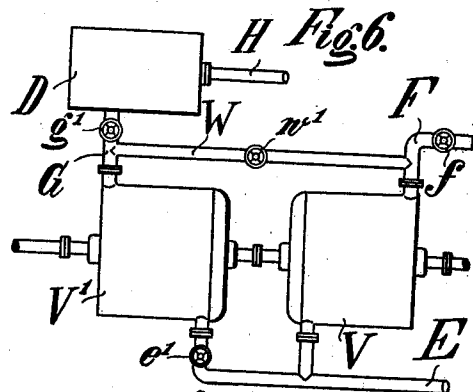
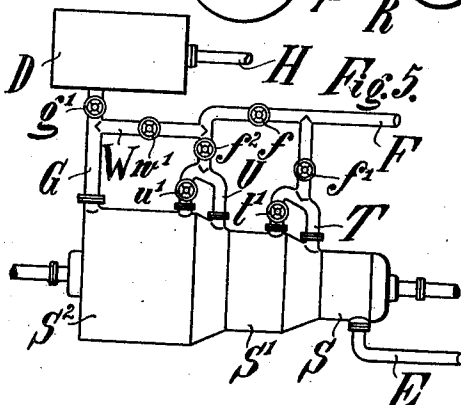
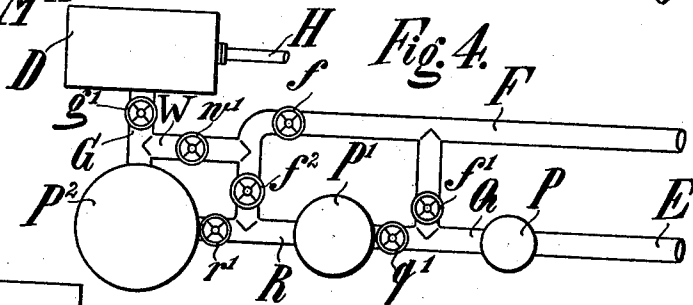
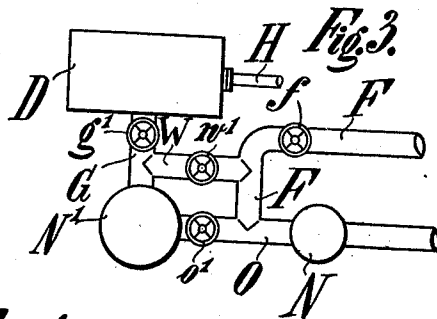
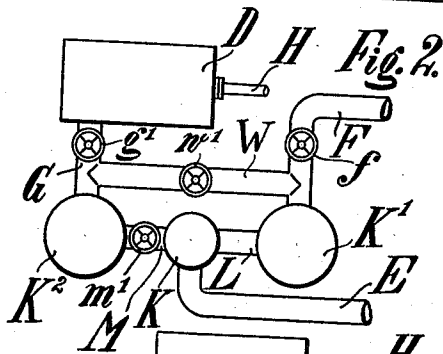
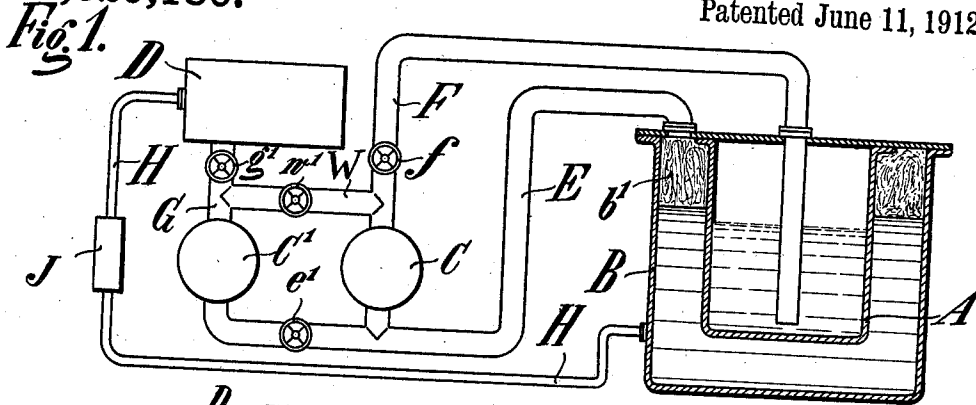


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SODA BOILER STEAM POWER PLANT.
APPLICATION FILED FOR

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RAYMOND D'EQUEVILLEY-MONTJUSTIN, OF KIEL, GERMANY.

SODA-BOILER STEAM-POWER PLANT.

1,029,180.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RAYMOND D'EQUEVILLEY-MONTJUSTIN, a subject of the King of Spain, residing at 94 Feldstrasse, Kiel, Germany, have invented certain new and useful Improvements in Soda-Boiler Steam-Power Plants, of which the following is a specification.

The present invention relates to such steam-power-plants in which the steam for driving is generated in the usual manner, in a so called soda boiler. In operation of such soda-boiler-steam-power plants, it has been found that it is inadvisable to return all of the exhaust steam from the steam engine to the soda boiler, for absorbing; because in transferring all of the exhaust steam, the temperature and the pressure in the boiler system will rise very rapidly. But the nearer the temperature of the soda solution approaches the boiling point, the more will the capability of the soda for condensing the exhaust steam from the steam engine diminish. As soon as the soda solution has reached the boiling point, its absorbing property ceases altogether. It has therefore been proposed, in order to prevent such a break down in the running, and to keep the absorbing property lasting in the soda, to return only a part of the exhaust steam from the steam engine to the soda, and to blow off the rest of the exhaust steam into the atmosphere.

The object of this invention is therefore to utilize this remaining, and till now useless part of the exhaust steam of the engine. This object is attained according to the present invention, by providing a separate steam engine connected to the condenser beside the principal steam engine which is connected to the soda receptacle; that portion of the steam, not conducted into the soda boiler, producing work in the first mentioned engine.

Different types of steam power plants are shown diagrammatically in the drawing as examples for carrying out the invention, Figures 1 and 6 showing plants where the fresh steam generated in the soda-boiler, is already divided before entering the steam engine; while Figs. 2 to 5 show plants where first a division of the exhaust steam is allowed. Fig. 1 shows a complete steam power plant consisting of a soda boiler, a

steam engine and a condenser; while, Figs. 2 to 6 are confined to different types of steam engines with a condenser and the necessary piping.

Reference will first be made to the steam power plant shown in Fig. 1. It consists principally of a soda boiler A B, a twin steam engine C C' with pistons, and condenser D. Furthermore, the soda steam boiler consists of a soda receptacle A surrounded by a water evaporating tank B. From the steam space *b'* of the tank B, a pipe E for live steam leads to the cylinders C C' of the steam engine. In the pipe E, between the cylinders C, C' is attached a throttling-valve *e'* and by means of this, the steam, conducted through the pipe, may be regulated to enter the engine in required quantities. The steam cylinder C is connected with the soda receptacle A through the medium of the exhaust pipe F containing a check-valve *f*. The steam cylinder C' is connected with the condenser D through the medium of the exhaust pipe G, which is provided with a closing valve *g'*. The exhaust pipes G and F are connected with each other by means of a pipe W, which has a closing valve *w'*. Further, a pipe H leads from the water chamber of the condenser D through a feed pump J, to the water chamber of the water evaporating tank B of the soda steam boiler.

During the operation of the described steam power plant, the live steam, generated in the water evaporating tank B, is conducted through the pipe E to the working cylinders C, C'. The steam will then be divided between the two steam cylinders C, C' in proportions suitable for different conditions of the running, and this will be accomplished by the suitable setting of the throttling valve *e'*. For instance, the cylinder C may receive 80% and the cylinder C' 20% of the live steam. With the valve *w'* closed and the valve *f* opened, the exhaust steam from the steam cylinder C passes through the pipe F into the soda receptacle A, in which it is absorbed by the soda, so that, in the usual manner, steam is generated in the water tank B. The exhaust steam from cylinder C', on the other hand, is conducted through the pipe G to the condenser D, from which the condensing water from time to time, may again be

introduced as feed water into the water tank B, by means of the feed pump J. The arrangement of the piping will, however, also permit, on special occasions of conducting the exhaust steam from both cylinders C, C' of the steam engine, either into the condenser only, or into the soda receptacle only.

In the steam power plant, in part shown in Fig. 2, it has been assumed that the engine consists of a compound steam engine with piston, having a high pressure cylinder K and two low pressure cylinders K', K². All the live steam generated in the soda boiler in this engine is conducted by the pipe E to the high pressure cylinder K, and not until the steam has performed its work in this cylinder, does the division take place, effected by the regulating of the throttled valve m'. The steam in proportions of four to one (for instance) is conducted to the low pressure cylinders K', K² through the piping L, M. The exhaust steam from the low pressure cylinder K' is introduced into the soda receptacle through the pipe F; and the exhaust steam from the low pressure cylinder K² into the condenser D through the pipe G. Even here, when needed, may the total exhaust steam from all the cylinders be conducted either to the condenser alone or to the soda receptacle alone.

Fig. 3 shows an ordinary compound steam engine with pistons, which has its high pressure cylinder N and low pressure cylinder N' connected with each other by a pipe O. The pipe F, leading to the soda receptacle is branched off from this pipe O, in which again a throttle valve o' is situated. In this case, the throttle valve o', governing the division of the steam, is arranged in that part of the pipe O, which is located between the low pressure cylinder N' and the place where pipe E is branched off. The pipe W connects the exhaust-pipe G of the low pressure cylinder with the exhaust pipe F. The steam, conducted through the live steam piping, is working in the high pressure cylinder N, and about 80% of the total exhaust steam quantity goes through the pipe F to the soda solution, while the remaining 20% produces work in the low pressure cylinder N' and after that, is carried through the pipe G to the condenser.

The steam power plant illustrated in Fig. 4 shows the application of the invention to a triple-expansion steam engine, which has its high pressure cylinder P, mean-pressure cylinder P' and low pressure cylinder P² connected with each other by means of the connecting pipes Q and R. In this case, the exhaust pipe F leading to the soda receptacle communicates with the connection Q as well as the connection R. The connections Q and R are provided with throttling valves q' and r' and the exhaust pipe F is provided

with check-valves f' and f². The low-pressure cylinder P² communicates with the condenser by means of a pipe G. And the exhaust pipes G and F are connected with each other by a pipe W. As long as the reaction in the soda receptacle A does not exceed a certain pressure, the operation of the motor of this steam power plant is effected in this manner; that all the live steam in sequence operates the high pressure cylinder P and the mean-pressure cylinder P' and then, by suitable adjustment of the throttling valve r', about 20% of the steam is supplied to the low pressure cylinder, and 80% to the soda-receptacle A, through the pipe F. The check valves f' and w' are closed during this operation, while the throttling valve q' and the check valves f², f and g' are opened. Should the reacting pressure in the soda receptacle, gradually increasing during the operation, exceed the permissible limit, the quantity of steam, 80%, supplied to the soda receptacle, will be drawn off by the connecting pipe Q, where a correspondingly higher pressure exists. This is accomplished on the one hand by closing the check valves f, f² and opening the check valve f' as well as the throttling valve r', and on the other hand by adjusting the throttling valve q', to suit the required steam consumption. The exhaust steam from the low pressure cylinder P² is always carried to the condenser D.

The steam power plant shown in Fig. 5 is based on the use of a three-stage steam turbine. The casings S, S', S² of the three pressure-stages in this turbine, correspond in the same order to the cylinders P, P', P² of the triple expansion engine in Fig. 4, and the operation is practically the same. The arrangement of the connecting pipes T and U between the separate pressure stages corresponds also with the connections Q and R in the engine of Fig. 4. When the pressure in the soda receptacle A is comparatively low, the steam to be conducted to the soda receptacle is taken from the connecting pipe U, and when the pressure becomes higher the steam is taken from the connecting pipe T just as in the above described triple expansion engine. The arrangement of the check and throttling valves f, f', f², t', u', g', w' corresponds to the arrangement of the check and throttling valves in the engine of Fig. 4.

The power plant illustrated in Fig. 6 shows the application of the invention to a steam turbine consisting of two parts V, V'. The arrangement of the piping E, F, G, W corresponds to the arrangement shown in Fig. 1. As is the case of the twin cylinder steam engine shown in Fig. 1, the live steam is here divided, so that, by proper adjustment of the throttling valve e', 80% thereof is given to the turbine V and 20% to the tur-

bine V'. The exhaust steam from turbine V is conducted to the soda receptacle and the exhaust steam from the other turbine V' to the condenser. This steam, which has been ejected as useless in the heretofore known working methods, is now in all of the above described steam power plants utilized for driving the machinery, besides being recovered in the form of feed water for the boiler. The last mentioned advantage is of less consequence in stationary engines and locomotives; but, in such cases, where the extremely limited space puts the greatest value on the saving of the evaporated water, as for instance in submarine boats, it is of the greatest importance.

Should the absorbing property of the soda be diminished in consequence of its thinness at the end of the process, this property must be increased in the ordinary way through heating.

I claim:—

1. A steam power plant comprising a primary engine, a soda steam generating boiler connected therewith and adapted to supply power thereto, said engine adapted to return a portion of its exhaust to said soda boiler, a separate secondary engine connected with and adapted to receive the remaining exhaust from the primary engine, and a condenser connected with said secondary engine.

2. A steam power plant comprising a multi-cylinder compound engine, divisible into two or more pressure units, a soda steam generating boiler having a soda receptacle, a condenser, means connecting the cylinders of the engine with the soda boiler and the condenser, and controlling means in said connection adapted to effect communication of the cylinders with each other and with the soda receptacle of the boiler, whereby said soda receptacle may receive the exhaust from one or more of the cylinders and the other cylinders may receive the remaining exhaust as the power medium from the first named cylinders.

3. A steam power plant comprising twin steam engines, a soda steam generating boiler communicating with the engines, and having means whereby the live steam from said boiler may be divided between the engines and means whereby the exhaust steam from one of the engines may be returned to the generating boiler.

4. A steam power plant comprising a primary and a separate secondary engine, a soda steam generating boiler connected with and adapted to supply live steam to said engines separately or together, a condenser, and means whereby the exhaust steam from one of the engines is returned to the soda boiler, and the exhaust from the other engine is conducted to the condenser.

5. A steam power plant comprising a

compound steam engine having a high pressure and two similar low pressure cylinders in communication, a soda steam generating boiler having a soda receptacle, a condenser; one of said low pressure cylinders communicating with and adapted to return its exhaust steam to the soda receptacle, the other low pressure cylinder communicating with and adapted to deliver its exhaust steam to the condenser, and a throttling valve intermediate the high pressure cylinder and said last named low pressure cylinder for controlling the passage of steam therebetween.

6. A steam power plant comprising a compound engine having a high pressure and a low pressure cylinder, a communicating connection between the cylinders, a soda steam generating boiler having a soda receptacle, a communicating connection between the high pressure cylinder and said boiler, a pipe connecting the connection between the cylinders with the soda receptacle and adapted to conduct exhaust steam to said soda receptacle, a condenser, a pipe connecting the low pressure cylinder with the condenser and adapted to conduct the exhaust steam from said cylinder to the condenser, and a throttling valve in the connection between the cylinders for controlling the passage of steam therebetween.

7. A steam power plant comprising a multiple expansion steam engine having communicating connections between the cylinders thereof, a soda steam generating boiler having a soda receptacle, pipes connecting the soda receptacle with the connections between the cylinders of the engine and adapted to receive a portion of the exhaust steam from said cylinders, a condenser having communication with the lowest pressure cylinder of the engine and adapted to receive the exhaust therefrom regulating valves in the communicating connections between the cylinders, and regulating valves in the connecting pipes between the soda receptacle and the cylinder connections, whereby said last named connections may be separately brought into communication with the soda receptacle.

8. A steam power plant comprising a multiple expansion steam engine having communicating connections between the cylinders thereof, a soda steam generating boiler having a soda receptacle, pipes connecting the soda receptacle with the communicating connections between the cylinders of the engine and adapted to receive a portion of the exhaust steam from the cylinders, a condenser having communication with the lowest pressure cylinder of the engine and adapted to receive the exhaust therefrom, and regulating valves in the pipes connecting the soda receptacle and the communicating connections between the cylinders; said soda receptacle adapted to

have communication with the connection between the intermediate and low pressure cylinder when the reacting pressure in the soda receptacle is low, and adapted to have communication with the connection between the
5 intermediate and high pressure cylinder when said reacting pressure is high.

The foregoing specification signed at Kiel, Germany, this 27th day of January, 1909.

RAYMOND D'EQUEVILLEY-MONTJUSTIN.

In presence of—

JULIUS ROJKE,

HUGO LIEBELT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."