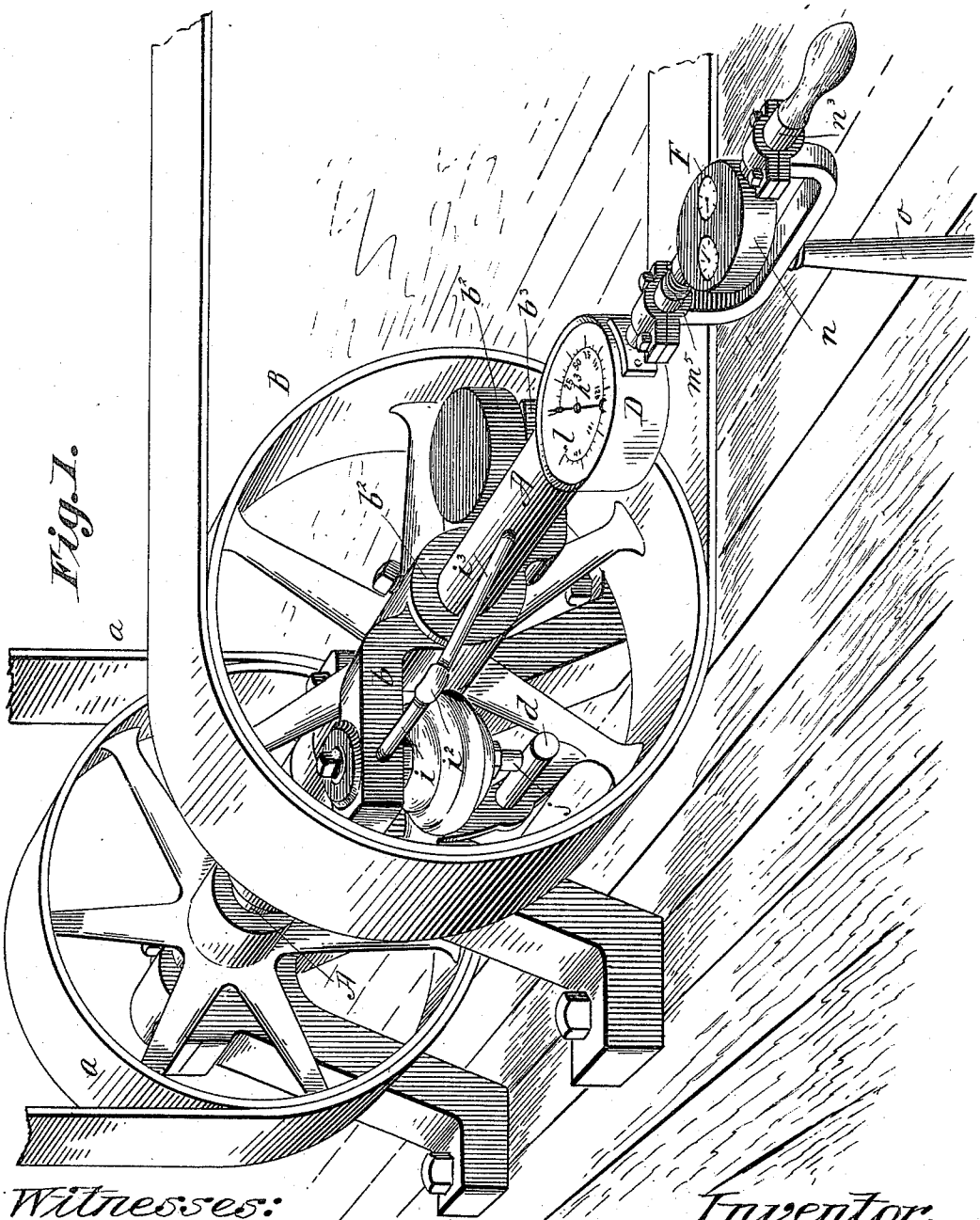
(No Model.) 3 Sheets—Sheet 1.

B. F. PERKINS.

DYNAMOMETER.

No. 535,856. Patented Mar. 19, 1895.



Witnesses:
J. W. Garfield
K. S. Clemons

Inventor,
Benj. F. Perkins,
by Burpindle & Co.
Attys.

(No Model.) 3 Sheets—Sheet 2.

B. F. PERKINS.

DYNAMOMETER.

No. 535,856. Patented Mar. 19, 1895.

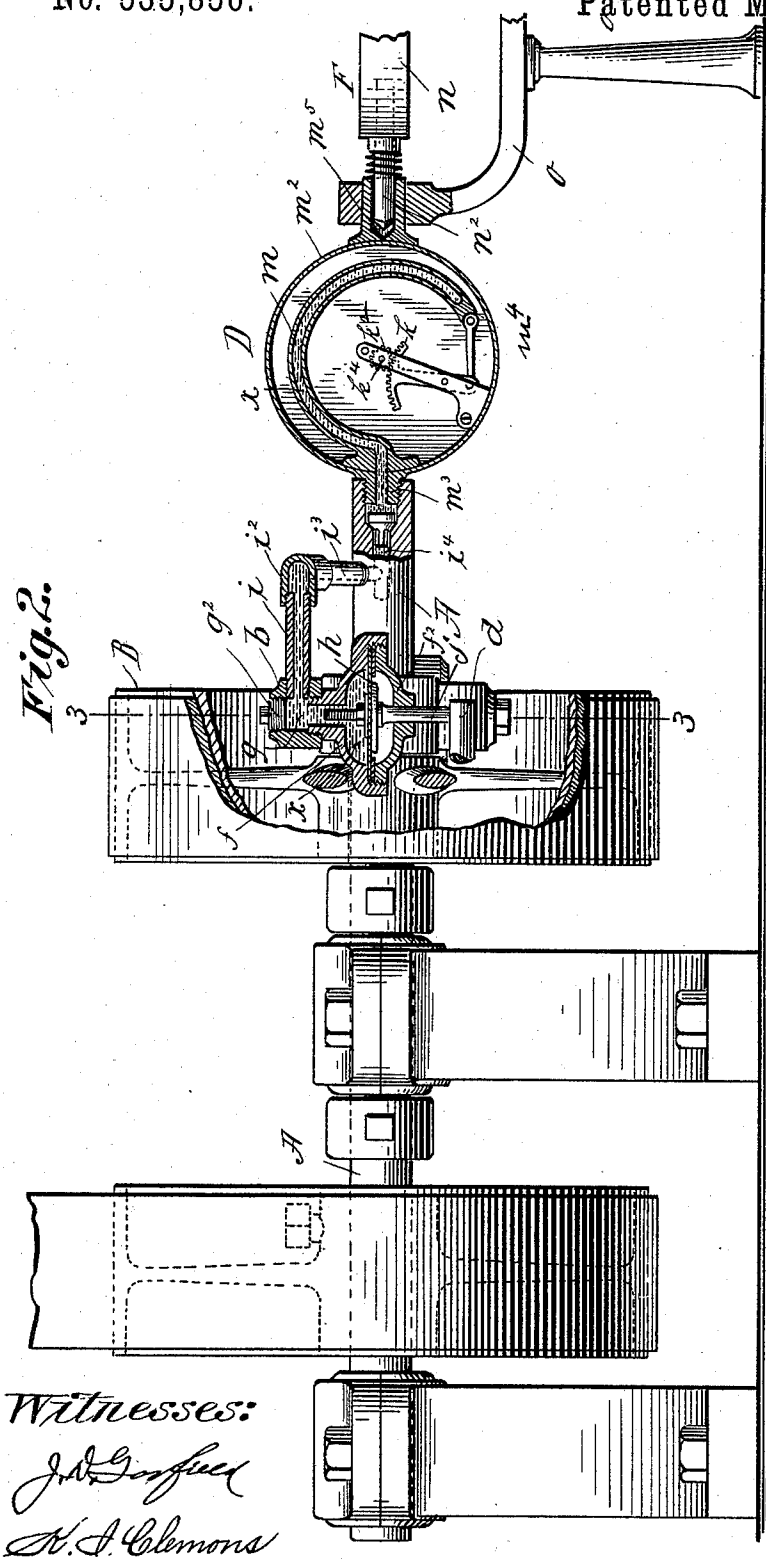


Fig. 2.

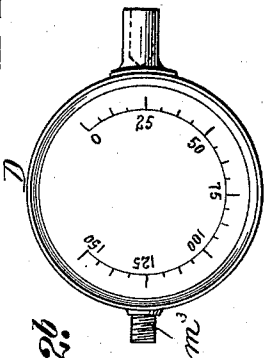


Fig. 2b

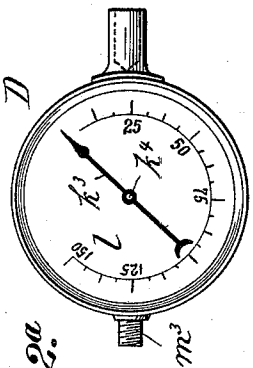


Fig. 2a

Witnesses:
J. D. Gonfuel
K. A. Clemons

Inventor:
Benj. F. Perkins
by Chapin & Co.
Attys.

(No Model.) 3 Sheets—Sheet 3.

B. F. PERKINS.

DYNAMOMETER.

No. 535,856. Patented Mar. 19, 1895.

Fig. 3.

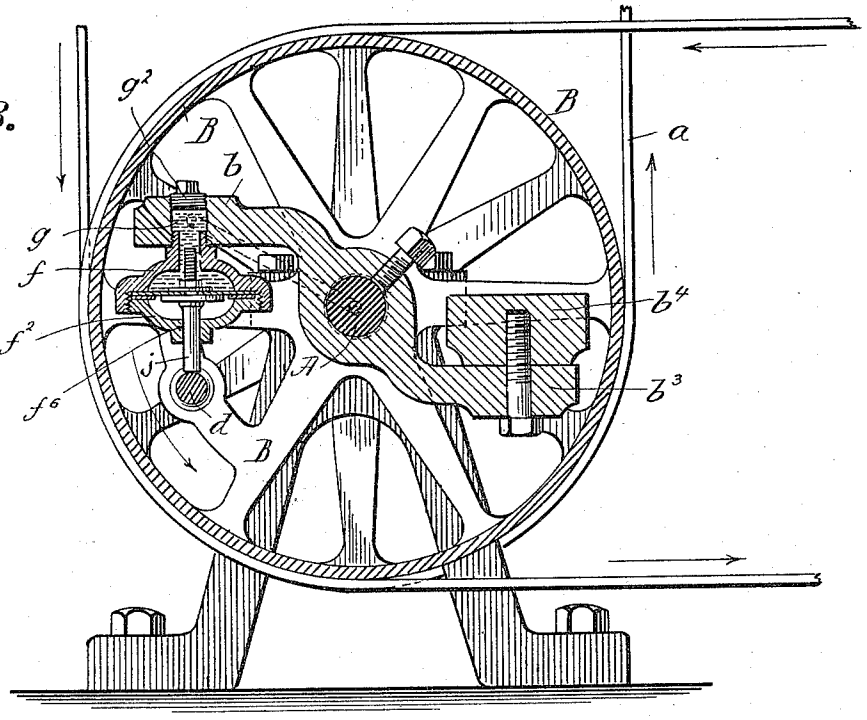
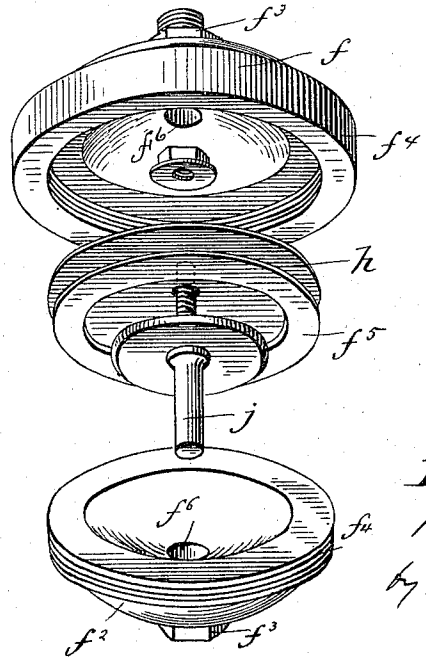


Fig. 4.



Witnesses:
J. W. Garfield
K. S. Clemons

Inventor
Benj. F. Perkins
by Chapin & Co.
Attys.

UNITED STATES PATENT OFFICE.

BENJAMIN F. PERKINS, OF HOLYOKE, MASSACHUSETTS.

DYNAMOMETER.

SPECIFICATION forming part of Letters Patent No. 535,856, dated March 19, 1895.

Application filed March 2, 1894. Serial No. 502,090. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. PERKINS, a citizen of the United States of America, residing at Holyoke, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Dynamometers, of which the following is a specification.

This invention relates to improvements in dynamometers or power measuring apparatus, the object being to improve the mechanism to the end of rendering it more readily available and efficient; and the invention consists in constructions and combinations of parts all substantially as will hereinafter fully appear and be set forth in the claims.

In the accompanying drawings, Figure 1 is a perspective view showing the driving-shaft, a pulley driven by the shaft and the dynamometer applied so as to show the force in transmission, and as exerted by the shaft to carry around the pulley, a speed indicator being also shown. Fig. 2 is a side elevation of the same, the parts which are especially comprised in the dynamometer mechanism being, however, shown substantially in central, or axial vertical section. Figs. 2^a and 2^b illustrate the pressure indicators, externally. Fig. 3 is a vertical, transverse section taken on the line 3—3, Fig. 2. Fig. 4 is a perspective view showing the different parts of the diaphragm, diaphragm-casing, and diaphragm operating element here employed.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings, A represents a shaft which may be driven by the belt and pulley seen at *a*. This shaft is the dynamic element, or primary movable part, and B represents a pulley which is loose on the shaft, A, but which constitutes the secondary part which is driven, and around this shaft is shown a driving belt which may run to the machine, or machines, for which the power is desired to be determined. This loose pulley is driven by the shaft through means of a part of the dynamometer shown as interposed between an arm, *b*, fixed to move as one with the shaft, and a stud, *d*, extended from a web, or spoke, of the driven pulley. Said stud, *d*, engages with a rod connected to a diaphragm, below described, whereby the latter is deflected by a piston-like movement thus given to said stud. The said arm, *b*, is extended to one side of a hub, b^2, which is by a set screw, or key, fixed to the shaft, A, and another arm, b^3, is extended at the opposite side of the hub and carries, or has, as a part of its end the counterweight, b^4, which is effective in balancing the dynamometer parts to be next described.

A part of the dynamometer which constitutes the medium of the transmission between the arm, *b*, of shaft, A, and the stud, *d*, of the pulley, B, will be now described in detail, the same consisting of a diaphragm casing supported and carried by the arm, *b*, a diaphragm in, or forming a side of, the casing, and a diaphragm-compressing element which is borne upon by the stud.

The diaphragm casing consists of casing-sections, f, f^2, of hemi-spheroidal form having edge flanges, f^4, respectively, externally and internally screw-threaded, to be screw-united, and each has an axially extended hub, f^3, which is centrally bored, as seen at f^6. The hub, f^3, of the casing section, f, screws into the threaded orifice of a hole, g, which is bored through the thickness of the shaft-arm, *b*. The opposite end of this hole is closed by the screw-stopper, g^2.

h represents the flexible diaphragm which is clamped between the two sections of the casing,—a washer, or clamping ring, f^5, being provided, as usual, at the margin of the diaphragm and a rod, or piston-like element, *j*, is attached to, and projects axially from, the diaphragm through and beyond the hole, f^6, in the hub of the casing-section, f^2. The manner of engagement of this stud, *j*, with the diaphragm, consists in the flange of the stud lying against one side of the diaphragm, its attenuated and threaded inner end passing through the central hole of the diaphragm, while the nut screws against the washer and presses it against the inner side of the diaphragm.

Within the chamber constituted by the diaphragm and the casing-section, *f*, a body of liquid is placed which is subject to displacement in a greater or lesser degree according to the extent of the deflection of the diaphragm, and which will consequently operate the scale, or indicator, which determines the amount of the power in transmission, which

scale, or indicator, is seen at D; and it comprises an arc-formed chamber, m, the walls of which are yielding and resilient, or reactive. This arc-shaped chamber is mounted in a casing, m^2, at its one end and opens to the hub, m^3, thereof, while its other end, m^4, is closed, as seen in Fig. 2. This arc-chamber, m, is in communication with the space behind the diaphragm through means of conduits, as follows: From the hole, g, which is open to the diaphragm chamber, the tube, i, leads which has the elbow coupling, i^2, and angular tube section, i^3, which radially communicates with the axial passage, i^4, within the said shaft, A, at an end portion thereof which is beyond the part surrounded by the pulley, B. The hub of the indicator casing (through which is the orifice of the chamber, m,) screws axially into the enlarged mouth of the passage, i^4. The liquid, x, is of such quantity as not only to fill the diaphragm chamber, but also the chamber, m, and intermediate connecting conduits, i, i^3, i^4. This pressure of the liquid, as induced by the deflection of the diaphragm, insures the tendency of the arc-chamber to straighten out thereby swinging, through the link, the lever, on one arm of which is the sector gear, k. This sector meshes with the pinion, k^3, the arbor, k^4, of which is mounted in the casing, m^2, and which arbor carries the pointer, k^5, at the outer dial face of the pressure indicator casing. As here arranged the casing rotates as one with the shaft, A, and it is preferably painted, or enameled, white, its figures and graduations, and the pointer, being black. By reason of the persistence of the vision to retain intermittently exposed objects, the bodily rotating indicator apparently becomes resolved into a graduated and figured dial face having a pointer which may be easily read. In order to increase the clearness, or intensity, of this effect, I place upon the rear side of the casing an exact duplicate of the dial-face, as seen in Fig. 2^b.

In conjunction with this dynamometer it is necessary to know the speed of rotation of the shaft and pulley, and a speed indicator of any of the well known descriptions may be used for this purpose.

In the present illustrations a speed indicator of a very common type is shown in a general way at F, it not being necessary to describe or show its detailed construction. It will be understood, however, that this speed indicator has the casing, n, to contain the mechanism which is held stationary relative to that part, the rotations of which it is to determine, while its operating shaft, n^2, is rotatable within the casing and derives its rotation by having a suitable manner of engagement with the rotating part. Now, as indicated in Figs. 1 and 2, the shaft, n^2, enters a socket, m^5, in the outer hub of the indicator casing, n. The end of the shaft is of diamond pointed, or other angular form so that when pressed inwardly to the seat of the socket, m^5, the shaft must rotate as one with the socketed part. By reason of a spring suitably applied as usual, the shaft, n^2, is designed to recede from within the socket so as normally to be out of a rotating engagement. As shown in these drawings the speed indicator casing has a handle-bar, n^3, which is extended, trunnion-like, radially opposite the shaft, n^2, and the stand, o, may be provided to support this arm and also the socketed hub, m^5, of the pressure-indicator. By forcing the handle, n^3, endwise and maintaining it in its position of engagement, the rotational velocity may be determined.

In lieu of mounting the speed indicator in a stand therefore, as shown, of course the same may be presented momentarily properly relative to the shaft, as is common among mechanical engineers and others for determining, by an indicator of this description, the rotational velocity.

Of course there is a great variety of speed indicators which might be utilized other than the one of the character here superficially illustrated.

The resistance element in the pressure indicator, or scale, is to be originally by the constructor adjusted, or regulated, in a determinate manner to accord with the power applied or transmitted through the diaphragm—that is to say, in explanation, in the present illustrated instance, every pound of force transmitted by the shaft-arm, b, through the diaphragm to the driven pulley, B, will, of course, before being transmitted to said pulley, insure a deflection of the diaphragm and a consequent and corresponding straightening of the resilient chamber, m, in such a degree as to register in a corresponding number of pounds upon the face of the dial.

Now, the process of computation, making use of the data established by the mechanism here contemplated, is as follows: Multiply the circumference of the pulley, in feet, (which is the travel of the working belt) by the number which is found to indicate the rotations per minute of the shaft and the driven pulley, and multiply this product by the number shown by the pressure indicator representing pounds, whereby I learn the number of foot pounds carried per minute, and dividing this by thirty-three thousand, the quotient gives the horse power developed.

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

1. The combination with the shaft, A, having the passage, i^4, therein which opens to its end, and the pulley, B, loose on the shaft having the projecting stud, d, of the arm, b, fixed on the shaft and having the hole, g, transversely through it, a diaphragm casing having a hollow hub screwed into one orifice of said hole, and a reciprocatory stud engaging the diaphragm and in turn engaged by the said stud, d, of the pulley, the removable stopper, g^2, screwing into the other orifice of said

hole, g, the tube section communicating with said hole, g, and the tube section, i^3, coupled to said section, i, and communicating with the shaft passage, i^4, and a pressure indicator connected with the said passage, i^4, all substantially as described and shown.

2. In combination, the shaft, A, with hole, i^4, extended to its end and having the fixed arm, b, with hole, g, and conduits, i, i^3, leading therefrom to said hole, i^4, and the diaphragm-casing and diaphragm supported by said arm and having its chamber in communication with said hole, g, the screw stopper at one end of said hole, and the diaphragm-stud, j, the loose pulley, B, having the projection, d, in engagement with said stud, j, the reactive casing, m, having the hollow hub, m^3, screwing into the open end of shaft, A, and the inclosing casing, m^2, movable as a part of said hub and having double dial faces, the diaphragm-operating liquid, and the pointer over one of the dials, operated by said reactive casing, all substantially as described and shown.

BENJAMIN F. PERKINS.

Witnesses:
HENRY A. CHAPIN,
K. I. CLEMONS.