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(54) **SLAG DISPERSAL DEVICE AND METHOD**

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Description

[0001] This invention relates to a slag stream dispersal device and a method of processing overflow material in a dry slag granulation device. The slag material may be metal based, such as iron; a metal oxide, such as titanium oxide; a non-metal, such as slag generated as a by-product of a metals production process; or a mixture thereof.

[0002] Dry slag granulation is a relatively undeveloped technology which uses a rotary atomiser, typically a spinning cup or dish, to convert molten slag (for example obtained as a by-product of iron making in a blast furnace) into granules, without the addition of water to cool and harden the slag. Examples of dry slag granulation apparatus and methods are given in GB2148330, EP0605472 and EP0804620. The molten slag from the blast furnace is received at a dry slag granulation device for granulation. However, a problem encountered in dry slag granulation is that the flow rate of the slag stream onto the granulator can vary significantly. In some cases, the rate of flow exceeds the rate at which the spinning cup of the granulator can process the slag stream and as a result, the excess slag stream passes over the edge of the cup and hardens in a single mass, requiring heavy excavators to be used within the shell of the blast furnace building to break up and remove the overflowed slag.

[0003] In accordance with a first aspect of the present invention, a slag stream dispersal device comprises a rotary slag granulator, wherein the granulator comprises a rotary distributor; and wherein the device further comprises a plurality of flexible extensions distributed about a circumference of the rotary distributor and configured to extend radially therefrom.

[0004] The present invention provides a device, to address the problem of overflow of the slag stream during dry slag granulation, which has flexible extensions to break up the overflowing material, so that the material ends up in a form that can be removed without having to resort to mechanical diggers to break up a single mass of hardened material.

[0005] Preferably, each of the flexible extensions comprises a plurality of chain links, a chain-mail skirt, a plurality of articulated sections, or wire rope.

[0006] Preferably, the flexible extensions comprise a metal.

[0007] Metal has good conductivity, so the slag is less likely to stick to the extensions, than for materials with less good conductivity.

[0008] Preferably, the metal comprises one of steel, or iron.

[0009] Preferably, the flexible extensions depend from the rotary distributor, when the granulator is at rest.

[0010] Preferably, the rotary distributor comprises one of a cup, or plate.

[0011] In accordance with a second aspect of the present invention, a method of processing overflow material in a dry slag granulation device comprises providing about a perimeter of a dry slag granulator, a plurality of

flexible extensions configured to rotate with the dry slag granulator and extend radially therefrom; rotating the granulator and flexible extensions; applying a stream of slag to the granulator; breaking up slag in the slag stream which overflows the granulator using the rotating flexible extensions; and depositing the broken up slag stream at a distance from the granulator.

[0012] Preferably, the broken up overflow slag stream is deposited beyond the ends of the rotating flexible extensions.

[0013] An example of a slag stream dispersal device and a method in accordance with the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 illustrates an example of dry slag granulation plant in which the present invention may be used; Figure 2 illustrates the problem encountered in a conventional rotary dry slag granulation device; Figure 3 is an example of a device according to the present invention in use;

Figure 4 is an example of a device according to the present invention at rest;

Figure 5 is an exploded view of one example of part of a device according to Fig.3;

Figure 6 shows a section through part of Fig.3;

Figure 7 illustrates a number of alternative implementations of flexible extensions for use in the device of Figs.3 and 4;

Figure 8 illustrates a further implementation of the flexible extensions for use in the device of Figs.3 and 4; and,

Figure 9 shows an alternative connection for the flexible extensions for use in the device of Figs.3 and 4.

[0014] Fig. 1 illustrates an example of a dry slag granulation plant 1. The precise construction may vary, but the main components comprise a rotary granulator, typically comprising a rotary distributor, e.g. a plate, or cup 2 adapted for rotation about a centreline 5, mounted on a support 3 and drive shaft 4, which is driven by a controllable drive (not shown) able to vary the speed of rotation of the cup. The drive may be mounted within the support, or elsewhere. Slag is fed from the blast furnace, or other source of molten slag, onto the centre 5 of the rotary cup 2 via a guide 8. Typically, the guide is in the form of an open trough of refractory material, which is less costly than constructing pipes. The rotary cup 2 is illustrated as a flat disc, but more commonly, the cup is a concave surface onto which the stream of molten slag from the guide falls. The granulator cup may take various shapes, such as a flat disk, or one with raised bars, fins or curved paddles extending radially from a centrepoin; or a cup with smooth or terraced sides. The plant 1 is enclosed by a wall, or walls 7, depending on the shape of the plant, through which the guide 8 passes.

[0015] In the example shown in Fig.1, an annular trough 6 is positioned at a distance from the centreline 5

of the spinning cup 2, with a top edge of the trough at a lower level than the cup 2. Optionally, a guide surface 9 is also provided between the rotary cup and a first wall 10 of the annular trough, the guide surface extending downwardly from the rotary cup. The plant 1 may be entirely enclosed, by providing a cover (not shown) to the tops of the walls 7 and the walls may have cooling, either internally, or by means of a spray of a coolant gas along the walls, to lower the temperature of the enclosure thereby assisting in solidifying the granulated slag.

[0016] The problem addressed by the present invention is illustrated in Fig.2. From time to time a deluge of slag falls onto the centre 5 of the spinning cup 2 and instead of breaking up into granules, the slag stream 11 overflows onto the floor area surrounding the support (or onto the guide surface 9 if that is provided) and then solidifies. This single mass of solidified material prevents correct operation of the rotary granulator 2 and so must be broken up, usually using heavy equipment that has to enter the blast furnace shell and the enclosed area of the granulation plant 1. This is inconvenient and may have safety implications if the periods between batches of slag are not sufficient to allow the clean up to take place in the time available.

[0017] As illustrated by Fig.3, the present invention addresses this problem by providing a plurality of flexible extensions to the spinning cup 2, which depend from the edge or the underside of the cup when at rest (see Fig. 4), but, in operation, are caused to extend radially from the cup 2 due to the centrifugal force as the cup with the flexible extensions spins around. These spinning extensions 12 then impact the overflow of slag 11 coming off the edge of the cup and break it up into clinker 13, which can then be cleared away more easily than a single solid mass.

[0018] One particular embodiment is illustrated in more detail in Figs. 5 and 6. Fig. 5 shows how the granulator cup 2 is mounted on a cup drive 14 in a cup drive stand 16. For this example, the flexible extensions are in the form of a chain and are fixed in place beneath the granulator cup 2 by means of a chain keep plate 15. The end link of the chain may be attached to the keep plate by hooking over a pin 17 on the upper surface of the plate and the plate is then held in place against the base of the granulator cup by screws, or other fixing means 18 which pass through the keep plate 15 and the cup drive 14. This can also be seen in Fig.6. The cup drive 14 may be separately attached to the granulator cup by a screw, or other fixing means 19.

[0019] The form taken by the flexible extensions 12 is not limited to a chain, but may be any flexible arrangement capable of transition from a rest position generally below the granulator cup to an extended position, when in use. Further examples are shown in Fig.7. Fig.7a shows articulated metal blocks 20, with joints 21. Fig.7b shows a wire rope 22 and Fig.7c illustrates another type of chain, with different sized links 23, 24. In the example of Fig.7d, offset bars 25, 26 are rotatable about pins 27

allowing a degree of undulating in the length of the flexible extension. Another embodiment, shown in Fig.8 is one in which a continuous chain-mail skirt 30 is provided, the individual links of which move relative to one another to have the same effect of breaking up the overflowing slag stream. Thus, the flexible extensions may be individual or coupled together.

[0020] The means by which the flexible extensions are fixed to the granulator cup is not limited to the pins and keep plate of Figs.5 and 6. Alternatives, e.g. as shown in Fig.9, include forming a ring 32 of slightly smaller diameter than the cup drive shaft 29 embedded in a circular indent in the shaft, and fixing this with struts 31 to a larger diameter ring 28 to which the flexible extensions 12 are attached

[0021] The ring 28 may have the same structure as the flexible extensions which are attached to it. In most cases, this naturally fixes each flexible extension at a certain position around the ring. Even with a wire ring and wire rope extensions spliced onto the ring, in use, the extensions 12 will be distributed about the circumference of the granulator cup 2 by the centrifugal force.

Claims

1. A molten slag stream dispersal device, the device comprising a rotary dry slag granulator, wherein the granulator comprises a rotary distributor for receiving a molten slag stream from a source of molten slag; wherein the rotary distributor comprises one of a cup, or plate; and wherein the device further comprises a plurality of flexible extensions distributed about the rotary distributor, which extensions depend from the edge or the underside of the cup, or plate, when at rest; wherein, in use, the extensions are configured to extend radially therefrom.
2. A device according to claim 1, wherein each of the flexible extensions comprises a plurality of chain links, a chain-mail skirt, a plurality of articulated sections, or wire rope.
3. A device according to claim 1 or claim 2, wherein the flexible extensions comprise a metal.
4. A device according to claim 3, wherein the metal comprises one of steel, or iron.
5. A device according to any preceding claim, wherein the flexible extensions depend from the rotary distributor, when the granulator is at rest.
6. A method of processing overflow material in a dry slag granulator of a dry slag granulation device, the granulator comprising a rotary distributor for receiving a molten slag stream from a source of molten slag, the rotary distributor comprising one of a cup,

or plate, the method comprising providing about the dry slag granulator, a plurality of flexible extensions which depend from the edge or the underside of the cup, or plate, when at rest, the extensions configured to rotate with the dry slag granulator and extend radially therefrom; rotating the granulator and flexible extensions; applying a stream of slag to the granulator; breaking up slag in the slag stream which overflows the granulator using the rotating flexible extensions; and depositing the broken up slag stream at a distance from the granulator.

7. A method according to claim 6, wherein the broken up overflow slag stream is deposited beyond the ends of the rotating flexible extensions.

Patentansprüche

1. Verteilungsvorrichtung für einen geschmolzenen Schlackenstrom, wobei die Vorrichtung einen rotierenden Trockenschlacken-Granulator umfasst, wobei der Granulator einen Drehverteiler zum Aufnehmen eines geschmolzenen Schlackenstroms von einer Quelle geschmolzener Schlacke umfasst; wobei der Drehverteiler entweder eine Schale oder eine Platte umfasst; und wobei die Vorrichtung ferner mehrere flexible Verlängerungen umfasst, die um den Drehverteiler herum verteilt sind, wobei diese Verlängerungen im Ruhezustand vom Rand oder von der Unterseite der Schale oder Platte herabhängen; wobei im Gebrauch die Verlängerungen dafür ausgelegt sind, sich davon ausgehend radial zu erstrecken.
2. Vorrichtung nach Anspruch 1, wobei jede der flexiblen Verlängerungen mehrere Kettenglieder, eine Kettenschürze, mehrere gelenkige Abschnitte oder ein Drahtseil umfasst.
3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei die flexiblen Verlängerungen ein Metall umfassen.
4. Vorrichtung nach Anspruch 3, wobei das Metall entweder Stahl oder Eisen umfasst.
5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die flexiblen Verlängerungen von dem Drehverteiler herabhängen, wenn sich der Granulator im Ruhezustand befindet.
6. Verfahren zum Verarbeiten von überlaufendem Material in einem Trockenschlacken-Granulator einer Trockenschlacken-Granulationsvorrichtung, wobei der Granulator einen Drehverteiler zum Aufnehmen eines geschmolzenen Schlackenstroms von einer Quelle geschmolzener Schlacke umfasst, wobei der

Drehverteiler entweder eine Schale oder eine Platte umfasst, wobei das Verfahren umfasst: Bereitstellen mehrerer flexibler Verlängerungen um den Trockenschlacken-Granulator herum, welche im Ruhezustand vom Rand oder von der Unterseite der Schale oder Platte herabhängen, wobei die Verlängerungen dafür ausgelegt sind, mit dem Trockenschlacken-Granulator zu rotieren und sich von diesem aus radial zu erstrecken; Versetzen des Granulators und der flexiblen Verlängerungen in Rotation; Zuführen eines Stroms von Schlacke zu dem Granulator; Aufbrechen von Schlacke in dem Schlackenstrom, welcher in dem Granulator überläuft, unter Verwendung der rotierenden flexiblen Verlängerungen; und Ablegen des aufgebrochenen Schlackenstroms in einem Abstand von dem Granulator.

7. Verfahren nach Anspruch 6, wobei der aufgebrochene überlaufende Schlackenstrom jenseits der Enden der rotierenden flexiblen Verlängerungen abgelegt wird.

Revendications

1. Dispositif de dispersion d'un flux de laitier fondu, le dispositif comprenant un broyeur rotatif de laitier sec, dans lequel le broyeur comprend un répartiteur rotatif permettant de recevoir un flux de laitier fondu en provenance d'une source de laitier fondu ; dans lequel le répartiteur rotatif comprend une coupe ou un plateau ; et dans lequel le dispositif comprend en outre une pluralité d'extensions flexibles réparties autour du répartiteur rotatif, lesdites extensions pendant du bord ou du dessous de la coupe ou du plateau, au repos ; dans lequel, en service, les extensions sont configurées pour s'étendre radialement à partir de celui-ci.
2. Dispositif selon la revendication 1, dans lequel chacune des extensions flexibles comprend une pluralité de maillons de chaîne, une jupe de cotte de maille, une pluralité de sections articulées, ou un câble métallique.
3. Dispositif selon la revendication 1 ou 2, dans lequel les extensions flexibles comprennent un métal.
4. Dispositif selon la revendication 3, dans lequel le métal comprend de l'acier ou du fer.
5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les extensions flexibles pendent du répartiteur rotatif, lorsque le broyeur est au repos.
6. Procédé de traitement d'un matériau de trop-plein dans un broyeur de laitier sec d'un dispositif de

broyage de laitier sec, le broyeur comprenant un répartiteur rotatif permettant de recevoir un flux de laitier fondu en provenance d'une source de laitier fondu, le répartiteur rotatif comprenant une coupe ou un plateau, le procédé comprenant les étapes consistant à fournir autour du broyeur de laitier sec une pluralité d'extensions flexibles qui pendent du bord ou du dessous de la coupe ou du plateau, au repos, les extensions étant configurées pour tourner avec le broyeur de laitier sec et s'étendant radialement à partir de celui-ci ; faire tourner le broyeur et les extensions flexibles ; fournir un flux de laitier au broyeur ; rompre le laitier dans le flux de laitier qui déborde du broyeur en utilisant les extensions flexibles en rotation ; et déposer le flux de laitier rompu à une distance du broyeur.

7. Procédé selon la revendication 6, dans lequel le flux de laitier de trop-plein rompu est déposé au-delà des extrémités des extensions flexibles en rotation.

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FIG 1

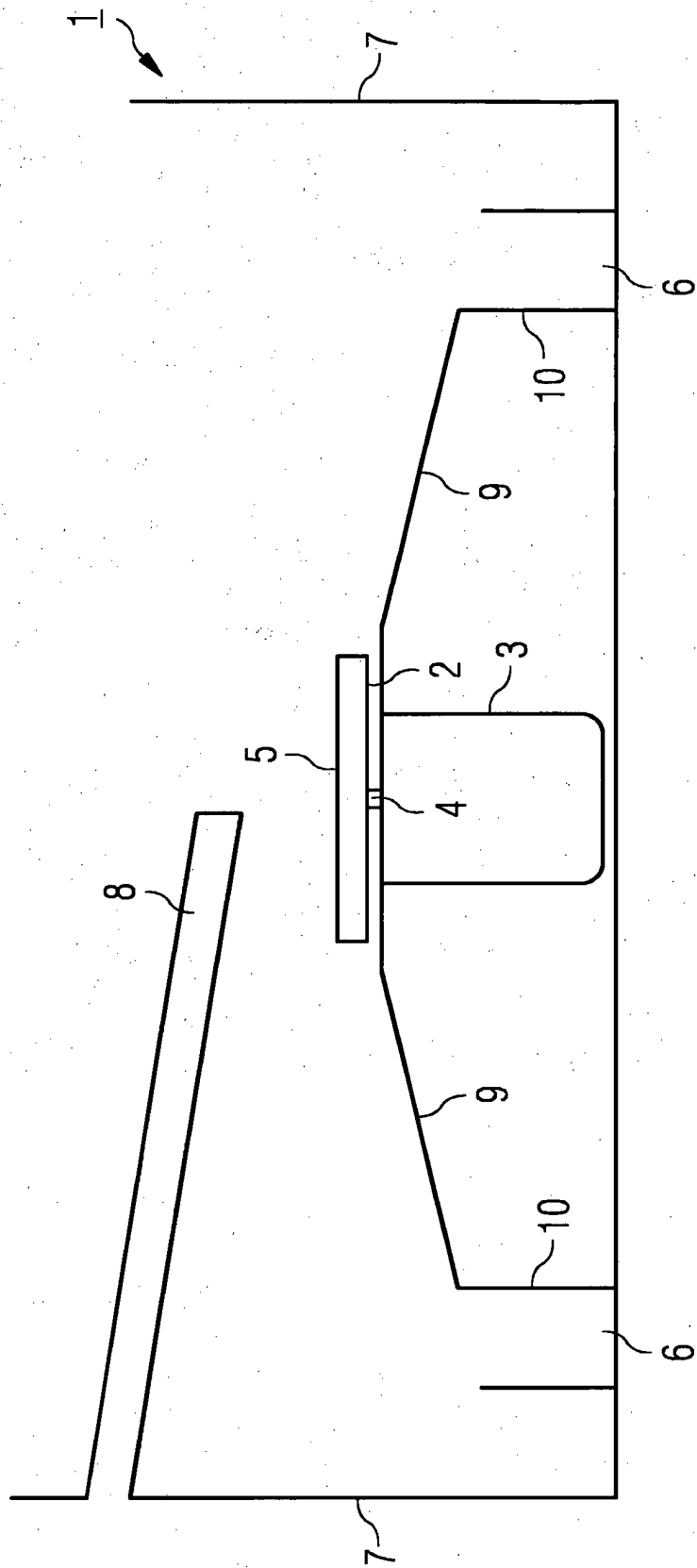


FIG 2

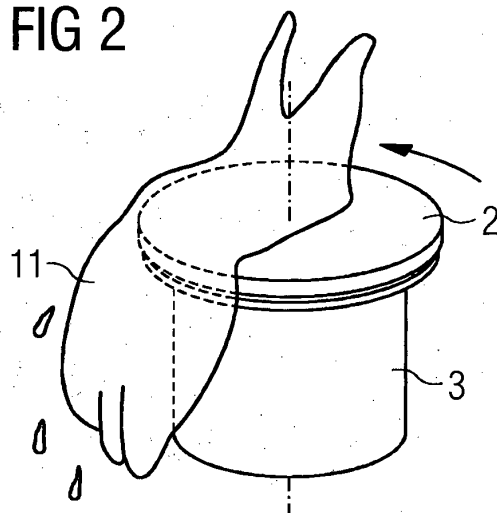


FIG 3

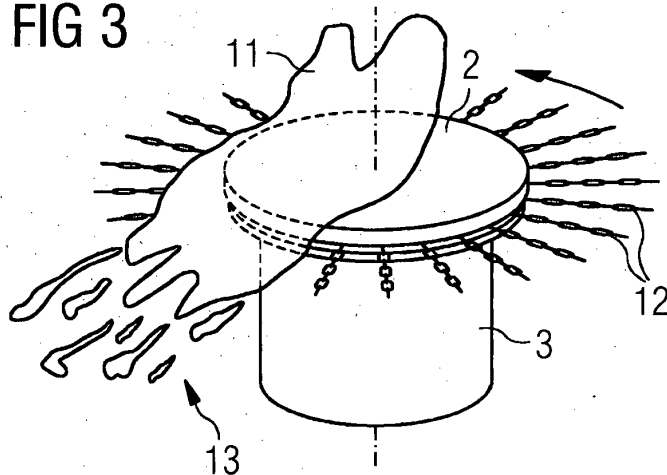


FIG 4

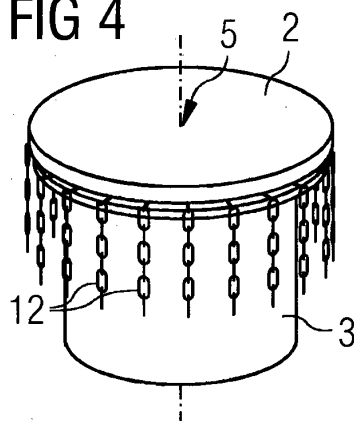


FIG 5

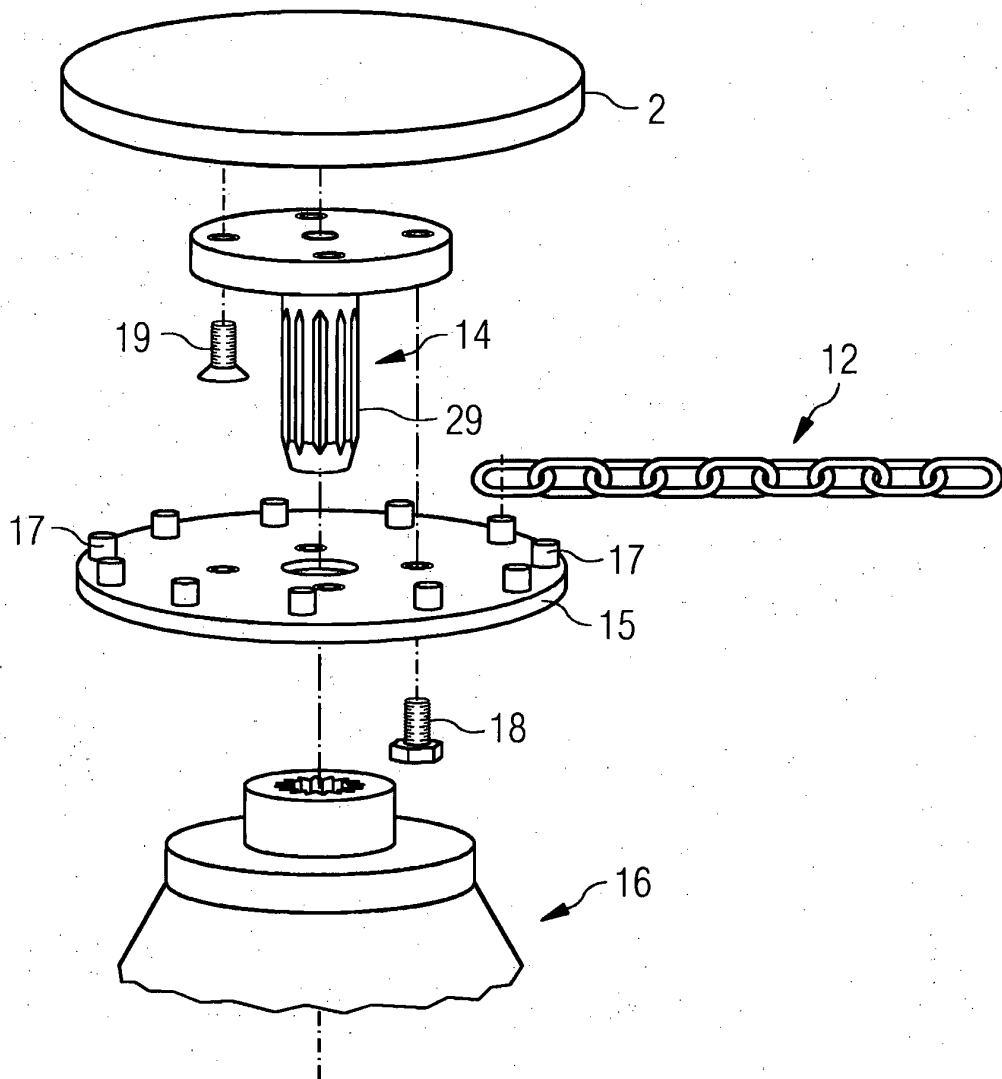


FIG 6

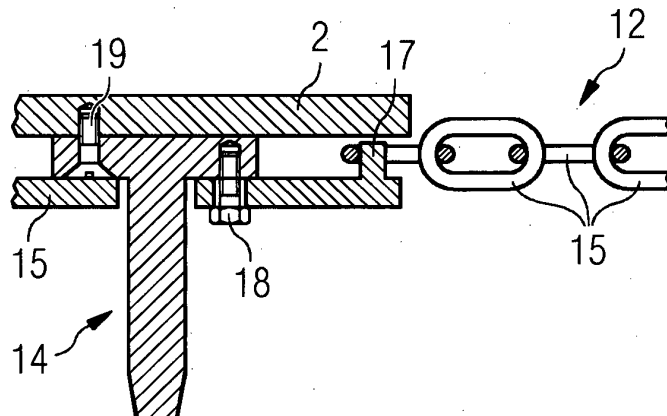
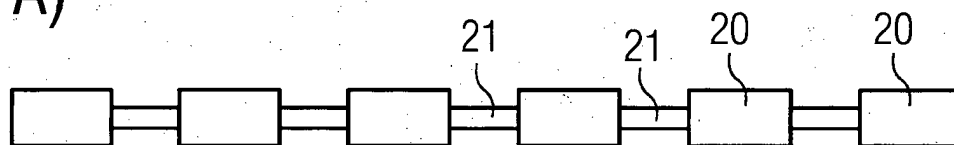
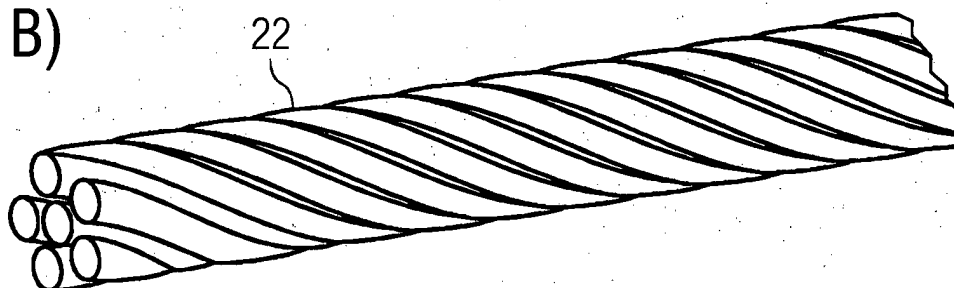


FIG 7

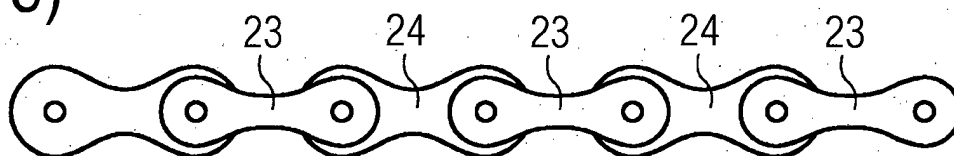
A)



B)



C)



D)

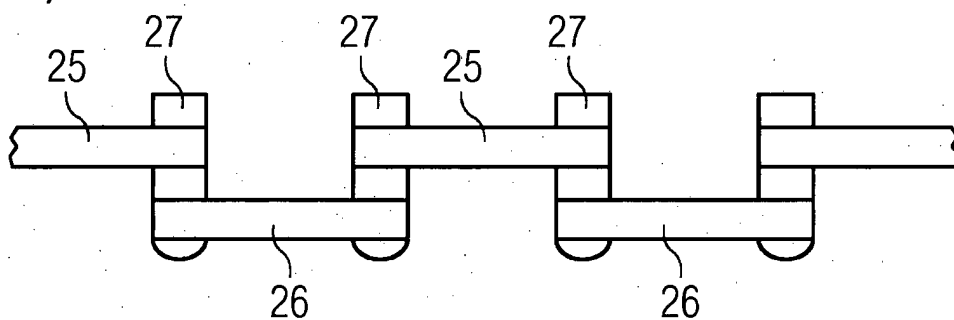


FIG 8

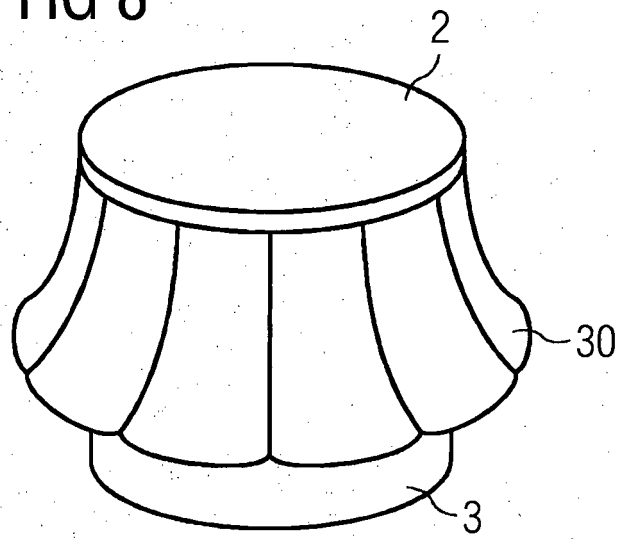
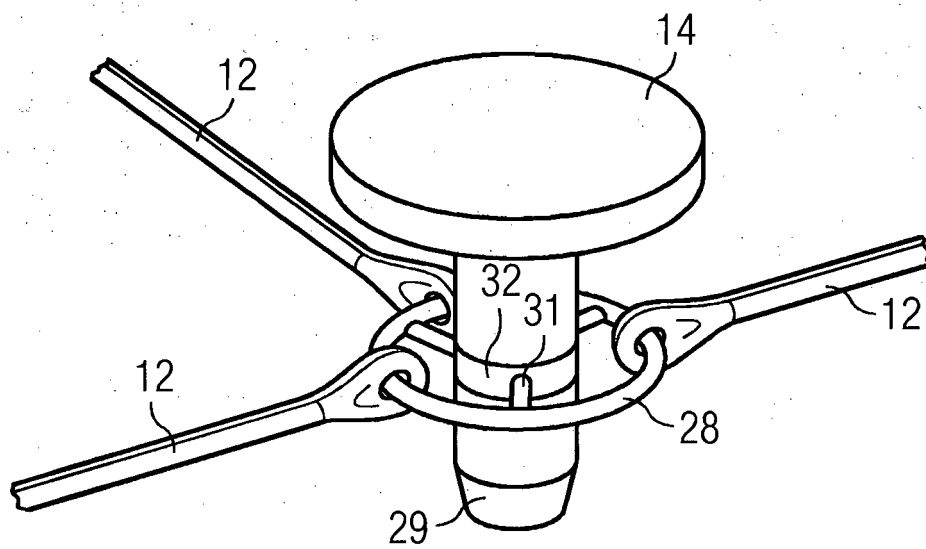


FIG 9



REFERENCES CITED IN THE DESCRIPTION

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