(No Model.)

J. F. McELROY.

STEAM PRESSURE GAGE.

No. 519,921. Patented May 15, 1894.

Fig. 1.

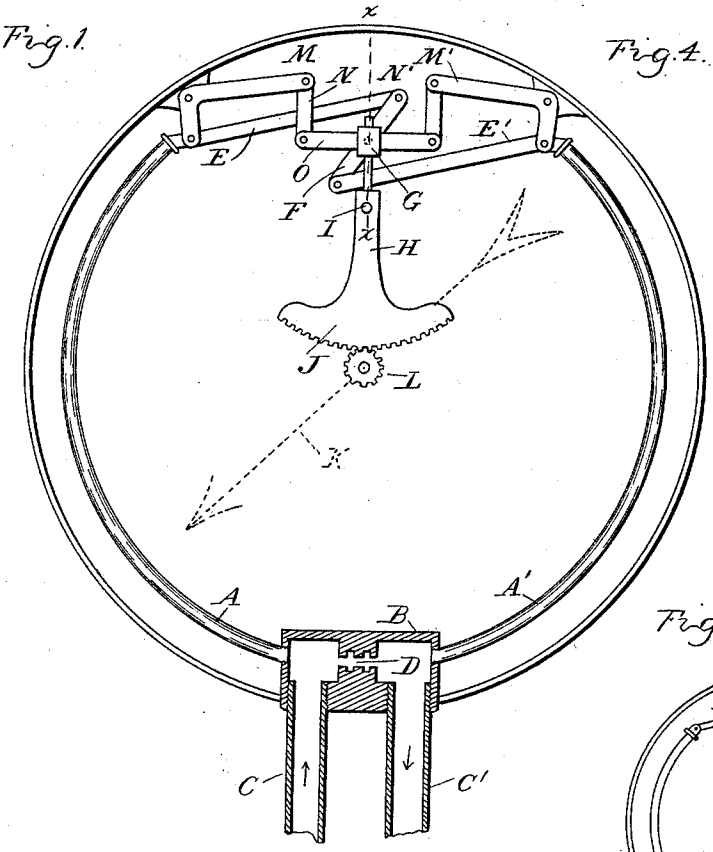


Fig. 4.

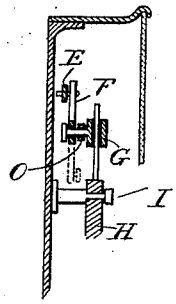


Fig. 2.

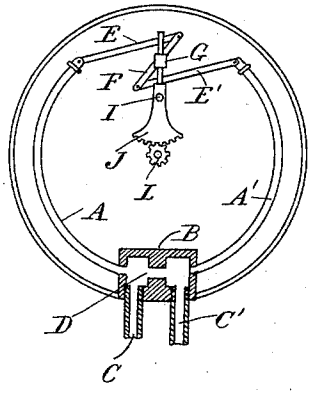
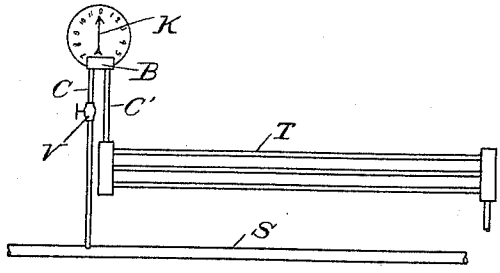


Fig. 3.



Witnesses
A. L. Hobbie
N. L. Lindop.

Inventor
James F. McElroy
By Thos. A. Spreyer & Son
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO THE CONSOLIDATED CAR-HEATING COMPANY, OF WHEELING, WEST VIRGINIA.

STEAM-PRESSURE GAGE.

SPECIFICATION forming part of Letters Patent No. 519,921, dated May 15, 1894.

Application filed April 10, 1893. Serial No. 469,747. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. McELROY, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Steam-Gages, of which the following is a specification, reference being had therein to the accompanying drawings.

The specific object of this invention is to construct a gage which can be used in connection with steam heating apparatus to indicate the relative amount of heat which is contained in the steam flowing into a regulator or other steam heating appliance. I obtain this object of my invention by means of a steam gage which, instead of indicating the absolute pressure of steam as the usual steam pressure gage is designed to do, indicates the momentum of the steam. As the momentum of steam is the direct result of the condensation of steam which takes place in the radiator or heating appliance, it is obvious that a gage indicating the momentum of steam must at the same time be an indicator of the relative amount of condensation which takes place in the radiator or in other words of the relative amount of heat absorbed by the radiator or other heating appliance into which the steam flows. The operation of such a gage in connection with a steam heating apparatus would then be to stand at zero when no steam is admitted into the apparatus, but when steam is admitted it opens out and indicates the relative amount of heat contained in the steam which the radiator absorbs. With such a gage as an indicator, the valve in the steam supply pipe can then be intelligently adjusted to the proper needs of the car or room which is to be heated by the radiator. It is quite true that in a certain sense the ordinary steam pressure gage is also indirectly a steam momentum gage for the reason that the pressure of the steam and the momentum of steam are reciprocal factors, that is, the pressure of steam increases or decreases inversely as the momentum decreases or increases, and thus it might appear that all we have to do to convert a steam pressure gage into a steam momentum gage would be to reverse the indication so as to indicate zero at the maximum pressure and from there open out as the pressure of steam decreases. This would be all right if our maximum pressure would be a constant factor, but as there is hardly a heating plant in which the pressure of steam from the boiler does not constantly vary more or less, or taking as an illustration the conditions found in train heating where we have a train pipe supplied from the locomotive with steam, the pressure of which in the train pipe fluctuates and not only this but where each car gets steam at a pressure different from the other cars, it must appear that a steam pressure gage is not a practical device for indicating the momentum of steam.

My invention has for its object to indicate the momentum irrespective of the pressure of the steam on the apparatus and it relates to a gage which is therefore not the converse of the steam pressure gage but accomplishes a new and useful result not accomplished heretofore in steam gages.

I obtain the object of my invention by a steam gage in which the index is moved by a difference in pressures produced only when steam is in motion and to this end I employ two spring-tubes arranged to move the index by their differential movement under unequal pressures of steam caused by a fall in pressure proportionate to the momentum of the steam, all as more fully hereinafter described in connection with the accompanying drawings, in which—

Figure 1 is a front elevation of my gage with the actuating mechanism exposed and partly in vertical section. Fig. 2 is a similar front elevation showing my invention in a simplified form more specifically explained hereinafter. Fig. 3 is a diagram showing the connection of my gage with a steam heating apparatus. Fig. 4 is a cross-section on line *x*—*x* Fig. 1.

Referring to Figs. 1 and 2, A A′ are two hollow spring tubes of the usual character employed in steam gages, B is a hollow base to which they are connected.

C C′ are pipes for conveying the steam into and out of the hollow base.

D is an orifice or a series of orifices between

the tube A and pipe C on one end and the tube A′ and pipe C′ on the other end of the hollow base; all so arranged that if steam flows into the base through the pipe C and out through the pipe C′, the tubular spring A is moved by the pressure of the steam before it passes through the orifice and the tubular spring A′ is moved by the pressure of the steam after it has passed through the orifice. Attached to the upper end of these springs are connecting links E E′ which are pivotally attached to opposite ends of the oblique bar F, and so arranged that when equal pressures are carried on the two springs A and A′, the bar F will rock about a fixed point in its center. At this point the bar is fulcrumed upon a wrist G which is carried upon the upper arm of the lever H. This lever H is fulcrumed at I and carries upon its lower end the rack J which actuates the index K through a pinion L.

As far as the operation of the parts so far described is concerned it is evident that if steam is admitted into the base B no movement could be produced upon the index as long as the steam is not flowing, but when it flows the orifice produces a resistance to the free flow of steam and we obtain therefore a difference of pressure of the steam on the two sides of the orifice and this difference of pressure will cause the tubes A A′ to expand differently and the differential movement of the tubes is transmitted to the index and indicates the measure of velocity of the steam, as a result of the difference in pressure of the steam in the tubes. The device therefore as far as described and shown singly in Fig. 2, would therefore not be a true indicator of the momentum as the latter is the product of velocity and density. For a more perfect working device I also take into account the factor of the density of the steam (which depends upon the degree of pressure of the steam). To this end I arrange the differential motion in such a manner as to give a proportional increase or decrease to the movement of the index hand by the increase or decrease of the pressure of the steam, as shown in Fig. 1 in which M M′ are two bell crank levers attached to the casing, one arm of each is connected to the ends of the springs A A′ and the other arms I connect to the links N N′ which in turn are pivotally connected to a bar O. This bar at its center is also fulcrumed upon the wrist G and the latter is now arranged to slide freely upon the arm of the lever H on which it is carried. The result of the last described connection of the tubular springs with the lever H is obviously to lengthen or shorten the arm of the lever H by the greater or less absolute movement of the springs under the varying pressure of the steam. It is evident that I may so arrange and proportion the parts that the point of connection of the lever H with the bar F is shifted in such a manner that by the increase in pressure in A and A′, the sliding wrist pin is moved toward the fulcrum of the lever H, so that a given rise in pressure in the two springs may be made to have an effect in moving the hand of the gage in proportion thereto.

A gage constructed on the principles herein explained can be made to indicate the true momentum of steam in motion and hence the quantity of water which will condense from the steam which passes through it in a given length of time. It is evident that by taking advantage of the resistance of orifices to the flow of steam, I obtain a difference in pressures as a factor to determine the momentum of the steam in a very simple and practical manner which greatly simplifies the construction of such a device. The differential movement of the spring tubes alone would absolutely indicate the flow of steam provided the pressures on the two sides remained constant, but it will be understood that a fixed difference of pressure on the two sides will give practically the same velocity through the orifice regardless of the pressure that may be carried, thus for example a fall from ten to five pounds would give practically the same velocity as a fall from thirty to twenty-five pounds. In the latter instance, however, we would have steam of much greater density and hence a greater weight of steam would pass through in a given length of time. Therefore the different movement of the spring tubes determines only the factor of the velocity of the steam and (unless the density of the steam is constant) we will have to increase or decrease this movement proportionately to the increase or decrease of the pressure of the steam (that is its density). To this end I shift the sliding wrist G upon the lever H proportionately to the absolute movement of the tubular springs under varying pressure of steam and thereby increase or decrease the movement of the index hand proportionately to the increase or decrease of the absolute pressure of the steam acting upon the springs.

In Fig. 3 I show my gage as applied to indicate the momentum of steam flowing from a pipe S (which may be the train pipe) into a radiator T through the supply pipes C C′. The valve V for controlling the admission of steam may be placed in the pipe C or C′, in either case the gage stands at zero when this valve is closed, but when the steam is admitted into the radiator, the index will open out and indicate precisely the relative amount of heat admitted into the radiator. Suppose for instance, the radiator should not condense properly by becoming filled with water of condensation (a contingency frequently encountered in steam heating) the index hand would show it immediately to the train hand; now let us compare this action with the action of the steam pressure gage under like conditions, here evidently the induction would show an increase in the pressure on the ap-

paratus and the train hand seeing the pressure rise would reduce the steam and thus do the opposite from what is required. It is thus evident that as an adjunct to steam heating my device clearly accomplishes a new and important result.

While I have heretofore referred to my invention only in connection with steam, I want it distinctly understood that I claim it broadly for ascertaining the momentum of any other gas or fluid, as it is obvious that its operation is in no wise dependent upon the use of steam.

What I claim as my invention is—

1. In a steam or other fluid gage, the combination with a fluid conductor, of a plurality of movable members connected with the conductor and actuated independently by the pressure of the fluid therein, an indicator actuated by the members, and means for causing a relative variation in the actuation of the members, substantially as described.

2. In a steam or other fluid gage, the combination with a fluid conductor, of a plurality of hollow springs, communicating with the interior of the conductor, an index hand, actuating mechanism between the springs and hand, and means at the conductor interposed between the springs, for causing a differential pressure in the springs, substantially as described.

3. In a steam or other fluid gage, the combination with a fluid conductor, of a plurality of differentially movable tubular springs, communicating with the conductor, indicating mechanism actuated by the springs and means for causing the differential movement of the springs, substantially as described.

4. In a steam or other fluid gage, the combination of a hollow base provided with steam inlet and outlet connection, an orifice or series of orifices formed in said base and through which the steam passes, two tubular springs connected to said base and adapted to be actuated by the pressure of the steam on opposite sides of said orifice and indicating mechanism operated by the differential movement of said springs, substantially as described.

5. In a steam or other fluid gage, the combination of a hollow base provided with steam inlet and outlet connection, an orifice or series of orifices formed in said base, and through which the steam passes, two tubular springs connected to said base and adapted to be actuated by the pressures of the steam on opposite sides of said orifice and indicating mechanism operated by the differential movement of said springs, in proportion to the absolute and relative movement of the springs, substantially as described.

6. In a steam or other fluid gage, the combination with the tubular springs adapted to be differently actuated respectively by different pressures of steam acting upon them, of indicating mechanism comprising an oscillating lever, a sliding wrist upon one arm of said lever, intermediate connection between said sliding wrist and the tubular springs for oscillating the lever by the differential movement of the springs, intermediate connection between said sliding wrist and the springs for controlling the adjustment of said wrist by the absolute movement of the springs, and an index hand deriving its motion by suitable connection with the other arm of the said lever, substantially as described.

7. In a steam or other fluid gage, the combination with a single conduit, of a plurality of independent movable members connected with the conduit and actuated by the pressure of a fluid therein, a partition in the conduit intermediate the members, having an aperture therein of a diameter less than the diameter of the interior of the conduit, and an indicator actuated by the members, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES F. McELROY.

Witnesses:
EDWIN A. SMITH,
WILLIAM P. EDDY.