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(54) IMPROVEMENTS IN OR RELATING TO NUCLEAR SHIELDS

(71) We, BABCOCK & WILCOX LIMITED, a British Company of Cleveland House, 19, St. James's Square, London, SW1Y 4LN, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

To provide a shield against nuclear radiation, steel plate may be used. In the construction of fuel transport flasks, for instance, steel plates of a thickness as great as 14 inches are used. The present invention is concerned with the production of a nuclear radiation shield from pieces of steel.

According to the present invention there is provided a nuclear radiation shield comprising two pieces of steel held together edge-to-edge by a weld of which the depth is less than the thickness of either of the edges and of which the radiation shielding effect is less than that of either of the pieces adjacent the weld, and shielding additional to that provided by the weld is provided by material attached to one or each of the pieces and overlying the weld.

By way of example, embodiments of the invention will now be described with reference to the accompanying drawing in which each of the three figures shows a section through the connection between two flat, steel plates forming part of a transport flask intended to contain, and provide a shield against, radioactive material. Each of the plates is 14 inches thick.

The plates 1 shown in Figure 1 are coplanar. They are similarly rabbeted, at 2, at one outer corner, the rabbet 2 having a depth of 10 inches. Beneath the rabbets 2, the edges 3 of the plates 1 are chamfered slightly to provide between them a V-shaped groove in which a strength or high integrity weld 4 is deposited. The weld 4 extends to the plane containing the bottoms of the rabbets 2 and the recess formed by the rabbets 2 is filled by a steel insert 6 resting on the floor of the recess and welded along its edges at 7 to the plates 1. The welds 7 are of low strength and therefore easier to make and inspect than the weld 4. The weld 4 provides all the strength necessary to hold the plates together, although in modifications, the weld might be less effective than that, so that the welds 7 make some necessary contribution to the total strength.

It will be realised that in the region of each weld, part of the shielding thickness is provided by a steel insert and part by weld material. Thus, although a strength weld of the minimum depth necessary to establish the requisite strength in the joint can be used, and the depth of that weld is less than the thickness of the plates, the appropriate shielding effect is established by the material 6 that overlies outwardly of the weld.

In the construction illustrated in Figure 2, there are two plates 21 at right angles to each other. The ends 21*a* of the plates are square cut and the inner corners of the plates are bevelled to provide bevel surfaces, each 4 inches long, at 45° to the adjacent surfaces. A strength weld 23 is deposited between the bevelled surfaces. The square sectioned recess, formed by the surfaces 21*a* diverging outwardly from the weld 24, that lies outwardly of the weld 24, is filled by a fillet 26 held in position by welds 27. The junctions between the fillet 26 and the plates 21 are not parallel to the direction of radiation escaping from within the flask, so that the welds 27 simply serve to hold the fillet in position and are not required to effect shielding as are the welds 7 in Figure 1. For this reason, bridging plates held by bolts, such as are indicated at 28 and 29 respectively, could be used in place of the welds 27.

Figure 3 illustrates a variation of Figure 2 in which two plates, 31, at right angles to each other are bevelled at each of their corners. A strength weld 34 is deposited between the bevel surfaces 33 whilst the other bevel surfaces 31*a* lie in a common plane to which the

weld 34 extends. Outwardly of the weld 34, a fillet 36 right-triangular section abuts both the bevel surfaces 31*a* and is welded in position at its corners by welds 37. Again, since the welds 37 are not needed as part of the shileding material of the flask, they may be replaced by plates 38 and bolts 39.

In the construction of the joints illustrated in the drawings, the high integrity welds 4, 24 and 34 are non-destructively examined, to ensure that they meet the appropriate quality requirements, before the overlying shielding material is fixed in position. To make welds of equal quality extending through the entire thickness of the plates would be much more difficult. The material overlying the welds is of a thickness sufficient to provide adequate shielding thickness and, of course, the shielding thickness is maintained throughout. Thus, the welds 7 together with the parts of the plates that are aligned with these welds constitute a shielding thickness.

WHAT WE CLAIM IS:—

1. A nuclear radiation shield comprising two pieces of steel held together edge-to-edge by a weld of which the depth is less than the thickness of either of the edges and of which the radiation shielding effect is less than that of either of the pieces adjacent the weld, and shielding additional to that provided by the weld is provided by material attached to one or each of the pieces and overlying the weld.

2. A shield as claimed in Claim 1 in which additional shielding is provided by a steel insert let into a recess of which part is provided in one of the pieces and part is provided in the other.

3. A shield as claimed in Claim 2 in which the base of the recess defines one of the limits of the weld.

4. A shield as claimed in either of Claims 2 and 3 in which the recess has a base that extends generally transversely of the weld.

5. A shield as claimed in either of Claims 2 and 3 in which the recess is defined by two surfaces that diverge outwardly from the weld.

6. A shield as claimed in any of the preceding claims and associated with nuclear material lying to one side of the pieces of steel, the additional shielding overlying the end of the weld that is remote from the nuclear material.

7. A shield as claimed in Claim 6 when appedent to Claim 5, in which the pieces are plates that are inclined to each other, the surfaces between which the weld is effected each constitute a bevel along a corner of a plate, and the surfaces by which the recess is defined are edges of the plates.

8. A shield as claimed in Claim 1 in which the pieces are plates that are inclined to each other, the surfaces between which the weld is effected each constitutes a bevel along a corner of a plate, each bevel leads to a surface that is co-planar with the surface to which the bevel of the other plate leads, and additional shielding is provided by a steel strip having a flat surface that abuts both the surfaces to which the bevels lead.

9. A shield as claimed in any of Claims 2 to 8 in which the insert, or strip, is welded along one edge to one of the pieces and along the other edge to the other of the pieces.

10. A shield as claimed in any of Claims 2 to 8 which the insert, or strip, is bolted to each of the pieces.

11. A nuclear radiation shield including a joint substantially as described with reference to, and as illustrated by, any of the figures of the accompanying drawing.

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1587717 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1.

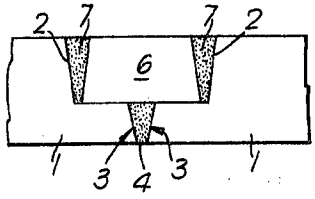

Fig.2.

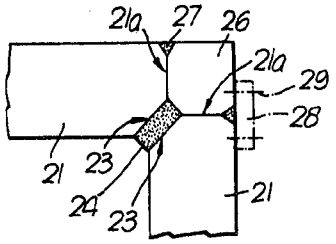

Fig.3.