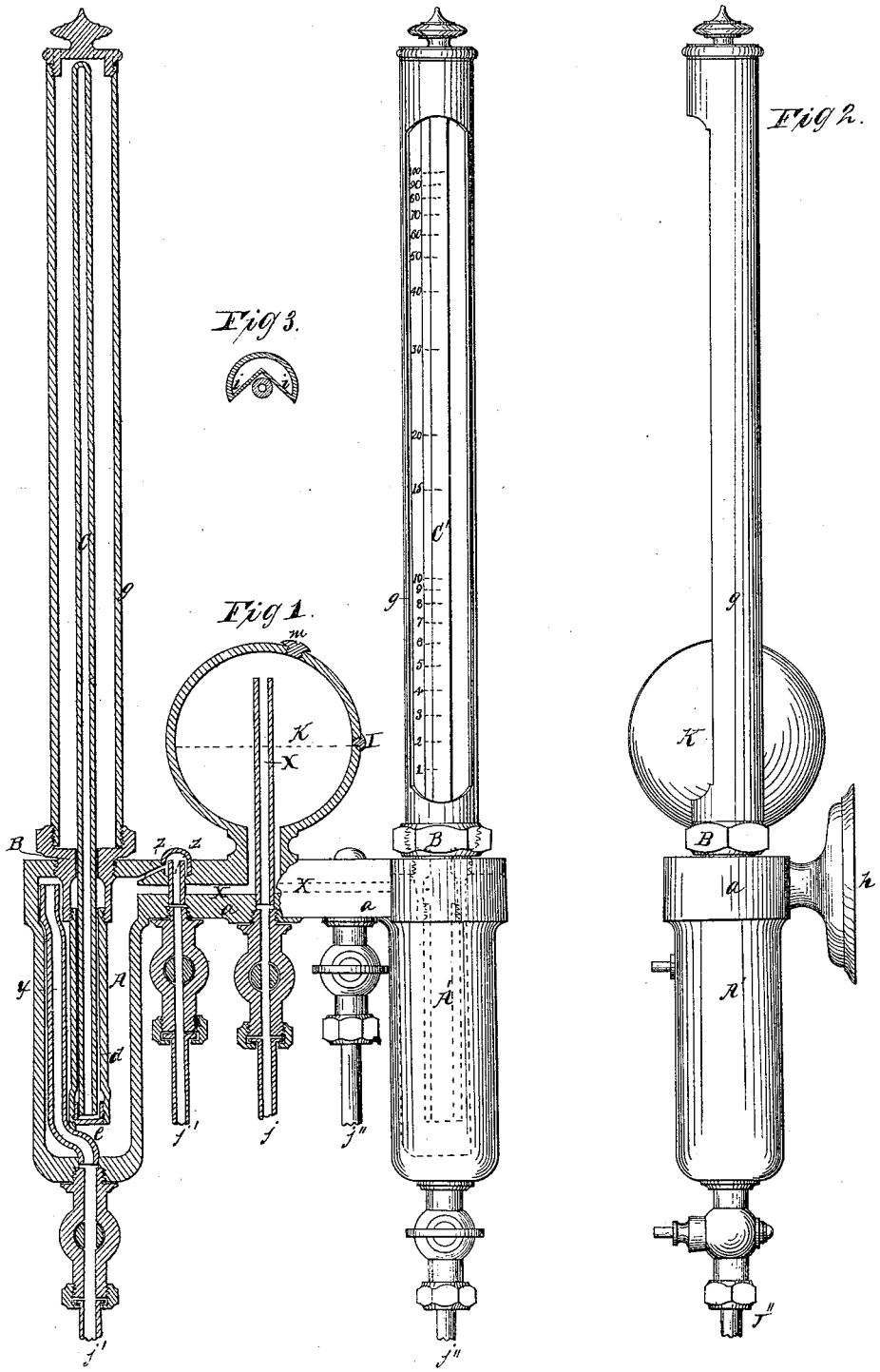
P. Stillman,

Pressure Gage.

No. 5,552. Patented May 9, 1848.



UNITED STATES PATENT OFFICE.

PAUL STILLMAN, OF NEW YORK, N. Y.

STEAM AND VACUUM GAGE.

Specification forming part of Letters Patent No. 5,552, dated May 9, 1848; Reissued July 29, 1851, No. 205.

To all whom it may concern:

Be it known that I, PAUL STILLMAN, of the city, county and State of New York, have invented new and useful Improvements in manometers or gages for determining the pressure of steam and the extent of the vacuum in steam-engines, but which may be applied separately to ascertain either the pressure of steam or the extent of vacuum in steam-boilers, vacuum-pans, &c., and that the following is a full, clear, and exact description of the principle or character which distinguishes them from all other things before known and of the manner of making, constructing, and using the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of my improved instrument with one half of it represented in section to exhibit the internal arrangement; Fig. 2, a side elevation; and Fig. 3, a horizontal section of one of the tubes with the surrounding case and scales. The same letters indicate like parts in all the figures.

The first part of my invention consists in combining with the reservoir of mercury at the lower end of the gage or manometer tube or tubes, an elevated chamber or bulb that the mercury in the tube or tubes may at all times be sufficiently high in them to be visible in the surrounding case, and for the additional purpose, when applied to the steam gage, of preventing the partial condensation in the boiler or pan with which it is connected from exhausting the air from the tube.

The second part of my invention consists in inserting the lower and open end of the glass tubes each in a metal gland, that is, a metal tube for the protection of the glass being provided at bottom with a screw cap the threads of which are loose or provided with a small hole through which the mercury will flow when immersed in the reservoir of mercury, and at the same time facilitate the filling of the tube, and when in place prevent air or vapor from passing up into the tube.

The third part of my invention consists in preventing moisture produced by the condensation of the steam that presses on the mercury in the reservoir from passing down between the mercury and the outer surface of the metal gland that surrounds the lower end of the tubes, and thus finding its way to the inside of the tube, by tinning the outer surface of the metal gland to establish a capillary attraction between the surface of the gland and the mercury. And the last part of my invention consists in preventing the glass tube of the steam gage from being soiled by the oxidation of the mercury within it, by introducing within the tube, and on the surface of the mercury within it naphtha, or any other liquid which will prevent the oxidation of the mercury.

In the accompanying drawings (*a*) represents a sole piece to which all the main parts of the instrument are attached, and provided at the back edge with a flanch piece (*h*) by which the instrument can be secured in place. From the under surface of this sole piece project downward two hollow reservoirs (A, A′) one near each end, and made of such length and diameter inside as to contain the requisite quantity of mercury for the working of the instrument. To the upper surface is properly secured a spherical or other formed bulb or chamber (K) which communicates by a hole through the bottom thereof and through the sole piece (see dotted lines) with the reservoir (A′), but this bulb or chamber may make part of the reservoir of mercury (A′), and a pipe (X) passes through the sole piece and extends up into and near the top of the bulb, and a pipe (*j*) provided with a stop cock is secured to the bottom of the sole piece to form a continuation of the pipe (X) and to extend to the boiler or other steam vessel, that the steam may pass into the bulb or chamber (K) and make pressure on the surface of the mercury contained therein.

The other reservoir (A) communicates by a hole (*z*) in the sole piece with a vertical pipe (*j′*) also provided with a stop cock, which pipe is to communicate with the condenser or any other vessel in which the degree of exhaustion is to be measured.

In each of the reservoirs (A, A′) is to be inserted the open end of a glass tube (C, C′), the one (C) to measure the degree of exhaustion, in the condenser, and the other (C′) the pressure of steam in the boiler, and as these tubes are both inserted in their appropriate reservoirs in the same way the description of one of them will be sufficient.

The glass tube is inserted in a hole in a metallic tube holder (B) that is tapped into the upper surface of the sole piece, and for the purpose of securing the glass tube therein air tight the lower end of the holder is enlarged and lapped to form a stuffing box and to receive the upper end of a metal tube called the gland (*d*), made of iron or copper, so that by screwing this up into the tube holder the packing is compressed around the glass tube. The lower end of this gland extends down a little below the end of the glass tube to receive a cap screw (*e*) provided with a small hole (*f*) or else screwed into the gland with a loose thread to admit of the slow passage of the mercury, to establish a communication between the reservoir and the inside of the tube, and yet prevent any sudden variation of pressure from agitating the mercury in the tube too violently. This gland is also for the protection of the glass, and to facilitate the filling of the tube with mercury, which is done in the following manner; after the tube has been inserted and secured in the holder it is inverted and filled with mercury, and the screw cap (*e*) is then inserted, and as it is screwed in, any air that may be in the gland finds its way out through the hole (*f*), which should however be very small—just large enough to permit the escape of the air. The tube is then turned up again and the gland inserted in the reservoir, the smallness of the hole in the cap not permitting the escape of the mercury except very slowly, so that the operation of inverting and inserting the tube is not attended with any difficulty. The mercury gradually oozes out from the tube into the reservoir until the required level has been established, leaving a vacuum in the upper end which has been hermetically sealed. Of course so long as the pressure in the tube (*j'*) is equal to the atmosphere the mercury will be sustained in the tube (C) at the height due to that pressure, but as the condenser is exhausted the mercury will descend showing the extent of such exhaustion on a scale (*i*) properly laid out on a part or parts of a metal case (*g*) which partly surrounds the glass tube, the lower end of which is secured into the upper end of the tube holder. As there is no attraction between the mercury and the outer metal surface of the gland, and the steam acts on the surface of the metal in the reservoir, it will gradually find its way between the mercury and the surface of the gland and through the threads or hole of the screw cap, and thence rise into the upper part of the tube, and thus derange the instrument. To prevent this I tin the outer surface of the gland to establish a sufficient attraction between the gland and the mercury in the reservoir, and thus effectually cut off the passage of moisture. The other tube (C) is as stated above secured in the same manner and properly charged with mercury, and therefore the quantity of air in the tube will always remain the same.

It will be obvious that this part of my invention requires the tube to be partially exhausted at the time the instrument is charged, that when the air above the mercury in the tube is at the pressure of the atmosphere a considerable portion of the lower part of the tube shall contain mercury; and therefore whether the bulb be used or not is immaterial to this part of my invention so long as the reservoir is of sufficient capacity to prevent the expansion of the air in the tube, when the steam is condensed, from forcing all the mercury out of the tube. The pipe (X) which communicates from the steam boiler to the bulb (K) should extend some distance above the level of the mercury in the bulb, so that when a partial vacuum is effected in the boiler the tension of the air above the mercury in the tube shall not force the mercury high enough in the bulb to pass over into the tube (X). By the use of this bulb it will be seen that a sufficient column of mercury will always be kept above the lower end of the tube to prevent the tension of the air therein from forcing the mercury entirely out of the tube.

The steam being admitted to the bulb or chamber (K) the mercury is forced down through the pipe and into the reservoir and from thence into the glass tube to any height proportional to the pressure, the amount of which is indicated by a scale (*i*) on the case. The scales (*i'*, *i'*) for the tubes (C, C') will of course differ, one indicating the vacuum, and the other the pressure.

The bulb or chamber (K) is provided with a screw plug (*m*) through which mercury can be introduced, and with another one (*l*) at the side to regulate the height to which it is to be filled. So long as the inside of the bulb is exposed to the pressure of the atmosphere alone the mercury may be at the same level in the bulb and tube which is out of view, the level of the mercury in the tube will always be visible. Atmospheric air oxidizes the mercury which assumes a dark color that settles on the surface of the tube which measures the pressure of steam, and the consequence is that in a short time the glass becomes so darkened that the level of the mercury cannot be seen. To prevent this I insert in the upper part of the tube a few drops of naphtha or any other liquid which will prevent the oxidation of the mercury and which will float on its surface and thus prevent the oxidizing effect of the atmospheric air in the glass tube of the steam gage, and thus preserve the transparency of the glass. This is not admissible in the vacuum gage as the naphtha or other liquid would evaporate, and besides it is not need-

ed as there is a perfect vacuum in the upper part of that tube.

As that part of the instrument which measures the exhaustion in the condenser is not generally required to indicate more than 28 inches, and therefore only an approximation to a perfect vacuum, I usually make that part of the instrument as described above and represented in the accompanying drawings, because when the mercury is drawn down to the lowest point with the capacity of the working of the air pump the level of the mercury in the tube will be visible in the tube without any danger of carrying the mercury over the end of the tube (*z*) that leads to the conductor, but when the instrument is to be used to measure the pressure in a vessel in which a perfect or nearly perfect vacuum is to be obtained, then I provide the instrument with another elevated bulb or chamber (K) in the same manner as the steam gage. That part of the instrument which measures the pressure of the steam may however be used without the elevated bulb or chamber (K), if it is not desired at all times to have the level of the mercury in the tube, by connecting the reservoir with the boiler or other steam vessel by means of a pipe (*j''*) in manner similar to the vacuum gage described above. It may be well to add that if desired when the bulb or bulbs (K) are not used, the tubes (*j'*) and (*j''*) instead of being inserted in the sole piece may be passed through the lower ends of the reservoirs (A, A') and carried up to the upper end thereof as shown in the accompanying drawings.

It will be obvious from the foregoing that this instrument may be divided, and that for high pressure steam engines or any other purpose which requires only the indication of the pressure of steam that the vacuum gage may be dispensed with, and so of the other part of the instrument; but for condensing engines the entire instrument is required, as the actual pressure of the steam can only be ascertained by comparing it with the vacuum in the condenser, the pressure of the steam on the piston being dependent on this vacuum.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. Combining with the reservoir of mercury at the lower end of the gage tube or tubes, an elevated bulb or chamber to form part of the reservoir, substantially as herein described, that the level of the mercury in the tube may at all times be sufficiently high in the tube to be visible, as described.

2. I claim making the bulb or reservoir of such capacity in combination with the partial exhaustion of the tube of the steam gage at the time of charging the instrument as that the tension of the air above the mercury in the tube, when a partial vacuum is produced in the boiler shall not be sufficient to force all the mercury out of the tube, substantially as described, whereby the quantity of oil in the tube shall be always the same.

3. I claim surrounding the lower edge of the glass tube with a metallic gland or tube provided with a cap at bottom through whicch the mercury can pass slowly to establish the connection with the reservoir, substantially in the manner and for the purpose specified.

4. I claim the method of preventing the passage of moisture from the surface of the mercury in the reservoir between the mercury and the metallic gland, by tinning the outer surface of the gland, that the mercury may adhere thereto sufficiently to effect the purpose desired as described.

5. And lastly, I claim preventing the glass tube of the steam gage from being soiled by the oxidation of the mercury within it, by introducing within the tube and on the surface of the mercury therein, naphtha, or any other fluid which will prevent the oxidation of the mercury, substantially as described, and thus preserve the glass tube in a clear and transparent state, as described.

PAUL STILLMAN.

Witnesses:
ALEX. PORTER BROWN,
ED. PETERS.

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