J. L. ALBERGER.

Steam Condensers.

No. 140,232. Patented June 24, 1873.

Fig. 1.

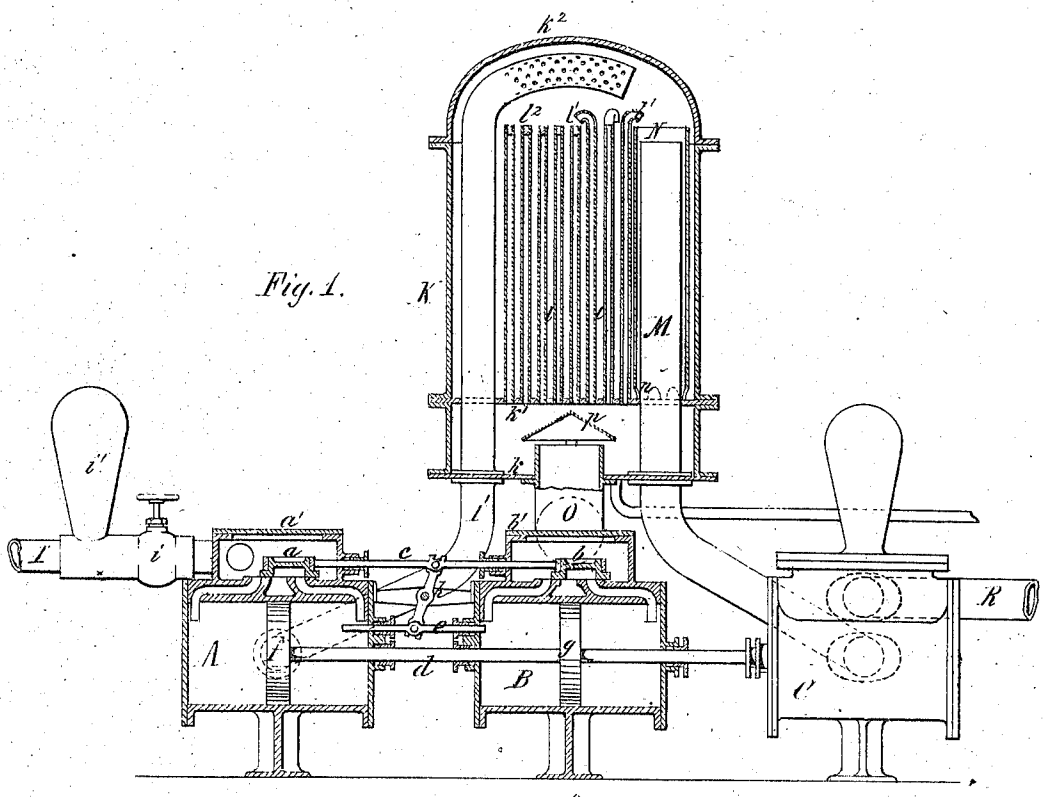
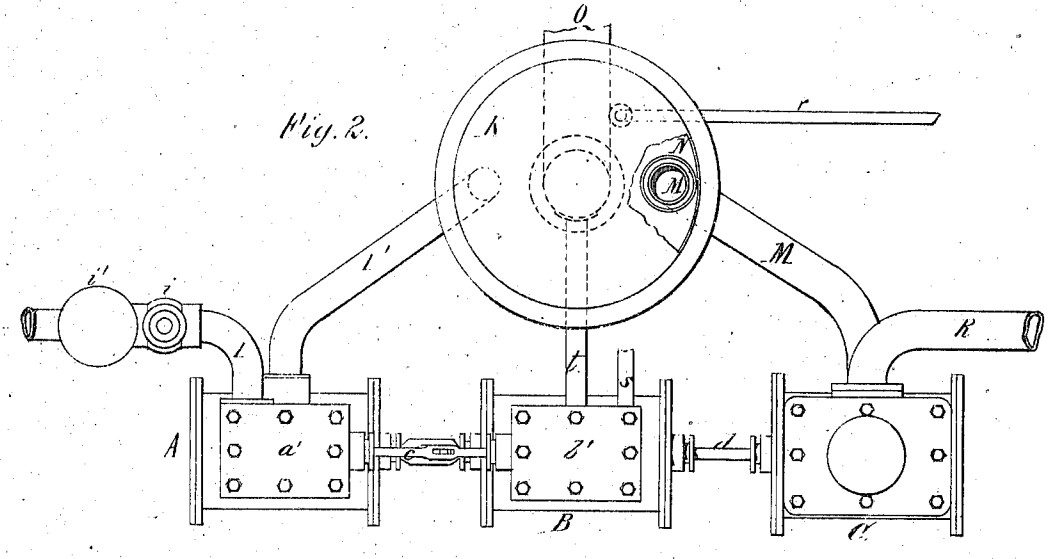


Fig. 2.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN STEAM-CONDENSERS.

Specification forming part of Letters Patent No. **140,232**, dated June 24, 1873; application filed January 28, 1873.

To all whom it may concern:

Be it known that I, JOHN L. ALBERGER, of the city of Buffalo, in the county of Erie and State of New York, have invented certain Improvements in Steam-Condensers, of which the following is a specification:

In injection-condensers the water enters the condensing-vessel with a certain force dependent upon the vacuum maintained in the condenser, and the height at which the condenser is located above or below the level from which the injection-water is supplied. When the condenser is located below this level, as, for instance, in marine engines, and in industrial establishments using steam in addition to water-power, the pressure under which the injection-water is forced into the condenser is greater than necessary for supplying the required quantity of water, and the injection-pipe has to be contracted in order to prevent an excessive influx of water. The motive power contained in the injection-water is thus spent in overcoming useless friction, and lost.

The object of one part of my invention is to properly utilize this power; and another part of my invention relates to certain improvements in the construction of the condenser. The invention consists, first, in the combination, with the air-pump and injection-condenser, of a steam-engine or other apparatus, in which a vacuum is produced, of a double-acting hydraulic engine, arranged with the injection-pipe so as to be operated by the inflowing water before it enters the condenser, and connected with the air-pump so as to actuate, or assist in actuating, the same, whereby the power contained in the injection-water is utilized in removing the hot water and air from the condenser, while the admission and removal of water into and from the condenser being simultaneous, the injected water is prevented from overflowing into the engine when the latter is stopped and the injection-cock not closed; second, in the combination, with an injection-condenser, air-pump, and a steam-engine actuating the same, of an auxiliary hydraulic-engine operated by the inflowing injection-water, the pump and two engines being arranged in line and the three pistons thereof connected by a single piston-rod, whereby the power received by the hydraulic engine from the injection-water is directly transmitted to the air-pump, and assists the steam-engine in actuating the same; third, in the combination, in a condenser, of vertical steam-pipes, rigidly secured at their lower ends in the diaphragm or tube-sheet separating the steam-space from the water-space, while their upper ends are curved and left open and left free, so as to enable each pipe to expand and contract without injury to its connection with the tube-sheet and independent of the other pipes; fourth, in the combination, in a condenser provided with vertical steam-pipes open at the top, and an injection-pipe delivering the water into the space around said pipes, of a hot-water discharge-pipe, having its orifice at a point below the open upper ends of the steam-pipes, so as to prevent the injection-water from overflowing into the steam-space; fifth, in the combination, in a condenser provided with vertical steam-pipes and a vertical hot-water discharge-pipe, of a sleeve or tube surrounding the latter, so as to project above the same, while its lower end is provided with openings, through which the water from the lowest and hottest portion of the water-space passes into the annular space between the sleeve and the discharge-pipe, and ascends therein to the mouth of the latter before it can escape; sixth, in the combination, in a condenser having a cold-water jet at the top, of steam-pipes bent over at the top to form escapes, and yet prevent the injection-water from entering the same, as will be hereinafter more fully set forth.

In the accompanying drawing, Figure 1 is a sectional elevation, and Fig. 2 a plan view of my improved apparatus.

Like letters designate like parts in all of the figures.

C is the air-pump; B, the steam-engine actuating the same; and A, the auxiliary hydraulic engine, all arranged in line so that a single piston-rod, *d*, connects the respective pistons thereof. *a* and *b* are the respective valves of the hydraulic and steam engines, arranged in suitable valve-chests *a'* *b'*, and attached to a valve-rod, *c*, which is connected by a rock-lever, *h*, with a push-rod, *e*, projecting through the opposite heads of the hydraulic and steam cylinders, so as to be alternately actuated by the pistons *f* and *g* thereof. The valve mech-

anism may, however, be constructed in any other suitable and well-known manner. I is the injection-pipe, leading from the water-reservoir (in a marine engine, from the sea) to the valve-chest of the hydraulic engine A. It is provided with a stop-valve, *i*, and air-vessel, *i'*. I' is the continuation of the injection-pipe, leading from the exhaust-port of the hydraulic engine A to the condenser K. The latter consists of a shell or case, preferably cylindrical in shape, a bottom plate, *k*, a diaphragm or tube-sheet, k^1, arranged above the latter so as to form an intervening steam-space, and a top plate, k^2. *l* are the verfical steam-pipes, rigidly secured with their lower ends in the diaphragm k^1, and opening into the chamber below the same. Their upper ends are left free, which allows each pipe to expand and contract without disturbing its connection with the diaphragm k^1. The injection-pipe I' enters the condenser K through the bottom plate *k*, passes tightly through the diaphragm k^1, and terminates above the steam-pipes *l* in a suitable rose-jet. In order to prevent the injected water from entering the pipes *l* through their upper ends, the latter are bent over so as to form a lateral discharge-opening, l^1, as shown in Fig. 1; part of the pipes may, however, be entirely closed, as shown at l^2, Fig. 1. The pipes *l* may also be protected by a hood or plate arranged over their open upper ends, or by contracting the latter so as to leave a small discharge-opening sufficient only for the escape of the air and uncondensed steam. M is the hot-water discharge-pipe, leading from the water-space of the condenser through the diaphragm k^1 and bottom plate *k* to the air-pump C. The upper end of the discharge-pipe M is located somewhat below the open upper ends of the steam-pipes *l*, to prevent the water in the space around said pipes from entering through the top thereof into the steam-space. N is the sleeve or tube arranged around the discharge-pipe M in the water-space of the condenser, its upper end projecting above the water-level, while its lower end rests on the diaphragm k^1, and is provided with openings *n*, through which the injected water from the lowest and hottest part must pass into and ascend the annular space to the orifice of the discharge-pipe before it can escape. O is the steam-exhaust pipe of the principal steam-engine vacuum-pan, or other apparatus in which a vacuum is to be produced by condensation. It enters the condenser through the bottom plate *k*, and is provided with a deflecting-plate, *p*, arranged above its orifice for more uniformly distributing the steam to the pipes *l*. R is the discharge-pipe of the air-pump, *s* the steam-pipe through which steam is supplied to the engine B, and *t* the exhaust-pipe of the latter, connecting with the main exhaust-pipe O. The water of condensation accumulating on the bottom plate *k* is conducted by a pipe, *r*, to the boiler feed-pump.

The apparatus is set in motion by admitting steam to the cylinder B, and opening the stop-valve *i* to admit the injection-water to the cylinder A. The injection-water, after imparting motion to the piston *f* in passing through the cylinder A, is discharged into the condenser, and fills the space between the steam-pipes *l* until its level reaches the top of the discharge-pipe M, when it overflows into the air-pump C, by which it is expelled. The exhausted steam or vapor enters the condenser through the pipe O, and passes into the pipes *l*, in which the greater portion thereof is condensed, while the remainder passes through the open ends l^1 of the pipes *l* into the space above the surface of the water, where it is condensed by commingling with the injected water. Assuming the reservoir, from which the injection-water is supplied to be on a level with the discharge-opening of the pipe I', the pressure with which the injection-water acts upon the piston *f* must be equal to the vacuum maintained in the condenser. The power thus derived from the injection-water is transmitted to the air-pump C, and the steam-engine B relieved to that extent. If the level of the said reservoir is above or below the mouth of the injection-pipe I' the pressure upon the piston *f* is increased or reduced in accordance with the fall or rise of the water. With a moderate head—as, for instance, in marine engines—the main part of the work of exhausting the condenser will be performed by the hydraulic engine A, while, when a considerable hydrostatic pressure is at command, the steam-engine B may be entirely dispensed with, and the air-pump C actuated by the hydraulic engine A alone.

The capacity of the air-pump cylinder exceeds that of the hydraulic cylinder A a little, so as to expel at each stroke as much water from the condenser as is discharged into it from the hydraulic cylinder, and all the air accumulating during that time, whereby a steady water-level is maintained in the apparatus. Should the air-pump be stopped from any cause the hydraulic engine A, and the influx of water into the condenser, will likewise be arrested, whereby the injection-water is prevented from overflowing into the engine.

In steam-engines provided with injection-condensers, as heretofore constructed, this overflow has occurred, causing greater or less damage, when the injection-cock was not immediately closed upon stopping the engine, or properly adjusted when reducing its speed, which requirements have rendered the employment of injection-condensers objectionable on ferry and other steamboats making frequent stoppages.

In my improved apparatus the above difficulties are entirely obviated. The circulating-pump used in connection with ordinary surface-condensers is dispensed with in my improved apparatus, and the steam-pipes *l* are enabled to be made very light, as they are not exposed to any pressure, the vacuum being on both sides thereof.

Although my improved apparatus is spe-

cially designed for steam-engines, it is evident that it may be used for producing a vacuum in evaporating-pans, drying or other apparatus in which steam is generated, by connecting the steam-exhaust pipe of the vacuum-chamber of such apparatus with the condenser.

I claim as my invention—

1. The combination, with the air-pump and injection-condenser of a steam-engine vacuum-pan, of the hydraulic engine A operated by the inflowing injection-water and connected with the air-pump, so as to actuate or assist in actuating the same, substantially as hereinbefore set forth.

2. The combination, with an injection-condenser, of the hydraulic engine A, steam-engine B, and air-pump C, arranged in line, and connected by a single piston-rod, *d*, substantially as hereinbefore set forth.

3. The combination, with the condenser K, provided with the diaphragm k^1, of the steam-pipes *l* rigidly secured to said diaphragm at their lower ends, and left free at their upper ends, to allow each pipe to expand radially and vertically and contract independent of the others, when said pipes are curved and left open at their upper ends, substantially as hereinbefore set forth.

4. The combination and arrangement, in a condenser provided with an injection-pipe, I′, of the steam-pipes *l* and discharge-pipe M, substantially as and for the purpose hereinbefore set forth.

5. The combination and arrangement, in an injection-condenser provided with steam-pipes *l* and the discharge-pipe M, of the sleeve N surrounding the latter, substantially as and for the purpose hereinbefore set forth.

6. The combination, in a condenser, and with the injection-pipe I′ and discharge-pipe M, of the steam-pipes *l*, bent down at their upper ends, with discharge-openings l^1, substantially as and for the purpose hereinbefore set forth.

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