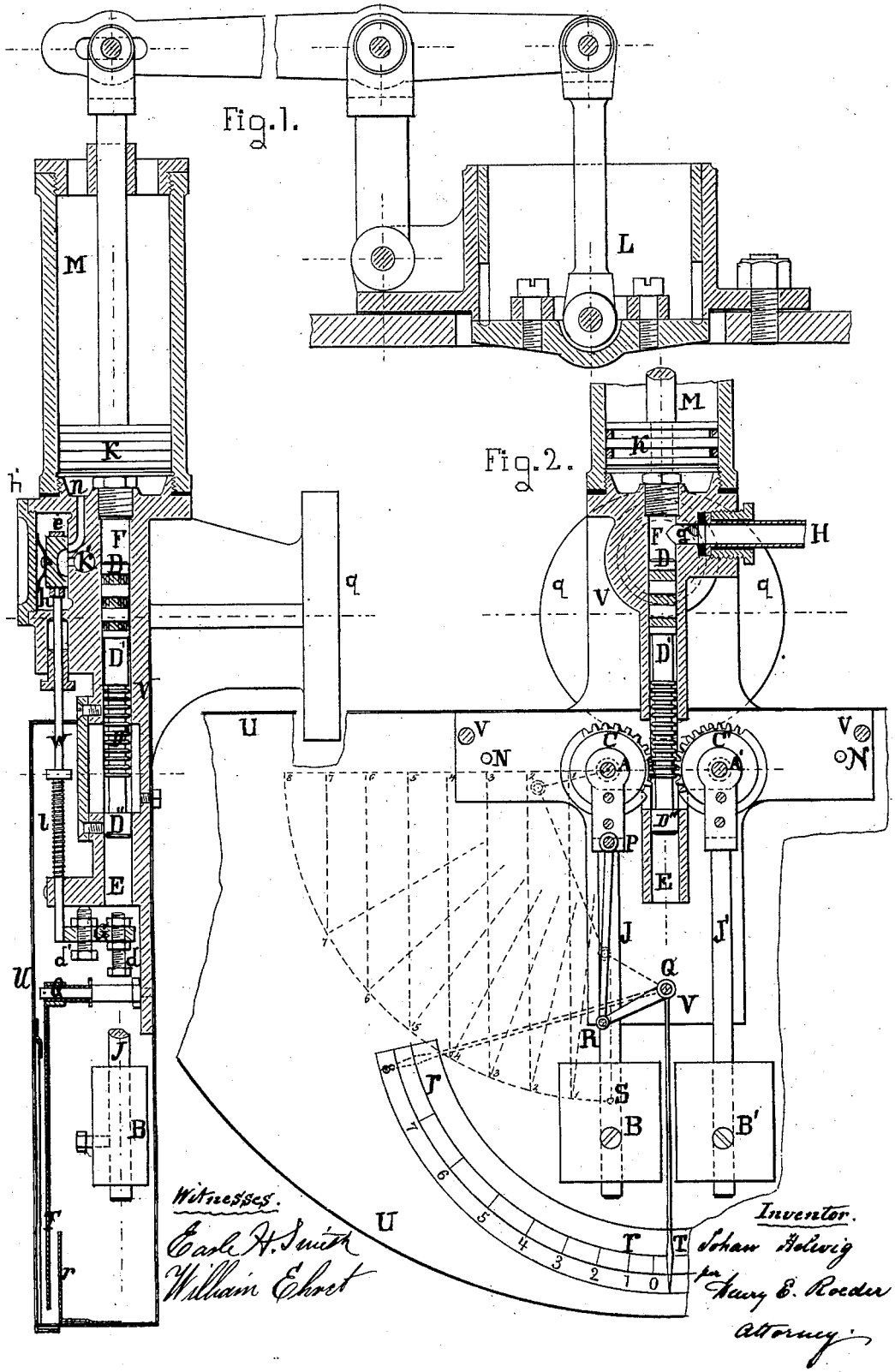
J. HELWIG.

Pressure-Gage for Steam-Boilers.

No. 199,157. Patented Jan. 15, 1878.



UNITED STATES PATENT OFFICE.

JOHAN HELWIG, OF FRANKFORT-ON-THE-MAIN, GERMANY.

IMPROVEMENT IN PRESSURE-GAGES FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **199,157**, dated January 15, 1878; application filed September 24, 1877.

To all whom it may concern:

Be it known that I, JOHAN HELWIG, of the city of Frankfort-on-the-Main, in the Empire of Germany, have invented a new and Improved Combined Pressure-Gage and Safety-Valve, which improvement is fully set forth in the following specification, reference being had to the accompanying drawing.

The nature of my invention consists in the construction of an apparatus to measure the pressure of steam, water, or gases in pounds or atmospheres, and to open a safety-valve at any desired normal maximum pressure, in order to diminish the pressure and to keep it within its normal and desired limits.

My apparatus is constructed according to the following principles: The fluid or gases under pressure act upon a small piston provided with a rack, which operates toothed sectors, whose motions are balanced by weights adjustable on levers. The farther these levers and weights move from their initial vertical position into a horizontal position the more the leverage of the weights increases and counteracts the pressure on this piston. The vertical position of the levers and weights corresponds with a pressure = 0, while the horizontal position of said levers and weights corresponds with the maximum pressure, and the intermediate positions with the intermediate degrees of pressure. As soon as the maximum of pressure is attained a combination of levers opens a small valve, to allow the pressure to act against a suitable piston, which latter operates a valve corresponding with a usual safety-valve, or its equivalent, and large enough to allow the surplus pressure to escape into the atmosphere. As soon as the pressure returns to its desired normal state the small valve returns into its initial position, and allows the steam to escape from below the piston, when the safety-valve will be closed.

In the accompanying drawings, Figure I represents a vertical section of my improved pressure-gage and safety-valve combined. Fig. II shows a vertical cross-section of the same.

Similar letters represent similar parts.

The apparatus is mounted on a cross-shaped plate, V, provided with a flange, *q*, to attach the same to the boiler.

A small piston, D, provided with suitable metallic packing, is fitted in a suitable cylinder, F, which may be cast in one piece with the ground-plate V. The pressure is admitted to act upon this piston D through a pipe, H, connected with the boiler. To this piston D a rack, D′, is attached, meshing into two toothed segments, C C′, turning the same as soon as the piston D moves. Instead of this rack and toothed segments, levers may be arranged to operate in the same manner. To the axles A A′, which carry these segments, levers J J′ are fitted, to the ends of which suitable weights B B′ are fastened.

When the levers J J′ hang down vertically, as shown in Fig. II, the steam or other pressure is = 0; but as soon as the levers rise into the positions 1, 2, 3, 4–8, as shown in dotted lines in Fig. II, the leverage of the weights B B′ is increasing, whereas the levers, or the radius of the segments C C′, on which the piston D acts, remains unaltered. The weights B B′ are so calculated that they rise with the maximum pressure—say eight atmospheres, or any other fixed pressure—into the horizontal position 8, Fig. II, on their levers. Now, divide the horizontal distance from S to A into eight equal parts, and draw vertical lines 7 7, 6 6, 5 5, &c., to A0, intersecting a quadrant, drawn by the radius A S round the center A, where S represents the common center of gravity of the weight B, lever J, and toothed segment C combined, and the positions A8, A7, A6, &c., to A0 of the lever J and weight B will correspond with as many atmospheres of pressure in the boiler as the number indicates.

It will readily be understood that any other desired scale of division of pressure may be adopted.

The position of the weights B B′, and with it the pressure in atmospheres, is shown on the divided scale *r r* by means of the combination of the levers PR RQ and the hand QT, the center Q being fixed to the plate V, and the end P of the lever PR being attached to either one of the levers J or J′.

The apparatus thus described has only the effect of indicating the pressure in the boiler. The following mechanism is added to make it an automatic safety-valve: The prolongation of the piston D which forms the rack D′ terminates in a small piston, D″, working

in a suitable guide or cylinder, E. Below this guide or cylinder E an arm, G, is arranged, attached to a rod, W, and provided with a set or stop screw, *d'*, and a regulating-screw, *d*. (See Fig. I.)

As soon as the maximum pressure is reached the piston D, and consequently the piston D'', is pressed downward, when the piston D'' strikes against the regulating-screw *d*, and moves the arm G and rod W downward. To the upper end of the rod W a suitable slide-valve, *e*, is attached, which will consequently be moved likewise downward, so as to allow steam or pressure from the valve-chest *h* to enter into a cylinder, M, below its piston K, through the passage *n*, and thus force said piston K upward. This piston K is connected, through suitable levers, with the safety-valve L, which latter will consequently be opened as soon as the piston K is raised. The valve L, opening inward, lets the pressure escape. As soon as, in consequence of this discharge of the pressure through the safety-valve, the pressure in the boiler returns to its normal state, the small piston D rises again, the slide-valve *e*, being released from the action of the piston D'' against the arm G as the end of its rod W will be lifted or moved upward through the spiral spring *l*, arranged on the rod W, returning to its initial position, where the screw *d'* in the arm G, coming in contact with the under side of the guide or cylinder E, stops its motion. The waste-steam and condensed water from the cylinder M, which previously has operated the piston K, find their outlet through the pipe K', and allow the piston K to move down again and close the safety-valve L.

The safety-valve L may be made a balanced valve; but this is not essential for the nature of my invention, though it would make the same more compendious.

The levers PR QR and hand QT play within a case, U, which is provided at its front side with an opening covered by a pane of glass, through which the graduated scale *r* and point of the hand are seen.

N N are pins or screws to stop the motion of the levers J J' in their highest position. The whole mechanism is to be placed into a locked box, in the same manner as safety-valves, so that the engineer or other parties cannot overcharge the valve.

The opening *g*, Fig. II, connects the pressure or steam pipe H with the interior space *h* of the valve-chest from where the steam or pressure has access to the slide-valve *e*. The waste pressure or steam and condensed water find their outlet through the opening K' and a small pipe on the outside of the apparatus. Although the apparatus as represented is chiefly constructed for use on locomotive-engines, it can as well be applied to all steam or other pressure boilers.

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

1. The combination of a piston, D, acted upon by the boiler-pressure, with rack D', toothed segments C C', levers J J', weights B B', and suitable gearing with hand to indicate the pressure on a scale, substantially in the manner and for the purpose described.

2. In combination with a piston, D, acted upon by pressure, and the piston D'' at the end of its rod, the arm G, with screws *d d'*, rod W, valve *e*, piston K, and safety-valve L, arranged to operate in the manner and for the purpose substantially as set forth.

JOHAN HELWIG.

Witnesses:
LOUIS BASSE,
LOUIS MASCHMANN.