R. D'E. MONTJUSTIN.

STEAM GENERATOR FOR SUBMARINE BOATS.

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943,153. Patented Dec. 14, 1909.

Fig. 1.

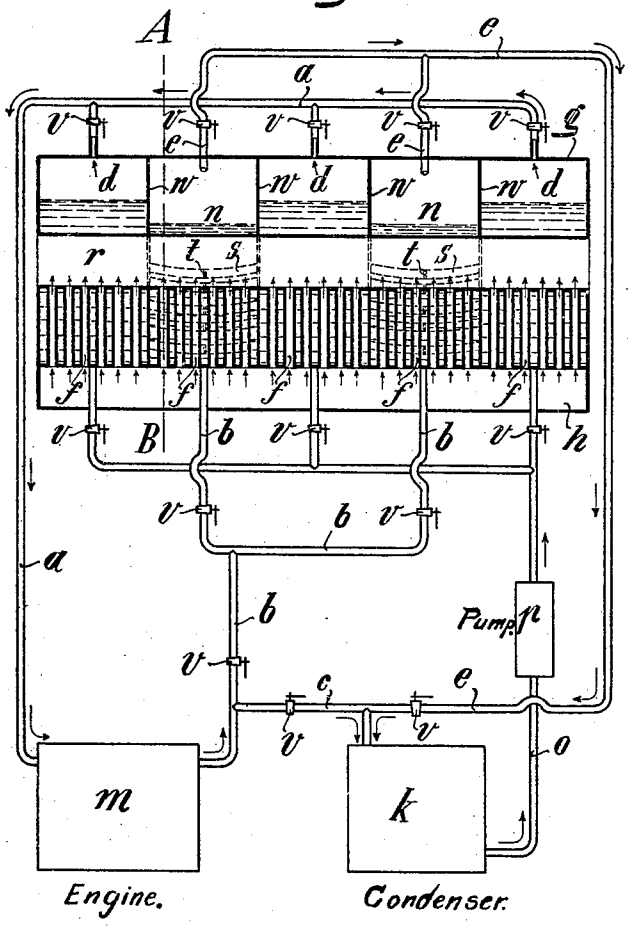
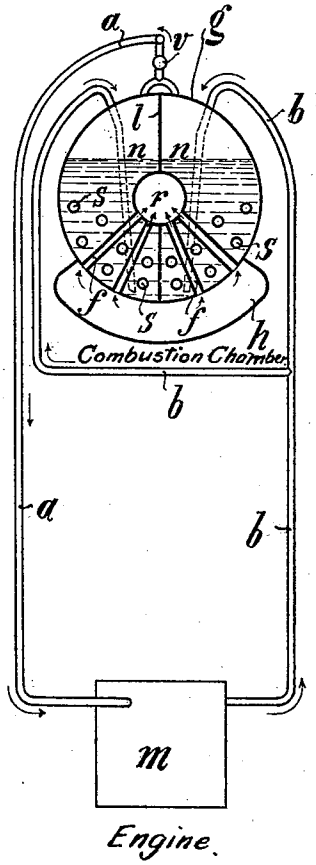


Fig. 2.



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UNITED STATES PATENT OFFICE.

RAYMOND D'EQUEVILLEY MONTJUSTIN, OF KIEL, GERMANY.

STEAM-GENERATOR FOR SUBMARINE BOATS.

943,153. Specification of Letters Patent. Patented Dec. 14, 1909.

Application filed November 27, 1907, Serial No. 404,075. Renewed March 6, 1909. Serial No. 481,687.

To all whom it may concern:

Be it known that I, RAYMOND D'EQUEVILLEY MONTJUSTIN, a subject of the King of Spain, and a resident of Kiel, in the Empire of Germany, have invented certain new and useful Improvements in Steam-Generators for Submarine Boats, of which the following is a specification.

This invention relates primarily to a method of propelling submarine boats by means of steam power, and the object of the invention is to make the "mixed" driving of the screw unnecessary, that is to say to obviate the driving of the screw by steam engines or combustion engines when running on the surface, and by electromotors or compressed air motors when running under water as has hitherto been common in the propulsion of submarine boats, and to effect such driving of the prime mover by steam power, both during the running of the boat on the surface, as well as when running under water. According to this invention, this object is attained by producing the steam required in fired boilers for the driving of the prime mover while the boat is running on the surface, while when the boat is running under water, it is produced in the well known way in fireless boilers containing a suitable absorbent medium such as caustic soda, caustic potash or the like.

Secondly the invention relates to a steam generator and an arrangement in connection therewith which are suitable for the carrying out of the method.

Finally the invention also relates to a modified form of the above-mentioned method.

In the drawing is diagrammatically shown a constructional example of the steam generator and the arrangement in connection therewith.

Figure 1 shows the steam generator in longitudinal section and other parts in elevation. Fig. 2 is a transverse section on the line A—B of Fig. 1.

The steam generator consists of a long cylindrical fire tube boiler g, which is divided by transverse partitions w into steam boilers d and soda boilers n, a steam boiler d being preferably arranged at each end of the entire boiler g, so that each soda boiler n lies between two steam boilers d. From each steam boiler d a suitable number of heating tubes s lead through the soda boiler n to the next steam boiler d in the order to afford greater heating surface to the soda solution; but these tubes s are provided in the center of their length with a transverse partition t, so that the water in the boilers d cannot pass by way of the tubes t from the forward boiler d to the rearward boilers d, or vice versa. In addition the entire boiler g is provided with a vertical longitudinal partition l which divides each of the boilers d, n into halves, in such manner as to prevent the lateral oscillation of the water within the boilers. Each of the steam boilers d may, if necessary, be provided with a steam dome. Beneath the entire boiler g is a fire box h arranged for oil firing and from which a suitable number of heating tubes f lead through each of the boilers d, n to the smoke flue r which passes through the whole length of the boiler g and communicates with the chimney in the usual way. From the steam boilers d the live-steam pipe a leads to the engine m. The exhaust pipe from the engine m divides into the pipes b and c, each of which can be independently shut off.

The pipe b leads to the soda boilers n, and the pipe c leads to the condenser k. The pipe c is then continued in the form of a water pipe o, to the pump p, and farther on the pipe o from the pump is continued and communicates by branches with the steam boilers d. The exhaust steam pipes b are introduced from above into the two compartments of the soda boilers n (as shown in Fig. 2) and terminate just above the bottom thereof, so that the exhaust steam is compelled to pass through the whole layer of soda solution.

All the steam and water pipes are provided at suitable points with stop valves v for the purpose of enabling the circulation to be regulated in any desired manner.

The apparatus works as follows: As long as the submarine boat is running on the surface, the plant works like any other steam plant, the products of combustion from the fire box h pass through all the heating tubes f. collect in the smoke flue r and pass out into the open through the smoke-stack. The steam generated in the boilers d passes through the live steam pipes a to the engine m, and after having done its work, passes to the condenser k, whence it is sent back as hot water to the steam boilers d by the pump p through the pipes o.

When the submarine boat is required to dive, the fire in the fire box *h* is extinguished, the pipe *c* leading to the condenser *k* shut off, and the pipes *b* leading to the soda boilers *n* opened, so that the exhaust steam now passes from the engine *m* through the pipes *b* into the boilers *n*, to be there absorbed in the well known way by the soda or potash solution. This absorption of the exhaust steam causes the soda solution to become heated, and the heat is transmitted to the walls *w* of the boiler and the walls of the heating tubes *s*, so that the boiler water in the boilers *d* and the tubes *s* is further evaporated and the working steam pressure maintained constant. The pipe *b* is temporarily closed according to requirements, and the exhaust steam passed through the pipe *c* to the condenser *k* and sent back as water to the boilers *d*, so that the level of the water in the boilers *d* may not be too greatly lowered.

When the submarine boat is to run on the surface again, the fire in the fire box *h* is again lighted, and the plant works once more in the ordinary way in the cycle stated; that is from the boiler *d*, to the engine *m*, condenser *k*, pump *p*, and back to the boilers *d*.

As the boilers *n* are conjointly heated, the water taken up by the soda or potash solution during the submerged "run" from the exhaust steam, is evaporated again, the pipes *e* leading from the boilers *n* to the condenser *k* being opened for facilitating the evaporation. In this way the steam issuing from the boilers *n* is led to the boilers *d* in the form of water, so that no loss at all in the weight of water can take place, and the weight of the whole boiler plant remains permanently constant.

The oil fire may obviously be extinguished when running on the surface, for the purpose of economizing the oil, and the exhaust steam from the engine *m* then temporarily sent into the soda boilers *n*, instead of into the condenser *k*. If, however, the oil firing be at the same time maintained, forced steam generation takes place.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. A steam generator for submarine boats comprising a combustion chamber; a plurality of compartments for containing water for the generation of steam; and a plurality of compartments for containing steam-absorbing medium, the latter compartments being arranged alternately with the water compartments along the combustion chamber.

2. A steam generator for submarine boats comprising a combustion chamber and a plurality of compartments arranged along said combustion chamber, some of said compartments being adapted to contain water for the generation of steam, and others thereof being adapted to contain an absorbent medium and all of said compartments being arranged in such manner as to have each compartment for the absorbent medium between two adjacent water compartments.

3. A steam generator for submarine boats comprising steam-generating and steam-absorbing compartments having connections through which they may be connected up to opposite sides of a steam engine; a condenser into which the steam from the generator may be exhausted, said condenser having connections through which it may be connected up to the same side of the engine as the absorbing compartment; and means for conducting the steam from the engine to either the absorbing compartment or the condenser.

4. Steam-generating apparatus for submarine boats, comprising a fire-chamber, steam-generating and steam-absorbing compartments arranged alternately along said fire-chamber; a condenser for the exhaust steam from the engine; and means for directing the exhaust steam alternately into the condenser and said steam absorbing compartments.

The foregoing specification signed at Kiel, Germany, this 9th day of November, 1907.

RAYMOND D'EQUEVILLEY MONTJUSTIN.

In presence of—

JULIUS ROPKE,

OTTO LAU.