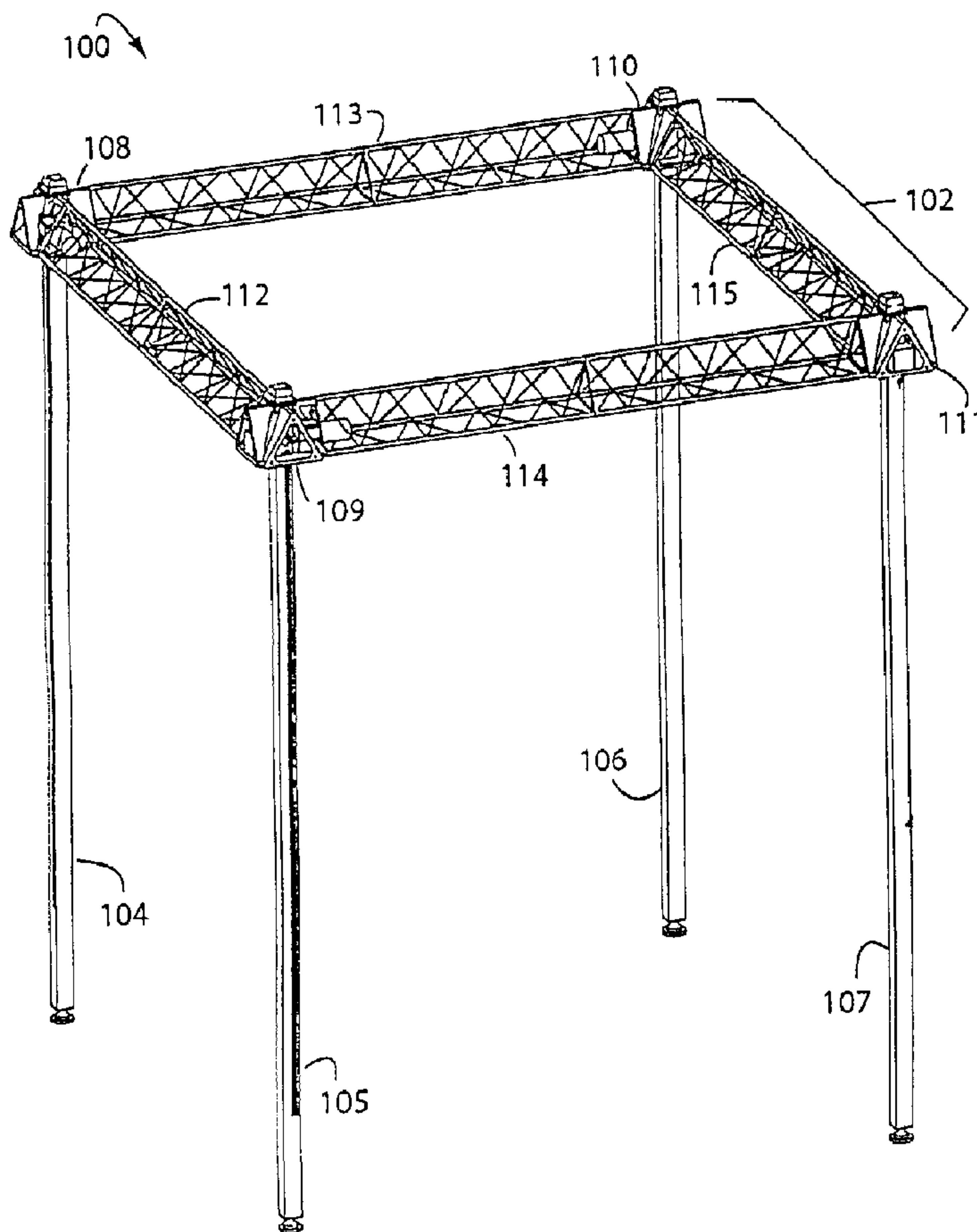




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 (72) Inventeur/Inventor:
 CALLEJA, MICHAEL J., US
 (73) Propriétaire/Owner:
 CALLEJA, MICHAEL J., US
 (74) Agent: MACRAE & CO.

(54) Titre : ECHAFAUDAGE AUTOELEVATEUR AVEC POTEAUX A ENGRENAGE A CREMAILLIERE
 (54) Title: SELF-ELEVATING STAGING WITH RACK-AND-PINION POSTS



(57) Abrégé/Abstract:

A staging system includes vertical posts each with rack gears disposed along their lengths. A self-propelled truss-support collar with a motor and pinion gear can climb up and down the vertical post by engaging the rack gear. A battery inside the collar provides

(57) **Abrégé(suite)/Abstract(continued):**

electrical power to the motor so AC utility power is not needed. The collar provides an anchoring plate for attachment and support of horizontal staging trusses for assembly on the ground and self-elevation overhead. A protective track cover tape in the vertical post hides the rack gear from view. A threading roller in the collar routes the protective track cover tape around the pinion gear so it can engage the rack gear.

ABSTRACT OF THE DISCLOSURE

A staging system includes vertical posts each with rack gears disposed along their lengths. A self-propelled truss-support collar with a motor and pinion gear can climb up and down the vertical post by engaging the rack gear. A battery inside the collar provides electrical power to the motor so AC utility power is not needed. The collar provides an anchoring plate for attachment and support of horizontal staging trusses for assembly on the ground and self-elevation overhead. A protective track cover tape in the vertical post hides the rack gear from view. A threading roller in the collar routes the protective track cover tape around the pinion gear so it can engage the rack gear.

SELF-ELEVATING STAGING WITH RACK-AND-PINION POSTS

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BACKGROUND1. Field of the Invention

10 The present invention relates to tradeshow and theatrical stages, and more particularly to motorized truss and post assemblies that can lift themselves aloft without special lifting equipment and personnel.

15 2. Description of the Prior Art

 Tradeshow booths and theatrical proscenium stages typically require highly modular and portable assemblies that can be rapidly and easily erected and torn down for each new venue. Conventional modular stages and theaters have
20 routinely required forklifts and other specialized equipment to be used by highly skilled union laborers.

 Fredric Lange describes a modular proscenium theater in United States Patent 4,512,117, issued 04/23/1985. Several posts with wire-cable pulleys on their tops provide vertical
25 support for horizontal trusses that bridge over the stage between them. A motorized unit with a cable strung over each corresponding pulley provides an anchoring junction for each end of the horizontal trusses. The motors in each are all operated in parallel to winch the cables and lift the truss

systems aloft. Decorations, lights and curtains can then be hung in place.

Problems occur when trying to use prior art staging equipment. Units that need 110/220 VAC utility power to
5 elevate themselves consequently require union electricians to be hired to install the power sources. The voltages employed are themselves lethal and the correct power equipment is costly. Units that use winches and cables require big enough drums to wind 20-30 feet of cable. Wire winch cable can also
10 be difficult to control and keep from kinking. Wire ropes only provide hanging support over a post-top pulley, and do not naturally lock the horizontal structural members to the vertical supports.

15

SUMMARY OF THE INVENTION

Briefly, a self-elevating staging system embodiment of the present invention comprises vertical posts with rack
5 gears, motorized collars with pinion gears to engage the rack gears, and horizontal trusses that join the collars and are lifted aloft in tandem. Each collar slips over a respective post and includes its own battery and motor. A remote control synchronizes all the collars so they operate in synchronism up
10 and down. The self-propelled truss-support collar with a motor and pinion gear can climb up and down the vertical post by engaging the rack gear. The battery inside the collar provides electrical power to a DC motor so AC utility power is not needed. The collar provides an anchoring plate for
15 attachment and support of horizontal staging trusses for assembly on the ground and self-elevation overhead. A protective track cover tape in the vertical post hides the rack gear from view. A threading roller in the collar routes the protective track cover tape around and in front of the
20 pinion gear so it can engage the rack gear.

An advantage of the present invention is that a staging system is provided which self-elevates.

Another advantage of the present invention is that a staging system is provided that does not require specialized
25 lifting equipment or personnel to put the horizontal trusses in place aloft.

A further advantage of the present invention is that a staging system is provided that is inexpensive to manufacture.

A still further advantage of the present invention is that a staging system is provided that is simple and easy to use.

In accordance with one aspect of the present invention, there is provided a staging system, comprising: a vertical post with a rack gear disposed along a part of its length; a self-propelled motorized collar which slips over said vertical post having a motor and pinion gear for climbing up and down said vertical post by engaging said rack gear; and a battery disposed within the collar and providing for electrical power to said motor; wherein, the collar provides an anchoring plate for attachment assembly and support of horizontal staging trusses for assembly on the ground and self-elevation aloft.

In accordance with another aspect of the present invention, there is provided a staging system, comprising: a plurality of vertical posts each with a rack gear disposed along a substantial part of their lengths; a corresponding set of synchronized and self-propelled truss-support collars each with a motor and pinion gear for climbing up and down respective vertical posts in tandem by engaging the post rack gears; a protective track cover tape disposed in each vertical post and for hiding the rack gear from view; and a threading roller disposed in each collar for routing the protective track cover tape around and behind said pinion gear so it can engage said rack gear; wherein, each collar provides an anchoring plate for attachment and support of horizontal staging trusses for assembly on the ground and self-elevation aloft.

These and other objects and advantages of the present invention will no doubt become obvious to those of ordinary skill in the art after having read the following detailed description of the preferred embodiments which are illustrated in the various drawing figures.

IN THE DRAWINGS

Figs. 1A and 1B are perspective diagrams of a self-rising stage embodiment of the present invention, wherein Fig. 1A represents the condition where a horizontal truss assembly has been self-elevated to its maximum vertical height, and Fig. 1B shows it descended for easy access by ground crews;

Fig. 2 is a cut-away perspective diagram of a motorized collar useful in the system illustrated in Figs. 1A and 1B;

Fig. 3 is an exploded perspective diagram of a self-propelled staging collar useful in the system illustrated in Figs. 1A and 1B;

Figs. 4A-4C are perspective view diagrams showing the major pieces of a typical vertical post and how they assemble together; and

Fig. 5 is a diagram of a staging system that includes a vertical post and a self-propelled motorized collar.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figs. 1A and 1B represent a self-rising staging system
5 embodiment of the present invention, and is referred to herein
by the general reference numeral 100. The staging system 100
comprises a horizontal truss assembly 102 supported on four
vertical posts 104-107. The horizontal truss assembly
comprises four motorized collars 108-111 that are inter-tied
10 by four trusses 112-115. Figs. 1A and 1B illustrate a typical
embodiment of a self-rising staging system 100 with four posts
and motorized collars, however some applications could only
require one post and motorized collar, and others could
require several in a variety of topologies.

15 The self-propelled truss-support collars 108-111 are
preferably such that their motors include transmissions and
controls for uniform lifting of the whole given non-uniform
loading amongst them. Matching, very high gear ratios in the
transmissions, and motors with more than adequate torque would
20 be one way to guarantee uniform lifting despite uneven or lop-
sided loading. Limit switches and stops can be used to
synchronize all the motors and collar positions every time
they travel to their respective stops. Another way would be
to temporarily slow down or turn off any motor that was
25 advancing its corresponding collar up or down too much ahead
of the others by using level or position sensors, stepper
motors, or shaft encoders. Other ways to coordinate the
lifting will no doubt be obvious to artisans.

Each vertical post 104-107 is equipped with a full-length
30 rack gear up which crawl the matching pinion gears turned by

the motors in the collars 108-111. The rack gears are hidden behind a protective track cover retained by each post to improve appearance, safety, and prevent gear fouling. Such protective track cover can comprise Teflon or Nylon plastic tape or other flexible materials.

The collar provides an anchoring plate for attachment and support of horizontal staging trusses for assembly on the ground followed by self-elevation overhead. Each truss has a matching triangular profile mounting plate that is most easily bolted to the collars when all are close to the ground. This avoids having to jostle heavy structural members while having to stand on ladders, as is done with conventional systems. Once everything is assembled at ground level, all the motors in tandem lift the structure aloft on the standing posts.

Fig. 2 represents a typical motorized collar 200. A truss-anchor frame 202 provides butt-plates 204-206 to bolt-up the horizontal trusses, e.g., 112-115. The truss-anchor frame 202 further provides a housing for a battery 208, a motor 210, and a gear-reduction transmission 212. Such transmission has a high gear ratio or an automatic braking device that prevents any forced turning of the pinion gear by the weight of the horizontal truss assembly 102 when the motor is off. Alternatively, motors with brakes can be used, e.g., as are common in table saws.

A squared slip tube 214 includes, e.g., Teflon roller bearings 216 and 218 that allow it to ride up and down the vertical posts with very little friction, wobble, and play. The protective track cover tape that was mentioned as part of the vertical posts is shown in Fig. 2 as tape 220 and is threaded so as to allow a pinion gear 222 to engage the post

rack gear. Three tape threading rollers 224-226 guide tape 220 around and in front of pinion gear 222 as it travels up and down the rack gears, for example, inside vertical posts 104-107.

5 The electrical system is rather simple and does not require a detailed description here. Battery power, e.g., 12-volt minimum, is employed exclusively to avoid the risks and costs of using utility power (110/220 VAC) in tradeshow and theatrical venues. Conventional electrical controls, not
10 shown, can be used to coordinate the movements of all the motors involved in raising and lowering a single horizontal truss assembly 102 (Fig. 1). Limit switches 228 and matching stop tabs top and bottom are used to prevent out-of-bounds travel up and down the posts.

15 Fig. 3 illustrates how another motorized collar 300 might be constructed from die cut sheetmetal pieces. A completed top housing 302 is assembled by welding butt-plates 304-307 and webs 308-311 together, e.g., as in partial assembly 312. A motor and transmission 314 is attached to mounting plates
20 316. The squared slip tube is fabricated by joining pieces 318 and 319. These are then enclosed and joined by bottom plate 320. A top roller bearing system 322 and bottom roller bearing system 324 stabilize and help the collar glide on the post.

25 Figs. 4A-4C illustrate a vertical post 400 useful in the staging shown in Figs. 1A and 1B, and compatible with the motorized collars shown in Figs. 2 and 3. The typical vertical post comprises a U-channel 402 with a surface mounted rack gear 404 inset inside a box-channel 406. A slot 408 in
30 box-channel 406 allows the pinion gear, e.g., 222 in Fig. 2,

to engage and climb the rack gear 404. A top stop mounted at a top hole 410 is used to trigger a limit switch that disables further collar travel upward. Such stop is mounted on the post after the collar is positioned.

5 Fig. 5 shows a staging system 500 that includes a vertical post 502 and a self-propelled motorized collar 504. A roller bearing system 506 and 508 keeps the motorized collar 504 in tight alignment with the post 502 and guarantees tooth engagement between a rack gear in the post and a pinion gear
10 in the collar. A motor 510 drives a gear-reduction transmission 512 that may include a brake to hold the collar's position on the post. A bottom limit switch 514 will disable further downward travel of the collar 504 on the post 502 when it is triggered by a bottom stop 516. A similar top limit
15 switch 518 operates to disable further upward travel when it encounters a corresponding top stop (not shown).

Although the present invention has been described in terms of the presently preferred embodiments, it is to be understood that the disclosure is not to be interpreted as
20 limiting. Various alterations and modifications will no doubt become apparent to those skilled in the art after having read the above disclosure. Accordingly, it is intended that the appended claims be interpreted as covering all alterations and modifications as fall within the "true" spirit and scope of
25 the invention.

What is claimed is:

What is Claimed is:

1. A staging system, comprising:
 - a vertical post with a rack gear disposed along a part of its length;
 - a self-propelled motorized collar which slips over said vertical post having a motor and pinion gear for climbing up and down said vertical post by engaging said rack gear; and
 - a battery disposed within the collar and providing for electrical power to said motor;wherein, the collar provides an anchoring plate for attachment assembly and support of horizontal staging trusses for assembly on the ground and self-elevation aloft.
2. The staging system of claim 1, further comprising:
 - a protective track cover tape disposed in the vertical post and for hiding the rack gear from view; and
 - a threading roller disposed in the collar for routing the protective track cover tape around said pinion gear.
3. The staging system of claim 1, further comprising:
 - additional vertical posts and corresponding collars all inter-connected by horizontal staging trusses, and wherein the motors are synchronized to move at least two collars up and down in tandem.
4. The staging system of any one of claims 1 to 3, further comprising:
 - a brake included in said motor for holding the position of said pinion gear when said motor is off.

5. The staging system of claim 1 or 2, further comprising:
a box-channel and U-channel combination disposed in the post and for providing vertical support of said self-propelled motorized collar and pinion drive gear; and
a rack gear inset into one longitudinal surface of the box-channel for providing vertical gearing to said pinion drive gear.

6. A staging system, comprising:
a plurality of vertical posts each with a rack gear disposed along a substantial part of their lengths;
a corresponding set of synchronized and self-propelled truss-support collars each with a motor and pinion gear for climbing up and down respective vertical posts in tandem by engaging the post rack gears;
a protective track cover tape disposed in each vertical post and for hiding the rack gear from view; and
a threading roller disposed in each collar for routing the protective track cover tape around and behind said pinion gear so it can engage said rack gear;
wherein, each collar provides an anchoring plate for attachment and support of horizontal staging trusses for assembly on the ground and self-elevation aloft.

7. The staging system of claim 6, further comprising:
at least one battery providing for electrical power to said motors so that utility power is not required to elevate or de-elevate said horizontal trusses.

8. The staging system of claim 7, wherein:

the self-propelled truss-support collars are such that said motors include means for uniform lifting of the whole given non-uniform loading amongst them.

9. The staging system of any one of claims 6 to 8, further comprising:

a battery disposed within each collar for providing electrical power to said motor.

10. The staging system of any one of claims 6 to 9, wherein each collar slips over a respective post.

11. The staging system of any one of claims 6 to 10, wherein the plurality of vertical posts is four.

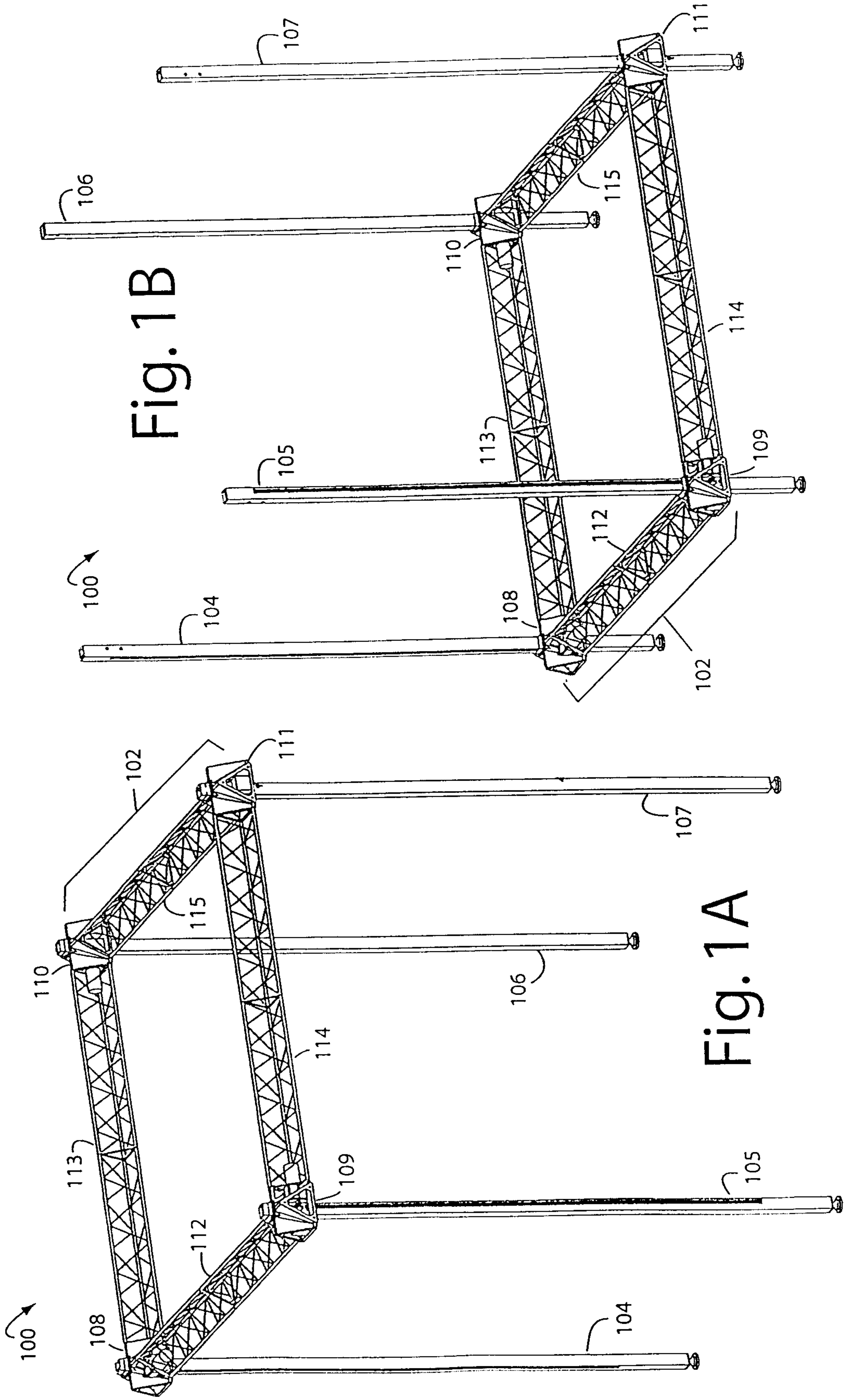
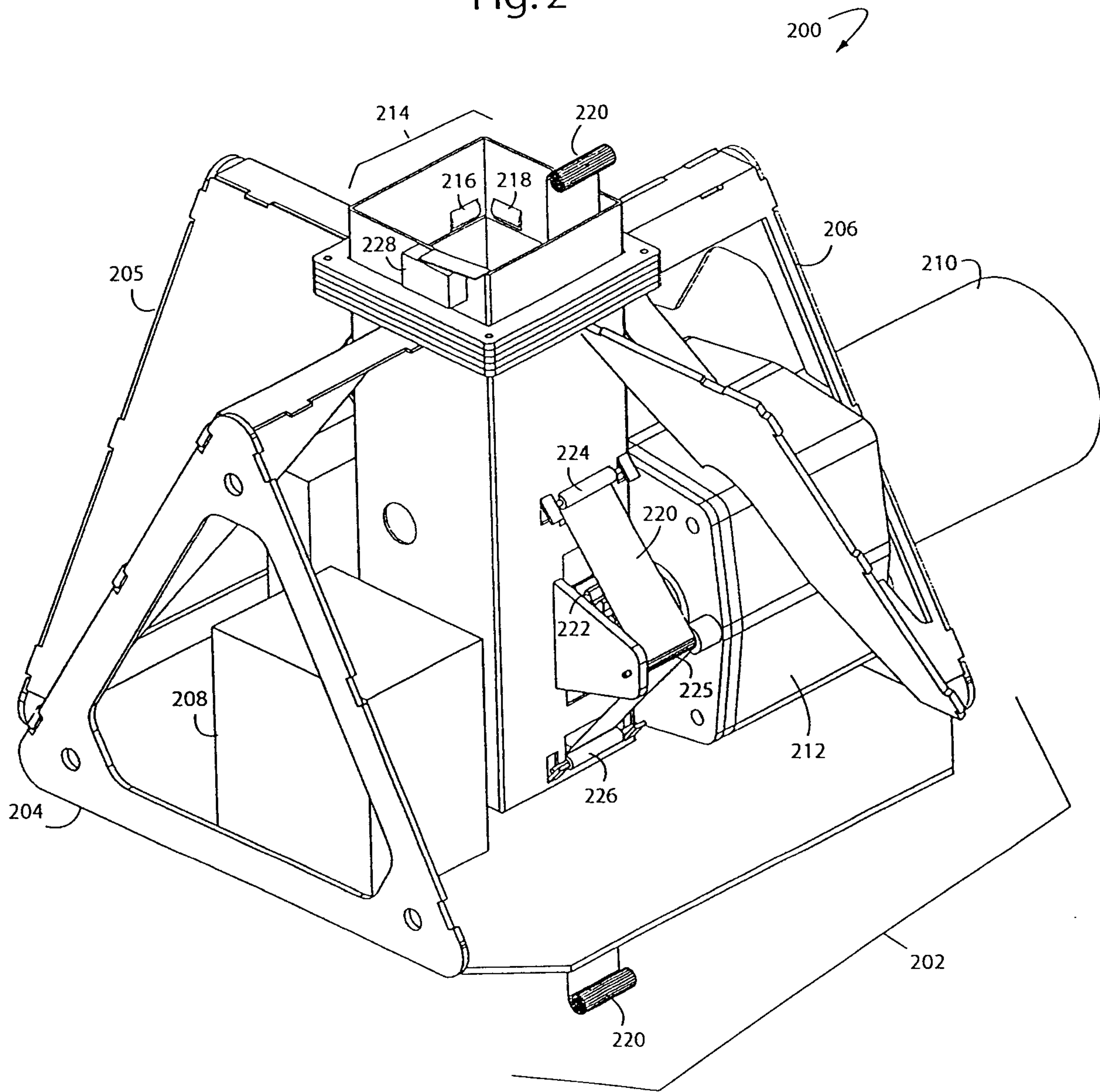


Fig. 1B

Fig. 1A

Fig. 2



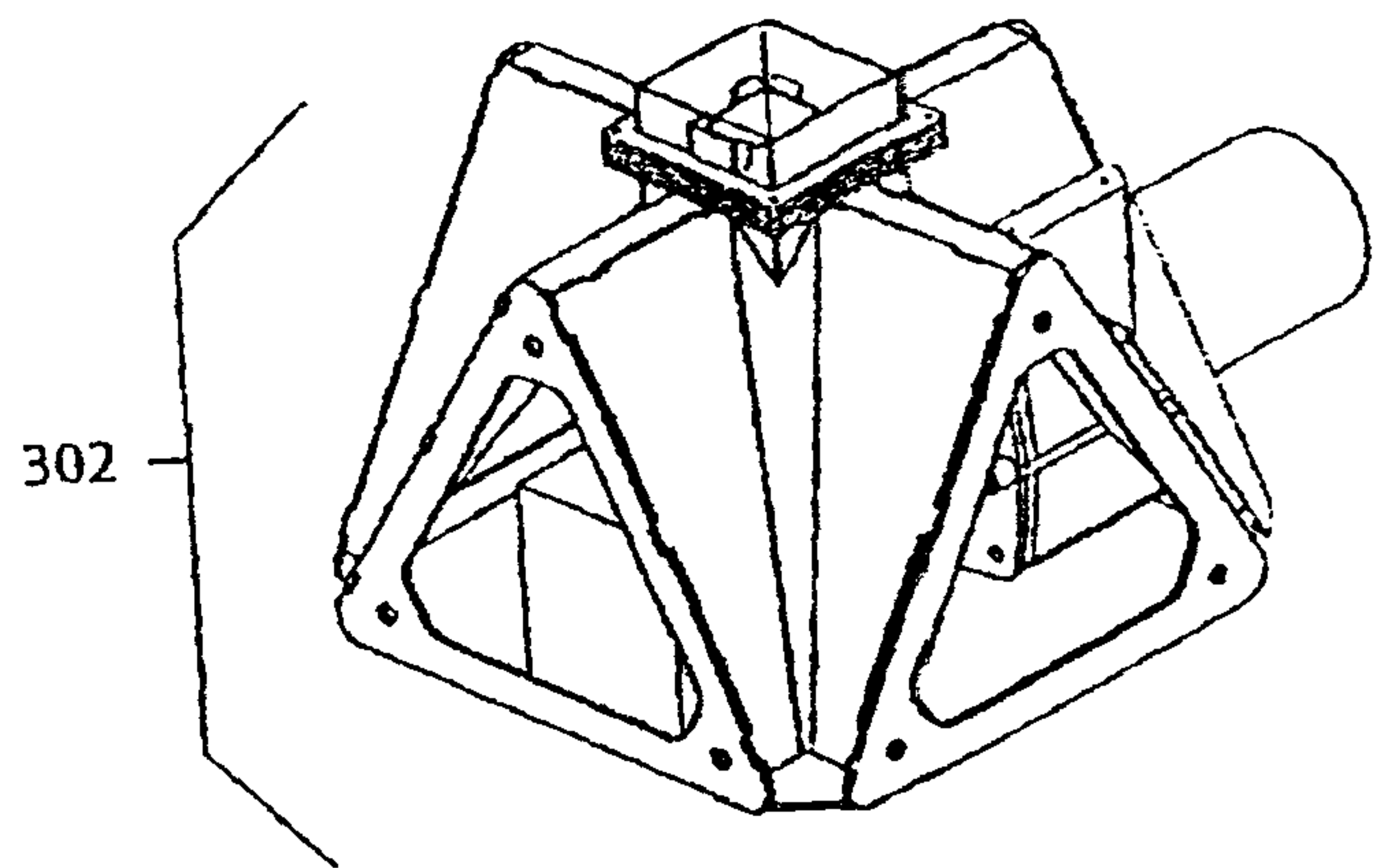
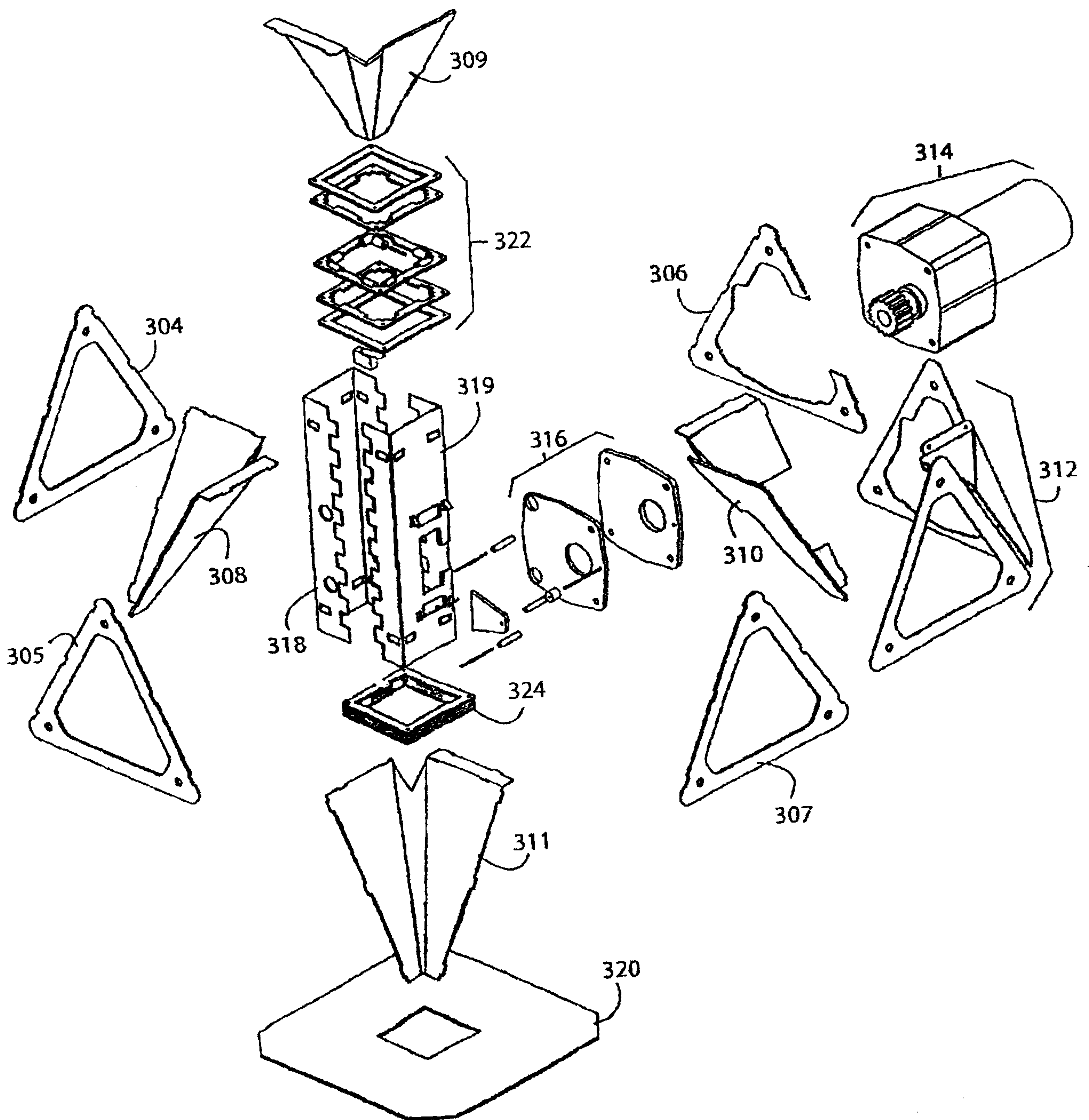


Fig. 3



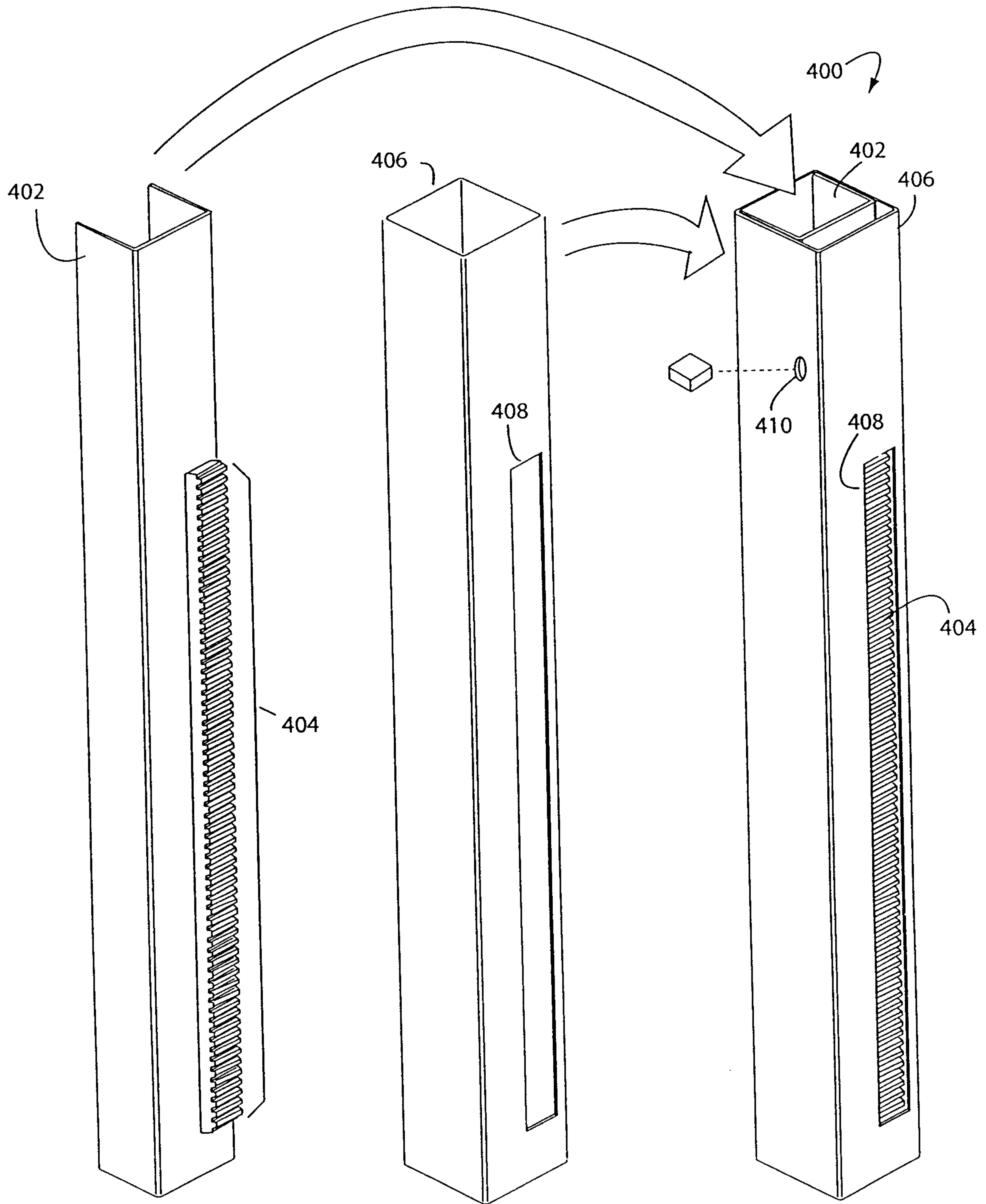


Fig 4A

Fig 4B

Fig 4C

Fig. 5

