(No Model.)

2 Sheets—Sheet 1.

J. I. THORNYCROFT.

SPEED MEASURE.

No. 409,524. Patented Aug. 20, 1889.

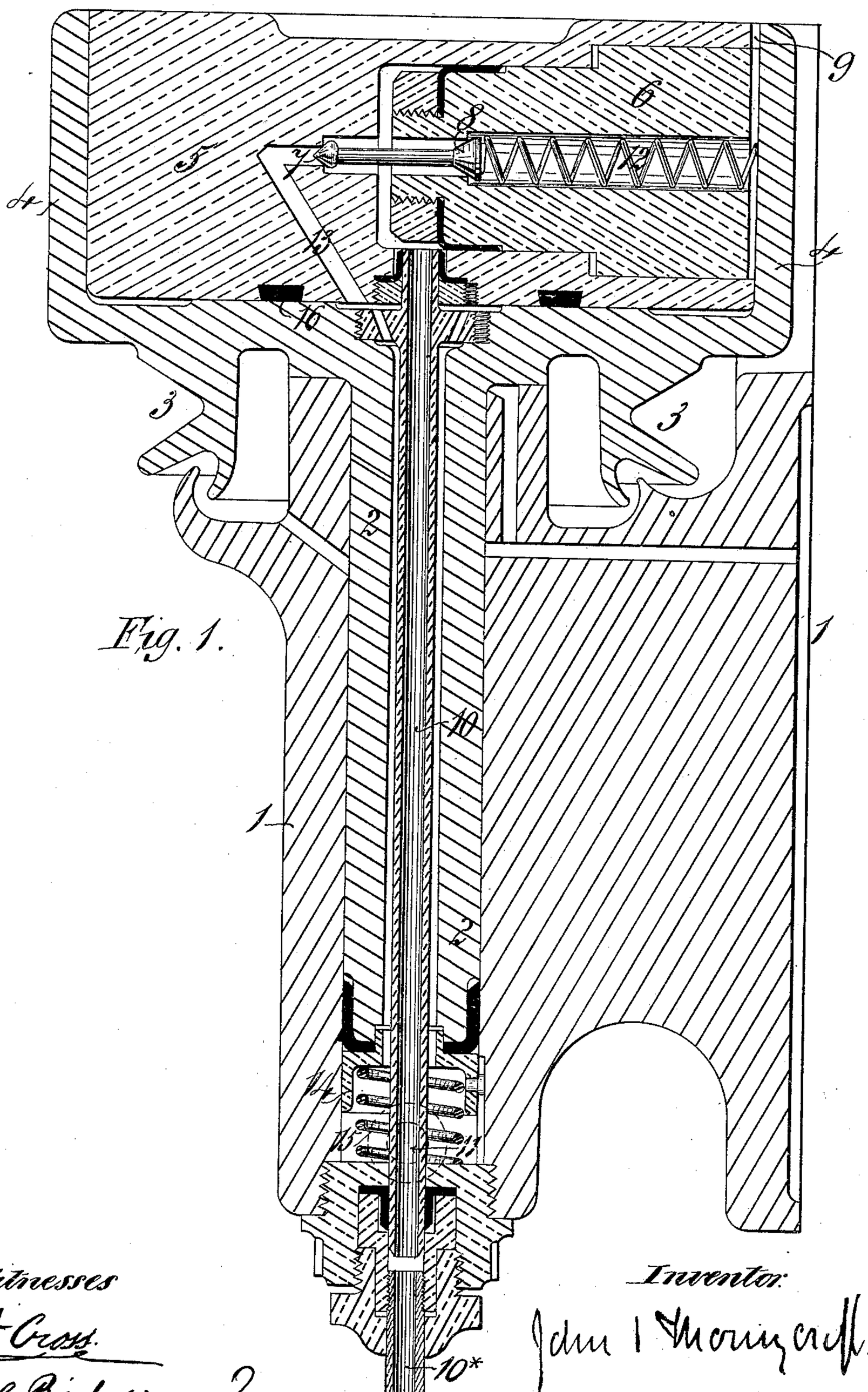

Fig. 1.

Witnesses
W. Cross.
Tobg Ridgway

Inventor:
John I Thornycroft.

(No Model.)

2 Sheets—Sheet 2.

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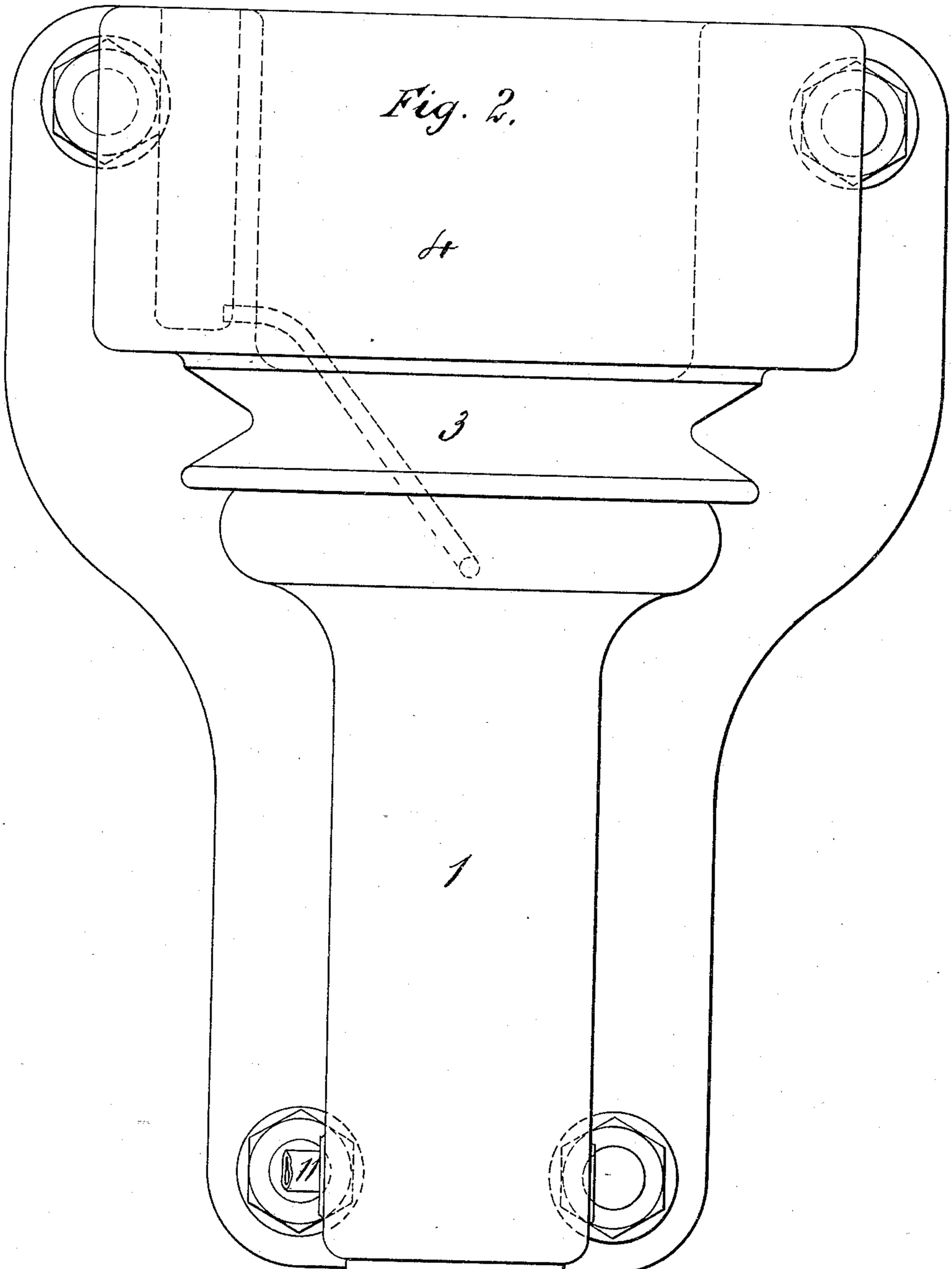
SPEED MEASURE.

No. 409,524. Patented Aug. 20, 1889.

Fig. 2.



Witnesses

W. Cross

W. B. Ridgway

Inventor:

John I. Thornycroft.

UNITED STATES PATENT OFFICE.

JOHN ISAAC THORNYCROFT, OF CHISWICK, COUNTY OF MIDDLESEX, ENGLAND.

SPEED-MEASURER.

SPECIFICATION forming part of Letters Patent No. 409,524, dated August 20, 1889.

Application filed January 3, 1888. Serial No. 259,736. (No model.) Patented in England March 18, 1887, No. 4,122; in Sweden December 21, 1887, No. 1,813; in France December 24, 1887, No. 187,806; in Germany December 24, 1887, No. 43,957; in Italy February 23, 1888, No. 22,843; in Spain April 30, 1888, No. 7,751, and in Austria-Hungary May 7, 1888, No. 49,953.

To all whom it may concern:

Be it known that I, JOHN ISAAC THORNYCROFT, a subject of the Queen of Great Britain and Ireland, residing at Chiswick, in the county of Middlesex, Kingdom of Great Britain and Ireland, have invented Improved Apparatus for Indicating the Speed of Rotating Shafts, (for which I have obtained patents as follows: England, March 18, 1887, No. 4,122; France, December 24, 1887, No. 187,806; Germany, December 24, 1887, No. 43,957; Austria-Hungary, May 7, 1888, No. 49,953; Sweden, December 21, 1887, No. 1,813; Spain, April 30, 1888, No. 7,751, and in Italy Reg. A. H., Vol. XLV, No. 150, Patent No. 22,843, February 23, 1888,) of which the following is a specification.

This invention relates to apparatus designed for use as a speed-indicator for rotating shafts.

The apparatus according to this invention indicates the speed of a rotating shaft by varying the pressure existing in a pipe on which is or are mounted one or more gages or indicators constructed after the manner of pressure or vacuum gages.

The apparatus comprises a cylinder or valve-case connected at one part to an apparatus capable of exercising a constant exhausting or compressing action, at another part to the pipe in which the pressure is to be varied, and at a third part with the atmosphere. The first and third connections are each provided with a valve, the two valves being on one spindle and moving together. The third inlet or opening to the cylinder or valve-case is located in a piston or diaphragm subject to the direct action of centrifugal force. It is this force exercised on the piston or diaphragm which determines the pressure maintained in the cylinder or valve-case and in the pipe connected with it. This force will vary as the square of the number of rotations, and the receiving-dials must be marked in accordance with this law.

Referring to the accompanying two sheets of drawings, Figures 1 and 2 show in section and elevation apparatus for controlling pressure applied to indicating the speed of rotating shafts.

Within a fixed bearing 1 there rotates a vertical spindle 2, driven by a band which partly encircles the pulley 3. At the top of the spindle is a cup or disk 4, in which lies a cylinder or body 5. Within this body there is a bored cavity in which there works the piston or plunger 6, capable of endwise motion. A valve-seat is formed in this plunger for the valve 8, which is connected by a stem or spindle to the valve 7.

The apparatus has three connections. The opening 9 admits the atmosphere to the interior of the plunger 6. The pipe 10 is connected to the external tube, on which the indicators 10^a are fixed, while the outlet 11 is connected to an exhausting apparatus, such as a pump or fan. Owing to the fact that the piston and valves are carried in a rotating body, while the connections to the external pipes are stationary, the passages are not quite direct. They can, however, be easily followed on the drawings, and will be most readily understood by tracing the movements of the air within them. Let it be assumed that the spindle is rotating with a uniform velocity and that the exhausting apparatus is in operation. The plunger 6 will be urged outward by centrifugal force and this force will be balanced by the excess of pressure on its outer end over that on its inner end. Any outwardly-acting centrifugal force in the coupled valves 7 and 8 is resisted by the spring 12. Now, should the speed of rotation of the spindle increase the piston will move outward and the valve 7 will leave its seat. Air will then be drawn from the external indicator-tube through the tubes 10* and 10 past the valve 7 into the tube 13 and down the annular passage in the spindle to the chamber at the bottom of it, and thence by the outlet 11 to the exhausting apparatus. When the pressure has been reduced sufficiently to balance the centrifugal force of the plunger, the latter returns to its former position and the valve 7 closes the tube 13. Should the speed of the shaft be decreased, the centrifugal force of the plunger will also be decreased and will cease to balance the pressure of the external atmosphere on the outer side of the plunger, due to the

partial vacuum at the inner side thereof. The plunger will consequently be moved inward by the difference of the external over the internal pressure and the external air will pass the valve 8 until the partial vacuum existing below the plunger and in the indicator-pipe is so far reduced that the plunger moves back to its normal position and closes the valve 8.

Leather packing-rings form a convenient means of rendering the various joints air-tight. Such rings are shown on the piston at the top of the tube 10, and also at the bottom of it and of the spindle 2. This latter ring is held in place by a stuffing-box 14, held up by a spring 15. The stuffing-box is kept from rotating by a pin which engages in a vertical groove in the bracket 1. The body 5 is not fixed in the cup 4. It is made to fit air-tight around the passages in the spindle by the packing-ring 16.

What I claim is—

1. In apparatus for indicating the speed of rotating shafts, a rotating valve-case or cylinder connected at one part to an apparatus for increasing or reducing fluid-pressure—such as an exhauster—at another part to the pipe in which pressure is to be varied, and at a third part to a source of constant pressure—such as the atmosphere—in combination with a body—such as a piston—arranged to rotate with said valve-case or cylinder and itself subjected to the direct action of centrifugal force, and a valve or valves controlling two of the connections to the said valve-case or cylinder, substantially as described.

2. In apparatus for indicating the speed of rotating shafts, a rotating valve-case or cylinder connected at one part to an apparatus for increasing or reducing fluid-pressure—such as an exhauster—at another part to the pipe in which pressure is to be varied, and at a third part to a source of constant pressure—such as the atmosphere—a piston arranged to be rotated with said valve-case or cylinder and to be subjected to the direct action of centrifugal force, and two valves, of which one is seated in the said piston, substantially as described, for the purpose specified.

3. In apparatus for indicating the speed of rotating shafts, a rotating valve-case or cylinder connected at one part to an apparatus for increasing or reducing fluid-pressure—such as an exhauster—at another part to the pipe in which pressure is to be varied, and at a third part to a source of constant pressure—such as the atmosphere—a piston arranged to be rotated with said valve-case or cylinder and to be subjected to the direct action of centrifugal force, and two valves, of which one is seated in the said piston, while the other commands a connection between the apparatus for increasing or reducing fluid-pressure and the space in which the pressure is to be varied, substantially as described.

4. In apparatus for indicating the speed of rotating shafts, a rotating body in which is a piston that rotates with and can slide radially within said body, is directly acted upon by centrifugal force, and is subject on one side to the pressure of the atmosphere and on the other side to the pressure to be varied, and a valve or valves controlled by the said piston, substantially as described, for the purpose specified.

5. In apparatus for indicating the speed of rotating shafts, the combination, with a rotating body 5, formed with a passage 13, in communication with an apparatus for increasing or reducing pressure, of the piston 6, arranged to move radially in said body and provided with a passage therethrough, air-inlet opening 9, in communication with the passage through said piston, the connected valves 7 and 8, said valve 7 being arranged to control said passage 13 and said valve 8 being arranged to control the passage through said piston, and a passage 10, in communication with the pipe in which pressure is to be controlled, all substantially as described.

6. In apparatus for indicating the speed of rotating shafts, the combination, with a rotary valve-case or cylinder connected at one part to an apparatus for increasing or reducing fluid-pressure, at another part to the pipe in which pressure is to be varied, and at a third part to a source of constant pressure—such as the atmosphere—a piston which is in rotation and is subject to centrifugal force, and a valve or valves controlling two of the connections to the said valve-case or cylinder, of indicating-dials, substantially as described, for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN ISAAC THORNYCROFT.

Witnesses:

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