J. WOZNIAKOWSKI.

Improvement in Feed-Water Apparatus.

No. 131,490. Patented Sep. 17, 1872.

Fig. 2.

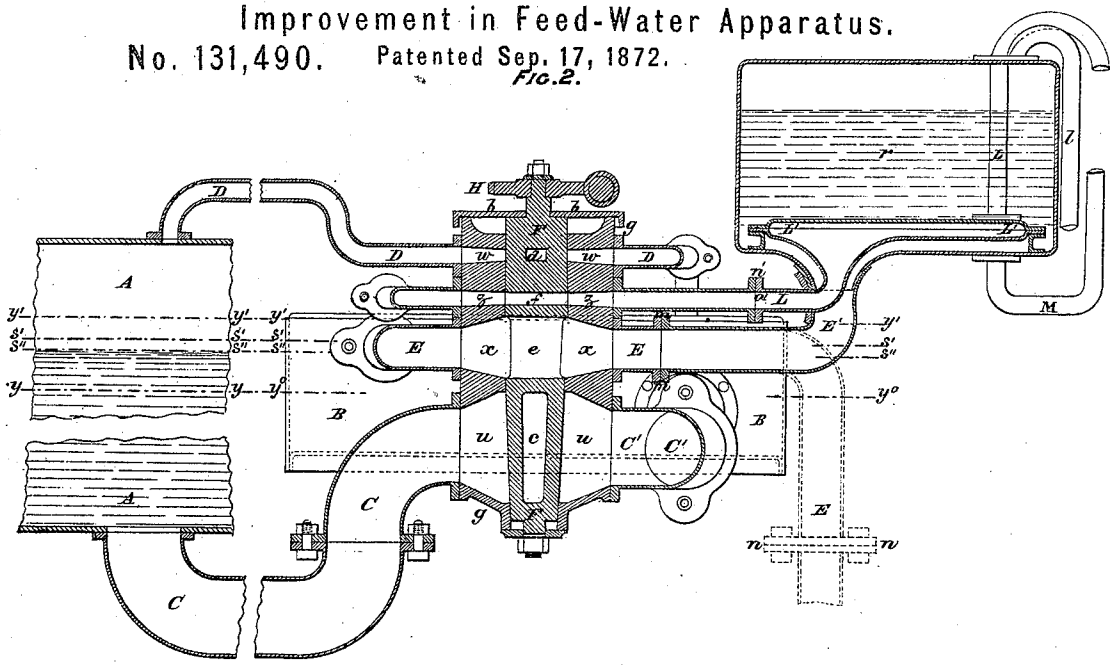
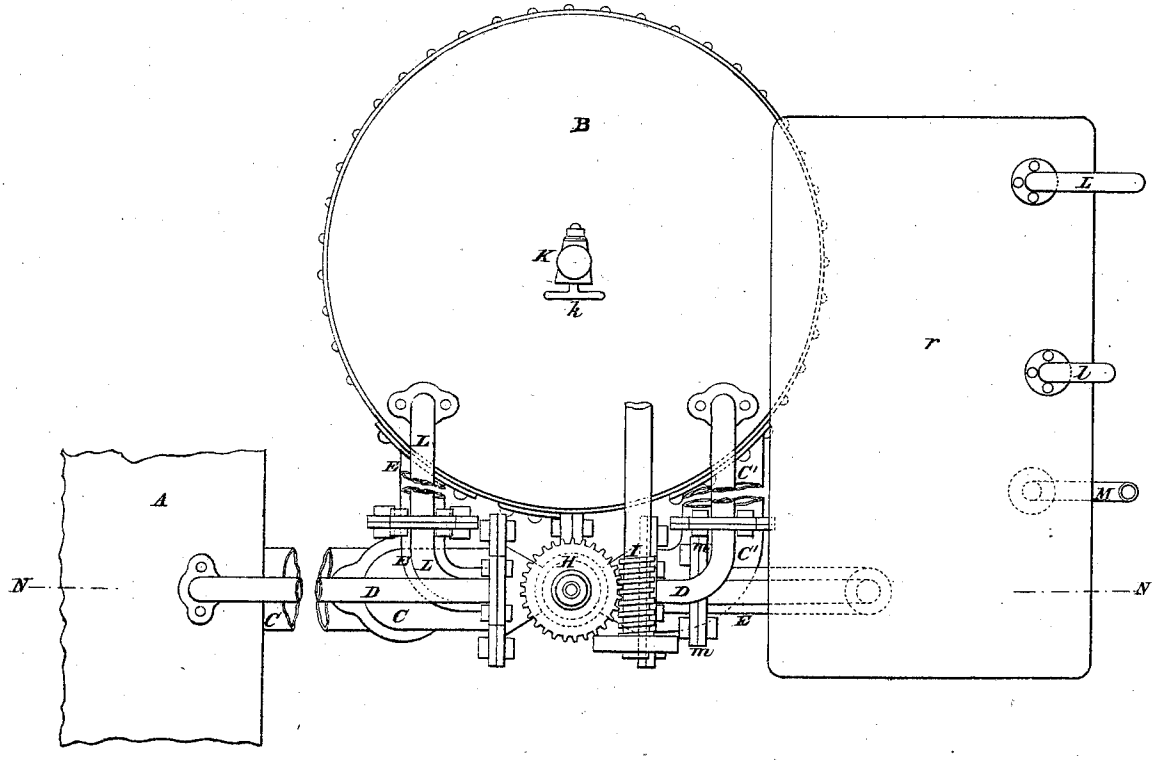


Fig. 1.



Witnesses.

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JAN WOZNIAKOWSKI, OF ST. PETERSBURG, RUSSIA.

IMPROVEMENT IN FEED-WATER APPARATUS.

Specification forming part of Letters Patent No. **131,490**, dated September 17, 1872.

To all whom it may concern:

Be it known that I, JAN WOZNIAKOWSKI, of St. Petersburg, Russia, military engineer, have invented an Improved Feed-Water Apparatus for Steam-Boilers, of which the following is a specification:

The chief object of the said invention is the construction of an automatic apparatus which, without the aid of an attendant and without any regulation, will supply the boiler of a steam-engine with water, keeping the water-level therein at one constant height or subject only to slight variations.

Description of the Drawing.

Figure 1 is a plan of my improved apparatus. Fig. 2 is a section on the line N N, Fig. 1.

At any distance from the boiler A is placed a metallic feeding-vessel, B, tightly closed on every side. In one of the sides, or at the bottom of the vessel, a hole is made for the purpose of cleansing. The top of the vessel has a short vertical pipe, K, with a cock, *k*, which is always hermetically closed and is covered with a carefully-adjusted cap to prevent any communication with said pipe during the time the feeding apparatus is acting. The said cap is not shown on the drawing. The aforesaid pipe, with the cock *k*, serves to fill the vessel B with water. The vessel should be filled at the same time as the boiler A. For this purpose a hand-pump is screwed into the pipe K; the cock *k* is then opened and the vessel B is filled with water from the primary cistern up to the cock *k*. This being done, the hand-pump is taken down and the cock *k* closed, as above explained, during the time that the feed apparatus is working. The interior of the feed-vessel B is in communication, first, with the inside of the boiler A by two pipes—the water-pipe C and the steam-pipe D; secondly, with the water in the cistern, either by the pipe E extending downward, or by the pipe E′ extending upward, its end joining the bottom of a water-tank, *r*, when the boiler is to be fed with heated water. In this latter case the inside of the vessel B is made to communicate also with the atmosphere by the pipe L, of which the horizontal part L′ may have the shape of a flattened parallelopiped, with a basis rather smaller than the transversal section of the tank *r*. The aim of such flattening is to extend as much as possible the surface of the steam-pipe L, in order that the steam passing through it may be more rapidly cooled by the water which surrounds the said pipe. The aforesaid alternate communication of the feed-vessel B with the boiler A with the primary cistern or the tank *r*, together with the atmosphere, are effected consecutively through the continuous rotary motion of the plug F in the cock-barrel *g*. From the moment the steam-engine has been set working the cock-plug F commences a continuous and slow rotary motion by means of the screw I and cog-wheel H. The object intended to be realized by this motion of the plug F will be made clear by the following explanation: At each half-turn of the said plug the ways *c* and *d* therein meet simultaneously; the parts *u* and *w* of the cock-barrel *g*, then the water, as well as the steam of the boiler A, are freely and without any interruption whatever admitted into the cavity of the vessel B; then the plug assumes a position in which none of the ways meet with the ports of the cock-barrel *g*, and lastly the ways *e* and *f* in the plug F meet the ports *x* and *z* of the cock-barrel *g;* then, all the steam being exhausted from the vessel B, the said vessel is filled with water from the primary cistern through one or the other of the pipes E or E′, so that there is no interruption between the water in the vessel B and that in the cistern. While the steam-boiler A is being filled with water up to the level *y y* the feeding-vessel B is also to be filled with water up to the cock *k*. During the working of the pump the waterways *e* and *f* in the plug F must be brought to meet the ports *x* and *z*, in order that the water flowing from the primary cistern into the vessel B through the downwardly-extending pipe E should fill up the whole capacity of this pipe and of the said ports. In consequence of the development of steam in the boiler the water-level in the boiler A sinks from its original height *y* to the level *s;* the volume *y s s y* is then smaller than the volume $y' y^0 y^0 y'$ in the vessel B, as the decrease of water in the boiler A during one complete turn of the plug F, even under the most intense heat, is smaller than the volume $y' y^0 y^0 y'$—that is to say, than half the capacity of the vessel B; consequently, at the moment of the subsequent simultaneous opening of the ways

c and *d* and of the ports *u* and *w*, the water-level *y' y'* in the vessel B will be higher than the water-level *s s;* and whereas, from the instant of the opening of the ways *c* and *d* and of the ports *u* and *w*, two pressures equal in force but diametrically opposite act upon the water in the vessel B, mutually balancing each other—one downward, produced by the water through the pipe C, and the other upward, produced by the steam through the pipe D—therefore the column of water in the vessel B, being quite free and at a higher level than the water-level *s s* in the boiler A, will descend by its own weight and drive through the pipe C C a volume of water into the boiler A, till both water-levels *s' s'* and *s'' s''* in the boiler A and in the vessel B are again brought to the same height. In consequence thereof a similar volume of steam will at the same time pass over from the boiler A through the pipe D into the vessel B, and above the water therein remaining; therefore, until the ways *c* and *d* and the ports *u* and *w* are completely closed by the continuous rotary motion of the plug F, the two water-levels in the boiler A and in the vessel B, remaining in one common plane, will both equally and gradually sink. The continued rotation of the plug F finally closes the ways *c* and *d*, and the ports *u* and *w* gradually open the ways *e* and *f*, and the corresponding ports *x* and *z*. If at that moment the downwardly-extending pipe E is used the steam contained in the vessel B, by its elasticity, enters the pipe E, tending to penetrate into the water of the primary cistern; but meeting in the said pipe with a much greater amount of water than is required for its condensation, (the quantity of water required therefor being from twenty to twenty-two times the weight of the steam to be condensed,) it instantly returns to a liquid condition, and the empty space thereby left is filled with water, which rapidly runs into the vessel B by the pipe E, being driven thereinto from the primary cistern by the pressure of the atmosphere, which acts upon the surface. This pressure is many times superior to the slight elastic resistance of the mass of steam in the vessel B in the immediate vicinity of the stream of water, and whose refrigerating contact instantly destroys the elastic action. Thus the whole volume of steam which was contained in the vessel B suddenly disappears from it and is replaced by a similar volume of water, which, entering by the pipe E from the primary cistern, fills the whole capacity of the said vessel as when it was first filled up to the cock *k*, as also the pipe E and the ways *e f*. If, on the contrary, the pipe E', extending upward into the special tank *r*, is used, then, immediately on the opening of the ways *e* and *f* and of the corresponding ports *x z*, the steam contained in the vessel B enters, by its elasticity, into both pipes E and L, its tendency being to escape into the atmosphere; but meeting a powerful refrigerating action in both pipes, the whole or a portion of it, according to the heat of the water in the tank *r r*, becomes liquid, as in the former case, while the surplus steam, which has not had the time to condense freely, escapes by the pipe L into the atmosphere. In consequence thereof, the feed-vessel B, in lieu of a volume of steam which has disappeared, becomes almost instantly filled to the cock *k* with a similar volume of water driven into it through the pipe E' from the tank *r r* by a powerful pressure exercised on its surface by the atmosphere, the strength of this pressure being much superior to that of the elastic resistance of the steam in the vessel B, condensing at the contact of a thick stream of water, which it encounters. To replace such decrease of water in the tank *r*, a fresh supply of water, even with a certain excess, as hereinbefore explained, is introduced into the said tank by the action of a pump through the pipe M, which is fixed to the tank *r*, the constant excess being returned to its source by a pipe, *l*, extending from the top of the tank *r*. Immediately after the feed-vessel B has been, by means of either the pipe E or the pipe E', filled with water up to the cock *k*, it becomes from that moment, and until the reopening of the ways *c* and *d* and of the corresponding ports *u* and *w*, remains, a continuation of the primary cistern, there being no interruption of communication whatever between the water in the said level and that in the primary cistern or in the tank *r*. The further rotation of the plug F finally closes the ways *e f* and the corresponding ports *x* and *z*. From that moment the feed-vessel B is again isolated from everything, and remains so until the ways *c* and *d* and the ports *u* and *w* are reopened. Then the column of water in the vessel is again acted upon by two pressures equal in strength, but diametrically opposite and balancing each other—that is to say, by the pressure of the water and the steam through the pipes C and D. In consequence thereof the said column of water, being again at full liberty and having its level *y* higher than the water-level in the boiler A, descends again. A fresh volume of water is introduced into the boiler A through the pipe C, and is replaced in the vessel B by a similar volume of steam. Then, the ways *c* and *d* being again closed, the vessel B is again isolated, containing, over the water which has remained in it, a volume of steam, which, at the subsequent opening of the ways *e* and *f* and of the corresponding ports X and Z, instantly passes either into the pipe E, if the boiler is fed from the primary cistern, which is placed lower than the vessel B, or into the two pipes E' and L, if the boiler is fed from the tank *r*. In both cases the water flows rapidly through the said pipes into the vessel B in a similar volume, and fills the said vessel up to the cock *k*, and so on throughout the whole process of feeding.

The adaptation of my feed apparatus to any

existing steam-boiler is easily effected, as nothing is required for that purpose but to screw two pipes into the boiler—the water-pipe C and the steam-pipe D.

I claim—

In a feed-water apparatus for steam-boilers, the arrangement of the plug F, operated so as to have a continuous rotation, as described, and provided with the ways *c e f d*, in combination with the cock-barrel ports *u x z w*, communicating with the boiler A, vessel B, and tank *r* by means of the pipes C E L D and chamber L′, all constructed in the manner and for the purpose herein shown and described.

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Witnesses:
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