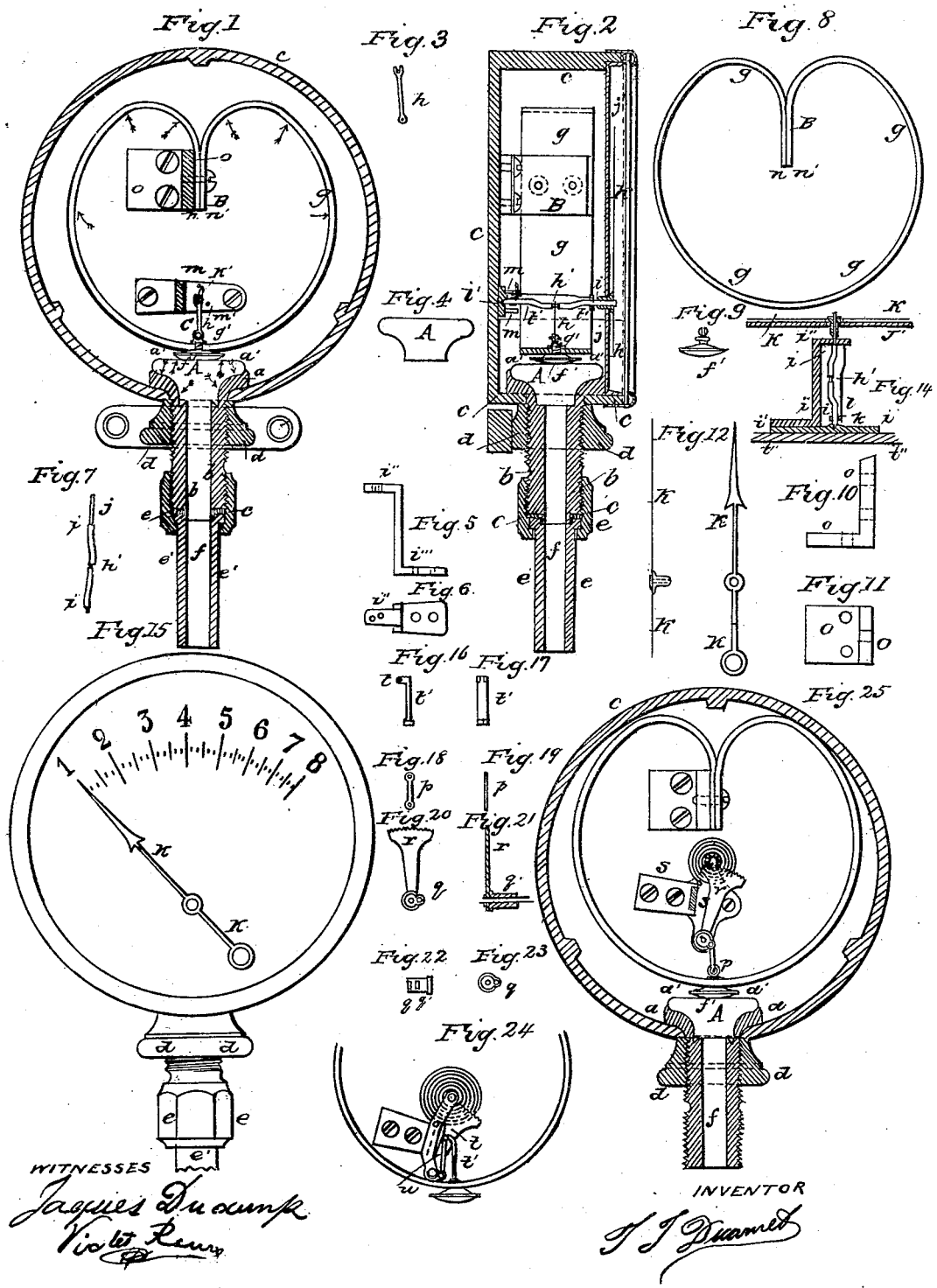
J. J. DUCOMET.

2 Sheets—Sheet 1.

Steam Pressure Gage.

No. 52,006.

Patented Jan'y 9, 1866.



2 Sheets—Sheet 2.

J. J. DUCOMET.

Steam Pressure Gage.

No. 52,006.

Patented Jan'y 9, 1866.

Fig. 29

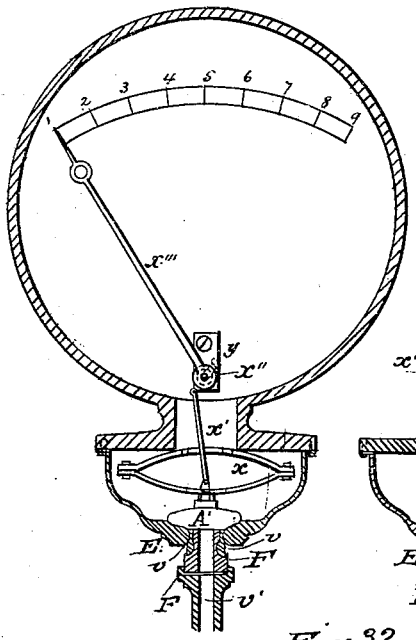


Fig. 30

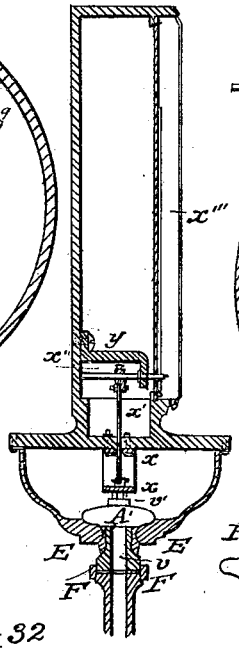


Fig. 26

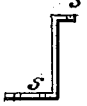


Fig. 27

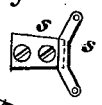


Fig. 31

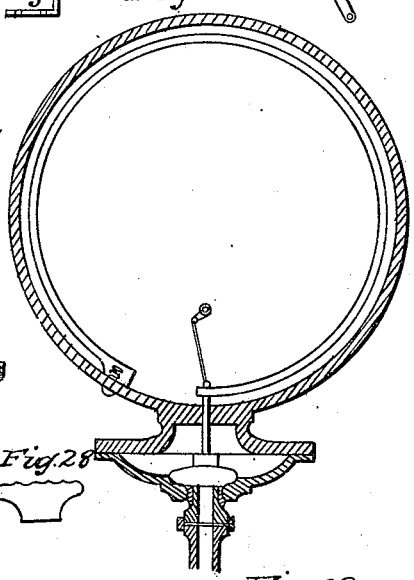


Fig. 28

Fig. 32

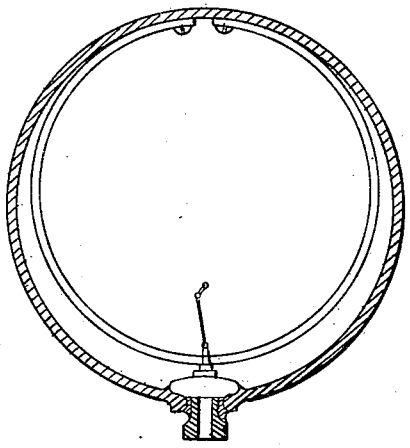
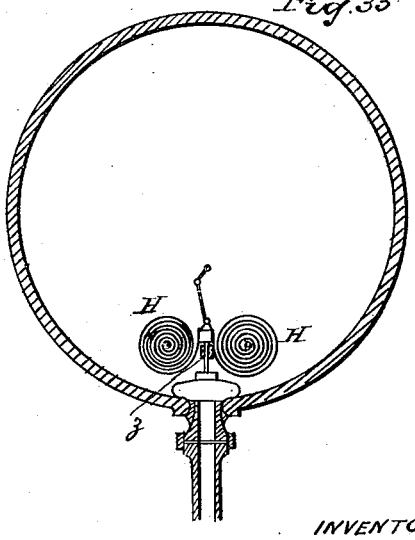


Fig. 33



WITNESSES

Jacques Ducomet

Victor Lenz

INVENTOR

J. J. Ducomet

UNITED STATES PATENT OFFICE.

JOACHIM JOSEPH DUCOMET, OF PARIS, FRANCE.

IMPROVEMENT IN STEAM-GAGES.

Specification forming part of Letters Patent No. **52,066**, dated January 9, 1866.

To all whom it may concern:

Be it known that I, JOACHIM JOSEPH DUCOMET, of No. 89 Boulevard de Sebastopol, R. D., Paris, in the Empire of France, civil engineer, have invented an Improved Metallic Steam-Gage; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The important improvements I have introduced in constructing the metallic gage give these instruments a great sensitiveness, allowing them to work with constant and mathematical regularity, which to this day none of the instruments used for similar purposes has been able to do for any length of time. All of them, after working some time, give false and dangerous indications if they be relied on.

In the annexed drawings I have represented, in full size, my improved steam-gage and several modifications, which may be introduced in its arrangements and fittings. The most important part of my steam-gage is a metallic cap or steam-receiver, A. (Shown in Figures 1, 2, and 4.) This cap is entirely different from any other contrivance hitherto made for the same purpose. It is composed of a very thin copper or brass sheet rolled up many times between hard cylinders, then covered up with a silver sheet still thinner. This second sheet is also rolled up several times. These repeated rollings are for the purpose of tightening the particles of metal and give them, when together, great power of resistance and pliability in small thickness. The two sheets, being thus placed over one another, are heated to the degree of melting silver. They become closely united together and form a single sheet. When in this state the compound sheet is again rolled up before it is submitted to the following operation. It is obvious that the metallic sheet thus obtained must be very dense, and besides its thickness, brought down to one-fortieth or one-fiftieth of an inch, becomes very pliable, and may be compared to a sheet of paper. After having been thus prepared round pieces of the required size are cut off from it and formed on the lathe by pressure to the shape of a cap, as shown in Figs. 1, 2, and 4, as above mentioned. When the required shape has been obtained, and the cap being still on the lathe's mandrel, running at great speed, the flat-bottomed part of the cap is strongly pressed upon with a round steel tool. By this pressure the flattened bottom acquires a great rigidity, although remaining very pliable. The silver sheet is in the internal part of the cap; but the cap could be formed by a copper sheet between two silver sheets. The cap thus obtained is the most important piece of my gage. It is adjusted in a hollow brass screw, *a a b b*, shaped for the purpose. In order to have these two pieces strongly united together the lower part of the cap A is previously dipped in a melted tin or silver bath, and the upper inner part of the screw *a b* is also tinned over. Then both pieces, being introduced in one another, are submitted to heat, so as to have them strongly and tightly joined together. When cool, the cap and screw form but one piece. This joint is merely a soldering, which is entirely a new mode of making joints. Hitherto the joints of steam-gages were flat, which caused the escape of steam or gas, and besides were both difficult and costly to make. This joint has another great advantage which is not to be found in any other, viz., the soldering is not liable to be impregned to by the fluid pressing in the cap, since it is outside of the said cap. Then the pressing fluid can cause no damage, since it only touches the silver covering, which cannot be affected by it, and the joint is out of its reach.

The screw in which the cap A is fitted is composed of two parts, the top or head *a a* and stem *b b*, which stem is tapped outside and put through the lower part of the gage-box *c c*, the head *a* bearing on the inside of the box, and a nut, *d d*, engaged on the screw *b*, squeezes the head of the screw in its place, so that the screw bearing the cap A is bound to the box *c*. The screw *b* is lower and fitted into the screw-nut *e*, which holds the flanged tube *c' c'*, with which is soldered the tube conveying the steam or gas which exerts a pressure. The screw *b* is hollow, as shown, corresponding with the hole of the tube *e* to convey the steam within the cap A. This cap being very pliable, its upper part, *a*, yields, becoming convex as soon as the fluid exerts a pressure within. This pressure is exerted in all directions, as shown by arrows; but on account of the very shape of the cap the pressure takes place without tearing or exhausting the cap, since the pressure tending to throw it up

is partly balanced by the pressure against the sides of the head *a a* and by the solder of the cap in its seat.

Over the upper part of the cap A is a small button, *f*. It is lens-shaped at its lower side, and bears at its upper side a small screw-tapped rod, which crosses freely through the spring *g g g*. (Shown alone in Fig. 8.) A small nut, *g'*, is put on the tapped rod, to hold those two pieces fast together. The end of the screw-tapped rod is notched, and the end of a small steel connecting-rod, *h*, entering this notch, is attached to it by a small pin for hinging. The other end of the connecting-rod *h* is forked, as shown in Fig. 3. A neck, *h'*, of a small crank-shaft, *i*, Figs. 2, 7, and 14, enters into the forked end of the connecting-rod *h*. The shaft *i* moves the hand *k*, showing the degrees of pressure on a dial. The cranked shaft *i* runs on one side on a small support. On the other side, at *j*, Fig. 7, it runs in a hole of the deck *i'' i''*, Figs. 5, 6, and 14. The lengthened shaft *j* crosses the dial *j'*, to be fitted outside with the hand *k*. The cranked shaft *i* bears at its lower side a small ring, *k'*, kept fast on it, Figs. 1, 2, and 14, which ring is pierced through to enter the end of a thin steel or brass wire, *l*. The other end of this wire enters in a hole of the deck *i'' i''*, Figs. 5 and 6, where it is strongly held, while the other end can move in the ring *k''*. The effect of this wire, which is slightly twisted, is to bring the hand back when the connecting-rod *h* moves down or when the pressure lessens, because the connecting-rod, being forked and open above, can work upward only, while the twisted wire *l* performs the rod's duty when the latter moves down. The action of this unbending or untwisting wire is the same as that used to close the open doors. The combined action of these two pieces is new in mechanical purposes. The bearing *i'* is also provided with two small pins, *m m'*, (shown in Figs. 1 and 2,) against which the ring *k* can hit. The object of the said pins is to stop the cranked shaft, and to prevent it to revert to its motion when arriving at the lower dead-point, being actuated by the wire working as a spring.

The application of the steel spring *g g* is of very great importance in the construction of my improved steam-gages. This spring is formed, by preference, of a steel blade, and can be made of any other suitable metal. This blade is bent so as to have its two ends coming near each other, as shown in Figs. 1, 8, and 25. They are attached by screws to the chair *o o*, Figs. 1, 10, and 11. The spring *g g*, being left free, is so formed that it does not tend to unbend or lose its shape. This form is very advantageous, because, when the pressure of the steam forced into the cap A is conveyed to the spring *g g* by means of the lens-shaped piece *f*, the former is depressed according to the degree of pressure; but, unlike any other spring used in steam-gages, the alteration of shape takes place without any friction or fatigue, which can easily be understood, since the immovable point of the spring is at B and the pressure is applied at C, at the other end of the diameter. The modification of shape and motion of the spring takes place as shown by arrows—viz., on free points, where no other resistance but that of the spring is to be found. The length of this spring is about eight inches. Now, to work the hand for the whole way it is to travel on the dial, the cap A and spring have to move at most but one-twenty-fifth of an inch, and consequently the alteration in the spring is the one two-hundredth part of its whole length. The length of this spring is very advantageous for the most important end for which steam-gages are used. The springs hitherto used were too short, and both ends were tightly fastened. If not, they were subject to strong friction as they moved, which soon spoils them, wears them out, and presents wrong indications of the degrees of pressure.

The fitting of the dial-glass and box are the same as in those used for similar purposes.

I will now describe how the apparatus works.

The fluid passing into the cap A causes the upper side, *a' a'*, of the said cap to swell up. This swelling up causes the touching pieces *f'* to move up, and, of course, the spring is depressed. The spring *g g* gives the measure of the pressure, and as this organ is in an unchangeable condition and always gives true indications, these indications we can safely rely on. The cap, as already stated, is very pliable, and is only used for transferring or conveying the pressure to the spring without suffering any space to be lost, and the spring transfers the same over to the dial by the help of the hand. By the pressure transferred to the spring it is depressed a little. The end of the little tapped rod moves up the same length, raising up the small forked connecting-rod *h*, which actuates the cranked shaft conveying the hand, and the latter points out on the dial the corresponding pressure. As soon as the pressure decreases the swelling up of the cap recedes and the spring unbends the corresponding quantity. The piece *f'*, resting on the cap and the connecting-rod, follows the motion. The forked shaft, being no longer acted upon by the forked rod *h*, untwists and brings back the hand to show the depression of the fluid on the dial. When the pressure increases anew the cap swells up again and the reverted motion of the hand takes place. It will be easily understood that whenever the pressure increases or decreases the same motions of the pieces are performed in the same manner, and the exact state of the pressure of the fluid will always be correctly shown on the dial.

My improved steam-gage being now described with reference to the figures above mentioned, I will now enumerate all the said figures in the annexed drawings.

Fig. 1 is the inside front view of the steam-gage, the dial of which being taken out, the whole inside part can be plainly seen. Fig. 2 is a vertical section of the same through the

line X Y. Fig. 3 is the forked connecting-rod. Fig. 4 is the pliable metallic cap. Figs. 5 and 6 are the hand-bearing deck; Fig. 7, the cranked shaft; Fig. 8, the spring; Fig. 9, the lens-shaped piece resting over the cap; Figs. 10 and 11, the chair or seat to which the spring is attached; Figs. 12 and 13, the hand. Fig. 14 shows the fitting and arrangement of the cranked shaft, twisting-wire, deck, and hand. Fig. 15 is an exterior front view of the steam-gage ready to work. Fig. 25 is a front view of a steam-gage somewhat differently disposed from the first by the mode of actuating the hand for the purpose of obtaining circular divisions around the dial.

The connecting-rod *p* (shown in Figs. 12, 19, and 25) is not forked, but hinged at *q* between two small projecting plates at the lower part of the toothed sector *r*, as shown in Figs. 20, 21, 22, 23, and 25. The said sector cogs with a pinion fitted on the hand's shaft at the center of the gage. The deck carries two bearings for the axles of the hand and sector to run in the said deck or chair, which is attached to the bottom of the gage with screws. When the connecting-rod *p* is moved up or down, by the swelling or shrinking of the cap, the sector is actuated, and causes the pinion to move round, and, of course, the hand carried by the axle of the pinion partakes of this motion, showing the degrees of pressure over the dial. A thin spiral spring wound up round the axle of the pinion causes its teeth, to bear constantly on the sector's teeth to insure their regular combined movement and prevent their wabbling.

Fig. 24 shows a similar disposition with some difference in the connecting-rod, which hangs from the upper part of the piece *t'*. The foot of the rod *t'* (shown in Figs. 16, 17, and 24) forms a nut to take the place of the one shown in Figs. 1 and 2. The connecting-rod *u*, hinging at *t'* at its upper end, hangs down, entering between two small plates at the bottom of the sector. The motion is communicated to the hand as in Fig. 25. The chairs or decks for this last arrangement are shown in Figs. 26 and 27.

Fig. 28 shows another shaped cap a little different from the first. Its upper side is undulated, which allows a greater swelling up.

Figs. 29 and 30 show another disposition of a steam-gage, in which the fitting of the cap and spring is different from those before described. The cap A' is carried by a piece, E, shaped for the purpose. A second piece or ring, F, is placed inside. Both pieces E and F are grooved at V. Some melted tin or silver is introduced into this groove, to form a joint that will bind both pieces firmly together as soon as the metal cools. The steam ingresses through V' and fills up the cap, swelling it higher. The pressure is transmitted to the double-bowed spring *x x* by the button V''. The up motion of the lower spring is conveyed to the hand *x'''* through the medium of the connecting-rod *x'*, which hinges at *x''* on the side of the hand. The ends of the blades of the spring are attached together by small bolts. The axle of the hand is carried by the chair.

Fig. 31 shows another kind of spring, having a circular shape. One of its ends is attached to the case of the gage. The other end, being free, bears on the rod of the button or lens-piece and actuates the connecting-rod.

Fig. 32 shows a round-shaped spring, of which both ends are fastened up to the case of the gage, while the lower part is actuated by the pressure of the steam through the cap.

Fig. 33 shows another disposition, composed of two spiral springs, H H', the outer ends of which are attached to the rod of the button resting on the cap. This rod is guided by the guide-piece Z.

My invention being now described, together with the arrangements, fittings, and the work of all its organs of this improved steam-gage, I wish to observe that I do not confine myself to the precise minute details which are represented in the annexed sheet of drawings, so long as the principal distinctive character of the invention is retained; but

I claim—

1. The metallic cap A, constructed and arranged substantially as and for the purposes described.

2. The joint of said cap, by which it is securely affixed to its seat, so as to prevent its being torn away therefrom by the internal pressure of the steam, as specified.

3. The spring *g*, constructed and arranged as herein described, whereby to prevent the friction, wear, and tiring thereof, so that the pressure of the steam shall be thereby constantly and correctly indicated.

4. The combination and arrangement of the connecting-rod *h*, crank *i*, and spring *l* to regulate the motion of the hand *k*, as above set forth.

5. The several parts of the steam-gage included in the above-enumerated claims and their connections combined, substantially as and for the purposes specified.

J. J. DUCOMET.

Witnesses:

JAQUES DUCAMP,
VICTOR PRINCE.