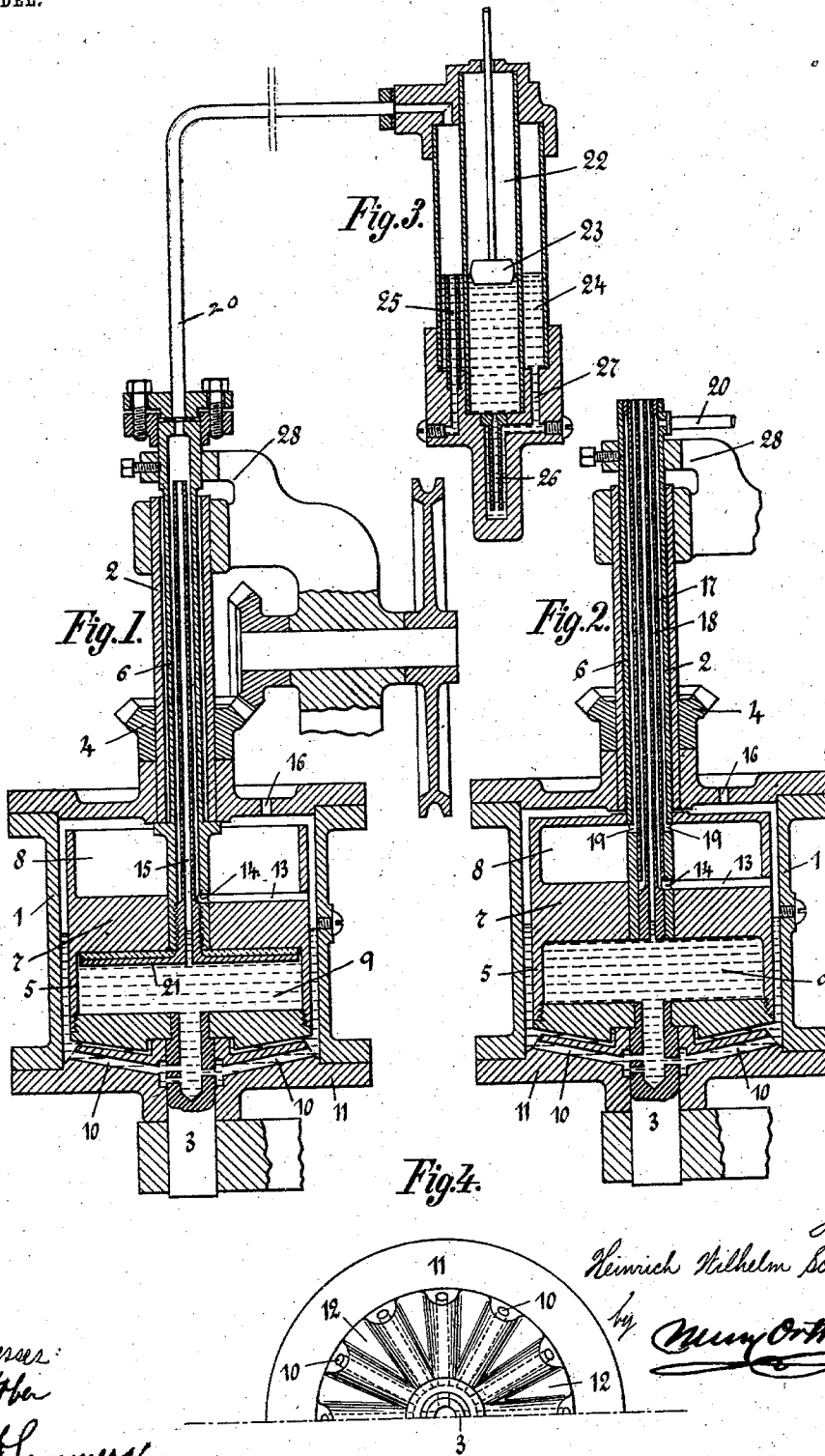


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H. W. SCHLOTFELDT.
ROTARY SPEED INDICATOR.
APPLICATION FILED NOV. 23, 1901.

NO MODEL.



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UNITED STATES PATENT OFFICE.

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ROTARY-SPEED INDICATOR.

SPECIFICATION forming part of Letters Patent No. 740,698, dated October 6, 1903.

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To all whom it may concern:

Be it known that I, HEINRICH WILHELM SCHLOTFELDT, a subject of the German Emperor, and a resident of Kiel, in the German Empire, have invented certain new and useful Improvements in Rotary-Speed Indicators, of which the following is a specification.

This invention relates to rotary-speed indicators, and refers more particularly to that class in which the rotary motion causes a displacement of liquid, whereby alterations in air-pressure are produced within the measuring apparatus. Between the pressure-gage and the external air is arranged a conduit for the liquid set in movement by the rotary motion in such a manner that upon said liquid entering the conduit the pressure-gage is closed to the atmosphere and owing to this closing action the latter is thereby subjected to an alteration of air-pressure—i. e., either rarefaction or compression.

In the accompanying drawings I have shown by way of example two forms of indicator constructed in accordance with this invention.

Figure 1 is a central vertical section of the first constructional form of my improved rotary-speed indicator. Fig. 2 is a similar section of the second constructional form of my rotary-speed indicator. Fig. 3 is a central vertical section of a preferred form of pressure-gage to be used in connection with my speed-indicator. Fig. 4 is a detailed view showing a plan or top view of the cylinder-bottom.

Similar numerals of reference refer to similar parts throughout the several views.

Both the constructional forms, as shown in Figs. 1 and 2 of the annexed drawings, comprise a cylinder 1, having two trunnions 2 and 3. The trunnion 2 is hollow and is fitted with driving means—for example, a beveled wheel 4—adapted to transmit the rotary motion of the part of a machine which it is desired to measure onto the cylinder 1. In the interior of the cylinder 1 is provided a second cylinder 5, with an intervening space, such cylinder being mounted loose on the trunnion 3 and fixed on a tube 6, passing through the tubular or hollow trunnion 2 and fixed to the bearing 28 of the latter. The internal cylinder is thus held stationary within the outer cylinder. The internal cylinder

is divided by a central partition 7 into two spaces 8 and 9, the latter being in communication with the interior of the outer cylinder 1 by means of the partly-hollow trunnion 3, having openings, and by radial passages 10 in the cylinder-bottom 11. Between each two radial passages 10 there is formed in the inner surface of the cylinder-bottom a radial groove or channel 12, the purpose of which will be hereinafter more fully explained. Upon the surface of the partition 7 are formed a number of radial channels 13, which connect the inner cylinder-space 8 with the internal space of the outer cylinder. In the latter and the cylinder-space 9 is provided a liquid—for example, mercury—which rises between the two cylinders 1 and 5 when the outer cylinder revolves. If the rotation reaches a certain speed, the liquid enters through the channels 13 into the cylinder-space 8 and through openings 14 into the fixed inner tube 6 of the inner cylinder.

In the form shown in Fig. 1 the inner tube 6 is fitted with a pipe 15, which opens at one end through the partition 7 into the cylinder-space 9 and on the other end freely into the tube 6, which is connected with a pressure-gage or measuring apparatus. Moreover, the upper end of the cylinder-space 8 is open and communicates with the outer air through an aperture 16 in the outer cylinder-cover. From this arrangement it is clear that the liquid entering through the openings 14 into the pipe 6 cuts off the passage of the outer air through the openings 14 and the tube 6 into the measuring apparatus and at a further increase of speed, and consequent further displacement of the liquid from the cylinder-space 9 into the cylinder-space 8, a rarefaction of the air in cylinder-space 9 and tube 15 is created and communicated to the measuring apparatus, the indicated degree of rarefaction of the air giving the speed of rotation.

In the second constructional form (shown in Fig. 2) the tube 6 is fitted with two tubes 17 and 18, one inside the other, and of which the innermost tube 18 is connected at one end with the outer air and on the other end with the cylinder-space 9, while the tube 17 forms annular spaces both with the tube 18 and the tube 6. The annular space between

17 and 18 is closed at bottom and open at top, and the orifices 14 open into it. The annular space between 17 and 6 is open at bottom and closed at top and communicates with the closed cylinder-space 8 through openings 19, while a conduit 20 places it in communication with the measuring apparatus. From this arrangement it follows, on the one hand, that the liquid entering through the openings 14 into the annular space between 17 and 18 closes the passage of the outer air through such annular space through the openings 14 and 19 and through the annular space between 17 and 6 to the measuring apparatus, and that then, on the other hand, the liquid entering the cylinder-space 8 creates an increase in the air-pressure in the measuring apparatus, the indicated degree giving the rotary speed.

The previously-mentioned radial grooves 12 upon the inner surface of the cylinder-bottom 11 have the object to cause the liquid to be everywhere rotated, and thereby forced outward, and to prevent the return flow of the liquid into the cylinder-space 9 through unavoidable escapes between the loosely-disposed inner cylinder-bottom and trunnion 3.

By an adjustable plate 21 in the cylinder-space 9 the vertical ascending distance for the liquid till it closes the openings 14—i. e., till the commencement of speed indication—may be regulated as required. The space between the plate 21 and the partition 7 of the cylinder is filled with shellac or any other suitable material.

The pressure-gage may be of the form shown in Fig. 3. This gage comprises an inner chamber 22, with float 23, and a surrounding annular chamber 24, with overflow-pipe 25, and communication-pipes 26 and 27, filled to the level of the overflow-pipe with appropriate liquid, such as mercury. As the air-pressure in the chamber 24 decreases or increases the liquid in the inner chamber 22 falls or rises and moves the float 23, which communicates its motions to an appropriate indicator.

The operation will be as follows: The outer cylinder 1 is set in rotation by any suitable means, here indicated as pulley-driven bevel-gears. The mercury in cylinder 9 will begin to rise between the walls of the two cylinders 1 and 5 and be replaced by that in the chamber 9, which acts as a sort of reservoir, through the hollow part of the trunnion 3 and passages 10. The rise of the mercury between the walls of the two cylinders will at a certain speed reach the channels 13, by means of which it enters the upper chamber 8 of the inner stationary cylinder and closes the opening or vent 14. By an increase in speed the mercury will still further rise in chamber 8 and tube 6 and cause a corresponding quantity of mercury to leave the lower chamber 9. Now since the tube leading to the indicator, Fig. 3, is sealed from the atmosphere at the point 14 the drop of the mercury in chamber 9 will cause a partial vacuum in the tube and chamber 24 on

the surface of the mercury therein, thereby causing a rise of the body of mercury in said chamber and a fall of the mercury in chamber 22, that communicates by pipes 26 and 27 with chamber 24. The drop of the level of the mercury in chamber 22 will cause the float 23 to drop, and thereby indicate the speed of the part to be measured.

In order to have the indicator, Fig. 3, act as a pressure instead of a vacuum gage, the structure shown in Fig. 2 is connected thereto by pipe 20. The central tube 18 is open, and atmospheric pressure is always on the mercury in chamber 9. Chamber 8 is a closed chamber communicating with tube 20 and gage, except when the passages 13 are uncovered. The speed of the cylinder 1 being such as to cause the mercury to rise and enter chamber 8 by passages 13, there will be a compression of the air in the chamber 8, which will be transmitted by port 19 between the tubes 2 and 17, through the tube 20 on top of the surface of the mercury in chamber 24 and force it through 27 and 26 into chamber 22 to raise the level of the mercury therein, as well as the float, and thereby indicate the speed.

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

1. The combination with a pressure-gage, of a vessel containing a suitable liquid, means to connect the pressure-gage with the atmosphere through said vessel and means to rotate the vessel, whereby the liquid contained therein will be caused by centrifugal force to close communication between the gage and atmosphere and also produce a variation of air-pressure in the gage dependent upon the speed of rotation of the vessel, substantially as and for the purpose set forth.

2. The combination with a pressure-gage, of an outer cylinder containing a suitable liquid, an inner cylinder supported stationary therein, means to connect the pressure-gage through the inner and outer cylinders to the atmosphere, and means to rotate the outer cylinder, whereby the liquid in said outer cylinder will be caused by centrifugal force to close the communication to the atmosphere and also produce a variation of air-pressure in the gage dependent upon the speed of rotation of the outer cylinder, substantially as and for the purpose set forth.

3. In a speed-indicator, an outer cylinder having a bottom provided with radial corrugations and radial passages through the corrugations, a stationary inner cylinder, a transverse partition intermediate its ends and containing a suitable liquid below the partition that enters the outer cylinder through the radial passages, means to establish communication from a suitable gage through the inner and outer cylinders to the atmosphere, and means to rotate the outer cylinder, whereby the liquid will be caused by centrifugal force to pass through the radial passages, rise between the two cylinders, close the com-

munication to the atmosphere to produce a pressure variation in the gage dependent upon the speed of rotation, substantially as and for the purpose set forth.

5 4. In a speed-indicator, a vessel capable of being rotated, a pressure-gage, means to connect the interior of the gage and vessel and vent them to the atmosphere, and a liquid in said vessel moved by centrifugal force to close
10 atmospheric connection to the gage and cause pressure variations therein, substantially as and for the purpose set forth.

5 5. In a speed-indicator, an outer cylinder having a bottom provided with radial corrugations and a longitudinal passage in each
15 corrugation, an inner stationary cylinder closed at its lower end, a trunnion fixed in the lower end of the outer cylinder, having a hollow upper end projecting into the inner
20 cylinder and having lateral perforations to communicate with said longitudinal passages, a pressure-gage, means to connect said gage with the inner cylinder and to vent it to the atmosphere through both cylinders, a liquid
25 contained in the lower parts of both cylinders, means to rotate the outer cylinder to cause the fluid to close communication between the gage and atmosphere and also to cause pressure variations in said gage, and
30 means in the inner cylinder to adjust the speed indication relatively to the velocity of

the outer cylinder, substantially as and for the purpose set forth.

6. A gage comprising an outer closed vessel, a float-chamber therein and a float in said
35 chamber; in combination with mechanism containing a liquid and operated by centrifugal force to cause pressure variations in the closed chamber and thereby alter the liquid-level in the float-chamber, substantially as
40 and for the purpose set forth.

7. A gage comprising an outer closed vessel, a float-chamber therein and a float in said
45 chamber; in combination with an outer cylinder, an inner stationary cylinder, having a transverse partition, a tube 6 to support the inner cylinder and vented above the partition, an adjustable tube in the aforementioned one, connecting the space below the
50 partition therewith above the vent, a liquid in the bottom of both cylinders, means to connect the tube 6 with the closed chamber of the pressure-gage and means to rotate the outer cylinder to cause the liquid to close
55 said vent and produce a partial vacuum in the gage, to cause the float and liquid-level in the float-chamber to be lowered, substantially as and for the purpose set forth.

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