

(No Model.)

3 Sheets—Sheet 1.

F. VAN WINKLE.
ROTARY TRANSMITTING DYNAMOMETER.

No. 472,466.

Patented Apr. 5, 1892.

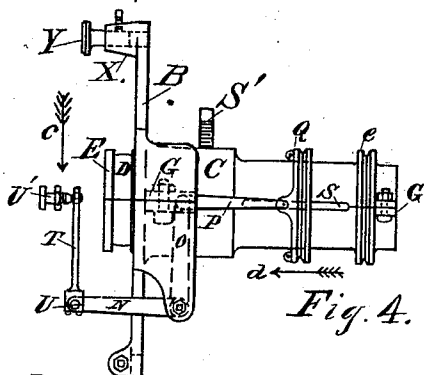


Fig. 4.

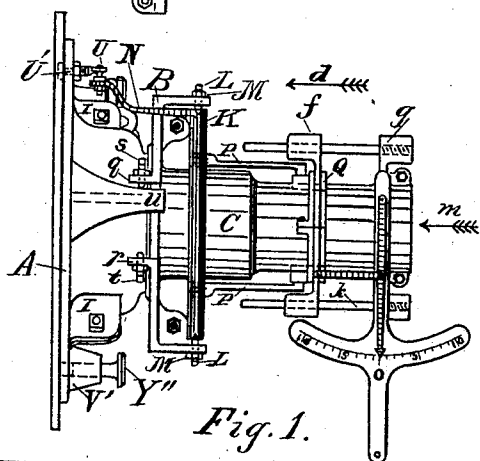


Fig. 1.

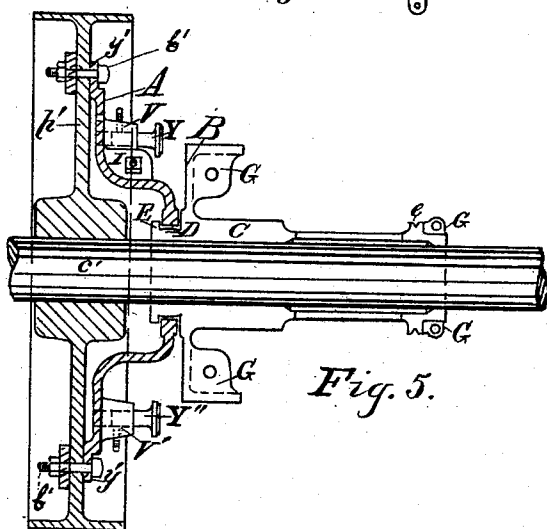


Fig. 5.

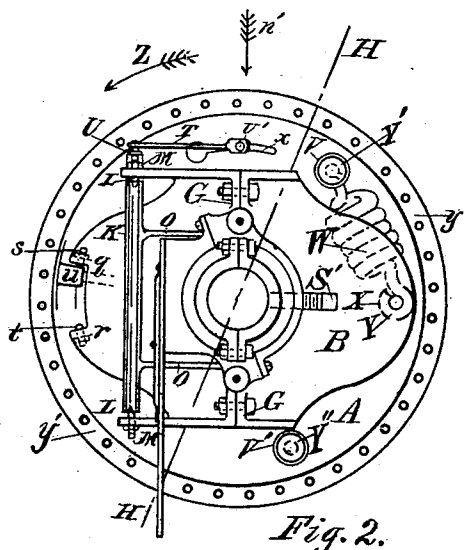


Fig. 2.

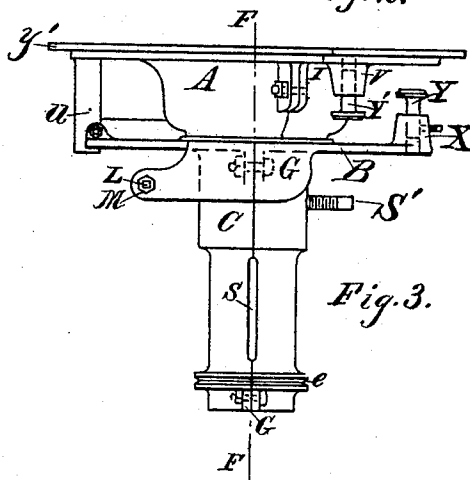


Fig. 3.

Witnesses

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By his Attorney

Geo. M. Baker

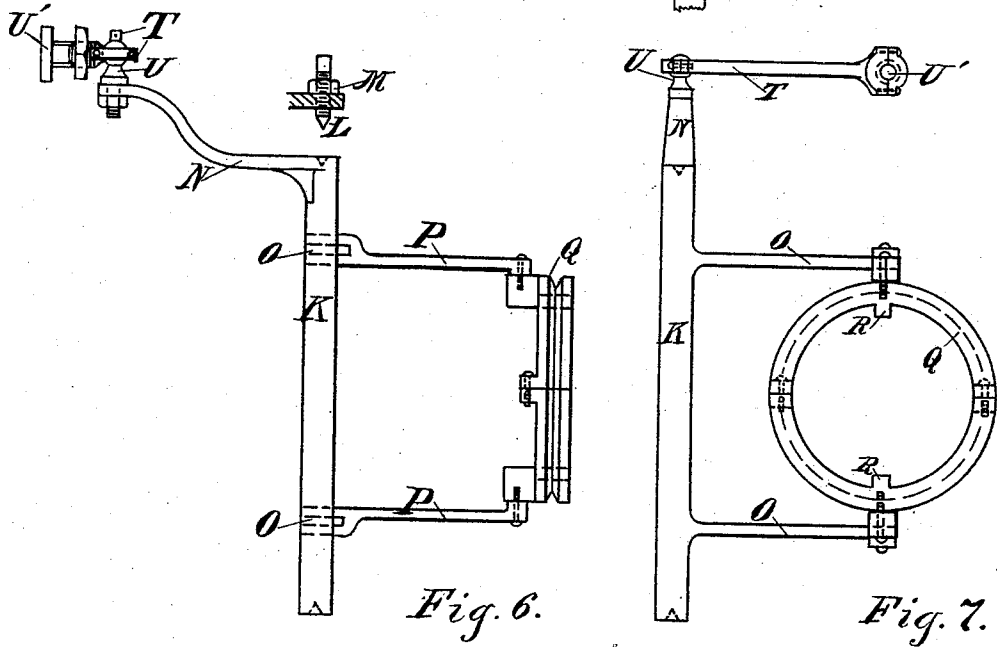
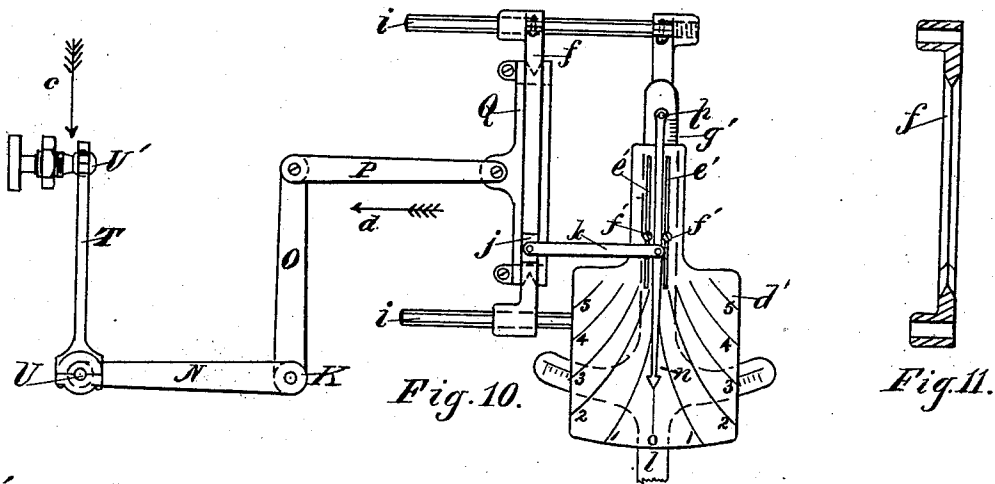
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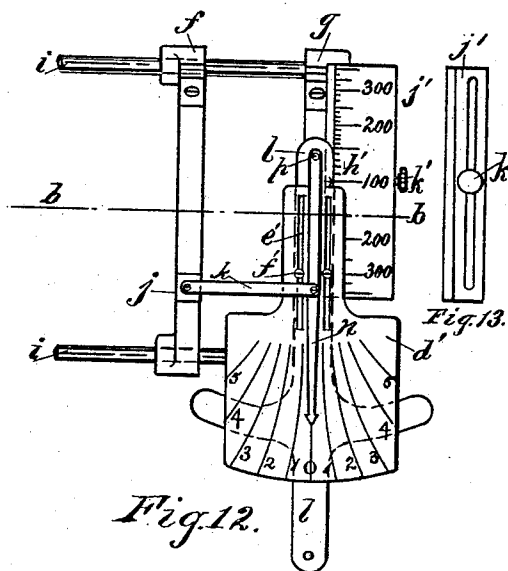
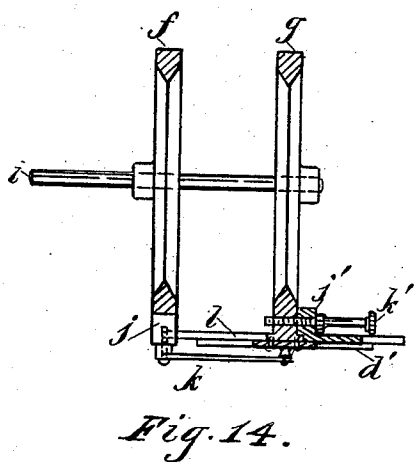
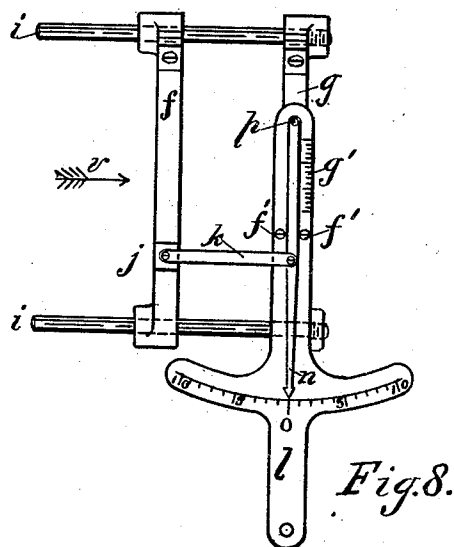
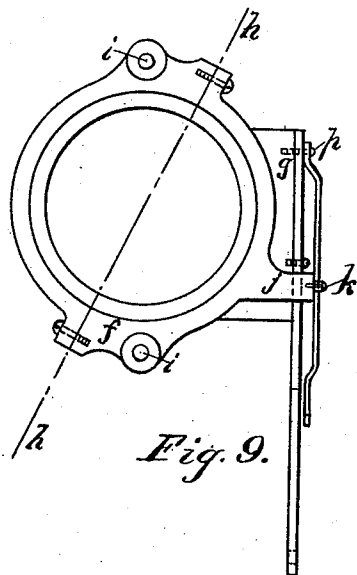


Fig. 13.

WITNESSES:

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UNITED STATES PATENT OFFICE.

FRANKLIN VAN WINKLE, OF PATERSON, NEW JERSEY.

ROTARY TRANSMITTING-DYNAMOMETER.

SPECIFICATION forming part of Letters Patent No. 472,466, dated April 5, 1892.

Application filed November 11, 1891. Serial No. 411,551. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN VAN WINKLE, a citizen of the United States, residing in the city of Paterson, county of Passaic, and State of New Jersey, have invented a new and useful Rotary Transmitting-Dynamometer, of which the following is a specification.

My invention relates more particularly to improvements in that class of rotary transmitting-dynamometers in which weighing-springs are employed for measuring the force of rotation or number of horse-powers communicated by an ordinary shaft to an ordinary pulley on such shaft or communicated by the pulley to the shaft.

The objects of my invention are to provide in this class of dynamometers positive mechanism to operate the pointer-hand of a stationary dial or scale in accordance with the performance of the weighing spring or springs, to provide differential scale-plates so laid off and constructed that when adjusted to any speed of rotation and strength of spring or other resisting element employed for weighing the force of rotation then the number of horse-powers or other units of work being transmitted may be ascertained at sight, and to provide such form of other parts as to eliminate errors arising from friction, wear of parts, adjustments of the operator, and otherwise to facilitate the accurate adjustment and operation of the dynamometer. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the dynamometer with an ordinary scale. Fig. 2 is an end elevation of the dynamometer, taken in direction of the arrow *m* in Fig. 1. Fig. 3 is a plan or top view of the main frame-work and plate A of the dynamometer, taken in direction of the arrow *n'* in Fig. 2. Fig. 4 is a part plan or top view of Fig. 1 to better illustrate the arrangement and mounting of the rock-shaft motion on the frame-work of the dynamometer. Fig. 5 is a sectional view of the plate A and a view of one-half of the main frame-work of the dynamometer, taken along the line F F in Fig. 3, showing the manner of applying the plate A and frame-work of the dynamometer to an ordinary shaft and pulley

on such shaft, the pulley being shown in section. Figs. 6 and 7 are details, on an enlarged scale, of rock-shaft and connections, the points of view being the same as that in Figs. 1 and 2, respectively. Fig. 8 is an enlarged view of scale and carrying-rings as shown in Fig. 1. Fig. 9 is a view of parts shown in Fig. 8, taken in direction of arrow *v* in Fig. 8. Fig. 10 is a top or plan view of parts shown in Figs. 6 with the parts shown in Figs. 8 and 9 attached, the scale shown in Figs. 1 and 8 being superimposed by my differential scale-plate for greater clearness of description, the carrying-rings *f* and *g* being revolved, so that the scale-plates appear in elevation. Fig. 11 is a sectional view of carrying-ring *f* shown in Figs. 1, 8, 9, and 10. Fig. 12 is a view of a simple scale as shown in Figs. 1 and 8, superimposed by my differential scale-plate used in conjunction with my compounding scale-plate. Fig. 13 is a side view of my compounding scale-plate; and Fig. 14 is a sectional plan of parts shown in Fig. 12, taken on line *b b*, Fig. 12.

Similar letters refer to similar parts throughout the several views.

To facilitate the application of the dynamometer to a shaft, the main frame-work and all parts which surround the shaft are made in halves in order that the dynamometer may be mounted on the shaft in the manner of a split or separable pulley.

The main frame-work of my dynamometer consists in an elliptically-shaped plate B, the outline of which is best shown in Fig. 2. This plate has a central hollow hub C, elongated to one side of the plate, with the grooved collar *e* near its end, said hub projecting a shorter distance to the other side of the plate, with a spherical exterior surface D, (see Figs. 4 and 5,) terminating in the plain collar E, said plate and hubs being made in halves coming together along the line F F, Fig. 3, and held together by bolts passing through the projecting lugs G G. The central hollow hub of this main frame-work is recessed along a portion of its elongated end and bored out in the remaining portions of its length to receive the shaft upon which it may be placed, as shown in Fig. 5.

A is a circular plate the middle portion of

which is dished or crowning, said plate being made in halves coming together along the line H H, Fig. 2, and held together by bolts passing through projecting lugs I I, Fig. 1, the plate being provided with a short central hollow hub which is bored out to fit loosely around the spherical portion D of the central hub of the main frame-work.

K is a rock-shaft the ends of which have countersunk recesses, by means of which it is mounted on conically-pointed screws L L, which pass through lugs projecting from B and are held firmly in place by lock-nuts M M. A partial section of one of these lugs and arrangement of screw and lock-nut is shown in Fig. 6. N is an arm on K projecting toward the plate A, and O and O are parallel arms projecting from K at right angles to N, one over each side of the hub C.

P P are links connecting by pivotal screws the ends of the parallel arms O O to the exteriorly-grooved collar Q, which, being made in halves, encircles the reduced portion of hub C, said collar being free to slide along C, and is provided with feathers R R, (see Fig. 7,) which project into the slots S, Figs. 3 and 4, said slots being formed through the sides of C by cutting back from both sides of the halving-line F F, Fig. 3.

T is a connecting-rod having spherical socket ends with detachable caps.

U and U' are spherical or ball ended stud-bolts set in the end of the arm N and in the curved slot *x* in the plate A, respectively, and connected by the connecting-rod T. (See Fig. 2.) When the plate A, rock-shaft K, and collar Q are mounted on the frame-work of the dynamometer and connected as described, then any change of relative angular position between the plates A and B around the axis of hub C will cause Q to move along the hub C, the direction and degree of travel of Q being dependent upon the relative direction and degree of motion between the two plates A and B.

V V' are hubs on one side of the plate A, projecting toward B. X is a similar hub on the plate B, projecting toward the plate A.

W, Fig. 2, is a helical pull-spring connecting the plates A and B. The material of the helix forming W is turned up in eyes at both ends, through which eyes the suspending pins Y and Y' pass, respectively, into the hubs X and V, said pins being held in place by set-screws, as shown in Fig. 5. If the plate A be rotated on its axis, which is also the axis of the hub C, in the direction indicated by the arrow Z, Fig. 2, any resistance offered to such rotation by B will be transmitted through W to A, causing W to elongate, and thereby permitting A to advance in its relative angular position with respect to B in direction of the arrow Z until the resistance offered by B is overcome by W. Then B follows along in the rotation primarily imparted to A. The direction of arrow *c* in Figs. 4 and 10 is the same with respect to B as arrow Z in Fig. 2.

Consequently when A advances in rotation with respect B in the manner previously described and the ball-stud U' is fixed in the slot *x* of the plate A, then U', T, and U and the end of the arm N are carried in direction of arrow *c*, imparting a partial revolution of the shaft K on its axis, resulting finally in movement of the parallel arms O, links P, and collar Q in direction of arrow *d*, Figs. 1, 4, and 10. If during such rotation of A the resistance offered by B lessens, then the spring W, by reason of transmitting a lesser strain, resiles to such length as may correspond to the reduced resistance and carries B forward in the direction of rotation toward its original position with respect to A, and Q moves in direction opposite to arrow *d*, Figs. 1, 4, and 10. Each particular degree of resistance transmitted by the spring from one plate to the other produces its particular position of the sliding collar Q on the hub C and will be indicated upon the scale, as herein-after described.

f and *g* are rings made in halves coming together along the line *h h*, Fig. 9, the interior surfaces of which rings are suitably beveled for fitting loosely around the beveled grooves in the sliding collar Q and fixed collar *e*, respectively. These rings are each provided with two hubs—such as shown in sectional view of ring *f* in Fig. 11—for the purpose of receiving the guide-rods *i i*, one end of each being screwed into the hubs of *g*, while the hubs of *f* are free to slide over the remaining portion of the rods. The ring *f* has a projection *j*, to which is pivoted the link *k*, and the ring *g* has projecting from it the scale-plate *l*, the lower portion of which is made in form of a segmental arc, on which is laid off a scale.

n is a pointer-hand pivoted at *p* and connected by the link *k* to the ring *f*, its free end being carried over the scale in accordance with the motion of the ring *f* in the sliding collar Q along the hub C. When the hub C is in rotation, the scale-rings *f* and *g* may be prevented from rotating with the hub C and caused to remain stationary by holding the downward-extending portion of the scale-plate in the hand or by securing the lower portion of the scale-plate by twine or otherwise to a stationary object. Thus the position assumed by the pointer-hand *n* on the scale may be noted while the hub C is in rotation. If the plate B receives the primary rotation instead of A, but in a direction opposite to that indicated by the arrow Z, Fig. 2, and such rotation be resisted by the plate A, then the spring W will be similarly elongated and *n* will be carried over the scale in the same manner. The periphery of the plate B has cut out of it a gap or notch bounded by projecting lugs *q* and *r*, through which pass screws *s* and *t*, respectively, held in place by lock-nuts.

u is the stop-bracket projecting from the plate A through said gap. When the spring W in its normal length and without any strain upon it connects A and B, as previously

described, then A is to be turned past B sufficiently to take up any lost motion between the suspending pins and the plates A and B or between the suspending pins and the eyes of the spring W. The screw *s* is then to be set down and secured in contact with *u*. With *u* and *s* thus in contact the dynamometer may be driven backward without injury to or derangement of its parts. When driven in the direction which tends to elongate the spring W, the maximum relative motion between the two plates and consequently the maximum elongation of the spring W are both limited by *u* coming in contact with the end of the screw *t*. If, however, it be desired to measure resistance transmitted between the plates when the relative directions of rotation are opposite to those previously described, then in order that such resistance may be transmitted in a manner tending to elongate W it is necessary for W to be connected from the projecting hub X of the plate B to the projecting hub V' of the plate A by means of the suspending pins Y and Y'. When the spring is connected without strain, as shown in Fig. 1, the proportions of the dynamometer are such that the distance from X to V' is greater than the distance from X to V by such an amount that in order to connect W without strain from X to V' it is first necessary to rotate A around B in direction of the arrow Z a sufficient distance to bring the side of the stop-bracket *u* against the end of *t*. *t* is then in position to operate as a backward stop, while *s* becomes the forward stop. When W is thus changed about, the partial rotation of A past B, which is incidental thereto, results in carrying the pointer-hand *n* to a point to the left of the zero of the scale—that is to say, in direction of the arrow *d*. The pointer-hand may be returned to zero by loosening the ball-stud U' in the slot *x* of the plate A and moving it along said slot to such position that *n* again indicates zero, in which position U' may be again secured to A. When thus adjusted, any resistance to rotation between the plates A and B, causing the spring to elongate, will cause *n* to assume a position to the right of the zero of the scale.

Successive positions which the end of the pointer-hand *n* will assume on the arc of the scale-plate for different numbers of horse-powers or foot-pounds per minute transmitted from A to B or B to A, employing a given spring W, may be determined for a given speed of rotation of the dynamometer, inasmuch as the degree of elongation of the spring is ascertainable for any degree of resistance to rotation which the plate A may offer to the plate B, or vice versa.

Figs. 1 and 8 best illustrate the appearance of a divided and figured scale laid off on *l* in the manner described for a stated speed of rotation of the dynamometer—as, for instance, one hundred revolutions per minute—using always the same spring. In dynamometers heretofore made this has been the only type

of scale provided, and when such a scale is used at any other speed of rotation or when any change is made in the spring employed different from those for which the scale is especially constructed, then, in order to arrive at the true number of horse-powers, the operator must make calculations for every reading.

To avoid the multiplicity of calculations and to cause the pointer-hand to indicate the true number of horse-powers, I provide my differential scale-plate.

When my dynamometer is used at different speeds of rotation, employing always the same spring, then my differential scale-plate *d'* is to be used. This consists of a flat spade-shaped plate *d'* of form shown in Figs. 10 and 12, the narrow upper portion of which has parallel slotted openings *e'*. The differential plate when used is to be laid upon the face of *l* under the pointer-hand *n*, as shown in Fig. 10, and may be secured in different positions of vertical adjustment by means of screws *f'*, which pass through the slots *e'* into the upper part of *l*. When using always the same spring or equal springs, arbitrarily-spaced lines, each representative of a speed of rotation, are made upon the face of the upper portion of *l* in form of a scale *g'*, (see Figs. 8 and 10,) and so laid off that the upper edge of *d'* may be brought opposite to any division on said scale *g'*. As shown in Fig. 10, the face of *d'* is laid off with a central zero-line, to the right and left of which are curved lines marked "1 2 3 4," &c. I call these curved lines "differential curves," and they are of such form that when the upper edge of *d'* is set opposite to that division of *g'* corresponding to any given speed of rotation made by the dynamometer then the end of the pointer-hand will be on the curve marked "1" when one-horse power is being transmitted, on curve "2" for two-horse powers, "3" for three-horse powers, &c., to the right or left of the zero-line, according to the direction of resistance for which the spring and pointer-hand may have been adjusted, in the manner previously described.

When the dynamometer is always to be used at a constant speed of rotation and for the purpose of greater or less sensitiveness of action, different strengths of springs are employed at different times. Then in a similar manner my differential scale-plate may be laid off in curves to be used for indicating different horse-powers in the same manner as previously described, the divisions of the scale *g'* being then taken as representative of different strengths of springs instead of different speeds of rotation.

For springs offering different degrees of resistance to elongation, each of which may be used in the dynamometer at different speeds of rotation of the latter, I employ the same general form of differential scale-plate in conjunction with my compounding scale-plate *j'*, Figs. 12, 13, and 14. The scale-divisions *g'*,

previously described, are then discarded, excepting a single division-line h' , (see Fig. 12,) which for greater explicitness of location I

12. By means of the binding-screw k' , which passes through the slotted projecting portion of the back of j' , the latter may be secured in different vertical adjustments with reference to l , so that any one of the division-lines drawn on the face of j' may be opposite to h' . Beginning at a certain division on j' —as, for example, that marked "100"—and proceeding upward lines are drawn, each of which is representative of the number of pounds required to elongate different springs one inch, as one hundred, two hundred, three hundred, &c., and similarly beginning at "100" on j' and proceeding downward lines are drawn representative of different speeds of rotation of the dynamometer—as, for instance, one hundred, two hundred, three hundred, &c., revolutions per minute.

In Fig. 12 some of the divisions below "100" are partially obscured from view by the differential scale-plate.

The spacings of the divisions of the compounding scale-plate j' and the curves on the differential scale-plate, when used in conjunction with the said compounding scale, are such that the pointer-hand n will indicate the correct number of horse-powers on the differential scale-plate in the manner previously described, provided j' is so adjusted that the division representing the strength of spring employed is opposite the division-line h' marked with an arrow-head, and the upper edge of d' is fixed opposite to that division on j' representing the speed of rotation.

In order to apply my dynamometer—as, for instance, for the purpose of measuring the number of horse-powers taken by a pulley, as p' , Fig. 5, from an ordinary line-shaft, as c' —the pulley is first to be loosened from the shaft by removing set-screws, keys, or other means of fastening, making of it a loose pulley. A short distance on one side or the other of the pulley the plate B is to be mounted on the shaft, the halves being secured together by the bolts through lugs G. Then the rock-shaft K and its connections, the scale-ring and scale employed, and finally the plate A are all mounted on B. The weighing-spring W is then to be connected according to the direction of motion, as before described, and the ball-stud U' is to be properly set in the slot x , so as to bring the pointer n to indicate zero when the stop-bracket u is against the end of the screw s or t for a back-stop, as described. The dynamometer is then to be moved along the shaft until the periphery of the plate A comes against the arms of the pulley. The periphery of A has a projecting or offset surface y' , which is perforated all around by holes, as shown, Fig. 2. The plate A is to be secured to one side of the arms of the pulley by means of bolts b' , passed through y' , one on each side of every arm so secured, each pair of

bolts passing through a strap-piece on the other side of each arm thus secured. (See Fig. 5.) The plate B is then to be secured to the shaft by the set-screw S' . (Shown in Figs. 2, 3, and 4.) When the shaft is set in motion, any power taken from it by the pulley for driving other machinery by means of a belt will be transmitted from the plate B to the pulley through the spring W, resulting in a greater or less elongation of W, and consequent movement of the pointer-hand n to a position on the scale-plate employed, and the latter, as previously described, may be held stationary or secured to a stationary or object to prevent its turning with the dynamometer.

In dynamometers heretofore constructed, wherein the part driving the pulley is centered on the part secured to the shaft, no provision is made for articulation between those parts in direction of the axis of the shaft. Therefore any imperfection of the pulley's arms from a true plane square across the shaft or springing of the arms results in binding together the two parts mentioned where they are held concentric.

In my improved dynamometer I provide for free articulation and preserve concentricity of those parts by making the exterior surface of the centering-hub D on the plate B spherical, as shown at D, Figs. 4 and 5. By means of the relative positions of the hubs X, V, and V' and stop-bracket u and screws s and t injury to the spring or indicating mechanism is prevented either from driving forward with too great a load or from driving backward by mistake or intention.

I claim as new—

1. In a rotary transmitting-dynamometer, the combination of a plate adapted to be made fast to the shaft and provided with a central hub, the exterior surface of which is spherical, and a loose plate adapted to be mounted upon said spherical hub and capable of changing its angular position relatively to the fast plate around the axis of rotation of the dynamometer and also of assuming positions in different planes inclined to the plane of the fast plate, substantially as shown and described.

2. In a rotary transmitting-dynamometer, the loose plate A, provided with the stop-bracket u , in combination with the shaft-plate B, having a gap cut in its periphery within which the end of the stop-bracket u is adapted to move, thereby limiting the relative angular movement of the two plates, substantially as shown and described.

3. In a rotary transmitting-dynamometer, in combination with the spring W, the loose plate A, provided with the stop-bracket u , the plate B, having a gap cut in its periphery within which the end of the stop-bracket u is adapted to move, and the adjusting-screws s and t , substantially as shown and described.

4. In a rotary transmitting-dynamometer, the combination of the plate A, provided with

the stop-bracket *u* and the suspending hubs V and V', with their pins, the spring W, and plate B, provided with the suspending hub X and its pin, and the gap in the periphery of B, bounded by the lugs *q* and *r*, the said several parts being arranged and placed relatively to each other, substantially as and for the purposes set forth and described.

5. In a rotary transmitting-dynamometer, the combination of the plate A, provided with the slot *x*, the plate B, spring W, a scale-plate upon which is indicated the number of horse-powers transmitted from one plate to the other, intermediate mechanism, one end of which intermediate mechanism is adjustably secured in said slot *x* and the other is attached to the pointer-hand of said scale-plate, substantially as shown and described.

6. In a rotary transmitting-dynamometer, the combination of a loose plate A, spring W, indicating device, and intermediate mechanism connecting said indicating device with said plate A, with a fixed or shaft plate having a spherical hub extending toward the loose plate and an elongated hub extending from the opposite side of said shaft-plate, upon which two hubs the loose plate and all the other parts of the dynamometer are mounted, substantially as shown and described.

7. In a rotary transmitting-dynamometer, the combination of the plates A and B, means for offering resistance to the rotation of one of said plates past the other, the connecting-rod T, provided at both ends with the universal ball-and-socket joints U U', one end of said rod being connected to the plate A and the other end being secured to suitable devices, which, with said connecting-rod, constitute a transmitting mechanism, for the purposes set forth.

8. In a rotary transmitting-dynamometer, the combination of the plates A and B, spring W, the connecting-rod T, provided at both ends with the universal ball-and-socket joints U U', one end of said rod being connected to the plate A and the other end being secured to suitable devices, which, with said connecting-rod, constitute a transmitting mechanism, for the purposes set forth.

9. In a rotary transmitting-dynamometer, the combination of the plates A and B, means for offering resistance to the rotation of one of said plates past the other, the rock-shaft K, the sliding collar Q, suitable devices connecting said rock-shaft with said plate A, and suitable devices connecting said rock-shaft with said sliding collar Q, substantially as shown and described.

10. In a rotary transmitting-dynamometer, the combination of the plates A and B, a weighing spring or springs, the rock-shaft K, the sliding collar Q, suitable devices connecting said rock-shaft with said plate A, and suitable devices connecting said rock-shaft with

said sliding collar Q, substantially as shown and described.

11. In a rotary transmitting-dynamometer, in combination with the two plates A and B, spring W, the connecting-rod T, arm N, rock-shaft K, arms O O, links P P, and sliding collar Q, substantially as shown and described.

12. In a rotary transmitting-dynamometer, in combination with the plates A and B, the spring W, the connecting-rod T, arm N, rock-shaft K, arms O O, links P P, the sliding collar Q, fixed collar *e*, and their respective encircling rings *f* and *g*, guide-rods *i*, link *k*, pointer-hand *n*, and a suitable scale-plate, substantially as shown and described.

13. As a new article of manufacture, a differential scale-plate adapted for use in connection with a dynamometer and capable of adjustment for different speeds of rotation of the shaft or for different springs or other weighing devices employed in the dynamometer and when so adjusted for any given speed or for any given weighing device the true number of horse-powers being transmitted through the dynamometer will be indicated upon said scale-plate without requiring any computation, substantially as shown and described.

14. In a rotary transmitting-dynamometer, the combination of the plates A and B, spring W, a differential scale-plate and suitable mechanism connecting the latter with the plate A, said scale-plate being so constructed that when suitably adjusted for any given speed of rotation of the shaft, the strength of the spring W being constant, or vice versa, for any given spring and the speed of rotation being constant, the actual number of horse-powers being transmitted through the dynamometer will be indicated upon said scale-plate without requiring any computation and may be read while the dynamometer is in operation, substantially as set forth and described.

15. In a rotary transmitting-dynamometer, the combination of the plates A and B, means for offering resistance to the rotation of one of said plates past the other, the scale-plate *d'* and its pointer-hand *n*, suitable mechanism connecting said pointer-hand with the plate A and the scale-plate *j*, all arranged and constructed substantially as shown and described.

16. In a rotary transmitting-dynamometer, the combination of the plates A and B, spring W, the scale-plate *d'*, and its pointer-hand *n*, suitable mechanism connecting said pointer-hand with the plate A and the scale-plate *j*, all arranged and constructed substantially as shown and described.

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Witnesses:

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