

STEEL COLUMN CONNECTING STRUCTURE, STEEL COLUMN MODULE, FORMING APPARATUS, STEEL STRUCTURE AND SHEAR WALL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Chinese Patent Application No. 202310803224.5 filed on June 30, 2023, the contents of which are hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The disclosure relates to the technical field of modular fabricated buildings, and in particular to a steel column connecting structure, a steel column module, a forming apparatus, a fabricated steel structure, a prefabricated shear wall, and a building.

BACKGROUND

[0003] In the related art, each of upper and lower floors of a modular fabricated building includes steel structures, and upper and lower steel structures are connected to each other by connecting structures. Usually, a connection end of the steel structure is designed to be a structure that is convenient for connection. The upper and lower steel structures are connected to each other by connecting structures arranged at their ends. After connection, cement is poured into the steel structures, and after the cement is solidified, a stable and strong connection is achieved.

[0004] However, existing connecting structures between the upper and lower steel structures are complex in design, and their forming process is inconvenient to operate, resulting in low production efficiency.

SUMMARY

[0005] In order to solve the above problem, a purpose of embodiments of the disclosure is to provide a steel column connecting structure, a steel column module, a forming apparatus, a fabricated steel structure, a prefabricated shear wall, and a building, to solve the above technical problem.

[0006] In a first aspect, an embodiment of the disclosure provides a steel column

connecting structure. The steel column connecting structure includes a first steel column and an insertion plate.

[0007] An end of the first steel column is provided with a first insertion slot along an axial direction.

[0008] The insertion plate is inserted into the first insertion slot, and at least one side of the insertion plate protrudes from an outer sidewall of the first steel column.

[0009] Further, the steel column connecting structure further includes at least one steel bar. The at least one steel bar is fixedly connected to the outer sidewall of the first steel column and extends along a preset direction.

[0010] Further, the steel column connecting structure includes a plurality of steel bars. The plurality of steel bars are arranged on the outer sidewall of the first steel column and are spaced apart from each other along the axial direction of the first steel column, and each of the plurality of steel bars extends along the preset direction.

[0011] Further, the at least one steel bar is located at an end of the first steel column away from the first insertion slot.

[0012] Further, the steel column connecting structure further includes a guide member. At least a portion of the guide member is fixedly connected to the outer sidewall of the first steel column. The guide member is configured to adapt to an inner wall at a bottom end of another steel column module inserted into the steel column connecting structure.

[0013] Further, the guide member is located at an end of the first steel column away from the first insertion slot.

[0014] Further, the guide member includes at least two lugs. The at least two lugs are fixedly connected to the outer sidewall at a diagonal position of the first steel column.

[0015] Further, a side of each of the at least two lugs away from the first steel column is an arc structure.

[0016] Further, the guide member includes a guide cone and at least two guide columns, the guide cone and the at least two guide columns being fixedly connected to each other. The at least two guide columns are fixedly connected to the outer sidewall at a diagonal position of the first steel column, and the guide cone is connected to an end of each of the at least two guide columns and is located at an end of the first steel column away from the first insertion slot.

[0017] Further, the guide member includes a plurality of guide columns. The plurality of guide columns are fixed to the outer sidewall at the diagonal position of the first steel

column in one-to-one correspondence. The guide cone includes a plurality of conical sheets, each of the plurality of conical sheets is connected to a respective one of the plurality of guide columns, and sides of the plurality of conical sheets away from the plurality of guide columns intersect at a middle position.

[0018] Further, the first insertion slot is coplanar with a central axis of the first steel column.

[0019] Further, two sides of the insertion plate protrude from the outer sidewall of the first steel column.

[0020] In a second aspect, an embodiment of the disclosure further provides a steel column module. The steel column module includes a second steel column and the steel column connecting structure as described above.

[0021] An end of the second steel column is provided with a second insertion slot along an axial direction.

[0022] The insertion plate is inserted into the second insertion slot. An end of the first steel column provided with the first insertion slot is embedded in a cavity of the second steel column, and the first steel column is fixedly connected to the second steel column through the insertion plate.

[0023] Further, the first insertion slot is coplanar with the second insertion slot. A middle portion of the insertion plate cooperates with the first insertion slot, and two side portions of the insertion plate cooperate with the second insertion slot.

[0024] Further, the first insertion slot is coplanar with a central axis of the first steel column, and the second insertion slot is coplanar with a central axis of the second steel column.

[0025] In a third aspect, an embodiment of the disclosure further provides a steel column forming apparatus. The steel column forming apparatus is configured to prepare the steel column connecting structure as described above. The steel column forming apparatus includes a rack, a clamping chuck mechanism, and a pushing mechanism.

[0026] The clamping chuck mechanism is rotatably arranged on the rack, and is configured to clamp an end of the first steel column away from the first insertion slot.

[0027] The pushing mechanism is arranged on the rack, and is configured to clamp the insertion plate and drive the insertion plate to move along the axial direction of the first steel column to insert the insertion plate into the first insertion slot.

[0028] Further, the pushing mechanism includes a first drive cylinder, a first base plate, a

second base plate and a third base plate, the first base plate, the second base plate and the third base plate being fixedly connected to each other.

[0029] Each of the first drive cylinder and the first base plate is fixedly connected to the rack. The first drive cylinder is configured to drive the insertion plate to move along the axial direction of the first steel column. The first base plate is a U-shaped structure. A first roller is rotatably arranged on each of two sidewalls of the first base plate. The second base plate and the third base plate are fixed to the two sidewalls of the first base plate respectively. A second roller is rotatably arranged on the second base plate, and a third roller is rotatably arranged on the third base plate.

[0030] The first roller is configured to adapt to a bottom wall of the insertion plate, and the second roller and the third roller are configured to adapt to two sidewalls of the insertion plate.

[0031] Further, the pushing mechanism further includes a second drive cylinder. The second drive cylinder is fixed to the third base plate, and the third roller is rotatably arranged at a drive end of the second drive cylinder.

[0032] Further, the drive end of the second drive cylinder is provided with a mounting plate. The third base plate includes a plurality of third rollers, and the plurality of third rollers are rotatably arranged on the mounting plate.

[0033] Further, the pushing mechanism further includes a third drive cylinder, a connection rod, and a fourth roller.

[0034] The third drive cylinder is fixedly connected to the rack. A first end of the connection rod is hinged to a drive end of the third drive cylinder, a middle portion of the connection rod is hinged to the rack, the fourth roller is rotatably arranged at a second end of the connection rod, and the third drive cylinder is configured to drive the fourth roller to abut against or move away from a top wall of the insertion plate through the connection rod.

[0035] Further, the clamping chuck mechanism includes a drive mechanism, a turntable, a first pushing component, and a second pushing component.

[0036] The drive mechanism is arranged on the rack, and the drive mechanism is connected to the turntable for transmission and is configured to drive the turntable into rotation. The turntable is provided with a central through hole for passage of the first steel column. The first pushing component and the second pushing component are arranged at one side of the turntable away from the drive mechanism, the first pushing component is configured to limit the first steel column in a first direction, and the second pushing

component is configured to limit the first steel column in a second direction.

[0037] Further, each of the first pushing component and the second pushing component includes an abutment plate, a pushing plate and a fourth drive cylinder. The pushing plate is fixedly connected to a drive end of the fourth drive cylinder, the abutment plate is fixedly connected to the turntable, and the abutment plate and the fourth drive cylinder are located at two sides of the central through hole respectively.

[0038] In a fourth aspect, an embodiment of the disclosure further provides a fabricated steel structure. The fabricated steel structure includes at least two steel column modules as described above. The at least two steel column modules include a lower steel column module and an upper steel column module. A second steel column of the upper steel column module is arranged around a first steel column of the lower steel column module, and the second steel column of the upper steel column module abuts against a top end of a second steel column of the lower steel column module.

[0039] In a fifth aspect, an embodiment of the disclosure further provides a prefabricated shear wall. The prefabricated shear wall includes a shear wall body and two steel column modules.

[0040] The shear wall body is provided with an accommodation cavity.

[0041] The two steel column modules are fixedly connected to two sides of the shear wall body along a length direction respectively, and the shear wall body and the two steel column modules collectively form a wall body cavity for casting-in-situ concrete.

[0042] Further, the shear wall body includes an inner formwork and an outer formwork which are arranged in parallel and opposite to each other. The inner formwork, the outer formwork and the two steel column modules collectively form the wall body cavity.

[0043] Further, the prefabricated shear wall further includes a shear wall steel frame. The shear wall steel frame is arranged in the wall body cavity and fixedly connected to the wall body cavity, and two ends of the shear wall steel frame are fixedly connected to the two steel column modules respectively.

[0044] Further, the two steel column modules are fixedly connected to the two sides of the shear wall body along the length direction, and are located in the accommodation cavity.

[0045] In a sixth aspect, an embodiment of the disclosure further provides a modular building. The modular building includes the steel column connecting structure as described above, the steel column module as described above, the fabricated steel structure as described above, or the prefabricated shear wall as described above.

[0046] The disclosure has advantageous effects as follows.

[0047] In the solution provided in the above first aspect of the embodiments of the disclosure, the steel column connecting structure includes a first steel column and an insertion plate, an end of the first steel column is provided with a first insertion slot, and the insertion plate is inserted into the first insertion slot. The end of the first steel column is fixedly connected to the insertion plate, which facilitates that the first steel column is fixedly connected to a top portion of the lower steel column module through a portion of the insertion plate protruding from the outer sidewall of the first steel column. The steel column connecting structure is easy to be formed, has a simple structure, and is convenient for its assembly, which may improve the production efficiency under a premise of ensuring the product quality, and may be beneficial to the automated production, thereby reducing cost of manual production.

[0048] In the solution provided in the above second aspect of the embodiments of the disclosure, the steel column module fixedly connects the first steel column with the second steel column through the insertion plate. After the insertion plate is inserted into the second insertion slot of the second steel column, the insertion plate may be fixedly connected to the second steel column by welding. The steel column module has a simple structure and is convenient for its assembly. When the upper and lower steel column modules are connected through their ends, the upper steel column module is arranged around the steel column connecting structure of the lower steel column module, which facilitates that the second steel column of the upper steel column module is arranged around the steel column connecting structure of the lower steel column module. Thus, the steel column module has the above advantages of the steel column connecting structure.

[0049] In the solution provided in the above third aspect of the embodiments of the disclosure, the steel column forming apparatus is configured to prepare the steel column connecting structure as described above or the steel column module as described above. The steel column forming apparatus has a reasonable structural design. One element to be assembled is clamped by the clamping chuck mechanism, and another element to be assembled is clamped and driven by the pushing mechanism to move along a preset assembly direction, until the two elements to be assembled are inserted into each other. It is convenient to perform the pushing operations, which may improve the assembly efficiency under a premise of ensuring the assembly quality, and may also be beneficial to achieve the fully automated production.

[0050] In the solution provided in the above fourth aspect of the embodiments of the disclosure, the fabricated steel structure has the above advantageous effects of the steel column module.

[0051] In the solution provided in the above fifth aspect of the embodiments of the disclosure, the prefabricated shear wall has the above advantageous effects of the steel column module.

[0052] In the solution provided in the above sixth aspect of the embodiments of the disclosure, the modular building has the above advantageous effects of the steel column module.

BRIEF DESCRIPTION OF THE DRAWINGS

[0053] The drawings described here are intended to provide further understanding of the disclosure, and constitute a part of the disclosure. Exemplary embodiments of the disclosure and descriptions thereof are intended to explain the disclosure, and do not constitute undue limitation on the disclosure.

[0054] FIG. 1 shows a schematic diagram of a steel column connecting structure according to an embodiment of the disclosure;

[0055] FIG. 2 shows a schematic exploded diagram of a steel column connecting structure according to an embodiment of the disclosure;

[0056] FIG. 3 shows a schematic diagram of a first structure of a guide member arranged on a first steel column in a steel column connecting structure according to an embodiment of the disclosure;

[0057] FIG. 4 shows a schematic diagram of a second structure of a guide member arranged on a first steel column in a steel column connecting structure according to an embodiment of the disclosure;

[0058] FIG. 5 shows a schematic diagram of a steel column module according to an embodiment of the disclosure;

[0059] FIG. 6 shows a schematic diagram of a second steel column in a steel column module according to an embodiment of the disclosure;

[0060] FIG. 7 shows a schematic diagram of a steel column forming apparatus according to an embodiment of the disclosure;

[0061] FIG. 8 shows a schematic diagram from a first visual angle of a pushing mechanism in a steel column forming apparatus according to an embodiment of the

disclosure;

[0062] FIG. 9 shows a schematic diagram from a second visual angle of a pushing mechanism in a steel column forming apparatus according to an embodiment of the disclosure;

[0063] FIG. 10 shows a schematic diagram from a third visual angle of a pushing mechanism in a steel column forming apparatus according to an embodiment of the disclosure;

[0064] FIG. 11 shows a schematic diagram of a clamping chuck mechanism in a steel column forming apparatus according to an embodiment of the disclosure;

[0065] FIG. 12 shows a schematic diagram of a pushing component in a steel column forming apparatus according to an embodiment of the disclosure;

[0066] FIG. 13 shows a schematic diagram of a fabricated steel structure according to an embodiment of the disclosure;

[0067] FIG. 14 shows a cross-sectional view of connection portions between an upper steel column module and a lower steel column module in a fabricated steel structure according to an embodiment of the disclosure;

[0068] FIG. 15 shows a schematic diagram of a first structure of a prefabricated shear wall according to an embodiment of the disclosure; and

[0069] FIG. 16 shows a schematic diagram of a second structure of a prefabricated shear wall according to an embodiment of the disclosure.

[0070] List of reference numerals: 100-steel column connecting structure; 101-preset direction; 103-first direction; 105-second direction; 110-first steel column; 112-first insertion slot; 115-insertion plate; 117-steel bar; 121-lug; 123-guide cone; 125-guide column; 200-steel column module; 210-second steel column; 212-second insertion slot; 300-steel column forming apparatus; 310-rack; 320-clamping chuck mechanism; 321-drive mechanism; 323-turntable; 3230-central through hole; 325-first pushing component; 327-second pushing component; 3251-abutment plate; 3253-pushing plate; 3255-fourth drive cylinder; 330-pushing mechanism; 3301-first drive cylinder; 3303-first base plate; 3305-second base plate; 3307-third base plate; 3311-first roller; 3313-second roller; 3315-third roller; 3321-second drive cylinder; 3323-mounting plate; 3325-third drive cylinder; 3327-connection rod; 3329-fourth roller; 400-fabricated steel structure; 410-lower steel column module; 420-upper steel column module; 500-prefabricated shear wall; 510-shear wall body; 515-wall body cavity; 5102-inner formwork; 5104-outer formwork; 530-shear wall

steel frame.

DETAILED DESCRIPTION

- [0071] In order to make technical solutions and advantages in the embodiments of the disclosure more apparent and clearer, exemplary embodiments of the disclosure will be further described in detail below with reference to the drawings. It is apparent that the described embodiments are only a part of the embodiments of the disclosure, rather than an exhaustive list of all the embodiments. It should be noted that the embodiments of the disclosure and features in the embodiments may be combined with each other without conflict.
- [0072] In descriptions of the disclosure, it should be understood that orientations or positional relationships indicated by terms "vertical", "horizontal", "inner", "outer", "upper", "lower", "front", "back", "left", "right", "central", "longitudinal", "transversal", "length", "width", "thickness" or the like are based on orientations or positional relationships shown in the drawings, and are only intended to facilitate describing the disclosure and simplifying the descriptions, rather than indicating or implying that a referred device or element must have a specific orientation, or must be configured and operated in a specific orientation, and thus cannot be understood as limitation on the disclosure.
- [0073] Furthermore, terms "first" and "second" are only for the purpose of descriptions, and cannot be understood as indicating or implying relative importance, or implicitly specifying a number of indicated technical features. Therefore, features defined by "first" and "second" may explicitly or implicitly include one or more of the features. In the descriptions of the disclosure, "multiple" means two or more, unless otherwise defined clearly and specifically.
- [0074] In the disclosure, unless otherwise specified and defined clearly, terms "mount", "connect", "connection", "fix" or the like should be understood in a broad sense. For example, they may be a fixed connection, or a detachable connection, or an integral connection; may be a mechanical connection or an electrical connection; may be a direct connection, or an indirect connection through an intermediate medium, or a communication between interiors of two components. Specific meanings of the above terms in the disclosure may be understood by those of ordinary skill in the art according to specific situations.
- [0075] An embodiment of the disclosure provides a steel column connecting structure

100. With reference to FIG. 1, a schematic diagram of the steel column connecting structure 100 is shown, and with reference to FIG. 2, a schematic exploded diagram of the steel column connecting structure 100 is shown.

[0076] Specifically, the steel column connecting structure 100 may include a first steel column 110 and an insertion plate 115. The first steel column 110 is a hollow structure. An end of the first steel column 110 is provided with a first insertion slot 112 along an axial direction. The insertion plate 115 is inserted into the first insertion slot 112, and at least one side of the insertion plate 115 protrudes from an outer sidewall of the first steel column 110.

[0077] The steel column connecting structure 100 provided in the embodiment of the disclosure may be used as an insertion structure between the upper and lower steel column modules of a modular fabricated building. The first steel column 110 may be fixedly connected to a top portion of the lower steel column module through the insertion plate 115, which facilitates that a bottom end of the upper steel column module is arranged around the steel column connecting structure, so as to achieve the connection between the upper and lower steel column modules. The first insertion slot 112 is provided on the first steel column 110, the insertion plate 115 is inserted into the first insertion slot 112, and at least one side of the insertion plate 115 protrudes from the outer sidewall of the first steel column 110, which facilitates that the first steel column 110 is fixedly connected to the top portion of the lower steel column module through a portion of the insertion plate 115 protruding from the outer sidewall of the first steel column 110. The steel column connecting structure 110 is easy to be formed, has a simple structure, and is convenient for its assembly and welding, which may improve the production efficiency under a premise of ensuring the product quality, and may be beneficial to the automated production, thereby reducing cost of manual production.

[0078] In order to improve anti-drawing performance after the ends of the upper and lower steel column modules are connected to each other and cement is poured, optionally, a structure for improving the anti-drawing performance may be provided on the steel column connecting structure 100.

[0079] With reference to FIG. 1, the steel column connecting structure 100 may further include at least one steel bar 117. The at least one steel bar 117 is fixedly connected to the outer sidewall of the first steel column 110, and the at least one steel bar 117 extends along a preset direction 101.

[0080] It should be noted that the preset direction 101 here refers to a direction having an angle with the axial direction of the first steel column 110. When the steel column

connecting structure 100 is in a use state, the steel bar 117 substantially extends along a transversal direction, that is, the steel bar 117 is arranged on the outer sidewall of the first steel column 110 along the transversal direction, or the steel bar may be obliquely arranged on the outer sidewall of the first steel column 110.

[0081] Further, the steel column connecting structure may include a plurality of steel bars 117. The plurality of steel bars 117 are arranged on the outer sidewall of the first steel column 110 and are spaced apart from each other along the axial direction of the first steel column 110, and each of the plurality of steel bars 117 extends along the preset direction 101. The plurality of steel bars 117 are sequentially spaced apart from each other, such that the outer sidewall of the first steel column 110 forms an anti-drawing structure in a concave-convex shape.

[0082] Optionally, the plurality of steel bars 117 may be uniformly welded to one outer sidewall of the first steel column 110, or may be uniformly welded to each outer sidewall of the first steel column 110. Each of the plurality of steel bars 117 extends along the preset direction 101, and the plurality of steel bars 117 are sequentially distributed along the axial direction of the first steel column 110.

[0083] Optionally, a shape of the steel bar 117 welded on the outer sidewall of the first steel column 110 is not limited, which may be a wavy structure, an arc structure, a straight long linear structure, a long diagonal structure, a special-shaped structure or the like, or may be a bent structure. The specific shape of the steel bar 117 is not limited in the disclosure, as long as the steel bar 117 is welded on the first steel column 110 and extends along the preset direction 101 as a whole, such that the outer sidewall of the first steel column 110 forms a concave-convex shaped structure and has an anti-drawing effect.

[0084] In the embodiment of the disclosure, in order to improve the anti-drawing performance between the insertion portions at the ends of the upper and lower steel column modules, a plurality of steel bars 117 may be provided on each outer sidewall of the first steel column 110. That is, the first steel column 110 includes a plurality of outer sidewalls, each outer sidewall is provided with the plurality of steel bars 117, to enhance the anti-drawing performance from each sidewall.

[0085] Optionally, the steel bars 117 with the anti-drawing performance may be located at an end of the first steel column 110 away from the first insertion slot 112, which is not only beneficial to fix the insertion plate 115 to the first steel column 110 by insertion, but also achieves the anti-drawing performance of the steel column connecting structure 100.

- [0086] In other optional embodiments, the steel bars 117 may be distributed on all of outer sidewalls of the first steel column 110, that is, the end of the first steel column 110 provided with the first insertion slot 112 may also be provided with the steel bars 117, which is not limited in the disclosure and is specifically determined according to actual requirements.
- [0087] In order to facilitate the smooth engagement of the upper and lower steel column modules of the modular fabricated building, when multiple upper and lower steel column modules are engaged and assembled together, in order to facilitate the smooth engagement of a bottom end of the upper steel column module to a top end of the lower steel column module, optionally, a guide member may be provided on the top portion of the lower steel column module, so that the lower steel column module is guided through the guide member to facilitate the smooth engagement.
- [0088] Specifically, the steel column connecting structure 100 may further include a guide member. At least a portion of the guide member is fixedly connected to the outer sidewall of the first steel column 110, and the guide member is configured to adapt to an inner wall at a bottom end of another steel column module inserted into the steel column connecting structure 100.
- [0089] The guide member is configured to adapt to a bottom end of the upper steel column module to play a guiding role. Therefore, the guide member is located at an end of the first steel column 110 away from the first insertion slot 112.
- [0090] With reference to FIG. 3, a schematic diagram of a first structure of a guide member arranged on the first steel column 110 is shown.
- [0091] The guide member may include at least two lugs 121. The at least two lugs 121 are fixedly connected to the outer sidewall at a diagonal position of the first steel column 110. There may be at least two lugs 121, and two of the lugs 121 may be fixedly connected to the outer sidewall at the diagonal position of the first steel column 110 respectively. An outermost side of each lug 121 is configured to cooperate with an inner sidewall of the upper steel column module, and a guiding purpose is achieved through the lug 121.
- [0092] In order to further achieve the guiding role, optionally, a side of each of the at least two lugs 121 away from the first steel column 110 may be designed as an arc structure.
- [0093] The lugs 121, of which an outer edge is an arc structure are provided on the outer sidewall at the diagonal position of the first steel column 110, which facilitates the smooth engagement of the upper steel column module to the lower steel column module.

- [0094] With reference to FIG. 4, a schematic diagram of a second structure of a guide member arranged on the first steel column 110 is shown.
- [0095] Specifically, the guide member may include a guide cone 123 and at least two guide columns 125, the guide cone and the at least two guide columns being fixedly connected to each other. Each guide column 125 is an elongated rod-shaped structure. The at least two guide columns 125 are fixedly connected to the outer sidewall at a diagonal position of the first steel column 110, and the guide cone 123 is connected to an end of each of the at least two guide column 125 and is located at an end of the first steel column 110 away from the first insertion slot 112.
- [0096] Optionally, the guide member may include a plurality of guide columns 125. The plurality of guide columns 125 are fixed to the outer sidewall at the diagonal position of the first steel column 110 in one-to-one correspondence (when the first steel column 110 is a quadrangular pillar, there are four guide columns 125, and the four guide columns 125 are fixedly connected to outer sidewalls of four corners of the quadrangular pillar in one-to-one correspondence). The guide cone 123 may include a plurality of conical sheets. Each of the plurality of conical sheets is connected to a respective one of the plurality of guide columns 125, and sides of the plurality of conical sheets away from the plurality of guide columns 125 intersect at a middle position, such that the guide cone 123 may have a structure in which the outer sides are lower and the middle portion is higher.
- [0097] It may be understood that the guide member may further include other structures, which are not specifically limited in the disclosure and are determined according to actual requirements.
- [0098] The steel column connecting structure 100 is mounted at a middle position of the top portion of the lower steel column module, which facilitates to fixing of the upper and lower steel column modules by insertion, and also facilitates to adjustment of positions of the upper and lower steel column modules after their initial engagement, such that the top portion of the first steel column of the lower steel column module is aligned with and abuts against the bottom portion of the first steel column of the upper steel column module.
- [0099] Optionally, with reference to FIG. 1, the first insertion slot 112 of the first steel column 110 is coplanar with a central axis of the first steel column 110.
- [0100] The insertion plate 115 is a rectangular steel plate, and the rectangular steel plate is symmetrically inserted onto the first steel column 110, that is, after the insertion plate 115 is inserted into the first insertion slot 112 of the first steel column 110, two sides of the

insertion plate 115 protrude from the outer sidewall of the first steel column 110. The two sides of the insertion plate 115 protruding from the outer sidewall of the first steel column 110 are configured to be fixed to a steel column in the lower steel column module by insertion.

[0101] The steel column connecting structure 100 provided in the embodiment of the disclosure is configured to be mounted at a connection position between the upper and lower steel column modules, which facilitates to the engagement of the upper steel column module to the lower steel column module. Further, it facilitates to the fixing and mounting of the steel column connecting structure 100 to the lower steel column module, the forming process of the steel column connecting structure is convenient to operate, and the steel column connecting structure 100 has a simple structure, which may improve the production efficiency, and may also be beneficial to improve the anti-drawing performance after the upper and lower steel column modules are connected to each other and the cement is poured.

[0102] An embodiment of the disclosure further provides a steel column module 200. With reference to FIG. 5, a schematic diagram of the steel column module 200 is shown. With reference to FIG. 6, a schematic diagram of a second steel column 210 in the steel column module 200 is shown.

[0103] Specifically, the steel column module 200 may include a second steel column 210 and the steel column connecting structure 100 as described above. The second steel column 210 is also a hollow structure, and an end of the second steel column 210 is provided with a second insertion slot 212 along an axial direction. The insertion plate 115 of the steel column connecting structure 100 is inserted into the second insertion slot 212 of the second steel column 210. After mounting, an end of the first steel column 110 provided with the first insertion slot 112 is embedded in a cavity of the second steel column 210, and the first steel column 110 is fixedly connected to the second steel column 210 through the insertion plate 115.

[0104] According to the steel column module 200 provided in the embodiment of the disclosure, the first steel column 110 is fixedly connected to the second steel column 210 through the insertion plate 115. After the insertion plate 115 is inserted into the second insertion slot 212 of the second steel column 210, the insertion plate 115 may be fixedly connected to the second steel column 210 by welding.

[0105] The steel column module 200 has a simple structure, is convenient for its

assembly and welding, and has the above advantages of the steel column connecting structure 100. During mounting, the steel column module is vertically arranged, and the steel column connecting structure 100 is located at a top end of the second steel column 210. A cross-sectional size of the first steel column 110 is less than a cross-sectional size of the second steel column 210, and the first steel column 110 protrudes from a top portion of the second steel column 210.

[0106] When the upper and lower steel column modules are connected through their ends, the upper steel column module is arranged around the steel column connecting structure 100 of the lower steel column module, which facilitates that the second steel column 210 of the upper steel column module is arranged around the steel column connecting structure 100 of the lower steel column module.

[0107] In order to facilitate connection, optionally, the first insertion slot 112 of the first steel column 110 is coplanar with the second insertion slot 212 of the second steel column 210, which facilitates simultaneously inserting the insertion plate 115 into the first insertion slot 112 and the second insertion slot 212.

[0108] In order to further improve the stability of connection between the steel column connecting structure 100 and the second steel column 210, optionally, a middle portion of the insertion plate 115 cooperates with the first insertion slot 112 of the first steel column 110, and two side portions of the insertion plate 115 cooperate with the second insertion slot 212 of the second steel column 210.

[0109] In order to achieve smooth engagement of the upper and lower steel column modules, a relative position of connection ends of the second steel columns 210 of the upper and lower steel column modules may also be adjusted according to actual requirements.

[0110] Optionally, the steel column connecting structure 100 may be arranged at a middle position of the second steel column 210, that is, the first insertion slot 112 provided on the first steel column 110 is coplanar with a central axis of the first steel column 110, and the second insertion slot 212 provided on the second steel column 210 is coplanar with a central axis of the second steel column 210.

[0111] It may be understood that under a premise of the first insertion slot 112 provided on the first steel column 110 being coplanar with the central axis of the first steel column 110, the first insertion slot 112 may be perpendicular to a sidewall of the first steel column 110; or, the first insertion slot 112 may be obliquely arranged to have an angle with the sidewall of the first steel column 110; or, the first insertion slot 112 may be provided at a

diagonal position of the first steel column 110.

[0112] Similarly, under a premise of the second insertion slot 212 provided on the second steel column 210 being coplanar with the central axis of the second steel column 210, the second insertion slot 212 may be perpendicular to a sidewall of the second steel column 210; or, the second insertion slot 212 may be obliquely arranged to have an angle with the sidewall of the second steel column 210; or, the second insertion slot 212 may be provided at a diagonal position of the second steel column 210.

[0113] The steel column module 200 provided in the embodiment of the disclosure has the above advantageous effects of the steel column connecting structure 100, which will not be elaborated here.

[0114] An embodiment of the disclosure further provides a steel column forming apparatus 300. The steel column forming apparatus 300 is configured to prepare the steel column connecting structure 100 or the steel column module 200 as described above.

[0115] With reference to FIG. 7, a schematic diagram of the steel column forming apparatus 300 is shown.

[0116] Specifically, the steel column forming apparatus 300 may include a rack 310, a clamping chuck mechanism 320, and a pushing mechanism 330. The rack 310 is fixedly arranged on a workbench or the ground, the clamping chuck mechanism 320 is rotatably arranged on the rack 310, and the pushing mechanism 330 is arranged on the rack 310.

[0117] When the steel column forming apparatus 300 is configured to prepare the steel column connecting structure 100, the clamping chuck mechanism 320 is configured to clamp an end of the first steel column 110 away from the first insertion slot 112, and the pushing mechanism 330 is configured to clamp the insertion plate 115 and drive the insertion plate 115 to move along the axial direction of the first steel column 110, to insert the insertion plate 115 into the first insertion slot 112 of the first steel column 110.

[0118] Similarly, when the steel column forming apparatus 300 is configured to prepare the steel column module 200, the clamping chuck mechanism 320 is configured to clamp the second steel column to allow an end of the second steel column provided with the second insertion slot to protrude, the pushing mechanism 330 is configured to clamp the steel column connecting structure to allow an end of the steel column connecting structure provided with the insertion plate to be close to the end of the second steel column provided with the second insertion slot, and the pushing mechanism 330 drives the steel column connecting structure to move along an axial direction of the second steel column, to insert

the insertion plate into the second insertion slot of the second steel column.

[0119] It may be understood that in other optional embodiments, the clamping chuck mechanism in the steel column forming apparatus may be also configured to clamp the insertion plate, the pushing mechanism is configured to clamp an end of the first steel column away from the first insertion slot and drive the first steel column to move along its axial direction, such that the first steel column is inserted into and fixed to the insertion plate. Alternatively, the clamping chuck mechanism in the steel column forming apparatus may be also configured to clamp an end of the steel column connecting structure away from the insertion plate, the pushing mechanism is configured to clamp the second steel column to allow an end of the second steel column provided with the second insertion slot to be close to an end of the insertion plate, and the pushing mechanism drives the second steel column to move along its axial direction, such that the second steel column is inserted into and fixed to the insertion plate of the steel column connecting structure.

[0120] Specific solution for preparing the steel column connecting structure 100 or the steel column module 200 by using the steel column forming apparatus 300 is not limited in the disclosure, and is determined according to actual requirements and convenience.

[0121] The steel column forming apparatus 300 provided in the embodiment of the disclosure has a reasonable structural design. One element to be assembled is clamped by the clamping chuck mechanism 200, and another element to be assembled is clamped and driven by the pushing mechanism 330 to move along a preset assembly direction, until the two elements to be assembled are inserted into each other. It is convenient to perform the pushing operations, which may improve the assembly efficiency under a premise of ensuring the assembly quality, and may also be beneficial to achieve the fully automated production.

[0122] Specific structure of the steel column forming apparatus 300 will be introduced in detail below by an example of preparing the steel column connecting structure 100 by using the steel column forming apparatus 300 provided in the embodiment of the disclosure.

[0123] With reference to FIG. 8, a schematic diagram from a first visual angle of the pushing mechanism 330 is shown.

[0124] Specifically, the pushing mechanism 330 may include a first drive cylinder 3301, a first base plate 3303, a second base plate 3305 and a third base plate 3307, the first base plate, the second base plate and the third base plate being fixedly connected to each other.

[0125] Each of the first drive cylinder 3301 and the first base plate 3303 is fixedly

connected to the rack 310. The first base plate 3303 may be a U-shaped structure including two sidewalls opposite to each other. A first roller 3311 is rotatably arranged on each of the two sidewalls of the first base plate 3303, and a central axis of the first roller 3311 is arranged horizontally, such that the first roller 3311 may rotate vertically. The second base plate 3305 and the third base plate 3307 may be fixed to the two sidewalls of the first base plate 3303 respectively. A second roller 3313 is rotatably arranged on the second base plate 3305, and a central axis of the second roller 3313 is arranged vertically, such that the second roller 3313 may rotate horizontally. A third roller 3315 is rotatably arranged on the third base plate 3307, and a central axis of the third roller 3315 is arranged vertically, such that the third roller 3315 may rotate horizontally.

[0126] After the insertion plate 115 is mounted on the pushing mechanism 330, the first roller 3311 of the pushing mechanism 330 is configured to adapt to a bottom wall of the insertion plate 115, and the second roller 3313 and the third roller 3315 are configured to adapt to two sidewalls of the insertion plate 115.

[0127] The first roller 3311 on the first base plate 3303, the second roller 3313 on the second base plate 3305, and the third roller 3315 on the third base plate 3307 cooperate with each other to clamp the insertion plate 115, the first roller 3311 is in rolling cooperation with the bottom wall of the insertion plate 115, and the second roller 3313 and the third roller 3315 are in rolling cooperation with the two sidewalls of the insertion plate 115. The first drive cylinder 3301 pushes the insertion plate 115, and the insertion plate 115 moves toward an end of the first steel column provided with the first insertion slot under an action force of the first drive cylinder 3301 and the rolling cooperation of the first rollers 3311, the second roller 3313 and the third roller 3315, such that the insertion plate 115 is inserted into the first insertion slot of the first steel column.

[0128] In order to adapt to insertion members of different sizes, optionally, the third roller 3315 on the third base plate 3307 may be designed as an adjustable structure.

[0129] Specifically, with reference to FIG. 9, a schematic diagram from a second visual angle of the pushing mechanism 330 is shown.

[0130] The pushing mechanism 330 may further include a second drive cylinder 3321. The second drive cylinder 3321 is fixedly connected to the third base plate 3307, and the third roller 3315 is rotatably arranged at a drive end of the second drive cylinder 3321.

[0131] In order to provide a plurality of third rollers 3315 at the drive end of the second drive cylinder 3321, further, a mounting plate 3323 may also be fixedly connected to the

drive end of the second drive cylinder 3321. There are a plurality of third rollers 3315. The plurality of third rollers 3315 are rotatably mounted on the mounting plate 3323.

[0132] Optionally, there may be a plurality of first rollers 3311, a plurality of second rollers 3313 and a plurality of third rollers 3315. The plurality of first rollers 3311, the plurality of second rollers 3313 and the plurality of third rollers 3315 are arranged in sequence. There is rolling friction between the rollers and the insertion plate 115, which may reduce a friction resistance when the insertion plate 115 moves along the axial direction of the first steel column under an driving action of the first drive cylinder 3301, and may be beneficial for the insertion plate 115 to slide under the action of the first drive cylinder 3301.

[0133] Further, in order to position the insertion plate 115 from a top surface and prevent the insertion plate 115 from falling out from top during movement, optionally, with reference to FIG. 10, a schematic diagram from a third visual angle of the pushing mechanism 330 is shown.

[0134] Specifically, the pushing mechanism 330 may further include a third drive cylinder 3325, a connection rod 3327, and a fourth roller 3329.

[0135] The third drive cylinder 3325 is fixedly connected to the rack 310. A first end of the connection rod 3327 is hinged to a drive end of the third drive cylinder 3325, a middle portion of the connection rod 3327 is hinged to the rack 310, and the fourth roller 3329 is rotatably arranged at a second end of the connection rod 3327. The third drive cylinder 3325 is configured to drive the fourth roller 3329 to abut against or move away from a top wall of the insertion plate 115 through the connection rod 3327.

[0136] For example, when the third drive cylinder 3325 extends, the first end of the connection rod 3327 connected to the third drive cylinder 3325 rotates upward (counterclockwise, from the visual angle of FIG. 10), and the second end of the connection rod 3327 provided with the fourth roller 3329 rotates downward (counterclockwise, from the visual angle of FIG. 10), while driving the fourth roller 3329 to press against the top wall of the insertion plate 115, thereby limiting the position of the insertion plate 115 from its top portion.

[0137] When the third drive cylinder 3325 contracts, the first end of the connection rod 3327 connected to the third drive cylinder 3325 rotates downward (clockwise, from the visual angle of FIG. 10), and the second end of the connection rod 3327 provided with the fourth roller 3329 rotates upward (clockwise, from the visual angle of FIG. 10), while driving the fourth roller 3329 to move away from the top wall of the insertion plate 115,

thereby removing limitation on the insertion plate 115 from its top portion.

[0138] The pushing mechanism 330 fixed on the rack 310 pushes the insertion plate 115 along the axial direction of the first steel column 110, and limits the insertion plate 115 from the bottom wall, sidewalls and top wall thereof through the first roller 3311, the second roller 3313, the third roller 3315 and the fourth roller 3329 respectively, which may ensure that the insertion plate 115 will not deflect during axial movement along the first steel column 110, thereby ensuring smooth insertion and a correct insertion position, which is beneficial to improve the assembly quality in the subsequent assembly processes.

[0139] With reference to FIG. 11, a schematic diagram of the clamping chuck mechanism 320 is shown.

[0140] Specifically, the clamping chuck mechanism 320 may include a drive mechanism 321, a turntable 323, a first pushing component 325, and a second pushing component 327.

[0141] The drive mechanism 321 is arranged on the rack 310, and the drive mechanism 321 is connected to the turntable 323 for transmission and is configured to drive the turntable 323 into rotation. In order to facilitate clamping the first steel column, a middle portion of the turntable 323 is provided with a central through hole 3230 for passage of the first steel column. The first pushing component 325 and the second pushing component 327 are arranged at one side of the turntable 323 away from the drive mechanism 321, the first pushing component 325 is configured to limit the first steel column in a first direction 103, and the second pushing component 327 is configured to limit the first steel column in a second direction 105.

[0142] From the visual angle shown in FIG. 11, optionally, the first direction 103 refers to a transversal direction, and the second direction 105 refers to a vertical direction.

[0143] Optionally, the drive mechanism 321 may be connected to the turntable 323 by gear transmission. That is, the drive mechanism 321 may include a motor and a first gear. The motor is fixedly connected to a mounting frame of the rack 310, and the motor is located on one side of the mounting frame away from the pushing mechanism 330. A power output end of the motor is connected to the first gear for transmission. The first gear and the motor are located on two sides of the mounting frame respectively. An outer circumferential wall of the turntable 323 is provided with multiple teeth meshed with the first gear, and the motor drives the turntable 323 provided with the multiple teeth into rotation through the first gear.

[0144] In other optional embodiments, the drive mechanism 321 may further include a

second gear. The turntable 323 is a plate-shaped structure. The turntable 323 is fixedly connected to the second gear, the first gear is externally meshed with the second gear, the motor drives the first gear into rotation, and the first gear drives the turntable 323 into rotation through the second gear.

[0145] Specific structure of the drive mechanism 321 is not limited in the disclosure, and is specifically determined according to actual requirements, as long as the drive mechanism 321 may drive the turntable 323 into rotation.

[0146] Further, the first pushing component 325 cooperates with the second pushing component 327 to limit the first steel column from four directions of cross section of the first steel column. Since the first pushing component 325 pushes the first steel column along the first direction 103, the second pushing component 327 pushes the first steel column along the second direction 105.

[0147] In order to avoid interference between the first pushing component 325 and the second pushing component 327 during pushing, optionally, the first pushing component 325 and the second pushing component 327 are misaligned in a direction perpendicular to the turntable 323. That is, a pushing path of the first pushing component 325 and a pushing path of the second pushing component 327 are not located in the same plane.

[0148] Optionally, a structure of the first pushing component 325 may be the same as or different from a structure of the second pushing component 327, which is specifically determined according to actual requirements. In the embodiment of the disclosure, the structure of the first pushing component 325 is the same as the structure of the second pushing component 327.

[0149] With reference to FIG. 12, a schematic diagram of the pushing components is shown.

[0150] Each of the first pushing component 325 and the second pushing component 327 may include an abutment plate 3251, a pushing plate 3253, and a fourth drive cylinder 3255. The fourth drive cylinder 3255 is fixedly connected to the turntable 323. The pushing plate 3253 is fixedly connected to a drive end of the fourth drive cylinder 3255, and the pushing plate 3253 is configured to cooperate with a sidewall of the first steel column. The abutment plate 3251 is fixedly connected to the turntable 323, and the abutment plate 3251 and the fourth drive cylinder 3255 are located at two sides of the central through hole 3230 of the turntable 323 respectively. The pushing plate 3253 pushes the first steel column under an action of the fourth drive cylinder 3255, and the abutment plate 3251 is configured to block

the first steel column, thereby positioning the first steel column.

[0151] In other optional embodiments, the clamping chuck mechanism 320 may also be other structures. For example, the clamping chuck mechanism may be a hollow columnar structure, the clamping chuck mechanism may be rotated relative to the rack. A clamping mechanism is provided in a cavity of the clamping chuck mechanism, and the first steel column is embedded in the cavity of the clamping chuck mechanism and is clamped and fixed by the clamping mechanism. The clamping chuck mechanism may drive the first steel column to rotate relative to the rack, to adjust an angle of the first steel column.

[0152] Specific structure of the clamping chuck mechanism is not limited in the disclosure, as long as the first steel column may be clamped and fixed by the clamping chuck mechanism, and the first steel column may be driven to rotate by the clamping chuck mechanism.

[0153] The steel column forming apparatus 300 provided in the embodiment of the disclosure is designed reasonably, and the first steel column 110 is clamped and fixed by the clamping chuck mechanism 320. The insertion plate 115 is clamped by the pushing mechanism 330, and the insertion plate 115 is driven to move toward a direction close to the first steel column 110, until the insertion plate 115 is inserted into the first insertion slot 112 of the first steel column 110. It is convenient to perform clamping and pushing operations of the steel column forming apparatus, and an insertion action may be achieved accurately and conveniently, which is beneficial to the subsequent welding operations, to increase the assembly speed and to improve the assembly efficiency under a premise of ensuring the assembly quality, and to achieve the fully automated production.

[0154] An embodiment of the disclosure further provides a fabricated steel structure 400. With reference to FIG. 13 and FIG. 14, FIG. 13 shows a schematic diagram of the fabricated steel structure 400, and FIG. 14 shows a cross-sectional view of connection portions between an upper steel column module 420 and a lower steel column module 410.

[0155] The fabricated steel structure 400 may include at least two steel column modules as described above. The at least two steel column modules may include a lower steel column module 410 and an upper steel column module 420.

[0156] After mounting, a second steel column 210 of the upper steel column module 420 is arranged around a first steel column 110 of the lower steel column module 410, and the second steel column 210 of the upper steel column module 420 abuts against a top end of a second steel column 210 of the lower steel column module 410.

- [0157] For example, with reference to FIG. 14, the fabricated steel structure 400 includes two steel column modules, that is, a lower steel column module 410 and an upper steel column module 420. The first steel column 110 of the lower steel column module 410 is located at the top end of the second steel column 210. During mounting, the second steel column 210 of the upper steel column module 420 is arranged around the first steel column 110 of the lower steel column module 410, and the second steel column 210 of the upper steel column module 420 cooperates with and abuts against the second steel column 210 of the lower steel column module 410.
- [0158] After mounting completes, the steel bars 117 protruding from an outer sidewall of the first steel column 110 face toward an inner sidewall of the second steel column 210, which is beneficial to improve the anti-drawing performance after the cement is poured.
- [0159] The fabricated steel structure 400 has the above advantageous effects of the steel column module 200, which will not be elaborated here.
- [0160] An embodiment of the disclosure further provides a prefabricated shear wall 500. With reference to FIG. 15, a schematic diagram of a first structure of the prefabricated shear wall 500 is shown.
- [0161] Specifically, the prefabricated shear wall 500 may include a shear wall body 510 and the steel column module 200 as described above. the shear wall body 510 is provided with an accommodation cavity. There are two steel column modules 200. The two steel column modules 200 are fixedly connected to two sides of the shear wall body 510 along a length direction respectively. The shear wall body 510 and the two steel column modules 200 collectively form a wall body cavity 515 for casting-in-situ concrete.
- [0162] The shear wall body 510 includes the accommodation cavity, and the shear wall body 510 and the two steel column modules 200 located at two ends of the shear wall body 510 collectively form the wall body cavity 515. The wall body cavity 515 is configured to accommodate the concrete poured into the prefabricated shear wall 500 at the construction site, such that the shear wall body 510 and the steel column modules 200 may be formed as a shear wall. After the concrete is poured into the wall body cavity 515 and the concrete is solidified, the shear wall may be formed.
- [0163] As shown in FIG. 15, the two steel column modules 200 are fixedly connected to the two sides of the shear wall body 510 along the length direction respectively, and are located in the accommodation cavity of the shear wall body 510. The two sides of the shear wall body 510 along the length direction as described above refer to the left and right sides

of the shear wall body 510 in a mounting/use state of the shear wall body, and a geometric shape of the prefabricated shear wall 500 is defined by the shear wall body 510.

[0164] Further, the shear wall body 510 may include an inner formwork 5102 and an outer formwork 5104 which are arranged in parallel and opposite to each other. The inner formwork 5102, the outer formwork 5104 and the two steel column modules 200 collectively form the wall body cavity 515. That is, the wall body cavity 515 is formed by the inner formwork 5102, the outer formwork 5104 and the two steel column modules 200 in four directions, i.e., front, back, left and right directions.

[0165] With reference to FIG. 15, in the embodiment of the disclosure, the two steel column modules 200 are fixedly connected to the two sides of the shear wall body 510 along the length direction respectively, and are located in the accommodation cavity. One side surface of the steel column module 200 close to the inner formwork 5102 is fixedly connected to the inner formwork 5102, and another side surface of the steel column module 200 close to the outer formwork 5104 is fixedly connected to the outer formwork 5104. For example, fixed connection methods may include welding, bolt connection, or self-tapping nail connection or the like. The above fixed connection methods are not specifically limited in the embodiment of the disclosure, and are specifically determined according to actual requirements.

[0166] Further, the prefabricated shear wall 500 may further include a shear wall steel frame 530.

[0167] Specifically, the shear wall steel frame 530 is arranged in the wall body cavity and fixedly connected to the wall body cavity 515, and two ends of the shear wall steel frame 530 along a transversal direction are fixedly connected to the two steel column modules 200 respectively.

[0168] Optionally, one side of the shear wall steel frame 530 along a thickness direction is fixedly connected to the inner formwork 5102 through a first connection element, and another side of the shear wall steel frame 530 along the thickness direction is fixedly connected to the outer formwork 5104 through a second connection element. The shear wall steel frame 530 may be connected to the inner formwork 5102 and the outer formwork 5104 through the first connection element and the second connection element respectively, such that the shear wall body 510 forms a "sandwich" structure. That is, one side of the shear wall steel frame 530 is connected to the inner formwork 5102 through the first connection element, and the other side of the shear wall steel frame 530 is connected to the outer

formwork 5104 through the second connection element, to form an integral structure with a non-removal formwork.

[0169] Optionally, each of the first connection element and the second connection element may include a self-tapping nail, an angle steel, a channel steel, or a flat steel plate, etc.

[0170] A length direction of the shear wall steel frame 530 is a transversal extension direction of the shear wall body 510. Two ends of the shear wall steel frame 530 extending along the length direction are fixedly connected to the two steel column modules 200 in a vertical direction respectively, and the two ends of the shear wall steel frame 530 in the length direction may be fixedly connected to surfaces of the two steel column modules 200 by welding.

[0171] With reference to FIG. 16, a schematic diagram of a second structure of the prefabricated shear wall 500 is shown.

[0172] The second structure of the prefabricated shear wall is substantially same as the above first structure of the prefabricated shear wall, with a difference lies in that: the two steel column modules 200 are fixedly connected to two sides of the shear wall body 510 along the length direction, however, each steel column module 200 is not located in the accommodation cavity of the shear wall body 510, that is, the two steel column modules 200 are fixedly connected to two ends of the shear wall body 510 along the length direction respectively.

[0173] As shown in FIG. 16, the shear wall body 510 includes an inner formwork 5102 and an outer formwork 5104. Two steel column modules 200 are fixedly connected to two ends of the shear wall body 510 respectively. The wall body cavity 515 is formed by the inner formwork 5102, the outer formwork 5104 and the two steel column modules 200 arranged at left and right sides in four directions, i.e., front, back, left and right directions. The shear wall steel frame 530 is arranged in the wall body cavity and fixedly connected to the wall body cavity 515, and two ends of the shear wall steel frame 530 along the transversal direction are fixedly connected to the two steel column modules 200 respectively.

[0174] In summary, for the prefabricated shear wall 500 of the above two structures, in a case that a shear wall formed by pouring the concrete into the prefabricated shear wall 500 is an exterior wall of a building, the inner formwork 5102 of the shear wall body 510 is located at one side of the shear wall facing indoors, and the outer formwork 5104 of the

shear wall body 510 is located at another side of the shear wall facing outdoors. Further, the inner formwork 5102 and the outer formwork 5104 are arranged in parallel and opposite to each other, and the wall body cavity 515 is formed by the inner formwork 5102, the outer formwork 5104 and the two steel column modules 200 arranged at two sides. That is, at the construction site, the concrete poured into the prefabricated shear wall 500 will be poured between the inner formwork 5102, the outer formwork 5104 of the shear wall body 510 and the two steel column modules 200.

[0175] The inner formwork 5102 and the outer formwork 5104 included in the shear wall body 510 may be used as the wall side panels in the module production and hoisting stages, and may be used as formworks in the construction stage, so that the usage of a prefabricated room module provided in the embodiment of the disclosure may not only improve rigidity of the module in the production and transportation stages, but also eliminate the on-site works of binding the wall steel bars of the shear wall and supporting the formwork of the shear wall, thereby saving the construction operations and construction personnel.

[0176] An embodiment of the disclosure further provides a modular building. The modular building includes the steel column connecting structure as described above, the steel column module as described above, or the fabricated steel structure as described above.

[0177] The modular building has the above advantageous effects of the steel column module, which will not be elaborated here.

[0178] Although preferred embodiments of the disclosure have been described, those skilled in the art may make additional changes and modifications to these embodiments once they have learned basic creative concepts. Therefore, the appended claims are intended to be interpreted as including the preferred embodiments and all changes and modifications falling within the scope of the disclosure.

[0179] It is apparent that those skilled in the art may make various variations and variants to the disclosure without departing from the spirit and scope of the disclosure. Therefore, if these variations and variants of the disclosure fall within the scope of the claims of the disclosure and their equivalent technologies, the disclosure is also intended to include these variations and variants.

CLAIMS

1. A steel column connecting structure, comprising:
 - a first steel column, wherein an end of the first steel column is provided with a first insertion slot along an axial direction; and
 - an insertion plate, wherein the insertion plate is inserted into the first insertion slot, and at least one side of the insertion plate protrudes from an outer sidewall of the first steel column.
2. The steel column connecting structure according to claim 1, further comprising at least one steel bar, wherein the at least one steel bar is fixedly connected to the outer sidewall of the first steel column and extends along a preset direction.
3. The steel column connecting structure according to claim 2, wherein the steel column connecting structure comprises a plurality of steel bars, wherein the plurality of steel bars are arranged on the outer sidewall of the first steel column and are spaced apart from each other along the axial direction of the first steel column, and each of the plurality of steel bars extends along the preset direction.
4. The steel column connecting structure according to claim 2, wherein the at least one steel bar is located at an end of the first steel column away from the first insertion slot.
5. The steel column connecting structure according to any one of claims 1 to 4, further comprising a guide member, wherein at least a portion of the guide member is fixedly connected to the outer sidewall of the first steel column, and the guide member is configured to adapt to an inner wall at a bottom end of another steel column module inserted into the steel column connecting structure.
6. The steel column connecting structure according to claim 5, wherein the guide member is located at an end of the first steel column away from the first insertion slot.
7. The steel column connecting structure according to claim 5, wherein the guide member comprises at least two lugs, wherein the at least two lugs are fixedly connected to the outer sidewall at a diagonal position of the first steel column.

8. The steel column connecting structure according to claim 7, wherein a side of each of the at least two lugs away from the first steel column is an arc structure.

9. The steel column connecting structure according to claim 5, wherein the guide member comprises a guide cone and at least two guide columns, the guide cone and the at least two guide columns being fixedly connected to each other, wherein the at least two guide columns are fixedly connected to the outer sidewall at a diagonal position of the first steel column, and the guide cone is connected to an end of each of the at least two guide columns and is located at an end of the first steel column away from the first insertion slot.

10. The steel column connecting structure according to claim 9, wherein the guide member comprises a plurality of guide columns, wherein the plurality of guide columns are fixed to the outer sidewall at the diagonal position of the first steel column in one-to-one correspondence; the guide cone comprises a plurality of conical sheets, each of the plurality of conical sheets is connected to a respective one of the plurality of guide columns, and sides of the plurality of conical sheets away from the plurality of guide columns intersect at a middle position.

11. The steel column connecting structure according to claim 1, wherein the first insertion slot is coplanar with a central axis of the first steel column.

12. The steel column connecting structure according to claim 1, wherein two sides of the insertion plate protrude from the outer sidewall of the first steel column.

13. A steel column module, comprising:

a second steel column, wherein an end of the second steel column is provided with a second insertion slot along an axial direction; and

the steel column connecting structure according to any one of claims 1 to 12, wherein the insertion plate is inserted into the second insertion slot, an end of the first steel column provided with the first insertion slot is embedded in a cavity of the second steel column, and the first steel column is fixedly connected to the second steel column through the insertion plate.

14. The steel column module according to claim 13, wherein the first insertion slot is coplanar

with the second insertion slot, a middle portion of the insertion plate cooperates with the first insertion slot, and two side portions of the insertion plate cooperate with the second insertion slot.

15. The steel column module according to claim 13, wherein the first insertion slot is coplanar with a central axis of the first steel column, and the second insertion slot is coplanar with a central axis of the second steel column.

16. A steel column forming apparatus, configured to prepare the steel column connecting structure according to any one of claims 1 to 12, comprising:

- a rack;

- a clamping chuck mechanism, wherein the clamping chuck mechanism is rotatably arranged on the rack, and is configured to clamp an end of the first steel column away from the first insertion slot; and

- a pushing mechanism, wherein the pushing mechanism is arranged on the rack, and is configured to clamp the insertion plate and drive the insertion plate to move along the axial direction of the first steel column to insert the insertion plate into the first insertion slot.

17. The steel column forming apparatus according to claim 16, wherein the pushing mechanism comprises a first drive cylinder, a first base plate, a second base plate and a third base plate, the first base plate, the second base plate and the third base plate being fixedly connected to each other;

- wherein each of the first drive cylinder and the first base plate is fixedly connected to the rack, the first drive cylinder is configured to drive the insertion plate to move along the axial direction of the first steel column, the first base plate is a U-shaped structure, a first roller is rotatably arranged on each of two sidewalls of the first base plate, the second base plate and the third base plate are fixed to the two sidewalls of the first base plate respectively, a second roller is rotatably arranged on the second base plate, and a third roller is rotatably arranged on the third base plate; and

- wherein the first roller is configured to adapt to a bottom wall of the insertion plate, and the second roller and the third roller are configured to adapt to two sidewalls of the insertion plate.

18. The steel column forming apparatus according to claim 17, wherein the pushing mechanism further comprises a second drive cylinder, wherein the second drive cylinder is fixed to the third base plate, and the third roller is rotatably arranged at a drive end of the second drive cylinder.

19. The steel column forming apparatus according to claim 18, wherein the drive end of the second drive cylinder is provided with a mounting plate, wherein the third base plate comprises a plurality of third rollers, and the plurality of third rollers are rotatably arranged on the mounting plate.

20. The steel column forming apparatus according to claim 17, wherein the pushing mechanism further comprises a third drive cylinder, a connection rod, and a fourth roller;

wherein the third drive cylinder is fixedly connected to the rack, a first end of the connection rod is hinged to a drive end of the third drive cylinder, a middle portion of the connection rod is hinged to the rack, the fourth roller is rotatably arranged at a second end of the connection rod, and the third drive cylinder is configured to drive the fourth roller to abut against or move away from a top wall of the insertion plate through the connection rod.

21. The steel column forming apparatus according to claim 16, wherein the clamping chuck mechanism comprises a drive mechanism, a turntable, a first pushing component, and a second pushing component;

wherein the drive mechanism is arranged on the rack, and the drive mechanism is connected to the turntable for transmission and is configured to drive the turntable into rotation; the turntable is provided with a central through hole for passage of the first steel column; the first pushing component and the second pushing component are arranged at one side of the turntable away from the drive mechanism, the first pushing component is configured to limit the first steel column in a first direction, and the second pushing component is configured to limit the first steel column in a second direction.

22. The steel column forming apparatus according to claim 21, wherein each of the first pushing component and the second pushing component comprises an abutment plate, a pushing plate and a fourth drive cylinder, wherein the pushing plate is fixedly connected to a drive end of the fourth drive cylinder, the abutment plate is fixedly connected to the turntable, and the abutment plate and the fourth drive cylinder are located at two sides of the central through hole

respectively.

23. A fabricated steel structure, comprising at least two steel column modules according to any one of claims 13 to 15, wherein the at least two steel column modules comprise a lower steel column module and an upper steel column module, wherein a second steel column of the upper steel column module is arranged around a first steel column of the lower steel column module, and the second steel column of the upper steel column module abuts against a top end of a second steel column of the lower steel column module.

24. A prefabricated shear wall, comprising:

a shear wall body, wherein the shear wall body is provided with an accommodation cavity; and

two steel column modules according to any one of claims 13 to 15, wherein the two steel column modules are fixedly connected to two sides of the shear wall body along a length direction respectively, and the shear wall body and the two steel column modules collectively form a wall body cavity for casting-in-situ concrete.

25. The prefabricated shear wall according to claim 24, wherein the shear wall body comprises an inner formwork and an outer formwork which are arranged in parallel and opposite to each other, wherein the inner formwork, the outer formwork and the two steel column modules collectively form the wall body cavity.

26. The prefabricated shear wall according to claim 24, further comprising a shear wall steel frame, wherein the shear wall steel frame is arranged in the wall body cavity and fixedly connected to the wall body cavity, and two ends of the shear wall steel frame are fixedly connected to the two steel column modules respectively.

27. The prefabricated shear wall according to claim 24, wherein the two steel column modules are fixedly connected to the two sides of the shear wall body along the length direction, and are located in the accommodation cavity.

28. A modular building, comprising the steel column connecting structure according to any one of claims 1 to 12, the steel column module according to any one of claims 13 to 15, the

fabricated steel structure according to claim 23, or the prefabricated shear wall according to any one of claims 24 to 27.