

May 20, 1969

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3,445,012

BRIDGE MOUNTED STRUCTURE FOR HOT CELLS

Filed July 25, 1966

Sheet 1 of 5

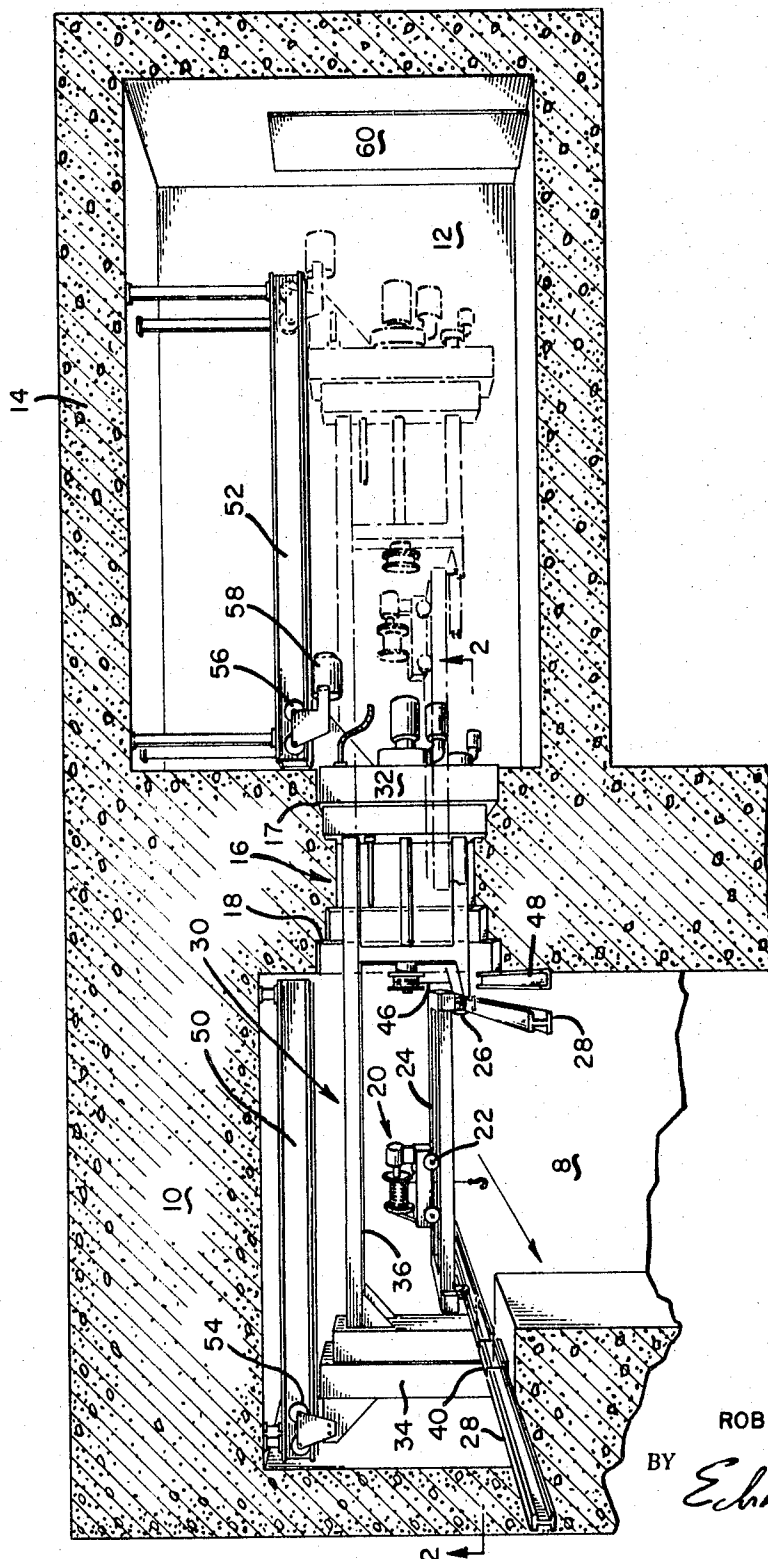


FIG. 1

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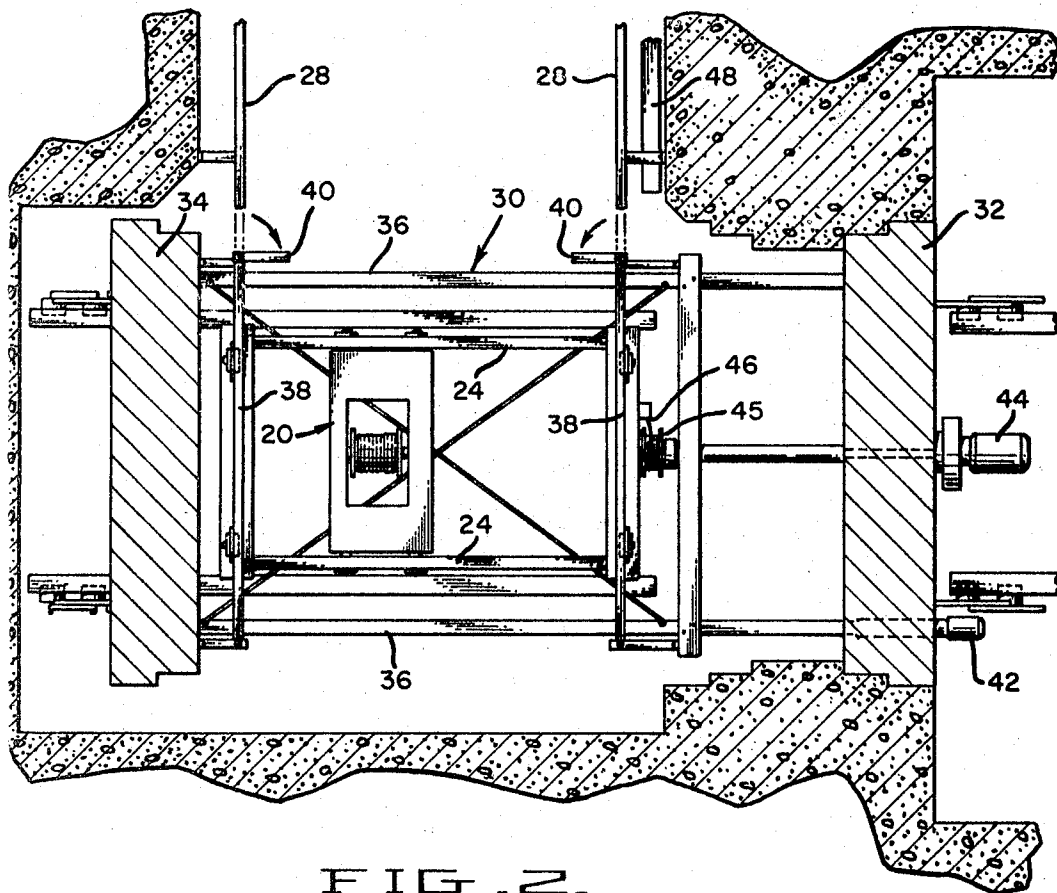


FIG. 2.

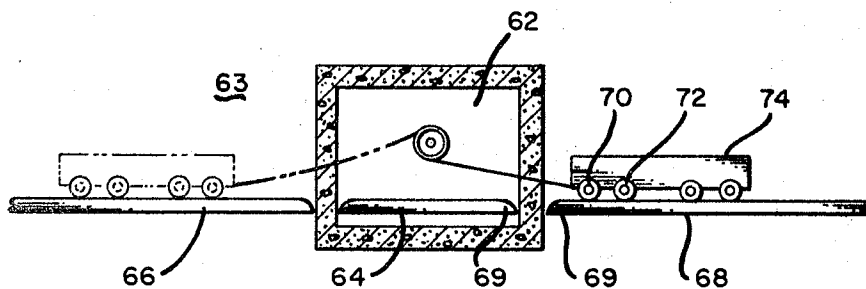


FIG. 3.

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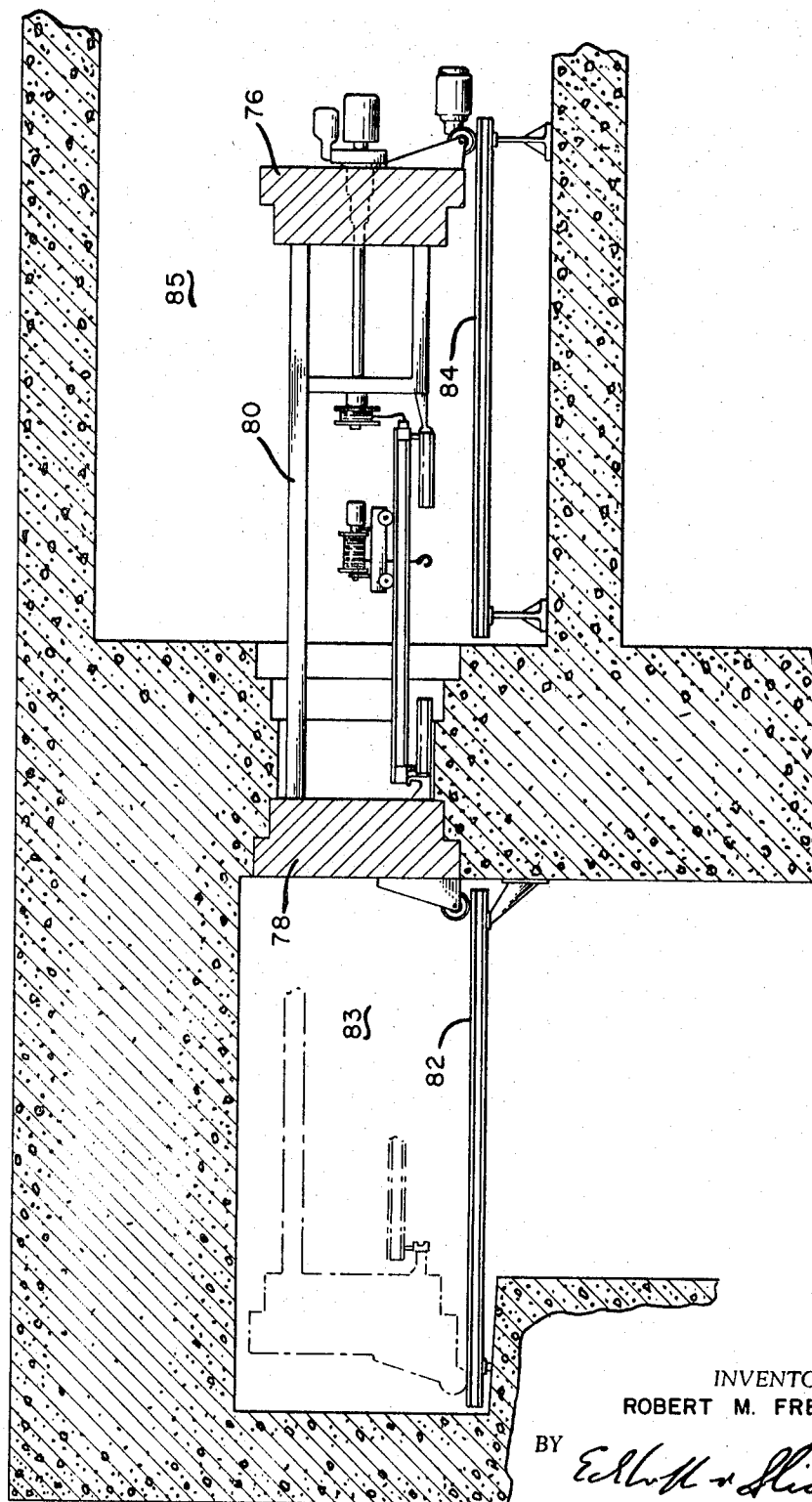
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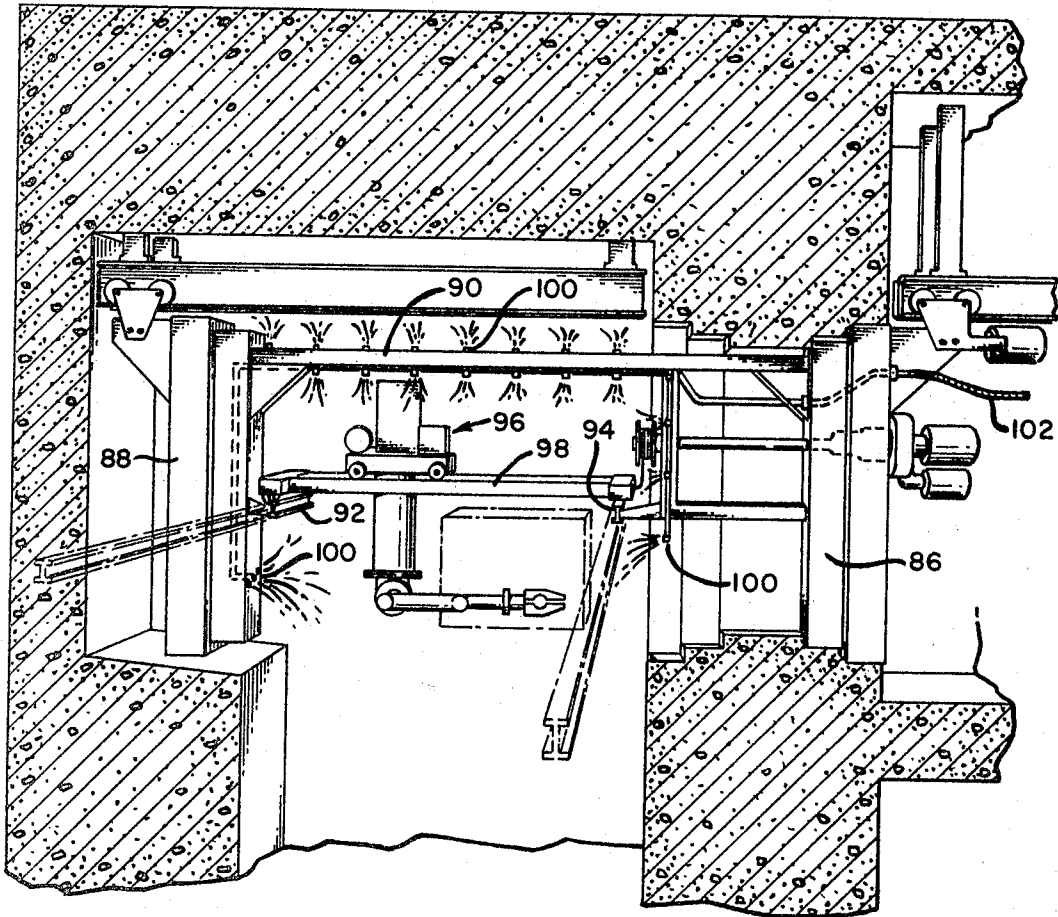


FIG. 5.

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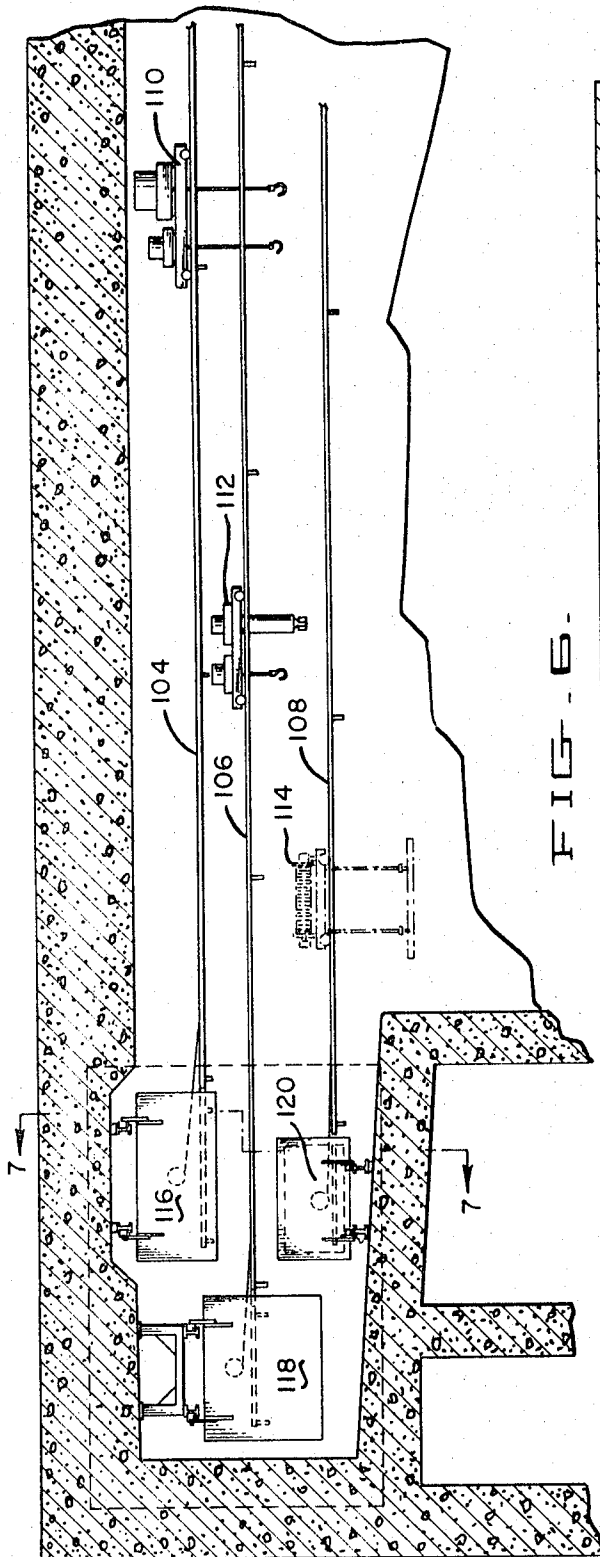


FIG. 6 -

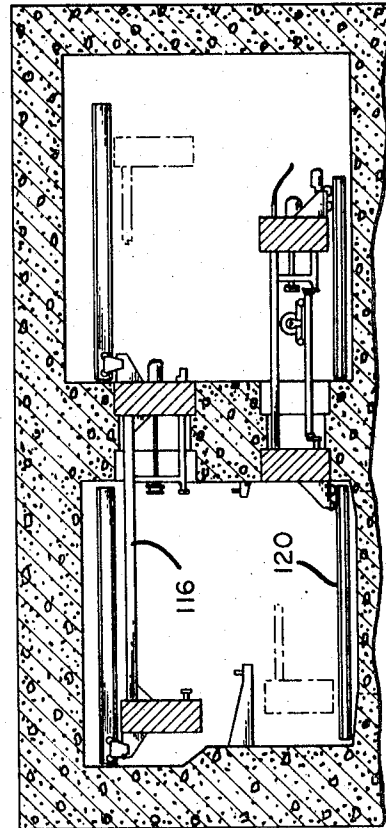


FIG. 7 -

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BRIDGE MOUNTED STRUCTURE FOR HOT CELLS
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Filed July 25, 1966, Ser. No. 567,473
Int. Cl. B66c 17/08, F23k 3/00

U.S. Cl. 214—18

11 Claims

This invention relates to an improved structure for radioactive hot cells and more particularly relates to an improved form of bridge mounted structure within such hot cells which can be easily removed from the cell for maintenance, replacement or other operations.

In radioactive hot cells and particularly those which are used as part of a production operation, the reliability of bridge structures such as overhead cranes and power manipulators is extremely important because their failure will shut down the plant until repairs are made. Also the duration of time for repairs must be kept to a minimum because of the high cost of plant "downtime." The removal of an inoperative crane from a hot cell has heretofore involved retrieving it complete with attached power cable from point of breakdown in cell, through a large shielding door or hatch into an adjacent repair room. It must be decontaminated to allow controlled entry of repair personnel.

Most rail mounted bridge equipment is considerably wider than it is long, so that if one removes the equipment in the direction that the rail would normally allow it to move, one must have a very large opening in the hot cell. Since such openings are expensive, and their closure doors have a very large space requirement, it is highly desirable to provide a means of removing the crane sideways through a much smaller opening in the cell.

It is therefore an object of the present invention to provide a built-in means for readily removing a piece of bridge mounted equipment from a hot cell through the smallest possible opening.

Another object of this invention is to provide an efficient means for supplying power and control cables to a piece of bridge mounted equipment wherein all of such power and control equipment can be mounted on the exterior of the closure means for closing the opening in the hot cell.

Another object of this invention is to provide an efficient means for servicing or replacing a piece of bridge mounted equipment for a hot cell.

Still another object of this invention is to provide a means whereby a piece of bridge mounted equipment can be decontaminated, repaired and returned to a hot cell in a minimum amount of time.

Other objects will be apparent from the balance of the specification which follows.

In the drawings forming part of this application:

FIGURE 1 is a perspective view, partly in section, showing a typical radioactive hot cell and an adjacent repair room with a bridge crane structure therein embodying the present invention.

FIGURE 2 is a bottom view looking up on an enlarged scale on the line 2—2 of FIGURE 1.

FIGURE 3 is a diagrammatic view illustrating other embodiments of the invention.

FIGURE 4 is a side-view of an embodiment of the invention wherein the removal structure is mounted on rails beneath the removal structure.

FIGURE 5 is a perspective view of a power manipulator embodying the present invention and showing built in decontamination equipment.

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FIGURE 6 is a side view of a hot cell wherein a plurality of structures embodying the present invention are employed.

FIGURE 7 is a section on the line 7—7 of FIGURE 6.

Referring now to the drawings by reference characters and particularly to FIGURES 1 and 2, there is shown a hot cell 8 having the usual shielding 10 surrounding it. Adjacent to the hot cell is a repair cell 12 for repairing or replacing equipment to be used in the hot cell and, since the equipment in this room has been at least partially decontaminated, the shielding 14 surrounding it can be somewhat thinner than the shielding 10. An opening generally designated 16 is provided between the hot cell 8 and the repair cell 12 and this opening is provided with a number of stepped sections as at 17 and 18 to provide reentrant corners thus preventing direct streaming of radioactivity from the hot cell. In the structure shown only two steps are employed but it will be understood that this is merely for convenience of illustration and that normally a larger number of steps would be provided to attenuate the transmission of radioactivity as is well known to those skilled in the art. Within the hot cell there is mounted a bridge trolley 20 which is provided with the usual wheels 22 so that it can move back and forth across rails 24 on the bridge and the bridge crane structure in turn is mounted on wheels 26 so that it can traverse the length of the hot cell on rails 28.

The withdrawal means which forms the gist of the present invention has been generally designated 30 and consists of a first closure member 32 and a second closure member 34 mounted together in fixed, spaced apart relationship by frame members 36. The frame members support a set of rails 38 which together with the folding stub sections 40 form a continuation of the rails 28. The first closure member 32 also supports a drive unit 42 for actuating the stub rail sections 40 between their two alternate positions and also a cable reel collector ring structure 44 which controls cable reel 45 and cable 46 which is used for retrieval, power and control of the crane. For long stretches, a cable trough 48 is provided in which the cable lies, it being understood that normally the cable would be kept under a slight tension and reeled up on the reel 45 to the greatest extent possible. It will be understood to those skilled in the art, that other control and accessory equipment might be mounted on the closure member 32, and that the equipment described is only for purposes of illustration.

In this embodiment of the invention, the entire withdrawal structure is mounted for movement on two sets of overhead rails namely a set 50 located within the hot cell and a second set of rails 52 mounted in the repair cell. Suitable wheels and support members 54, and 56 are attached to and near the top of the two closure members while a motor drive 58 is provided for actuating the withdrawal mechanism.

Having described one embodiment of the invention, the method of operation will now be described. Assuming that the crane is some distance down the rails 28 and one wishes to withdraw it for repair or other purposes, the crane would be self propelled or retrieved with cable 46 toward the withdrawal structure with the stub rails 40 extended to the position shown in dot-dash lines in FIGURE 2 so that the crane can roll onto the rails 38. At this time, actuator 42 would move the stub rails 40 to the position shown in solid lines and at this time a preliminary decontamination of the crane and withdrawal structure could be effected while it is still in the hot cell. After the crane is sufficiently decontaminated, motor 58 would be activated changing the position of the

withdrawal structure from that shown in solid lines in FIGURE 1 to that shown in phantom. It will be apparent when the parts are in the position shown in solid lines in FIGURE 1, the first closure member 32 acts as an effective shield against radiation through the opening 16 while when the withdrawal structure has been moved to position shown in phantom, the second closure member 34 now seals the opening. The crane is now in the repair cell 12 and the hot cell has been sealed by closure 34 as described. A further decontamination can now be made on the crane and withdrawal structure and, when radiation reaches a safe level, personnel can enter through closure 60 for repair or replacement of the crane parts. Naturally, the reverse sequence of steps would be employed to get the crane back into operation within the hot cell.

FIGURE 3 shows in diagrammatic form two variations which can be made on the above structure. In the structure thus far described, it has been assumed that the withdrawal structure is at one end of the hot cell and that folding or otherwise collapsible rail segments are used to provide clearance for the steps 18 in opening 16. In the embodiment of the invention shown in FIGURE 3, a different mechanism is used for bridging the gap between the rail segments and also the withdrawal section is not at the center of the room. In this embodiment of the invention, a first closure 62 is provided at some intermediate point of the hot cell 63 and this closure carries rails 64 for transporting the crane out of the cell as well as transporting the crane from one end of the cell to the other when the cell is in closed position. At one end of the cell, rails 66 provide a continuation of the rails 64 while rails 68 provide a continuation at the opposite end of the cell. It will be noted that there is no rail segment between 64 and 66 or 68. This gap is traversed by providing pairs of spaced wheels 70 and 72 on the crane 74. Now if we assume that crane 74 moves to the left from the solid line position shown in FIGURE 3, the wheel 70 will first arrive at the gap between rails 64 and 68, but the crane will be supported by the wheels 72. After the wheels 70 reach the rails 64 and support the structure, the wheels 72 will then cross the gap. For a smooth transition between rail sections, the ends of the rails can be turned down slightly or chamfered as at 69.

In FIGURE 4 another embodiment of the invention is illustrated wherein the rails supporting the withdrawal structure are mounted under the withdrawal structure. Here a first closure member 76 and a second closure member 78 are mounted together on a frame work 80 as before but are supported by a first lower set of rails 82 within the hot cell 83 and a second lower set of rails 84 in the repair cell 85. The method of operation is exactly the same as previously described and in FIGURE 4 the crane is shown in the withdrawal position, i.e., in the repair cell in solid lines and in the hot cell, partially in phantom. Obviously a hybrid mounting might be used with the rails in the hot cell overhead and the rails in the repair cell underneath or vice versa.

In FIGURE 5 another item of bridge mounted equipment is shown. Here the first closure member 86 and second closure member 88 are connected by a frame work 90. Rails 92 and 94 are supported by the withdrawal unit and in turn a manipulator 96 rides on the bridge 98. Control and manipulation are similar to that described in connection with FIGURES 1 and 2. In this embodiment of the invention a plurality of spray units 100, supplied with a liquid through line 102, provide a built-in decontamination capability.

In FIGURES 6 and 7 there is illustrated a method by which a number of bridge-mounted units embodying the present invention can be utilized within a single hot cell. Here the hot cell is provided with three sets of rails 104, 106 and 108. Mounted on these rails are the bridge units 110, 112, and 114, respectively. Further, each of the rails leads to a withdrawal unit 16, 18 and 20, respectively. It

will be understood of course that the operation of the individual withdrawal units is exactly as described above.

Many variations can be made in the present invention without departing from the scope thereof. For instance, the stub rail segments have been described as folding inwardly but it is obvious that they could fold up or down as well as sideways. Further, the stub rails could be made in parallelogram or telescoping form as well is known to those skilled in the art so that they could extend and fill a gap or be contracted to give clearance for the stepped opening.

In the drawings it will be noted that the closure members are of much thinner structure than the cell walls themselves. This is possible for the reason that ordinarily nuclear cells are made of a relatively cheap and inefficient shielding material while the closures themselves, being much smaller, can be made of a more expensive and more efficient shielding material. For instance, in one typical cell, the wall between the hot cell and the repair cell was 6 feet of regular density concrete. To secure equivalent shielding, the closure members need only be made of 16 inches of lead or 22 inches of steel.

I claim:

1. A rail mounted device for use in a nuclear cell comprising in combination:

- (a) first spaced rails in said cell for supporting said device;
- (b) a withdrawal structure for removing the device;
- (c) an opening in said cell at one side of and beyond said rails;
- (d) second rails mounted on said withdrawal structure, said second rails forming a continuation of said first rails;
- (e) first and second closure means mounted on said withdrawal structure near the ends thereof;
- (f) traversing means for said withdrawal structure, said traversing means being adapted for movement of the withdrawal means at right angles to said rails and
- (g) said first closure means blocking said opening when said withdrawal means is in a first position with the device within the cell and said second closure means blocking said opening when said withdrawal means is in a second position with said device outside the cell.

2. The structure of claim 1 wherein the opening has stepped sections facing inwardly and outwardly with the first and second closure means have mating stepped sections and wherein said second rails include folding rail section for clearing the stepped sections of the opening.

3. The structure of claim 1 wherein the opening has stepped sections facing inwardly and outwardly with the first and second closure means have mating stepped sections and wherein a gap exists between the first and second set of rails whereby a device on the second rails can be drawn past the stepped opening without interference from the rails and wherein the device is mounted for movement over the first and second rails by pairs of spaced axles whereby the device is supported by at least two of the axles in passing over the gap between the first and second rails.

4. The structure of claim 1 wherein the first closure means carries power and control means for actuating the rail mounted device.

5. The structure of claim 1 wherein the device is a bridge crane.

6. The structure of claim 1 wherein the device is a manipulator.

7. The structure of claim 1 wherein the traversing means includes a first rolling supported mounted inside the cell and a second rolling support mounted outside the cell.

8. The structure of claim 7 wherein the first and second rolling supports comprise wheels moving on overhead rail.

9. The structure of claim 7 where the first and second

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rolling supports comprise wheels moving on rails lying under the traversing structure.

10. The structure of claim 1 wherein the withdrawal structure includes spray means for decontamination.

11. The structure of claim 1 wherein the first closure means includes constant tension and retrieval motors and cable contactors for supplying power and control to the device and for retrieving the device.

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