J. Ryan,

Ejecting Pump,

No. 62,893. Patented Mar. 12, 1867.

Fig. 2.

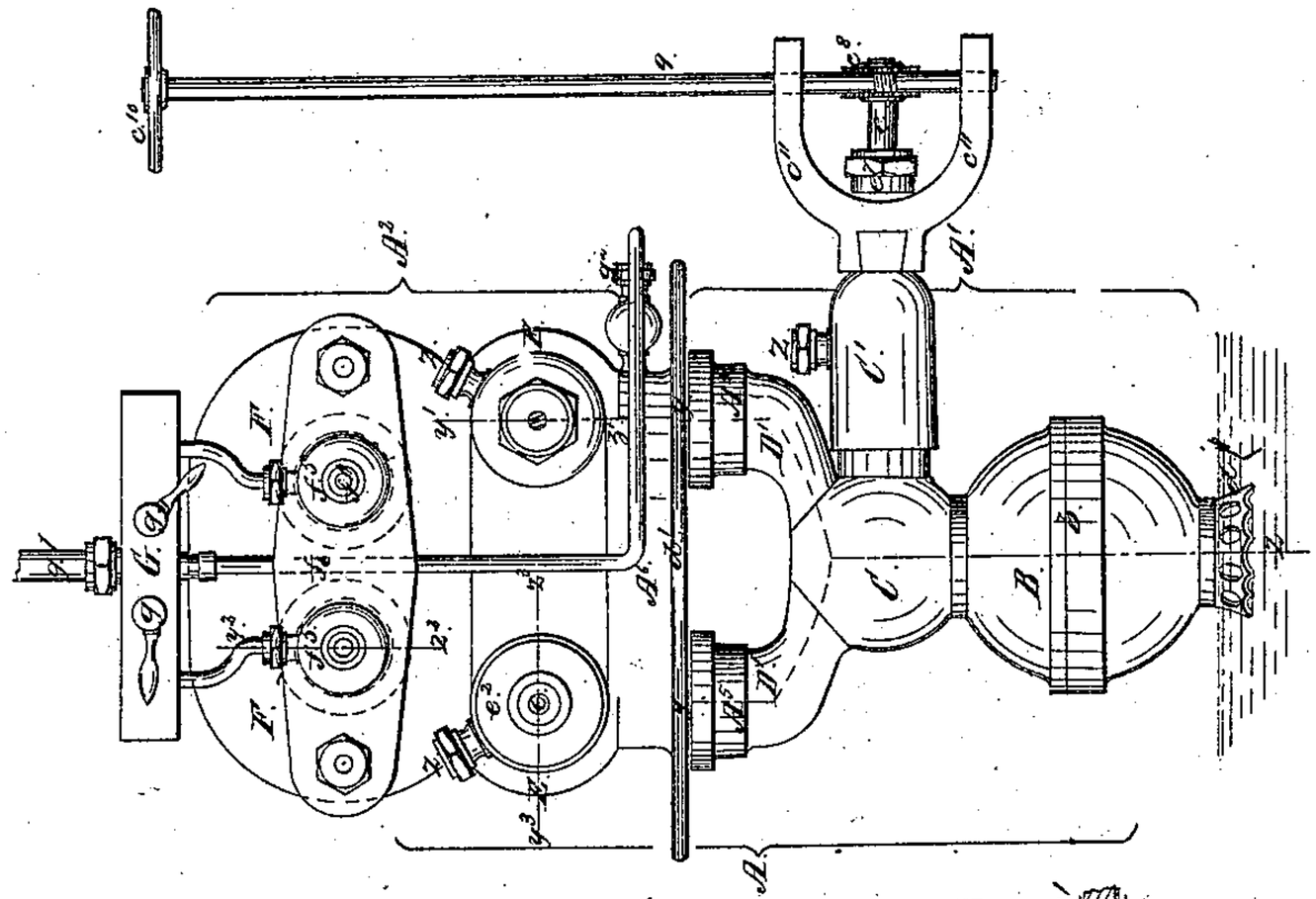


Fig. 4.

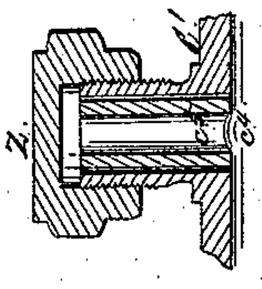


Fig. 1.

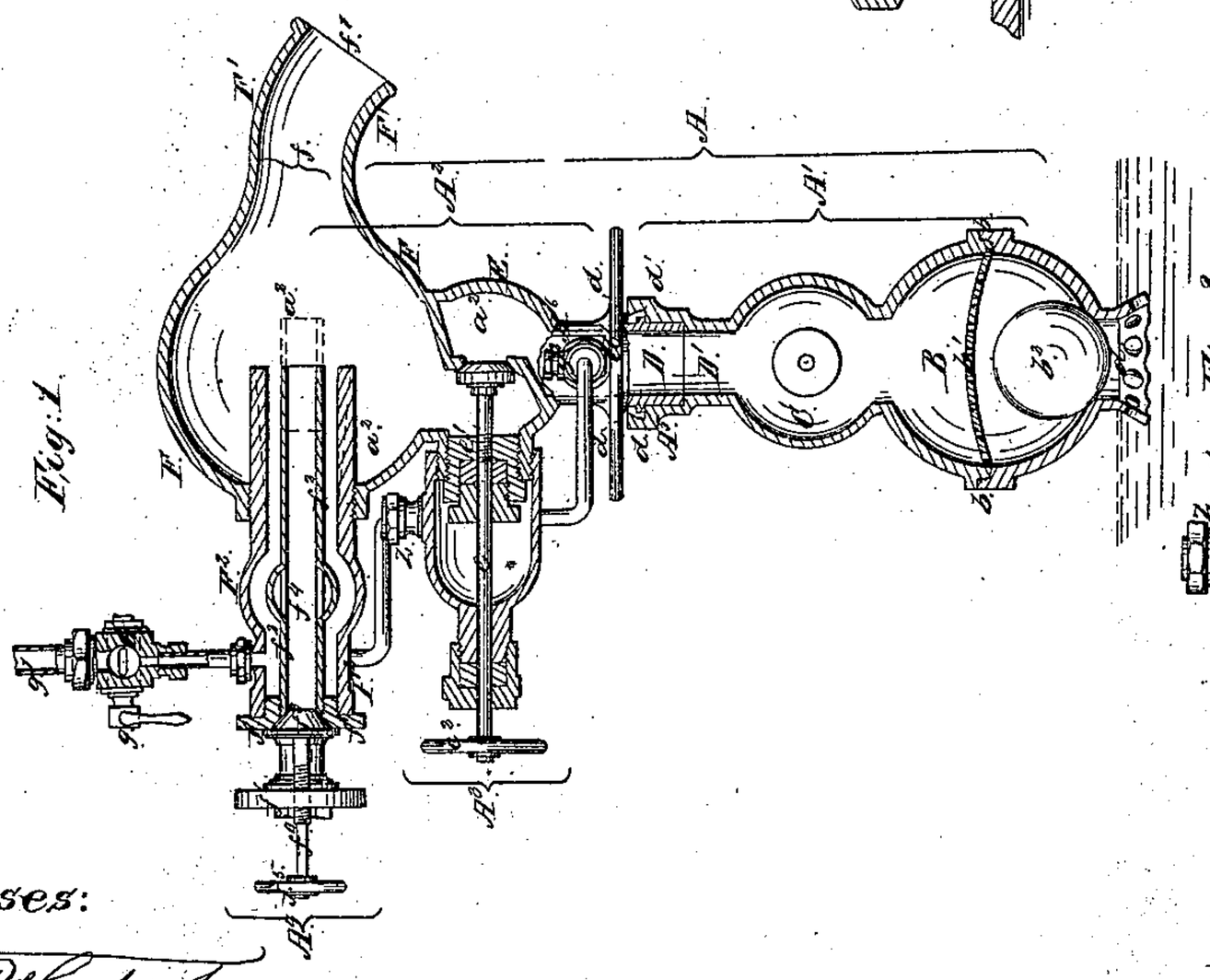
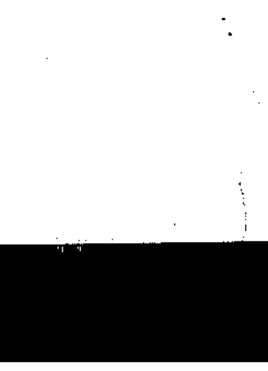


Fig. 3.



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Letters Patent No. 62,893, *dated March* 12, 1867; *antedated February* 27, 1867.

IMPROVEMENT IN FLUID EJECTERS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, JOSEPH RYAN, of the city and county of St. Louis, in the State of Missouri, have invented a new and improved Single or Double-Acting Combined Air and Steam Siphon; 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. Of said drawings—

Figure 1 shows the siphon in a series of vertical central sectional elevations, thus: the part included in the bracket marked A^1, shows the section at $y\ z$, of fig. 2; the part included in the bracket marked A^3 shows the section at $y^1\ z^1$, of fig. 2; the part included in the bracket marked A^4 shows the section at $y^2\ z^2$, of fig. 2.

Figure 2 is a rear end elevation of the siphon.

Figure 3 is a sectional plan at line $y^3\ z^3$, of fig. 2.

Figure 4 is an enlarged central section of the cap nut Z.

The nature of my invention has the following general features: In raising water by air pressure in the steam siphon, the partial vacuum formed by the condensation of the steam is vitiated by air leaking into it, thus diminishing the effective action of the siphon. I therefore seek to perfect and preserve the attained partial vacuum by providing a packing or stuffing-box arrangement wherever valves are necessary, which shall be virtually air-tight. This is effected, as hereinafter especially set forth, by a fluid packing. Secondly, after water has been raised it must be discharged against air pressure. This in common siphons is overcome by the action of a current of steam simply. I aid this current of steam by introducing a current of air, and in such manner that the steam current imparts to the air current a part of its velocity, thereby giving the air current a propelling action, aiding the discharge of water. Now as in the air action there is no appreciable loss by condensation, it will be seen that this improvement is effective and valuable. The steam current, moreover, imparts, by transmission, to the air current a portion of its heat, which, by expanding the volume of air, increases the velocity of the air current and affects beneficially the water-discharging action. In a detail feature the nature of my invention consists in so arranging the parts of my siphon that while drawing from a single supply pipe it may discharge water from one or two discharge pipes, or, as I shall hereafter term it, be single or double acting.

To enable others skilled in the art to make and use my improved siphon, I will proceed to describe its construction and operation.

I construct the housing A of cast iron, brass, or other suitable material, and of the peculiar shape presented in the drawings, the same being in its parts composed of rounded hollow cylinders and hollow globes, as best shaped for an economical resistance of pressure and for reducing to a minimum the frictional resistance against the flow of water. The part of the housing marked A^1 is at its lower end a immersed in water to the depth indicated by blue lines in figs. 1 and 2. The neck part A^5 is lengthened according to the height to which the water shall be raised; for instance, in a ship the flange a^1 rests the whole apparatus and secures it in the usual water-tight manner to the deck, the neck pieces A^5 being then of sufficient length to allow a to reach to the bilge water, the parts A^2, and especially the several hand-wheels, being then easily accessible to the operator standing on deck. The lowest bulb B is halved at b, the parts being joined in a water-tight manner by screw-threads or by common flanges. Between the halves is inserted the diaphragm plate b^1, which allows water to pass its perforations, but prevents the ingress of such impurities as will injure parts above. The lower part of B forms the seat for a globe-valve, b^2. Of this the ball b^2 is made of a wooden body, coated with vulcanized rubber, gutta percha, or some equivalent substance. This coating will secure a water-tight fit of this valve when closed, and as the wear will affect the ball b^2, and not so much the metal seat, and this ball can easily be replaced, I hold that this arrangement will be beneficial. The plate b^1 serves, furthermore, to limit the rise of the ball b^2. The bulb B connects by a short neck with the bulb C, which contains a throttle-valve, as shown in horizontal section in fig. 3. The bulb C connects by a screw joint, or by flanges, in a water-tight manner, with the rounded cylinder C^1. Through the axis of this passes the valve stem c. As will be hereafter more fully shown it is of importance to prevent air to leak into the bulb C. I have therefore made the following arrangement: I screw into the inner surface of the joint-piece of the bulb C the cap nut c^1; into this again is screwed the packing nut c^2, leaving between the two the place c^3 to be filled by cotton yarn or other suitable packing material. By screwing the cap nut c^2 into c^1 the packing is pressed against the valve stem

securing the water-tight passage of the steam; but lest this packing should allow air to leak through I fill the cylindrical space c^4 with some liquid, usually water, and this will, moreover, preserve the packing in c^3 in a moistened condition. The liquid filling c^4 is poured in by the funnel pipe c^5. This is shown enlarged in fig. 4. There are small annular openings, extending from the inner edge of C^1 to the top of c^5, to allow the escape of the air in filling c^4 with fluid. The cap Z screws on the upper end of c^5. The stem c passes on through the neck part of C^1, there being at c^6 another packing, secured by the cap nut c^7 in a water-tight manner. This throttle-valve being usually some twenty feet below the station of the operator, in order to actuate it I secure to the end of the stem c the worm gear-wheel c^8, which is turned by the worm or screw on the shaft c^9. This shaft passes up to the station of the operator, and is there turned by the hand-wheel c^{10}. The shaft c^9 finds its support in the bearings of the forks of the standard c^{11}, which is secured around the neck-piece of C^1. Now as the worm-wheel must remain in contact with worm on c^9, the stem cannot at this point move horizontally. I therefore construct it of two parts, $c_/$ and $c_{//}$, being male and female screws, so that by turning $c_{//}$ and preventing it from horizontal motion by the pin $c_{///}$, which bears in the annular slot of $c_{//}$, and is fast in the neck of C^1, the part $c_/$ is drawn forward, opening the valve passage, or forced backward, closing it. It is here immaterial which of the parts $c_/$ and $c_{//}$ are male or female. The two branches of the neck part A^5 connect with the upper part of the bulb C. Each of these branches consists of a pipe, D, and a root-piece, D^1; this latter will usually connect immediately with C. The joint between D and D^1 I construct as follows: the upper end of D^1 is widened, forming the conical space d so as to pass the flange d^1 on D and rest it securely on D^1; the intervening space is then filled by some (to water) impervious substance, lead, iron, cement, or some other. Next above the flange a^1 is the chamber A^6, which connects with the priming apparatus hereafter described. This chamber is divided equally by a partition wall, a^2, which extends from the flange a^1 to the upper end of the apparatus, dividing it into two separate parts. Next above are the globes E, both equal in construction and operation, and on different sides of the partition a^2. These contain throttle-valves, with liquid packing similar to that in the cylinder C^1. These valves are actuated by the hand-wheels e^2, and these simply turn the stems e, which being provided with screw-threads where they pass the cap nuts e^1, will move horizontally, opening or closing the valve passages. Next above are the double-bulb chambers F. These are at their front side shaped to discharge the water. The mouth-pieces F^1 are narrowest in area of section about at f, and widen toward the end f^1, thus facilitating the easy discharge of water. At the rear end of F are the cylinders F^2; these are closed by the caps f_1 and contain an inner cylinder f_2, which again at their rear ends are closed by the throttles f_3; these throttles f_3 are operated through the stems f_4 and hand-wheels f_5. The stems find a bearing in the support f_6, through which they pass with screw-threads, so that in turning the hand-wheels f_5 the stems receive the necessary horizontal motion. The cylinders F^2 are connected each by pipes with the steam chamber G; this connection is opened or closed by the common stop-cocks g. The steam chamber G receives steam direct from the boiler through the main supply pipe g^1. Furthermore, G is connected by a pipe with the chamber A^6. This pipe has a stop-cock, g^2.

I will now proceed to describe the operation of my improved siphon in single action. All the throttle-valves on the one side of the partition a^2 remain and are closed. The throttle-valve in C is closed, that in E is open. When the priming-cock g^2 is opened steam passes into all parts above the lowest throttle-valve, (in C,) and drives out the air; this effected, close the throttle-valve in E. The steam condenses between the two valves, and if now the valve in C is opened, the water in rising fills the partial vacuum to the valve in E. If now the valve E is opened, the air pressure from above would force the water back were it not that the ball b^2, which was raised by the water in its upward passage, now drops and prevents the return flow. Moreover, if now the steam cocks g permit steam to pass into the outer chamber of F^2, the steam current passing forward carries the air with it, and also by condensation creating a partial vacuum, causes the water to rush forward to the discharge at f^1. As was observed, the action of the siphon to raise water depended on the formation of the partial vacuum between the throttle-valves in C and E; hence it is important to prevent any leakage of air at these valves, which could vitiate the vacuum thus formed, and to effect this I have introduced the liquid packings as hereinbefore described. It has been observed that the air pressure from the discharge f^1 opposes the passage of the water after its rise to the throttle in E. To aid the steam current in overcoming this air resistance I introduce an air current, thus: when the steam current through F^2 is in action, open the throttle f_3, thus permitting air to pass into the cylinder f_2; this will rush forward to fill the partial vacuum created by the steam current, surrounding it, and thus the air current will act upon the water, forcing it to discharge at f^1. Moreover, the air being surrounded by steam will become heated; it will expand; and to permit and facilitate this expansion the tube f_2 may contain the globe f_4, this globe presenting also a large surface for the heating action of the surrounding steam to take effect upon. This expansion of the air necessarily causes an increase of its velocity and momentum, making the action upon the water still more effective. The air tubes f_2 may extend out even with the tubes F^2, or they may extend farther or be shorter, (the latter positions being marked by red lines,) according as the action of the air current may be desired. The shorter the air tube the sooner the steam current carries the air forward, but the less is gained by air expansion. Of course the amount of air admitted into the cylinder f_2 can be closely regulated by the throttle-valves f_3. I believe that above thirty per cent. of the useful effect produced is caused by the introduction of the air current in the tubes f_2. In order that I may get the benefit of an expansive action of the steam in F^2 when higher pressures are used, I make the inner surface of F^2 wider at the discharge end. This is shown by red lines in fig. 1. The flow of water will necessarily be continuous until the supply of steam is checked and the throttle-valves closed.

When the siphon shall be double acting, the throttle-valve in C is, as before, first closed and steam admitted on both sides of the partition a^2. Then the throttle-valves in E being closed the vacuum forms in both branches of A^5, between C and E. Then the throttles in E on both sides opened and the steam (first having been cut

off at g^2) permitted to pass in both tubes F^2, will cause the water to discharge from both discharge pipes. The air-current action is brought to bear in both tubes f_2.

Having described my said improvement, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The method of economizing the heat produced by the condensation of steam in a siphon by application thereof to one or more air currents then caused to act in combination with the steam current or currents upon the fluid to be raised, substantially as set forth.

2. The arrangement of the tube F^2, its feed of steam and stop-cocks, or their equivalent, with the tube f_2, its feed of air and throttle-valve, or equivalents, in such manner that the steam current shall impart to the air current velocity and heat, and bring said air current in acting contact with the water to be discharged, thus avoiding greater loss of power by condensation, which would ensue if steam alone were used, substantially as set forth.

3. The tube F^2, arranged to utilize the expansion of steam by widening the inner diameter thereof, substantially as set forth.

4. The globes or other increases of surfaces of the air-feed tube f_2, thus favoring an expansive action of air, substantially as set forth.

5. The combination of the supply pipe g^1, the steam chamber G, stop-cocks g, and feed pipes starting from G, for the purpose described.

6. The arrangement and combination of the chambers F, the bulbs E, with the necks A^5, and the bulbs C and D, when used as set forth.

7. The arrangement for packing the valve rods to effect the perfect exclusion of air from the vacuum, the same consisting of a stuffing-box arrangement, c^1, c^2, and c^3, (fig. 4,) and this surrounded by a liquid, usually water, as in c^4, and this backed by a second stuffing-box, as at c^6 and c^7, or any equivalent arrangement which uses a liquid to prevent the egress or ingress of air, in combination with some mechanical stuffing-box contrivance, to prevent the leakage of the air-checking fluid.

8. The combination of the male and female screw parts c and $c_{//}$ of the valve stem c, with the pin $c_{///}$, worm-wheel c^8, worm-shaft c^9, and hand-wheel c^{10}, as and for the purposes set forth.

9. The joint of the pipe D with the root-piece D^1, by means of a flange d^1 and lead, cement, or equivalents filling the space surrounding d^1 of D^1, substantially as described.

10. The valve ball b^2, when arranged of an inner wooden kernel, and coated with vulcanized rubber, or its equivalent, as set forth.

11. The combination of the bulb B, diaphragm plate b^1, and drop-valve b^2, as and for the purpose set forth.

JOSEPH RYAN.

Witnesses:
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