

TITLE OF THE INVENTION**SELF-GRIPPING SCREWING AND UNSCREWING DEVICE****FIELD OF THE DISCLOSURE**

The present invention relates to a device of self- gripping screwing and unscrewing.
5 Particularly, a device which performs screwing and unscrewing of a cylindrical shape top part of a cylindrical article, while holding onto the top part, after the top part is being removed.

BACKGROUND OF THE DISCLOSURE

The process of screwing and unscrewing an article includes the steps of holding an internally or externally threaded part of the article and mating an internally threaded hole or externally
10 threaded rod and performing a rotational motion to implement an insertion, as the threaded part travels linearly along the axis of the thread.

A device for screwing and unscrewing is already known, in which the activation of the gripping member for the closures is carried out by means of a stationary control curve in which curve
15 rollers revolving on a circular track engage with the gripping member. This is a conventional type of screwing or unscrewing device designed a long time ago.

PCT Publication No. WO2010118994A3 discloses a device for cap screwing-unscrewing that is composed of a collar provided on the internal surface with a series of seats and comprises corresponding catches contained with possibility of sliding inside the seats together with a
spring that pushes them towards the centre of the collar.

20 There are conventional types of requirements and problems of screwing and unscrewing of cap according to the state of the art, such as firstly, closing caps should be adequately tight to create a good seal and in particular for packaging of white wine, and secondly, it is to be able to be unscrewed and re-screwed by hand without the use of tools, and finally, it is important that these sealing and screwing/unscrewing torque values can be obtained under high speed
25 industrial conditions for capping, repeatedly. Good geometrical tolerance of bottles to be capped and control of capping torque is required.

US Patent No.5784933A disclose an apparatus for unscrewing a threaded cap from its associated threaded container, and such apparatus comprises a first body having a first aperture, and the first aperture is shaped to receive a variety of differently-sized threaded
30 caps; a second body having a second aperture, and the second aperture is shaped to receive a variety of differently-sized containers; and a means for coupling the first body to the second

body, wherein the means for coupling comprises a first coupling element located on the first body and a second coupling element located on the second body, and wherein the first coupling element is configured to mate with the second coupling element via a press-fitting engagement.

- 5 US Publication No. 20070068117A1 discloses a device for screwing sealing caps onto containers, comprising several closing heads revolving on a closed track, each closing head having a gripping tong which can be moved on and off in a controlled manner, each gripping tong having a control unit and to revolve with the gripping tong, each control unit movable relative to the closed track between an opening position opening the gripping tong and a
10 closed position closing the gripping tong, and the control units being operable to change direction by stationary stops between the opening position and the closed position.

Many conventional bottle and jar opening devices lack the ability to effectively open a variety of differently-sized containers and to retain the cap of the containers after it is opened. As seen in many conventional bottle opening devices, for example, some prior art devices are
15 rigidly configured to open a specific container, e.g., containers sealed with standard bottle caps. Other devices may be configured for compatibility with a small number of different container or cap sizes.

US Patent. No. 4,702,129, issued Oct. 27, 1987 to Allen, discloses a conventional device which receives a threaded cap within a cavity such that the user can apply an increased
20 amount of torque by squeezing the device around the cap. However, removal of the cap from the cavity can be a difficult and frustrating if the cap is coated with paint, glue, or other materials. Furthermore, the receiving cavity is not suitable to enable the user to impart an effective amount of compression about the cap without unnecessarily distorting the body of the device.

- 25 In some conventional openers, there is a first element for gripping lids or caps and a second element for gripping bottles or containers. Such a device is desirable to enable the user to impart an increased amount of torque simultaneously to the cap and container during use.

SUMMARY OF THE INVENTION

A main object of the present invention is to provide a self-gripping screwing and unscrewing
30 device, where the cylindrical article with no mechanical locking features is the top part of the cylindrical article to be screwed or unscrewed. The screwing and unscrewing device provides an increasing grip force as the resisting torque exerted from the top part of the cylindrical article increases, and the increased grip force together with a rotational motion of the top part

of the cylindrical article is required to loosen or tighten the top part. The mechanism works in direction of tightening or loosening.

A further object of the present invention is to provide a self-gripping screwing and unscrewing device, comprising

- 5 (i) a screwing/unscrewing module (200) having a back plate (20) and a plurality of finger members (110) mounted evenly onto and along the edge of one surface of the back plate (20); and a plurality of guide rods (30) being used to mount the back plate (20) onto a base plate (10) which is attached to an actuator (11), wherein a central chamber (120) is formed by the plurality of the guide rods (30) and the finger members (110) at the central of the back plate
10 (20);
- (ii) a gripping jaw device (400) having a central cavity to hold a cylindrical article (300) having a circular top part (301) and a bottom part (302), wherein the top part (301) is to be screwed or unscrewed by the screwing/unscrewing module (200) on the base plate (10), wherein the screwing/unscrewing module (200) is slidably mounted by a module assembly
15 mount such that the central chamber (120) is in engagement with the top part (301) of the cylindrical article (300) at the central cavity formed by the gripping jaw (400)

thereby in the course of screwing and/or unscrewing, the top part (301) of the cylindrical article (300) at the central chamber (120) pushes against tangentially on the external surface of the finger members (110) and each of the finger members (110) rotates in opposition direction to
20 that of the top part (301) at the central chamber (120) and the top part (301) is thus unscrewed or screwed.

Yet still another object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the rotating of the plurality of the gripping members (110) on the screwing and/or unscrewing module (200) renders the top part (301) of the cylindrical article
25 (300) to be unscrewed or screwed.

A further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the top part (301) is pressed against the finger members (110) attached to the back plate (20), and the top part (301) is held by friction formed between the plurality of finger members (110) and the external surface of the top part (301).

30 Yet another object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein a spring (50) is mounted to a guide bushing (40) which is disposed onto one end of the guide rod (30), wherein the spring (50) allows the back plate (20) to be

compressed towards the base plate (10), allowing the back plate (20) and the top part (301) to move linearly along the axis of rotation of the top part (301) of the cylindrical article (300).

5 Still a further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the plurality of guide rods (30) are placed between the base plate (10) and the back plate (20), and a torque generated by a motor is transmitted through the guide rods (30) to perform the screwing and the unscrewing of the top part (301) of the cylindrical article (300).

10 Another object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein if both tightening and loosening of the top part of the article are critical, two set of gripping fingers can be used to perform the capping and uncapping task. One set would provide self-gripping in the clockwise and the other in the anti-clockwise direction. As the top part of the article is rotated, the top part would move linearly in the direction of the axis of the rotation of cylindrical fingers or the gripping fingers.

15 Still an object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the movement of the screwing or unscrewing of the top part of the cylindrical article is linearly along the axis of the rotation, maintaining the grip on the top part throughout the process of screwing or unscrewing.

20 In accordance with the object of the present invention, the top part of the cylindrical article is pressed between a plurality of cylindrical fingers or gripping fingers attached to a back plate, wherein the top part is held by friction generated by the cylindrical fingers on the top part. In order to guide the back plate linearly along the axis of rotation, the guide rods are placed between the base plate and the back plate. A plurality of guide rods and springs are placed behind the back plate, allowing the top part to be pushed in between the gripping fingers, and allowing the back plate and the top part to move linearly along the axis of rotation until the
25 screwing or unscrewing process is completed.

In order to guide the back plate linearly along the axis of rotation, the guide rods are placed between the base plate and the back plate.

The torque produced by the motor is transmitted through the plurality of guide rods to perform both the screwing and unscrewing by the self-gripping screwing and unscrewing device.

30 The gripping fingers of the finger assembly of the self-gripping screwing and unscrewing device of the present invention has a plurality of an eccentric rubber sleeves, each of which

rotates due to a resisting torque from the top part, and each eccentric rubber sleeve is held at its initial position by a pin, and deformation of the eccentric rubber sleeve is allowed in torsion.

In accordance with the present invention, the resisting torque from the top part, in the course of screwing or unscrewing, is transmitted through friction to the gripping fingers, wherein the
5 eccentric rubber cylinder rotates about the axis of the cylindrical gripping fingers, hence further tightening the grip of the cylindrical gripping fingers against the top part.

The increased grip on the top part allows tangential force from the motor torque to be applied onto the top part without slipping. As the top part rotates, the back plate is constantly pressed against the top part, and the distance travelled by the back plate is the distance required from
10 the top part to be fully screwed or unscrewed.

In accordance with the self-gripping screwing and unscrewing device of the present invention, the resisting torque is removed at the end of a tightening process or reduced at the beginning of a unscrewing process, the rubber elastic modulus of the eccentric rubber sleeve returns to the initial position, hence returning the position of the eccentric rubber sleeve reduces the grip
15 on the top part.

Another main object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the device on a base plate is mounted onto a motor or rotary actuator to perform the screwing and unscrewing of a cylindrical top part, and in the course of the screwing and unscrewing process, the screwing and unscrewing device is lowered towards
20 the top part. In the course of lowering of the device, the top part is pressed into between the gripping fingers, and if the direction of rotation moves the top part towards the gripping finger, the assembly would be lowered to a height where the springs reach an initial compression. And if the direction of the rotation moves the top part away from the gripping fingers, the finger assembly is lowered to a height of initial compression of the spring plus the required linear
25 travel of the top part.

A further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the cylindrical top part does not have a mechanical locking feature, but relies on friction to allow torque to be transmitted effectively to the top part to perform the tightening and loosening process without relative slip.

30 Yet another object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein a relatively small initial grip allows the top part to be easily handled and inserted between the gripping fingers and removed it from the gripper assembly.

A further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the torque from the motor is transmitted to the top part, resisting torque from the top part rotates the eccentric rubber sleeve around each gripping finger, tightening the grip on the top part.

- 5 Yet a further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the increased grip prevents slip between the eccentric rubber sleeve and the top part, allowing the top part to be tightened or loosened, and as resisting torque from the top part is removed or reduced, the rubber eccentric sleeve returns to its initial position, allowing the top part to be easily removed.
- 10 Yet still a further object of the present invention is to provide a self-gripping screwing and unscrewing device, wherein the device is attached to a rotary motor or a mechanism at the base plate to allow the entire device to rotate about its axis, and in the course of screwing or unscrewing of the top part process, the position of the gripping fingers is maintained, and the back plate guided by the guide rods pushes on the top part, and is allowed to slide back and
- 15 forth during the unscrewing and screwing process respectively.

The above and other advantages of the present invention are carried out in one form by a self-gripping screwing and unscrewing device.

BRIEF DESCRIPTION OF THE DRAWINGS

- The preferred embodiment of the disclosure is described in the following by means of the diagrams. These depict the following:
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FIG. 1 is a perspective view of a self-grip screwing and unscrewing device holding onto a cylindrical part, attached onto the shaft of a rotary motor in accordance with the present invention.

- FIG. 2 is a perspective exploded view of the self-gripping screwing and unscrewing device in accordance with the present invention.
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FIG. 3 is a side view of the self-gripping and unscrewing device in accordance with the present invention, wherein the screwing/unscrewing module (200) is mounted onto the base plate and then disposed onto the rotary motor.

- FIG. 4 is a perspective view of a self-gripping screwing and unscrewing device attached to a linear actuator for screwing or unscrewing a cylindrical top part of a cylindrical article in accordance with the present invention;
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FIG. 5 is a schematic perspective view showing a cylindrical article having a cylindrical top part and a tube body as bottom part, wherein the cylindrical article is held by a pair of gripper jaws in accordance with the present invention.

5 FIG. 6 is a schematic perspective view showing the top part of the cylindrical article being held within the central chamber on the back plate and the bottom part of the cylindrical article being held within the gripper jaws after an unscrewing process is implemented in accordance with the present invention.

FIG. 7A shows the top view of the screwing/unscrewing module, showing the position of each of the finger assemblies and guide rod, whereby self gripping function of assembly is in the clockwise direction as viewed , in accordance with the present invention;

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FIG. 7B is a sectional view of the finger member, wherein the eccentric rubber sleeve is held by the sleeve pin in accordance with the present invention.

FIG. 8A is the top view of the finger member assembled onto the back plate in accordance with the present invention;

15 FIG. 8B shows the cross section view of the guide rod and the eccentric rubber sleeve mounted to the back plate along line B-B of FIG.8A of the present invention;

FIG. 9A and FIG. 9B are sectional views showing the movement of the screwing/unscrewing module during the screwing and unscrewing of the cylindrical top part in accordance with the present invention, wherein the eccentric rubber sleeve engages the cylindrical top part and forces the screwing/unscrewing module to move downwards, compressing the spring around the guide rod. FIG.9B is a sectional view showing the spring being compressed.

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FIG. 10 is a schematic view showing the eccentric rubber sleeves engaging the cylindrical top part as a resisting torque being experienced by the finger member in accordance with the present invention, wherein the direction of resisting torque of the top part is opposite to that to induce the twist of eccentric rubber sleeve.

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FIG. 11 is a perspective view of the finger members of the screwing/unscrewing module of the present invention, wherein the eccentric rubber sleeves twist the cylindrical part of the cylindrical article, and additional material of the cylindrical article is drawn towards the top part from the eccentric rubber sleeves as the eccentric rubber sleeves rotate.

DETAILED DESCRIPTION OF THE DISCLOSURE

A self-gripping device (500) of a preferred embodiment of the present invention shown in FIG. 1 is designed for the screwing and unscrewing of a sealing cylindrical top part of a cylindrical article. The article has a top part (301) and a bottom part (302) as shown in FIG. 5 and FIG. 6. FIG. 1 is a perspective view of the self-gripping screwing and unscrewing device (500), wherein the device (500) is mounted onto the shaft of a rotary motor (11) or the like in accordance with the present invention.

In accordance with a preferred embodiment of the present invention, the screwing and unscrewing device (500) comprises a gripping assembly (100) including a plurality of finger members (110) and a plurality of guide rods (30), the finger members (110) and the guide rods (30) are mounted onto one surface of a back plate (20) with a circular edge, which is then disposed onto a base plate (10). The gripping assembly (100) together with the back plate (20) and the base plate (10) forms into a screwing/unscrewing module (200) as shown in FIG. 5. In other words, the screwing/unscrewing module (200) as shown in FIG. 5 and FIG. 6 is mounted to the shaft of a rotary motor (11) or the like, and the rotary motor (11) turns the screwing/unscrewing module (200) in the course of screwing and unscrewing the top part (301) of the cylindrical article (300).

A central chamber (120) is formed on at the central part of one of the surfaces of the back plate (20). The central chamber (120) is a space substantially surrounded by the plurality of the guided rods (30) and the finger members (110). The guided rods (30) and the finger members (110) are equally spaced out along the edge of the back plate (20), as shown in FIG. 1.

As shown in FIG. 1, the gripping assembly (100) holds a cylindrical top part (301) located at the central chamber (120) on the back plate (20), and is attached onto the shaft of a rotary motor. In the figure, the cylindrical top part (301) is positioned at the central of the back plate (20) and the figure shows how the top part (301) is held by the gripping assembly (100).

FIG. 2 is a perspective exploded view of the self-gripping screwing and unscrewing device (500) in accordance with the present invention. The screwing/unscrewing module (200) comprises a plurality of guide rods (30) and a plurality of eccentric rubber sleeves (60), or the gripper assembly (100) on the back plate (20), wherein the guide rods (30) are mounted onto the back plate (20), and a plurality of holding screws (90), a plurality of sleeve pins (70) together with a plurality of sleeve bushings (60) and dowel pins (101) are secured onto the back plate (20) in adjacent to the position of the guide rods (30) on the back plate (20) along

the edge thereof. A plurality of the guide bushings (40) are used to fasten with the guide rods (30) at the back plate (20). A plurality of springs (50) are used to support the guide bushings (40), wherein the guide bushings (40) sit onto the spring (50) on the base plate (10). In other word, the back plate (10) can compress the base plate (10) by way of the springs (50), and
5 the guide bushings (40) sit onto the springs (50).

FIG. 3 is a sectional view of the self-gripping and unscrewing device (500) in accordance with the present invention, wherein the screwing/unscrewing module (200) is mounted onto the rotary motor (11). As shown in the figure, the eccentric rubber sleeves (60), and the guide rods (30) are located on the surface of the back plate (20) along the edge thereof. The guide
10 bushings (not shown), each sits onto the spring (50), and the springs (50) are positioned onto the surface of the base plate (10). In other words, the screwing/unscrewing module (200) can be compressed since the spring (50) is positioned between the back plate (20) and the base plate (10).

In accordance with the preferred embodiment of the present invention, as shown in the figures,
15 the gripper assembly (100) comprises of a back plate (20) guided by a plurality of bushings (40) to allow the guide rod (30) to slide through, while a plurality of springs (50) on the guide bushing (40) are used to engage the back plate (10). As the top part (301) is pressed in between the finger members (110), and the springs (50) are compressed which overcome the frictional force between the eccentric rubber sleeves (60) and the top part (301), allowing the
20 top part (301) to be inserted to the central chamber (120).

The plurality of finger members (110) are mounted onto the back plate (20), and each of which is fastened with a holding screw (90) through each of the finger members (110). On each finger member (110), an eccentric rubber sleeve (60) is inserted over each sleeve pin (70). Assembling onto the back plate (20), the position of both sleeve pin (70) and eccentric rubber
25 sleeve (60) are fixed to the intended position thereof by a plurality of dowel pins (101). One or more sleeve bushings (80) are inserted into the eccentric rubber sleeve (60) to allow the eccentric rubber sleeve (60) to rotate about the sleeve pin (70).

The sleeve pin (70) is used to hold the eccentric rubber sleeve (60) at a desired pitch circle diameter according to the diameter of the top part (301) of the cylindrical article (300), to hold
30 the angle and allowing torsional rotation of the eccentric rubber sleeve (60), a sleeve pin (70) is placed into a hole (61). This also to allow the eccentric rubber sleeve (60) to return to its original position thereof when the resisting torque is removed.

FIG. 4 is a perspective view of a self-gripping screwing and unscrewing device (500) attached to a linear actuator (11) for screwing or unscrewing a circular top part (301) in accordance with the present invention. As shown in the figure, the screw and unscrewing module (200) is attached onto the holding bracket (55) and the top part (301) grabbed by a plurality of gripper jaws (400) for screwing and unscrewing of the top part (301) by the module (200) of the present invention.

The entire screwing and unscrewing module (200) is moved to position by a linear motor (12) as shown in FIG. 4, and rotated by the rotary motor (11), where the height of the module (200) is held constant and the back plate (20) is allowed to slide along the guide rods (30) as the top part (301) is being rotated.

As shown, FIG. 5 is a schematic perspective view showing a cylindrical article (300) having a cylindrical top part (301) and a tube body or the bottom part (300) being held by the gripper jaws (400) in accordance with the present invention. FIG. 6 is a schematic perspective view showing the top part (301) of the cylindrical article (300) being held within the screwing/unscrewing module (200) and the bottom part (302) of the cylindrical article (300) being held within the gripper jaws (400) after an unscrewing process is implemented in accordance with the present invention.

As shown in FIGs. 4, 5 and 6, there are shown the gripper jaws (400) having a central cavity to hold the cylindrical article (300) having a circular top part (301) and a bottom part (302), wherein the top part (301) is to be screwed or unscrewed by the screwing/unscrewing module (200), and wherein the screwing/unscrewing module (200) is slidably mounted by a module assembly mount (55) (as shown in FIG. 4) that can move upward or downward such that the central chamber (120) on the screwing/unscrewing module (200) can be in engagement with the top part (301) of the cylindrical article (300) being gripped by the gripper jaws (400).

In FIG. 5, there is shown the top part (301) of the cylindrical article (300) held by the gripper jaws (400) being positioned directly below the screwing and unscrewing module (200) of the present invention. In FIG. 6, the top part (301) of the cylindrical article (300) is being removed or unscrewed and held by the screwing/unscrewing module (200) and the bottom part (302) is held by the gripper jaws (400) in accordance with the present invention.

In accordance with the preferred embodiment of the present invention, in the course of screwing and/or unscrewing, the top part (301) of the cylindrical article (300) at the central chamber (120) touches the external surface of the finger members (110) and each of the finger members (110) rotates in opposition direction to that of the top part (301) at the central

chamber (120) and the top part (301) is dislocated from the bottom part (302) of the cylindrical article (300), and the top part (301) is thus unscrewed or screwed.

FIG. 7A shows the top view of the gripper assembly (100) showing the layout of the fingers and guide rods to form a cavity. Direction offset of the asymmetrical finger assemblies shows the designed function of the gripper assembly in the clockwise direction as view from the figure, in accordance with the present invention. FIG. 7B is a sectional view of the finger members (110), wherein the eccentric rubber sleeve (60) is held by the sleeve pin (70), and the sleeve pin (70) is fastened to the back plate (20) by the holding screw (90) through the sleeve pin (70) in accordance with the present invention.

In FIG. 7A, the central chamber (120) is for the accommodation of the top part (301) of the cylindrical article (300). There are only three finger members (110) shown. The top part (301) is pressed between three fingers members (110) attached to the back plate (20) where the top part (301) is held by friction. The three guide rods (30) are shown and the springs (not shown) are placed behind the back plate (20), allowing the top part (301) to be pushed in between the gripper assembly (100) and allowing the back plate (20) and the part (301) to move linearly along the axis of rotation until the process is complete. To guide the back plate (20) linearly along the axis of rotation, the three guide rods (30) are placed between the base plate (10) and the back plate (20). Torque from the motor (11) is transmitted through the three guide rods (30) to perform both screwing and unscrewing.

FIG. 10 is a schematic view showing the eccentric rubber sleeves (60) engaging with the cylindrical top part (301) as a resisting torque being experienced by the finger members (110) in accordance with the present invention. As shown, the direction of twist of the eccentric rubber sleeve (60) which is denoted as arrow 702 is of opposite direction of rotation of the top part (301). The direction of rotation of the top part (301) is denoted as arrow 701.

FIG. 11 is a perspective view of the finger members (110), wherein the eccentric rubber sleeves (60) twist the cylindrical part (301) of the cylindrical article (300), and additional material of the cylindrical article (300) is drawn towards the top part (301) from the eccentric rubber sleeves (60) as the eccentric rubber sleeves (60) rotate.

As shown in FIG. 10, each of the finger members (110) has an eccentric rubber sleeve (60), which rotates due to a resisting torque from the top part (301). Each eccentric rubber sleeve (60) is held at its initial position by the sleeve pin (70) and the bottom end of the eccentric rubber sleeve (60) is fixed by a dowel pin (101) through a dowel hole (61), as shown in FIG. 7B. Deformation of the eccentric rubber sleeve (60) is allowed in torsion.

Resisting torque from the top part (301) is transmitted through friction to the finger members (110), where the eccentric rubber sleeve (60) rotates about the axis of the finger members (110), hence further tightening the grip of the finger members (110) against the top part (301) of the cylindrical article (300). The increased grip on the top part (301) allows tangential force from the motor torque to be applied on to the top part (301) without slipping. As the top part (301) rotates, the back plate (20) is constantly pressed against the top part (301). The distance travel led by the back plate (20) is the distance required for the top part (301) to be fully screwed or unscrewed.

As the resisting torque is removed at the end of a tightening process or reduced at the beginning of an unscrewing process, the elastic modulus of the eccentric rubber sleeve (60) returns to the initial position hence returning the position of the eccentric rubber sleeve (60) reducing grip on the top part (301).

FIG. 8A is the top view of the finger members (110) assembled to the back plate (20) in accordance with the present invention, and FIG. 8B shows the cross section of the finger member (110) mounted to the back plate (20) along line B-B of FIG.8A of the present invention. From FIG. 8B, it is clear that the guide rod (30) is mounted with the guide bushing (40), which is then positioned on the spring (50). The position of the guide bushing (40) is located below the back plate (20), and the spring (50) is located below the back plate (20) but above the base plate (10).

FIG. 9A and FIG. 9B are sectional views showing the movement of the screwing/unscrewing module (200) during the screwing and unscrewing of the cylindrical top part (301) in accordance with the present invention, wherein the eccentric rubber sleeve (60) engages the cylindrical top part (301) and forces the screwing/unscrewing module (200) to move downwards, compressing the springs (50) around the guide rod (30). FIG.9B is a sectional view showing the springs (50) being compressed.

In the preferred embodiment of the present invention, as shown in FIGs. 5 and 6, the gripper jaw (400) for gripping the cylindrical top part (301) is located directly below the screwing/unscrewing module (200), wherein the external surface of the top part (301) touches the external surface of the finger members (110) and each of the finger members (110) rotate in opposition direction to that of top part (301) located at the central chamber (120). The gripping jaw (400) is provided with a central cavity to hold the cylindrical article (300) to be screwed or unscrewed by the central chamber (120) on the back plate (20). The rotation of the cylindrical article (300) will render the top part (301) of the article (300) to be unscrewed or screwed.

In accordance with the present invention, there is provided a device for self-gripping screwing and unscrewing of a cylindrical top part (301), such as a cap or the like structure. In the process of screwing and or unscrewing, the top part (301) is retained when it is removed from the cylindrical article (300).

- 5 The invention is designed to perform the screwing and unscrewing of round cross sectional object where no mechanical locking features are present. The invention creates an increasing grip force as the resisting torque increases, where the increased grip force is required to loosen or tighten the part. The mechanism works in direction of tightening or loosening. If both tightening and loosening are critical, two set of fingers can be used to perform the capping and uncapping task. As the part is rotated, it would move linearly in the direction of the axis of rotation. The contraption is designed to move linearly along the axis of rotation, maintaining grip on the part throughout the process of screwing and unscrewing.
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- In summary, a preferred embodiment of the present invention provides a self-gripping screwing and unscrewing device for removing cap or a cylindrical top part from a cylindrical container. The device is particularly suitable for use with containers and is configured for compatibility with an assortment of differently-sized containers and caps. The device is configured to enable a cap to be easily screwed and unscrewed from the cylindrical container and after the cap has been removed the cap is retained by the device.
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- The present invention has been described above with reference to a preferred embodiment. However, those skilled in the art will recognize that changes and modifications may be made to the preferred embodiment without departing from the scope of the present invention. These and other changes or modifications are intended to be included within the scope of the present invention, as expressed in the following claims.
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CLAIMS

1. A self-gripping screwing and unscrewing device or the like, comprising
 - (i) a screwing/unscrewing module (200) having a back plate (20) with a circular edge and a plurality of finger members (110) mounted evenly onto and along the edge of one surface of the back plate (20); and a plurality of guide rods (30) being used to mount the back plate (20) onto a base plate (10) which is attached to an actuator (11), wherein a central chamber (120) is formed by the plurality of the guide rods (30) and the finger members (110) at the central of surface of the back plate (20);
 - (ii) a gripping jaw device (400) having a central cavity to hold a cylindrical article (300) having a circular top part (301) and a bottom part (302), wherein the top part (301) is to be screwed or unscrewed by the screwing/unscrewing module (200) on the base plate (10), wherein the screwing/unscrewing module (200) is slidably mounted by a module assembly mount such that the central chamber (120) is in engagement with the top part (301) of the cylindrical article (300) at the central cavity formed by the gripping jaw (400),thereby in the course of screwing and/or unscrewing, the top part (301) of the cylindrical article (300) at the central chamber (120) touches the external surface of the finger members (110) and each of the finger members (110) rotates in opposition direction to that of the top part (301) at the central chamber (120) and the top part (301) is rotated and thus unscrewed or screwed.
2. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the rotating of the plurality of the gripping members (110) on the screwing and/or unscrewing module (200) renders the top part (301) of the cylindrical article (300) to be unscrewed or screwed.
3. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the top part (301) is pressed against the finger members (110) attached to the back plate (20), and the top part (301) is held by friction formed between the plurality of finger members (110) and the external surface of the top part (301).
4. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein a plurality of springs (50) are mounted to a guide bushing (40) which is disposed onto one end of the guide rod (30), wherein the springs (50) allows the back plate (20)

to be compressed towards the base plate (10), allowing the back plate (20) and the top part (301) to move linearly along the axis of rotation of the finger members (110).

5. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the plurality of guide rods (30) are placed between the base plate (10) and the back plate (20), and a torque generated by a motor is transmitted through the guide rods (30) to perform the screwing and the unscrewing of the top part (301) of the cylindrical article (300).
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6. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the finger assemblies (110) each has an eccentric rubber sleeve (60), which rotates when a resisting torque from the top part (301) is imparted onto the eccentric rubber sleeve (60).
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7. The self-gripping screwing and unscrewing device or the like as set forth in Claim 6, wherein the eccentric rubber sleeve (60) is deformable.
8. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein a resisting torque from the top part (301) of the cylindrical article (300) is transmitted through friction to the finger assemblies (110).
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9. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the top part (301) rotates, the back plate (20) is constantly pressed against the top part (301), and the distance travelled by the back plate (20) is the distance required for the top part (301) to be fully screwed or unscrewed.
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10. The self-gripping screwing and unscrewing device or the like as set forth in Claim 9, wherein the distance travelled by the back plate (20) is the distance required for the top part (301) to be fully screwed or unscrewed.
11. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the base plate (10) is mounted onto a motor (11) or a rotary actuator to perform the screwing or unscrewing of the top part (301) of the cylindrical article (300).
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12. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the back plate (20) guided by the guide rods (30) pushes onto the top part (301) and is allowed to slide back and forth in the course of unscrewing and screwing of the top part (301).
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13. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the finger members (110) comprises an eccentric rubber sleeve (60) and a sleeve pin (70), and the eccentric rubber sleeve (60) is inserted over the sleeve pin (70) on a back plate (20).
- 5 14. The self-gripping screwing and unscrewing device or the like as set forth in Claim 13, wherein the sleeve pin (70) is used to hold one end of the eccentric rubber sleeve (60) to limit the rotation of the eccentric rubber sleeve (60).
- 15 15. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the screwing/unscrewing module (200) is rotated by the motor and the height of the screwing/ unscrewing module (200) to the back plate (20) is held constant, and the back plate (20) is allowed to slide along the guide rods (30) as the top part (301) is being rotated.
- 16 16. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the finger assemblies (110) holds the top part (301) and the finger assemblies (110) is attached onto the shaft of a rotary motor.
- 17 17. The self-gripping screwing and unscrewing device or the like device as set forth in Claim 1, wherein the sleeve pin (70) is fastened to the back plate (20) by a holding screw (90) through the sleeve pin (70).
- 20 18. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the eccentric rubber sleeve (60) engages the top part (301) and forces the screwing/unscrewing module (200) to move downwards and compresses the spring (50) around the guide rod (30).
- 25 19. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein in the course of screwing and/or unscrewing, the eccentric rubber sleeve (60) rotates at the top part (301) but the eccentric rubber sleeve (60) is fixed and stationery at the base thereof.
- 30 20. The self-gripping screwing and unscrewing device or the like as set forth in Claim 1, wherein the direction of rotation of the eccentric rubber sleeve (60) is opposite to the direction of rotation of the cylindrical top part (301), which is the direction of resisting torque of the top part (301).