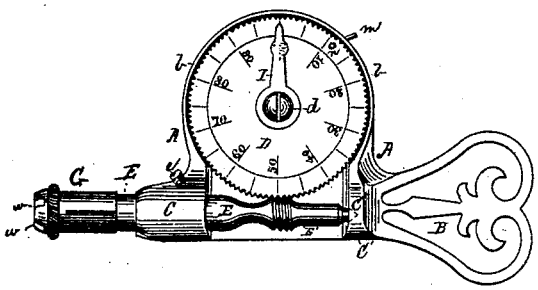


Fig.2.

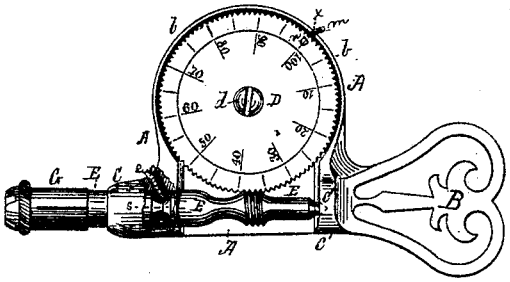


Fig.5.

Fig.6.

Fig.7.

Fig.8.

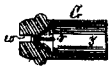


Fig.9.

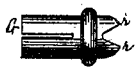


Fig.10.

Fig.12.

Fig.11.

Fig.3.

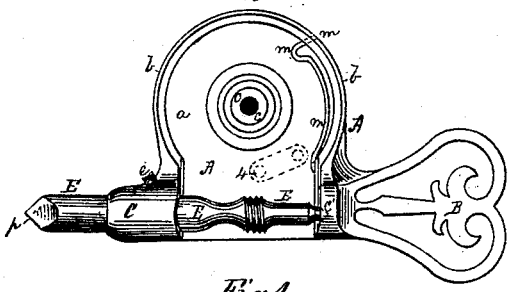
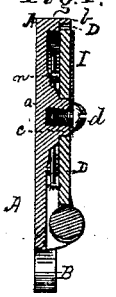


Fig.4.



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UNITED STATES PATENT OFFICE.

DANIEL DAVIS, JR., AND EDWARD WRIGHT, OF WORCESTER, MASSACHUSETTS, ASSIGNORS TO WILLIAM F. HUDSON, OF SAME PLACE.

IMPROVEMENT IN ROTARY MEASURES.

Specification forming part of Letters Patent No. **182,177**, dated September 12, 1876; application filed April 7, 1875.

To all whom it may concern:

Be it known we, DANIEL DAVIS, Jr., and EDWARD WRIGHT, both of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Speed-Indicators; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification, in which—

Figure 1 represents a front elevation of a speed-indicator having our improvements applied thereto, and Fig. 2 a similar view of a modification of the same, a portion of the frame being broken off, to show the arrangement of the adjusting-screw. Fig. 3 represents a front view, with the dial-wheel and detachable cap-piece removed, and Fig. 4 a vertical transverse section, as taken through the line *x x* of Fig. 1. Fig. 5 represents a side elevation; Fig. 6, a front end view; Fig. 7, a rear end view, and Fig. 8 a vertical longitudinal section of the removable cap-piece; and Figs. 9, 10, and 11, corresponding views (with the exception of the sectional view) of a modified form of the removable cap-piece shown in Figs. 5, 6, and 7. Fig. 12 represents a side view of a modified form of the spring-pricker.

Our invention relates to a new and improved mode of constructing speed-indicators whereby their construction is much simplified, and their cost of manufacture and liability to get out of order much lessened.

Our improvement consists, first, in forming or casting the casing or frame and handle in one piece, so as to impart the necessary rigidity and strength to the apparatus when applied to the shaft whose speed is to be tested; secondly, in the use of a single-toothed wheel in connection with a worm-spindle for receiving motion from the shaft to be tested, as the means of indicating the speed, instead of two or more differential wheels, as heretofore; thirdly, in combining with this toothed wheel a spring pricker or point in such manner as to prick or impress the finger or thumb of the hand holding the indicator once for every revolution of the toothed wheel; fourthly, in the use in connection with the worm-spindle of a removable metallic cap-piece, provided on its outer end with slots or sharp angular teeth, for the purpose of grasping, in a positive manner, the ends of such shafts as have pointed terminals, and whose speed is to be tested.

To enable those skilled in the art to make, construct, and use our invention, we will now proceed to describe it in detail.

In making the indicator, the casing A, handle B, and lugs C C′ are cast in one piece, as shown in Fig. 3. The casing-frame consists of a back plate, *a*, having a flange or rim, *b*, cast upon the face of its outer edge, so as to form a shield or guard-plate for the toothed wheel or gear D. The face of the casing at its center is also provided with a stud, *c*, upon which is mounted the combined dial-plate and gear-wheel D.

The ear pieces or lugs C C′ are provided with bearings, in which is supported a worm-spindle, E, which, when fitted therein, is held in place by an adjusting-screw, *e*. The spindle E, for this purpose, is provided with a circumferential groove, *s*, into which the inner end of the adjusting-screw *e* projects.

Adjusting-screw *e* is set at an angle less than a right angle to the plane of the worm-spindle, by which arrangement, as its end or the groove wears, it is easily adjusted so as to keep the spindle in its proper relative position with respect to the gear-wheel; otherwise it would fail to move the gear-wheel D the proper distance to indicate correctly each and every revolution of the spindle E.

The gear-wheel may be provided with as many teeth as may be desired, so long as it is graduated or rated accordingly; but for all practical purposes it is deemed better to provide it with a hundred teeth, and graduate it accordingly. The gear-wheel represented in the drawings is so made, and consequently graduated with division-lines and numbers from ten to one hundred, reckoning by tens; but as many more divisions, lines, and numbers can be marked thereon as may be desired.

An index-finger, I, may or may not be used

in connection with the dial-plate. In Figs. 1 and 4 the use of such index is shown. When such is used, the stud *c* is made to project slightly beyond the face of the dial-plate D. To the face of this stud the index-finger is then applied, as shown in Fig. 4, and secured by means of the screw *d*, the stud *c* being provided with a female-screw socket for the purpose. This screw is turned so as to hold the index firmly in place when adjusted. It also serves to confine the gear D on this stud *c*, whether the index I is used or not.

The use of an index-finger possesses this advantage, that it may be adjusted to the zero or one-hundred point, wherever it may be, so as to start from that point, when it is desired to test the speed of a shaft. This is easily effected by simply turning index-finger I to zero-point, for which purpose, if necessary, screw *d* may be slightly loosened; or, instead of the adjustable index I, a stationary index-mark may be formed on or cut in the rim *b* of the casing, at any point whatever.

This mark may consist of a simple notch cut in the rim, as shown at *x*, opposite the one-hundred or zero line of Fig. 2; or it may consist of a small pointer cast on the rim *b*, and pointing inward toward the dial.

In the use of this index point or mark note must be made of the number of degrees intervening between the zero-point on the dial and the index-point before applying the instrument to the shaft, that the proper correction may be made in computing the speed; or (and which is but little trouble to do) the spindle E may be turned by hand until the zero-point and the index-pointer coincide, after which the observer has simply to note the number of complete revolutions of the dial-plate, which, together with the odd revolutions indicated by the dial and pointer, will give the total number made during the test.

As this, to a certain extent, may tax the observer considerably, in simultaneously watching the revolutions of the dial and the time, we simplify the matter by adding to the instrument a spring-pricker, *m*, and which consists of a piece of suitably-bent spring-wire, the one end of which is secured to the casing A, while the other is left free, and so as to project through the rim *b*.

The free end is bent in such manner (as, for instance, as shown in Fig. 3) as to form a cam, against the outer side of which a cam-pin, *n*, made fast to the inner face of the gear D, is brought to bear once for every revolution of the latter. The pin *n*, acting on the cam-shaped end of the spring *m*, forces its end out through rim *b* in a firm manner, and with sufficient force to apprise any one of the fact whose finger or thumb is placed over the opening in the rim through which the point of the spring *m* is protruded. This point enables any one, without looking at the dial, and while his eyes are noting the time on his watch or other time-keeper, to count the number of full revolutions made by the dial-wheel D during any given or required interval of time. As soon as the action of the cam-pin *n* passes or is withdrawn from the cam-shaped portion of the spring-pricker *m*, the latter returns to its normal position—*i. e.*, within the outer edge of the opening in rim *b*. The number of whole revolutions thus indicated, multiplied by one hundred, added to the odd number of revolutions indicated by the relative position of the zero-point on the dial-plate with respect to the index-mark on the rim *b*, will give the total number of revolutions made during the observed time, always supposing, however, that the stationary index mark or pointer on the rim *b* and the zero-mark (100) on the dial-plate coincided when the indicator was applied to the shaft being tested; otherwise the proper allowance must be made, where the two did not coincide, by deducting from the total number thus found the odd number of revolutions already indicated on the dial-plate before applying it to the shaft. As a rule, where the spring-pricker or point *m* projects through the rim, there will be the stationary pointer or notched mark, which, when coinciding with the graduated line marked 100 on the dial-plate, will mark zero. Where the stationary mark or pointer on the rim *b*, or the index-finger I, when used as a stationary index alone, does not coincide with a radial line drawn from the center of the dial to the opening in the rim *b*, through which the pricker *m* projects, then the cam-pin should be so inserted in the dial as to act on the pricker at the moment that the graduated zero (100) line coincides with the index-finger I, or other mark or pointer formed on the rim, which will give the correct reading by following the rule before described.

Again, by adjusting the cam-pin *n* immediately in the line of the zero-line, the index I may be adjusted to that line wherever it may be with respect to the opening in the rim *b* for the passage of the pricker *m*.

This arrangement will enable the indicator to be applied at any time without adjusting the gear-wheel, so as to make the zero-line coincide with the stationary mark at the opening in the rim for the passage of the pricker. In this case the difference in degrees between the index and the pricker-point opening, as indicated upon the scale, will show the odd number of revolutions to be deducted from the first revolution indicated by the pricker—as, for instance, suppose that when the instrument was first applied, the graduated line marked 60 coincided with the mark at the opening in the rim for the point of the pricker *m;* index I is then moved to 100 on the dial. This done, the number of revolutions of the dial D, as indicated by the pricker *m*, is then noted. Then, suppose these were seven, thus indicating seven hundred revolutions, from this number, in computing the full number of revolutions, must first be taken the sixty revolutions which the dial indicated before it was applied to the shaft, which would give six

hundred and forty revolutions. To this must then be added the odd number of revolutions indicated on the dial, computing for these from the pricker-opening in the rim—as, for example, say that those represented ninety, then the full number of revolutions would be 640+90=730 revolutions for the observed time.

The index I, in this case, acts simply as a reminder of the number of centenary units which the dial had passed beyond its initial mark, these units being easily computable from the graduated dial.

In Fig. 3 a modified arrangement of the pricker device is shown, a side view of the device itself being shown in Fig. 12, it being a simple bent or curved spring-plate riveted at one end to the casing at 4, and carrying a small pin at its other end, and which is made to project through an opening made in the casing. The end of the cam-pin *n* as it revolves acts on the outwardly-curved face of this spring-plate, depressing it, and thereby forcing its pin out through the opening in the casing against the finger of the operator, as in the former case; but the spring-pricker *m* as arranged is preferred.

The worm *o* on spindle E is so formed with relation to the teeth of the gear-wheel D that one revolution of the spindle will advance the gear-wheel in its revolution one tooth, and that irrespective of the number of teeth on the gear, although, as before stated, it is preferred to provide the latter with a hundred, as it facilitates the computation of revolutions made, each revolution of the gear indicating one hundred of the spindle.

The end of spindle E is provided with a sharp angular point, *p*, adapted to receive motion when forcibly inserted and held in the centering-mark formed in the end of a revolving shaft or spindle. As some shafts and spindles, instead of having a central depression or concavity at their ends, are provided with conical or sharp tapering ends, and consequently cannot impart motion to another spindle provided with a sharp point, we, in order to overcome this difficulty, provide the spindle E with a detachable metallic cap-piece or thimble, G, which is so made as to slip over the end of spindle E, the inner end of which is provided with notches *v*, corresponding to the angular lines of the pointed end of spindle E, and into which they take. These notches *v* are shown at Figs. 7, 8, and 11.

This construction of the cap-piece, when properly adjusted on the end *p*, insures a positive motion to the spindle E when the cap-piece is held firmly against the pointed end of the shaft whose speed is to be tested.

To insure a positive motion to the cap-piece G, and through the latter to spindle E, a couple of notches or slots, *w*, are cut at an angle to each other on the outer end of cap-piece G, a small hole or opening being first made through its end into the hollow *y* for the reception of spindle E, the slots *w* being then cut of a width sufficient to give a sharp edge to the four teeth thus formed, as seen at Figs. 5 and 6. Thus constructed, when these teeth *r* are pressed with sufficient force over the pointed end of the revolving shaft or spindle they will grasp the latter with such tenacity as to adhere thereto and turn with it, thereby causing spindle E to revolve with it also.

Spindle E is shown as being made cylindrical immediately adjoining its angular point *p;* but it may be made angular, in which case the socket part *y* of the cap-piece would be made of corresponding shape, in which event the notches *v* at its inner end may be dispensed with.

The teeth *r* thus formed by notches *w*, when their upper internal edge becomes dull from use, may be resharpened by simply grinding square upon the outer end of the guard-piece. This form of teeth, however, is better adapted to spindles having small and very sharp pointed ends than to more obtuse points.

In Figs. 9, 10, and 11 is shown a form of teeth better adapted to the latter. The cap-piece there represented only differs from that shown in Fig. 5 in the matter of the shape of the teeth, which are more pointed, and recede on an outwardly and upwardly inclined line from the periphery of the central opening back to the external line of the cap, and which give a much stronger hold on the end of the spindle to which they are applied. For self-evident reasons we prefer to use four, or an even number of teeth, instead of three, or an uneven number.

In using the indicator it is first examined as to its present condition, and, if desired, adjusted to zero-point. This done, a finger or thumb of the operator is pressed over the spot where the pricker *m* is intended to be protruded. In this position the end of the spindle E, either with or without the cap-piece G, according to the circumstances of the case, is pressed against the end of the shaft to be tested, and there firmly held for the time allotted, the operator counting the number of revolutions of the dial if no pricker is used; or, in the latter case, the number of pricks made on his finger. When done he withdraws it, notes the number of odd revolutions indicated by the dial, and completes the total number according to the methods before described.

It will be apparent that the same readings can be made by transferring the graduation lines and numbers, *i. e.*, the scale from the dial-gear D to the rim *b* of the casing, for which purpose the rim *b* may be provided at its upper edge with an inwardly-projecting flange. In this case we prefer to make the zero-point—100 of the scale—immediately above the opening in the rim of the spring-pricker *m*, and thence around, as in the case of the dial. The wheel D should then be provided with an index mark or pointer, and which we prefer to arrange in a line coinciding with a radial line drawn through the center

of the wheel and the cam-pin *n*. Thus constructed, the method of using the indicator, from what has been heretofore said, will be obvious, and therefore unnecessary to be further described.

We are aware that speed-indicators have been made in which two or more gears and wheels, having graduation marks and numbers on one, have been heretofore used in connection with a removable worm-spindle and hinged handle. Such construction we do not claim; but

What we do claim is—

1. The frame A of a speed-indicator, in which the back plate *a* and rim *b*, that protects the gear-wheel D, the stud-pin *c*, on which the latter is mounted, and lugs C C′, in which the worm-spindle is supported and turns, and a handle B, are all cast in one piece, substantially as set forth.

2. A speed-indicator composed of a casing, A, a graduated scale and corresponding zero index, mark, or point, a worm-spindle, E, having a projecting end, *p*, through which it receives motion, either by an angularly-shaped point, *p*, or a removable metallic cap-piece, G, and a single gear-wheel, D, the whole being arranged and combined so as to operate in the manner substantially as set forth.

3. In combination with the gear-wheel of a speed-indicator carrying a cam-pin, *n*, a spring point or pricker, substantially as set forth.

4. The removable metallic cap-piece G, constructed with teeth *r* having sharp and unyielding edges, substantially as and for the purposes set forth.

5. The combination of an angularly-arranged adjusting-screw, *e*, with a removable worm-screw, E, provided with a circumferential groove, *s*, gear-wheel D, and casing A, of a speed-indicator, substantially as set forth.

6. In a speed-indicator, the combination of an adjustable index-finger, I, with a single gear-wheel, D, having a graduated scale, and a worm-spindle, E, having a projecting end, *p*, through which motion is imparted to the latter, the whole operating in the manner and for the purposes set forth.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

DANIEL DAVIS, JR.
EDWARD WRIGHT.

Witnesses:
ABIEL E. WILSON,
PHINEHAS BALL.