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(54) Device for the transfer of loads from floors to columns

(57) A device for connecting a concrete floor (7) to a cylindrical steel column (3) comprises a steel frusto-conical element (1) for positive attachment to a cylindrical steel column (3) intended to pass therethrough and for embedding within and/or being placed beneath a concrete floor (7) for carrying the said floor (7).

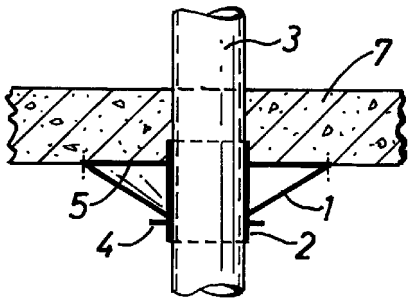

FIG.3

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Description

[0001] This invention relates to a device for the transfer of loads from floors to columns in the construction of a building

[0002] In the construction of buildings, there are two common means of construction. The first involves the use of reinforced concrete. In this means of construction, reinforced concrete floors are carried on reinforced concrete columns. While this method of construction produces perfectly satisfactory buildings, it will be understood that the horizontal dimensions of the columns in buildings of any height need to be quite large so as to carry the weight of the floors of the building. This can mean, particularly on the ground floor, a considerable loss of floor space.

[0003] The second method of building involves the use of a steel frame. Thus the concrete floors are supported by a steel frame and are carried on steel columns. In the optimum case a cylindrical form gives the smallest section proportion available for a given load. However, this method of providing an entire steel supporting structure has the disadvantage compared with the first method in that the overall floor construction depth is far greater.

[0004] The ideal solution would dearly be to enable the use of a combination of reinforced concrete flooring with steel columns but significant problems exist in transferring the necessary loads from the flooring to the columns due to the poor shear strength of the concrete flooring.

[0005] Several arrangements of structural members have been devised to enhance the shear strength of a concrete floor in the vicinity of a column and to transfer this shear to a column. Most of these devices consist of structural steel sections - channels or beams - embedded in the concrete floor. Another arrangement for enhancing the shear strength of the concrete floor consists of pre-assembled systems of reinforcement links which are dropped on to the shuttering for the floor and cast with other reinforcement.

[0006] In general these devices are meant for use with concrete columns. The structural steel sections in these devices act as short cantilevers. Being essentially flexural members; they tend to require heavy sections. Also they bear either directly on the column or they are located close to the column perimeter. In the former position they take up space which would otherwise be utilised for the vertical reinforcement in the concrete columns. This necessitates an increase in the column size. When placed around the column, the bearing surface for the cantilevers is not well defined and therefore they act at a reduced efficiency.

[0007] Such devices can be applied to rectangular profiled steel sections, but not to circular hollow steel sections.

[0008] The invention seeks to provide an arrangement which will enable the transfer of loads and moments from a reinforced concrete floor to a circular section steel column.

[0009] According to the invention, a device for connecting concrete floors to circular steel columns comprises a steel frusto-conical element for positive attachment to a cylindrical steel column intended to pass therethrough and for embedding within and/or being placed beneath a concrete floor for carrying the said floor.

[0010] Preferably, the device is so constructed that the dominant stresses in its parts are in-plane membrane stresses.

[0011] The device may comprise a hollow conical frustum attached to a sleeve which extends through the narrow end of the frustum and through which a cylindrical steel column is intended to pass so as to be attachable thereto. A stiffening collar may be provided around the sleeve beyond the frustum. A stiffening plate may be used to close generally the wide end of the frustum except for a central circular passage through which the cylindrical steel column is adapted to pass.

[0012] In an alternative embodiment of the device, the stiffening plate may be omitted and a second frusto-conical element may be secured to the first frusto-conical element by its widest end so as to form a mirror image thereof.

[0013] The frusto-conical element may be welded to a cylindrical steel column which passes therethrough.

[0014] The invention also includes a building structure comprising a plurality of cylindrical steel columns, a floor laid therebetween and a plurality of connecting devices as claimed in any preceding claim connecting the floor to the cylindrical columns.

[0015] The connecting devices may be embedded in the concrete floor or may be located beneath the floor so as to support it. Alternatively, with a connecting device comprising two frustums, one frustum of the connecting device may be embedded in the floor while the mirror image frustum may be located beneath the floor.

[0016] The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:-

Figure 1 shows in perspective view and in exploded form, a first embodiment of a device in accordance with the invention;

Figure 2 is a view similar to figure 1 but showing a second form of the invention;

Figure 3 shows diagrammatically one typical application of the device in accordance with the first embodiment of the invention:

Figure 4 is a view similar to figure 3 but showing a second application of the device in accordance with the first embodiment, and

Figure 5 is a view similar to figures 3 and 4 but showing an application using the second embodiment of the invention.

[0017] Referring firstly to figure 1, there is shown a first embodiment of a device in accordance with the invention. This is the basic form of device and comprises a hollow frusto-conical element 1 attached to a cylindrical sleeve 2 which passes through the apex of the element 1 so as to extend both inside and outside the element. On the inside of the element, the sleeve extends beyond the wider end of the element 1 so as to protrude therefrom as will be more dearly seen from figures 3 and 4. It is suitably attached to the element by welding. It has an internal diameter such as to achieve a dose tolerance fit to a cylindrical column on which it is to be carried and which will be referred to hereafter. Above the junction between the apex of the element 1 and the sleeve 2, a stiffening collar 4 is incorporated. The base of the element 1 is substantially closed by a stiffening plate 5 which has a central hole the diameter of which corresponds with the outside diameter sleeve 2 and is welded to both the sleeve 2 and the perimeter of the element 1.

[0018] The device is specially constructed so that the dominant stresses in its parts are in-plane membrane stresses.

[0019] In this configuration, the device is welded to a carrying steel column at each end of the sleeve 2.

[0020] Figure 2 shows a second embodiment of the invention in which the stiffening plate, 5, is replaced by a second frusto-conical element 6 complete with a second sleeve. The sleeves 2 in this case are of reduced length so that they do not interfere with each other. The second element 6 is seam welded to the first element 1 at their outer perimeters. As can be seen, the second element 6 is identical to the first element 1.

[0021] Figures 3, 4 and 5 show some typical applications of the various embodiments of the invention above described.

[0022] In Figure 3, the device is welded to a cylindrical steel column 3 by welds at both ends of its tube 2. The device is located upside down as compared to figure 1 and concrete floor 7 is seated on the stiffener 5 so that the device project below the soffit of the slab and is in compression.

[0023] The outer diameter of the device is chosen so as to eliminate the need for shear reinforcement in the concrete floor. The shear and bending moments from the floor 7 are transmitted to the circular steel column by the device.

[0024] In Figure 4, the situation is opposite to that shown in figure 3 with the device upright as compared to figure 1 and embedded within the concrete floor 7 and is in tension.

[0025] The arrangement shown in figure 5 utilises the second embodiment of the invention as shown in figure 2. Here the upper frusto-conical element 1 is embedded in the concrete floor 7 and is in tension while the lower frusto-conical element 6 is exposed below the soffit of the slab and is in compression.

[0026] It will be appreciated that various additions to or modifications of the embodiments described above may be made without departing from the scope of the invention as defined in the appended claims. For example, with certain constructions, the location of the stiffening flange 4 could be different to that shown and could, for example, be located where the frustum joins the tube.

Claims

1. A device for connecting a concrete floor (7) to a cylindrical steel column (3) comprising a steel frusto-conical element (1) for positive attachment to a cylindrical steel column (3) intended to pass therethrough and for embedding within and/or being placed beneath a concrete floor (7) for carrying the said floor (7).

2. A device as claimed in claim 1. wherein the device is so constructed that the dominant stresses in its parts are in-plane membrane stresses.

3. A device as claimed in claim 1 or 2, wherein the device comprises a hollow conical frustum (1) attached to a sleeve (2) which extends through the narrow end of the frustum (1) and through which a cylindrical steel column (3) is intended to pass so as to be attachable thereto.

4. A device as claimed in claim 3, and comprising a stiffening collar (4) around the sleeve (2) beyond the frustum (1).

5. A device as claimed in claim 3 or 4, and incorporating a stiffening plate (5) generally closing the wide end of the frustum (1) except for a central circular passage through which the cylindrical steel column (3) is adapted to pass.

6. A device as claimed in any one of claims 1 to 4, and including a second frusto-conical element (6) is secured to the first frusto-conical element (1) by its widest end so as to form a mirror image thereof.

7. A device as claimed in any preceding claim, wherein the frusto-conical element (1) is welded to a cylindrical steel column (3) which passes therethrough.

8. A building structure comprising a plurality of cylindrical steel columns (3), a floor (7) laid therebetween and a plurality of connecting devices as claimed in any preceding claim connecting the floor (7) to the cylindrical columns (3).

9. A structure as claimed in claim 8, wherein the connecting devices are embedded in the concrete floor. (7).

10. A structure as claimed in claim 8, wherein the connecting device is located beneath the floor (7) so as to support it.

11. A structure as claimed in claim 8 with a device as claimed in claim 6, wherein one frustum (1) of the connecting device is embedded in the floor (7) while the mirror image frustum (6) is located beneath the floor.

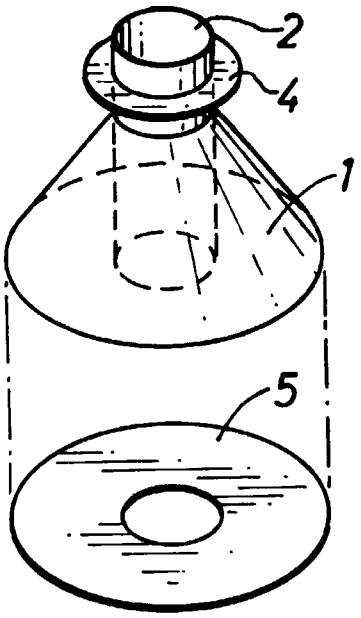

FIG.1

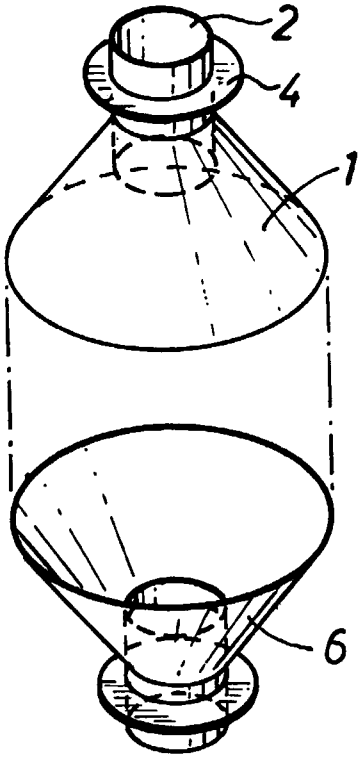

FIG.2

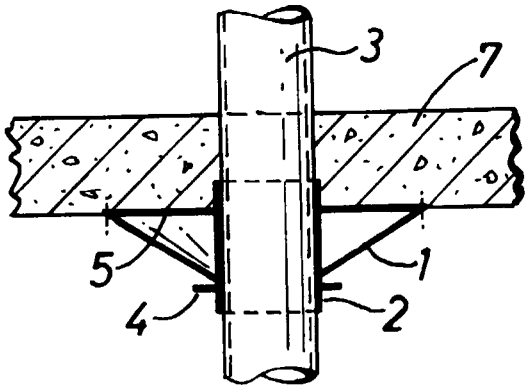

FIG.3

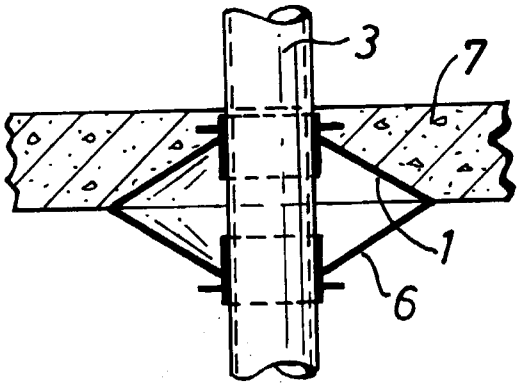

FIG.5

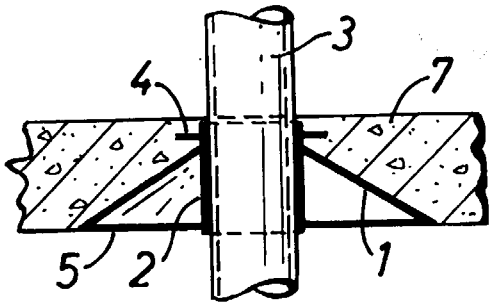

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 4613

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	* the whole document *	5,6,10, 11	
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A	* the whole document *	2-7,11	
A	US 2 768 520 A (STREHAN) 30 October 1956 (1956-10-30) * column 2, last paragraph; figures *	1,7	
A	FR 1 263 369 A (PIERRE) 4 October 1961 (1961-10-04) * the whole document *	1,8,10	
A	FR 438 950 A (THOMSON) * figures 1-3 *	1,8	
A	EP 0 557 731 A (DALSBRUK) 1 September 1993 (1993-09-01) * abstract; figures *	1,8	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E04B E04C
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 September 2000	Righetti, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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