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(54) IMPROVEMENTS IN AND RELATING TO DRUMS FOR STORING FUEL ASSEMBLIES OF NUCLEAR REACTORS

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This invention relates to the recharging of nuclear reactors and in particular to drums for storing fuel assemblies of such reactors.

Recharging a nuclear reactor involves replacing used fuel assemblies by new ones and transporting the spent assemblies to washing means with the aid of a recharging machine. In the course of this recharging process a drum is generally used as a short-term store of both the new and the spent fuel assemblies.

According to the present invention, there is provided a drum for storing fuel assemblies of a nuclear reactor, comprising a housing, a holder mounted in the housing and rotatable about an axis, the holder being provided with tubular sockets extending parallel to said axis and arranged in a number of circular rows therearound, the sockets being intended to receive fuel assemblies through access ports in the drum housing, each access port being associated with a respective said row of sockets and the mutual positioning of the access ports and the sockets being such that rotational indexing of the holder is effective to successively bring each socket of one row into axial alignment with the associated access port simultaneously with the axial alignment of a corresponding socket from each other row with the access port associated with that row.

Where a drum according to the present invention is incorporated in a nuclear reactor, the reactor should be provided with a recharging machine for inserting and removing fuel assemblies into and out of the tubular sockets through the access ports, the recharging machine having a fuel assembly handling mechanism which is movable over a trajectory taking it over each access port. This enables several fuel assemblies to be loaded into or removed from the drum for each rotational indexing operation of the holder. In this manner, the operational wear on the rotational indexing mechanism of the holder is considerably reduced

A drum embodying the invention and for storing fuel assemblies of a nuclear reactor, will now be particularly described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a general elevation view in section of the drum;

Figure 2 is a section on line II-II of Figure 1 illustrating the arrangement of sockets a holder of the drum and

Figure 3 is a view similar to Figure 2 but showing an alternative arrangement of the sockets.

As shown in Figure 1, the storage drum comprises a housing 1 mounting an axle 2 carrying a holder 3. The lower end of the axle 2 is rotatably mounted in a bushing 4 whereas the upper end of the axle 2 is rigidly connected to a gear 5 which abuts through a bearing 6 with the upper surface of a lid 7 of the drum housing 1. Drive means (not shown) are provided which engage the gear 5 to rotatably drive the axle 2 and the holder 3 to enable rotational indexing of the holder 3.

The holder 3 carries a plurality of sockets 8, 9 and 10 in the form of vertical tubes arranged to receive rod-type fuel assemblies 11. As can be seen from Figure 2, the sockets 8, 9 and 10 are arranged in three circular rows concentric with the axle 2.

Each row has sixty-nine sockets.

The lid 7 has three access ports 12 each associated with a respective one of the circular row of sockets. The access ports 12 lie on a circle 17 whose centre is outside the drum. The circle 17 corresponds to the trajectory of a handling mechanism 16 of a recharging machine 15 of the nuclear reactor. The recharging machine 15 lies within a containment 14 and pipes 13 extend through the walls of the containment 14 to respective ones of the access ports 12.

The arrangement of the sockets 8, 9 and 10 in the holder 3 is such that rotational indexing of the holder 3 is effective to successively bring each socket of one row into axial alignment with the associated access port simultaneously with the axial alignment of a corresponding socket from each other row with the access port associated with that row. Thus, the sockets 8, 9 and 10 can be aligned in groups of three, one from each row, with the access ports 12; the aligned group sockets can then be changed by suitable rotational indexing of the holder 3.

Figure 3 shows an alternative arrangement of the sockets 8, 9 and 10 in the holder 3. With this arrangement, the positioning of the access ports 12 required in order that one socket from each row is simultaneously aligned with its associated access port, is such that the access ports 12 lie on a straight line 18.

The operation of the described drum during recharging of a nuclear reactor will now be described.

The holder 3 is rotated until three sockets, 8, 9 and 10 are axially aligned with the access ports 12. The handling mechanism 16 of the recharging machine 15 then starts moving along the trajectory 17 (describing a circle) until the mechanism 16 lies over a first one of the access ports 12. The handling mechanism 16 then inserts a spent fuel assembly 11 through the pipe 13 and the access port 12 into the socket 8 of the holder 3.

The handling mechanism is then withdrawn into the containment 14 where it picks up the next spent fuel assembly 11, moves to a position overlying a second one of the access ports 12, and then lowers the held fuel assembly into the socket 9 of the holder 3. In a similar manner, the handling mechanism 16 inserts a third spent fuel assembly into the socket 10. During transfer of the spent fuel assemblies 11 into the sockets 8, 9 and 10 the holder remains stationary.

After the first three spent fuel assemblies 11 have been transferred to the holder 3, the holder is rotationally indexed such that the tenth sockets 8, 9 and 10 (counting from the filled sockets) come beneath the access ports 12. These sockets are then filled with spent fuel assemblies 11 in the manner described above.

Thus, following each rotational indexing operation of the holder 3, each tenth socket counting from the last filled socket is moved beneath the access ports 12. After a full revolution of the holder 3, the group of three sockets 8, 9 and 10 brought into alignment with the access ports 12, is the group adjacent to the three sockets which were first to be filled. It will therefore be appreciated that continued rotational indexing of the holder 3 enables all the sockets 8, 9 and 10 to be brought beneath the access ports 12 in order that spent fuel assemblies 11 may be inserted into these sockets.

During removal of fuel assemblies 11 from the drum into the containment 14 the sequence of events described above is reversed.

The described form of drum is advantageous in that for each rotational indexing operation of the holder 3 it is possible to transfer three fuel assemblies into or out of the drum. This considerably reduces wear on both the drum and its drive means as compared to drum arrangements which required rotational indexing between each transfer operation. The described drum also enables the recharging operation to be speeded up and gives an increased reliability of the drum. Furthermore, it is possible to achieve a better spatial arrangement of the sockets within the holder 3 such as to reduce the risk of overrunning and jamming of the holder 3 during rotational indexing.

WHAT WE CLAIM IS:-

1. A drum for storing fuel assemblies of a nuclear reactor, comprising a housing, a holder mounted in the housing and rotatable about an axis, the holder being provided with tubular sockets extending parallel to said axis and arranged in a number of circular rows therearound, the sockets being intended to receive fuel assemblies through access ports in the drum housing, each access port being associated with a respective said row of sockets and the mutual positioning of the access ports and the sockets being such that rotational indexing of the holder is effective to successively bring each socket of one row into axial alignment with the associated access port simultaneously with the axial alignment of a corresponding socket from each other row with the access port associated with that row.

2. A drum according to claim 1, in which the access ports lie in a straight line.

3. A drum according to claim 1, in which the access ports lie on a notional circle the centre of which is outside the drum housing.

4. A nuclear reactor incorporating a

drum according to any one of the preceding claims and including a recharging machine for inserting and removing fuel assemblies into and out of the tubular sockets through the access ports, a fuel assembly handling mechanism of the recharging machine being movable over a trajectory taking it over each access port.

5. A method of recharging the nuclear reactor of claim 4, including rotationally indexing the holder to align a group of empty sockets, one from each row, with their associated access ports, inserting a spent fuel assembly into each said empty socket with the handling mechanism being appropriately moved along its trajectory into alignment above each empty socket in turn, and repeating the rotational indexing of the holder to align further empty sockets with the access ports.

6. A drum for storing fuel assemblies of a nuclear reactor, the drum being substantially as hereinbefore described with reference to Figure 1 and Figure 2 or 3 of the accompanying drawings.

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1553013 COMPLETE SPECIFICATION
2 SHEETS This drawing Is a reproduction of the Original on a reduced scale
Sheet 1

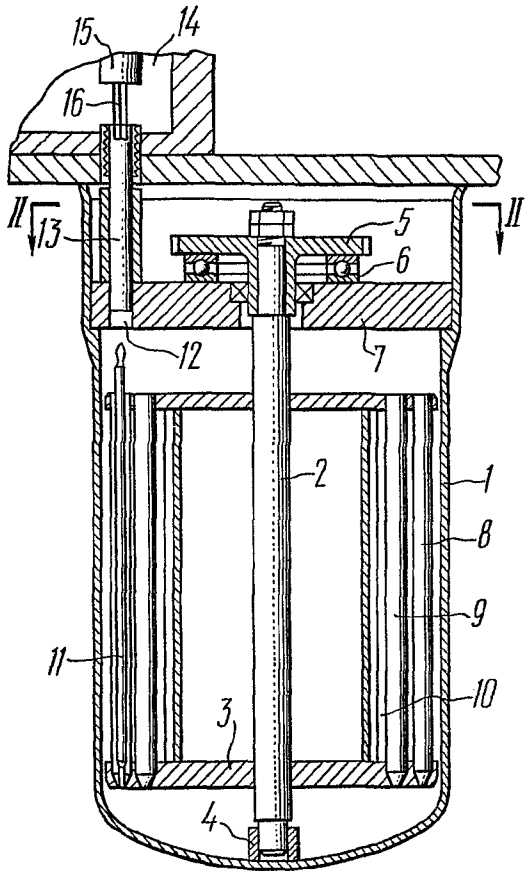

FIG. 1

1553013 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

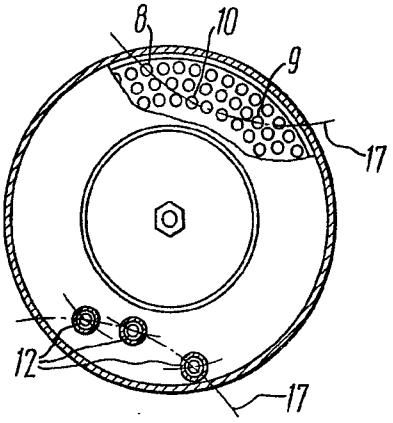

FIG. 2

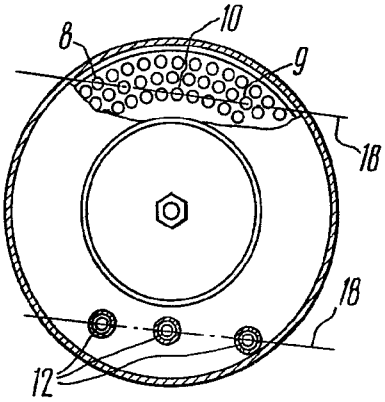

FIG. 3