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DESUPERHEATER FOR LOCOMOTIVE APPLICATION

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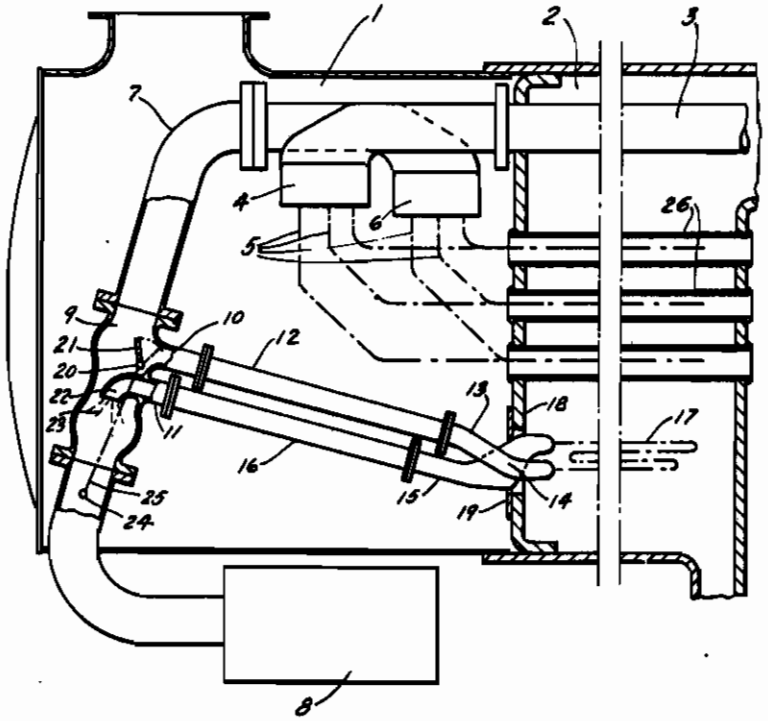

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ALIEN PROPERTY CUSTODIAN

DESUPERHEATER FOR LOCOMOTIVE APPLICATION

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The present invention relates to improvements in locomotive superheaters, the object being to assure constancy of the temperature of superheated steam upon its arrival at the driving turbine or engine cylinders or at the high pressure cylinders in the case of compound engines.

In carrying out the invention a locomotive is equipped with a superheater designed to afford at least the superheat temperature desired under the most unfavorable operating conditions which, in general, obtain when locomotives operate at low speed. One or more desuperheaters are provided through which part of the superheated steam is diverted under control of a thermostat installed in the steam pipe near its connection to the cylinder or in other suitable location. When the temperature of the superheated steam is too high a part is desuperheated and again mixed with the part of the steam not desuperheated. The desuperheater is mounted in the locomotive boiler so that the heat units taken from the steam by desuperheating are returned to the water of the boiler.

The single figure of the drawing shows schematically a vertical section of the smoke box of a locomotive boiler to which the invention has been applied.

In this figure the numeral 1 designates the smoke box at the front end of a fire tube boiler 2 and 3 is the dry pipe which conducts saturated steam to the header 4 from which it passes into the superheating elements 5. These elements are, for example, of looped form and located in the flues 26, the steam passing finally to the superheater outlet header 6.

From header 6 the superheated steam is led to the cylinders 8 through the steam pipe 7. Interposed in pipe 7 at a point within the smoke box is a union-like section 9 having lateral branches 10 and 11. The branch 10 is connected by a pipe 12 to a pipe 13 which forms part of a fitting 14 having another pipe 15 connected by pipe 16 to the branch 11 of the union 9. The pipe 13 of the fitting 14 serves to admit superheated steam to a desuperheater consisting of one or several tubular elements 17 from which the desuperheated steam passes to the pipe 15 and thence to the pipe 18. The desuperheater is, as may be seen in the figure, located in the cylindrical part of the boiler tube so as to be immersed in the boiler water.

The fitting 14 which serves at once to support the desuperheater elements 17 and also to close the opening made in the front tube sheet 18 of the boiler to introduce the desuperheater is fixed to the latter by a flange 19 and suitable fastenings. Fitting 14 is formed in such fashion that in the plane of the flange the pipe 13 is entirely surrounded by a cavity of the pipe 15. The flange 19 is in contact at all points with surfaces of the fitting 15 which are touched only by desuperheated steam coming from the desuperheater elements 17; this assures substantial uniformity of temperature and homogeneous expansion between tube sheet 18 and flange 19, these conditions serving to maintain proper sealing relationship between the flange 19 and sheet 18.

Within the union 9 at the entrance of the tube 10 there is mounted on a pivot 20 a flap valve 21 which in its closed position blocks the pipe 10. This valve is mounted with its free unhinged edge turned towards the direction from which the superheated steam comes from the header 6 so that when it is open its rear face is struck by part of the steam coming from the superheater and causes this portion of steam to be directed towards the pipe 12 and the desuperheater. At the same time the more so the wider it is opened, the valve 21 obstructs more or less of the cross sectional area of the pipe 8, that is to say the area of direct passage of superheater steam from the header 6 towards the cylinder 8.

The valve 21 can have any suitable form. It may particularly be in the form of a trough and may be curved or otherwise so shaped as to facilitate the deflection of superheated steam toward the pipe 12. It may also have dimensions greater than those required to shut off the pipe 10 so that when open the obstruction it creates in the union 9 may be such as to assure the best proportioning between the portion of steam that flows through the desuperheater and that which flows directly to the engine cylinder.

By means of pipes 16 and 11 the portion of steam which has been desuperheated in the elements 17 rejoins in the union 9 the portion which is not desuperheated. These two vapors being a different temperature do not mix homogeneously except with difficulty. In the interior of the union 9 beyond the function of the pipe 11, there is provided a nozzle 22 whose opening is turned in the direction of steam flow and toward diffusing apparatus 23 designed to create as intimate a mixture of the two portions of steam as possible. For such purposes there have been provided diffusors having concentric conical surfaces adjustable with respect to concentric cylindrical surfaces, but any other apparatus capable of assuring a proper mixture of the steam portions may be utilized.

As shown in the drawing the union 9 may be formed with local enlargements to assure the constance of pressure drop of steam flowing therethrough despite the presence of the valve 21, the nozzle 22 and the diffusor 23.

Between the union 9 and the admission chamber of the steam chest there is schematically shown a thermostat 24 which can be of any known type. The thermostat being immersed in the steam flowing through the union 9 acts through a linkage 25 of any suitable form to effect the opening or closing of the valve 21 so as to insure the flow through the desuperheater of a suitable amount of steam to maintain uniformity of temperature of the mixture of superheated and desuperheated steam before its arrival at the cylinders 8. For example, if the superheated steam coming from the header 6 is exactly at the desired temperature when it reaches the thermostat 24, the latter will maintain the valve 21 in the position where it blocks off the pipe 10. If the temperature of the superheated steam is too high, the thermostat causes opening of the valve 21.

In the exemplification of the invention which has been described above the valve 21 produces a constriction of the free cross-sectional area for steam flow through the pipe to the engine. It may even happen for certain conditions and sizes of the valve that as a consequence of this constriction of the steam pipe the pressure drop between the superheater and the cylinder may be increased. In locomotives generally, high superheat temperature corresponds to high speeds and to heavy steam consumption, conditions under which the pressure drop has a tendency to increase. To avoid this disadvantage is part of the invention. One can design the valve controlling steam admission to the pipe 10 in such manner that it never creates a restriction in the direct path of the steam flow; for example, one can arrange the valve 21 so that it opens into the interior of the pipe. Under these conditions the total area offered to the steam will be greater the more the valve 21 is opened.

The steam to be desuperheated need not necessarily be taken from the union 9. It can also be taken from any other point, as directly from the superheated steam header 6.

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