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(54) **A DEVICE FOR ROLL FORMING OF SHEET METAL**

(57) A device for roll forming of sheet metal, comprising a series of forming stations (10), each of said forming stations (10) having a pair of mutually parallel shafts (11, 12) with complementary forming rolls (111, 112) for gradual shaping of sheet metal between the rolls (111, 112). The device comprises a series of pairs of rotatable turret type fittings (30A, 30B) with radial arms (32A, 32B), on which forming stations (10) are mounted such that the shafts (11, 12) of a particular station extend between the arms (32A) of the first fitting (30A) and the arms (32B) of the second fitting (30B) of a particular pair of fittings, wherein on each pair of the fittings (30A, 30B) at least two different forming stations (10) are mounted, each of said forming stations (10) being configured to shape a different profile. Each pair of the fittings (30A, 30B), comprises a station drive (20) for driving the forming station (10) and a coupling mechanism (50) for releasable coupling of the station drive (20) with the forming station (10) arranged in a predetermined working position in a particular pair of rotatable turret type fittings (30A, 30B).

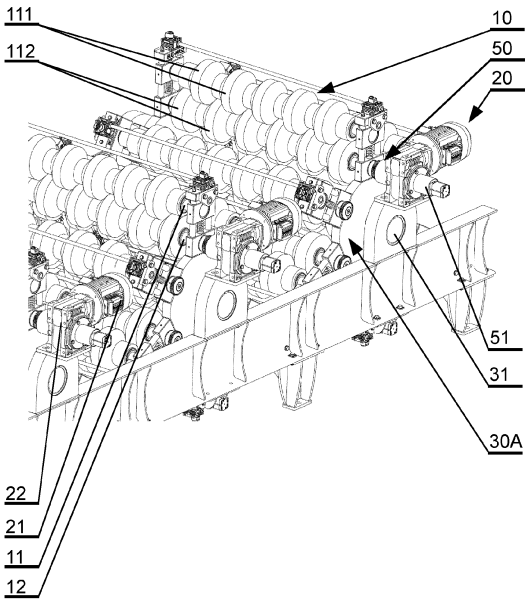

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to roll forming of sheet metal.

BACKGROUND

[0002] There are known various devices for roll forming of profiled metal strips or sheets, wherein the profiled shape is formed from a flat strip or sheet in a multi-step process.

[0003] For example, EP1339508 discloses a roll-forming machine that includes in line a device for unwinding metal strip from a strip reel, a strip cutter, and a roll-forming section. The roll-forming section includes a row of forming stations that include forming rolls that are carried by shafts which are supported on a respective one side of the sheet section.

SUMMARY

[0004] There is a need to provide a device for roll forming of sheet metal which would enable the production of corrugated metal sheets having various shapes of profiles.

[0005] An object of the invention is a device for roll forming of sheet metal, comprising a series of forming stations, each of said forming stations having a pair of mutually parallel shafts with complementary forming rolls for gradual shaping of sheet metal between the rolls. The device comprises a series of pairs of rotatable turret type fittings with radial arms, on which forming stations are mounted such that the shafts of a particular station extend between the arms of the first fitting and the arms of the second fitting of a particular pair of fittings, wherein on each pair of the fittings at least two different forming stations are mounted, each of said forming stations being configured to shape a different profile. Each pair of the fittings, comprises a station drive for driving the forming station and a coupling mechanism for releasable coupling of the station drive with the forming station arranged in a predetermined working position in a particular pair of rotatable turret type fittings.

[0006] Such device enables the production of corrugated metal sheets with various shapes of profiles. It can be used in production halls of small sizes, since it basically replaces as many devices as the number of various forming stations which it comprises on the turret type fittings. This is important, considering the fact that devices of this type occupy a lot of space (especially if they comprise a series of several dozen stations) and require large material inputs for their construction.

[0007] The station drive and the coupling mechanism can be located at one of the fittings of the pair of fittings. This simplifies the design of the device.

[0008] The device may comprise at least one positioning drive configured to change the angular position of at least two pairs of fittings. This reduces the number of elements of the device.

[0009] The pairs of fittings can be connected to each other by means of a drive element. This allows to simultaneously control a plurality of fittings by a single drive.

[0010] The device may comprise a plurality of positioning drives, each configured to change the angular position of a single pair of fittings. This allows to control the fittings independently of each other.

[0011] The metal sheets can steel sheets or sheets of any other metal that is to be roll formed.

BRIEF DESCRIPTION OF FIGURES

[0012] The object of the invention has been shown by means of an example embodiment in the drawing, wherein:

Fig. 1 shows a fragment of a device in an axonometric view;
Fig. 2 shows a fragment of the device in a side view;
Fig. 3 shows a fragment of the device in a top view;
Fig. 4 shows a fragment of the device in a front view;
Fig. 5 shows a fragment of the device in an axonometric front view;
Fig. 6A shows a coupling mechanism in an extended position;
Fig. 6B shows a cross-section of the coupling mechanism in a coupled position;
Fig. 7A shows a locking mechanism in an unlocked position;
Fig. 7A shows the locking mechanism in a locked position;
Fig. 8 shows a location of a position sensor of a forming station;
Fig. 9 shows the device with a series of forming stations,
Fig. 10 shows final stations of the device with a formed metal sheet.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0013] Figs. 1-5 present a fragment of a device for roll forming according to an example embodiment, shown in its entirety in Fig. 9.

[0014] The device for roll forming of sheet metal comprises a series of forming stations 10 aligned one after another, each of which has a pair of mutually parallel shafts 11, 12 with complementary forming rolls 111, 112 for gradual forming of sheet metal between the rolls 111, 112. Forming consists of feeding flat sheet metal to the first forming station 10A, the forming rolls 111, 112 of which bend the sheet metal to a certain degree, and subsequently, on the following forming stations, further bends are made until achieving the desired final shape on the last forming station 10Z (as shown in Figs. 9, 10). Depending on the degree of complexity of the desired

shape of sheet metal to be formed, it can be required for the sheet metal to pass through a smaller or larger number of forming stations, usually from 10 to 30 forming stations 10.

[0015] The forming stations 10 are mounted on rotational turret type fittings 30A, 30B arranged in pairs, with radial arms 32A, 32B (shown in detail in Fig. 5), preferably at the ends of these arms 32A, 32B, in such a manner that the shafts 11, 12 of a particular forming station 10 extend between the arms 32A, 32B of the first and the second fitting 30A, 30B of a particular pair of fittings. On each pair of rotatable turret type fittings 30A, 30B there are at least two different forming stations 10, each of which is configured to perform shaping of a different profile of sheet metal.

[0016] Moreover, near one of the rotatable turret type fittings 30A in each pair of turret type fittings 30A, 30B, there is a station drive 20 for driving the forming station 10 and a coupling mechanism 50 for releasably coupling the station drive 20 with the forming station 10 arranged in a predetermined working position in this pair of rotatable turret type fittings 30A, 30B.

[0017] When in operation, on each pair of rotatable turret type fittings 30A, 30B, one forming station 10 is arranged in the working position, enabling gradual shaping of sheet metal.

[0018] A change in the angular position of rotatable turret type fittings 30A, 30B can be realised manually or by means of a positioning drive 40.

[0019] In one of possible embodiments, the device can comprise at least one positioning drive 40 to change the angular position of at least two pairs of rotatable turret type fittings 30A, 30B. Preferably, the subsequent pairs of rotatable turret type fittings 30A, 30B driven by a respective drive 40 are connected to each other by means of driving elements 41, for example by means of a cog belt or a chain, which engage pulleys or cogwheels 44 mounted on the axles 31 of the rotatable turret type fittings, in order to synchronously change the angular position of all pairs of rotatable turret type fittings (30A, 30B). Preferably, each driving element 41 connects only the two neighbouring pairs of rotatable turret type fittings to each other. This allows avoiding inaccuracies in positioning, resulting from the expansion of long driving elements.

[0020] In another embodiment, each pair of rotatable turret type fittings 30A, 30B can comprise its own positioning drive 40 to change their angular position.

[0021] Each time after rotating the pair of rotatable turret type fittings by 60° (for an embodiment with six forming stations at each pair of turret type fittings), a subsequent forming station 10 is set into the predetermined working position, preferably a top vertical position, enabling the shaping of sheet metal with a specified profile. Preferably, the rotation of the pair of rotatable turret type fittings 30A, 30B is realised by means of the positioning drive 40 comprising a motor 42 connected to the axle 31 by means of a gear 43 (Fig. 4).

[0022] As mentioned above, each forming station 10 which is currently in its working position is driven by means of the individual drive 20. Preferably, the station drive 20 comprises a motor 21 and a gear 22 connected to a coupling mechanism 50. The coupling mechanism 50 allows releasable coupling of the drive axle (which can be the axle of one of the shafts 11, 12) of the forming station 10 with the station drive 20. When, after the rotation of the pair of turret type fittings 30A, 30B, the selected forming station 10 gets into the predetermined working position, then a multi-ribbed outer cup 52 of the coupling mechanism 50 is inserted by means of an actuator 51, preferably by means of a pneumatic actuator, onto its corresponding multi-ribbed protrusion 53 of the drive axle (as shown in detail in Figs. 6A, 6B).

[0023] Preferably, before coupling the forming station 10 with the drive 20, the rotary movement of the pair of turret type fittings 30A, 30B is blocked by means of a locking mechanism 60. Preferably, the locking mechanism 60 comprises a pneumatic actuator ended with a conical moulding, which in the working position of the actuator slides into a conical slot, fixing the position of the pair of rotatable turret type fittings (as shown in Figs. 7A, 7B). Likewise, in order to rotate the pair of turret type fittings, the locking mechanism 60 releases the lock, enabling the rotation of the fittings.

[0024] Preferably, the reaching of the predetermined working position by the forming station 10 is detected by means of a position sensor 80 mounted at the top of one of the arms 32A, 32B (Fig. 8).

[0025] Preferably, the distance between the shafts 11, 12 with the forming rolls 111, 112 is adjustable by means of an adjustment mechanism 70, which comprises a motor with a gear, on which one among the pair of shafts 11, 12 is movably mounted.

[0026] In a preferable embodiment, each pair of rotatable turret type fittings 30A, 30B has six pairs of arms 32A, 32B, wherein on each pair of the arms 32A, 32B the forming station 10 is mounted, each one configured to perform shaping of a different profile of sheet metal. A device of this type enables the shaping of sheet metal into six different shapes of profiles, depending on which forming stations 10 are arranged in the working position. Such a method for changing the configuration of the device is fast and (so far) it does not require the replacement of shafts with the rolls at the individual stations.

[0027] Fig. 10 shows the final stations of the device with a formed metal sheet. The sheet metal can be cut by means of a cutter with a straight knife placed before the first forming station - the metal sheets 90 being formed in the device are then cut to a specified length, preferably no shorter than two times the distance between the neighbouring forming stations, so that the sheet would be captured by three stations at the same time. Sheet metal can also be formed as a strip and cut only after the last forming station by means of a floating cutter with a tool bit corresponding to the shaped profile.

Claims

1. A device for roll forming of sheet metal, comprising a series of forming stations (10), each of said forming stations (10) having a pair of mutually parallel shafts (11, 12) with complementary forming rolls (111, 112) for gradual shaping of sheet metal between the rolls (111, 112), **characterised in that** the device comprises:

   - a series of pairs of rotatable turret type fittings (30A, 30B) with radial arms (32A, 32B), on which forming stations (10) are mounted such that the shafts (11, 12) of a particular station extend between the arms (32A) of the first fitting (30A) and the arms (32B) of the second fitting (30B) of a particular pair of fittings, wherein on each pair of the fittings (30A, 30B) at least two different forming stations (10) are mounted, each of said forming stations (10) being configured to shape a different profile;
   - wherein, each pair of the fittings (30A, 30B), comprises:

     - a station drive (20) for driving the forming station (10) and
     - a coupling mechanism (50) for releasable coupling of the station drive (20) with the forming station (10) arranged in a predetermined working position in a particular pair of rotatable turret type fittings (30A, 30B).

2. The device according to claim 1, wherein the station drive (20) and the coupling mechanism are located at one of the fittings (30A, 30B) of the pair of fittings (30A, 30B).

3. The device according to any of previous claims, comprising at least one positioning drive (40) configured to change the angular position of at least two pairs of fittings (30A, 30B).

4. The device according to any of previous claims, wherein the pairs of fittings (30A, 30B) are connected to each other by means of a drive element (41).

5. The device according to any of previous claims, comprising a plurality of positioning drives (40), each configured to change the angular position of a single pair of fittings (30A, 30B).

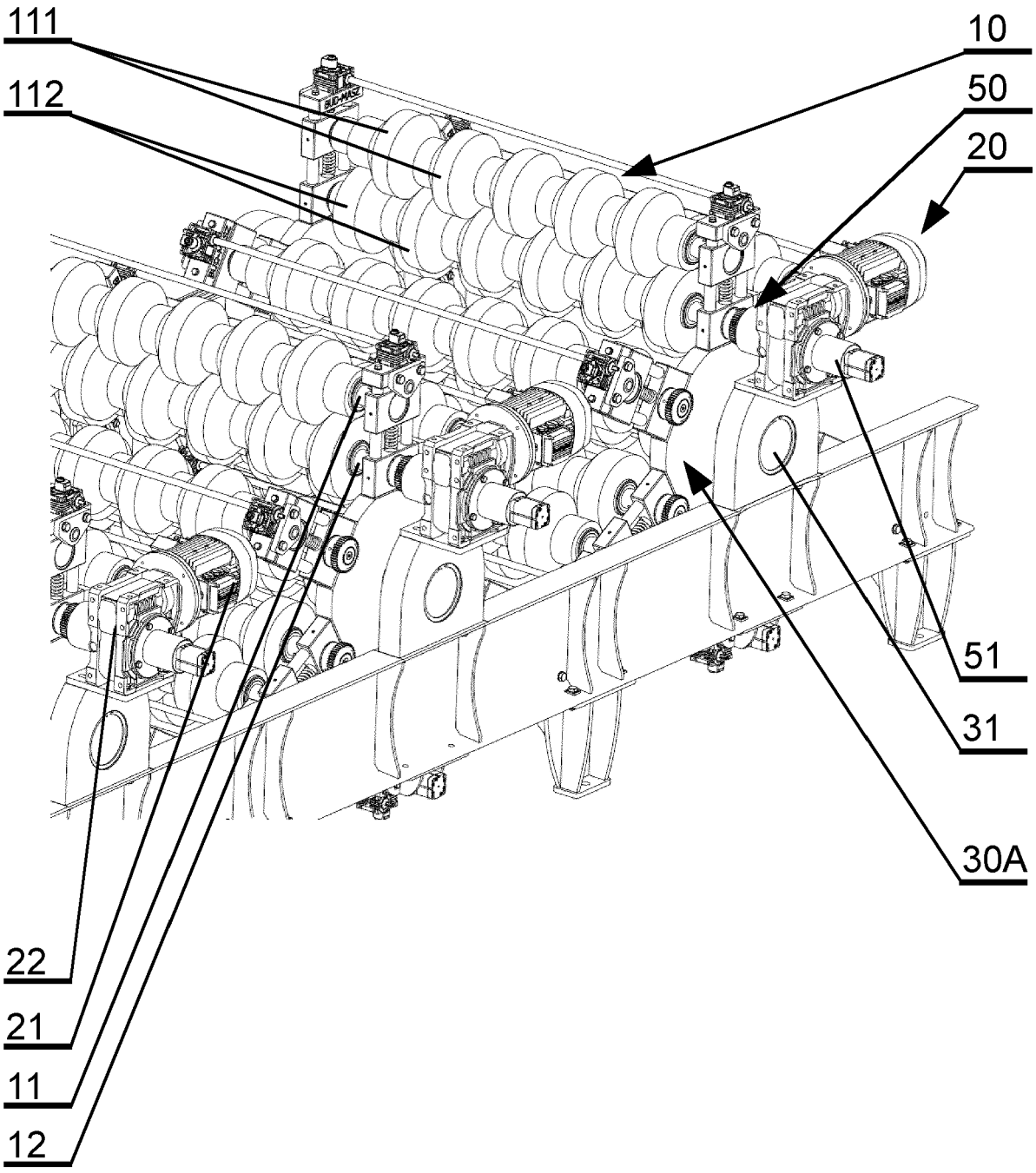

Fig. 1

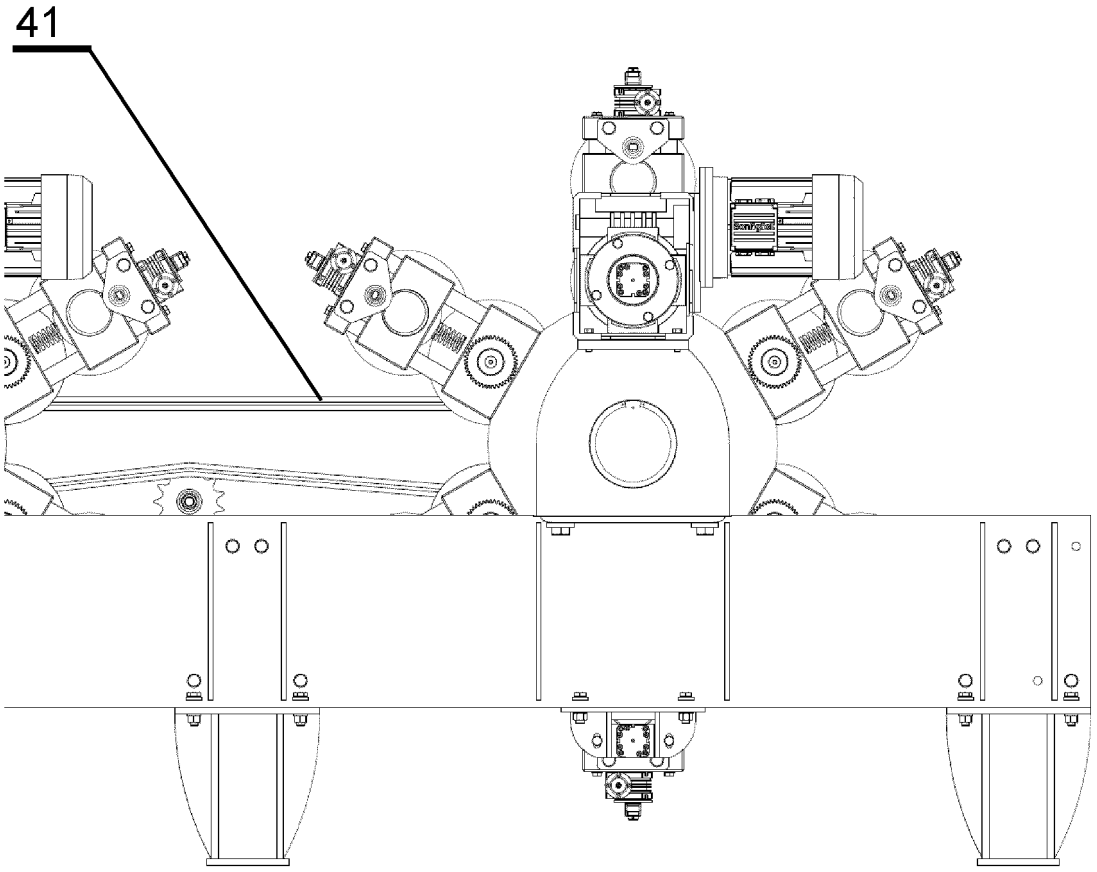

Fig. 2

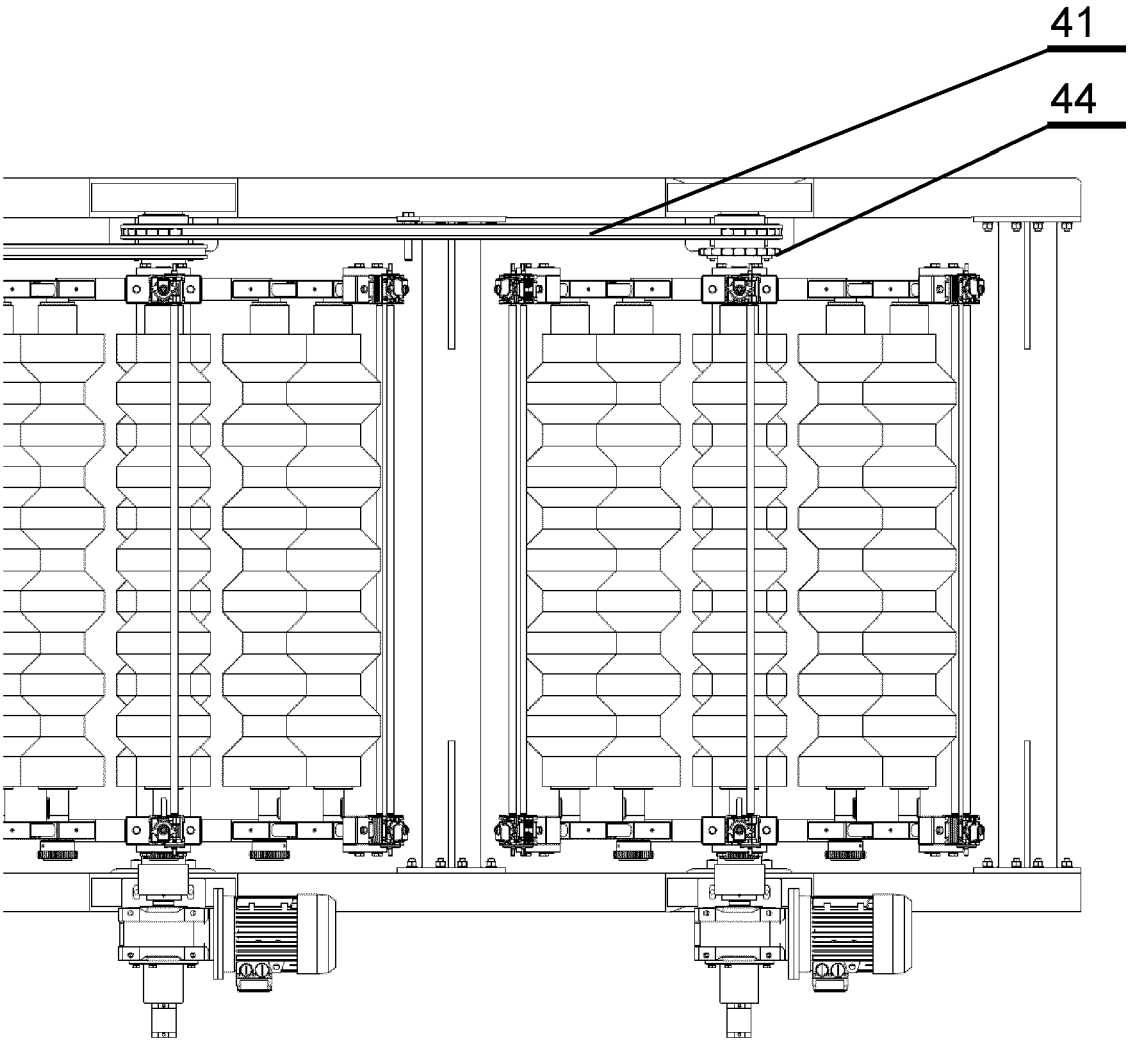

Fig. 3

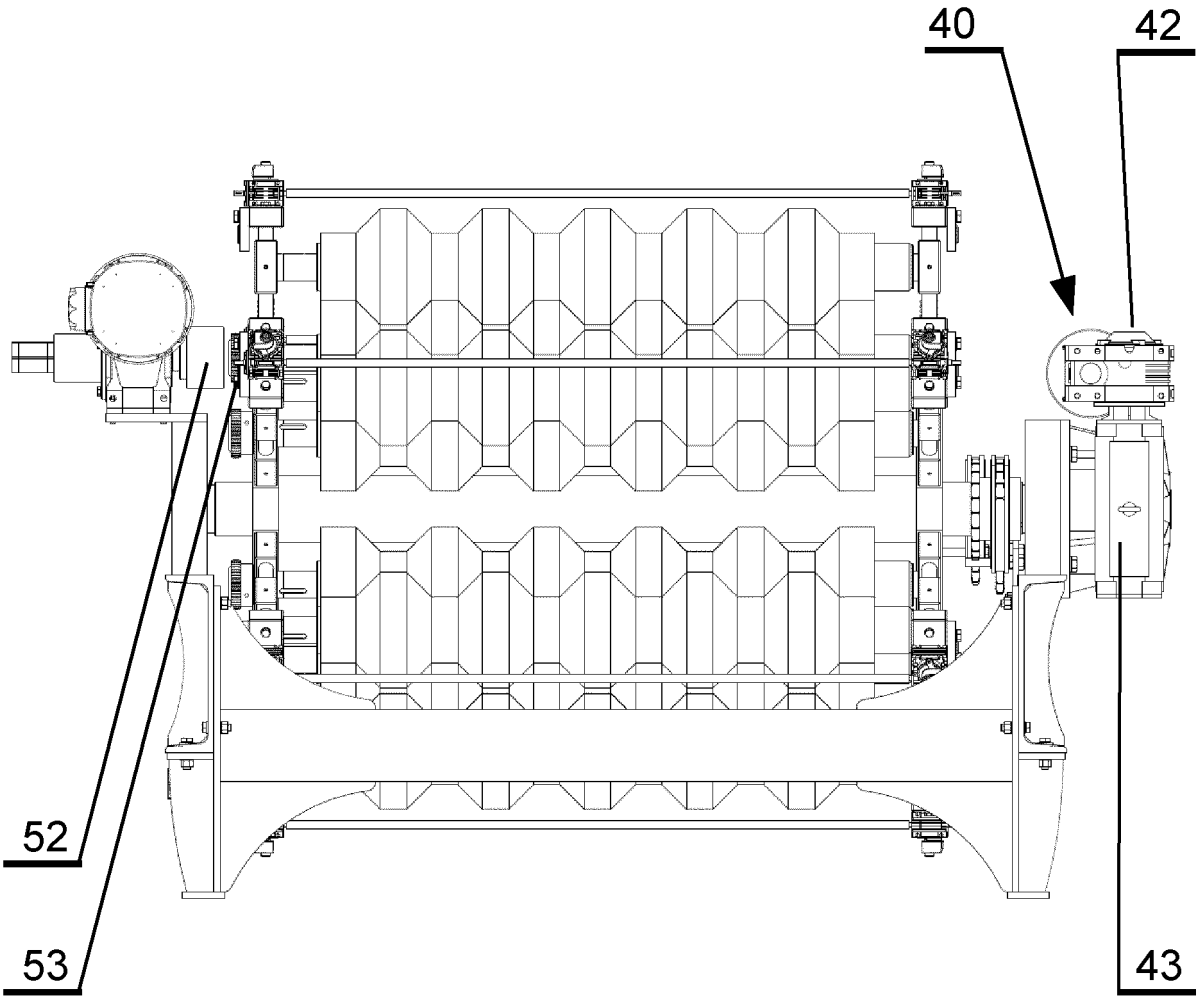

Fig. 4

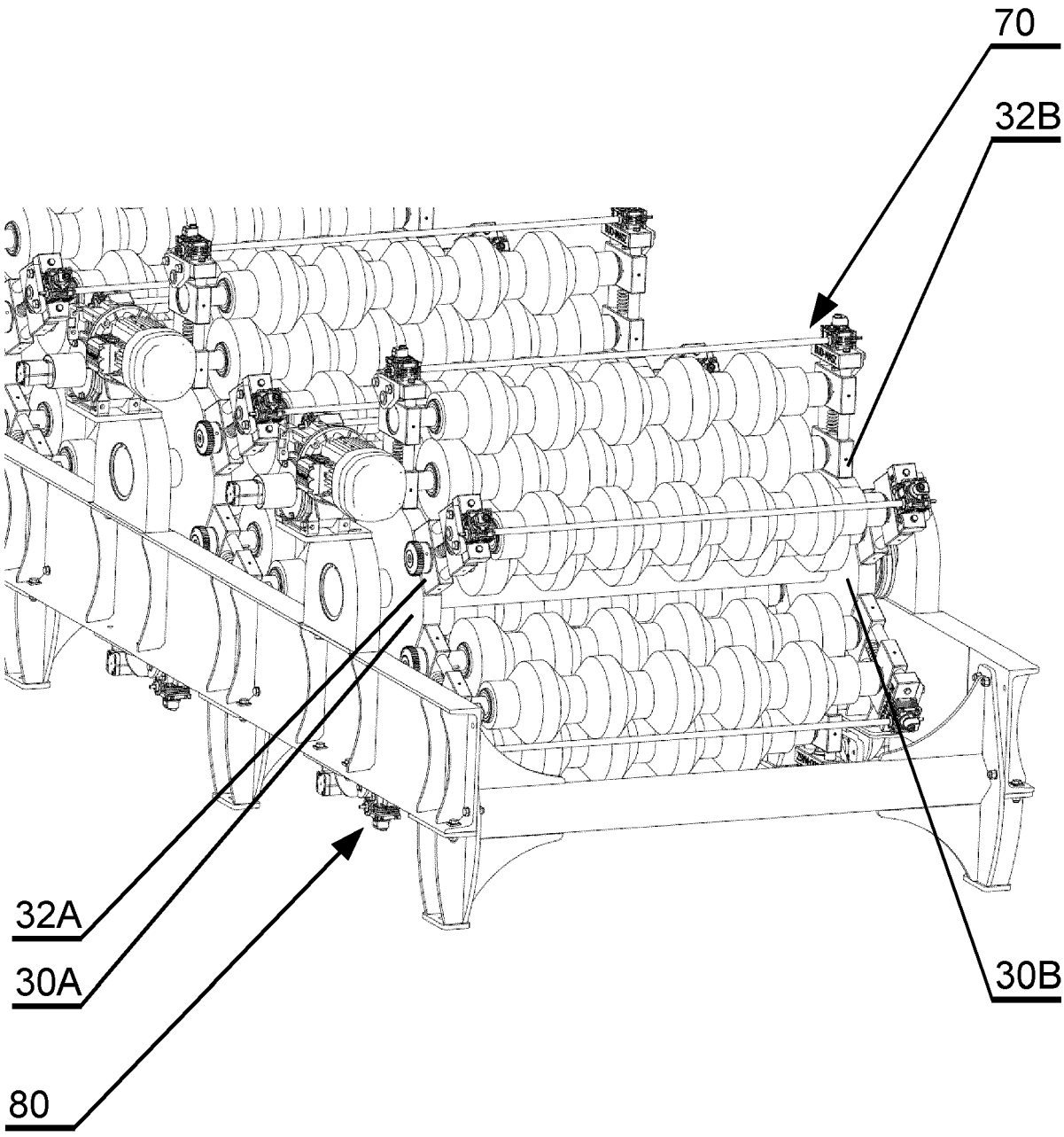

Fig. 5

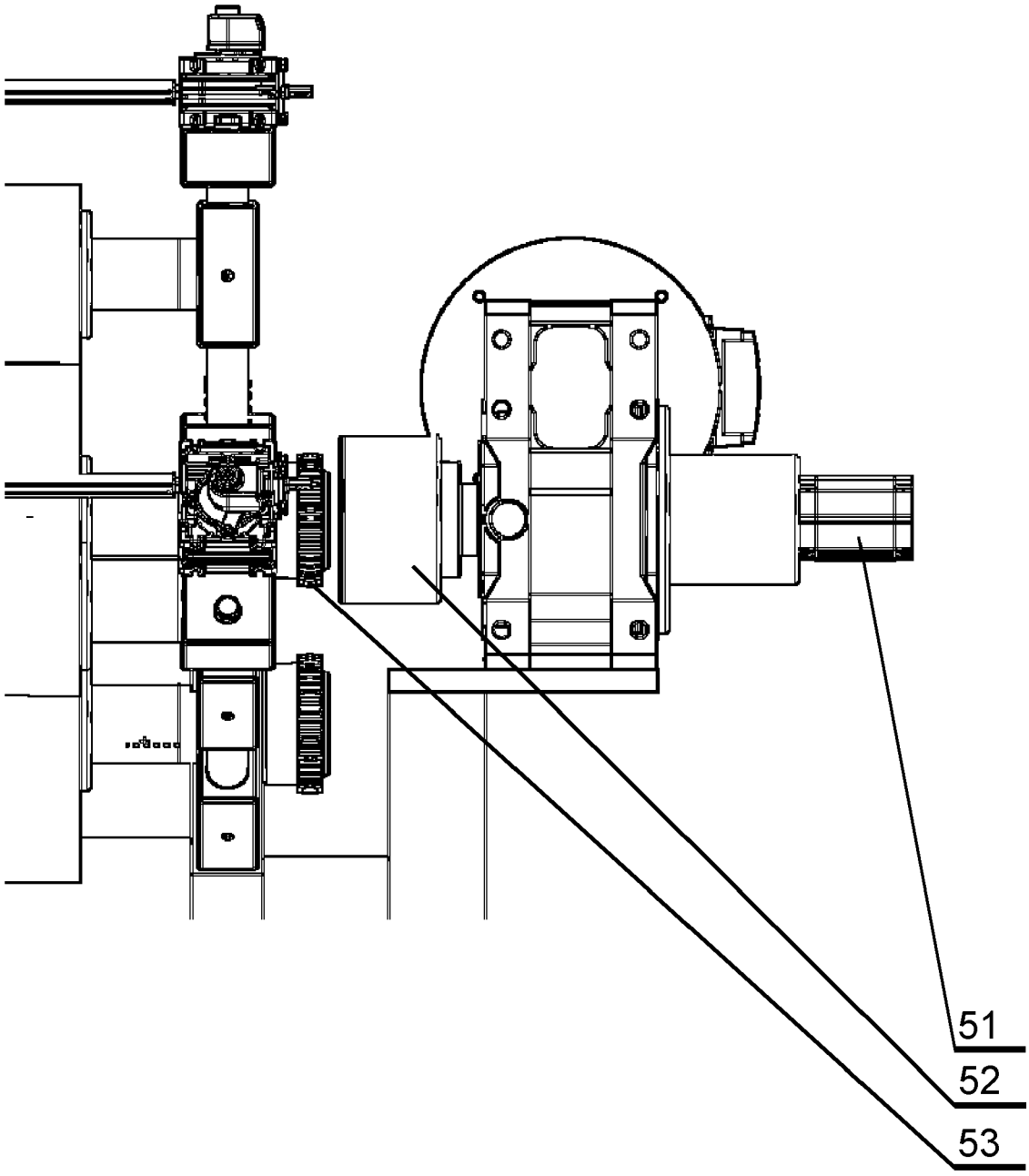

Fig. 6A

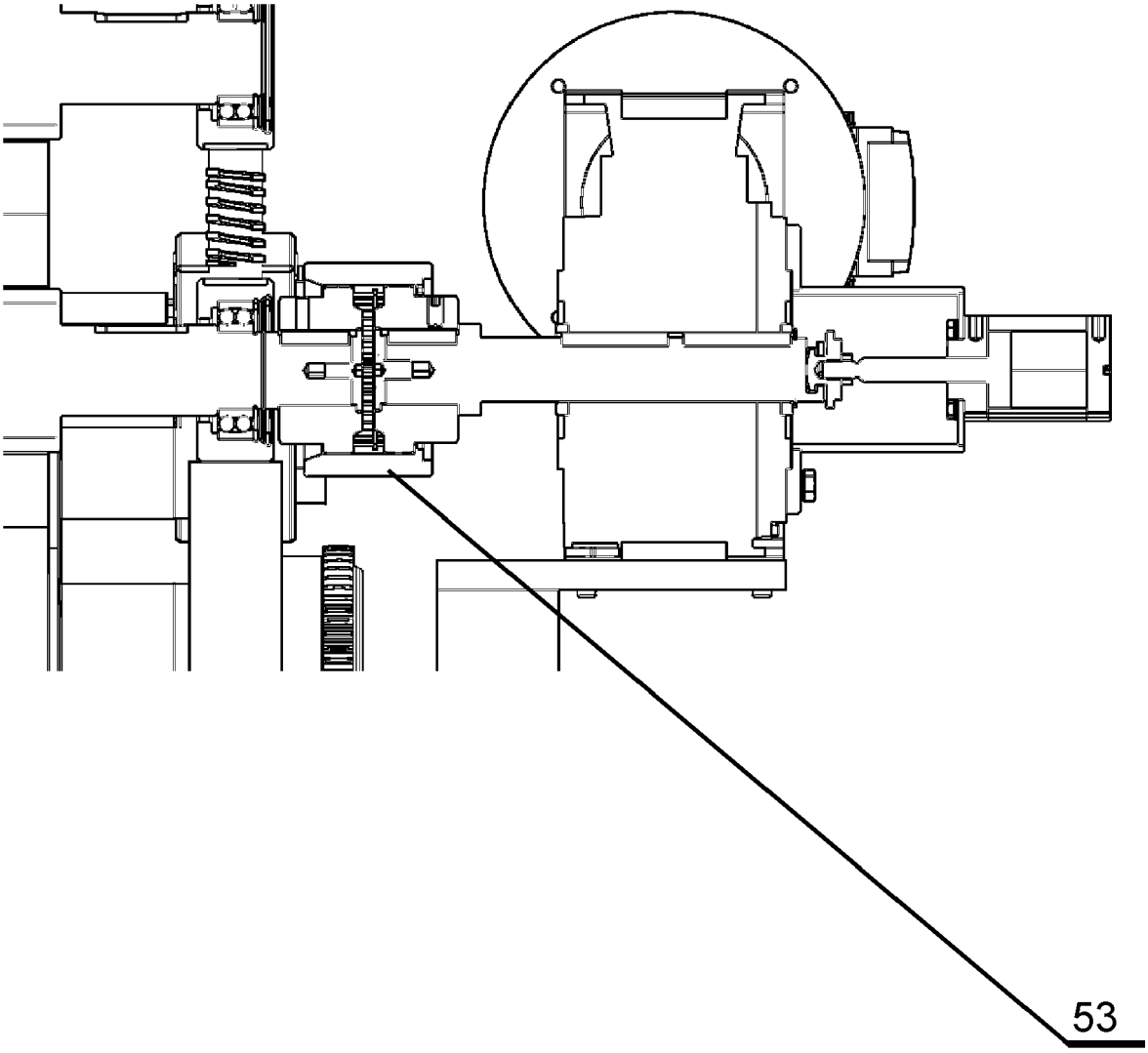

Fig. 6B

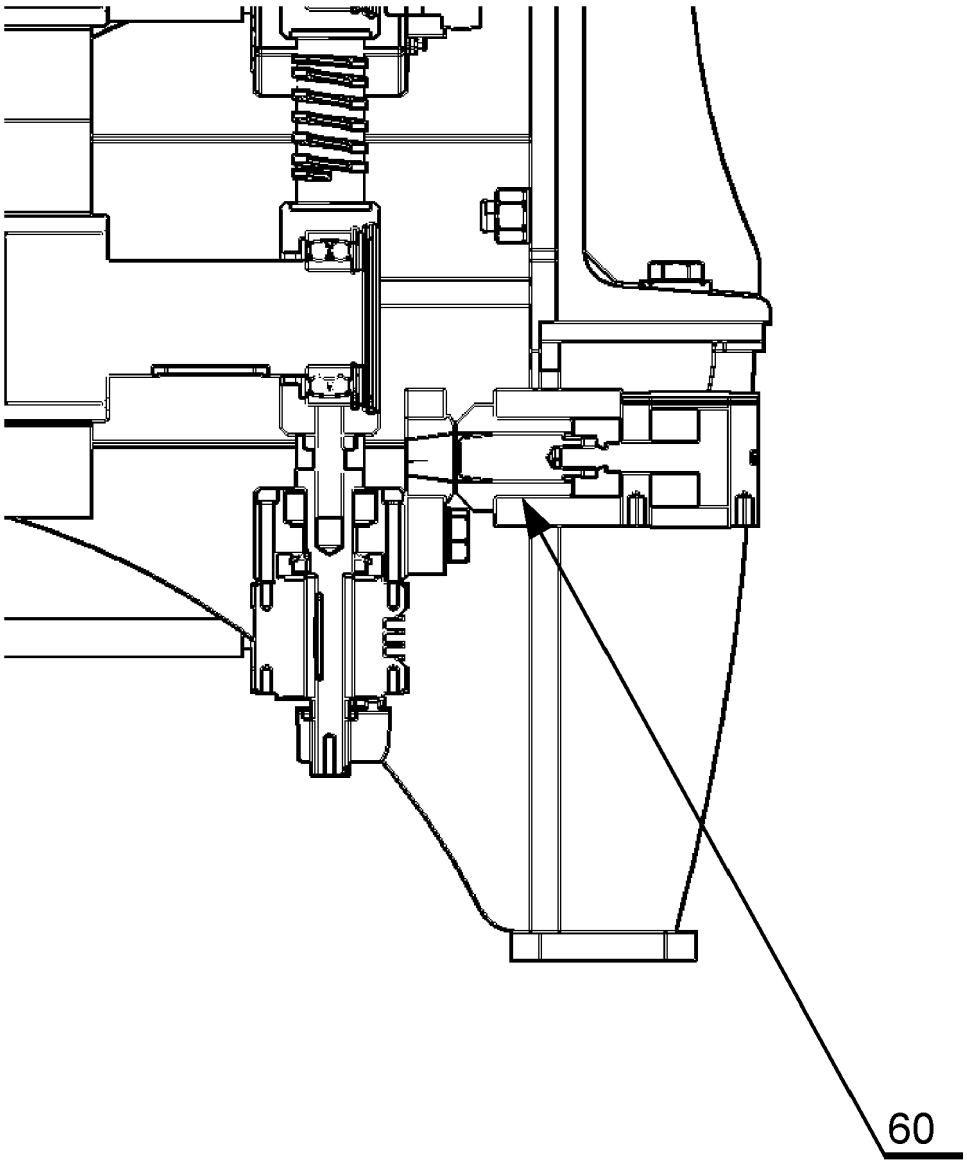

Fig. 7A

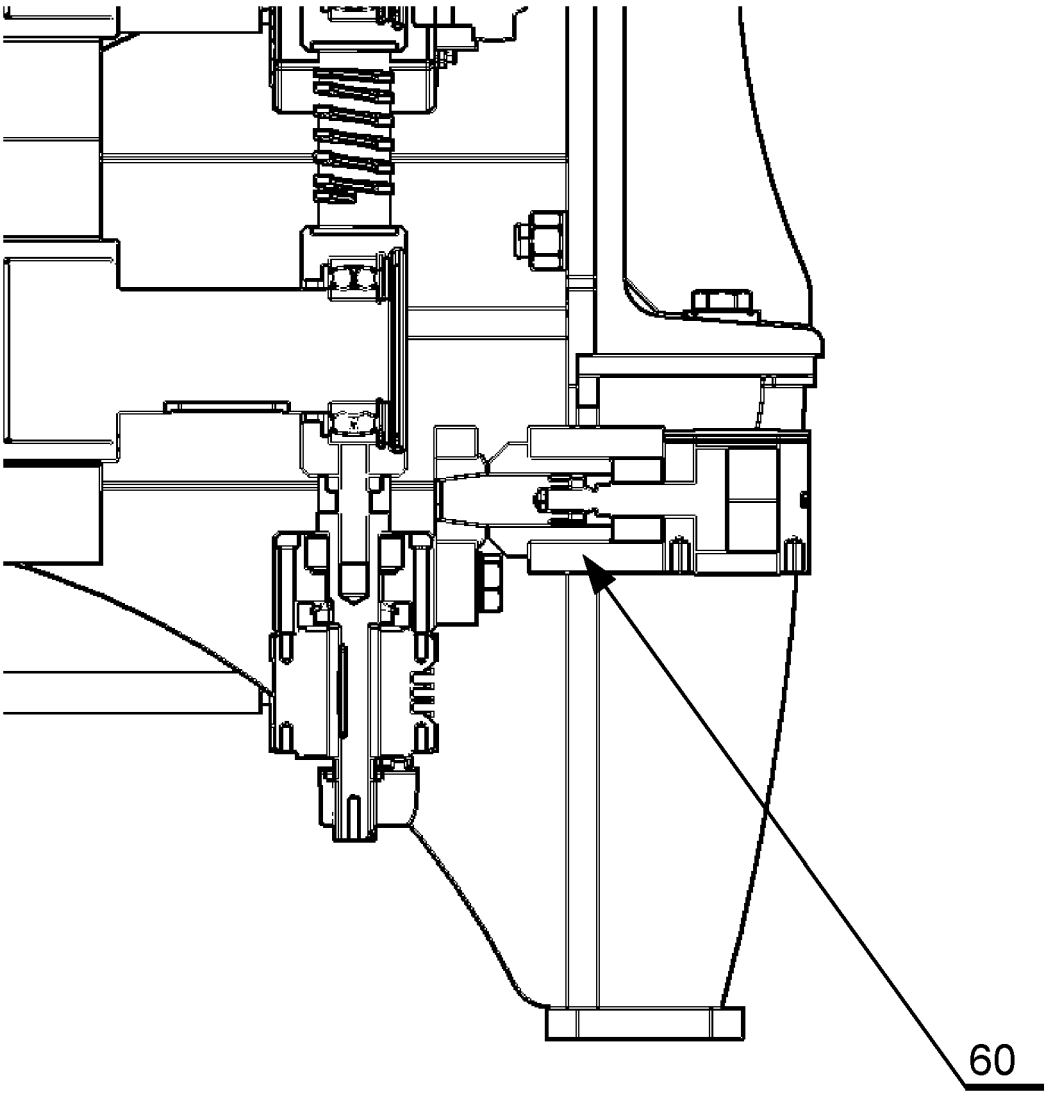

Fig. 7B

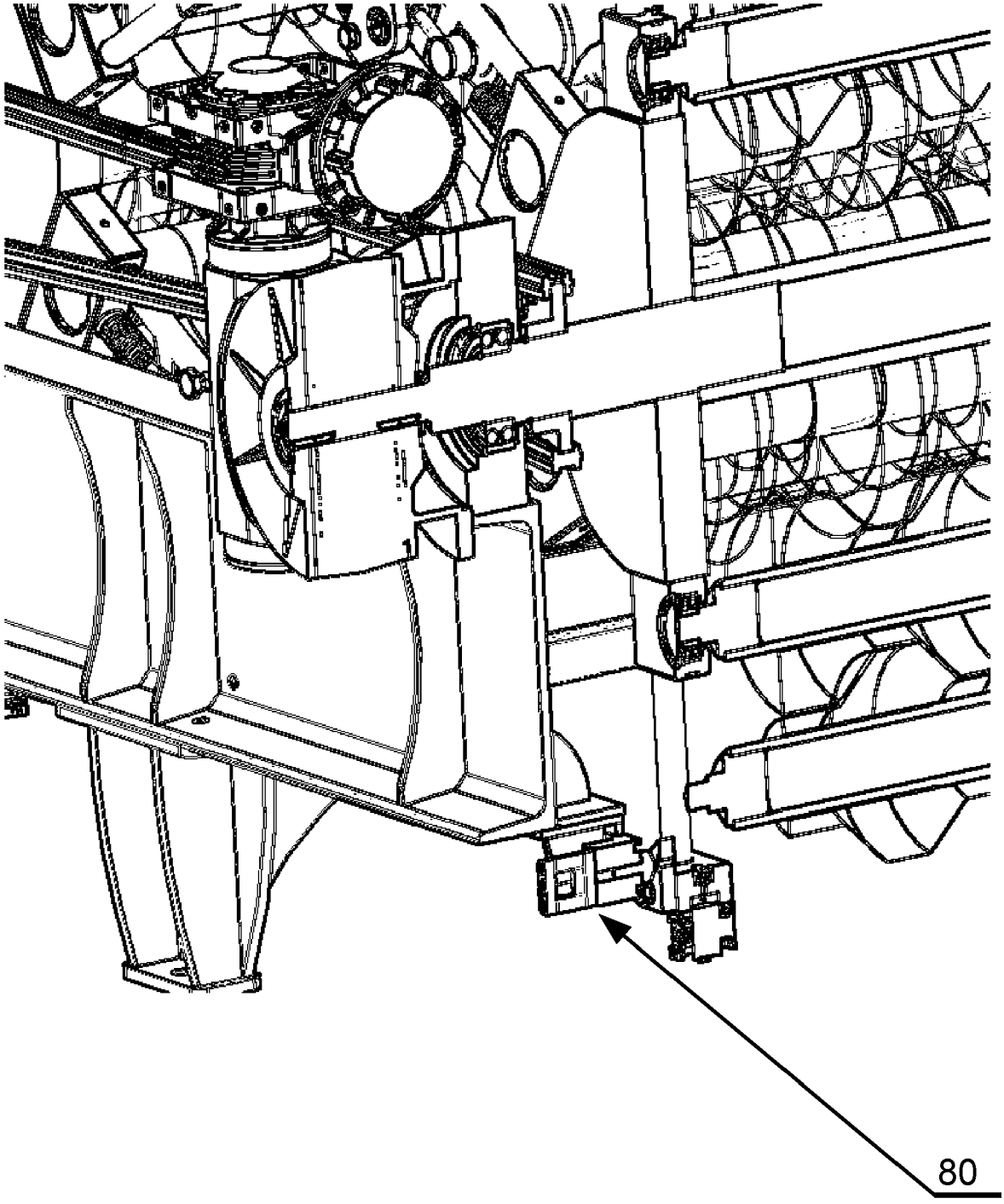

Fig. 8

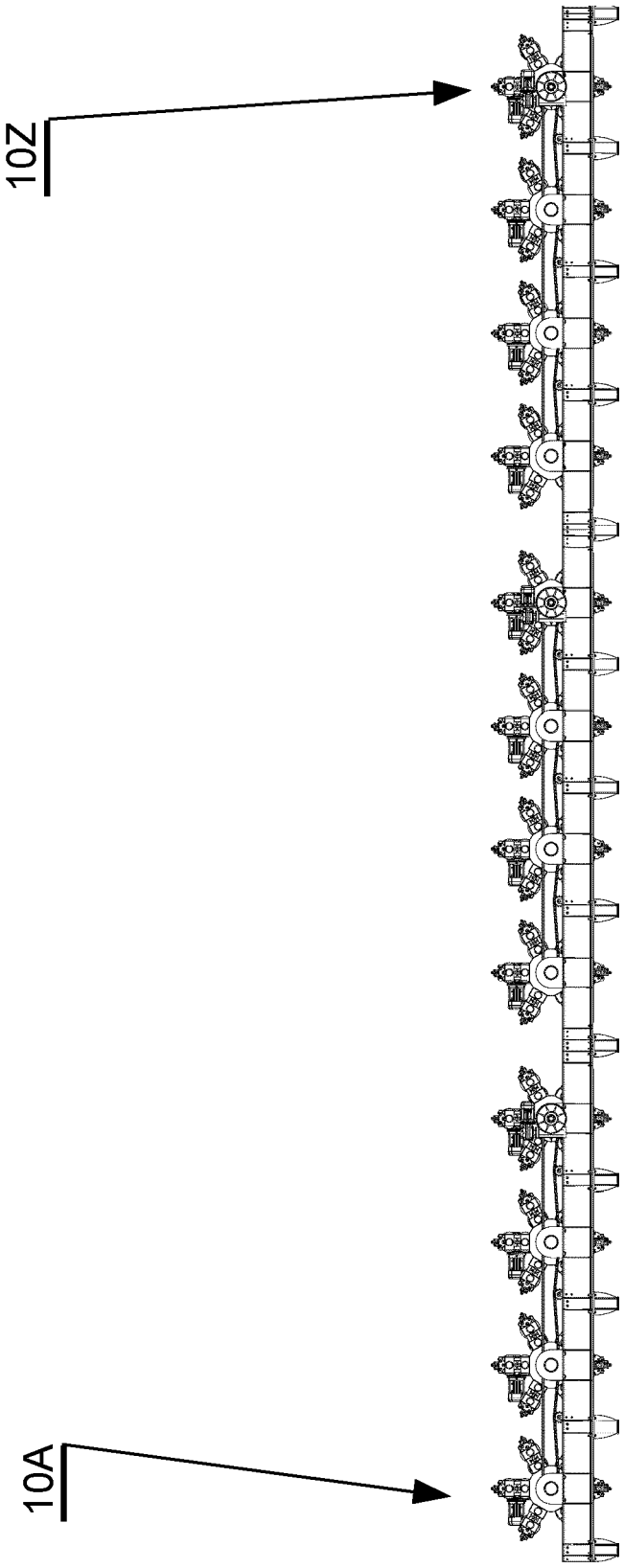

Fig. 9

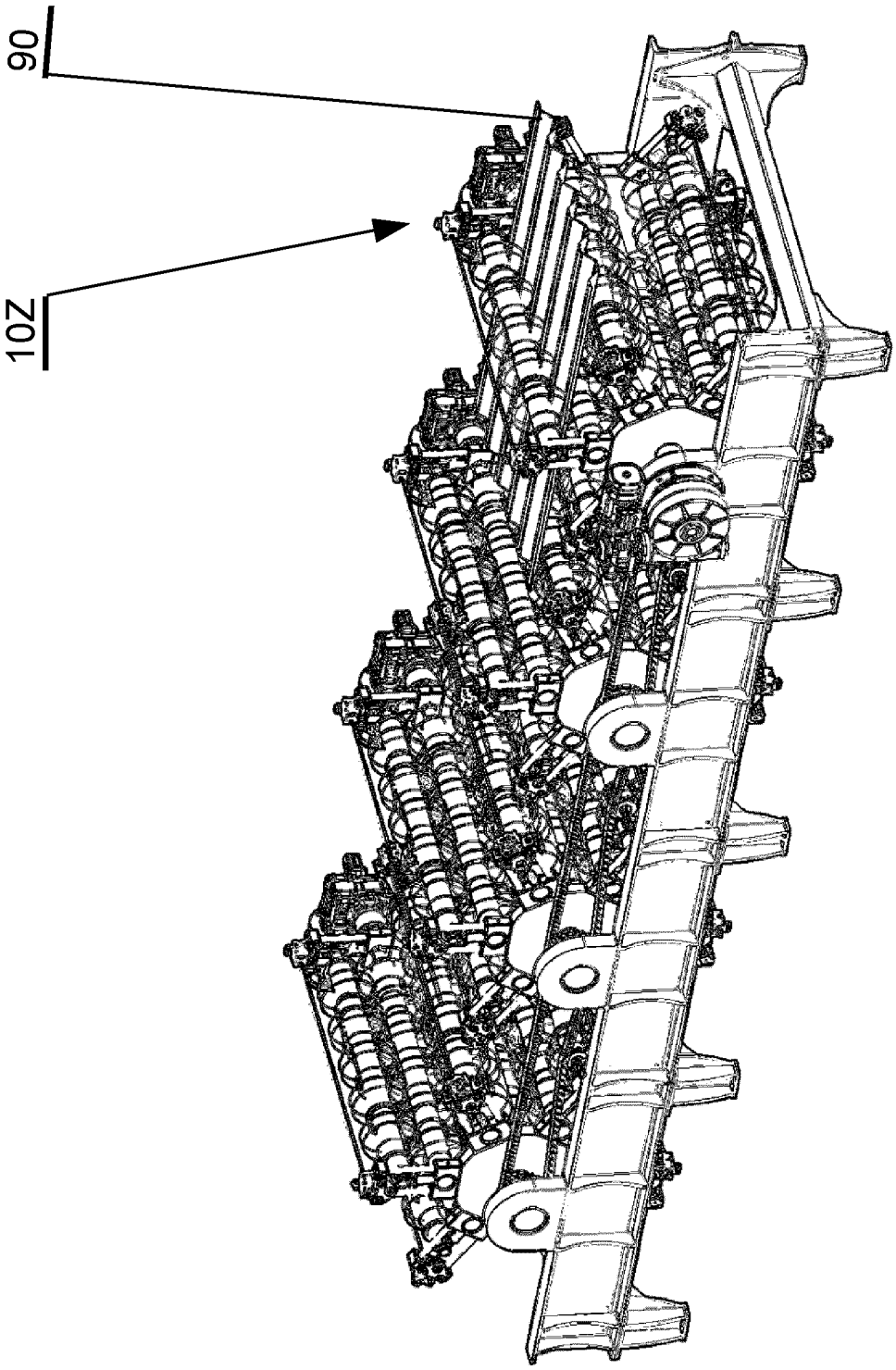

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 21 16 8777

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2 179 849 A (ROY FREEZE JONATHAN) 14 November 1939 (1939-11-14) * column 2, lines 1-11; figures 1-3 * -----	1-5	INV. B21D5/08 B21D13/04 B21D37/06
Y	WO 90/00096 A1 (NILSEN TROND [NO]; NORMANN ERLING C [NO]) 11 January 1990 (1990-01-11) * page 6, lines 18-23; figures 1, 4-6, 10 * -----	1-5	
Y	DE 28 16 993 A1 (FISCHER KG J) 31 October 1979 (1979-10-31) * figure 2 * -----	5	

TECHNICAL FIELDS SEARCHED (IPC)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 September 2021	Vassoille, Philippe

CATEGORY OF CITED DOCUMENTS

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03-09-2021

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