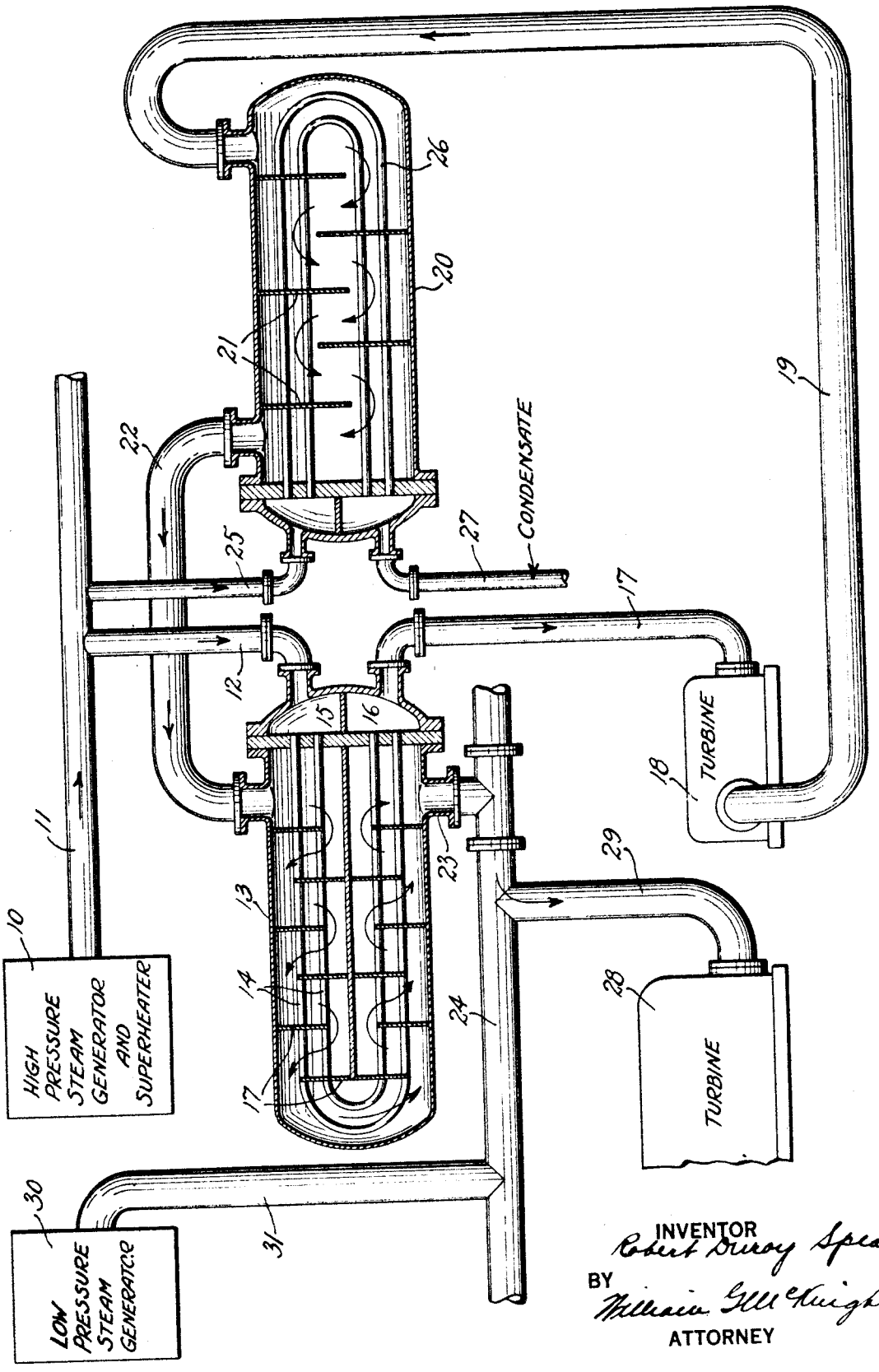
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STEAM POWER PLANT

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INVENTOR
Robert Duray Spear
BY
William McKnight
ATTORNEY

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ROBERT DUROY SPEAR, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO FOSTER WHEELER CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

STEAM-POWER PLANT

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My invention relates to steam plants and more particularly to steam plants in which steam is used for obtaining power, in which there are one or more prime movers such as steam turbines.

One purpose of my invention is to provide an efficient utilization of steam in a steam plant. Another purpose of the invention is to provide a simple and efficient means for converting an existing steam plant into a steam plant of higher initial steam pressure.

In accordance with the invention, steam passing from a higher pressure prime mover to a lower pressure prime mover is reheated in a plurality of heaters through which the steam is conducted in series, the steam first being heated by high temperature steam which is condensed and then heated by the steam supply for the high pressure prime mover. In a steam plant in accordance with the present invention, steam is generated at high pressure and with high superheat in a high pressure steam generating unit. This generator may operate, for example, at 1200 pounds per square inch pressure and provide highly superheated steam of a temperature of, for example, 800° F.

The steam generated would ordinarily pass direct to the higher pressure prime mover, but in accordance with this invention, the steam is passed through a heater in heat exchange relation with exhaust steam withdrawn from the higher pressure prime mover, so that some of the superheat in the high pressure steam is given up to the exhaust steam, thereby superheating the exhaust steam. The high pressure steam with reduced superheat then passes to the higher pressure prime mover. From this prime mover the steam passes through what is termed a dead-end heater and thence to the heater above described. This dead-end heater is preferably arranged and connected so that the high pressure, high temperature steam from the higher pressure steam generator is supplied to it, the heating surface of this heater being such that the exhaust steam is brought up to a point close to the saturated temperature of this high pressure steam, this reheating being done by the latent heat of the high pressure steam, which is condensed in this heater. In this way a certain amount of superheat is added to the exhaust steam. The temperature of the exhaust steam is still further raised in the heater heated by the steam supplied to the higher pressure prime mover. In this way the exhaust steam is brought up to a fairly high temperature. From this point the exhaust steam passes into the lower pressure main supplying the lower pressure prime movers or other steam consuming apparatus.

The accompanying drawing shows, more or less diagrammatically, a steam power plant layout embodying the present invention.

Referring to the drawing, reference character 10 designates a high pressure steam generator and superheater. This source of high pressure steam may provide steam of, for example, 1200 pounds per square inch pressure and 800° F. temperature. This steam is supplied to the high pressure steam main 11. Steam flows from main 11 through conduit 12 and into thoroughfare heater 13. A thoroughfare heater is one in which the heating steam passes through the heater without being condensed; in contrast to a dead-end heater in which the heating steam is condensed. The thoroughfare heater 13 may be of one of various types, but I prefer a heater of the general construction indicated on the drawing employing a number of tubes 14, extending between a supply chamber 15 and an outlet chamber 16, and equipped with baffles 17 to give a tortuous path of flow for the steam to be heated around tubes 14. The heating steam for this heater passes through tubes 14 and out through chamber 16 and into conduit 17 which supplies the steam to high pressure prime mover 18 which may be a turbine.

The exhaust steam from turbine 18 passes through conduit 19 and enters a dead-end heater 20 which may be of the same general construction as thoroughfare heater 13. Baffles 21 are provided to obtain a tortuous flow of the steam and an efficient heat transfer. From heater 20 the steam passes through conduit 22 and into the heated part

of thoroughfare heater 13. The steam passes around tubes 14 and is heated by steam in the same and then passes through a connection 23 and into the lower pressure steam main 24.

Steam for heating heater 20 is withdrawn from conduit 11 through conduit 25, passes through tubes 26 within the dead-end heater where it is condensed. The condensate is withdrawn through conduit 27 and is carried directly or indirectly back to the boiler system of the plant.

The lower pressure pressure prime mover 28 is connected to receive steam from conduit 24 through conduit 29. Prime mover 28 may also be a turbine and may operate at an initial pressure of, for example, 400 pounds per square inch. This prime mover may be the higher pressure prime mover or the only prime mover or one of several prime movers of an existing plant to which the present invention is applied.

Such an existing plant includes the steam generator, 30, supplying steam through conduit 31 to conduit 24. In applying the invention to a plant in which it is desired to increase the initial steam pressure, the parts 10, 13, 18 and 20, with the inter-connecting conduits, may be added and connected to the conduit 24. This in effect changes conduit 24 from the higher pressure main to a low pressure main or a main of intermediate pressure. It will be understood that steam generator 30, while a low pressure steam generator so far as a plant embodying the invention is concerned, may be a high pressure generator with reference to an existing plant to which the invention is applied.

In applying this arrangement to an existing plant, no changes need be made in the parts of the existing plant. Reheating by stages is obtained with the present invention without using reheaters heated by flue gases. This gives a simple arrangement with the advantages and high efficiency of steam reheating in stages.

Instead of one thoroughfare heater and one dead-end heater, I may employ a number of each of these heaters.

It will be obvious that the invention may be carried out by any great variety of plant layouts and that steam plant apparatus may be added and interposed in the various conduits without departing from the spirit or scope of the invention.

What I claim is:—

1. A steam plant comprising, in combination, a source of high pressure superheated steam, a high pressure prime mover, a lower pressure prime mover, a thoroughfare heater, a dead end heater, means to conduct steam from said source to the heaters in parallel, means to conduct steam from the thoroughfare heater to the high pressure prime mover, from the high pressure prime mover to the dead-end heater, from the dead-end heater to the thoroughfare heater and from the thoroughfare heater to the lower pressure prime mover and means to withdraw condensate from the dead-end heater.

2. A steam plant comprising in combination, a source of high pressure superheated steam, a high pressure prime mover, a lower pressure prime mover, a thoroughfare heater, a dead-end heater, conduits for conducting steam from said source to the heaters in parallel, a conduit for conducting steam from the thoroughfare heater to the high pressure prime mover, a conduit for conducting steam from the high pressure prime mover to the dead-end heater, a conduit for conducting steam from the dead-end heater to the thoroughfare heater, a conduit for conducting steam from the thoroughfare heater to the lower pressure prime mover and a conduit for withdrawing condensate from the dead-end heater.

ROBERT DUROY SPEAR.