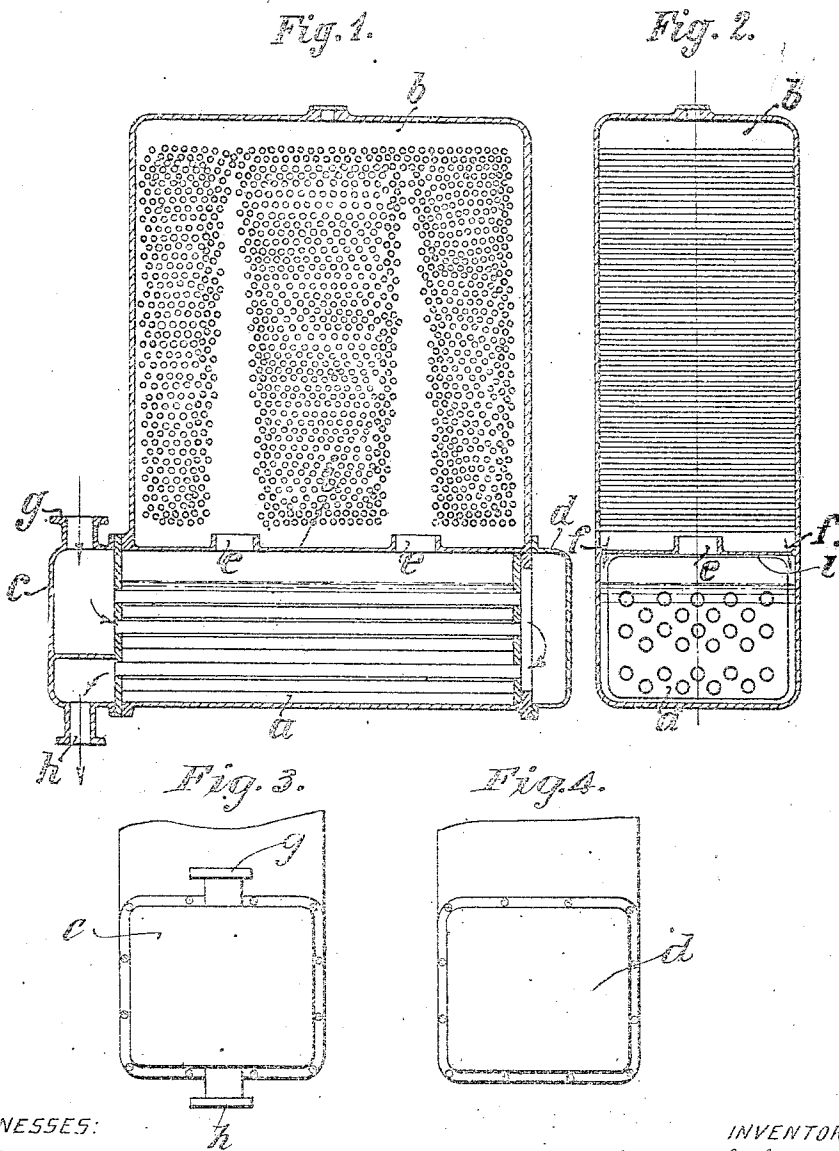


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 COOLING AND CONDENSING APPARATUS.
 APPLICATION FILED JUNE 3, 1912.

1,123,392.

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COOLING AND CONDENSING APPARATUS.

1,123,392.

Specification of Letters Patent.

Patented Jan. 5, 1915.

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To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, a subject of the King of Prussia, residing at Wilhelmshöhe, near Cassel, Germany, have invented a new and useful Improvement in and Relating to Cooling and Condensing Apparatus.

The invention relates to cooling and condensing apparatus for elastic fluid engines such as steam engines and is especially adapted for vehicles in which the cooling liquid is evaporated by the heat of the exhaust and a vapor thus generated is re-condensed by air.

The object of the invention is to make such apparatus more suitable for practical use by diminishing the space occupied by such apparatus and hence its weight. This is done by establishing a thorough circulation of the cooling liquid throughout the apparatus. In this way a very small amount of cooling liquid is required and every part of the apparatus is utilized to the utmost extent.

In order to accomplish my purpose I arrange a cooling chamber provided with steam conduits surrounded by cooling liquid, said chamber being in communication with an air-cooled container. The liquid in the cooling chamber is evaporated by the heat of the exhaust steam and the vapor thus generated is then admitted into the container in which it is thoroughly distributed by a special arrangement of communication ports and of air-cooled walls provided therein and after being thereby condensed it is led back into the cooling chamber. By the circulation thus established fresh cooling liquid continuously comes into contact with the exhaust steam passing through the steam conduits in the cooling chamber without the aid of any pump or the like for renewing the whole body of liquid.

The condensed exhaust steam or condensate may also be used as feed water for the main generator which supplies the working fluid for the engine. Since this condensed water is at boiling temperature when it is used as feed water for the main generator a large part of the heat of liquid is recovered, while the amount of water required by the condenser-generator is exceptionally small and only requires to be renewed at long intervals, thus rendering my invention especially suitable for steam engines for ve-

hicles and airships. It is obviously also suitable for engines used for other purposes and may be employed with advantage in localities where water is scarce.

In a cooling and condensing apparatus of the type set forth, it is evident that there must be an appreciable back pressure in the condenser part. In practice I find that this back pressure can be conveniently maintained at about one atmosphere. In the case of low pressure engines, therefore, it is clear that the loss by reason of this back pressure is substantial. The higher the pressure at which the engine is run, the less will be the percentage loss of power caused by the back pressure in the condenser part. I find, in practice, that engines operated by steam pressures of twenty atmospheres or more may be very satisfactorily combined with the apparatus of my invention, and it is clear that in such a combination the loss due to back pressure is inappreciable.

Referring now to the accompanying drawings which illustrate my invention and form part of my specification, Figure 1 is a sectional elevation, and Fig. 2 is a cross section of a condensing and cooling apparatus constructed according to my improvements. Figs. 3 and 4 are, respectively, views taken from the left and right of Fig. 1 so as to show the manner in which heads *c* and *d* are fastened to the condenser part.

In carrying my invention into effect according to one form, I provide a condenser-part *a* and an air cooling apparatus *b* in operative relationship therewith. The condenser-part *a* is constructed along the lines of a tubular boiler and is provided at its ends with inlet and outlet chambers *c* and *d* for introducing the exhaust steam into the tubes and removing the condensate therefrom. The end of the chamber *d* is adapted to be easily removed in order to enable the heating tubes to be cleaned. Between the condenser-part *a* and the cooling apparatus *b* a partition *e* is arranged having two large central openings *f* and numerous small lateral openings *g*. The exhaust steam from the engine enters into the chamber *c* through the pipe connection *h* and flows along the path indicated by the arrows, being thereafter discharged as condensed water through the pipe *k*. The steam generated in the condenser-part *a* rises through the openings *e* and is condensed on the surfaces of the air

cooling apparatus *b*, after which it returns as water through the openings *f* to the condenser-part.

Cooling and condensing of the steam in the air cooling part *b* is facilitated by the use of a plurality of air circulating tubes *z* which pass entirely through (horizontally) said part *b* and have their ends sealed into the opposite walls thereof but open to the atmosphere; air thus passes freely through said tubes and, because of the very large wall surface belonging to the totality of the tubes, quickly cools and condenses the steam. The parts of the air cooling part *b* which are immediately above the openings *e* have no air circulating tubes, however, so that the steam is perfectly free to ascend through said openings to the top, or close to the top, *b*. Circulation is thus quickly and vigorously established.

I wish it to be understood that my invention is not limited to the particular apparatus described as it is evident that many modifications may be made in the details of such apparatus without departing beyond the scope of my invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits passing through said chamber for carrying exhaust steam and evaporating the cooling liquid, a container for the vapor generated by the heat of the exhaust communicating with the cooling chamber, and means for recondensing the vapor in the container.

2. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of a plurality of tubes for passing exhaust steam through said chamber so as to evaporate the cooling liquid, and a container, communicating with the cooling chamber, for the vapor thus generated by the heat of the exhaust said container being provided with air-cooled walls.

3. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits passing through said chamber for carrying exhaust so as to evaporate the cooling liquid, a container communicating with said cooling chamber for the vapor generated by the heat of the exhaust, means for distributing the vapor throughout said container, and means for recondensing the vapor in said container.

4. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits passing through said chamber for evaporating the cooling liquid, of a container pro-

vided with air cooled walls, and communicating with said cooling chamber, for the vapor generated by the heat of the exhaust, and means for distributing the vapor throughout said container.

5. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits consisting of a plurality of tubes passing through said chamber for carrying the exhaust steam so as to evaporate the cooling liquid, a container for the vapor generated by the heat of the exhaust, said container being provided with air cooled walls and being in communication with and arranged above said cooling chamber, and means for distributing the vapor throughout said container.

6. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits for exhaust steam consisting of a plurality of tubes passing through said chamber the number of which is determined by the amount of cooling liquid to be used, of a container for the vapor generated by the heat of the exhaust, said container being in communication with and arranged above said cooling chamber and having air cooled walls, and means for distributing the vapor throughout said container.

7. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits consisting of a plurality of tubes passing through said chamber, a container for the vapor generated by the heat of the exhaust said container having air cooled walls and a partition wall provided with openings separating the cooling chamber from the container.

8. In a cooling and condensing apparatus, the combination with a chamber adapted to contain cooling liquid, of steam conduits consisting of a plurality of tubes passing through said chamber, the number of said tubes being determined by the amount of cooling liquid to be used, a container for the vapor generated by the heat of the exhaust, a partition wall separating the cooling chamber and the container, and provided with a plurality of openings therethrough, some adapted to admit the vapor into the container and others adapted to lead the condensed steam back into the cooling chamber, and a plurality of air-circulating tubes in said container for condensing the vapor, said tubes being arranged in such a way that the spaces around and above the openings in the partition wall leading into the container are left free.

9. In a cooling and condensing apparatus, in combination, a chamber adapted to contain cooling liquid and provided with a steam inlet and with an outlet for the con-

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5 densed steam, a plurality of tubes passing
through said chamber connecting the inlet
and the outlet, a container attached to the
cooling chamber, a partition wall separat-
ing the cooling chamber and the container
10 and provided with a plurality of openings
therethrough, some adapted to admit into
the container the vapor generated in the
cooling chamber by the heat of the exhaust
and others adapted to lead the condensed
15 steam back into the cooling chamber, and a
plurality of air-circulating tubes, in said
container for condensing the vapor, said

tubes being arranged perpendicularly to the
tubes in the cooling chamber in such a way 15
that the spaces around and above the open-
ings leading into the container are left sub-
stantially free up to the top of the con-
tainer.

In testimony whereof I have hereunto set 20
my hand and seal in the presence of two sub-
scribing witnesses.

WILHELM SCHMIDT.

Witnesses:

JULIUS FRANKE,
EGMONT DOETTLOFF.