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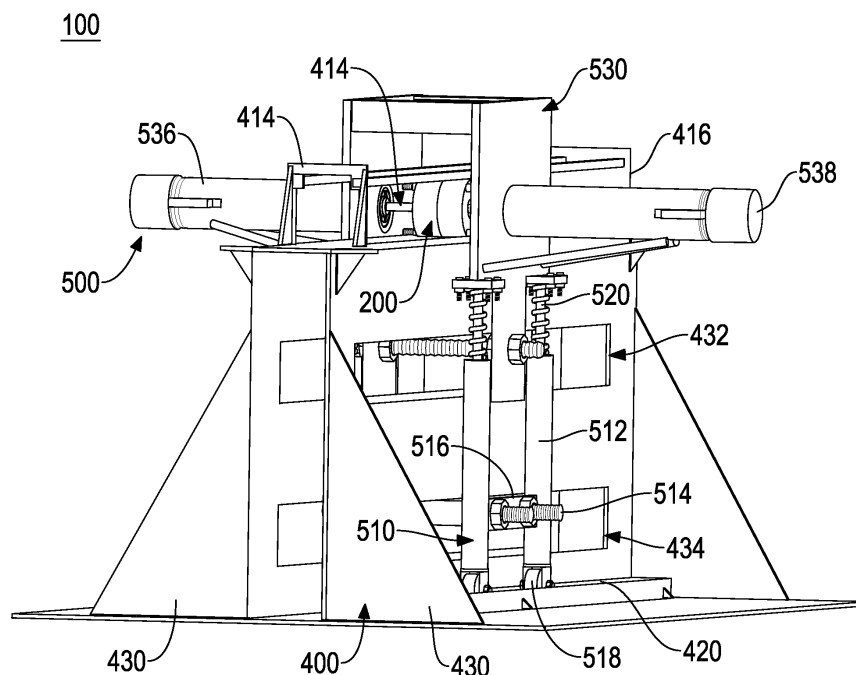
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(54) APPARATUS FOR ROLLING RING-SHAPED OBJECT

(57) An apparatus (100) for rolling ring-shaped object (R) has a rolling drum (200), a rolling device (300), and a base (400). The rolling drum (200) has two circular frames (210, 220) filled with an embedding medium (270) for tightly surrounding an outer periphery (RO) of the ring-shaped object (R) with removable fixtures, which are removed to form a cavity (272) for revealing an inner periphery (RI) of the ring-shaped object (R). The inner

periphery (RI) of the ring-shaped object (R) is rolled on a rolling platform (410) of the base (400) via a cylindrical roller (310) inserted through the cavity (272) of the embedding medium (270) to increase a density thereof. During the rolling process, the outer periphery (RO) of the ring-shaped object (R) is fixed and protected by the embedding medium (270) to protect textures and patterns formed thereon.

**FIG.1**

Description

1. Field of the Invention

[0001] The present invention relates to a rolling technology, and more particularly to an apparatus for rolling a ring-shaped object, which is configured to stably and uniformly roll an inner periphery of the ring-shaped object with protection of textures, patterns, or appearance of an outer periphery thereof.

2. Description of the Prior Art

[0002] To make various ring-shaped objects, e.g. bangle or finger-ring, with alluring appearances, the ring-shaped objects are formed by casting, and then are polished. However, various ring-shaped objects, such as the cast ring-shaped objects, may have poor internal structures with low densities, resulting in low hardness and low strength. The ring-shaped object is easily damaged or deformed while being compressed by external forces. A forged ring-shaped object has a high density, but is dull in appearance or is easily broken at welded portions.

[0003] In press forming technology, a pressing mold, made of rubber, acrylic plastic, or polyurethane (PU), is easily formed as a female mold or a male mold with complex patterns and is configured to increase a density of a ring-shaped object. However, the patterns, formed by one-time press forming with the mold, may not present alluring details as good as formed by casting. The pressing mold made of rubber or polyurethane easily cracks. The metal ring-shaped object is formed with burrs occurring as well.

[0004] Therefore, a technology for manufacturing a ring-shaped object in consideration of both appearance and structural strength is needed.

[0005] The main objective of the present invention is to provide an apparatus for rolling a ring-shaped object. An embedding medium of a rolling drum may tightly cover an outer periphery of the ring-shaped object and reveal an inner periphery of the ring-shaped object from a cavity thereof. During a process of rolling the inner periphery of the ring-shaped object to increase a density thereof by a cylindrical roller inserted through the cavity, the outer periphery of the ring-shaped object is protected by the embedding medium. The ring-shaped object is fixed in position with the protection of textures and patterns on the outer periphery thereof by the embedding medium. The rolling drum is cylindrical and the cavity is located at a center of the rolling drum, so the inner periphery of the ring-shaped object can be stably and uniformly rolled by a cylindrical roller.

[0006] The apparatus is configured to roll an inner periphery of a ring-shaped object and comprises a rolling drum, a rolling device, and a base. The rolling drum comprises two circular frames connected to each other, a removable-base-fixture, a removable-lower-central-

fixture, and a removable-upper-central-fixture connected to the removable-lower-central-fixture. The removable-base-fixture is configured to support the two circular frames and has a hole at a center thereof. The removable-lower-central-fixture is held in the hole of the removable-base-fixture and is aligned with a central axis of the two circular frames. A round pin is formed at a top of the removable-lower-central-fixture and has a diameter smaller than a diameter of the top of the removable-lower-central-fixture. The round pin is configured to be surrounded by the ring-shaped object. The removable-upper-central-fixture has a bore for receiving the round pin of the removable-lower-central-fixture. The two circular frames are filled with an embedding medium. After the removable-base-fixture, the removable-lower-central-fixture, and the removable-upper-central-fixture are removed, a cavity is formed in a center of the embedding medium. An outer periphery of the ring-shaped object is embedded in the embedding medium and the inner periphery of the ring-shaped object is revealed from the cavity. The rolling device comprises a cylindrical roller configured to roll the inner periphery of the ring-shaped object in the rolling drum. The base comprises a rolling platform. The rolling drum rolls along the rolling platform during a rolling process.

[0007] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

IN THE DRAWINGS:

[0008]

Fig. 1 is a perspective view of an apparatus for rolling a ring-shaped object in accordance with the present invention;

Fig. 2 is an enlarged perspective view of a rolling drum with a cylindrical roller of the apparatus in Fig. 1;

Fig. 3 is a side view of the rolling drum in Fig. 2;

Fig. 4 is a perspective view of a ring-shaped object to be fixed in the rolling drum in Fig. 2;

Fig. 5 is an exploded perspective view of the rolling drum in Fig. 2;

Fig. 6 is a perspective view of a rolling device of the apparatus in Fig. 1;

Fig. 7 is an exploded perspective view of the rolling device in Fig. 6;

Fig. 8 is a perspective view of a base of the apparatus in Fig. 1;

Fig. 9 is a perspective view of a stand of the apparatus in Fig. 1; and

Figs. 10 and 11 are operational side views of the apparatus in Fig. 1 showing the steps of assembling the rolling device.

[0009] With reference to Figs. 1 and 2, an apparatus

100 for rolling a ring-shaped object in accordance with the present invention is configured to perform a rolling process at an inner periphery RI of a ring-shaped object R as shown in Fig. 4, to increase a density of the ring-shaped object R for improving an inner material structure of the ring-shaped object R, and to increase structural strength and hardness of the ring-shaped object R. The ring-shaped object R may be a finger-ring or a bangle with complex patterns or textures formed thereon before the rolling process. The apparatus 100 comprises a rolling drum 200, a rolling device 300, and a base 400. The rolling device 300 comprises a stand 500.

[0010] With reference to Figs. 2 to 5, the rolling drum 200 comprises two circular frames 210, 220, a removable-base-fixture 230, a removable-lower-central-fixture 240, and a removable-upper-central-fixture 250. The circular frame 210 is an upper frame and the circular frame 220 is a lower frame. The two circular frames 210, 220 are connected to each other. The circular frame 210 has at least one first through hole 212 and at least one boss 214. The circular frame 220 has at least one second through hole 222 corresponding to the at least one first through hole 212 in position and at least one blind hole 224 corresponding to the at least one boss 214 in position. Each boss 214 of the circular frame 210 is inserted into a respective blind hole 224 of the circular frame 220. Each first through hole 212 is aligned with a respective second through hole 222. A bolt 260 is inserted through the first through hole 212 and the second through hole 222 aligned with each other and is screwed with a nut 262 to secure the two circular frames 210, 220. An amount of the first through hole 212, the boss 214, the second through hole 222, or the blind hole 224 may be implemented as three of each to provide a stable connection of the two circular frames 210, 220.

[0011] The removable-base-fixture 230 is configured to support the circular frames 210, 220. With reference to Fig. 5, the removable-base-fixture 230 has at least three positioning rods 232 formed thereon and spaced apart from one another to hold the circular frames 210, 220 in position and has a hole 234 formed in a center thereof.

[0012] The removable-lower-central-fixture 240 is held in the hole 234 of the removable-base-fixture 230 and is aligned with a central axis of the two circular frames 210, 220 connected together. A round pin 242 is formed at a top of the removable-lower-central-fixture 240 and has a diameter smaller than a diameter of the top of the removable-lower-central-fixture 240 to form a shoulder 241 on the top of the removable-lower-central-fixture 240 around the round pin 242. The round pin 242 is configured to be surrounded by the ring-shaped object R for rolling. As shown in Figs. 2 to 5, the ring-shaped object R comprises an outer periphery RO and an inner periphery RI within the outer periphery RO. A side of the ring-shaped object R is supported by the shoulder 241 on the top of the removable-lower-central-fixture 240. The outer periphery RO is disposed out of the top of the removable-lower-central-fixture 240. The top of the re-

movable-lower-central-fixture 240 may be slightly lower than the circular frame 220.

[0013] With reference to Figs. 4 and 5, after the ring-shaped object R is sleeved on the round pin 242 on the removable-lower-central-fixture 240, the removable-upper-central-fixture 250 is connected to the removable-lower-central-fixture 240. The removable-upper-central-fixture 250 has a bore 252 for receiving the round pin 242. The removable-upper-central-fixture 250 abuts against the other side of the ring-shaped object R. The removable-upper-central-fixture 250 has a ferrule 254 formed thereon, so a tool, e.g. a screwdriver, may be inserted into the ferrule 254 to remove the removable-upper-central-fixture 250 from an embedding medium 270 made of high temperature investment powders, e.g. phosphate investments or ethyl silicate investments.

[0014] With reference to Figs. 2 to 5, the embedding medium 270 may be filled into the two circular frames 210, 220 by several times to fix the removable-base-fixture 230, the removable-lower-central-fixture 240, the removable-upper-central-fixture 250, and the ring-shaped object R. After the embedding medium 270 is solidified, the removable-base-fixture 230, the removable-lower-central-fixture 240, and the removable-upper-central-fixture 250 are removed to form a cavity 272 in the embedding medium 270. The outer periphery RO of the ring-shaped object R is embedded in the embedding medium 270 and the inner periphery RI of the ring-shaped object R is revealed from the cavity 272 of the embedding medium 270.

[0015] With reference to Figs. 1, 6, and 7, the rolling device 300 comprises a cylindrical roller 310, two bearings 320, two lining fittings 330, and two mounting tubes 340. The two lining fittings 330 are respectively mounted in the two bearings 320. Each lining fitting 330 has a polygonal socket 332 at a center thereof. The two bearings 320 are respectively mounted in the two mounting tubes 340. Each mounting tube 340 has at least one protrusion 342 at an outer periphery thereof for connecting the rolling device 300 with the stand 500. The cylindrical roller 310 has two polygonal ends 312 respectively formed at two opposite ends thereof and respectively fitted in the polygonal sockets 332 of the two lining fittings 330. The cylindrical roller 310 is inserted through the cavity 272 of the embedding medium 270 of the rolling drum 200 and the ring-shaped object R fixed in the embedding medium 270 and is configured to roll the inner periphery RI of the ring-shaped object R. During the rolling process, the cylindrical roller 310 drives the lining fittings 330 to rotate by the polygonal ends 312. Since each lining fitting 330 is mounted in the bearing 320, an inner ring of the bearing 320 may rotate with the lining fitting 330. The polygonal ends 312 of the cylindrical roller 310 and the polygonal sockets 332 are polygonal to reduce idling during rotating.

[0016] With reference to Figs. 1 and 8, the base 400 comprises a rolling platform 410 and two rails 420. The rolling platform 410 has an extending direction ED and is

configured to allow the rolling drum 200 rolling thereon forwardly and backwardly along the extending direction ED. The two rails 420 are respectively arranged at opposite sides of and below the rolling platform 410. The stand 500 of the rolling device 300 is movable forwardly and backwardly on the two rails 420 along the extending direction ED. Two elongated blocks 412 are arranged at the opposite sides of the rolling platform 410 and extend along the extending direction ED to limit the rolling drum 200 to roll therebetween. Baffles 414, 416 are respectively arranged at a front and a rear of the rolling platform 410 to block the rolling drum 200. Two ends of each elongated block 412 are respectively combined with the baffles 414, 416.

[0017] With reference to Fig. 8, the base 400 comprises two supporters 430 to stably support the rolling platform 410 for the rolling process. Each supporter 430 has two openings 432, 434 arranged below the rolling platform 410 sequentially. The supporters 430 of the base 400 may be any structure for stably supporting the rolling drum 200 to stably roll on the rolling platform 410, which is not limited as shown in Fig. 8.

[0018] With reference to Figs. 1 and 9, the stand 500 is mounted to the base 400 for assembling the rolling device 300 and is movable along the two rails 420. The stand 500 comprises a carriage 510, multiple elastic members 520, and a rolling base 530. The carriage 510 is mounted to the two rails 420 of the base 400 and comprises four posts 512, two beams 514, two connecting blocks 516, and four wheels 518. Each connecting block 516 is connected to two of the posts 512 at a respective side of the rolling platform 410. The two beams 514 extend through the two connecting blocks 516 and through the openings 434 of the two supporters 430 of the base 400. The four wheels 518 are respectively disposed at bottoms of the four posts 512 to allow the carriage 510 to move along the rails 420. The carriage 510 can be any suitable structure.

[0019] The elastic members 520 may be springs, are respectively sleeved on the posts 512 of the carriage 510, and are arranged at the opposite sides of the rolling platform 410. In the rolling process, the elastic members 520 provide a compression stroke for rolling. The rolling base 530 is arranged above the elastic members 520 and crosses above the rolling platform 410. For example, as shown in Fig. 9, the rolling base 530 comprises two side plates 532 at opposite sides of the rolling platform 410 and two connecting plates 534 connected to the two side plates 532. The stand 500 further comprises a fixing rod 540 extending through the two side plates 532 of the rolling base 530, through the openings 432 of the two supporters 430 of the base 400, and arranged below the rolling platform 410 to stabilize the structure of the rolling base 530.

[0020] The rolling base 530 further comprises two fixing tubes 536 respectively mounted through the two side plates 532 opposite to each other and respectively arranged at the opposite sides of the rolling platform 410. The fixing tube 536 is perpendicular to the extending

direction ED of the rolling platform 410. Each fixing tube 536 comprises at least one slot 536a for receiving the at least one protrusion 342 of the mounting tube 340 of the rolling device 300 as shown in Fig. 6 to fix the mounting tube 340 in the fixing tube 536. Each fixing tube 536 has a thread 536b formed at an end thereof to be screwed with a nut 538 for fixing the mounting tube 340 within the fixing tube 536.

[0021] With reference to Figs. 2 to 4, when assembling the apparatus 100, the removable-lower-central-fixture 240 is placed in the hole 234 of the removable-base-fixture 230. The circular frame 220 is placed on the removable-base-fixture 230. The ring-shaped object R is sleeved on the round pin 242 of the removable-lower-central-fixture 240, and then the removable-upper-central-fixture 250 is placed on the round pin 242 and abuts against the side of the ring-shaped object R. After that, the embedding medium 270 in liquid state is filled into the circular frame 220 and encloses the outer periphery RO of the ring-shaped object R. After the embedding medium 270 is solidified, a separating agent is applied thereto. The bosses 214 of the upper circular frame 210 are inserted into the blind holes 224 of the lower circular frame 220 to connect the circular frames 210, 220. After that, the embedding medium 270 in liquid state is filled within the circular frame 210.

[0022] After the embedding medium 270 in the circular frames 210, 220 is solidified, the removable-base-fixture 230, the removable-lower-central-fixture 240, the removable-upper-central-fixture 250, and the ring-shaped object R are fixed. Then, a tool, such as a screwdriver, is inserted into the ferrule 254 on the removable-upper-central-fixture 250. The removable-upper-central-fixture 250 is removed from the embedding medium 270 via rotating the removable-upper-central-fixture 250. The removable-base-fixture 230 and the removable-lower-central-fixture 240 are also removed therefrom to form the cavity 272 in the embedding medium 270. The bolts 260 are respectively inserted through the corresponding first through holes 212 and the second through holes 222 and are screwed with the nuts 262. Accordingly, the ring-shaped object R is fixed in a center of the rolling drum 200. The outer periphery RO of the ring-shaped object R is embedded in the embedding medium 270 and the inner periphery RI is revealed from the cavity 272. As shown in Figs. 2 to 3, the rolling drum 200 fastened by the bolts 260 is placed into a furnace to be heated.

[0023] With reference to Figs. 10 and 11, after the rolling drum 200 is heated to a forging temperature, the rolling drum 200 is placed on the rolling platform 410 of the base 400 for rolling the ring-shaped object R. The rolling device 300 as shown in Fig. 6 may be prepared during heating the rolling drum 200. The cylindrical roller 310 of the rolling device 300 is movably inserted in the polygonal sockets 332 of each lining fitting 330 to be detachably connected thereto. The bearings 320, the lining fittings 330, and the mounting tubes 340 are connected to each other. That is, the lining fittings 330

are already mounted in the bearings 320, and the bearings 320 are already mounted in the mounting tubes 340.

[0024] As shown in Figs. 7 and 10, the polygonal end 312 at a right of the cylindrical roller 310 is inserted into the polygonal socket 332 of the lining fitting 330 in the bearing 320 in the mounting tube 340 at the right side, and the mounting tube 340 is inserted into the fixing tube 536 at the right side of the rolling base 530 of the stand 500. The cylindrical roller 310 is inserted through the cavity 272 of the embedding medium 270 of the rolling drum 200 and the ring-shaped object R as shown in Figs. 2 to 4. As shown in Fig. 10, the mounting tube 340 at the left side with the bearing 320 and the lining fitting 330 is inserted in the fixing tube 536 at the left side of the rolling base 530, and the polygonal end 312 at a left of the cylindrical roller 310 is inserted into the polygonal socket 332 of the lining fitting 330 in the bearing 320 at the left side. After that, the nuts 538 are screwed with the threads 536b of the fixing tubes 536.

[0025] While rolling the ring-shaped object R, with reference to Figs. 1 and 2, the operator holds the two fixing tubes 536 at opposite sides of the rolling base 530 of the stand 500 and presses the cylindrical roller 310 down to press the inner periphery RI of the ring-shaped object R in the rolling drum 200. Then, the operator presses the rolling base 530 of the stand 500 and moves the stand 500 forwardly and backwardly along the rails 420 of the base 400. After pressing and moving the rolling base 530 of the stand 500 forwardly and backwardly several times, the rolling process is completed. The rolling process may be processed by oil pressure, pressure equipment, or electricity without manual operation.

[0026] After the rolling process, the nuts 538 at the fixing tubes 536 of the rolling base 530 are removed. Then, the mounting tube 340 at one side of the rolling device 300 with the bearing 320, the lining fitting 330, and the cylindrical roller 310 is removed, the mounting tube 340 at the other side of the rolling device 300 with the bearing 320 and lining fitting 330 is also removed. After that, the rolling drum 200 is removed and the nuts 262 are loosened to remove the bolts 260. The circular frames 210, 220 are separated from each other. The embedding medium 270 is broken to retrieve the ring-shaped object R, which has been rolled. The ring-shaped object R may be polished after the rolling process.

[0027] The embedding medium 270 of the rolling drum 200 tightly encloses the outer periphery RO of the ring-shaped object R without covering the inner periphery RI of the ring-shaped object R. During the rolling process, the inner periphery RI of the ring-shaped object R is rolled by the cylindrical roller 310 inserted through the cavity 272 of the embedding medium 270 to increase the density of the ring-shaped object R. The outer periphery RO of the ring-shaped object R is protected by the embedding medium 270 to reduce the risk of damaging the textures or patterns on the outer periphery RO of the ring-shaped object R. In addition, since the rolling drum 200 is circular, and the cavity 272 is at the center of the

rolling drum 200, the inner periphery RI of the ring-shaped object R may be stably and uniformly rolled by the cylindrical roller 310.

Claims

1. An apparatus (100) for rolling ring-shaped object (R), configured to roll an inner periphery (RI) of the ring-shaped object (R), **characterized in that** the apparatus (100) comprises:

a rolling drum (200) comprising

two circular frames (210, 220) connected to each other;
 a removable-base-fixture (230) configured to support the two circular frames (210, 220) and having a hole (234) at a center of the removable-base-fixture (230);
 a removable-lower-central-fixture (240) held in the hole (234) of the removable-base-fixture (230) and aligned with a central axis of the two circular frames (210, 220);
 a round pin (242), formed at a top of the removable-lower-central-fixture (240), having a diameter smaller than a diameter of the top of the removable-lower-central-fixture (240), and configured to be surrounded by the ring-shaped object (R);
 a removable-upper-central-fixture (250) connected to the removable-lower-central-fixture (240) and having a bore (252) for receiving the round pin (242) of the removable-lower-central-fixture (240);
 wherein the two circular frames (210, 220) are filled with an embedding medium (270), and after the removable-base-fixture (230), the removable-lower-central-fixture (240), and the removable-upper-central-fixture (250) are removed, a cavity (272) is formed in a center of the embedding medium (270), an outer periphery (RO) of the ring-shaped object (R) is embedded in the embedding medium (270), and the inner periphery (RI) of the ring-shaped object (R) is revealed from the cavity (272);

a rolling device (300) comprising

a cylindrical roller (310) configured to roll the inner periphery (RI) of the ring-shaped object (R) in the rolling drum (200); and
 a base (400) comprising
 a rolling platform (410), wherein the rolling drum (200) rolls along the rolling platform (410) during a rolling process.

2. The apparatus (100) as claimed in claim 1, wherein

a shoulder (241) is formed on the top of the removable-lower-central-fixture (240) around the round pin (242) to support one of two sides of the ring-shaped object (R);
 when the removable-upper-central-fixture (250) is connected to the removable-lower-central-fixture (240), the removable-upper-central-fixture (250) abuts against the other one of the two sides of the ring-shaped object (R).

3. The apparatus (100) as claimed in claim 1, wherein

one of the two circular frames (220) of the rolling drum (200) comprises at least one blind hole (224);
 the other one of the two circular frames (210) comprises at least one boss (214) corresponding to the at least one blind hole (224) in position and configured to be inserted into the at least one blind hole (224).

4. The apparatus (100) as claimed in claim 1, wherein

one of the two circular frames (210) of the rolling drum (200) comprises at least one first through hole (212);
 the other one of the two circular frames (220) comprises at least one second through hole (222) aligned with the at least one first through hole (212); and
 at least one bolt (260) is inserted through the at least one first through hole (212) and the at least one second through hole (222) and is screwed with at least one nut (262).

5. The apparatus (100) as claimed in claim 1, wherein

the rolling device (300) comprises two bearings (320), two lining fittings (330), and two mounting tubes (340);
 each of the two lining fittings (330) is mounted in a respective one of the two bearings (320) and has a polygonal socket (332) at a center of the lining fitting (330);
 each of the two bearings (320) is mounted in a respective one of the two mounting tubes (340);
 each of the two mounting tubes (340) has at least one protrusion (342) at an outer periphery of the mounting tube (340);
 the cylindrical roller (310) has two polygonal ends (312) respectively formed at two opposite ends of the cylindrical roller (310) and respectively inserted in the polygonal sockets (332) of the two lining fittings (330); and
 the cylindrical roller (310) is inserted through the cavity (272) of the embedding medium (270) of the rolling drum (200) and the ring-shaped object (R).

6. The apparatus (100) as claimed in claim 1, wherein

the base (400) comprises two rails (420) respectively arranged at opposite sides of and below the rolling platform (410); and
 two elongated blocks (412) are arranged on the rolling platform (410) to limit the rolling drum (200) to roll between the two elongated blocks (412).

7. The apparatus (100) as claimed in claim 5, wherein

the rolling device (300) comprises a stand (500) comprising
 two side plates (532) arranged at opposite sides of the rolling platform (410) respectively; and
 two fixing tubes (536) arranged at the opposite sides of the rolling platform (410), respectively, each fixing tube (536) mounted through a respective one of the two side plates (532), being perpendicular to an extending direction (ED) of the rolling platform (410), and having at least one slot (536a) for receiving the at least one protrusion (342) of a respective one of the two mounting tubes (340);
 the base (400) comprises two rails (420) respectively arranged at opposite sides of and below the rolling platform (410); and
 the stand (500) is movable along the two rails (420) of the base (400).

100

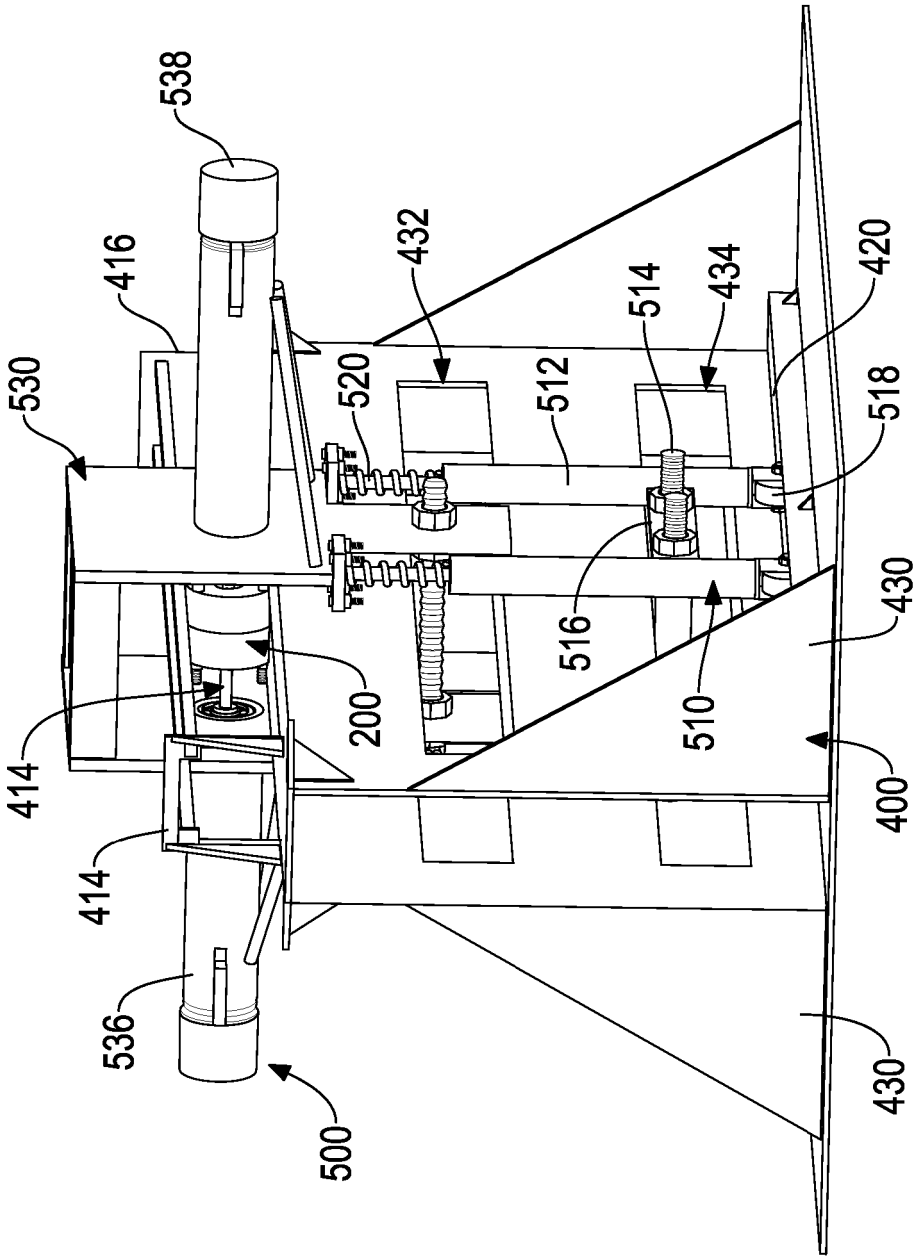


FIG.1

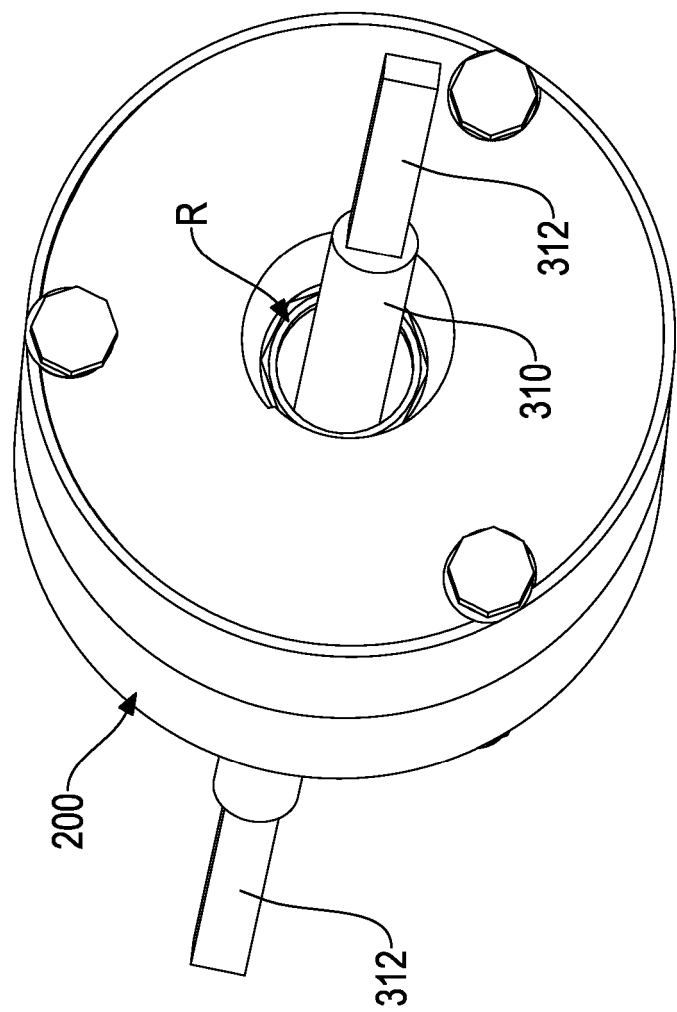


FIG.2

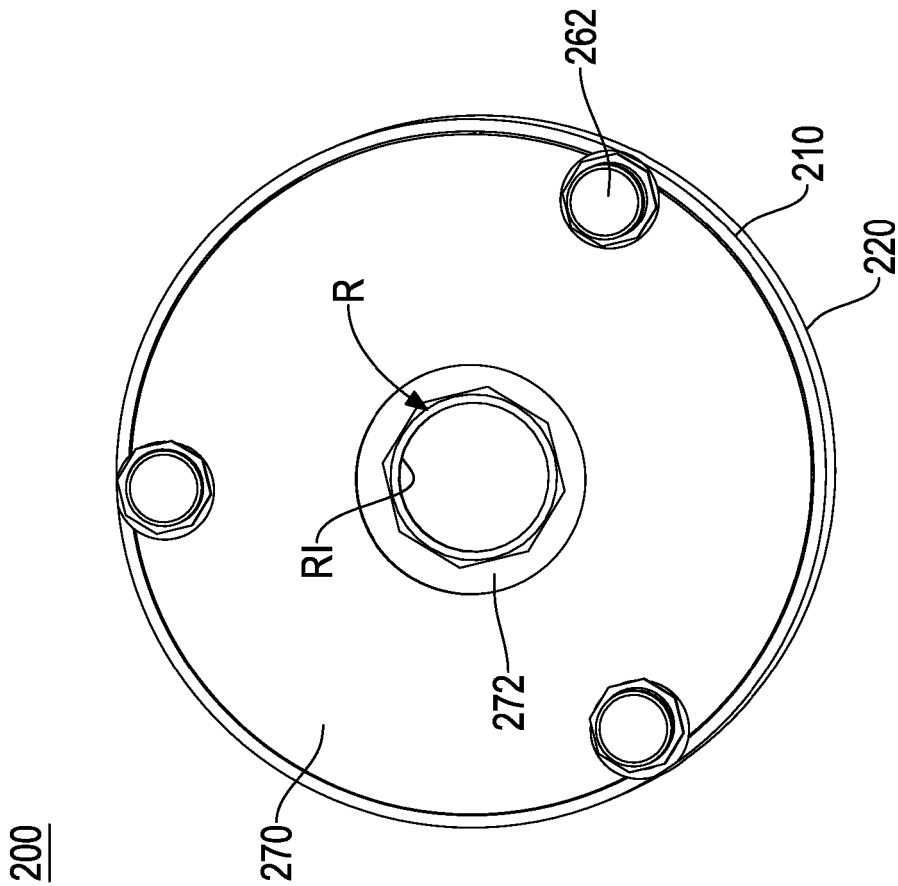


FIG.3

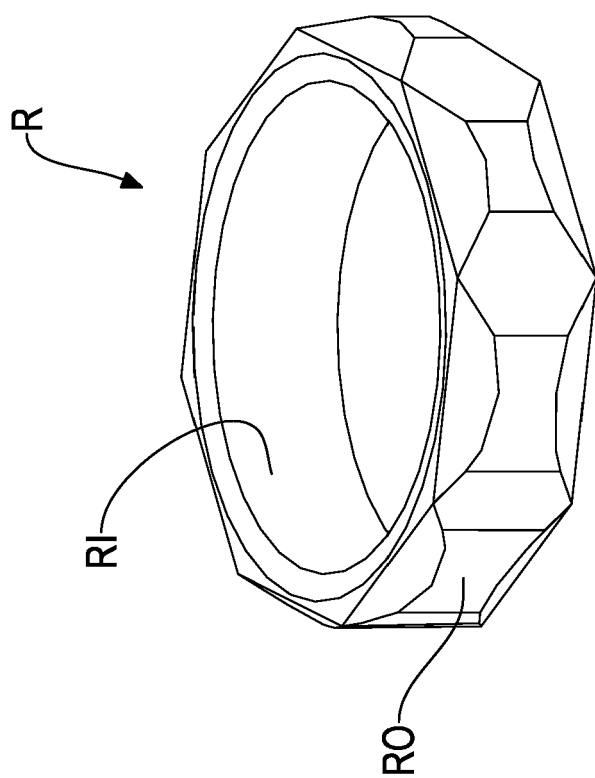


FIG.4

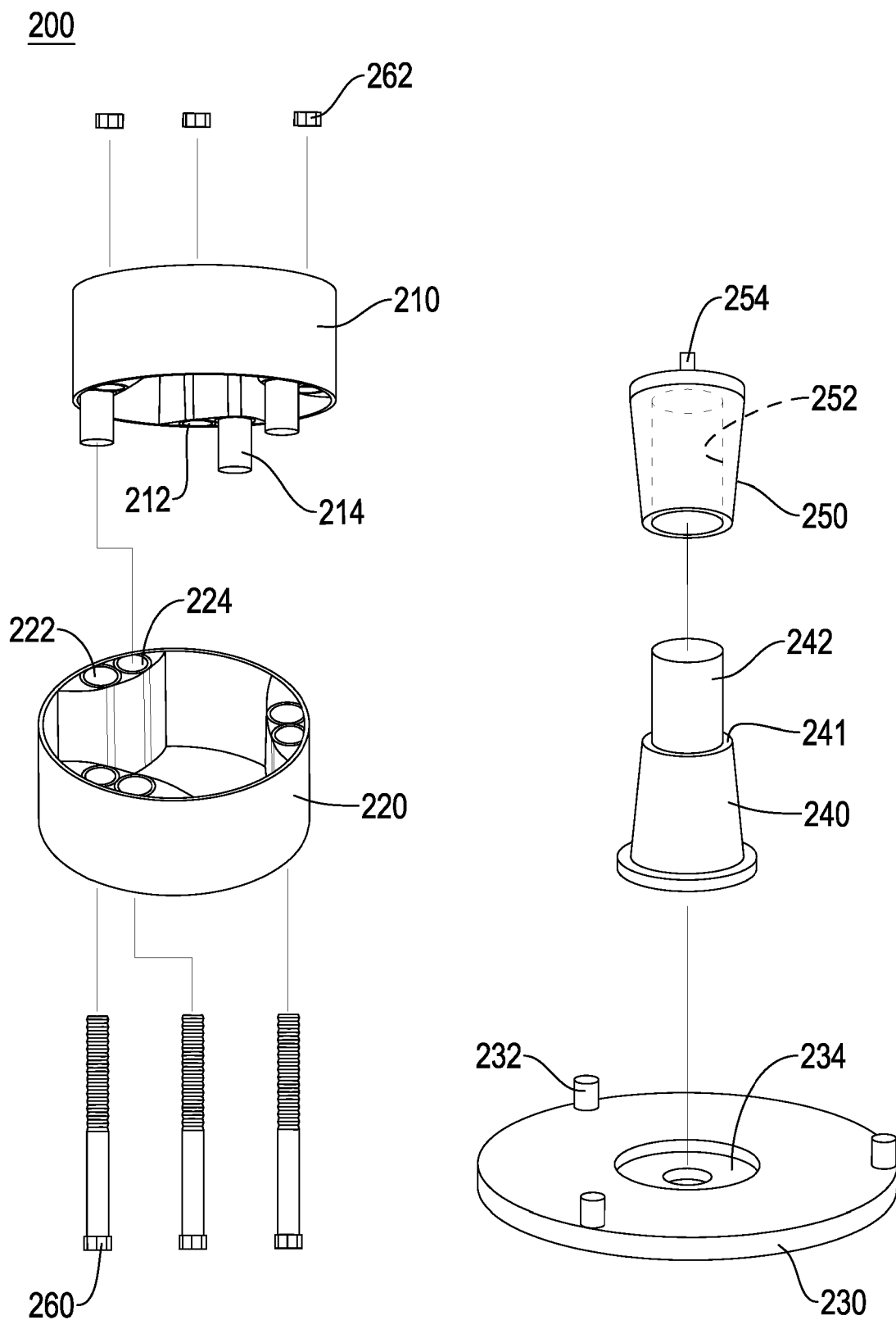


FIG.5

300

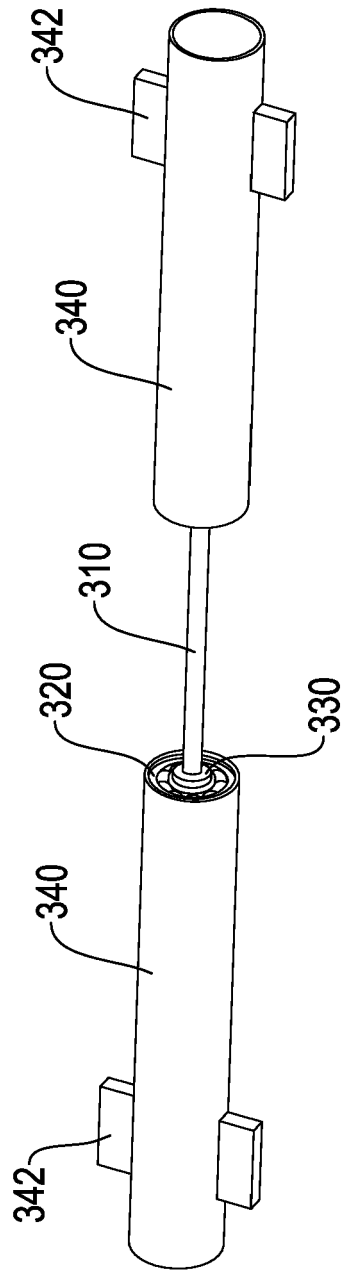


FIG.6

300

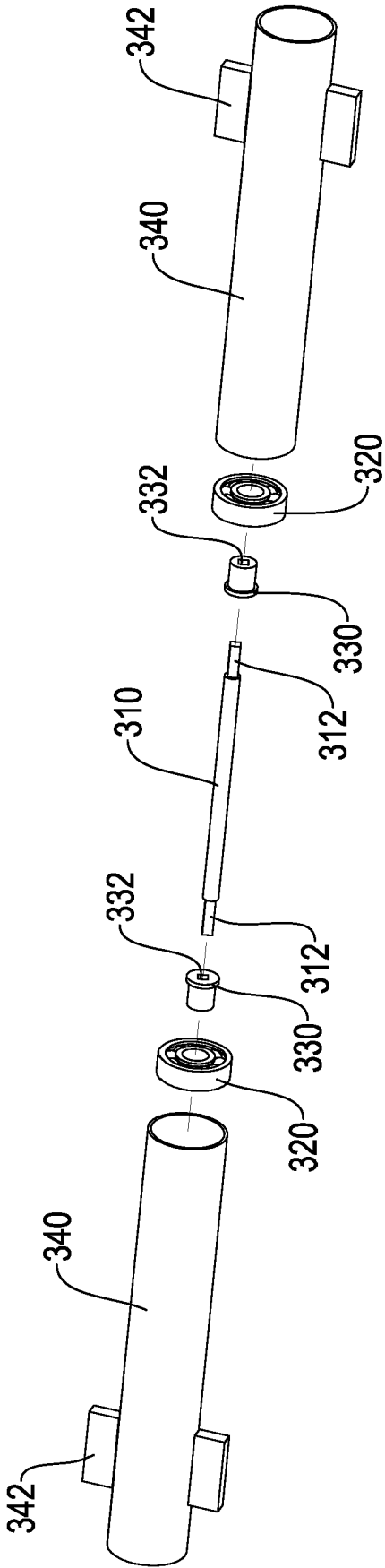


FIG.7

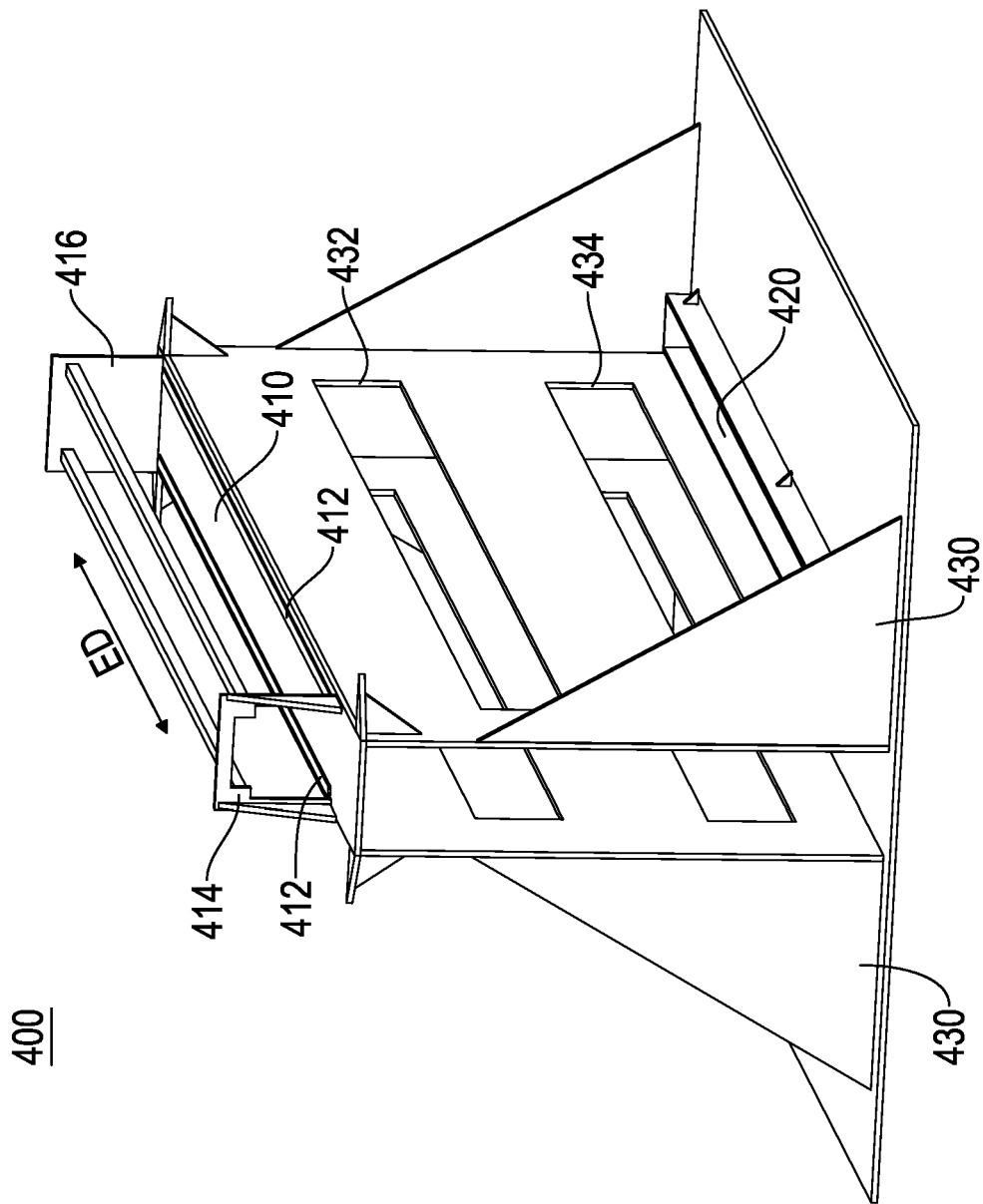
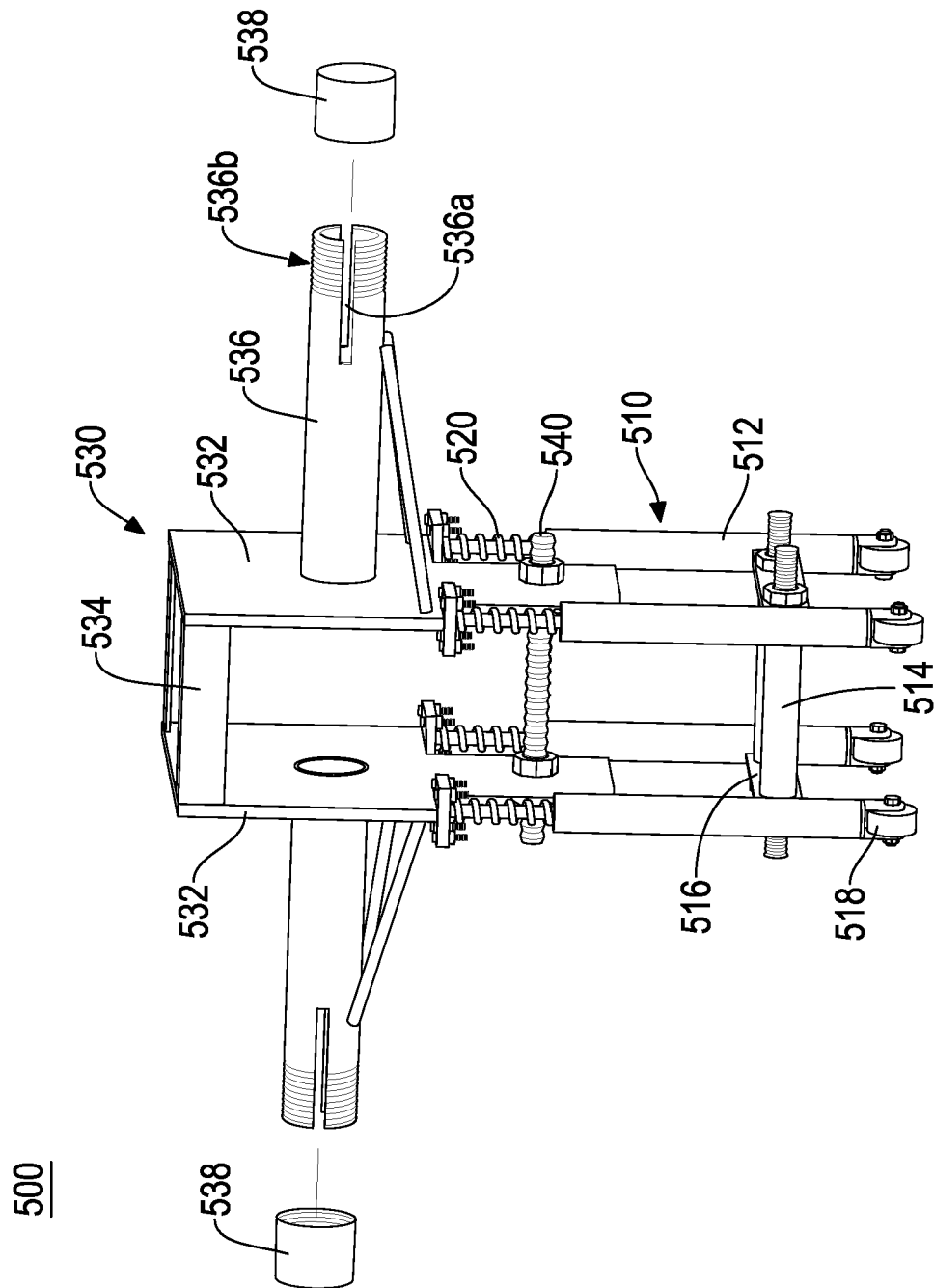


FIG. 8



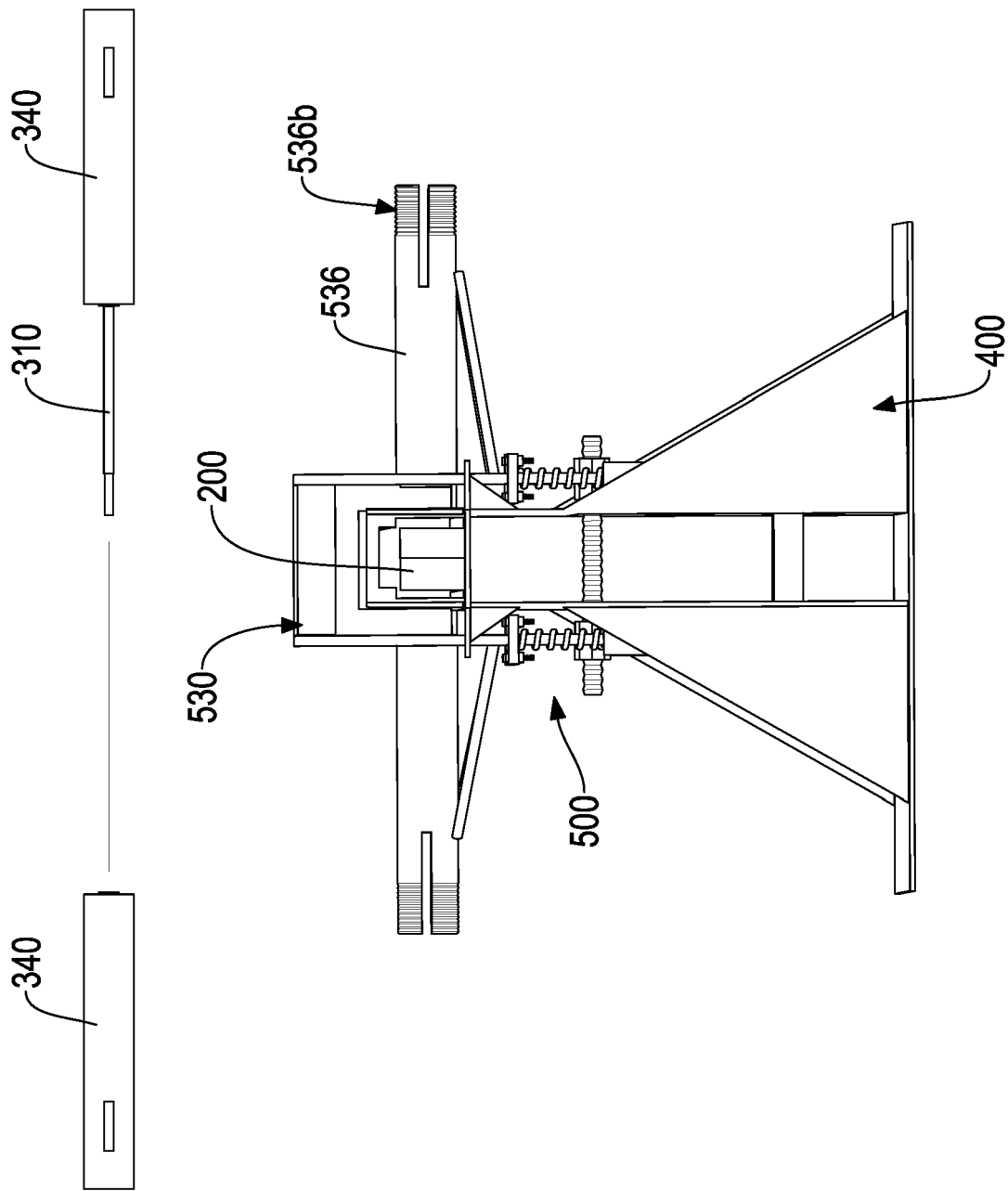


FIG.10

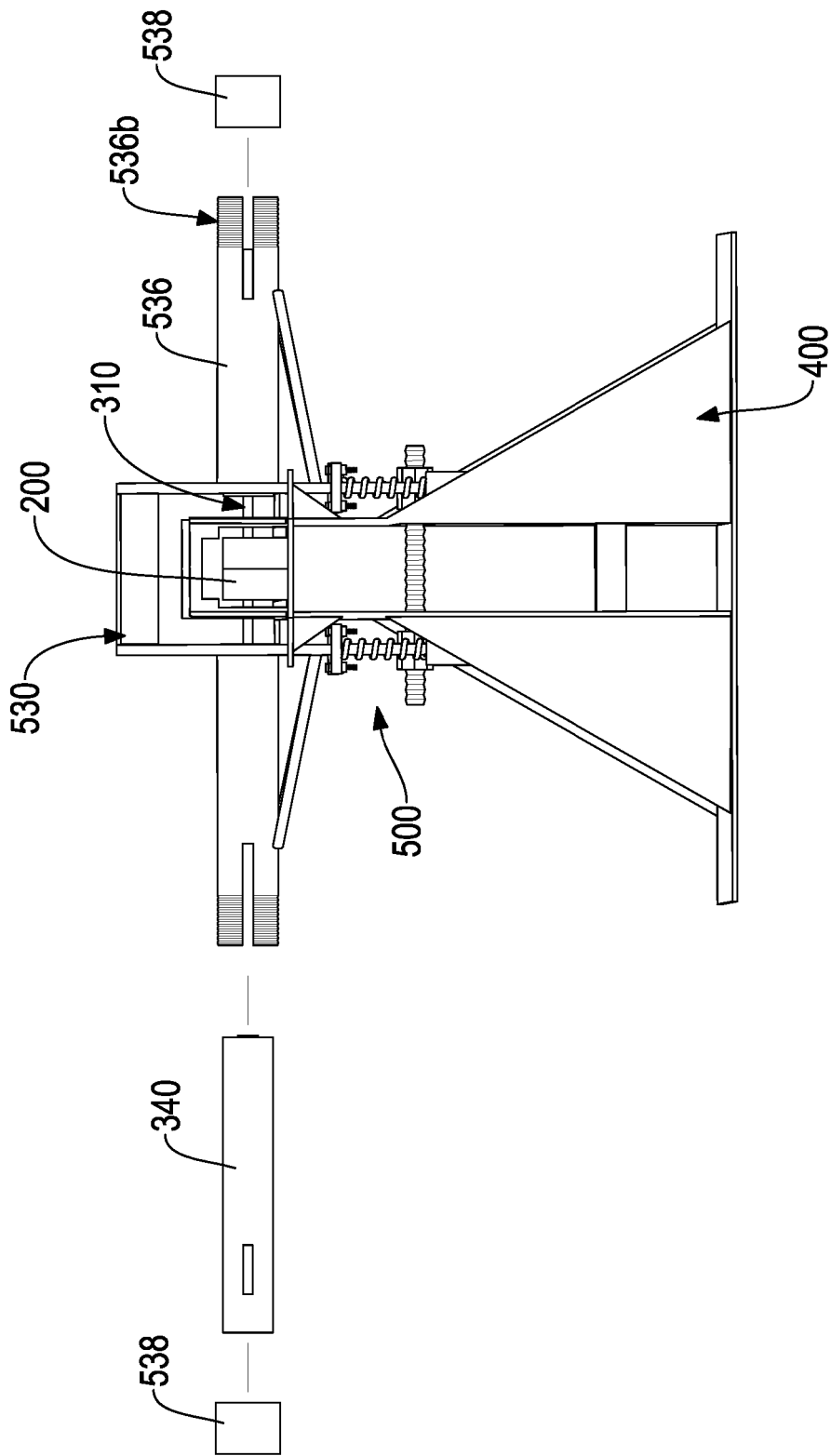


FIG.11



EUROPEAN SEARCH REPORT

Application Number

EP 25 18 5980

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		5 December 2025	Ritter, Florian
CATEGORY OF CITED DOCUMENTS			
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