There is provided a reactor building of steel concrete construction, which comprises a steel concrete containment vessel constructed on the center of a footing slab and also composed of a pair of relatively confronting steel plates and concrete placed in a space between the steel plates. The reactor building is constructed on the outer circumference of the same footing slab and is also composed of a pair of relatively confronting steel plates and concrete placed in a space between the steel plates. The containment vessel is separated from partial slabs among a plurality of slabs of the reactor building placed around the containment vessel or all the slabs of the reactor building.
FIG. 3
RELATED ART
REACTOR BUILDING OF STEEL CONCRETE CONSTRUCTION

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] This invention relates to a reactor building of steel concrete construction with a steel concrete containment vessel.

[0003] 2. Description of the Related Art

[0004] As shown in FIG. 3, a reactor building of reinforced concrete construction with a reinforced concrete containment vessel in the related art is united with the containment vessel through each slab placed around the containment vessel, so that there has been provided a design to allow ring bars arranged in the slabs placed around the containment vessel to bear circumferential tensile stress (hoop tension), which is caused by temperature and pressure load of the containment vessel.

[0005] In addition, there has been also provided a design to distribute horizontal load during earthquake to an earthquake-proof wall placed around the containment vessel and the containment vessel itself according to the rigidities of the earthquake-proof wall and the containment vessel by making use of the spring effects of the slabs connected to the containment vessel.

[0006] A containment vessel and a reactor building which are of steel concrete construction are realized merely by making a change of the structural form from reinforced concrete construction to steel concrete construction, and therefore are designed in a way similar to that applied to the above reinforced concrete construction. However, since each ring bar which bears the circumferential tensile stress is arranged in a narrow space, which is produced between an upper end bar within each slab placed around the containment vessel and a reinforcing joint as well as stud bolts mounted to a lower end steel plate, so as to extend in the circumferential direction of the containment vessel, difficulty is experienced in execution of works. In addition, when there is a difference in level between the slabs placed around the containment vessel, the ring bars produce a discontinuous portion, so that the execution of work cost is increased with the need for additional works to reinforce the discontinuous portion thus produced.

[0007] In addition, each slab bar needs to be anchored to the containment vessel in order to unite the containment vessel with the slabs placed around the containment vessel structurally. To meet the above need, it is necessary to provide holes in an external steel plate of the containment vessel so as to permit the slab bars to pass through, so that additional works to increase the thickness of a steel plate portion in the periphery of each hole and so on are required to make up for chipped portions of cross-section of holes, resulting in an increase in execution of work cost also in respect of the need for the above additional works.

[0008] Since the horizontal load during the earthquake is distributed according to the rigidities of the earthquake-proof wall of the building and the containment vessel itself, the containment vessel sometimes takes a large percentage in bearing seismic force depending on the balance of rigidities between the whole building and each of the earthquake-proof wall and the containment vessel. In such a case, it is necessary to generally increase the thickness of the steel plate, so that an increase in execution of work cost is also inevitable.

SUMMARY OF THE INVENTION

[0009] In view of the circumstances of the above related art, it is an object of the present invention to provide a reactor building of steel concrete construction, which takes the form enough to eliminate the factors of the increase in execution of work cost.

[0010] According to the present invention, in order to hold down the increase in execution of work cost resulting from uniting a reactor containment vessel with all slabs placed around the containment vessel, there is provided a means of separating the containment vessel from at least partial slabs among a plurality of slabs of a reactor building placed around the containment vessel, particularly from all the slabs as defined in claim 2.

[0011] Since the containment vessel is separated from at least the partial slabs placed around the containment vessel, no transmission of circumferential tensile stress from the containment vessel to the slabs placed around the containment vessel occurs, so that there is less or no need for ring bars in the slabs. In addition, there is also less or no need for reinforcement on a discontinuous portion, which is produced in the ring bars on the occasion for the presence of a difference in level between the slabs.

[0012] In addition, since portions to anchor the slab bars to the containment vessel are reduced or eliminated, there is also less or no need for holes in the external steel plate of the containment vessel, resulting in no need to increase the thickness of a steel plate portion in the periphery of the holes for making up for the chipped portions of cross-section of the holes.

[0013] Further, structural separation of the containment vessel from the slabs of the building prevents the containment vessel from taking a large percentage in bearing the seismic force on the occasion for connecting the containment vessel to the building through the slabs, according to the balance of rigidities between the earthquake-proof wall of the building and the containment vessel, resulting in also no need to generally increase the thickness of the steel plate.

[0014] Separation of the containment vessel from the slabs placed around the containment vessel causes the steel plate constituting the containment vessel to bear the circumferential tensile stress. While the containment vessel itself also bears the seismic force input to the containment vessel, there is provided no additional percentage in bearing the seismic force on the occasion for uniting the containment vessel with all the slabs placed around the containment vessel. Thus, no increase of the seismic force that the containment vessel should bear occurs, so that the seismic force is eventually reduced, leading to a reduction of the thickness of the steel plate.

[0015] Since there is less or no need for the ring bars, as well as less or no need to reinforce and thicken the external steel plate of the containment vessel, works to finish the external steel plate of the containment vessel as well as the slabs placed around the containment vessel may be simplified, and the execution of work cost for the containment vessel may be also reduced.
In addition, since there is less or no need for works to scramble for construction of the containment vessel and the building, the works for construction of the containment vessel and the building may make progress independently of and in parallel with each other. Thus, even if a difference in progress of the stage of works between the containment vessel and the building occurs in a portion to be scrambled for construction, there is provided no delay of construction to the effect that it takes a waiting time for the works to construct a portion where the stage of works is relatively advanced, so that a substantially reduction of the term of works may be realized.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and features of the invention will become apparent from the following description of preferred embodiments of the invention with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view showing a reactor building of steel concrete construction according to the present invention;

FIG. 2 is a schematic view showing the procedure of execution of works of a reactor building; and

FIG. 3 is a longitudinal sectional view showing a reactor building of steel concrete construction in the related art.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

According to the present invention, there is provided a reactor building (which will be hereinafter simply referred to as a building) of steel concrete construction (which will be simply referred to as SC construction). The building 2 has a steel concrete containment vessel (SCCV) (which will be hereinafter simply referred to as a containment vessel) 2 constructed on the center of a footing slab 1, and is constructed on the outer circumference of the same footing slab 1, as shown in FIG. 1. The containment vessel 2 is that is separated from at least partial slabs 3b among a plurality of slabs 3b of the building 2.

Since the containment vessel 2 is separated from at least the partial slabs 3b of the building 2 placed around the containment vessel 2, the works for construction of the containment vessel 2 and the building 3 are executed independently of and in parallel with each other. The construction of the containment vessel 2 and the building 3 is divided into an executing section of the containment vessel 2 and an executing section of the building 3 as viewed in plan in FIG. 2.

The footing slab 1, the containment vessel 2 and a frame body of each part of the building 3 are built in the form of SC construction, for instance, through the stage of installing a steel plate unit or the like, which is formed by combining a pair of confronting steel plates and a spacing member such as a steel plate for holding the space between both the steel plates into a united body of a size enough to be made hanging-down for installation, of joining the adjacent steel plate units to each other and of charging the space between the confronting steel plates with concrete.

A description will now be given of the procedure of constructing the building 3 including the containment vessel 2 with reference to FIG. 2. The footing slab 1 is constructed through the stage of installation of the steel plate unit 1a and of concrete placing. More specifically, before regular joining of the steel plates themselves and concrete placing are carried out in the stage of completing installation of the steel plate unit 1a, the external steel plate among the steel plates of the steel plate unit 1a is utilized as a working floor for execution of works of installation and joining or the like of the steel plate units constituting the first layer of the containment vessel 2 on the center of the footing slab 1 and also the frame body of the building 3, such as a SC wall, a SC column, a SC beam and a SC floor, on the outer circumference of the footing slab.

Since transition to the works for construction of the frame body of the building 3 may be made after installation of the steel plate unit 1a of the footing slab 1, concrete placing in the footing slab 1 is supposed to be not critical so far as transition to the works for construction of an upper portion is concerned.

In addition, use of vertical ribs and anchor bolts or the like preliminarily incorporated in the steel plates on the footing slab 1 at prospective positions of the containment vessel 2 and the wall and the column of the lowest story of the building 3, at need, makes it possible to support vertical loads (the own weight) of the steel plate units of the containment vessel 2, the SC wall and the SC column or the like and also to ensure the installing accuracy when the steel plate units are installed in position.

In particular, as shown in FIG. 2, the execution of works to hang down the steel plate units for installation on the building site after having built up the steel plate units out of the building site as a SCCV module 2a, which is formed in the shape resulting from dividing the containment vessel 2 into a plurality of blocks in elevation, and a SC wall module 3a and a SC floor module, which are formed in the shape resulting from dividing the steel plate or the like constituting the frame body equivalent to one story portion of the building 3 into a plurality of blocks in plan, may reduce the number of stages of joining works on the building site as compared with the case of joining the steel plates one by one on the building site, so that the reduction of the term of works may be realized, and besides, the building-up accuracy may be also improved.

Further, the execution of works to hang down the steel plate units for installation on the building site after having built up the steel plate units out of the building site as a monolithic module, which is formed by building up the equipment, the piping and an equipment operation frame out of the building site, or the SC wall module 3a and the SC floor module as described above, or a monolithic SC wall-floor module, which is formed by uniting the SC wall module and the SC floor module together, and a monolithic composite module, which is formed by combining the above modules with an equipment-piping module, may also reduce the need for works to scramble for installation of the equipment and construction of the building on the building site, so that the extreme reduction of the loss on the stage of works depending on complication of installation of the equipment and construction of the building may be realized, and besides, the building-up accuracy may be also further improved.

The SCCV module 2a (the first layer of the containment vessel 2) and the monolithic SC wall-floor module
or the like are installed on the footing slab 1 and concrete placing is carried out in the footing slab 1. Subsequently, concrete placing is further carried out in the first layer of the containment vessel 2 on the center of the footing slab 1, before hanging-down of the SCCV module 2a of the second layer of the containment vessel for installation in position.

[0030] In parallel to installation of the SCCV module 2a of the second layer of the containment vessel 2, the SC wall module 3a is installed on the outer circumference of the footing slab, while the equipment-piping module is also installed in position. Subsequently, the SC floor module is installed in position before concrete placing in the wall and the floor. Alternatively, the SC wall module 3a and the SC floor module or the monolithic SC wall-floor module and the monolithic composite module may also be installed in position before concrete placing in the wall and the floor.

[0031] The above works for construction on the center and the outer circumference of the footing slab 1 may be executed repeatedly so as to forward construction in sequence from the lower story toward the upper story, so that the term of works for construction of the reactor building 3 of steel concrete construction with the steel concrete containment vessel 2 may be reduced substantially.

[0032] In particular, as shown in FIG. 2, structural separation of the containment vessel 2 placed in the center from at least the partial slabs 3b among a plurality of slabs 3b of the building 3 placed around the containment vessel may eliminate or reduce the need for works to scramble for construction on the center and the outer circumference of the footing slab, so that the works for construction on the center and the outer circumference of the footing slab may make progress almost completely independently of each other, permitting the further reduction of the loss on the stage of works in plan. In the drawing, there is shown a case where some of the slabs 3a are connected to the containment vessel 2. However, all the slabs 3a may be also separated from the containment vessel 2 at need.

[0033] FIG. 3 shows the relation between the containment vessel and the building which are of reinforced concrete or steel concrete construction. In FIG. 3, the slab of each story of the building is connected to the containment vessel to unite the containment vessel with the building, a difference in relative progress of the stage of works between the containment vessel and the building easily occurs in a portion to be scrambled for construction. Thus, in any story where the above difference occurred, it takes a waiting time for the works to construct a portion where the stage of works is advanced, resulting in a loss on the term of works in the whole stage of works.

[0034] On the other hand, according to the present invention, the containment vessel 2 is separated from the slabs 3b of the building 2, other than the slabs 3b connected to the containment vessel 2, as shown in FIG. 1. Thus, in the slabs other than the connected slabs 3b, the need for the works to scramble for construction of the containment vessel 2 and the building 3 may be eliminated to realize the execution of works to construct the containment vessel 2 and the building 3 independently of each other, so that it does not take any waiting time which is caused by the difference in the stage of works in the portion to be scrambled for construction, thereby eliminating the loss on the stage of works. The reactor building and the containment vessel shown in FIGS. 1 and 3 are of advanced boiling water reactor (ABWR) type.

[0035] The reactor building of steel concrete construction with the steel concrete containment vessel according to the present invention as described above has the following effects.

[0036] Since the containment vessel is separated from at least the partial slabs 3b among a plurality of slabs of the reactor building, no transmission of circumferential tensile stress from the containment vessel to the slabs placed around the containment vessel occurs, so that there is less or no need for ring bars, which have been required for transmission of the stress. In addition, there is also less or no need for reinforcement on the discontinuous portion, which has been produced in the ring bars on the occasion for the presence of the difference in level between the slabs.

[0037] In addition, since the portions to anchor the slab bars to the containment vessel may be reduced or eliminated, there is also less or no need for holes in the external steel plate of the containment vessel, resulting in no need to increase the thickness of the steel plate portion in the proximity of the holes for making up for the chipped portions of cross-section of the holes.

[0038] Further, the containment vessel may be prevented from taking a large percentage in bearing the seismic force on the occasion for connecting the containment vessel to the building through the slabs of the building, according to the balance of rigidities between the earthquake-proof wall of the building and the containment vessel, resulting in also no need to generally increase the thickness of the steel plate.

[0039] While the containment vessel itself bears the seismic force input to the containment vessel, there is provided no additional percentage of bearing the seismic force on the occasion for uniting the containment vessel with the whole slabs placed around the containment vessel. Thus, no increase of the seismic force that the containment vessel should bear occurs, so that the seismic force is eventually reduced, thus leading to a reduction of the thickness of the steel plate.

[0040] Since there is less or no need for ring bars, as well as less or no need to reinforce and thicken the external steel plate of the containment vessel, the works to finish the external steel plate of the containment vessel as well as the slabs placed around the containment vessel may be simplified, while the execution of work cost for the containment vessel may be also reduced.

[0041] In addition, there is also less or no need for the works to scramble for construction of the containment vessel and the building, the works for construction of the containment vessel and the building may make progress independently of and in parallel to each other, and any delay of the works for construction of a portion to be scrambled for construction may be eliminated, so that the substantial reduction of the term of works may be realized.

[0042] According to claim 2, since the containment vessel is separated from all the slabs, it may be highly effective in realizing a smaller execution of work cost as well as a shorter term of works.
What is claimed is:

1. A reactor building of steel concrete construction comprising a steel concrete containment vessel constructed on the center of a footing slab and also composed of a pair of relatively confronting steel plates and concrete placed in a space between said steel plates, wherein said reactor building is constructed on the outer circumference of the same footing slab and is also composed of a pair of relatively confronting steel plates and concrete placed in a space between said steel plates; and said containment vessel is separated from partial slabs among a plurality of slabs of the reactor building placed around said containment vessel.

2. A reactor building of steel concrete construction according to claim 1, wherein said containment vessel is separated from all the slabs of the reactor building placed around said containment vessel.

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