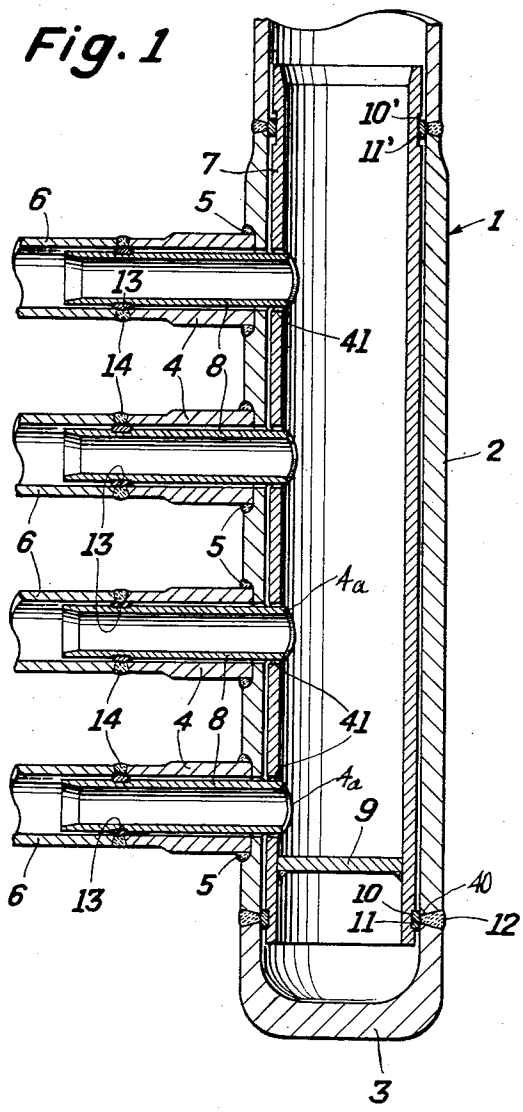
Feb. 4, 1964 H. VOGLER 3,120,247

PROTECTIVE LININGS FOR APPARATUS SUBJECTED TO CONSIDERABLE TEMPERATURE VARIATIONS

Filed Sept. 15, 1960 2 Sheets-Sheet 1

Fig. 1

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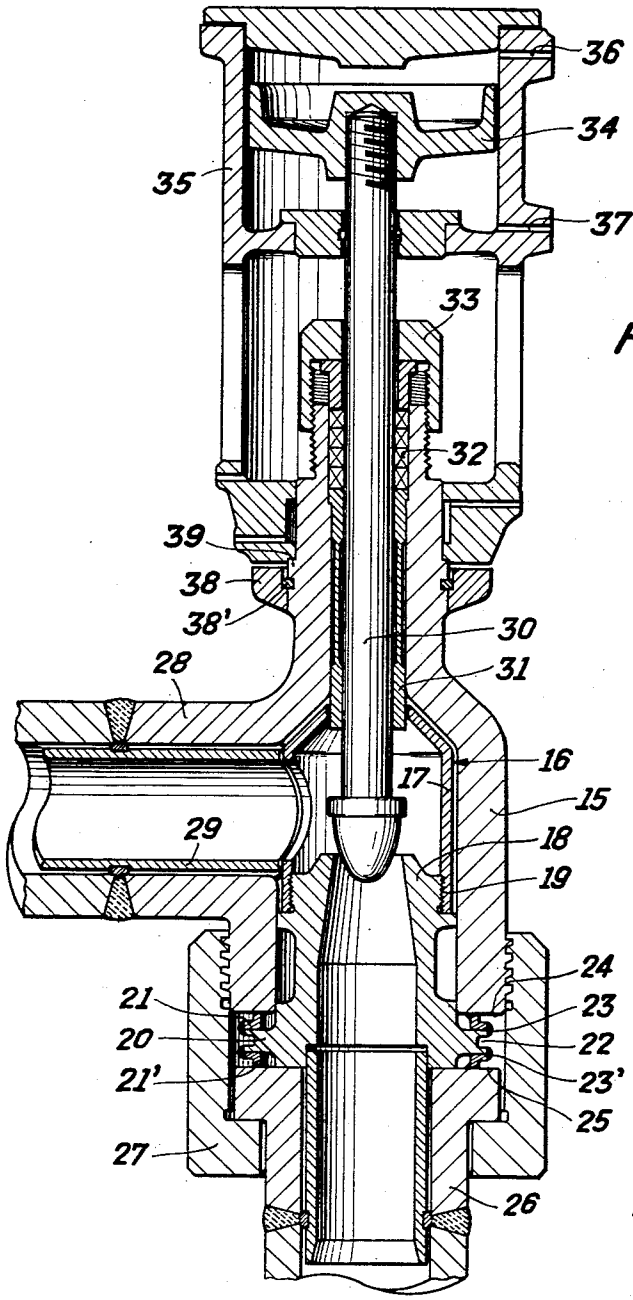


Fig. 3

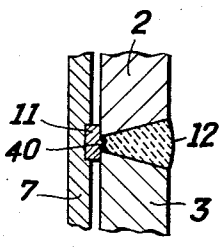


Fig. 2

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# PROTECTIVE LININGS FOR APPARATUS SUBJECTED TO CONSIDERABLE TEMPERATURE VARIATIONS

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5 Claims. (Cl. 138—148)

This invention relates to protective linings for apparatus subjected to considerable temperature variations. More particularly the invention relates to linings for apparatus to render the latter suitable for use in the treatment of materials which undergo temperature variations of a high order.

Examples of apparatus include regulating valves, heat exchangers, heat accumulators, collecting tanks, centrifugal drums, catalytic reaction chambers, steam power installation tanks, etc.

For structural reasons and possibly in order to prevent damage by corrosion and because such apparatus must be exposed to considerably elevated temperatures, as for example above 600° C., it is customary to construct such apparatus out of forged steel, stainless steel or austenitic steel.

Such steel, however, is not always resistant to sudden or sharp variations in temperature and on being exposed, for example, to a sharp temperature change of a high order, undergoes crack formations ending the useful life of the apparatus involved.

Sudden temperature changes of the degree contemplated occur, for example, on shutting down boilers as a precautionary measure at a time when the superheater is filled with water or again as when operating a steam power installation at pressures exceeding the critical pressure. The heat transfer from the steam to the steel walls is especially great because the vapor density of the steam is so high.

Broadly stated it is a primary object of this invention to provide means obviating the shortcomings outlined above, and additionally resulting in a number of unique functional and structural advantages.

More specifically, it is a general object of this invention to provide means conductive to a lining which is very resistant to temperature changes of a high order and which includes parts which are not only easily fabricated, but are replaceable at a minimum expenditure of time, effort and repair.

It is another important object of this invention to provide means affording the development of a lining resistant to temperature changes of a high order which is simple in configuration, readily removable and replaceable by virtue of its not being directly bonded to the body in which said lining is incorporated.

It is a further object of this invention to provide means facilitating the employment of a lining resistant to temperature changes of a high order which does not leave any part of the body to be protected, uncovered.

Still another object of the invention is to provide means envisaging a protective screen or sheathing, which is resistant to marked temperature changes and which not only protects the apparatus body, but also its inlet and outlet conduits, ports, etc.

Still a further object of the present invention resides in the provision of means redounding not only to a considerable structural increase in wear or strain, but also to a highly efficacious resistance to sudden or unforseen temperature changes to which such means may be subjected during operation.

Other objects and advantages of the invention will



appear from the following description taken in connection with the accompanying drawings.

In the drawings:

FIG. 1 is a vertical section of a superheater provided with a protective lining or sleeve-like sheating constructed pursuant to the invention;

FIG. 2 is an enlarged view of a section of the superheater of FIG. 1, showing the connection of the lining with the casing of said superheater; and

FIG. 3 is a vertical section of a pressure reducing valve provided with a protective lining in accordance with the invention.

This invention is principally directed to linings for apparatus e.g. pressure vessels employed in treating materials undergoing temperature variations of a high order, which linings are composed of a material resistant to sudden temperature changes of a high order and are further so constructed that its hollow interior constitutes the apparatus body with which the material being treated comes in contact, while its outer surface is therewith secured to the apparatus being lined by being welded or otherwise held to intermediate inserts such as rings which are bonded, welded or in some other manner fastened to the inner surface of the apparatus.

Referring in somewhat greater detail to the drawings, there is disclosed in FIG. 1 an apparatus in the form of a superheater main 1 consisting of a thick-walled pipe section or outer shell 2, which is closed off by a bottom wall or base 3 at its lower end. In the range of pipe section 2 there are provided four pipe or nipple connections 4 which in the embodiment shown are at their righthand ends inserted into counter bores 4*a* of the pipe section 2 and are rigidly connected thereto by welding seams 5. Adjacent the left-hand ends of the pipe connections 4 are the actual heated pipes 6 carrying the working medium.

Parts 2, 3 and 4 are constructed of austenitic steel, which is sensitive to sudden temperature changes in that under the action of sharp temperature variations it tends to crack. To protect such parts against sharp temperature changes, protective linings or sleeve-like elements 7, 8 are located in the pipe section 2 and in the pipe connections 4. These protective linings are adapted to conform to the shape of the parts to be protected and accordingly present in the instant embodiment a hollow-cylindrical form, the lining 7 being provided at its lower end with a welded-in disk 9 which serves to protect the main bottom 3 or base from sharp temperature virations. For the attachment of the protective lining 7 to pipe section 2, the latter is provided at the lower end with an annular groove 10 into which is inserted a weld-in ring 11 consisting of two halves, which is advantageously made of the same material as parts 2 and 3 and which is welded to the welding seam 12 connecting these parts.

In the embodiment shown in FIG. 2 the connection or means of securing the protective lining 7 and the pipe section 2 and bottom 3 is shown enlarged. The weld-in ring 11 has a substantially rectangular cross-section and presents on its outer peripheral face a bead 40 of about triangular cross-section.

During assembly of the parts, the ring 11 is so positioned that bead 40 lies just between the edges of parts 2 and 3 to be welded together and is fused in the welding operation. Thereby a rigid connection is ensured of parts 2, 3 and 11 and through the groove 10 also with the lining 7.

A similar attachment is provided for at what in FIG. 1 is the upper end of the protective lining 7, but in this instance groove 10′ receiving the split weld-in ring 11′ is larger than the ring in order that the protective lining 7 can expand in length under the influence of temperature

changes. The outside diameter of the protective lining 7 is a little smaller than the inside diameter of the pipe section 2, so that there remains between the inside of pipe section 2 and the outside of lining 7 a space or gap which serves to inhibit the heat transfer between the two parts.

According to the positioning of the pipe connections 4, there are provided in lining 7 openings 41 through which the protective nipple linings 8 of the connections 4 can project a little into the main space. At their other ends, i.e., facing the pipes 6, the linings 8 are, like the lower end of lining 7, provided each with an annular groove, into which split weld-in rings 13 are inserted and to which the pipe connections 4 and seam 14 connecting the pipes 6 are welded.

To hold the linings or sleeve-shaped screen in centered position relative to the particular pipe connection 4, a bead for each lining may be provided similar to bead 40 referred to above. Instead of beads, supporting rings of round or rectangular cross-section may be employed which are secured in correspondingly shaped grooves of the respective linings. By the arrangement of the linings 7 and 8, which may be made, for example, of any scale-resistant ferritic material, it is achieved that any sudden and sharp temperature changes of the working medium, which may be, for example, a gas, pulverulent or liquid substance, vapor, etc., flowing through the pipe or pipe connection are kept out of contact with those parts thereof exposed and sensitive to temperature changes.

FIG. 3 shows by way of example an embodiment of the invention as applied to a superheated-steam pressure-reducing valve. In the valve body 15, a protective lining 16 is inserted from below said body and consisting of an upper part 17 and a lower part 18 which forms the valve seat. The two parts 17 and 18 are locked together by means of a screw thread 19. At its lower end, the seat part 18 presents an annular shoulder 20 whose end faces rest against ring arrangement 21, 21' of angular cross-section which forms an intermediate piece according to the invention.

The rings 21, 21' have one leg welded to the end face 24 of the valve body 15, and the other to the end face 25 of a pipe connection 26 which is connected with the valve body 15 through a threaded sleeve 27. Between the two end faces of the annular shoulder 20, a groove 22 is recessed, and the flanges remaining on both sides of the groove are connected by lip welding 23, 23' with the other leg of the rings 21, 21' resting against the shoulder 20. The weld connections at the rings 21, 21' serve only to seal the seat portion 18 in the valve housing against the passage of steam; they do not serve to absorb axial tractive forces. This is done by the threaded sleeve 27. By light welding 23 and 23' it is possible easily to exchange the seat portion 18 forming a protective lining. The seat portion 18 and the lining portion 17 are in the instant embodiment constructed of austenitic steel.

The inlet opening 28 of the valve body 15 is provided with a cylindrical lining 29 which is secured in the same manner as the linings 8 in FIG. 1. The lining 29 extends to the left, as shown in FIG. 3, to a connecting flange not shown. The lining 29 is cylindrical in shape, as is the case also for the linings 8 in the embodiment shown in FIG. 1.

The valve construction is otherwise conventional. A valve spindle 30 is guided by means of a bearing bush 31 and sealed against the escape of steam into the valve body 15 by means of a packing 32. The known packing 32 is adjustable by means of a threaded bushing 33. At the upper end of the valve spindle 30 there is arranged a piston 34 which is guided in a cylinder 35. Above and below piston 34 apertures 36, 37 are provided in the cylinder 35, to which are connected pressure medium lines (not shown), through which a pressure medium is introduced and withdrawn, respectively, for the operation of piston 34. Cylinder 35 is clamped by means of



screws (not shown) to a flange 38 held at the collar 39 of the valve body 15 by a spreading ring 38'.

It can thus be seen, that there has been achieved according to the invention protective means of the type described comprising a sleeve-shaped element made of a material resistant to sudden temperature variations of a high order and having inner and outer surfaces, the inner surface of said element defining the inner boundary body of the apparatus, the outer surface of said element being fixedly retained in predetermined non-leaking relationship to the apparatus body, and intermediate insert means secured to and spacing said element from said body.

While very satisfactory forms of the invention are disclosed, modification of details is possible within the scope of the invention. The present disclosure is merely illustrative and in no wise limiting and the invention comprehends such modifications as will fall within the scope of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with a vessel comprising at least two vessel sections joined by a weld seam, means for thermally insulating said vessel from high temperature media received by the vessel, said thermal insulating means comprising: a hollow liner, including an outer surface, situated within the joined vessel sections and having a shape generally conforming to the shape of the vessel sections, said outer surface of said hollow liner including a groove therein running around the cross-sectional periphery of said liner and adjacent the weld seam, and spacer means partially seated in said groove and welded to the weld seam, said spacer means maintaining said liner a fixed distance from the vessel.

2. Apparatus for thermally protecting a vessel, comprising: a hollow liner, including an outer surface situated within the vessel and having a shape generally conforming to the shape of the vessel, said outer surface having two spaced-apart grooves running around the outer surface of said liner; two spacer rings within the vessel and welded thereto, one ring being partially seated in one of said grooves and the other ring being partially seated in the other of said grooves whereby said hollow liner is separated from the vessel by an air space, one of said grooves being longer axially than the ring seated therein to allow for differential thermal expansion of said liner axially within the vessel relative to the vessel and the other said spacer ring.

3. Apparatus for thermally insulating a vessel, which is comprised of at least two vessel sections joined by a weld seam, from high temperature media received by the vessel, comprising: a hollow liner, including an outer surface, situated within the joined vessel sections and having a shape generally conforming to the shape of the vessel sections, said outer surface of said hollow liner including a groove therein running around the cross-sectional periphery of said liner and adjacent the weld seam, and spacer means partially seated in said groove and welded to the weld seam, said spacer means maintaining said liner a fixed distance from the vessel, said groove being dimensionally larger than the spacer means seated therein to permit expansion of said liner.

4. Apparatus for thermally protecting a vessel, comprising: a hollow liner including an outer surface, said hollow liner being situated within the vessel and having a shape generally conforming to the shape of the vessel, said outer surface having a groove running thereabout, a spacer ring within the vessel and welded thereto, said spacer ring being partially seated in said groove whereby said hollow liner is separated from the vessel by an air space.

5. A protective lining for use in a vessel subject to widely varying temperatures, said vessel comprising at least two vessel sections adapted to be joined by a welding seam, said lining comprising: at least one sleeve element

of a material resistant to sudden widely varying temperature changes, said sleeve element including an inner surface and an outer surface and having a shape conforming to the shape of the interior of the vessel, said inner surface of said sleeve element defining the inner wall of the vesesl when emplaced within said vessel, said outer surface of said sleeve element including a groove running thereabout; and, a weldable insert partially nested within said groove whereby said sleeve element is separated from the inside wall of the vessel by a fixed distance, said weldable insert being situated at the welding seam between



the vessel sections whereby said insert may be welded to the welding seam as said vessel sections are weldably joined.

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