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(54) **WATER JET EJECTING DEVICE**

WASSERSTRAHLAUSSTOSSVORRICHTUNG

DISPOSITIF D'ÉJECTION DE JET D'EAU

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Description

Field of the invention

[0001] The invention relates to a water jet system for cutting away an outer layer of a surface, comprising two parallel guides, a device for keeping the guides parallel to the surface, a feed beam carried by the guides, a carriage with a jet nozzle directed towards the surface, mounted on the feed beam in such a manner that it is movable therealong, and a displacement device for each guide for displacing the feed beam along the respective guide.

Background of the invention

[0002] It is known to cut away the outer layer of cracked concrete on bridge roadways and to cast a new outer layer in order to maintain the construction. A wheel-mounted unit as shown, e.g. in US 6 877 930 B2 can then be used. However, the outer layer of columns and other vertical and inclined surfaces may also have to be repaired and it is known to use simpler devices. Plastered buildings may also have to be replastered and the old plaster must first be removed. There are many other fields of application where it is necessary to cut away the outer layer of a surface. DE 10 2007 039290 A1 constitutes the closest prior art of the present invention and discloses the features of the preamble of claim 1.

Aim of the invention

[0003] The aim of the invention is to ensure that the feed beam is moved along the guides in steps in an operationally reliable manner.

Brief description of the invention

[0004] The aim is achieved in that each displacement device comprises a fixed gripping jaw and a movable gripping jaw for the guide and a device for displacing one gripping jaw in each pair relative to the other along the guide, at least one gripping jaw being assigned a spring for gripping and a hydraulic cylinder for release.

Brief description of the drawings

[0005]

Figure 1 shows a water jet system according to the invention applied to a vertical concrete surface.
Figure 2 is an enlarged detail from Figure 1.
Figure 3 is a diagrammatic view of a stepping device shown in Figure 1.
Figure 4 is a section along the line 4-4 of Figure 3.
Figure 5 shows a water jet system designed for a round column.

Description of illustrated embodiments of the invention

[0006] Figure 1 is a section of a construction which may be of concrete, e.g. a vertical or inclined part of a bridge construction, the surface 11 of which has deteriorated and thus needs to be renewed. A frame is assembled from four tubes 12-15 with four wall supports or braces 16-19. The supports or braces form part of a device for keeping the frame parallel to the wall. The entire frame is shown made up of standard façade scaffolding elements comprising tubes having a diameter of 48.3 mm used worldwide.

[0007] The two vertical tubes 12, 13 of the frame form guides for two gripping devices 20, 21 having mountings 36 carrying a feed beam 22. The gripping devices and the feed beam are shown separately as Figure 2. The feed beam has two tubes 30, 31 which form guides for a slide or carriage 33 carrying a water jet lance with a jet nozzle 34 directed towards the concrete surface. The water jet lance receives its high-pressure water from a pump via a hose 35. The slide with the water jet lance executes a cutting pass in one direction with the water jet lance at an angle of attack relative to the concrete surface. The slide then turns and executes a cutting pass in the other direction with the water jet lance at an angle of attack in that direction. The water jet lance is oscillated during the cutting passes transversely to the direction of the slide in order to give a greater cutting width. The oscillation and the speed of the slide are advantageously coupled in a fixed ratio in the manner described in Swedish patent application 0801398-9. The feed beam is moved in steps between the passes so that the water jet strikes a new area upon each cutting pass or after a certain number of cutting passes.

[0008] Each gripping device 20, 21 has two gripping jaws 40, 41 which can be displaced relative to one another with the aid of a hydraulic cylinder 47 for stepping. The gripping jaw 40 is fixed on the gripping device 20, while the gripping jaw 41 is movable. Each gripping device 20, 21 has a mounting 36 for the feed beam 22 and the gripping devices are identical to one another.

[0009] One of the gripping devices, i.e. the gripping device 20, is shown in diagrammatic form in Figures 3 and 4 and these figures do not correspond entirely to the gripping devices as can be seen in Figure 2, but illustrate the principle. The gripping jaws 40, 41 are controlled by double-acting hydraulic cylinders 43, 44 which moreover also have springs 45, 46 which prevent the gripping device from releasing its grip if it becomes entirely pressureless. Alternatively, the cylinders may be single-acting and used only for release.

[0010] The gripping jaw 40 is fixed on the gripping device, while the gripping jaw 41 is controlled in such a manner that it is movable along the gripping device. Figure 4 shows the gripping jaw 40 in section. It has a retainer 49 with a semi-circular gripping surface adapted to the guide/tube 12. The piston rod of the hydraulic cylinder 43 forms a holding-down device and has a point-like hold-

ing-down surface 50. This design means that the feed beam can be moved in steps along bent tubes. The design also means that the gripping jaw has such a large opening that such a large part of the periphery of the tube is left free that the jaws can pass the supports of the guides. The hydraulic cylinder 43 has an internal stop 60 which limits the withdrawal of the surface 50 of the holding-down device from the gripping position to a few mm, i.e. 1-3 mm, so that the gripping jaw provides support even when it is not in the gripping position.

[0011] A hydraulic cylinder 47 is coupled between the hydraulic cylinders 43, 44, i.e. between the gripping jaws. A stroke length adjuster in the form of an adjustable stop 48, shown as a stop screw, results in accurate adjustment of the stroke length of the hydraulic cylinder 47. Accurate adjustment is important as the feed beam could otherwise become askew after a large number of steps. The stop 48 can take up the entire force of the hydraulic cylinder 47. Alternatively, the stop may be formed of a hydraulic valve which initiates stopping. The gripping devices on both sides always work in parallel and the feed beam can be moved in steps both upwards and downwards.

[0012] The feed beam 22 can be moved in steps in that the lower gripping jaw 41 can be displaced along the guide/tube 12 when it is in the gripping position and the upper gripping jaw is in the free position. When the upper gripping jaw 40 is then in the gripping position, the lower gripping jaw 41 can be released and brought back so that it is once again in position for a new stepping operation. Both the upper and the lower gripping jaws are kept in the gripping position during the cutting operation of the feed beam.

[0013] Figure 5 shows a water jet system designed for a column having a round cross section and upper and lower guides 51, 52 having a number of supports or mountings 53, 54 or mountings keeping the guides in place parallel to the surface of the column. For the sake of clarity, the column is not shown in the figure. The feed beam 55 is similar to the feed beam 22 shown in Figure 2 and it has gripping devices 56, 57 similar to the gripping devices 20, 21 in Figures 3 and 4. The vertical feed beam 55 is moved in steps around the column. The design of the supports or mounting 53, 54 is adapted to the opening of the jaws so that the jaws can be moved in steps past the supports.

[0014] The wall supports or braces 16-19 in Figure 1, like the supports or mountings 53, 54 in Figure 5, form part of carrying devices for keeping the guides 12, 13 or 51, 52 respectively parallel to the surface to be worked. These carrying devices must keep the guides in place and take up the reaction forces from the water jet nozzle. The carrying devices may be, e.g. in the form of a crane carrying the frame 12-19 or 53, 54 respectively. The frame may also be suspended on cables from a winch and the reaction forces can be taken up by scaffolding. The carrying devices are adapted to each site where possible. E.g. a crane can be disposed above the surface to

be worked or on the ground below it.

Claims

1. Water jet system for cutting away an outer layer of a surface (11), comprising two guides (12, 13; 51, 52),
a device for keeping the guides parallel to the surface,
a feed beam (22) carried by the guides,
a slide (33) with a jet nozzle (34) directed towards the surface, mounted on the feed beam in such a manner that it is movable therealong, and
a displacement device (20, 21) for each guide for displacing the feed beam along the respective guide, **characterised in that**
each displacement device (20, 21) comprises a fixed gripping jaw (40) and a movable gripping jaw (41) for the guide (12, 13; 51, 52) and a device for displacing the movable gripping jaw (41) relative to the other along the guide, at least one gripping jaw being assigned a spring (45, 46) for gripping and a hydraulic cylinder (43, 44) for release.
2. Water jet system according to claim 1, **characterised in that** both gripping jaws are assigned a spring for gripping.
3. Water jet system according to claim 1 or claim 2, **characterised in that** the guides are cylindrical tubes (12, 13; 51, 52) and each gripping jaw has a retainer (49) for bearing against the tube and a movable holding-down surface (50) for clamping the tube against the retainer, the retainer and the holding-down device being designed to leave part of the periphery of the tube free.
4. Water jet system according to claim 3, **characterised in that** the guide tubes (51, 52) have supports or mountings (53, 54) for the surface to be worked and each gripping jaw is designed to leave such a large part of the periphery of the guide tube (12, 13; 51, 52) open that the gripping jaw can pass the mountings of the guide tube.
5. Water jet system according to any one of the preceding claims, **characterised in that** the pair of gripping jaws (40, 41) for each guide is connected to a hydraulic cylinder (47) and an adjustable stop (48) is designed to define the step length for the displacement of the movable jaw.
6. Water jet system according to any one of the preceding claims, **characterised in that** each gripping jaw can be opened a distance of 1-3 mm from the gripping position.

Patentansprüche

1. Wasserstrahlsystem zum Wegschneiden einer äußeren Schicht einer Fläche (11), umfassend zwei Führungen (12, 13; 51, 52),
eine Vorrichtung, um die Führungen parallel zur Fläche zu halten,
einen Vorschubträger (22), der von den Führungen getragen ist,
einen Schlitten (33) mit einer Strahldüse (34), die in Richtung der Fläche gerichtet ist, der derart auf dem Vorschubträger montiert ist, dass er dort entlang bewegbar ist, und
eine Verschiebungsvorrichtung (20, 21) für jede Führung zum Verschieben des Vorschubträgers entlang der jeweiligen Führung,
dadurch gekennzeichnet, dass
jede Verschiebungsvorrichtung (20, 21) eine feste Greifbacke (40) und eine bewegliche Greifbacke (41) für die Führung (12, 13; 51, 52) und eine Vorrichtung zum Verschieben der beweglichen Greifbacke (41) zu der anderen entlang der Führung umfasst, wobei mindestens einer Greifbacke eine Feder (45, 46) zum Greifen und ein Hydraulikzylinder (43, 44) zum Lösen zugeordnet sind.
2. Wasserstrahlsystem nach Anspruch 1, **dadurch gekennzeichnet, dass** beiden Greifbacken eine Feder zum Greifen zugeordnet ist.
3. Wasserstrahlsystem nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** die Führungen zylindrische Röhren (12, 13; 51, 52) sind und jede Greifbacke einen Halter (49) zum Anliegen an die Röhre und eine bewegliche Fixierfläche (50) zum Festklemmen der Röhre gegen den Halter aufweist, wobei der Halter und die Fixiervorrichtung so ausgestaltet sind, dass sie einen Teil des Umfangs der Röhre freilassen.
4. Wasserstrahlsystem nach Anspruch 3, **dadurch gekennzeichnet, dass** die Führungsröhren (51, 52) Stützen oder Montageelemente (53, 54) für die zu bearbeitende Fläche aufweisen und jede Greifbacke so ausgestaltet ist, dass sie einen so großen Teil des Umfangs der Führungsröhre (12, 13; 51, 52) offen lässt, dass sich die Greifbacke an den Montageelementen für die Führungsröhre vorbeibewegt.
5. Wasserstrahlsystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Paar Greifbacken (40, 41) für jede Führung mit einem Hydraulikzylinder (47) verbunden ist und ein einstellbarer Anschlag (48) so ausgestaltet ist, dass er die Schrittlänge für die Verschiebung der beweglichen Backe festlegt.
6. Wasserstrahlsystem nach einem der vorhergehenden

den Ansprüche, **dadurch gekennzeichnet, dass** jede Greifbacke über einen Abstand von 1 bis 3 mm zur Greifstellung geöffnet werden kann.

Revendications

1. Système de jet d'eau pour découper une couche externe d'une surface (11), ledit système comprenant deux guides (12, 13 ; 51, 52),
un dispositif pour maintenir les guides parallèles à la surface,
une poutre d'avancement (22) portée par les guides, un chariot (33) avec une tuyère d'éjection (34) dirigée vers la surface, monté sur la poutre d'avancement de telle manière qu'il est mobile le long de celle-ci, et
un dispositif de déplacement (20, 21) pour chaque guide pour déplacer la poutre d'avancement le long du guide respectif,
caractérisé en ce que
chaque dispositif de déplacement (20, 21) comprend une mâchoire de préhension fixe (40) et une mâchoire de préhension mobile (41) pour le guide (12, 13 ; 51, 52) et un dispositif pour déplacer la mâchoire de préhension mobile (41) par rapport à l'autre le long du guide, un ressort (45, 46) pour la préhension et un vérin hydraulique (43, 44) pour la libération étant assignés à au moins une mâchoire de préhension.
2. Système de jet d'eau selon la revendication 1, **caractérisé en ce qu'**aux deux mâchoires de préhension est assigné un ressort pour la préhension.
3. Système de jet d'eau selon la revendication 1 ou la revendication 2, **caractérisé en ce que** les guides sont des tubes cylindriques (12, 13 ; 51, 52) et chaque mâchoire de préhension présente un élément de retenue (49) destiné à venir en appui contre le tube et une surface de serrage mobile (50) destinée à bloquer le tube contre l'élément de retenue, l'élément de retenue et le dispositif de serrage étant conçus pour laisser libre une partie de la périphérie du tube.
4. Système de jet d'eau selon la revendication 3, **caractérisé en ce que** les tubes de guidage (51, 52) présentent des supports ou montures (53, 54) pour la surface à travailler et chaque mâchoire de préhension est conçue pour laisser ouverte une partie tellement grande de la périphérie du tube de guidage (12, 13 ; 51, 52) que la mâchoire de préhension peut franchir les montures du tube de guidage.
5. Système de jet d'eau selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la paire de mâchoires de préhension (40, 41) pour chaque guide est reliée à un vérin hydraulique (47)

et un arrêt réglable (48) est conçu pour définir la longueur de pas pour le déplacement de la mâchoire mobile.

6. Système de jet d'eau selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque mâchoire de préhension peut être ouverte sur une longueur de 1 à 3 mm depuis la position de préhension.

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FIG 1

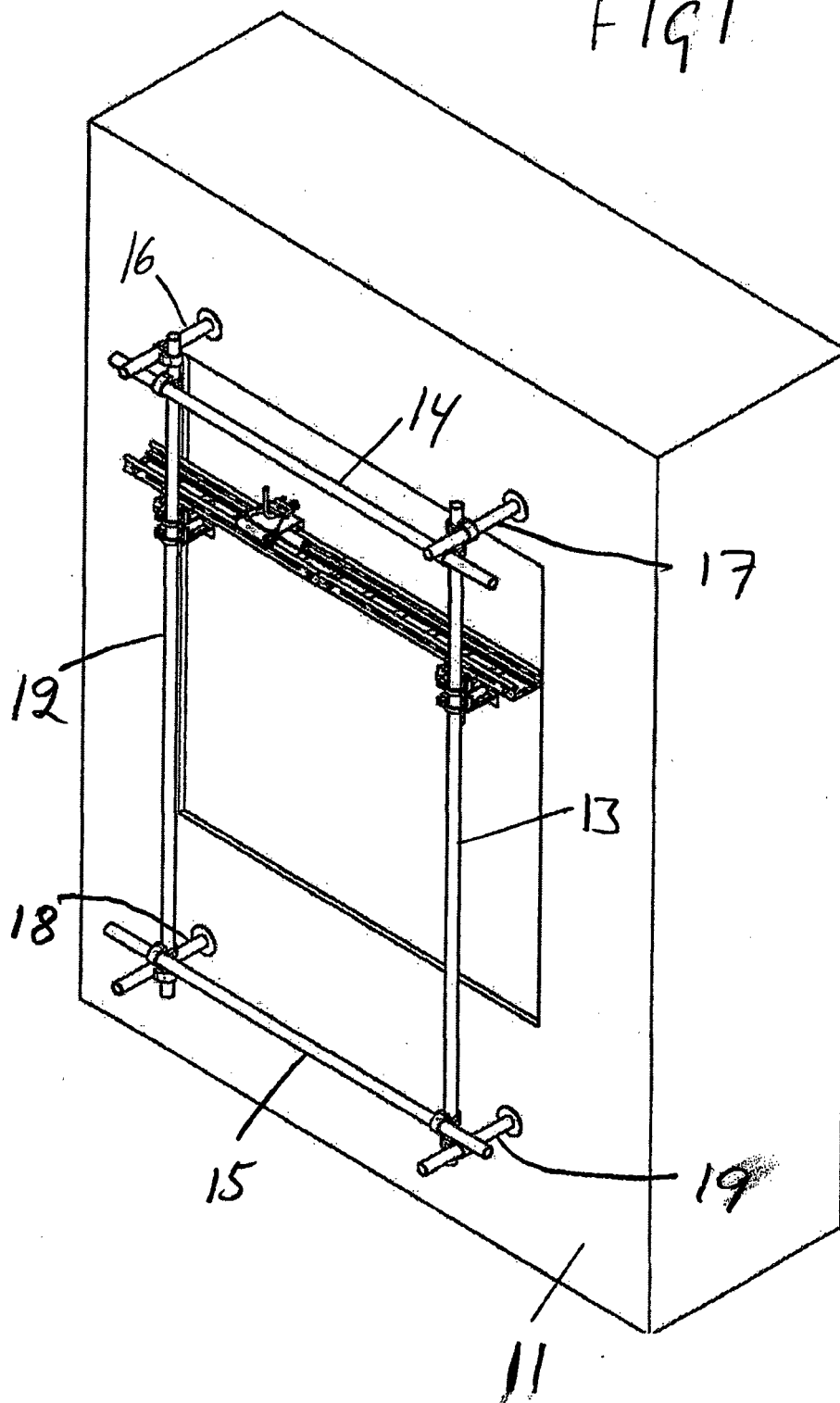


FIG 2

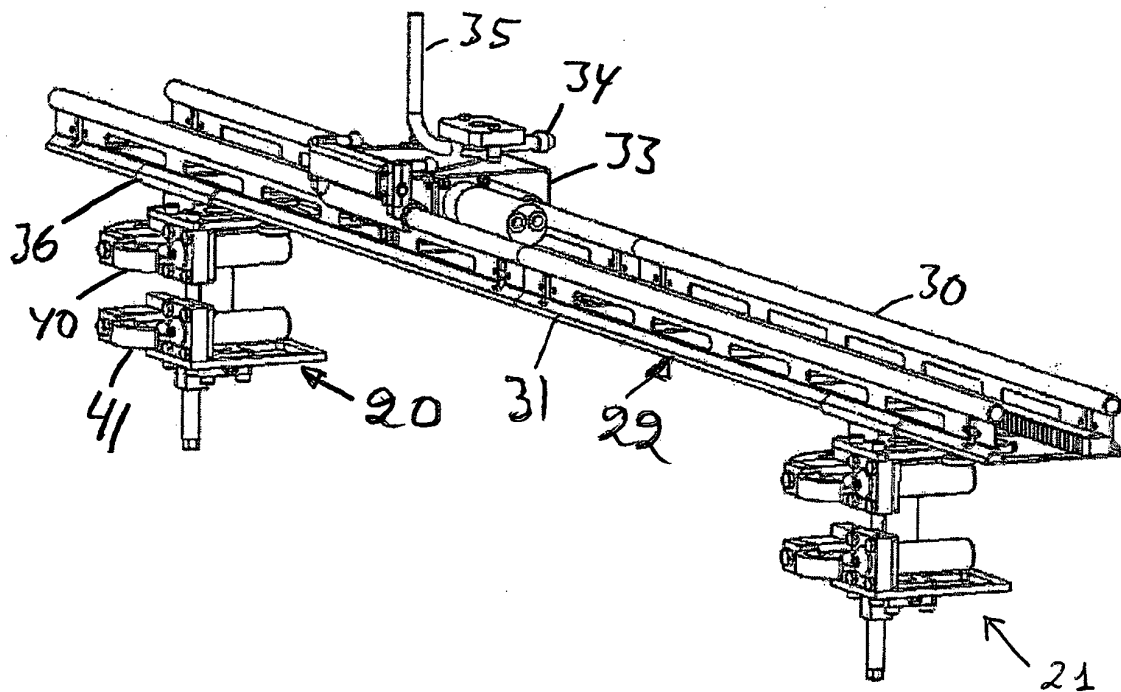


FIG 3

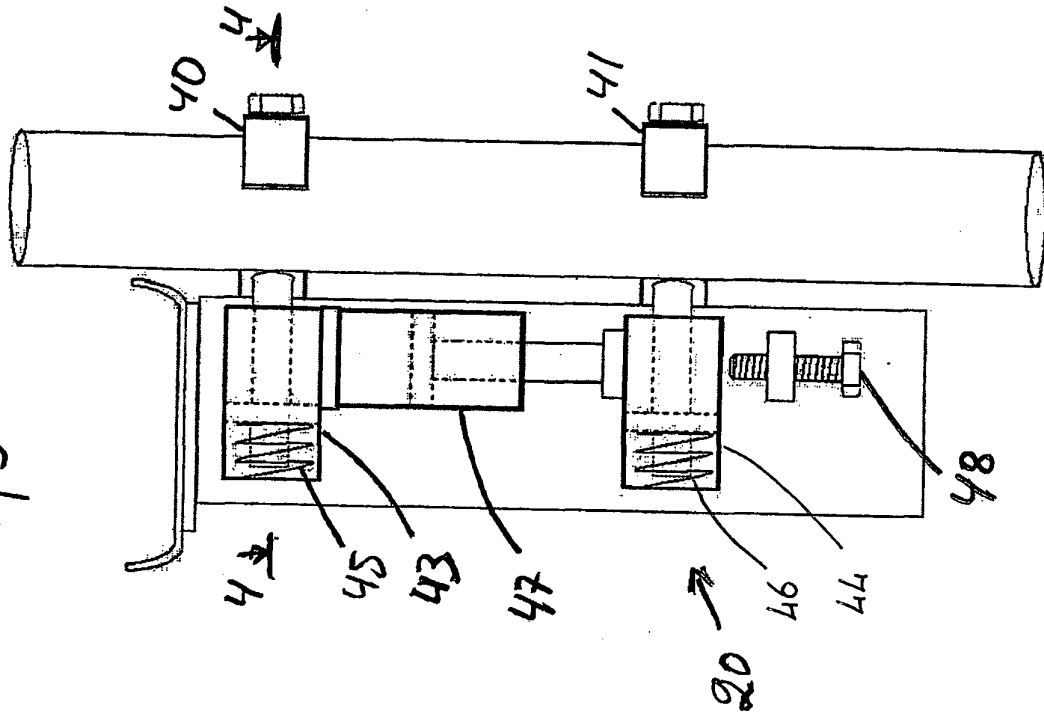


FIG 4

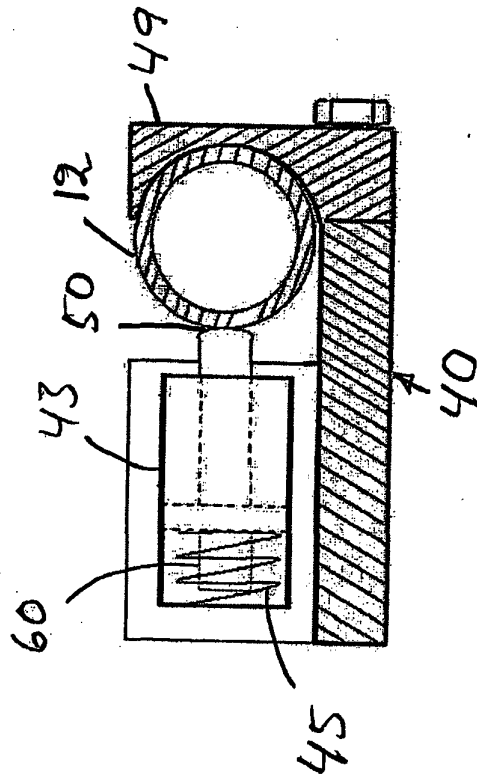
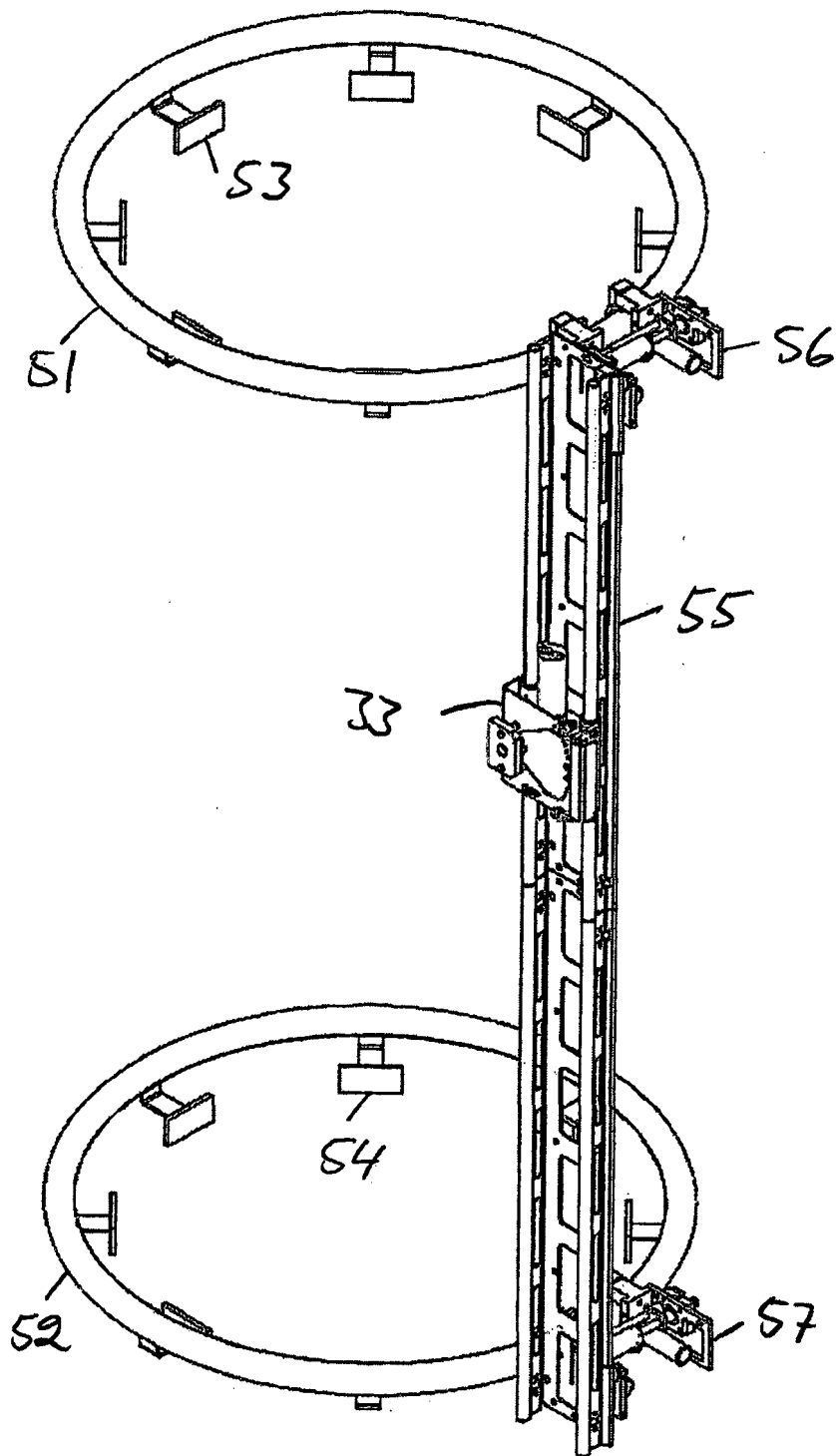


FIG 5



REFERENCES CITED IN THE DESCRIPTION

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