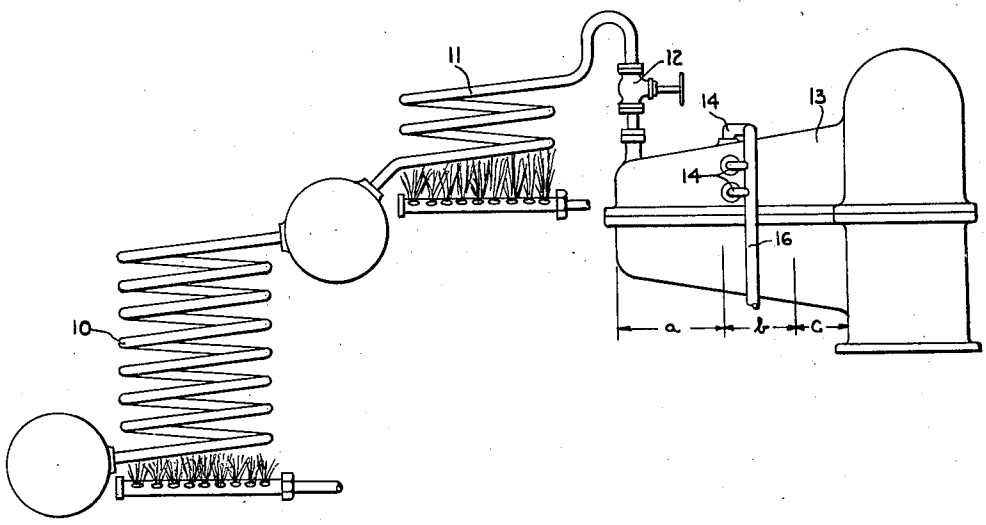
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TREATMENT OF STEAM TO REDUCE OR PREVENT CORROSION

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WITNESSES:

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UNITED STATES PATENT OFFICE.

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TREATMENT OF STEAM TO REDUCE OR PREVENT CORROSION.

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This invention relates to means for reducing or preventing corrosion of turbine blading. It has been observed that the corrosion of the blading of steam turbines appears to be most severe in the region where moisture is first formed and where the moisture content or wetness of the steam is comparatively low. The moisture content of the steam increases as it passes through the turbine towards the condenser and this is accompanied by a diminution of corrosion until in the last stages of expansion of the steam it is often negligible. The comparatively high rate of corrosion where moisture is first formed and where the moisture content is low is thought to be due to the fact that the water particles dissolve the active gases in the steam thereby rendering them corrosive and carry them at an appreciable degree of concentration to the blade surfaces. At a later stage in the expansion of the steam the increasing quantity of water present together with the partial exhaustion or neutralization of the corrosive elements which has taken place and the reduction in temperature results in diminishing the corrosion to an amount which is not serious.

In the accompanying drawing, I show a schematic representation of a turbine embodying my device.

According to the present invention, in order to reduce or prevent corrosion of turbine blading, liquid in the form of a fine spray or atomized condition is injected into the steam which operates the turbine. The liquid employed may either be water or an alkali which will dilute or neutralize the action of corrosive constituents, such as free oxygen or both water and a neutralizing solution may be separately injected in the steam path.

In the accompanying drawing, I show a somewhat diagrammatic elevation of a steam power installation, comprising a water tube boiler 10, which is provided with a superheater 11, from which steam is supplied through the throttle valve 12, to an elastic fluid turbine 13, in a manner well understood in the art.

In expanding through the turbine, the steam gradually loses its superheat and becomes wet steam, the zone in which the change from superheated to wet steam takes place being indicated by "*b*", while the zones of superheated and of wet steam are indicated by "*a*" and "*c*" respectively.

In order to reduce the corrosive action of the steam in this zone of change, I provide suitable nozzles 14, which are arranged to be supplied with a suitable inert liquid diluent from the manifold 16. While I have shown a plurality of nozzles, it will be understood that only one may be used, and also that the nozzles need not be all disposed to discharge into the same stage as shown. Preferably, the nozzles are arranged to discharge into a stage of the turbine on the high pressure side of the zone of change "*b*" as shown.

In the case where water only is employed, the injection may take place either at that part of the steam path where moisture is first formed or a little earlier in the superheated region. From thermodynamic considerations the temperature of the water should be equal or as nearly equal as possible to the saturation temperature corresponding to the temperature of the steam at the point of injection and the rate of injection should be proportionate to the flow of steam to, in effect, give a degree of dilution which prevents or adequately reduces corrosion.

Where an alkali is employed, this is injected at a stage of the turbine in which the steam is still superheated, the object being to provide alkali or other nuclei around which moisture can form and thereby the active corrosive substances may be diluted to such an extent that corrosion is reduced due to the dissolution of the corrosive substances by the water particles. Preferably a solution is used whose boiling point is higher than that of water under the same condition of pressure and consequently the liquid can exist as such at the point of injection and be available for performing the function above mentioned.

An aqueous solution of caustic soda is a suitable medium to employ when blades of ferrous material are used in the turbine, but the invention is not limited to the use of this substance as the most suitable substance would be determined by a consideration of the corrosive constituents of the steam having regard to the material of the blades and the action on other parts of the plant, the condenser tubes, for example. Other solutions suitable to employ are solutions of the

carbonates and hydroxides of sodium and potassium, also any other soluble hydroxides.

Where the liquid is to be injected into the steam path where the steam is superheated, it may obviously be injected on either side of the steam admission valve, but it is preferable for thermodynamic reasons to inject the liquid into the steam within the turbine where the degree of superheat is small or where the steam is at saturation temperature.

The injection may be effected by the use of a suitable nozzle or nozzles to which the liquid is supplied at a suitable pressure, said nozzles being adapted to atomize the liquid into the form of a fine spray. In some cases it may be desirable to provide a number of such nozzles so that the injection liquid may be distributed throughout the body of the steam passing through the turbine at the stage or stages where the injection takes place.

While I have disclosed a plurality of ways in which my invention may be practiced, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of being used or applied in various other ways without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:—

1. The process of minimizing corrosion in machines for abstracting the available energy of steam in the production of mechanical power, and in which steam changes from a superheated to a saturated condition, which consists in injecting an inert liquid diluent into the steam on the high pressure side of the zone of change from superheated to saturated conditions.

2. The process of reducing corrosion in machines for abstracting the available energy of steam in the production of mechanical power, and in which steam changes from a superheated to a saturated condition, which consists in injecting an inert liquid diluent, at a temperature substantially corresponding to the saturation temperature of the steam in the zone of change from superheated to saturated conditions, into the steam entering the zone of change.

3. The process of reducing corrosion in machines for abstracting the available energy of steam in the production of mechanical power, and in which steam changes from superheated to wet steam, which consists in injecting an inert liquid diluent, at a rate proportionate to the flow of steam, into the steam on the high pressure side of the zone of change from superheated to wet steam.

In testimony whereof, I have hereunto subscribed my name this 24th day of November, 1921.

RICHARD WILLIAM BAILEY.