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(54) Benævnelse: **Stilladssikkerhedsgelænder**

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DESCRIPTION

FIELD OF THE INVENTION

[0001] The present invention relates to the area of scaffolding systems, and in particular to the area of scaffolding structures according to the preamble of claim 1.

BACKGROUND OF THE INVENTION

[0002] Scaffolding systems in general are well known from a variety of application areas. The area of construction is a major application area, both in respect of erection and maintenance of constructions, where the scaffolding is used as working platforms for construction workers. Other areas of application may be temporary building structures, stages and similar structures.

[0003] A basic scaffolding system comprises two rows of vertical posts, which can be connected together for building a multi-storey scaffolding system, and substantially horizontally extending elongate bars, connecting the vertical posts juxtaposed to each other in a direction along and a direction orthogonal to a facade. Since the vertical posts and the horizontally extending elements are connected orthogonally to each other forming a substantially rectangular frame structure, diagonal supports can be added at regular intervals for securing the scaffolding system against collapsing. Deck or floor elements covering rectangles formed by the connections made in the substantially horizontal plane at regular intervals complete the scaffolding system. A number of deck or floor elements can have openings with a hatch, which can be hinged, and a ladder extending from one deck through an opening in a subsequent deck makes it possible to ascent and descent between storeys.

[0004] From EP 0 276 487 a scaffolding system comprising vertical posts with annular apertured connecting elements spaced along the lengths of the posts and horizontally extending elongate scaffolding elements, which are locked to the annular apertured connecting elements by means of an engagement element, is known. The engagement element has a connecting element-receiving slot by means of which the engagement element may engage with the apertured connecting element at both the bottom and top faces of the connecting elements. A wedge is used as locking element between the engagement element and the apertured connecting element on the vertical posts. The apertured connecting elements are connected to the vertical posts by means of welding, riveting, screws or other similar methods.

[0005] Similar constructions are known from US 4044523, from US 4867274 and from US 5127757, where a locking element is used to secure engagement elements and connection elements of horizontal and vertical scaffolding elements.

[0006] Such scaffolding systems are generally assembled by successively erecting individual

scaffolding planes, with the individual member of the vertical posts of a first scaffolding plane ending as a rule in each case just above a floor plate belonging to a second scaffolding plane positioned above it. This upper end of the vertical post is then coupled by the installer to the lower end of a further vertical post in an end to end continuation for a further scaffolding storey by means of a spigot connection.

[0007] Thereafter one or more substantially horizontally extending railing elements or bars are locked to the vertical posts on a subsequent storey, in which the installer was present during the former working step. These railing elements reduce the risk of falling.

[0008] In known facade scaffolding systems of this kind it is a disadvantage and in some areas prohibited by local legislation that the installer has to work both during the erection of the vertical posts for the next scaffolding plane and also during the installation of the railing elements for this next scaffolding plane without any form of side protection, for which reason a pre-installation of railing elements for side protection is advantageous.

[0009] It is also an important quality of the engagement element that it must securely withstand forces substantially in a horizontal direction, for instance a worker leaning against the railing supported by the engagement element. In a practical erection of a scaffolding system a lot more freedom for a first engagement with the openings in the annular connecting elements could improve accessibility and save time for the erection of the scaffolding.

[0010] This type of scaffolding system provides a high degree of safety when established.

[0011] In WO 02/057569, WO 98/07934 as well as in EP 0 997 593 several solutions for coupling locks attached to each end of a bar for railing are presented. Common to the proposed solutions they all suffer from the problem that a first engagement with the annular apertured connecting elements on the vertical post, where the coupling lock is introduced into the corresponding opening in the annular connecting element, must be performed in a certain angular interval in a certain plane with respect to the scaffolding system under construction, hence they do not have the flexibility which could be desired. Attaching the bar to a vertical post and lifting and positioning the vertical post on top of another vertical post has to be performed in substantially the same plane as suspended by the preceding vertical posts and accompanying bracing elements, which might not be an optimal working position.

[0012] All of the above referenced engagements must take place in a specific angle relative to the annular apertured connecting elements or similar connecting means.

[0013] JP 2004 324353 A discloses a scaffolding structure according to the preamble of claim 1.

[0014] An objective of the present invention is to maintain the level of safety during the erection of the scaffolding while increasing the safety level of the erected scaffolding structure for such structures erected under safety provisions.

SUMMARY OF THE INVENTION

[0015] According to the invention the objective of the invention is achieved through a scaffolding structure according to claim 1. By means of such scaffolding structure the erecting of the structure may be performed from a lower deck of the structure, while achieving a desired safe construction with locking elements in the connection between the vertical posts and the horizontal railing elements. The engagement element of the railing element is adapted to be movable along the longitudinal axis of the elongate element or bar. The railing element comprises elongate apertures in the side walls adapted to accommodate a shaft element extending through the apertures and holding the engagement element, allowing the engagement element to travel along the elongate aperture. As an alternative to this solution, said alternative not being covered by the present invention, the railing element comprises a fixed shaft element extending from the wall of the railing element and through an elongate aperture in the engagement element allowing the engagement element to travel along the shaft element. The engagement element of the railing element comprises parts protruding to overlap the connecting element of the vertical post above and below this. Hereby both upward and downward movement is prevented. The engagement element of the scaffolding structure of the invention is movable relative to the elongate bar between at least a first and a second position, where the locking element is mounted in the engagement element of the railing element to be movable from a mounting position to a locking position, and where the locking element is adapted to maintain the mounting position, and upon movement of the engagement element relative to the elongate bar the locking element is adapted to be released to move into the locking position. The engagement element of the railing element is adapted to be movable along the longitudinal axis of the elongate bar. The elongate bar comprises elongate apertures in the side walls adapted to accommodate a shaft element extending through the apertures and holding the engagement element, allowing the engagement element to travel along the elongate aperture. As an alternative, not covered by the present invention, the railing element may comprise a fixed shaft element extending from the wall of the railing element and through an elongate aperture in the engagement element allowing the engagement element to travel along the shaft element. The engagement element of the railing element comprises parts protruding to overlap the connecting element of the vertical post above and below this.

[0016] Preferably the locking element comprises an incision or a protrusion adapted to hold the locking element relative to the elongate element.

[0017] In a preferred embodiment of the railing element both ends of the elongate bar are provided with similar engagement elements, which will simplify both manufacturing and assembly of the scaffolding structure.

[0018] According to the invention the objective is in a further aspect of the invention achieved through methods for erecting and dismantling the scaffolding system according to the invention.

[0019] A method for erecting a scaffolding structure according to the invention comprises that the locking element in mounted in a mounting position, where the railing element is positioned to accommodate the connecting element of a vertical post between two protruding parts of the engagement element, and where the elongate bar is moved to cause the relative movement between the elongate bar and the engagement element and hence release the locking element from the mounting position and allowing this to propagate into the locking position.

[0020] A first method for dismantling a scaffolding structure according to the invention comprises that the vertical post carrying one end portion of a railing element is dismantled and lowered to a lower position of the scaffolding structure and where the locking element is released from the locking position to allow the engagement element to be released from the connecting element, and where following this the vertical post carrying the opposed end of the railing element is dismantled and lowered to a lower position where the locking element of the opposed end of the railing element is released from its locking position allowing the railing element to be removed with both ends free.

[0021] A second method for dismantling a scaffolding structure according to the invention comprises that the locking element is released from its locking position and where the engagement element is released from the connecting element, where the locking element is inserted into the locking position in relation to the engagement element and where the engagement element with the locking element protruding downwards is placed on top of the connecting element with the locking element protruding through the aperture in the connecting element, where following this the vertical post carrying the opposed end of the railing element is dismantled and lowered to a lower position where the locking element of the opposed end of the railing element is released from its locking position allowing the railing element to be removed with both ends free.

[0022] A third method for dismantling a scaffolding structure according to the invention comprises that the elongate bar is brought to engage with the locking element and by movement in an upward direction releases the locking element from the locking position with the engagement element and the connecting element to a position where the engagement element may be retracted from the connection element.

[0023] Hereby the scaffolding structure may be dismantled in a safe manner from a lower position, where security railing is still in place and further without the use of any additional tools.

DECSRIPTION OF THE DRAWINGS

[0024] The present invention will be explained, by way of example only, with reference to the accompanying figures, where:

FIG. 1 shows in a perspective view an end portion of a railing element according to the invention;

FIG. 2A shows a side view of an end portion of a railing element according to the invention;

FIG. 2B shows a sectional view along the line A-A' in FIG. 2A;

FIG. 3A shows a top view of an end portion of a railing element according to the invention;

FIG. 3B shows a sectional view along the line B-B' in FIG. 3A;

FIG. 4A shows a side view of an end portion of a railing element according to the invention;

FIG. 4B shows a sectional view along the line A-A' in FIG. 4A;

FIG. 5A shows a top view of an end portion of a railing element according to the invention;

FIG. 5B shows a sectional view along the line B-B' in FIG. 5A;

FIGS. 6A-D show the mounting process for a scaffolding system according to the invention;

FIGS. 7A-C show a further mounting process for a scaffolding system according to the invention;

FIGS. 8A-C show a first dismantling process for a scaffolding system according to the invention;

FIGS. 9A-C show a further dismantling process for a scaffolding system according to the invention;

FIGS. 10A-C show the mounting process for another embodiment of a scaffolding system according to the invention; and

FIGS. 11A-B show a dismantling process for a scaffolding system according to the invention and as shown in FIGS. 10.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0025] With reference to the drawings a preferred embodiment will be described.

[0026] From FIG. 1 an end portion of a railing element 2 appears. **T**he railing element comprises an elongate bar 8 and at the ends an engagement element 3.

[0027] **T**he engagement element 3comprises two protruding parts 4,4' with a space between them adapted to accommodate a connecting element 11 of a vertical post 1. A locking element 5, here shaped as a wedge, is mounted in the engagement element 3 to be movable into a

locking position where the locking element penetrates the openings in the two protruding parts 4,4' of the engagement element 3 and the connecting element 11.

[0028] The elongate bar 8 and the engagement element 3 are mutually connected with a bolt or a shaft 10 that is mounted movable through elongate openings 9 in the sidewalls of the elongate bar 8 and connected to the engagement element 3 at two opposed sides of the elongate bar 8.

[0029] The locking element 5 is provided with a holding part, which may be a protruding element 7' or an incision 7, adapted to be connected releasably to an end portion of the elongate bar 8. The engagement element 3 is movable along the elongate openings 9 of the elongate bar 8 from a first position where the locking element 5, when connected to the end portion of the elongate bar 8, is held in a position where the space between the two protruding parts 4,4' of the engagement element 3 is free to accommodate the connecting element 11 of the vertical post 1. Upon movement of the elongate bar 8 the engagement element 3 will travel along the elongate openings 9 in the elongate bar 8 and hence release the locking element 5 from the end portion of the elongate bar 8. The locking element 5 will following this enter the openings in the engagement element 3 and the connecting element 11.

[0030] From FIG. 2A an end portion of a railing element 2 appears in a side view. The parts described in connection with FIG. 1 are visible here as well. The locking element 5 in this illustration is in an inserted position. From FIG. 2B the element of FIG. 2A appears seen in a sectional view along the line A-A'. It appears that the locking element 5 may be locked through a friction force established between the locking element 5 and the engagement element 3. At the one end the locking element comprises a securing element 6, ensuring that the locking element 5 cannot be removed from the engagement element 3.

[0031] From FIG. 3A an end portion of a railing element 2 appears in a top view. The parts described in connection with FIG. 1 are visible here as well. The locking element 5 in this illustration is in an inserted position. From FIG. 3B the same element appears seen in a sectional view along the line B-B'. It appears that the locking element 5 may be locked through a friction force established between the locking element and the engagement element.

[0032] From FIG. 4A an end portion of a railing element 2 appears in a side view. The parts described in connection with FIG. 1 are visible here as well. The locking element 5 in this illustration is of a different type having a protruding part 7'. From FIG. 4B the same element appears seen in a sectional view along the line B-B'. It appears that the locking element 5 may be locked through a friction force established between the locking element and the engagement element. As with the first embodiment the one end of the locking element comprises a securing element 6, ensuring that the locking element cannot be removed from the engagement element 3.

[0033] From FIG. 5A an end portion of a railing element 2 appears in a top view. The parts described in connection with FIG. 1 are visible here as well. The locking element 5 in this

illustration is in an inserted position. From FIG. 5B the same element appears seen in a sectional view along the line C-C'. It appears that the locking element may be locked through a friction force established between the locking element and the engagement element. At the one end the locking element comprises a securing element 6, ensuring that the locking element cannot be removed from the engagement element.

[0034] The elements of a scaffolding structure may be:

- a plurality of elongate vertical elements 1, the lengths of said elongate elements being preferably respectively full and half standing heights of said scaffolding system, said elongate elements having connectors for being connectable in an end to end continuation, where the elongate elements have apertured connecting elements 11 secured thereto at regular intervals, the apertures 12 of said connecting elements being distributed in a regular pattern circumferential to the elongate elements, each of which apertures 12 define a maximum dimension in a radial direction to the axis of said elongate elements,
- a first set of railing elements 2 to be used in a substantially horizontal position for securing the scaffolding structure and comprising engagement elements 3 at opposite ends for coupling to said apertured connecting elements 11,
- a deck or floor system for the scaffolding system.

[0035] A perspective representation of the connection process between a vertical post 1 and a horizontal railing 2 of a scaffolding system according to the invention is shown in FIGS. 6A-D. In this preferred embodiment the elongated elements are of a tubular geometry, and the connecting elements 11 on said elongated vertical elements 1 are apertured annular connecting elements secured by means of welding at intervals defining the grid pattern of the rectangular lattice box structure. The apertures 12 of said connecting elements 11 are distributed at regular intervals circumferential to the elongate elements, so that the bars can be suspended between vertical posts in fixed angles in a horizontal plane. The railing element 2 comprises at at least one end, preferably at both ends, an engagement element 3. Said coupling head or engagement element at each end of said first set of the bars has openings extending through the engagement element at two protruding end portions 4,4' of this. The two end portions 4,4' of the engagement element defines between them a slot or opening for receiving the connecting element 11 of the vertical post 1. After engagement between the engagement element and the apertured annular connecting element 11, a releasable wedge 5 extends through these openings and through one of the openings 12 in the annular connecting element 11 for consolidation of the coupling. The couplings hereby accomplished secure and lock the dismountable first set of bars in the scaffolding system. More specifically FIG. 6A shows how the locking element 5 is held in a mounting position relative to the elongate bar 8 by inserting the end of the elongate bar into the incision 7 in the locking element 5. The engagement element 3 will by influence of gravity rest at the lower end of the elongate apertures 9 in the elongate bar 8, whereby the locking element 5 will be retracted toward the upper end of the engagement element and rest here. This will leave the slot between the two

protruding parts 4,4' of the engagement element 3 open for receiving the connecting element 11. As shown in FIG. 6B the elongate bar 8 is pivoted upwards to release the locking element 5 downwards through the opening in the engagement element and the connecting element, respectively. As shown in FIG. 6C and FIG. 6D the elongate bar 8 may finally be retracted further to be pivoted upwards to the horizontal mounting position for the railing element 2.

[0036] In order to avoid accident danger for the installer during erection of the scaffolding system when carrying out installations without side protection it is known to install side protection for the subsequent storey from the preceding storey. This side protection can be considered less mandatory for the rigidity of the scaffolding system, the coupling locks being less demanding, but they must withstand horizontal forces and be locked in place.

[0037] FIGS. 7A-C show a preferred method of a step in the process of erecting the scaffolding system. An additional member of the vertical elongate elements is attached to the free end of an already mounted vertical element. A horizontal railing element 2 is mounted using the sequential steps as explained in connection with FIGS. 6A-D. The free end of the railing element is connected to a vertical element 1 which is not yet mounted. The not yet mounted vertical element 1 is subsequently raised and mounted on top of an already mounted vertical element 1. In this manner the security railing of the next storey of the scaffolding structure is established before the personnel is actually using the storey for erecting the next following level.

[0038] The following sequence of steps outlines a first method of erecting a scaffolding system:

1. a. erecting at least four members of said elongate elements in a substantially vertical position to be used as vertical posts for a first storey,
2. b. mounting railing elements in a substantially horizontal position for securing the scaffolding system by securing engagement elements of the railing elements to said apertured connecting elements on respectively juxtaposed vertical posts and creating a substantially rectangular frame structure,
3. c. optionally suspending a bracing member diagonally between corners for added stability,
4. d. connecting a further elongate element on top of a said substantially rectangular frame structure using said connectors for stacking, constituting a vertical post for a subsequent storey,
5. e. attaching a first end of a member of the railing element with an aperture in an apertured connecting element having a position being predefined by said intervals on said vertical post constituted in step d,
6. f. attaching the opposed end of the railing element to an apertured connecting element on a further vertical element,
7. g. raising and manipulating said further vertical element into a substantially vertical position on top of said frame structure as a further vertical element,
8. h. mounting a deck or floor system according to the layout of the scaffolding system for

the storey with the recently mounted second set of bars which completes a storey in a scaffolding system.

[0039] FIG. 8A shows a step of a first method for dismantling the scaffolding structure according to the invention. The locking element 5 is removed from the locking position hereby allowing the engagement element 3 of the railing element to be retracted from the connecting element 11 of the vertical element. The locking element 5 is following this reinserted through the openings of the engagement element 3 and after this inserted into the opening 12 of the connecting element 11 and leaving the engagement element 3 to rest on top of the connecting element 11 .

[0040] FIG. 8b shows how a vertical element 1 is dismantled from a lower deck with the railing elements 2 still mounted on the vertical element 1. From FIG. 8C it appears that the railing element 2 resting on top of the connecting element 11, as described in connection with FIG. 8A, is removed from a safe lower position of the scaffolding structure.

[0041] FIGS. 9A-C show a further dismantling process for the scaffolding structure, where the vertical elements 1 from a lower position of the scaffolding structure are dismantled from their position with the railing elements 2 still fully attached to these and where these railing elements 2 are detached at the lower safe position of the scaffolding structure.

[0042] FIG. 10 shows in a perspective view a further embodiment of the invention. Corresponding to the description in FIGS. 7A-C the mounting of a railing element takes place from a lower safe position. The only difference between this embodiment and the embodiment shown in FIGS. 7A-C, is the configuration of the holding element 7' for the locking element 5, which in this case is a protruding hook shaped element 7'.

[0043] FIGS. 11A-B show the dismantling of the scaffolding structures shown in FIGS. 10. It appears that the elongate bar 8 is used to engage with the protruding part 7' of the locking element 5 and pushing this upwards to release this from the locking position and hence allow the engagement element 3 to be removed from the connecting element 11 of the vertical post 1.

Reference numbers:

[0044]

1,1'
: Vertical posts

2
: Railing element

3
: Engagement element
4,4'
: Protruding parts
5
: Locking element
6
: Securing element
7
: Incision
7'
: Protruding part
8
: Elongate bar
9
: Elongate apertures
10
: Shaft
11
: Connecting element
12
: Apertures

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

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- US4044523A **[0005]**
- US4867274A **[0005]**
- US5127757A **[0005]**
- WO02057569A **[0011]**
- WO9807934A **[0011]**
- EP0997593A **[0011]**

- JP2004324353A [0013]

PATENTKRAV

1. Stilladsstruktur omfattende et antal vertikale bærestolper (1) og imellem sæt af to vertikale stolper (1) et horisontalt gelænderelement (2), som ved enderne er fastgjort til de to vertikale stolper (1), hvor, til fastgørelse af gelænderelementet (2), de vertikale stolper (1) er forsynede med et forbindelseselement (11), som omfatter i det mindste én åbning, som strækker sig i det væsentlige vertikalt, og hvor gelænderelementet (2) til fastgørelse omfatter en aflang stang (8) og ved én ende af den aflange stang (8) et indgrebselement (3) til at modtage forbindelseselementet (11) og med åbninger indrettede til at blive placerede overlappende med åbningen (12) i forbindelseselementet (11) på den vertikale stolpe (1), idet indgrebselementet (3) på gelænderelementet (2) omfatter dele (4, 4'), som stikker ud for at overlappe forbindelseselementet (11) på den vertikale stolpe (1) over og under dette, og hvor yderligere et låseelement (5) er tilvejebragt til indsætning igennem åbningerne (12) i forbindelseselementet (11) på den vertikale stolpe (1) og indgrebselementet (3) på gelænderelementet (2) for at forhindre horisontal bevægelse af gelænderelementet (2), hvor indgrebselementet (3) på gelænderelementet (2) er bevægeligt i forhold til den aflange stang (8) imellem i det mindste en første og en anden position, hvor låseelementet (5) er monteret i indgrebselementet (3) på gelænderelementet (2) til at være bevægeligt fra en montageposition til en låseposition, og hvor låselementet (5) er indrettet til at fastholde montagepositionen, og efter bevægelse af indgrebselementet (3) i forhold til den aflange stang (8) er låseelementet (5) indrettet til at blive udløst til at bevæge sig ind i låsepositionen, **kendetegnet ved, at** indgrebselementet (3) på gelænderelementet (2) er indrettet til at bevæge sig langs den langsgående akse for den aflange stang (8), at den aflange stang (8) omfatter aflange åbninger (9) i sidevæggene, som er indrettede til at modtage et akselelement (10), som strækker sig igennem åbningerne (9), og som fastholder indgrebselementet (3), som tillader indgrebselementet (3) at bevæge sig langs de aflange åbninger (9), at låseelementet (5) er forsynet med en holdedel, som kan være et udstikkende element (7') eller en indskæring (7), som er indrettet til at blive forbundet udløseligt med en endedel af den aflange stang (8), at indgrebselementet (3) er bevægeligt langs de aflange åbninger (9) i den aflange stang (8) fra en første position, hvor låselementet (5), når dette er forbundet med endedelen af den aflange stang (8), fastholdes i en position, hvor mellemrummet imellem de to fremstående dele (4, 4') på indgrebselementet (3) frit kan modtage forbindelseselementet (11) på den vertikale stolpe (1), at indgrebselementet (3) er indrettet til, ved bevægelse af den aflange stang (8), at bevæge sig langs de aflange åbninger (9) i den aflange stang (8) og derved frigøre

låseelementet (5) fra endedelen af den aflange stang (8) med henblik på at låseelementet (5) trænger ind i åbningerne i indgrebselementet (3) og forbindelseselementet (11).

2. Fremgangsmåde til opstilling af en stilladsstruktur ifølge krav 1, hvor låseelementet (5) er monteret i en montageposition, hvor gelænderelementet (2) er placeret til at optage forbindelseselementet (11) på en vertikal stolpe (1) imellem to fremstående dele (4, 4') på indgrebselementet (3), og hvor den aflange stang (8) bevæges til at forårsage den relative bevægelse imellem den aflange stang (8) og indgrebselementet (3) og følgelig frigøre låseelementet (5) fra montagepositionen og tillader dette (5) at fremføres ind i låsepositionen.

3. Fremgangsmåde til adskillelse af et gelænderelement fra en stilladsstruktur ifølge krav 1, hvor den aflange stang (8) bringes til at indgribe med låseelementet (5) og ved bevægelse i en opadrettet retning at frigøre låseelementet (5) fra låsepositionen med indgrebselementet (3) og forbindelseselementet (11) til en position, hvor indgrebselementet (3) kan trækkes tilbage fra forbindelseselementet (11).

DRAWINGS

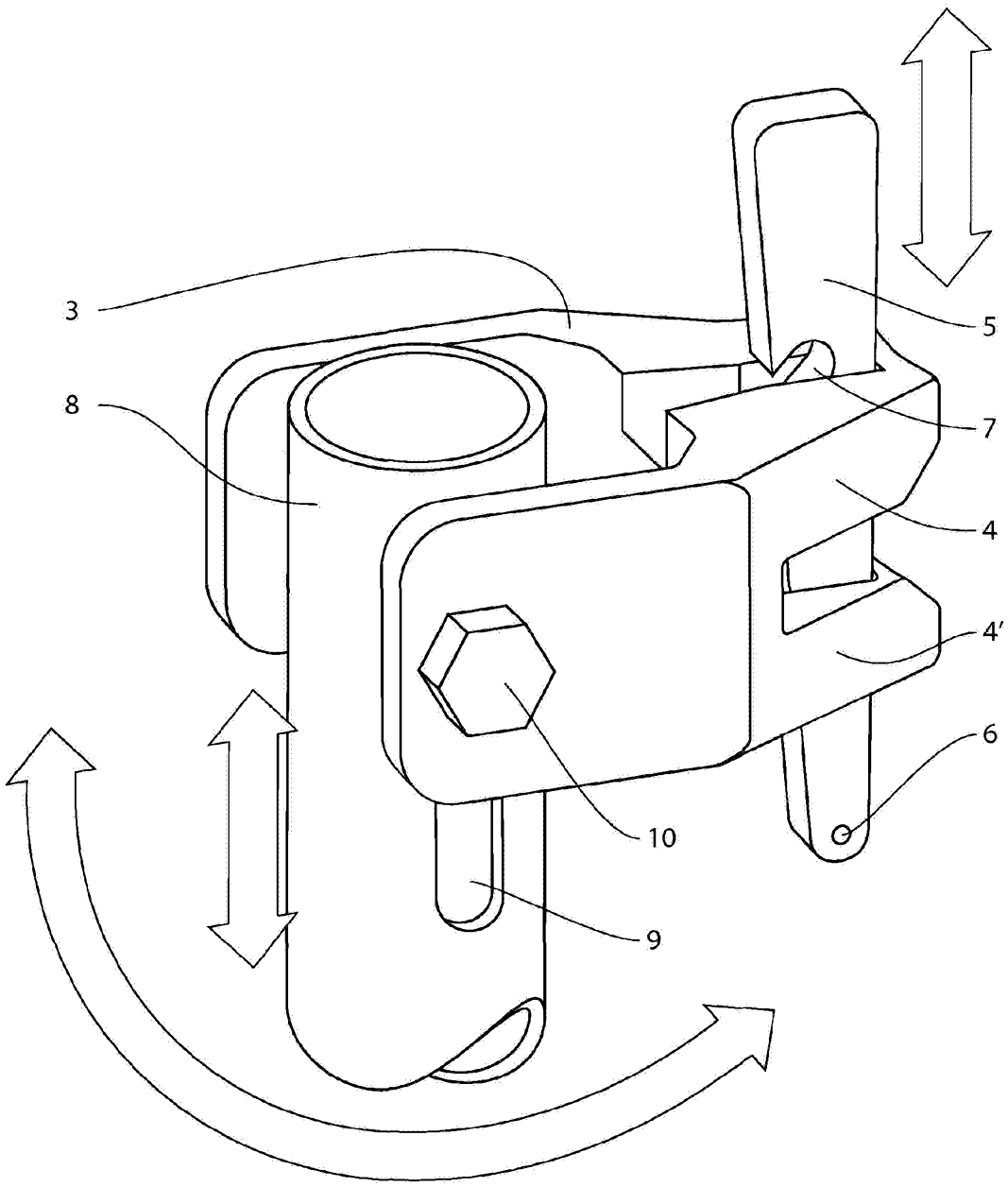

FIG. 1

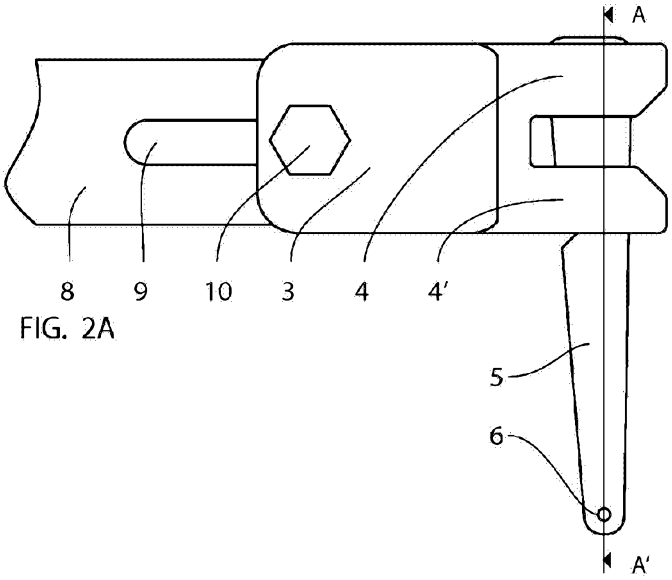

FIG. 2A

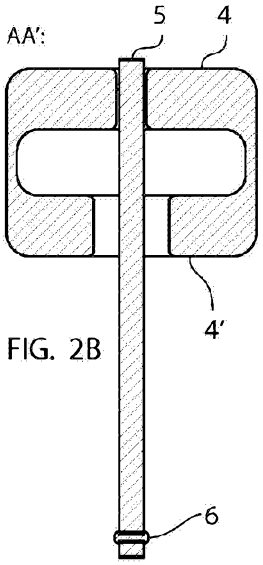

FIG. 2B

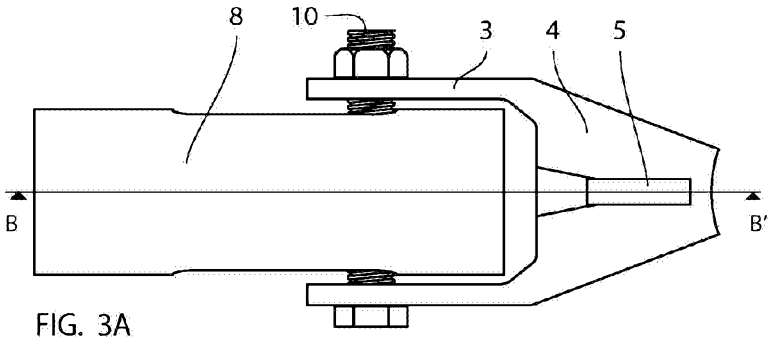

FIG. 3A

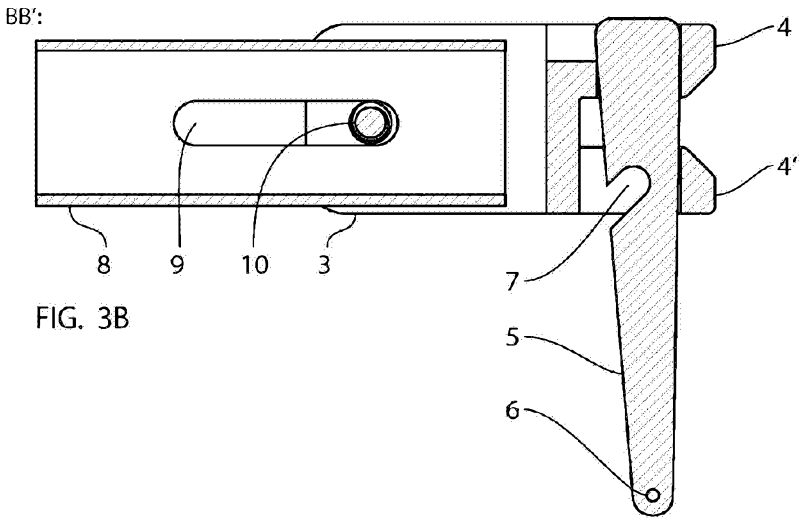

FIG. 3B

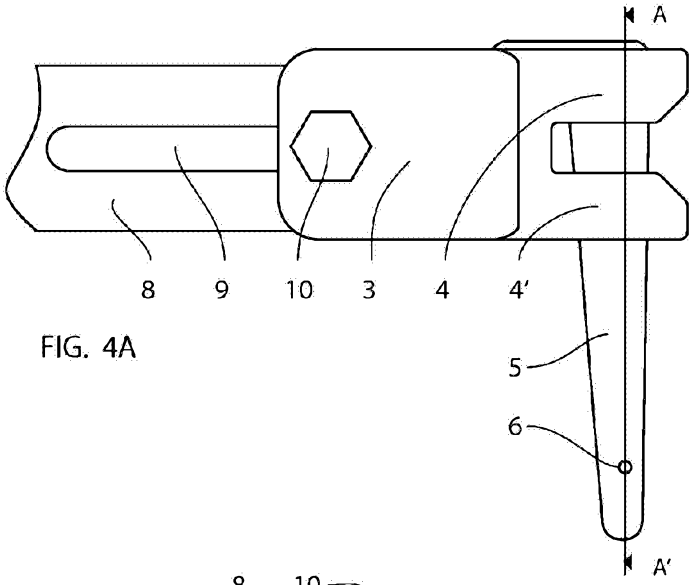

FIG. 4A

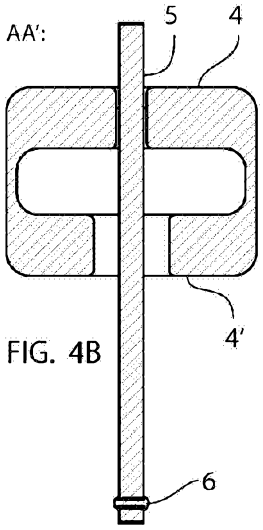

FIG. 4B

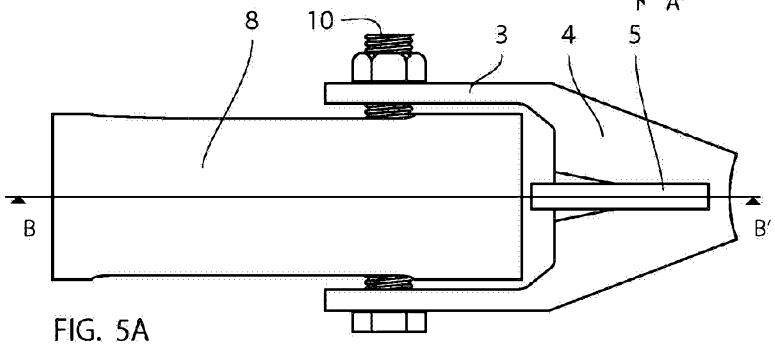

FIG. 5A

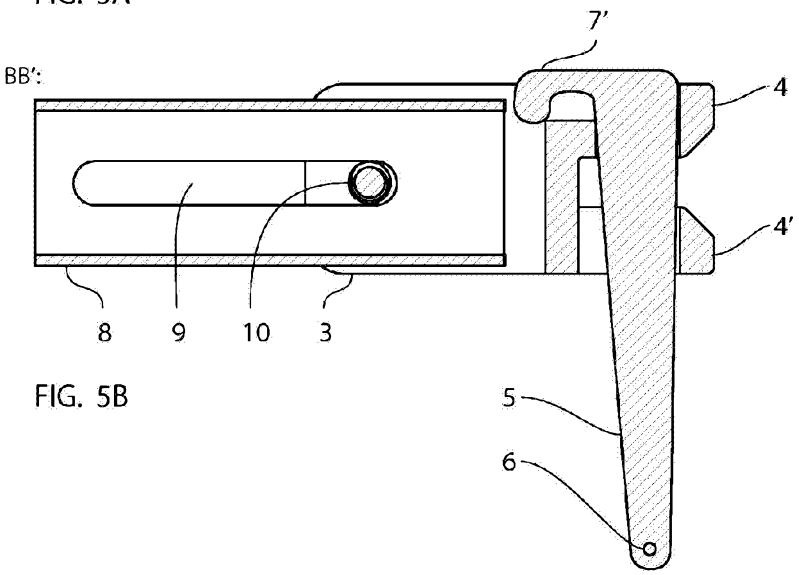

FIG. 5B

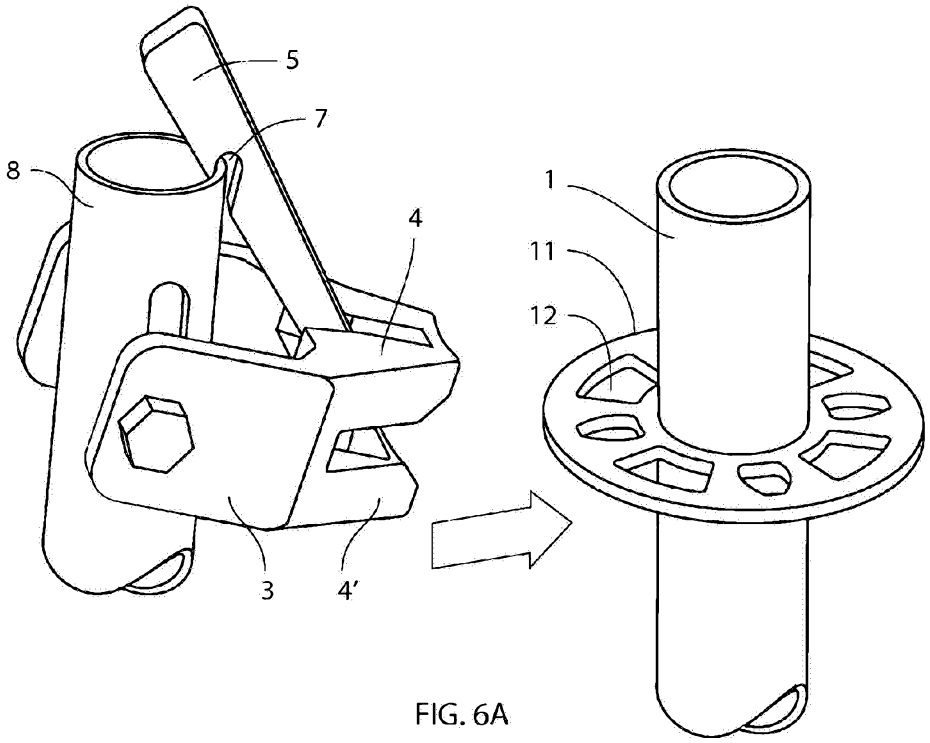

FIG. 6A

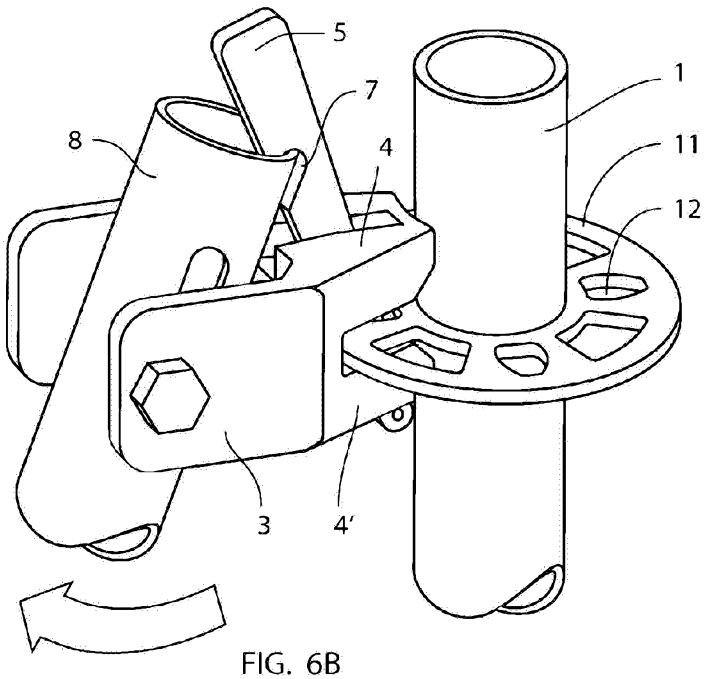

FIG. 6B

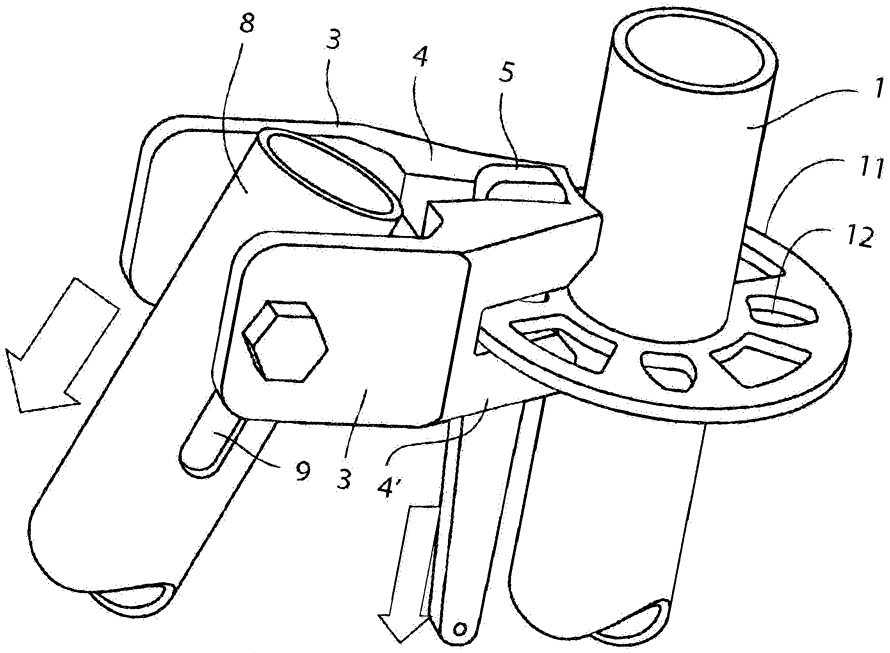

FIG. 6C

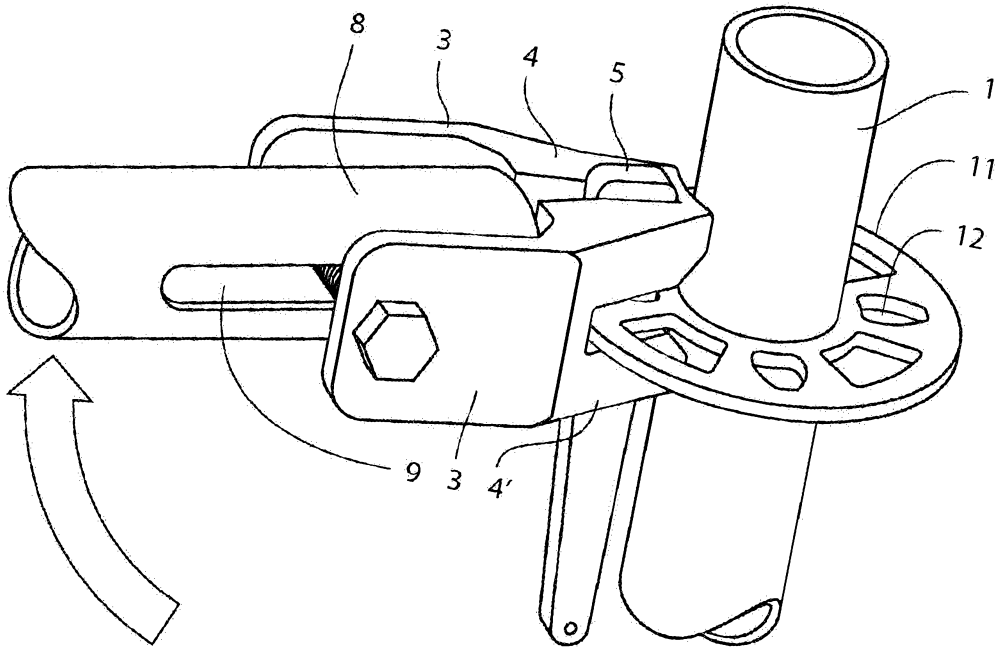

FIG. 6D

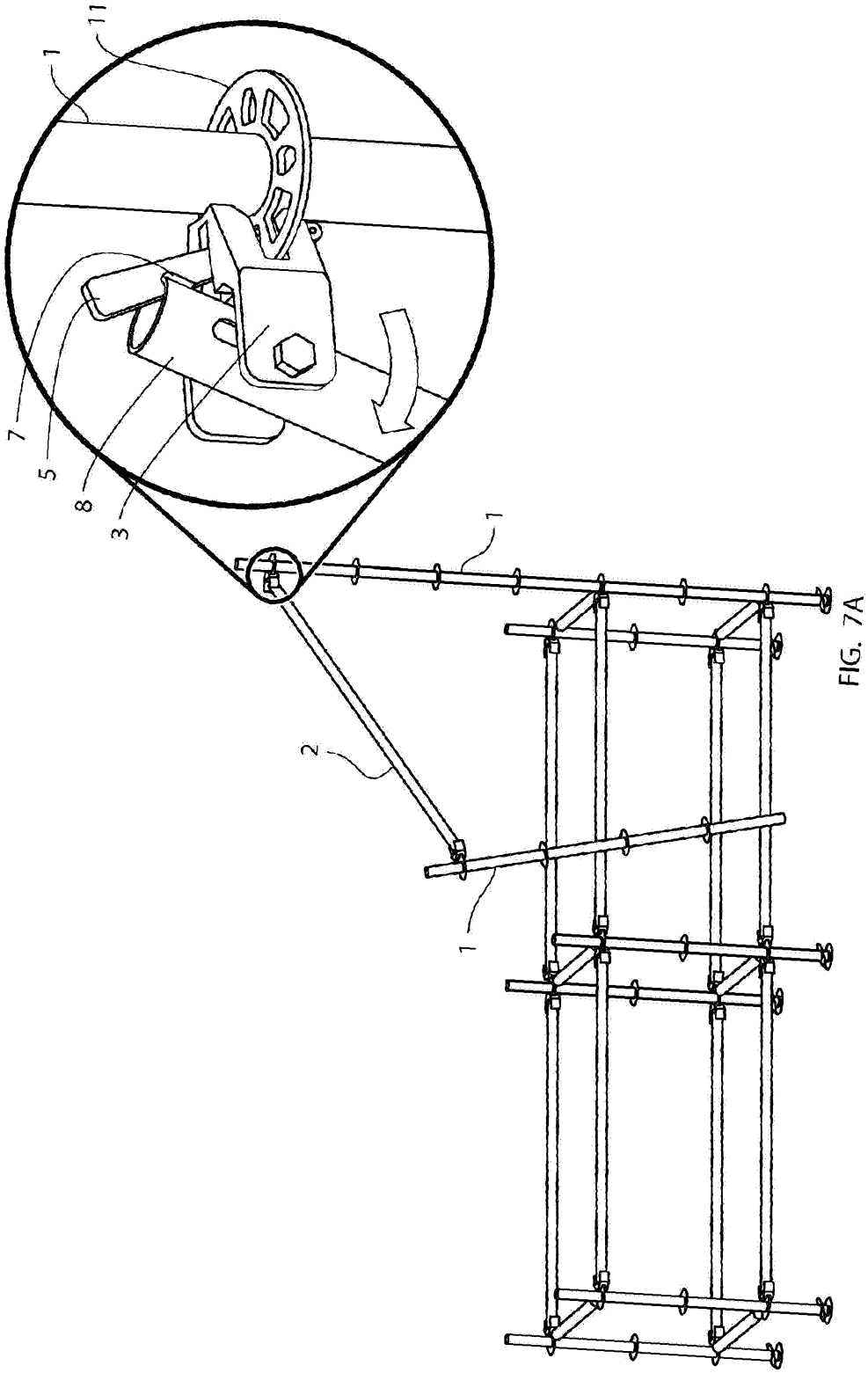

FIG. 7A

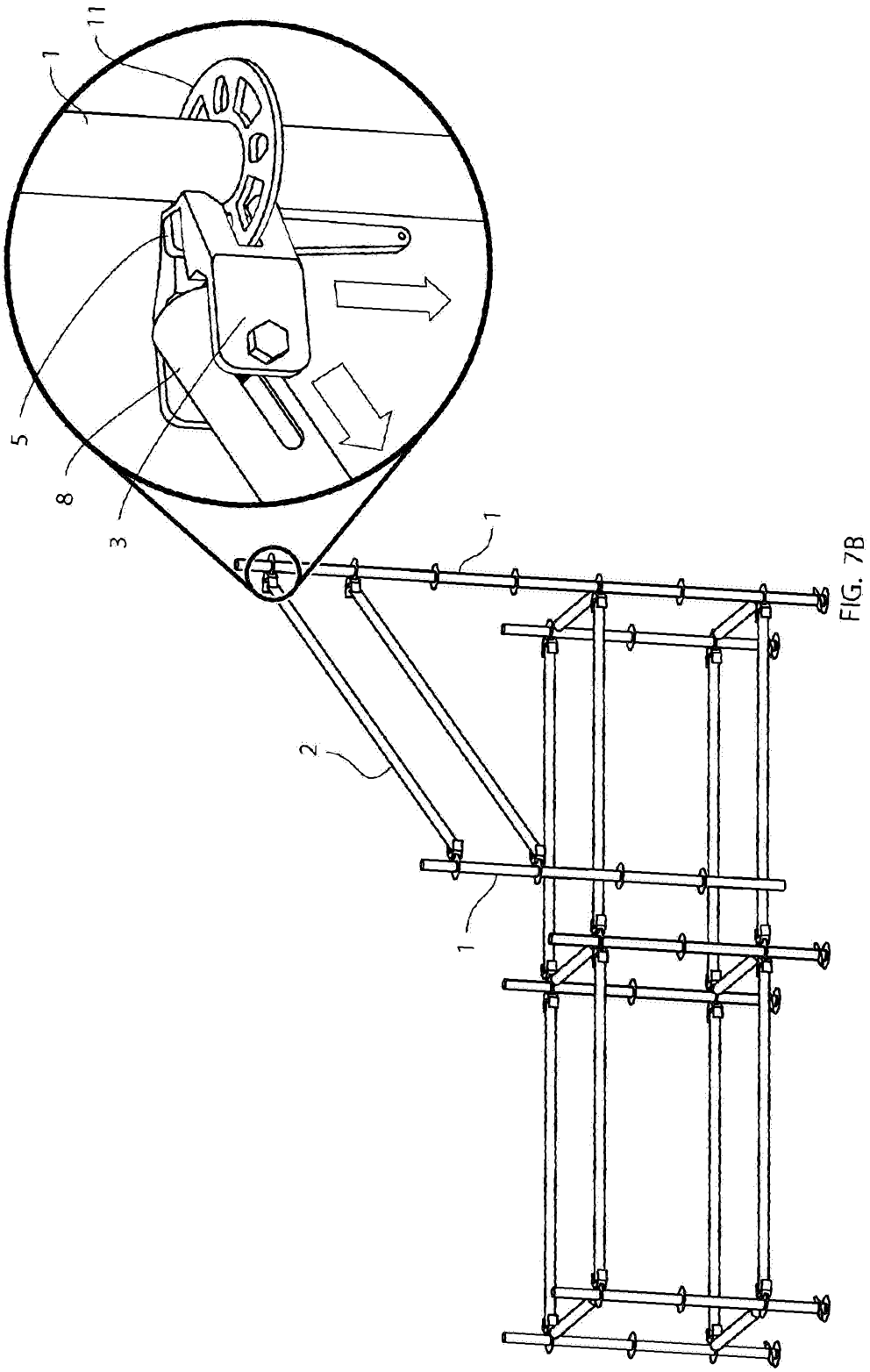

FIG. 7B

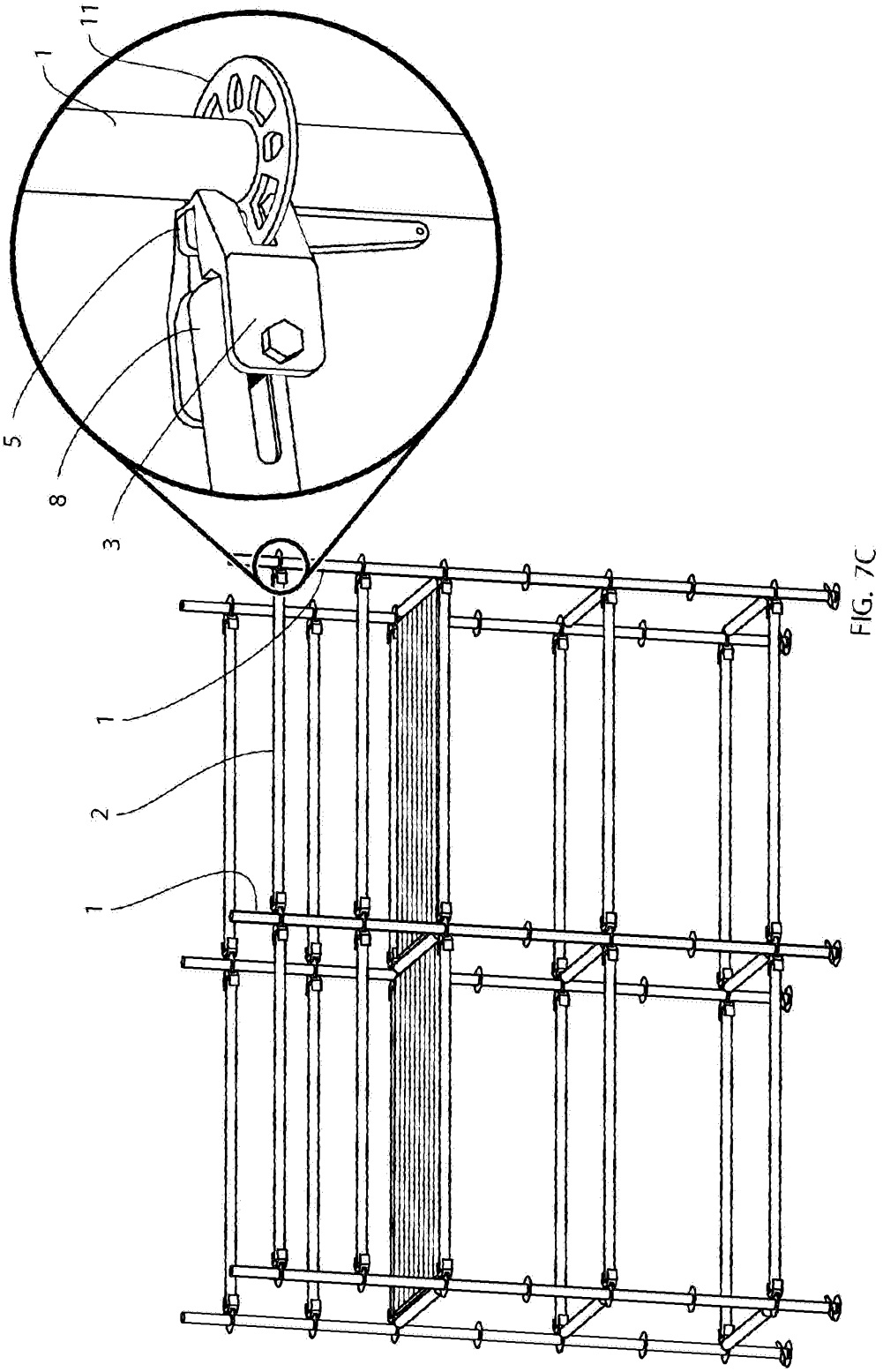

FIG. 7C

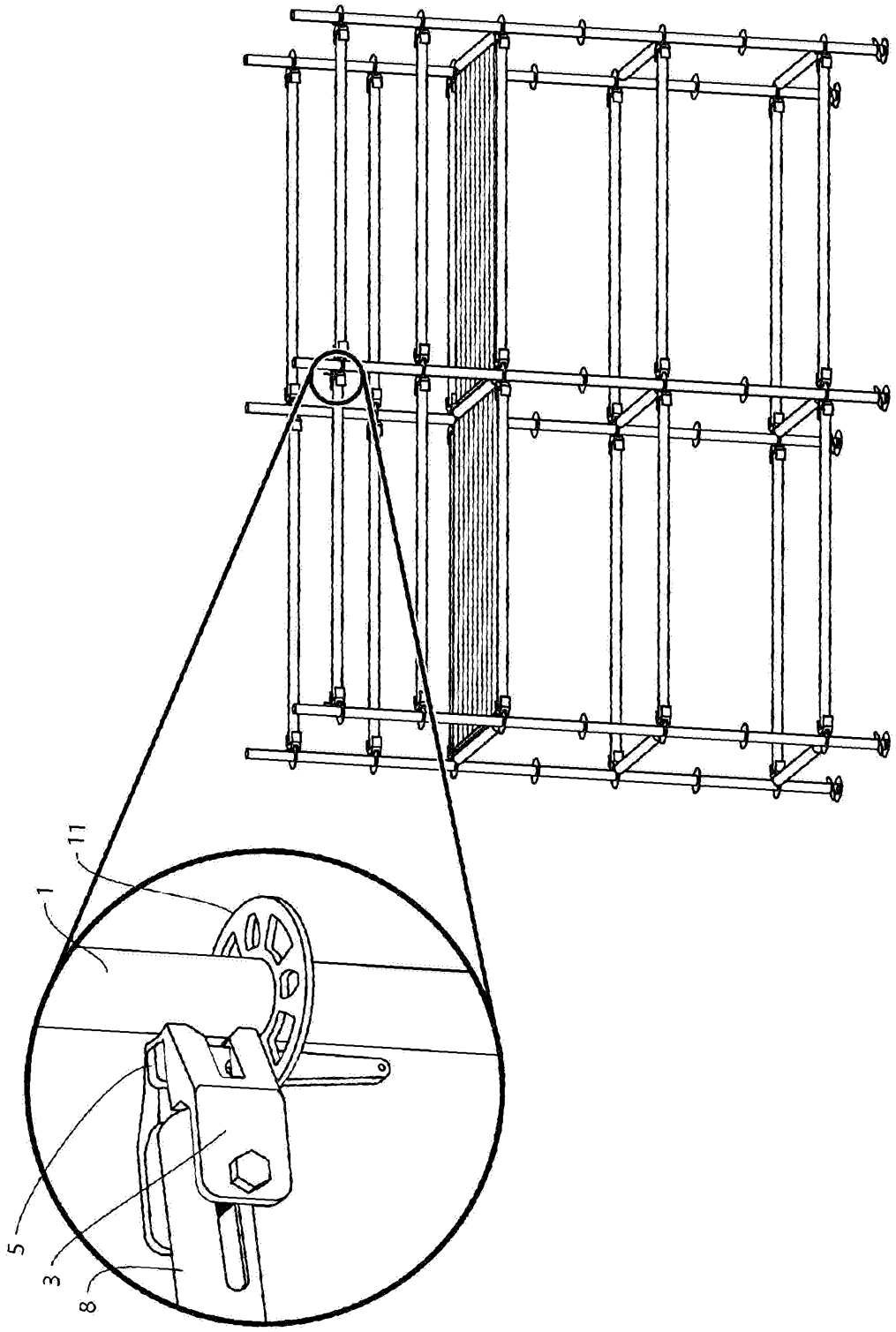

FIG. 8A

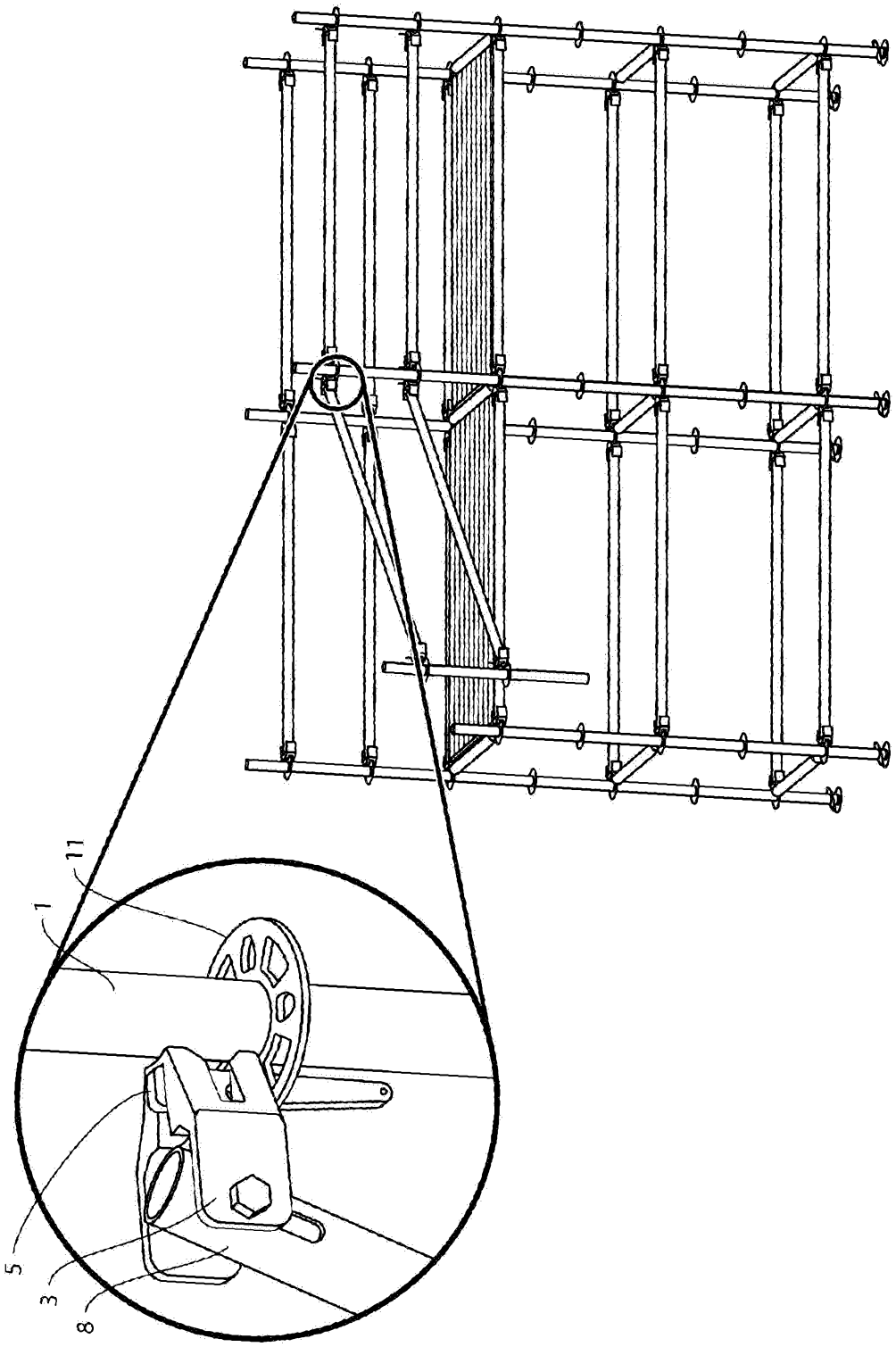

FIG. 8B

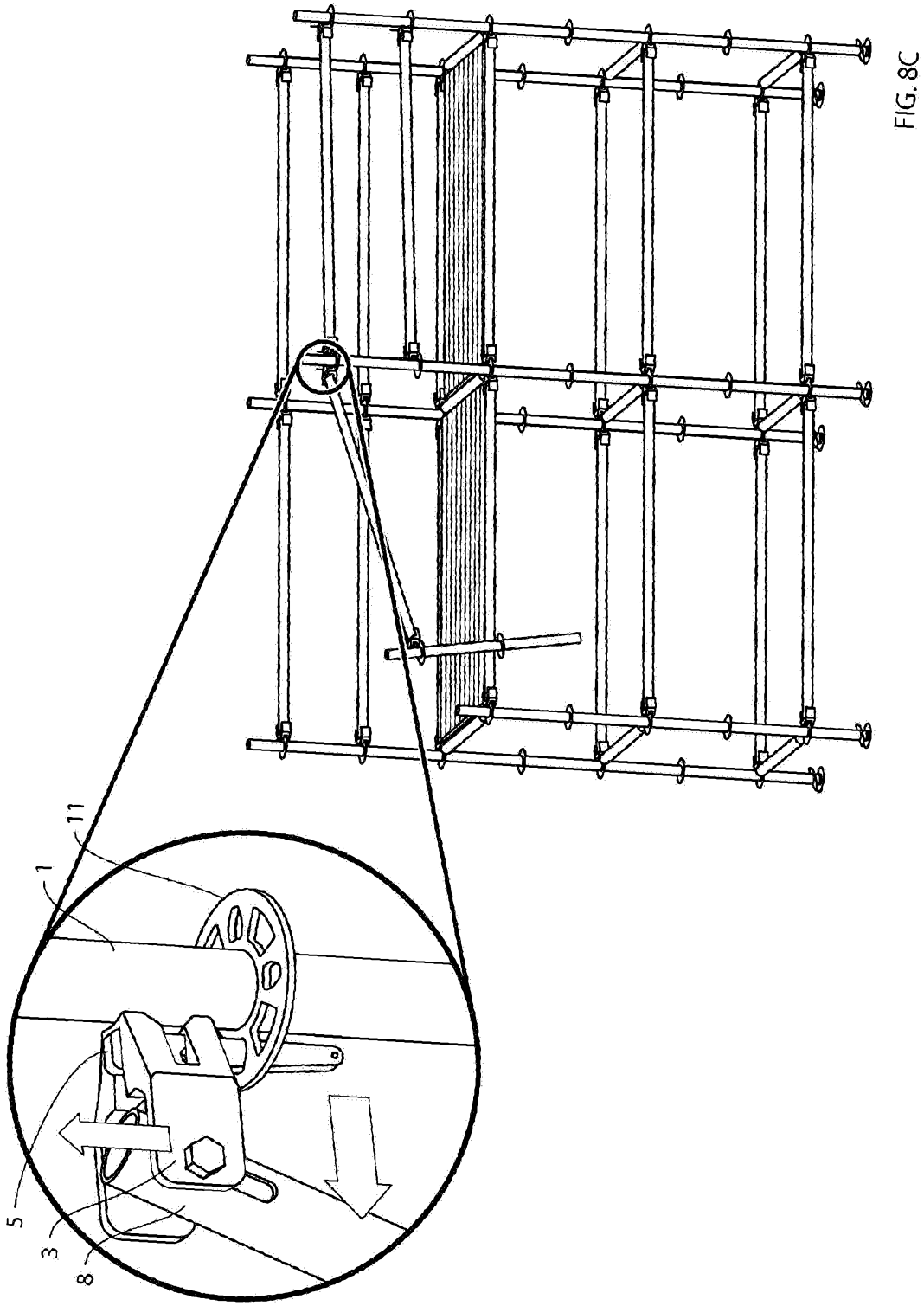

FIG. 8C

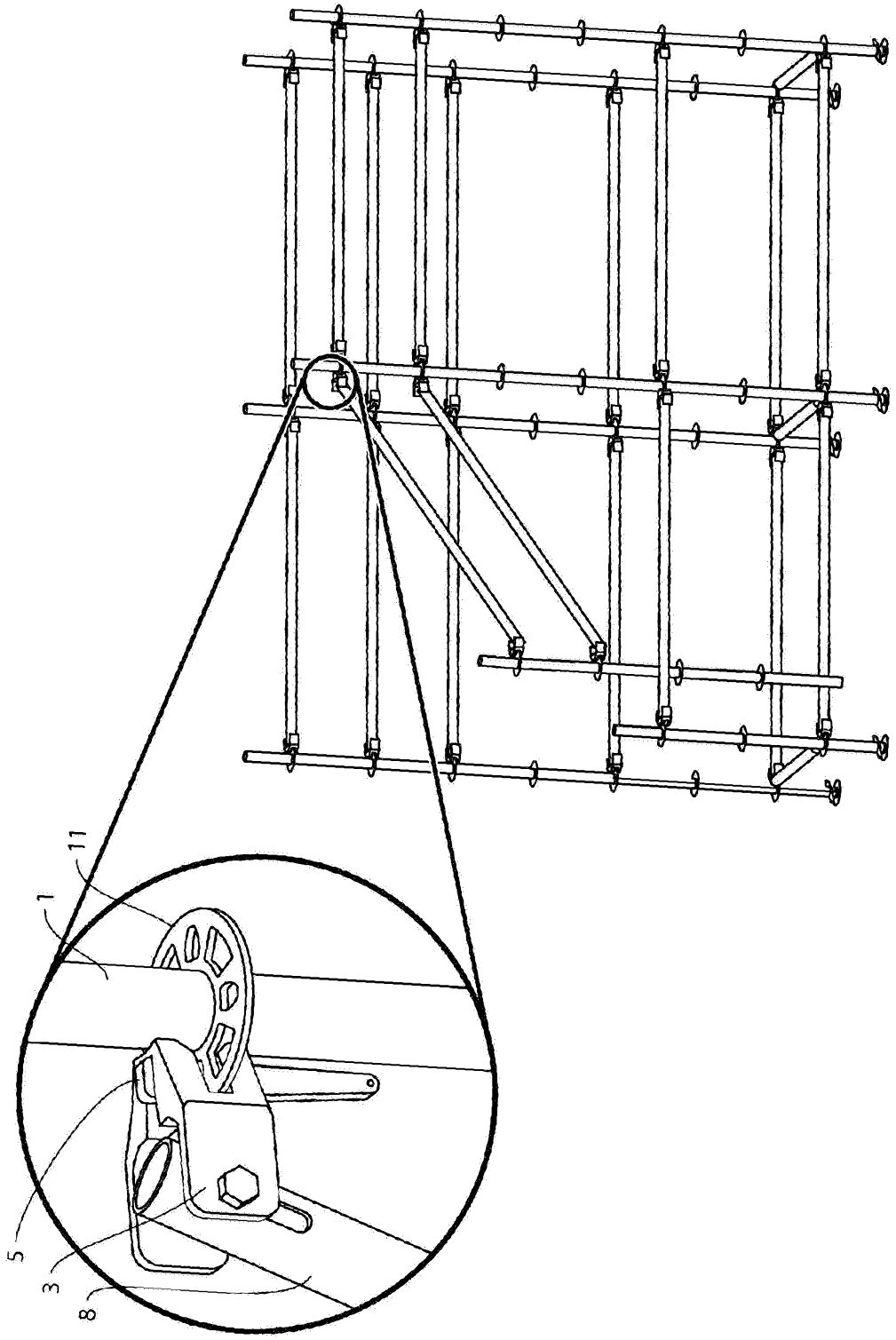

FIG. 9A

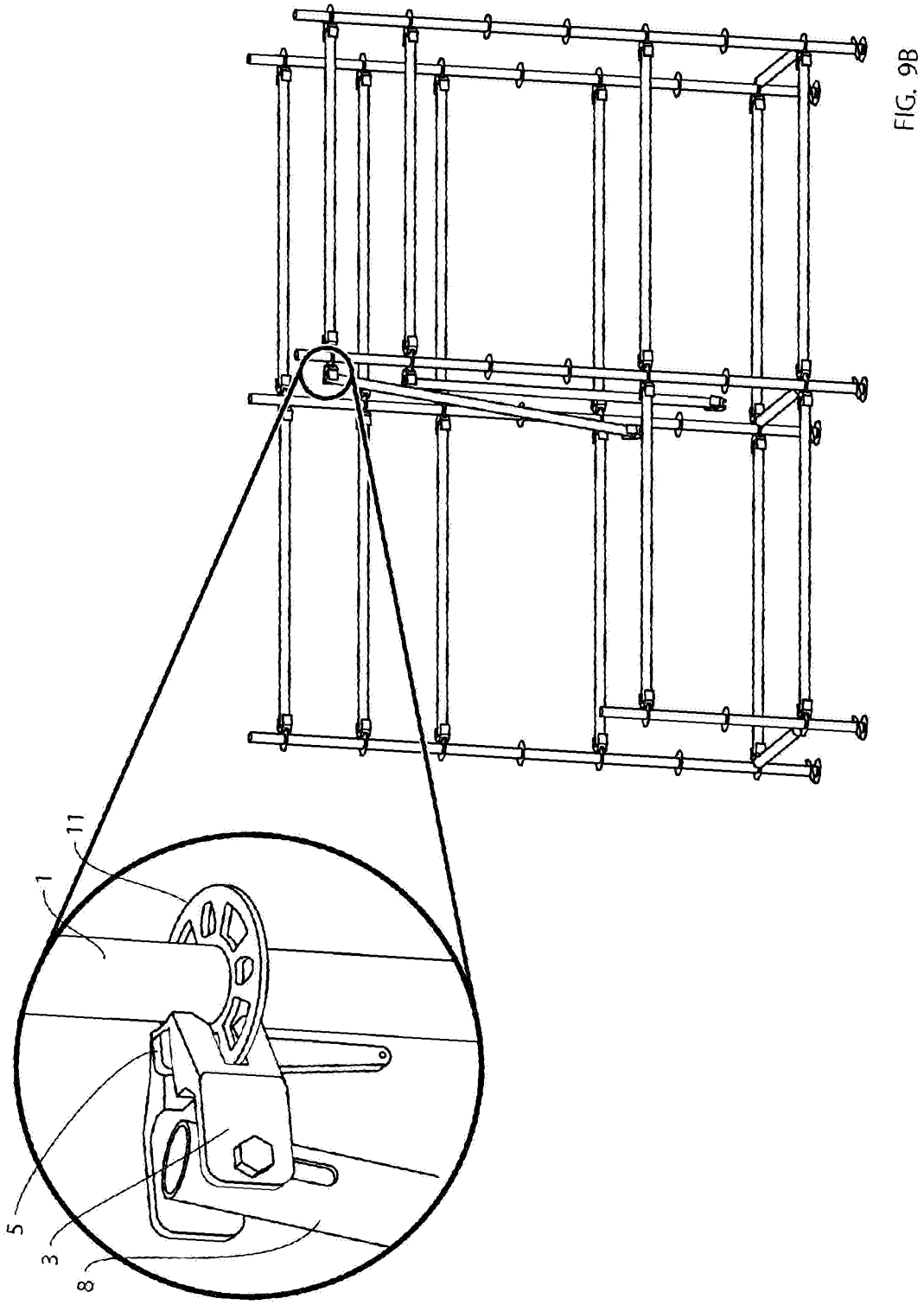

FIG. 9B

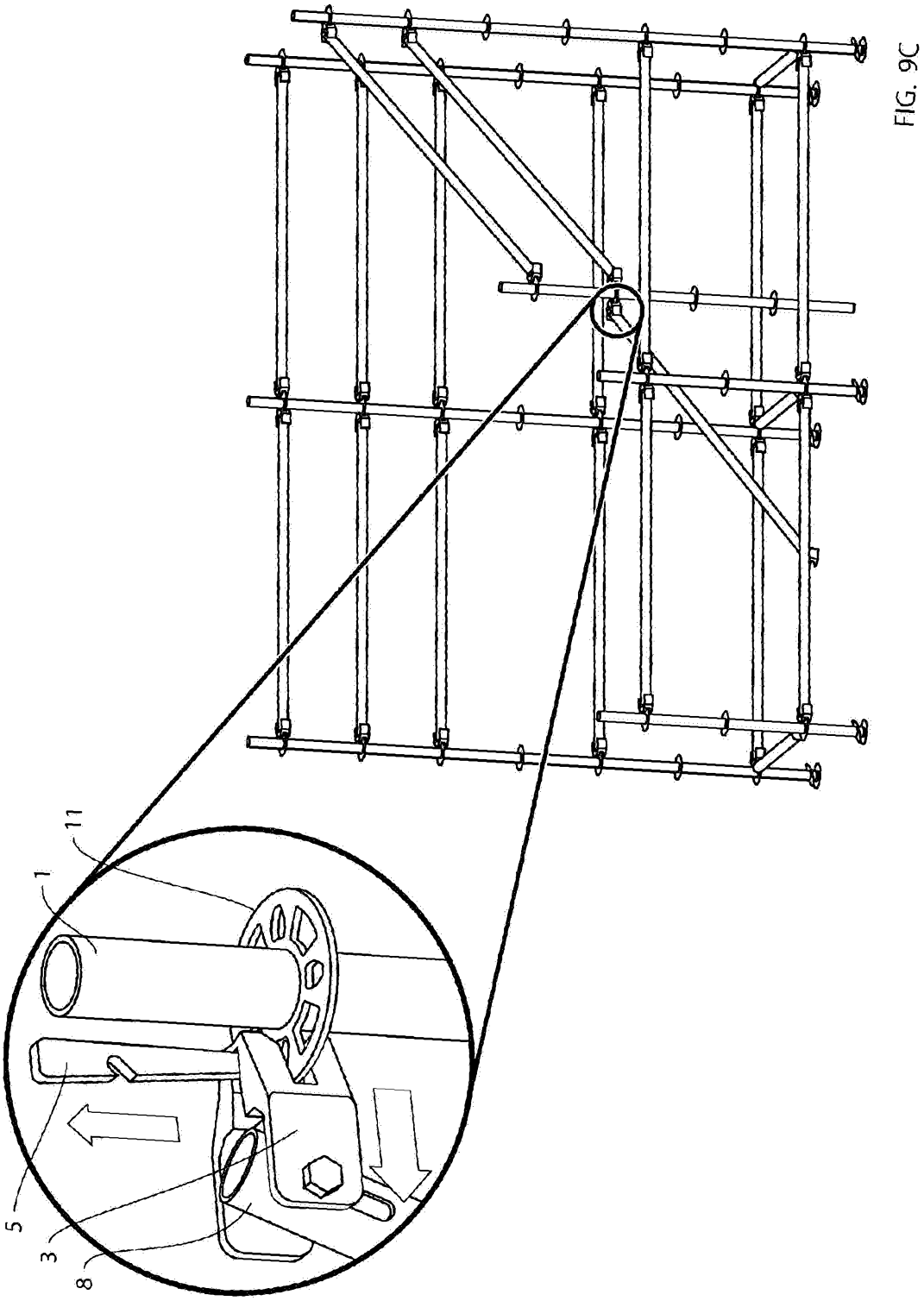

FIG. 9C

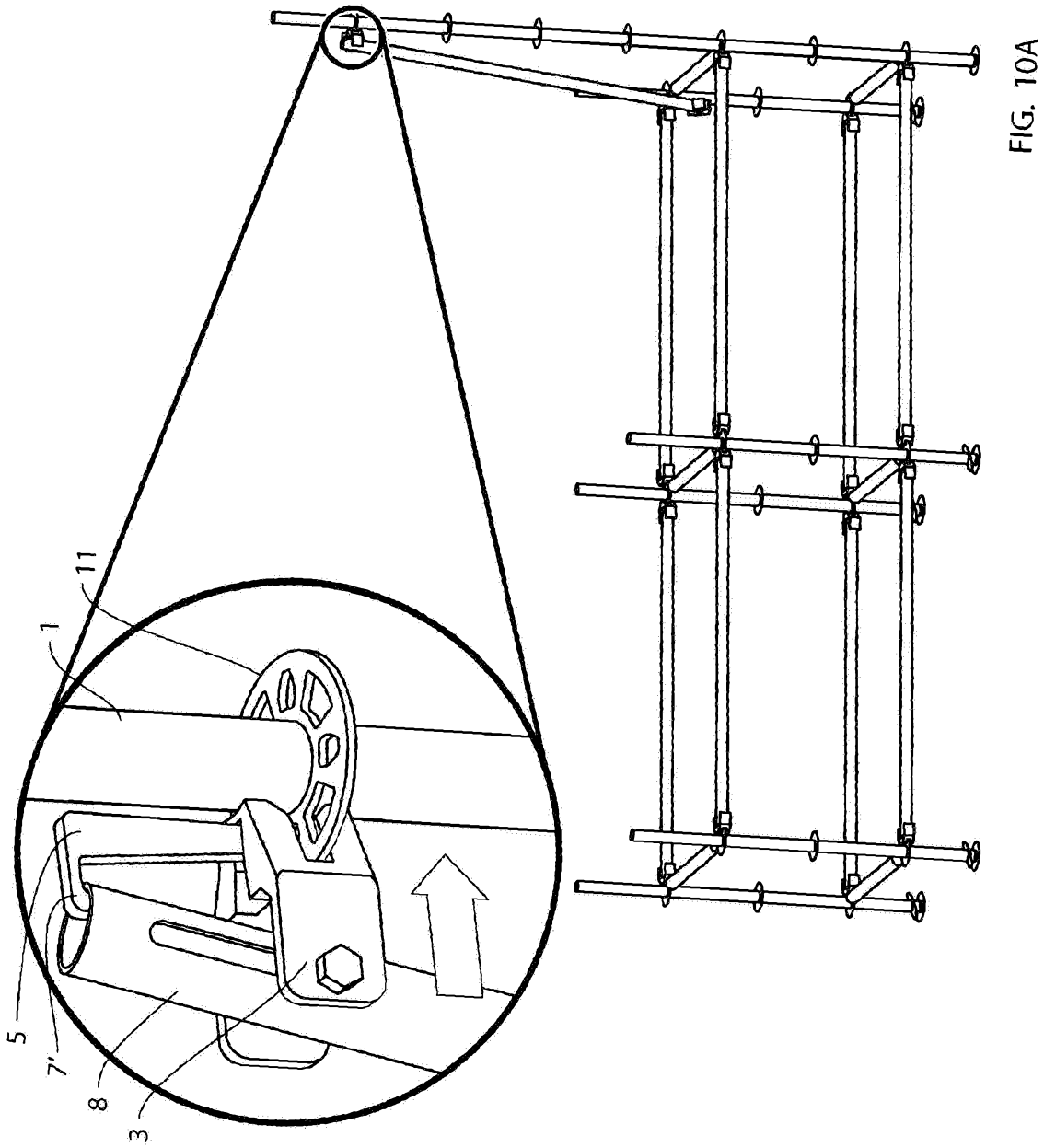

FIG. 10A

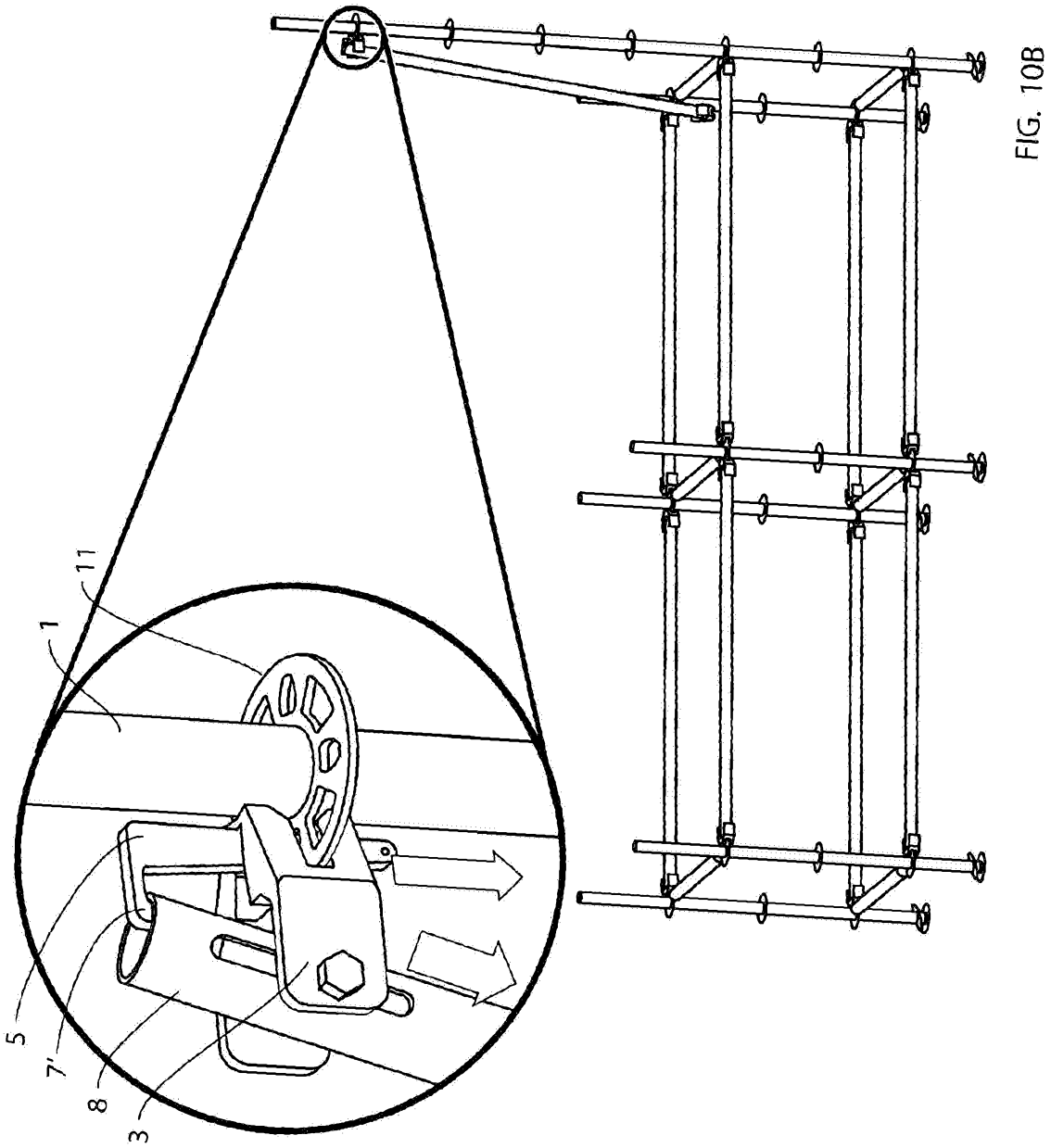

FIG. 10B

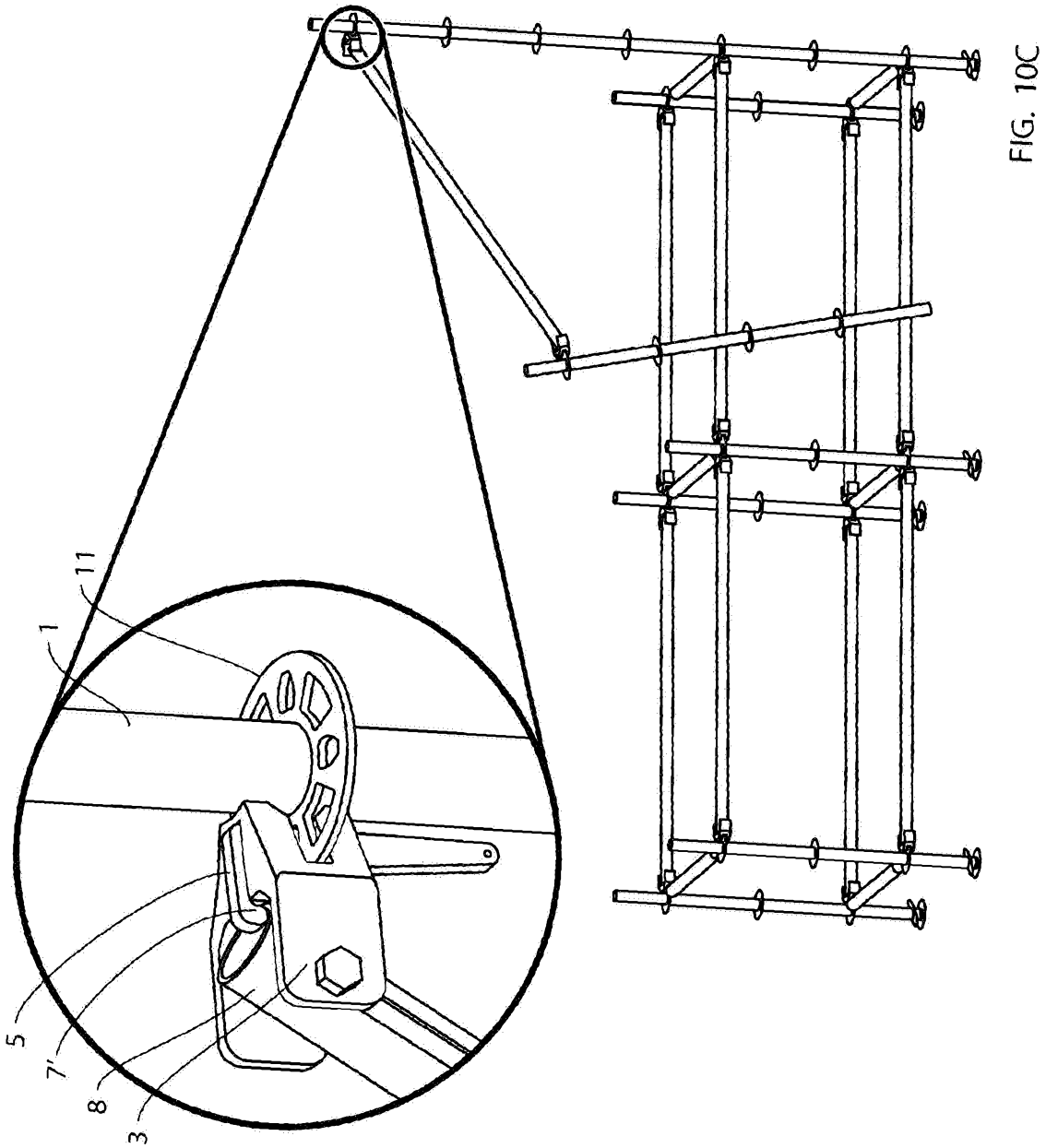

FIG. 10C

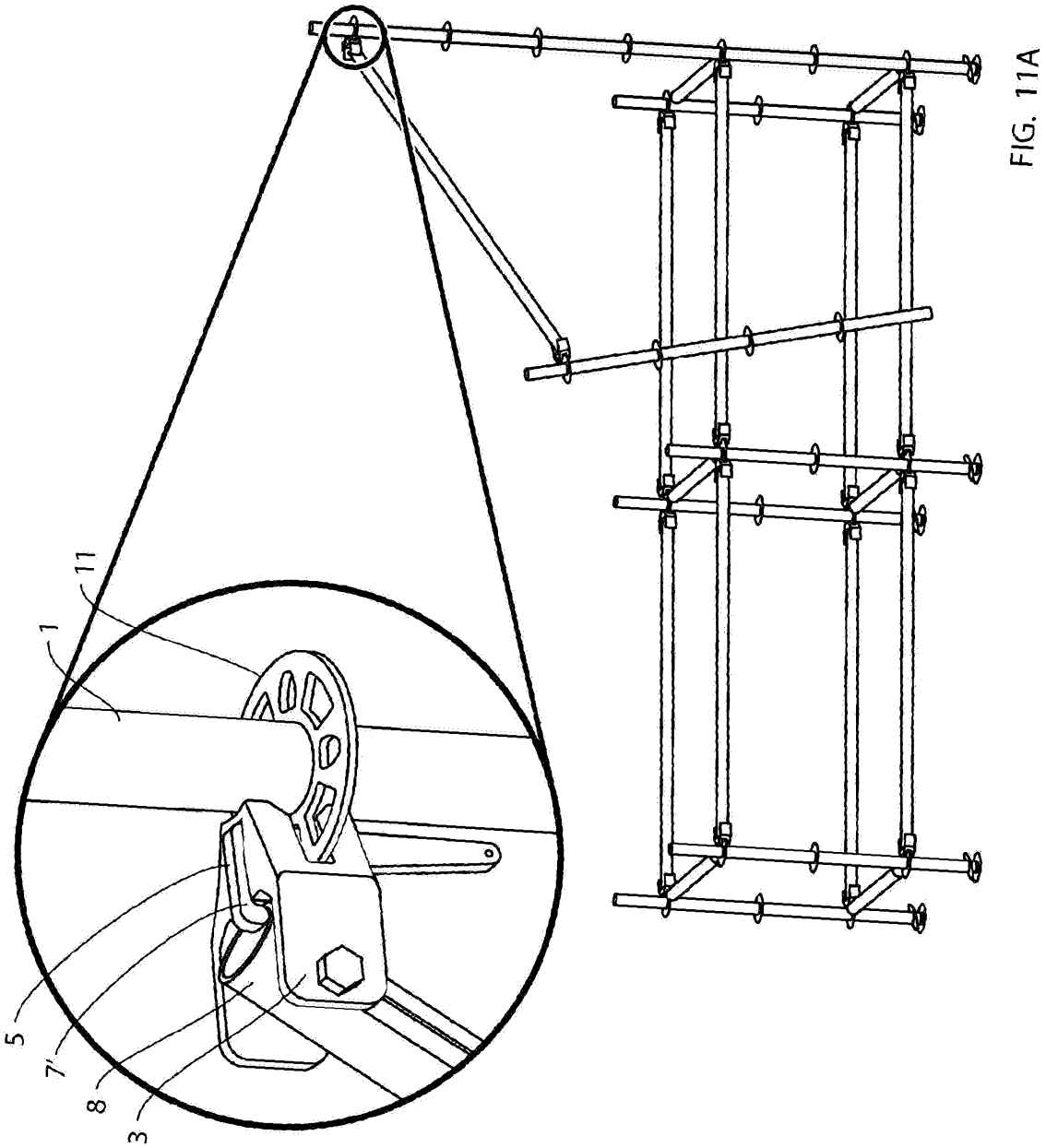

FIG. 11A

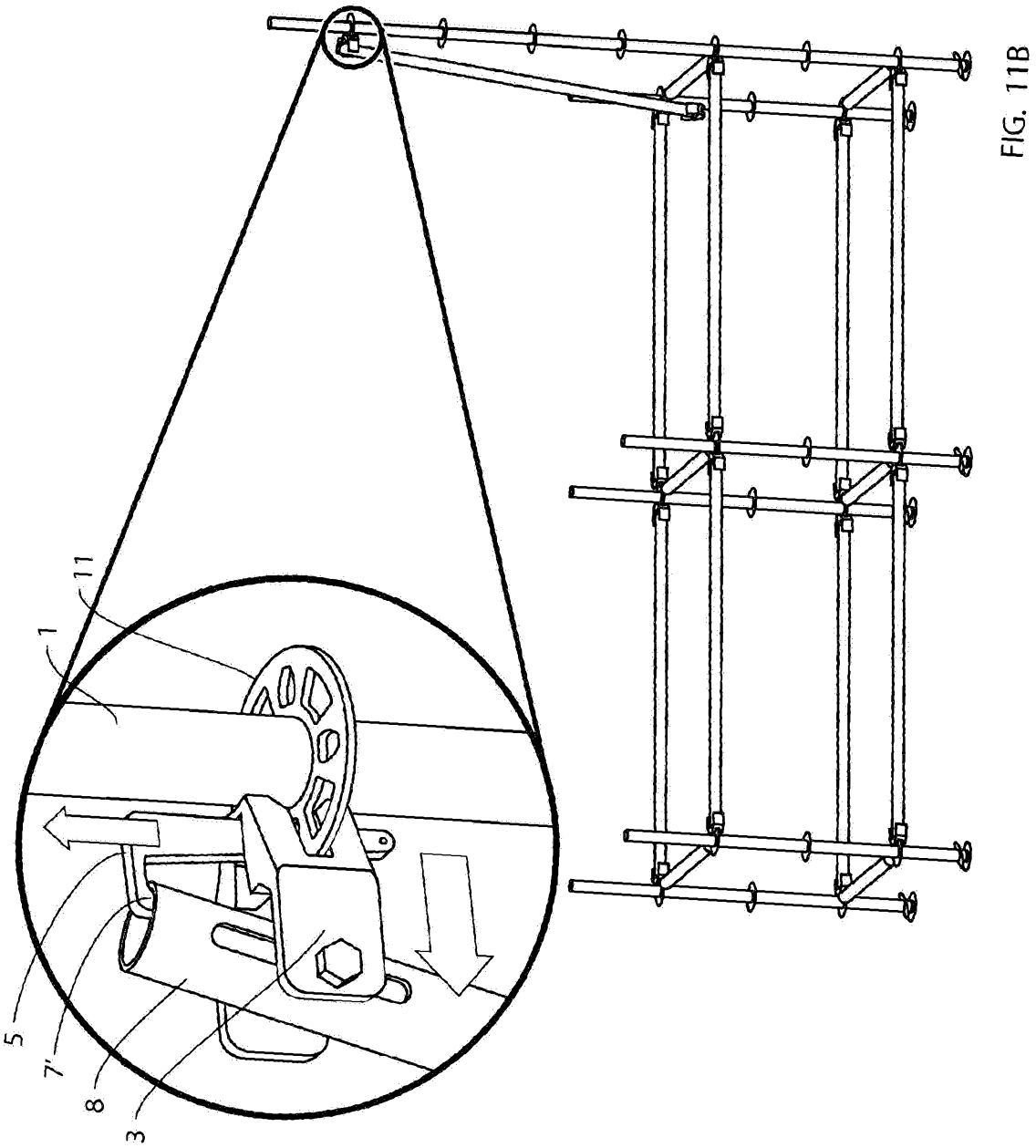

FIG. 11B