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A. C. LIPPINCOTT.

INDICATING INSTRUMENT.

(Application filed Oct. 18, 1899.)

(No Model.)

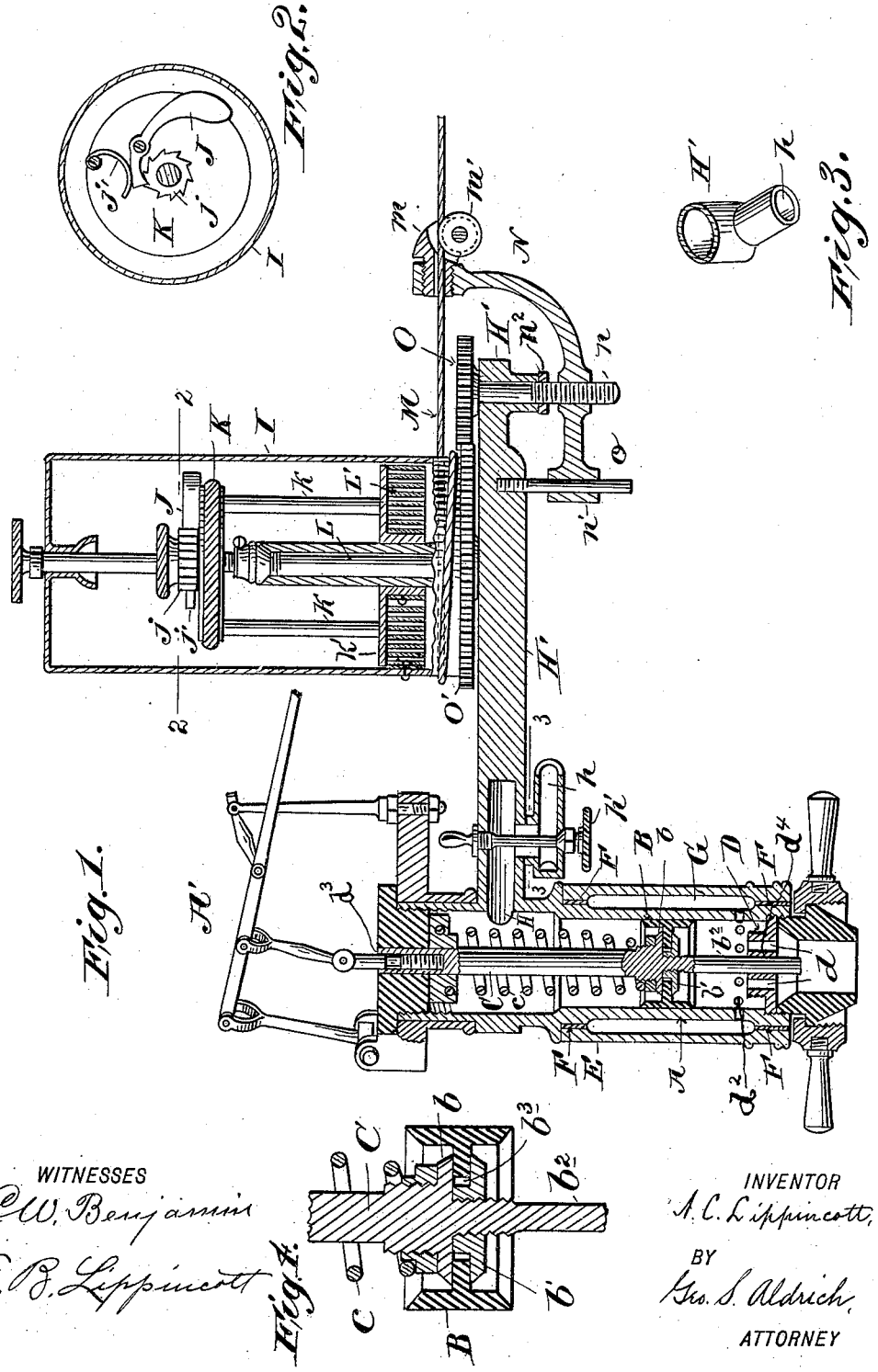

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

WITNESSES

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INDICATING INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 648,506, dated May 1, 1900.

Application filed October 18, 1899. Serial No. 733,972. (No model.)

To all whom it may concern:

Be it known that I, ALPHEUS C. LIPPINCOTT, of Newark, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Steam-Engine Indicators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain new and useful improvements in indicating instruments.

One object of my invention is to provide inexpensive and highly-efficient means of guiding the cord of a steam-engine indicator to prevent overlapping of the coils, and thus prevent inaccuracies that would result therefrom.

Further objects of my invention are to provide means for reducing the friction between the bearing-surfaces of the piston and cylinder of a fluid-pressure motor.

My objects are, further, to provide simple and inexpensive means for discharging the exhaust fluid of indicating instruments in a direction opposite to the operator, thus preventing the danger and annoyance otherwise attending the operation.

Further objects are to provide a spring-winding mechanism for indicating instruments which will be simple in construction and applicable to any ordinary indicator.

A further object of my invention is to provide means for surrounding the cylinders of fluid-pressure motors with a fluid of the same temperature and pressure as is contained therein.

With these objects in view my invention consists of the novel construction and combination of parts and details thereof, as hereinafter described with reference to the accompanying drawings and hereinafter more particularly pointed out in the claims.

In the drawings, Figure 1 is a sectional view of my invention. Fig. 2 is a detail and sectional view of my invention through the line 2 2, Fig. 1. Fig. 3 is a perspective view below the line 3 3, Fig. 1. Fig. 4 is an enlarged sectional view of an indicator-piston, showing my invention applied thereto.

While I have shown my invention as applied to one type of indicator, it will be understood that it is not limited thereto, since it may be applied to other forms of indicating instruments as well without departing from the breadth or scope of my invention.

Referring to the drawings, in which the same reference characters relate to the same or corresponding parts in all the views, my device is shown in Fig. 1 as applied to a special form of indicating instrument, of which A indicates a cylinder, from which extends a supporting-arm H', which carries a drum mechanism to support a card or other recording-surface. The cylinder A contains a piston B, which is provided with a rod C and a continuation of the same b^2. To resist the movement of this piston is superimposed a spring c, which is provided with simple means whereby it may be removed and replaced by another spring of a different strength should an increased or decreased pressure render it necessary. The movement of the piston B is proportional to the pressure acting thereon. This movement is transmitted to a pencil-point (not shown) through the multiplying device A' in a manner well known to those skilled in the art to which it appertains.

It is a well-known fact that the greatest source of inaccuracy in indicating instruments is the friction between the piston and the cylinder-walls, this friction being augmented by the side thrust of the spring when compressed. This pressure is all the more serious for the reason that the surfaces of the piston and cylinder are usually coated with foreign matter, such as core-sand and metallic particles carried by the steam from the engine-cylinder and the ports thereof. By my invention I seek to avoid this difficulty. This I accomplish by providing a continuation of the piston-rod and a guide D therefor. It will be readily seen that the side thrust of the spring is received at the points d^3 and d^4. I further provide the piston-rod with a flange b and a retaining-nut b', and between these members is carried the web of the piston B. The hole through this web is made appreciably larger than the smallest diameter of the retaining-nut, leaving a lost motion b^3, which in practice is about one thirty-second of an inch. This construction permits the piston to slide laterally between the flanges, and thus avoid any pressure between the piston

and cylinder-walls due to the passage therebetween of small particles of grit, and also permits lateral distortion of the piston-rod due to side thrust of the spring. My improvement also permits the piston to move freely across the axis of the cylinder to give free passage to particles of grit or other foreign material which would otherwise become embedded in the delicate surface thereof.

I am aware of the fact that various devices have been introduced between the pistons and springs of steam-engine indicators to reduce friction and wear. These devices have in every case within my knowledge comprised what is termed a "ball-and-socket" joint, allowing the piston to rotate, but without reducing the pressure between the surfaces. It will readily be seen that my invention maintains the face of the piston in a line exactly parallel with the axis of the cylinder, so that no cramping can exist therein.

It is a well-known fact that in the operation of indicating instruments, particularly at high speeds, a coil of the indicator-cord will sometimes come in contact with the preceding coil and ride thereon, thus increasing the real diameter of the cord-flange and introducing a serious error. In other cases, after having been carried in this position, the cord will slip off the preceding coil with a sudden shock, which also results in a misleading record. By means of my improvement I seek to overcome this difficulty.

As shown in the drawings, H′ represents a drum-carrying arm, upon which is supported the drum I, which is provided with a gear-wheel O′, which meshes with another gear O, preferably smaller. Firmly fixed to this spur-gear is a threaded spindle *n*. There is also firmly fixed to the drum-carrying arm H′ a straight pin or shaft *o*. I further provide a curved arm N, carrying at its outer end a small roller *m*′. At the inner end of the curved arm are located two openings properly spaced to receive the threaded spindle *n* and the shaft *o*. Upon attaching the cord M to some moving part of the engine to be indicated the motion will be transmitted to the threaded spindle *n*, which is prevented from moving longitudinally by means of the lock-nut n^2. It will thus be seen that for each revolution of the gear O the guide-pulley M′ will be elevated or lowered a distance equal to the pitch of the threaded spindle, thus effectually separating each coil of the cord M.

It is a matter of common knowledge among those skilled in the use of indicating instruments that one of the greatest sources of annoyance and danger is the discharge of the exhaust upon the operator, especially when the instrument is used in contracted locations. It will be observed that my improvements overcome this difficulty.

Referring again to the drawings, it will be noted that an internal port is provided in the arm H′, communicating with the cylinder B. This port is preferably cored in the casting, but may be drilled at slight expense. I have further provided an elbow, which is shown in perspective in Fig. 3. This elbow may be firmly held in contact with the port H′ by means of a thumb-nut *h*′. It will readily be seen that by loosening the thumb-nut *h*′ this elbow may be rotated and firmly fixed in any desired position, so that the discharged fluids will not come in contact with the operator. This improvement is of the greatest importance in the indication of ammonia-cylinders. My improvements also prevent the entrance of foreign matter into the indicator-cylinder, which would result in damage thereto.

The practical operation of indicating instruments discloses the fact that the pistons and cylinders of such instruments are seriously affected by unequal expansion and contraction due to the variations in temperature and pressure. To avoid this difficulty, many different forms of construction have been employed, preferably with a view to surrounding the cylinder with the same temperature and pressure as are contained therein. My invention contemplates certain improvements in these devices, whereby I seek to overcome the difficulties which have been experienced heretofore.

Referring again to the drawings, it will be seen that I have provided metallic rings F, which may be made of any material, preferably copper, having a proper expansive rate different from that of the cylinder. These rings are forced into their proper position on the cylinder and turned slightly larger than the opening in the outer casing E. This casing is then forced into position under a moderate pressure and is found to operate without leakage, notwithstanding the unequal expansion and contraction of the cylinder B and the casing E. Communication is had between the internal cylinder and the jacket-space G by means of a series of holes d^2.

By my invention it will be noted that the cylinder is supported rigidly both at the top and bottom and cannot be thrown out of line by external pressures or ordinary accidents.

It is a well-known fact that much difficulty has been experienced in retaining sufficient tension in drum-springs of ordinary construction, particularly when using the instrument upon motors at high speeds. In my invention I seek to overcome these difficulties by providing a winding mechanism which is simple and positive in operation and which may be constructed at slight expense. My improvements are shown in elevation in Fig. 1. A plan view is shown in Fig. 2, in which I is the cylinder for supporting the recording-surface. K is a disk provided with small standards *k*, which is firmly joined at the bottom to a spring-winder *k*′. Upon the disk K is supported a pawl J, which engages a ratchet *j*, which is firmly fixed to a shaft L. The pawl J is normally held in contact with the ratchet-wheel through the agency of the

spring j'. It will be noted by reference to Fig. 2 that the pawl J projects beyond the outer periphery of the disk K. My object in employing this construction is to enable the operator to use this device with one hand. This may be accomplished by pressing the pawl with the thumb, while the disk may be prevented from unwinding by means of the first and second fingers. I am aware that the use of a ratchet and pawl is old, especially in clocks and music-boxes, but am not aware of the present construction having been employed prior to my invention thereof.

The advantages of my invention are apparent to those skilled in the art. It will be observed that the piston is provided with means for reducing friction without adding materially to the cost thereof. Simple and highly-efficient means are provided for adjusting the tension of the drum-spring for varying speeds. The annoyance and danger usually experienced in the indication of steam and ammonia cylinders have been entirely eliminated. The indicator-cord is guided into its proper position without any danger of the coils overlapping and by means extremely simple and inexpensive.

I claim as my invention—

1. In an indicating instrument the combination of a cord-wheel with a threaded spindle and a guide-pin, as set forth.

2. The combination with a fluid-pressure cylinder of a piston therefor, slidably mounted between a plurality of flanges, substantially as set forth.

3. The combination with a fluid-pressure cylinder of a shaft, a plurality of guides therefor, an enlarged flange thereon, a loosely-mounted piston and a retaining member therefor, having a diameter smaller than the aperture through the piston, as set forth.

4. In a fluid-pressure cylinder, the combination with a piston-rod of guides therefor, a piston loosely mounted thereon, a stationary flange or plate designed to receive the thrust of said piston, and a retaining member to normally hold said piston in place, substantially as set forth.

5. In an indicating instrument the combination with a fluid-pressure cylinder having an opening communicating therewith, of a rotatable exhaust-pipe, and means for holding said pipe to said opening.

6. In an indicator or recorder, the combination of a fluid-pressure cylinder having an opening communicating therewith and a passage-way at right angles to said opening of a rotatable pipe attached to said opening.

7. The combination in a fluid-pressure cylinder, of a jacket therefor separated from said cylinder by means of one or more rings having a different coefficient of expansion from the cylinder.

8. In a fluid-pressure motor the combination of an inner cylinder with an outer casing, said inner cylinder having ports communicating with the live-steam space of said cylinder.

9. In a fluid-pressure motor the combination of a cylinder and a jacket therefor, and a plurality of separating-rings substantially as set forth.

10. In an indicator or recorder, the combination with a spring L', a winding-plate K, a shaft L having a ratchet j, threaded thereon, a pawl J, having its end projecting beyond the periphery of plate K, and a spring j' to normally hold the pawl in engagement with ratchet.

Signed at Newark, in the county of Essex and State of New Jersey, this 17th day of October, A. D. 1899.

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Witnesses:

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