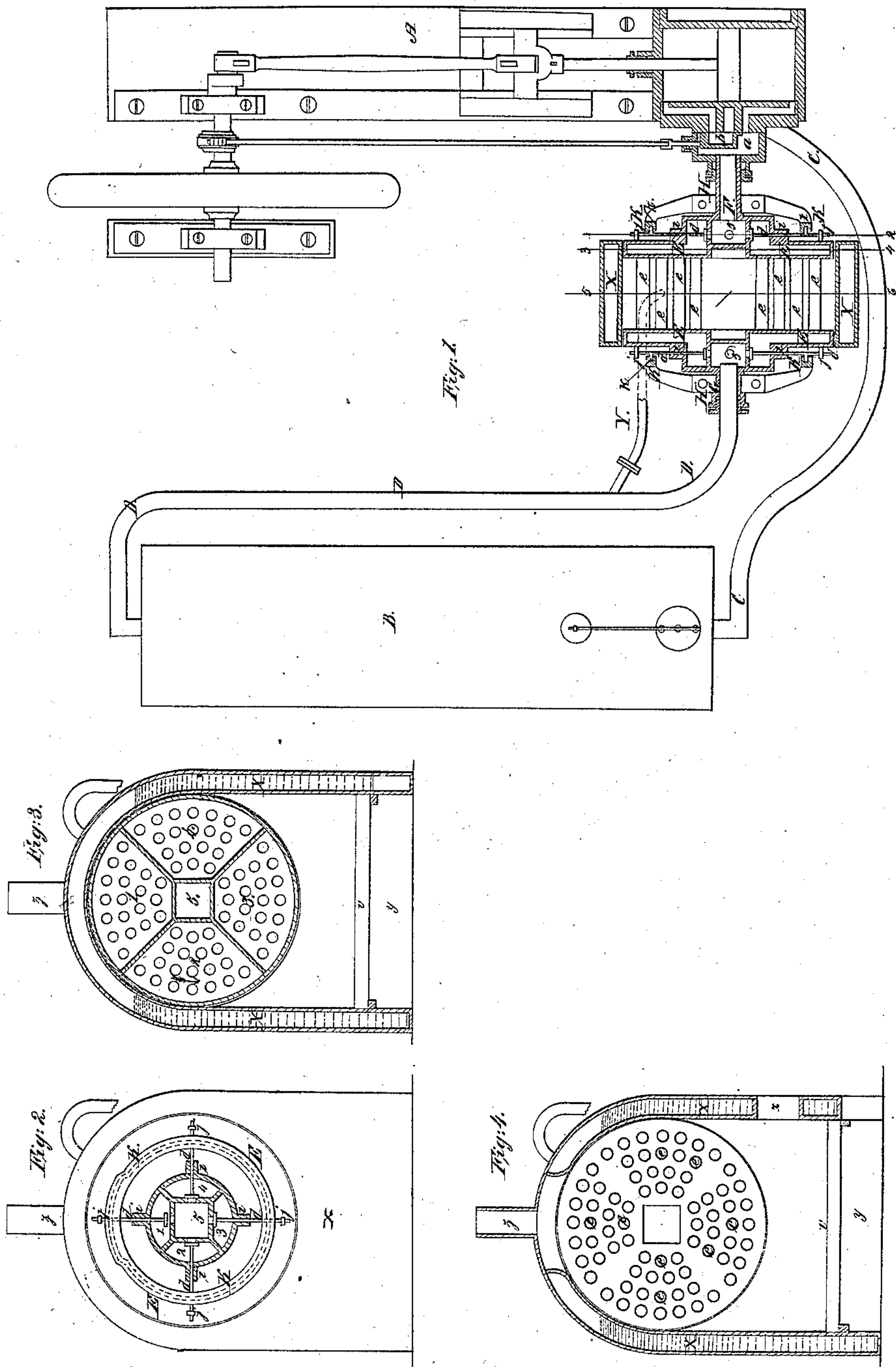


J. J. G. Collins,
Steam-Boiler Superheater.
N^o 21,165. Patented Aug 10, 1858.



UNITED STATES PATENT OFFICE.

J. J. G. COLLINS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO J. J. G. COLLINS, WM. A. RHODES, AND THOS. DRAKE, OF SAME PLACE.

STEAM-ENGINE.

Specification of Letters Patent No. 21,165, dated August 10, 1858.

To all whom it may concern:

Be it known that I, JOHN J. G. COLLINS, of the city of Philadelphia and State of Pennsylvania, have invented a Steam-Regenerating Engine; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing and to the letters of reference marked thereon.

My invention consists in combining together for joint action, a cooler, regenerator and steam engine, said regenerator being constructed and operated substantially in the manner set forth hereafter, and being furnished with devices herein described or their equivalents, in order that supplies of steam from the cooler may be received into the regenerator, there retained until superheated, then delivered to the engine at intervals regulated by the movement of the latter, and from thence pass again to the cooler, thence to the regenerator and so on, as long as the superheating of the steam takes place and as long as the engine revolves.

The objects of my invention are economy of fuel by using the same steam over and over again, and the avoidance of the usual cumbrous boiler arrangement.

In order to enable others skilled in the art to make and use my invention, I will now proceed to describe its construction and operation.

On reference to the drawing which forms a part of this specification—Figure 1 is a ground plan illustrating my steam regenerating engine; Fig. 2 a section on the line 1, 2, (Fig. 1); Fig. 3 a section on the line 3, 4, (Fig. 1); Fig. 4 a section on the line 5, 6, (Fig. 1).

A is an ordinary steam engine, which, although illustrated in the drawing as one of the horizontal class, may be of any of the ordinary forms, having the usual steam chest *a* and slide valve *b*.

B is a strong, plate iron vessel of a cylindrical or other convenient form.

C is the exhaust pipe communicating with the vessel B, and furnished, near the engine, with a valve by operating which the exhaust pipe may be made to communicate with the external atmosphere. Another pipe, D, communicates with the vessel, B,

and with the regenerator, in the manner set forth hereafter.

The regenerator is constructed as follows: E and E' are two, circular, steamtight chambers, divided into five, steamtight compartments, as illustrated in Fig. 3, and there marked respectively 1, 2, 3, 4, and 5, the fifth one being in the center, and not communicating with the other four, excepting at certain intervals during the movements of the engine, as described hereafter. The compartment 5' of the chamber E' communicates with the steam-chest of the engine through the pipe F, the latter being attached to, or forming a part of, the metal, which composes the compartment 5', and the steam-chest being furnished with the ordinary stuffing box, so that the pipe may revolve therein without any leakage of the steam. From the compartment 5 of the opposite chamber projects a pipe G, through which passes the end of the pipe D, the pipe G being also furnished with a stuffing box, in order to prevent leakage as it revolves on the end of the pipe D. The bearing of the pipe F is on the pillar H, and that of the pipe G, on the pillar H'. Between the compartments 1, 2, 3 and 4 of the opposite chambers E and E', are secured a series of tubes *e, e*. The opposite compartments 5 and 5' have each four openings, each opening communicating with one of the compartments 1, 2, 3 or 4, and being furnished with a valve, opening inward into one of the compartments, the valves being furnished with spindles *d*, which pass through stuffing boxes *i*, their ends being guided by brackets *j*, secured to the outside of the steam chambers.

The above described portion of the regenerator is that which revolves, motion being communicated to it from the engine by any system of gearing, which the locality of the engine as regards that of the regenerator may dictate, providing that the regenerator makes one complete revolution for two complete revolutions of the crank-shaft of the engine.

The several valves above described are operated as follows: From each of the valve spindles, projects a pin *k* (Fig. 1) fitting into the groove of the guides K, one of which is permanently secured to each of the

opposite pillars H and H'. It will be observed, on reference to Fig. 2, that the guide K is nearly circular, and concentric with the center of rotation of the regenerator, there being but a small portion, at the top, eccentric with the same, this portion forming an elevation in the groove, which, operating on the pins $\frac{1}{2}$ of the valve spindles in succession, raises them at the particular points hereafter set forth, and allows a communication to take place between one of the compartments 1, 2, 3 or 4, and the central compartment 5, and, through the pipe F, with the steam chest of the engine, the valves at the opposite side of the regenerator being operated in a similar manner, but at different intervals.

X is a boiler having a water space on all sides, with the exception of the necessary openings for the fire door x , ash pit y under the fire grate v and for the chimney z . A circular opening is formed through this boiler, so as to admit the two steam chambers E and E', which revolve in close, but not actual, contact with the openings. A pipe Y forms a communication between the boiler X and the vessel B.

The object of the revolving regenerator is to surcharge the steam, admitted to it through the pipe D from the vessel B, which I term the "cooler." It will be easily seen, that this is effected by the exposure of the tubes $e e$ to the action of the fire within the boiler, the revolving of the regenerator causing every portion of the tubes to be thoroughly heated. The object of the valves on one side of the regenerator is to admit a supply of steam to each of the four compartments in succession, and the object of the valves on the opposite side, to discharge the surcharged steam of each compartment in succession into the steam chest of the engine. The valve guides are so formed, that the opening and closing of the valves shall take place as follows: Supposing the regenerator to revolve in the direction of the arrow, and to have arrived at the position shown in Fig. 3, the compartment 1 will be in the act of discharging its hitherto confined and surcharged steam into the chest a of the cylinder. The compartment 2 has, by the rapid opening and closing of the valves on the opposite sides of the regenerator, been filled with steam from the cooler through the pipe D. The compartment 3 is situated directly over the fire, and its steam, previously obtained from the cooler B, is in the act of being surcharged. The compartment 4 also contains steam in the act of being surcharged, and will be the next to discharge its surcharged steam into the steam chest of the engine as the regenerator revolves. It will be thus seen, that each compartment in succession obtains a supply of steam from the cooler, which supply is, during three-

fourths of the revolution of the regenerator, confined, exposed to the action of the fire, and thus thoroughly surcharged, and that each compartment in succession discharges its surcharged steam into the chest of the engine. The slide valve of the engine is so regulated, that this surcharged steam of one compartment shall be admitted to the cylinder so as to act upon the piston throughout, or nearly throughout one half of the revolution of the engine. When the next compartment of surcharged steam is about to act on the opposite side of the piston, so as to complete the other half of the revolution, the steam which had previously exerted its pressure to complete the first half, and which has now been expanded and consequently lessened in temperature and pressure, passes off through the pipe C into the cooler B, where it is still further cooled, prior to being again admitted to the regenerator, and there again surcharged, prior to being again admitted to the engine, and from thence again passed to the cooler, and this alternate cooling, confining and surcharging of the steam, and its action on the engine are continued as long as the latter moves, and as long as the regenerator is submitted to the action of the fire.

The boiler X, which is furnished with a small feed apparatus, forms no especial portion of this invention, it being introduced merely as a means of supplying, through the pipe Y, sufficient steam to make up for the loss caused by leakage, and by the stopping and starting of the engine.

It will now be seen, that the adoption of the above described apparatus must result in the economizing of fuel by using the same steam over and over again, and also that the usual extensive boiler arrangements of other engines are dispensed with.

The general features of the apparatus and the general disposition of the several parts must, of necessity, be changed or modified, according to the locality in which they are situated. Thus when used for marine purposes, the arrangement must be very different from that of the apparatus when used on land. It will also be apparent, that the cooler may consist of a vessel of any convenient form other than that shown, and may be situated at any moderate distance from the regenerator, and that the supplementary boiler for supplying the loss by leakage may, if necessary, be situated apart from the regenerator.

Without claiming broadly the superheating of steam, prior to its admission to the cylinder of a steam-engine, I claim and desire to secure by Letters Patent,

Combining together, for joint action, a cooler, regenerator and steam-engine, when the said regenerator is constructed and operated substantially in the manner herein set

forth, and when it is furnished with the de-
vices specified, or any equivalent to the same,
by means of which it receives a supply of
steam from the cooler, retains until it is
5 superheated, and delivers it to the engine, at
intervals regulated by the movements of the
latter.

In testimony whereof, I have signed my
name to this specification before two sub-
scribing witnesses.

JOHN J. G. COLLINS.

Witnesses:

HENRY HOWSON,
HENRY ODIORNE.