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STEAM POWER INSTALLATION

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Fig.1.

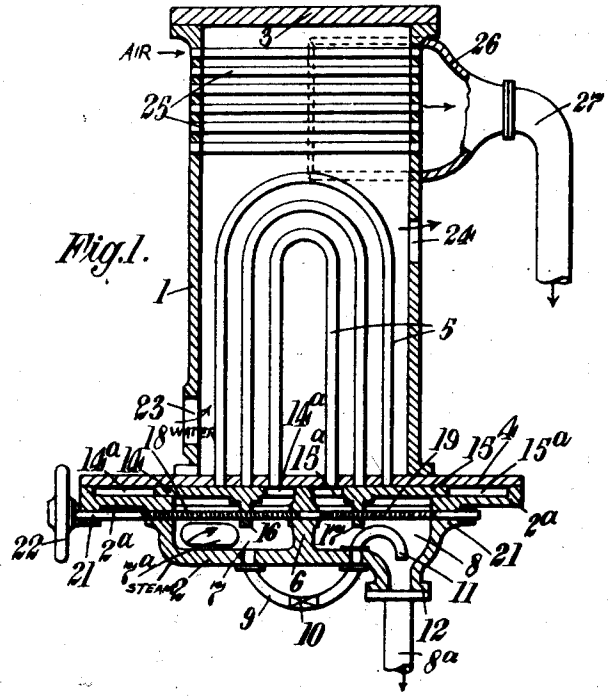
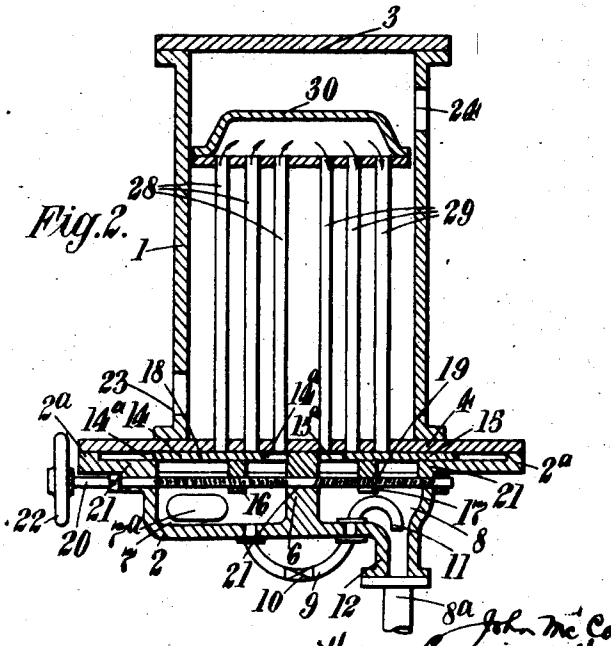


Fig.2.



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STEAM-POWER INSTALLATION.

Application filed December 5, 1927, Serial No. 237,969, and in Great Britain January 4, 1927.

This invention relates to steam power installations in which exhaust steam from a steam power unit is cooled and thereafter returned to the water space of a steam generator, preferably in the form of a mixture of steam and water (known as "steam-water").

According to the present invention, we provide, in a steam power installation of the type stated, a cooler comprising an inlet chamber into which exhaust steam from the steam power unit is passed, and an outlet chamber, adapted to communicate with the inlet chamber by a valve-controlled conduit, or valve-controlled conduits, acted on by cold water or other cooling medium.

Preferably the cooler is also provided with a valve-controlled passage through which exhaust steam can be passed directly from the inlet chamber to the outlet chamber.

The means to control the aforesaid conduit or conduits may comprise a pair of slide or other valves, one disposed at the inlet end of the conduit or conduits and the other disposed at the outlet end thereof, the said pair of valves being preferably operable so as to vary the openings at the inlet and outlet ends of the conduit or conduits simultaneously.

The invention will now be described, by way of example, with reference to the annexed drawings, in which:—

Fig. 1 is a view of one form of cooler in vertical half-section; and

Fig. 2 is a similar view of a modified form of cooler.

Referring to Fig. 1 of the drawings:—

The housing 1 is provided with a hollow base 2 and a top cover 3. Between the base 2 and the bottom of the housing 1, a plate 4 is secured. This plate is apertured so as to receive the ends of inverted U-tubes 5 projecting upwardly into the housing 1.

By means of a transverse wall 6, the base 2 is divided into inlet and outlet chambers 7 and 8 respectively, adapted to communicate with each other through the U-tubes 5. The chambers 7 and 8 are also adapted to communicate directly with each other through a bye-pass tube 9, controlled by a valve 10. A curved pipe 11 forms a continuation of the tube 9, the outlet end of the said pipe 11 projecting into the flared mouth of a nozzle 12 formed in the bottom of the outlet chamber 8.

The inlet chamber 7 communicates with the exhaust of the steam power unit (not shown) by means of an opening 7^a, whilst the nozzle 12 of the outlet chamber 8 is connected by piping 8^a through the medium of pumping means to the water space of the steam generator (not shown). The bottom surface of the plate 4, after the fitment therein of the U-tubes 5, is machined and scraped true so as to constitute a smooth valve face for a pair of slide valves 14 and 15. The top of the base 2 is formed with a broad flange 2^a, equal in circumference with the plate 4, and provided with a short upright portion round its outer edge adapted to effect a fluid tight joint between the base 2 and plate 4 and at the same time constitute therebetween grooves 14^a and 15^a, in which the valves 14 and 15 respectively are slidably supported.

On the underside of the valves 14 and 15 split nuts 16 and 17 are provided, the nut 16 being adapted to receive a right-handed screw-thread 18 and the nut 17 to receive a left-handed screw-thread 19. The screw-threads 18 and 19 are made with the same pitch and are formed on the same spindle 20, which is rotatably mounted in bearings 21 in the base 2. Inasmuch as the nuts 16 and 17 are split they can be adjusted on the spindle 20 independently of each other, thus permitting initial setting of the valves 14 and 15.

By means of a hand-wheel 22, the spindle 20 can be rotated so as to move the slide valves 14 and 15 either towards or away from each other. The said valves are set upon the spindle 20 so that, simultaneously with movement of the valve 14 in one direction to uncover or cover the inlet end of a U-tube or tubes 5, the valve 15 is moved in the opposite direction so as to uncover or cover respectively the outlet end of the same U-tube or tubes 5 correspondingly.

For the circulation of cooling water through the housing 1, inlet and outlet openings 23 and 24 respectively are provided. Tubes 25 are provided in the upper part of the housing 1 for the purpose of preheating air for the furnace (not shown) of the aforesaid steam generator, the air being drawn from the atmosphere, through the tubes 25,

manifold 26, and pipe 27 by means of fans (not shown).

Referring to Fig. 2 of the drawings:—

The cooler shown in this figure is substantially similar to that illustrated in Fig. 1, and like reference numerals appearing in both figures denote similar parts. It will be seen, however, that the U-tubes 5 comprised in the cooler shown in Fig. 1 are replaced by two sets of straight tubes 28 and 29 whose upper ends open into a common header 30. The tubes 28 and 29 and header 30 constitute a continuous water-cooled conduit, between the inlet and outlet chambers 7 and 8. As will also be seen from Fig. 2, the housing 1 in this modification is not provided with air preheating tubes.

By means of the valves 14 and 15 hereinbefore described, the steam power installation can be arranged to operate with different back pressures or with a partial vacuum on the steam power unit.

The valve 10 of the bye-pass tube 9 may comprise a needle or other valve controlled either manually, or automatically, in the latter case preferably by a diaphragm or piston acted on by the exhaust steam pressure. The flow of cooling water is also preferably regulated in similar fashion.

As will be obvious from the drawings, the circular plate 4 forms in each case the sole support for the water cooled tubes 5 or 28 and 29 and thus expansion and contraction of the said tubes can take place freely without distortion of adjacent parts of the cooler.

If desired, a plurality of inlet chambers and outlet chambers may be arranged to communicate with one another as aforesaid either in parallel or in series.

Although we have described a construction of the cooler in which the flow through the water-cooled tubes is controlled by slide valves, it is obvious that valves of other types may be used for the same purpose and that instead of operating the valve by a spindle formed with right and left handed screw-threads, we may provide other operating gear, such as a pinion engaging with the opposed racks, each connected to a valve as herein described, rotation of the pinion in one or the other direction effecting movement of the valves towards or away from each other simultaneously. Other modifications may be made within the scope of the invention.

Having now fully described our invention, what we claim and desire to secure by Letters Patent is:—

1. A cooler for a steam power installation of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of valve-controlled conduits establishing communication between the steam inlet and outlet chambers, means whereby the conduits can be subjected to the action of a cooling medium such as cold water, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

2. A cooler for a steam power installation of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of conduits establishing communication between the inlet and outlet chambers, a pair of slide valves disposed one at the inlet end and one at the outlet end of the conduits, means whereby the conduits can be subjected to the action of a cooling medium such as cold water, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

3. A cooler for a steam power installation of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of conduits establishing communication between the inlet and outlet chambers, a pair of slide valves disposed one at the inlet end and one at the outlet end of the conduits, means for simultaneously operating the valves to vary the openings at the inlet and outlet ends of the conduits, and means whereby the conduits can be subjected to the action of a cooling medium such as cold water.

4. A cooler for a steam power installation of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of conduits establishing communication between the inlet and outlet chambers, a pair of slide valves disposed one at the inlet end and one at the outlet end of the conduits, means for simultaneously operating the valves to vary the openings at the inlet and outlet ends of the conduits, means whereby the conduits can be subjected to the action of a cooling medium such as cold water, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

5. A cooler for a steam power installation of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of conduits establishing communication between the inlet and outlet chambers, a pair of slide valves disposed one at the inlet end and one at the outlet end of the conduits, split nuts on the slide valves, a right- and left-handed screw-threaded operating spindle engaging the nuts, and means whereby the conduits can be subjected to the action of a cooling medium such as cold water.

6. A cooler for a steam power installation

of the type stated, comprising an inlet chamber into which exhaust steam from the steam power unit is passed, an outlet chamber, any suitable number of conduits establishing communication between the inlet and outlet chambers, a pair of slide valves disposed one at the inlet end and one at the outlet end of the conduits, split nuts on the slide valves, a right- and left-handed screw-threaded operating spindle engaging the nuts, means whereby the conduits can be subjected to the action of a cooling medium such as cold water, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

7. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, and means whereby the conduits can be subjected to the action of a cooling medium.

8. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, means whereby the conduits can be subjected to the action of a cooling medium, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

9. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, means for simultaneously operating the valves to vary the openings at the plate in the inlet and outlet chambers, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, and means whereby the conduits can be subjected to the action of a cooling medium.

10. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, means for simultaneously operating the valves to vary the openings at the plate in the inlet and outlet chambers, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, and means whereby the conduits can be subjected to the action of a cooling medium.

11. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, split nuts on the slide valves, a right- and left-handed screw-threaded operating spindle engaging the nuts, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, and means whereby the conduits can be subjected to the action of a cooling medium.

12. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, split nuts on the slide valves, a right- and left-handed screw-threaded operating spindle engaging the nuts, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, means whereby the conduits can be subjected to the action of a cooling medium, and valve-controlled means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

13. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under

the control of the slide valves, and a housing for the circulation of a cooling medium surrounding the conduits.

14. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, a housing for the circulation of a cooling medium surrounding the conduits, and means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber.

15. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, a housing for the circulation of a cooling medium surrounding the conduits, and air heating tubes traversing the housing.

16. A cooler for a steam power installation of the type stated, comprising a hollow base divided by a partition into an inlet chamber for exhaust steam from the steam power unit and an outlet chamber, a fixed apertured plate completing the base and constituting a valve face, slide valves in the base co-operating with said valve face, conduits extending from the apertures in the plate so as to establish communication between the inlet and outlet chambers under the control of the slide valves, a housing for the circulation of a cooling medium surrounding the conduits, means whereby exhaust steam admitted to the inlet chamber can be passed directly to the outlet chamber, and air heating tubes traversing the housing.

In testimony whereof we affix our signatures.

JOHN McCALLUM.
HARRY PERCIVAL HARVEY ANDERSON.