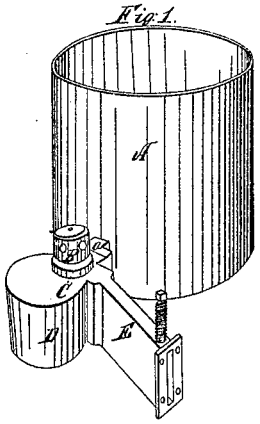
J. Echols,

Steam-Boiler Water-Feeder,

No. 2,212. Patented Aug. 11, 1841.

Fig. 1.



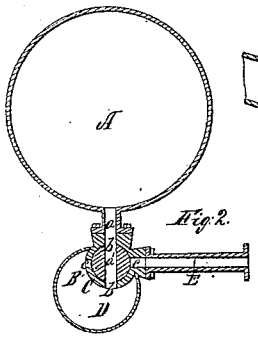


Fig. 2.

Fig. 3

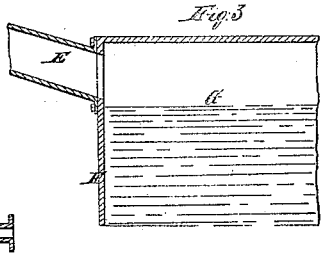


Fig. 4.

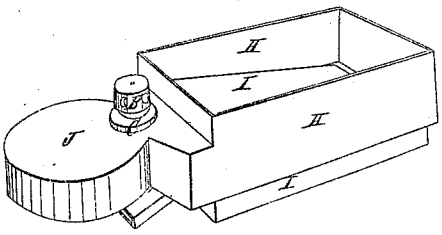


Fig. 5.

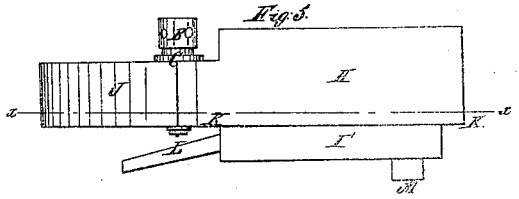
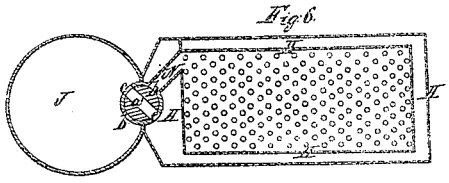


Fig. 6.



UNITED STATES PATENT OFFICE.

JOSEPHUS ECHOLS, OF COLUMBUS, GEORGIA.

CONDENSER OF STEAM-ENGINES AND APPARATUS FOR SUPPLYING THE BOILERS WITH WATER.

Specification of Letters Patent No. 2,212, dated August 11, 1841.

To all whom it may concern:

Be it known that I, JOSEPHUS ECHOLS, of the city of Columbus, in the county of Muscogee, in the State of Georgia, have invented certain improvements in the mode of constructing steam-engines, by means of which improvements water may be supplied to the boilers with perfect regularity and maintained at the same and desired height therein at all times and the force-pump now in use dispensed with and the power necessary to work them saved and the steam condensed after being used with great facility and economy and the power necessary to work the air-pump diminished; and I do hereby declare that the following is a full and exact description thereof.

In the accompanying drawing Figure 1 is a perspective view of the apparatus for supplying boilers with water in the manner and with the advantages above stated. A is a tank or cistern for containing water and which may receive its supply in any convenient manner dependent upon the particular situation. B is the key or plug of a cock, which fits into a socket C into which it is ground truly in the ordinary manner. The key or plug has but one water way through it but the socket has four standing at right angles with each other so as to constitute a four way cock.

Fig. 2 is a horizontal section through the middle of this cock through the water and steam receptacle D (in the side of which the cock is contained) and through the tank or cistern A. The receptacle D is alternately to receive and discharge water and is to be filled with it from the cistern A, the water passing into it when the water way through the plug or key of the cock is in the direction in which it is represented in Fig. 2; *a*, is a tube or water way leading from the cistern to the cock and through this into the receptacle D when the said way or passage through said plug or key B coincides with the openings *b*, *b*. In the socket E is a water way leading from the receptacle D into the boiler and when the plug B is turned one quarter around the ways *c c* in the socket will correspond with the way *a'* in said plug B and the water which may be contained in the receptacle D will tend to flow from it into the boiler while the way *b b* will be closed. The plug and socket of the cock and the ways through them and also that leading to them from the cistern and that from the receptacle into the boiler are made of considerable length say three or four inches and sometimes more according to the size of the apparatus, the design of forming these lengthened openings being to admit the water to pass through them in one direction while steam is passing above it in another direction and also to enable the receptacle when it cannot (as on a boat on the ocean) be maintained in a level position to receive water from the cistern when the way through said plug is in one direction and to discharge it into the boiler when said way is in the other direction.

In Fig. 3 F may represent a part of a boiler which is to receive its supply of water through the way or tube E leading from the receptacle D into it. G is the height at which the water may be supposed to stand in the boiler that is to say at a small distance below the opening through E and also at a less height than that which it is desired to attain.

I will now proceed to show what would be the operation of the before described apparatus under the foregoing circumstances first observing that the passage through the plug and those in the socket are limited to such width that whatever position the plug may be placed in by turning it in the socket the said receptacle cannot communicate at the same time with both the cistern and the boiler. The plug B of the cock may be worked either by an intermitting reciprocating motion or by a rotary intermitting motion one quarter of a circle at a time, as may be preferred, the effect being the same in either case resting between each movement of or to the extent of said one quarter of circle, so that the passage through it while in a state of rest will correspond with one or the other of the passages in the socket leading from the cistern to the receptacle and from the latter to the boiler. This motion is to be communicated to the said plug B from the engine in any of the ways adapted to that purpose and which are familiar to machinists. Suppose the plug in the position represented in Fig. 2 and the cistern A is supplied with water; a portion of this water would flow from the cistern A and fill the receptacle D and that the more freely and rapidly if said receptacle has been first filled with steam from

the boiler, which would always be the case if the engine were in action. On turning the said plug one quarter around the communication between said cistern and the said receptacle would be cut off and that between the latter and the boiler would be opened and the water in the receptacle would flow down into the boiler, provided the level of the water in the boiler was below that contained in the receptacle, but if this were not the case the water in the receptacle could not flow into the boiler as that in the former would be balanced by that in the latter. Hence the tube leading from said receptacle to the boiler should be attached to the latter at that point or height at which it is desired to maintain the height of the water in the boiler.

If it is desired to raise water into the cistern A by the action of the above described apparatus, it may be effected in the following manner. The top of the cistern is to be closed with an air tight cover and in this cover there must be a valve opening upward. From the bottom of the cistern a tube is to dip into the water in a well, river or other source from which the water is to be raised—and in the upper end of this tube where it is joined to said cistern is also to be situated a valve opening upward. In all other respects the apparatus should be made as herein before described and represented in the drawings—except that in this case the cistern should be very small in diameter and increased in height—and except that said upper valve should be covered by a small sheet iron or sheet copper vessel with an opening in its side near the top. This vessel is designed to receive such water as may be forced through the said upper valve. The operation of said apparatus so modified will be as follows: When the cock is turned for the purpose of opening the communication between said receptacle and said cistern and of condensing the steam contained in the former and of filling it with water, the first effect is that the steam contained in said receptacle operating by its elasticity expands and causes the water in said cistern to rise up with considerable force. In doing this it will cause the valve in the top of the cistern to rise and any air which may be contained in said cistern will be expelled. The almost instantaneous collapse from the condensation of the steam will cause this valve to close and a vacuum either perfect or partial being produced the valve in the pipe at the bottom of the cistern will rise from the pressure of the atmosphere and a fresh portion of water will be supplied to the cistern provided the source of supply be within the proper limits of the power by which it is operated upon. When this feeding apparatus is applied to a low pressure engine the cistern A may be closed at the top and said upper valve dispensed with, the said tube and lower valve remaining as last described. If then a very small tube be allowed to lead from the upper part or top of the cistern into the ordinary condenser, this will preserve a vacuum in the upper part of the cistern which the water from below will continually flow in to fill up.

The respective parts of this apparatus must be so constructed as to be capable of affording a supply of water to the boiler somewhat exceeding the quantity evaporated, when that process is going on with the greatest rapidity. When this apparatus is applied to locomotive engines or others that perform many revolutions in a minute the said plug of said cock may be turned a quarter of a circle every ten, fifteen or twenty revolutions of the engine and oftener during the performance of the same number of revolutions of the engine where the engine performs a less number of revolutions in a minute so that said receptacle may have time between the movements of said plug to receive its supply from said cistern, or to discharge its contents into the boiler, or nearly so.

Fig. 4 represents my condensing apparatus in perspective. In this apparatus, H is a cistern or reservoir which is to be supplied with cold water in any convenient manner and within and below this cistern is a box or receiver I, which answers the purpose of a condenser into which the steam to be condensed is to pass. From the cistern H cold water is admitted into a receptacle J which is to pass thence into the box or receiver I which receives the steam to be condensed. The water after passing into that box is to percolate through holes in a diaphragm or false bottom by which said box I is divided into two parts, the water being admitted above said diaphragm and falling through it in a shower on to the bottom of said box or condenser I. B is the plug and C the socket of a cock constructed in all respects like that employed in the before mentioned apparatus for supplying the boilers of steam engines with water.

Fig. 5 is a side view of my said condenser the same letters of reference being used to designate the same parts as are used in Fig. 4. K K is the line of the perforated bottom and I′ the lower part of the said steam receiver into which the steam is admitted through a pipe or tube L. At M there is a tube or opening for the discharge of the water of condensation and of such air if any as may not be removed from said condenser by this last apparatus and the process hereinafter mentioned.

Fig. 6 is a horizontal section of the said condenser in the line *x x* of Fig. 5 showing the arrangement of the four way cock and its appendages. K K is the perforated bot-

tom above which the water is to enter the said steam receiver or box I. H H is the lower part of the said cold water cistern surrounding the upper portion of the said box I. N is a water way leading from the receptacle J into said box or receiver 1. The opening *a'* in the plug B standing in the direction to admit it through the openings *b b* in the socket. As the water flows from the receptacle J into said condenser or box I a portion of the air contained in the said box or condenser will pass into the receptacle J and occupy the space which had been occupied by water; on turning the plug B one quarter around after the water has been discharged from said receptacle, the opening *a'* will coincide with the openings *c*, *c* in the socket and a fresh supply of water will pass into said receptacle J from the cistern H, and at the same time the air which had passed into it from the said condenser or box I will pass out by the pressure of the entering water. The plug of the said cock is to be rotated or vibrated by means of the engine as in the case of the said apparatus for supplying boilers with water. But as the whole of the air which may be disengaged from the steam or water or may find its way into said condenser may not be discharged through the receptacle J although it will operate as a powerful auxiliary in the discharge of it and as that the remaining air and also the water to effect condensation admitted through said cock and receptacle as herein before explained must be removed, an air pump may be applied to draw them off through the tube M or through any other aperture conveniently situated for that purpose. In situations admitting of a sufficient descent of the tube M say to the depth of twenty six feet or more by allowing the lower end of said tube to dip into water the water of condensation will be discharged by its own gravity and but little extra power if any will be required for the discharge of the air. And where in this case a sufficient quantity of water can be obtained and said apparatus made sufficiently large no extra power for exhausting said condenser of air will be required.

In engines in which the water supplying and the condensing apparatus are both used the water heated by the condensing process may be used to supply the cistern from which the boiler is to be replenished.

Having thus fully described the nature of my improvements in steam engines and shown the manner in which the respective parts operate what I claim therein and desire to secure by Letters Patent is—

1. The manner in which I have combined and arranged the said cistern, receptacle, the said four way cock, and the boiler with the said respective water passages, so as to effect the object of dispensing with force pumps (now in use for supplying boilers) and of giving a regular supply of water to the boiler and of maintaining it at the same and desired height at all times as above set forth. I do not claim the use of a four way (except so far as using the plug of the same with only one passage through it) or of any of the respective parts of this apparatus, taken individually but I do claim them collectively in the particular combination described not intending by this claim to limit myself to the exact form and manner of constructing the respective parts aforesaid but to vary them as I may find expedient while they remain substantially the same as herein before set forth.

2. I claim the manner in which I have combined and arranged the foregoing described apparatus for condensing steam and for discharging a portion of the air liberated therefrom without the employment of an air pump, that is to say, I claim the manner in which I have combined and arranged the cold water cistern the steam receiver or condenser the receptacle and the four way cock so as to effect the condensation of steam and of discharging a portion at least and in some situations nearly all the air from said receiver or condenser through the said receptacle and cock substantially as herein described.

JOSEPHUS ECHOLS.

Witnesses:

THOS. P. JONES,

B. A. MORSELL.