(No Model.) 2 Sheets—Sheet 1.

E. O. SCHARTAU.

REGENERATING EXHAUST STEAM.

No. 381,172. Patented Apr. 17, 1888.

Fig. 1.

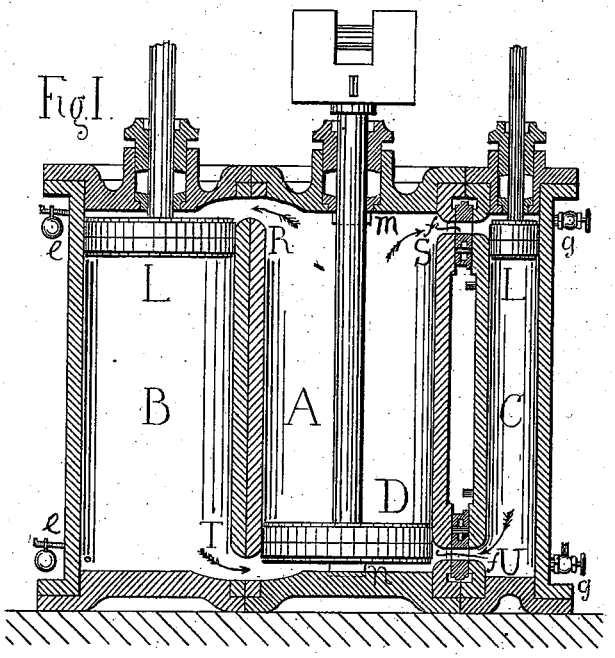
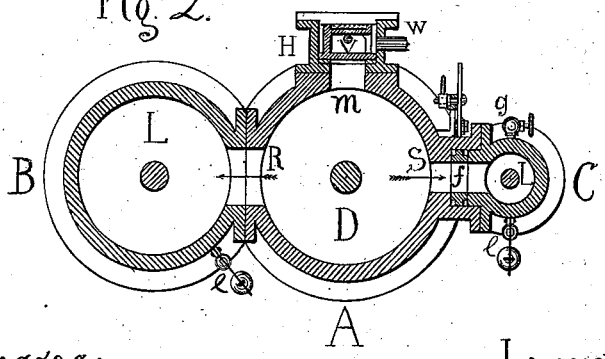


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

E. O. SCHARTAU.

REGENERATING EXHAUST STEAM.

No. 381,172. Patented Apr. 17, 1888.

Fig. 3.

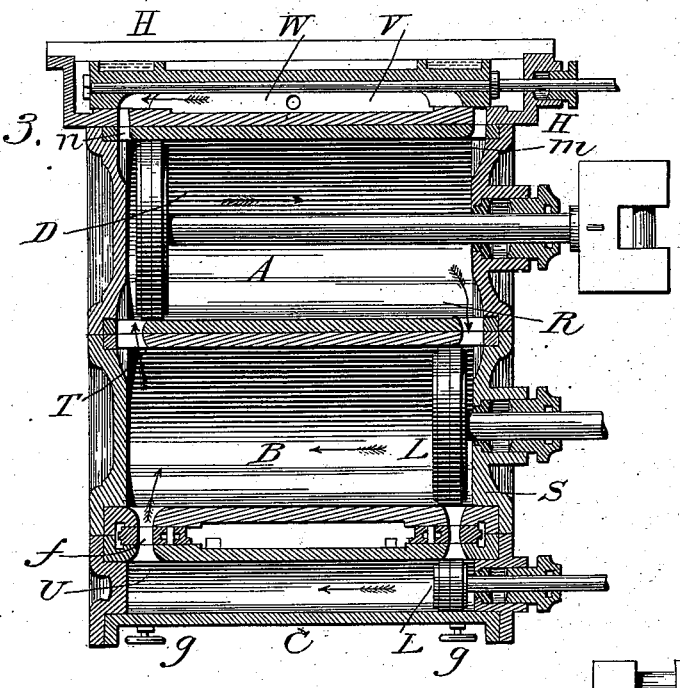


Fig. 4.

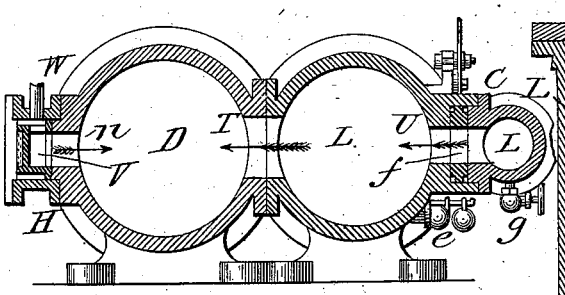
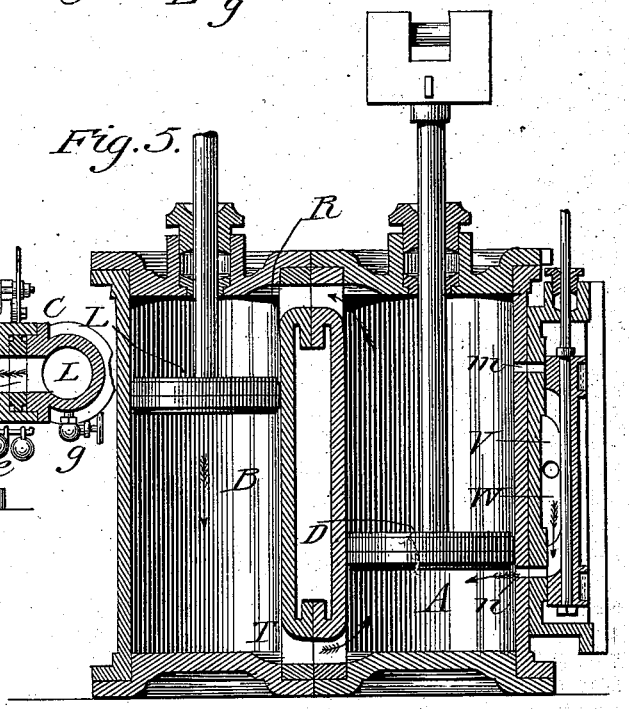


Fig. 5.



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UNITED STATES PATENT OFFICE.

EILERT O. SCHARTAU, OF PHILADELPHIA, PENNSYLVANIA.

REGENERATING EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 381,172, dated April 17, 1888.

Application filed January 4, 1887. Serial No. 223,947. (No model.)

To all whom it may concern:

Be it known that I, EILERT O. SCHARTAU, a citizen of the United States, residing in the city and county of Philadelphia, and State of Pennsylvania, have made a new and useful invention by means of which exhaust-steam is practically revived or regenerated; and I do hereby declare that the following is a full, clear, and exact description of the invention, reference being had to the accompanying drawings, same forming a part thereof.

It is a known fact that to convert a given quantity of boiling water into steam requires about six times as much fuel as would be necessary to raise the same water from the freezing to the boiling point. This result has an important relation to the economy of steam-power; and my invention has for its object the conservation of exhaust as steam, same to be utilized for immediate duty in the cylinder of the engine.

The process of regeneration of exhaust-steam, as herein set forth and claimed by me, is based on the theory that steam is an elastic fluid which (when compressed) increases in expansive power proportional to its decrease in volume.

Condensed steam (exhaust) is treated by me as an elastic fluid, which I revive or regenerate by means of compression in the manner herein specified, and illustrated by the accompanying drawings, in which the steam-cylinder A is represented in vertical section in Figure 1 and in sectional plan in Fig. 2. With the steam-cylinder A are connected cylinders B and C, same constituting exhaust-reservoirs with a united steam capacity less than that of the steam-cylinder A. The greater or less compression of the exhaust-steam is regulated by valves *f f*. If a required maximum compression of the exhaust is only temporary, then the turning open air-valves *g g* must be simultaneous with the shutting of valves *f f*. Consequently, by again reversing these valves the effective operation of the reservoir C is resumed, with the result of a minimum compression of the exhaust-steam. The reservoirs for exhaust, B and C, are provided with loaded valves *e e*, same having for object the relieving the engine of any occasional back-pressure.

W is the steam-pipe coming from the boiler.

Fig. 3 represents in sectional plan, and Fig. 4 in transverse section, the combined steam-cylinder A and exhaust-reservoirs B and C. In these figures are shown complete sectional views of the steam-chest H, illustrating the operative relation of the steam-regulating valve V with the operating-pistons D and L L.

Fig. 5 represents in vertical section a steam-cylinder, A, operating with only one exhaust-reservoir, B.

The modification made in the position of the steam-ports *m* and *n*, as shown in Fig. 5, has for result an economy of the live steam required in the process of regenerating exhaust. In this process the admission of live steam into the steam-cylinder is regulated by means of the common slide-valve or any other known steam-regulating valve, because no specially-constructed valve or valves are required for that purpose. The required compression for reviving exhaust is proportional to what the steam has lost by condensation. Consequently, if the condensation of the operating-steam is reduced to a minimum, (by preventing the loss of heat,) then the process of regenerating exhaust can successfully be effected within a reservoir of equal steam capacity with that of the steam-cylinder, because the velocity and force propulsion and vacuum are acting on the exhaust while that steam is passing from one cylinder to another. Naturally this has for result the producing alike a compression and a rebound.

Pistons L L are connected to a revolving crank or cranks, the working-points of same being in a direction opposite to that of the crank connected with piston D. By this arrangement an independent action is secured to pistons L L, and their descending and ascending motions in the exhaust-reservoirs B and C have for result the producing a double effect—namely, on one side of the piston-heads L L a vacuum for passing the exhaust into reservoirs B and C, while simultaneously on the other side of these piston-heads the propulsive force imparted to them by the connecting-crank is acting on the exhaust when (regenerated by compression) it is passing from the exhaust-reservoirs B and C into the steam-cylinder A.

Explaining the operation of my invention,

let us suppose that piston D has made a full stroke and is on the point of ascending, a position illustrated by the drawings in Figs. 1 and 3. We find, then, that all the exhaust which was below the piston-head D has passed through the exhaust-ports T and U, and on entering into reservoirs B and C been drawn upward by the vacuum produced by the ascending pistons L L. Having been forced (by the momentum imparted to piston D by the fly-wheel of the engine) into a space of less steam capacity than that which it occupied in the steam-cylinder A, the exhaust is compressed, regaining by this process in expansive power what it had lost by condensation. Thus revived for active duty, the exhaust re-enters into the steam-cylinder A, alike by force of its increased expansion and by propulsion. At this point of the operation the slide-valve V, as shown in Fig. 3, has a position of shutting off the admission of live steam through the steam-port *m*, leaving open steam-port *n*, with the result of a simultaneous and combined pressure on piston-head D of revived exhaust and live steam. On the raising of the piston D all the exhaust now above the same is carried upward and through exhaust-ports R and S, and on entering into reservoirs B and C the exhaust-steam is forced downward by the combined action of propulsion and vacuum, in the manner herein set forth.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

As a means for regenerating exhaust-steam, the combination, with a steam-engine cylinder, of one or more cylinders, B and C, same constituting a reservoir or reservoirs for exhaust-steam, their united capacity being less than or equal to that of the steam-cylinder, and the piston or pistons L L, all arranged and operating substantially as set forth.

EILERT O. SCHARTAU.

Witnesses:
WILLIAM S. TOLAND,
HENRY WUNNING.