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(71) Applicant: **ASTURIANA DE ZINC, S.A.**
E-33417 Asturias (ES)

(72) Inventors:
- **Sitges Menendez, Francisco J.**
  Alcobendas, Madrid (ES)
- **Sitges Menendez, Fernando M.**
  Salinas-Castrillon, Asturias (ES)
- **Alvarez Tamargo, Francisco**
  33006-Oviedo Asturias (ES)
- **Tamargo Garcia, Francisco**
  Salinas-Castrillon, Asturias (ES)
- **Quiroga Alvarez, José Mar a**
  Salinas-Castrillon, Asturias (ES)
- **Lefevre, Ives**
  Salinas-Castrillon, Asturias (ES)
- **Gonzalez Gonzales, Carlos**
  Santa-Cruz de Llanera, Asturias (ES)

(74) Representative: **Gomez-Acebo y Pombo, José Miguel**
c/o CLARKE, MODET & Co.,
Avda. de los Encuartes, No. 21
28760 Tres Cantos (Madrid) (ES)

(54) Facility to loosen off the layers electro-deposited upon cathodes

(57) Facility to remove the layers electro-deposited upon the cathodes, made up of a cathode reception area (1), a cathode treatment area (2) with cathode washing means (15) and means to extract (16) the layers electro-deposited thereupon, and a storage area (3) to keep already freed cathodes. The extraction means include vertical claws (35) and two parallel rollers (36) mounted so that they are capable of turning freely upon two horizontal parallel bars (34), being the bars (34) fixed between pairs of arms (31) that are mounted so that they may tilt upon a bracket (29), being said bracket a carrier of upper separating rollers.

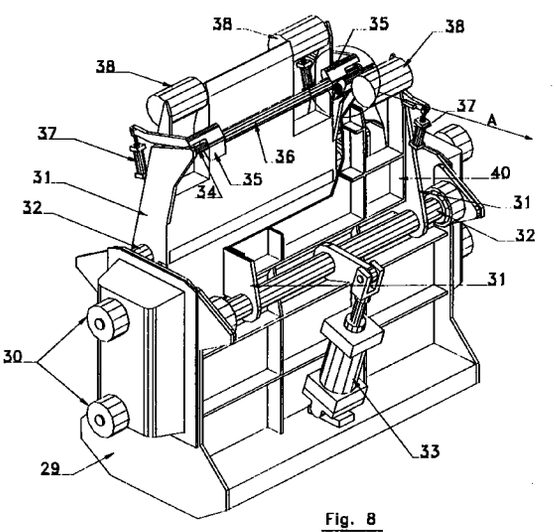

Fig. 8

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Description

This invention refers to a facility to loosen off the layers electro-deposited upon cathodes, particularly applicable to the obtention of metals through electrolysis, such as in the obtention of copper, zinc, etc. through electrolysis.

More specifically the facility object of the invention is of the type that include an area of reception of cathodes coming from the electrolytic vats, a cathode treatment area and a storage area for cathodes free from the electrolytic metal layer, whereas the cathodes may be moved consecutively along the three fore mentioned areas and including the treatment area means to wash the cathodes and means to take off the electro-deposited metal layers.

In the facilities of the type mentioned, generally the washing means are made of fixed water jets located at the same level as the cathodes and aimed at the space taken up by them. On the other hand, the operation to loosen off the metal layers electro-deposited are carried out in two successive operations: the first stage consists of an operation to separate the upper edge of the electro-deposited layers from the cathode plate, whereas said plates are then totally separated in a second operation.

In the electrolytic obtention of zinc are known facilities in which the first stage of separation of the upper edge is effected through a penetrator, whereas the second stage is effected using vertical blades. A facility of this type is described, for example, in Spanish Patent number 2020729 by the same applicants.

As regards the electrolytic obtention of copper is known, due to Spanish Patent number 2005673, of the company MIM Technology Marketing Ltd., a procedure to extract, according to which the first stage of separation is effected subjecting the cathode to bending so as to enable at least part of the electro-deposited metal layer to separate from the cathode. In the following stage the electro-deposited layers are then fully taken off using claws or gas jets.

Whichever may the system selected be, the full extraction of the electro-deposited metal layers requires two successive operations, with their corresponding equipment or means, which causes a considerable higher cost of the facilities.

On the other hand, whenever the first extraction stage is effected bending the cathode, there is a risk of provoking the separation of the protection of the edges of the cathode, which may cause the entry of fluid between protection and cathode during the electrolytic process, giving rise to the resulting deposition of metal in these areas of the cathode, up to the point of causing the separation of the protection.

The object of this invention is a installation to effect the separation of the metal layers electro-deposited on a cathode, by way of a continuous process constituting a unique stage or operation and requiring the use of only one extraction unit.

The facility of the invention allows the full separation of the electro-deposited metal layers without producing damage on the cathode plate nor upon the protection of its edges.

Furthermore, in the facility object of this invention the consumptions of water and energy are minimal when compared with traditional systems.

In the facility object of this invention, the washing and extraction means are made up of a number of independent brackets, each of which limits a vertical passage sized to allow the passage of a cathode. Each one of these brackets is fitted upon a gantry capable of vertical movement between a lower position in which it is placed below the lower edge of the cathode located in the corresponding station and another upper position in which the bracket embraces the cathode.

The washing station bracket is configured as a drawer and has the means necessary to spray pressurized water upon the cathode surface.

The extraction station bracket includes two sets of vertical claws that are set so that they may turn freely upon two horizontal parallel bars, each of which is set between end arms articulated by their lower end to the upper end of the bracket. The extraction station does furthermore also include two rollers, each of which is mounted coaxially and is also able to turn freely on one of the fore mentioned bars, between the claws of said bar. These arms may oscillate between maximum separation and approximation positions. The bracket may furthermore move vertically between a lower position, in which it is located below the lower edge of the cathode placed in the extraction unit and in a upper position in which the bracket embraces the cathode and the claws are located immediately above the upper edge of the electro-deposited metal layers.

The claws of the extraction means include a wedge-shaped vertical section lower area. These claws are furthermore capable of tilting between a cathode approximation position, in which the internal surface of the wedge-shaped areas is parallel to the cathode plate and a separation position, in which said internal surface comes off the cathode plate. Both the claws and the arms are actuated by way of pneumatic cylinders.

Because of the fore mentioned constitution, the internal surface of the wedge shaped area of the claws ends up close to the cathode plate without leaning thereupon, whenever the bracket is at its upper limiting position and the tilting arms towards the maximum bar approximation position and the claws tilt towards the cathode maximum approximation position.

The extraction means do furthermore include two upper rollers, parallel to the bars on which the claws are set, which are located above said claws. These rollers are mounted so that they are capable of turning freely between pairs of arms articulated by their lower end to the bracket. The arms are connected to actuating cylinders and may tilt between two limiting positions, one of them vertical, in which the rollers end up being located outside the bracket vertical passage, and another con-

verging one, in which said rollers end up being located towards the inside of said passage.

The characteristics described, as well as other characteristics specific to the invention and the operation of the installation are set out hereunder in greater detail with the help of the attached drawings, which show a possible way of execution, set out as a non limiting example.

In the drawings:

Figure 1 is a side elevation of an installation set out in accordance with the invention.

Figure 2 is a vertical section of the installation, taken as per the cutting line II-II of figure 1.

Figure 3 is a vertical section of the installation, taken as per the cutting line III-III of figure 1.

Figure 4 is a perspective view of one of the gantries part of the installation of figure 1.

Figure 5 is a perspective view of the washing chamber.

Figure 6 is a vertical view of the washing chamber.

Figure 7 is a longitudinal vertical section of the washing chamber.

Figure 8 is a perspective view of the bracket and extraction means.

Figure 9 corresponds to detail A of figure 7, at a greater scale.

Figure 10 is a side vertical section of the extraction bracket, showing the various elements or components in non-operating position.

Figure 11 is a section similar to figure 9, with the extraction claws positioned to initiate the process.

Figure 12 corresponds to detail B of figure 10 at a greater scale.

Figures 13, 14 and 15 are views similar to that of figure 11, showing the claws at successive extraction process stages.

Figure 16 is a view similar to that of figure 10, with the extraction elements at an intermediate process stage.

Figure 17 corresponds to detail C of figure 16, at a greater scale.

Figure 18 is a view similar to figure 10, showing the final stage of the extraction process.

Figure 19 is a view similar to figure 10, showing the position taken up by the different extraction means, once the process has ended.

The installation shown in figure 1 to 3 includes a reception area for cathodes coming from the electrolytic vats, generally marked by the number 1, a cathode treatment area 2 and an area 3 for storage of cathodes already freed from the metal layer electro-deposited upon them.

Along the upper portion of these three areas run two parallel beams 4 made up of a metal structure upon which is fixed at its upper portion a plastic profile of covering 4a, which shall define the support and slide surface of the cathode head bar. Both in the cathode reception area 1 and in the storage reception area 3, above the beams are arranged some cathode positioning and driving elements 5, with an actuation system that may be made up of a pneumatic cylinder 6. These two areas do furthermore include intermediate tops 7 which purpose is to avoid any swinging motion by the cathodes suspended from the beams 4. The positioning and driving means 5 are set upon profiles 8 supported upon beams 4.

The beams 4 are supported by vertical columns 9 among which runs a gangway 10 which shall be located at the height of the transit or working surface, made up of the floor surface.

The cathode treatment area 2 does also have cathode moving and positioning means 11, whereas said cathodes may be taken along a beam 12 located above the beams 4. Furthermore the cathode treatment area 2 includes two gantries, referenced by the numbers 13 and 14, the first one of which carries the washing means 15 whereas the second one carries the extraction means 16.

On the lower side of the storage area 3 runs a conveyor belt 17 upon which shall fall, for example from a hydraulic dampening device, the electro-deposited metal layers, after having been taken off the cathodes. There is a pushing mechanism 18 arranged upon the final belt portion, made up of a pneumatic cylinder that moves the extracted metal plates 19 upon guides 20 made up of L-shaped profiles which, upon opening up, let the plates 19 fall so that they pile up, as shown in figures 1 and 2.

Figure 4 shows one of the gantries 13 or 14, inside which run upwardly the beams 4 which shall support the cathode heads. The footings of these gantries include guides 21 upon which to slide the washing 15 or extraction 16 means. The gantries 13-14 carry a driving system 22 for the vertical movement of the washing or extraction means.

Figures 5 to 7 show the washing means, which are made up of a chamber 23, roughly shaped as a rectangular plan straight prism-shaped box, open at its upper end so as to enable it to receive and house a cathode. The box or bracket 23 is fitted on its smaller walls with plastic wheels 24, with duly sealed ball bearings, to

guide the bracket along the profiles 21 of the gantries, figure 3. To this wheel mechanism are attached linear displacement elements of the driving system 22, which shall also run upon the profiles 21.

As may be better observed in figure 6 and 7, the washing chamber 23 has internally mounted, upon its greater walls, two lines of spraying nozzles 25, anchored so that they may change the angle of incidence of the hot water stream projected upon the cathodes introduced into the box. The opening on the upper end of this box is fitted with a system of flexible closing sheets 26 that allow the entry of the cathode and prevent the exit of water from inside the chamber. This closing system may be made up of a curtain made of very flexible plastic material threads. Water feeding shall be effected using flexible hoses and the box shall be fitted with a steam extraction system 27 connected at its upper portion to suction slots and to a extraction system. The chamber 23 is also fitted with pipes 28 to empty the cleaning water.

Figures 8 and 9 show the extraction means, which also include a bracket 29 defining a vertical passage sized so as to be able to move and place itself around a cathode and is externally fitted with a guiding mechanism with plastic wheels 30 of the same constitution and function as that described for the washing chamber 23.

On the upper side of the bracket are fitted, on each side of the vertical passage, two arms 31 that tilt around a lower turning axis 32, being the turn of said axis 32 controlled by a pneumatic cylinder 33. Between the upper end of the arms 31 on each side runs a bar 34 parallel to axis 32. Upon each of the bars 34 are fitted, so that they may freely turn, two vertical claws 35 and a central coaxial roller 36, used as a separation element for the claws 35 and which side surface sticks out beyond said claws, at least on the side aimed towards the opposite roller. The claws 35 may tilt around bar 34, actuated by the hydraulic cylinders 37.

Finally the bracket 29 includes free turning upper roller 38, mounted upon the upper end of arms 39, figure 10, articulated at its lower end to panels 40 running between the arms 31, being the arms 39 tilt capable through the actuation of the hydraulic cylinders 41.

During the operating process of the installation described, a load of cathodes held at equal separation distances using appropriate devices are brought, using, for example, a crane bridge, and are positioned upon the beams 4, in the reception area 1. Once the cathodes are properly supported upon the beams 8, the first cathode is then moved using the pushing elements 5 until it is positioned in coincidence with the gantry 13. Hot water feeding is then activated through the nozzles 25 of the washing chamber 23 and the chamber 23 up and down movement is then initiated, acting the sprayed water uniformly and at constant pressure upon the surfaces of the cathode during the up and down trajectory of the washing chamber upon said cathode, thus ensuring its uniform and total cleaning. The arrangement and orientation of the nozzles 25 is such that the cathode ends up being fully cleaned, including its header

Whenever the washing chamber reaches again its lower limiting position, the cathode is then transferred up to the second gantry 14, by action of the pushing element 11. At that time the bracket 29 starts to rise, guided by the rollers 30 and with the arms 31 and 39 in opening position, as shown in figure 10. During this movement the cathode 42 is introduced into the bracket 29, up to the point when said bracket reaches its upper limiting position, in which the claws 35 are located above the upper edge of the electro-deposited metal layers 43. From that moment on the cylinders 33 are activated, so that the arms 31 and panels 40 occupy the position shown in figure 11, in which the claws 35 are near the cathode and the rollers 36 are supported upon the plate of said cathode 42, immediately above the upper edge of the electro-deposited layers 43.

As may be observed in figure 12, the claws 35 include a wedge shaped vertical section lower area 44, with the angle edge parallel to the cathode plate 42. In the initial working position, represented in figures 11 and 12, the internal surface of the wedge shaped area 44 is parallel to the cathode plate and is slightly separated from it. In order to avoid any risk of metal contact between the claw 35 and the cathode plate 42, the claws may be fitted with a plastic protection device 45. The angle edge of the areas 44 is subjected to an anti-wear treatment, to enable said angle edges to withstand high number of working cycles without showing any appreciable wear.

In the described position the support of the rollers 36 ensure a correct positioning, both of the cathode and of the claws 35 in respect to it. The distance between lower angle edge of the wedge shaped areas 44 of the claws and the upper edge of the electro-deposited layers 44 may be adjusted, regulating for instance the position of the plate 46 supporting on each side one of the claws 35.

From the position shown in figures 11 and 12, the bracket 29 initiates a lowering movement, with the rollers 36 turning freely in contact with the plate of the cathode 42 and, therefore, maintaining the relative position of the claws 35 in respect to said cathode.

Figure 13 shows the beginning of the lowering stage of the bracket 29, in which stage takes place the contact of the angle edge of the wedge shaped areas, of the claws 35, with the upper edge of the electro-deposited layers 43, causing a penetration of said angle edge and initiating the separation of the deposits 43, all of the above as shown on figure 13.

In the fore mentioned situation are actuated the cylinders 37, figure 11, causing the turn of the claws 35, separating from the cathode the angle edge of the wedge shaped area 44 and further causing the final separation of the upper portion of the electro-deposited layers 43, all of the above as shown on figure 14, continuously supporting and turning the rollers 36 upon the cathode plate surfaces, at the same time as the separation of the electro-deposited layers 43 continues, as

shown on figure 15.

Whenever the electro-deposited layers 43 already separated from cathode 42 have come up above the bracket, the cylinders 41 are then activated, figure 16, causing a tilting of the arms 39 towards their converging position, at which the free turning rollers 38 mounted at the end of said arms shall be supported upon the areas that have come off the electro-deposited layers 43, bringing them closer towards the plate of the cathode 42.

Maintaining the described position of the various cylinders and continuing with the lowering of the bracket 29 the situation shown in figure 18 may then be reached, in which the total separation of the electro-deposited layers 43 in respect of the cathode plate 42 has been provoked. In the position shown on figure 18 a certain torque is caused between the free turning rollers 38 and the claws 35, which tends to peel off the lower portion of the electro-deposited layers 43, without being necessary for the claws 35 and rollers 36 to reach the lower edge of the cathode 42. At the same time the layers 43 separated from the cathode 42 are kept held between the rollers 38 and the claws 35.

The adoption of the described working method eliminates the risk of damaging the protection of the lower edge of the cathode, given that neither the claws nor the rollers do ever get to contact this lower protection. The torque created between the free turning rollers 38 and the claws prevents the lower edge of the peeled layers from colliding with the protection of the lower edge of the cathodes. To sum up, it prevents any action that may damage the lower protection of the cathode plate.

On the other hand, the vertical claws do not get to lean directly upon the cathode plate, thus preventing any metal to metal contact that may damage the surfaces of the plate.

Once the electro-deposited layers 43 have been fully separated and whilst the lowering movement of the bracket 29 ends, the cylinders 33 are collected, which cause an outward tilt of the arms 31 and panels 40, as may be observed in the figure 18, thus preventing the collision between the free turning rollers 36 and the protection of the lower edge of the cathodes. The retraction of the remaining cylinders 37 and 41 then takes place, freeing the sheets 43 that correspond to the electro-deposited layers which fall through the bracket onto the dampening mechanism of the receiving conveyor belt 17, figure 1.

Upon ending this stage, all the cylinders are then collected and the bracket 29 is placed at its lower position, ready to start a new extraction cycle.

With the facilities described the cathodes are subjected to a full washing operation at the cathode reception area 1, and the electro-deposited metal layers are taken off by way of a continuous process carried out using the claws 35, during the lowering motion of the bracket 29, without causing any damage to the cathode plate 42, because of the free turning rollers 36, mounted on the same turning axis as the claws 35 and to the plastic material protection devices 45 fitted on said claws.

The modular constitution of the facilities described allows the arrangement, as required, of two or more treatment areas, each one of them with their corresponding washing and extraction means.

Claims

1. Facility to loosen off layers electro-deposited upon cathodes, made up of an area for the reception of cathodes coming from the electrolytic vats, a cathode treatment area and a storage area for cathodes already freed from electro-deposited metal layers, being the cathodes capable of consecutive displacement along the three fore mentioned areas and including the treatment area cathode washing means and means to extract the electro-deposited metal layers, characterized because the extraction means include two sets of vertical claws and two parallel rollers, both of them coaxially mounted and free to turn upon two horizontal parallel bars, each one of which carries a roller and a claw set and is fitted upon end arms articulated at their lower end to the upper side of a bracket and may oscillate between maximum bar approximation and separation positions; which bracket defined between the bars a vertical passage for the cathodes and is capable of vertical movement between a lower position, at which it is then placed below the lower edge of the cathode located at the extraction unit, and a upper position at which the bracket embraces the cathode and the claws are then located immediately above the upper edge of the electro-deposited metal layers; and which claws include a lower wedge shaped vertical section and tilt between a cathode approximation position, on which the internal surface of the wedge shaped areas is parallel to the cathode plate, and a separation position at which said internal surface turns away from the cathode plate, being then located the internal surface of the wedge shaped area of the claws near the cathode plate whenever the bracket is at its upper limiting position, once the tilting arms tilt towards the maximum approximation position of the bars and the claws tilt towards the cathode approximation position; being the claws and arms capable of actuation by cylinders.

2. Facility as by the claim 1, characterized because each one of the claw carrying bars has coaxially mounted at its central point a free turning roller, acting as an element to separate the claws located at both sides, sticking the lateral surface of said roller in respect of the side surfaces of the claws, at least on the side facing the other roller, in order to support the cathode plate surface whenever the bracket is located at its upper limiting position and

the tilting arms are at the bar maximum approximation position, whichever may the claw position be.

3. Facility as by the claim 1, characterized because the cathode washing means include a washing chamber that is open at its upper base and capable of vertical movement between two limiting positions, a lower one at which it is placed below the suspended cathodes and an upper one at which it is located at cathode height, housing one of them; having said chamber upon the internal surface of its greater walls, close to their upper edge, at least one row of constant pressure water sprayers on each wall.

4. Facility as by the claim 1, characterized because the extraction means do furthermore include two upper rollers, parallel to the rollers mounted upon the claw carrying bars and located above said claws, which rollers are mounted so that they may freely turn between pairs of arms articulated at their lower edge to the extraction unit bracket and connected to external actuating cylinders, being said arms capable of tilting between two limiting positions, a vertical one in which the rollers are located outside the vertical bracket passage and a converging one, at which said rollers are located towards the inside of said passage.

5. Facility as by the claim 1 and 3, characterized because the washing means chamber and the extraction means bracket are mounted upon two consecutive gantries, to which they are related by suspension and lifting elements.

6. Facility as by the claim 1, characterized because the claws do have, on the wedge shaped area internal surface, a plastic material protection to support it against the cathode plate.

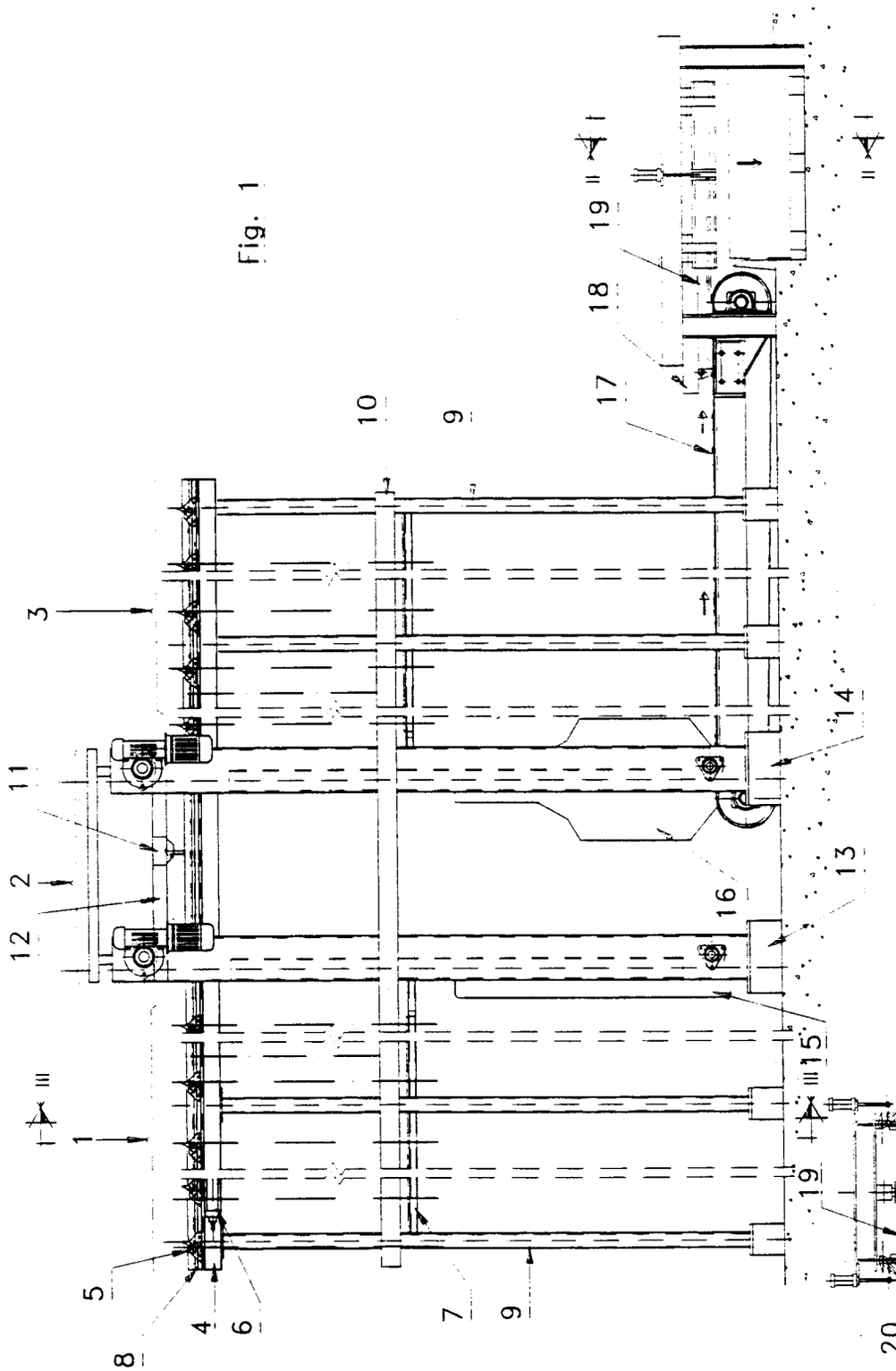
Fig. 1
Fig. 2
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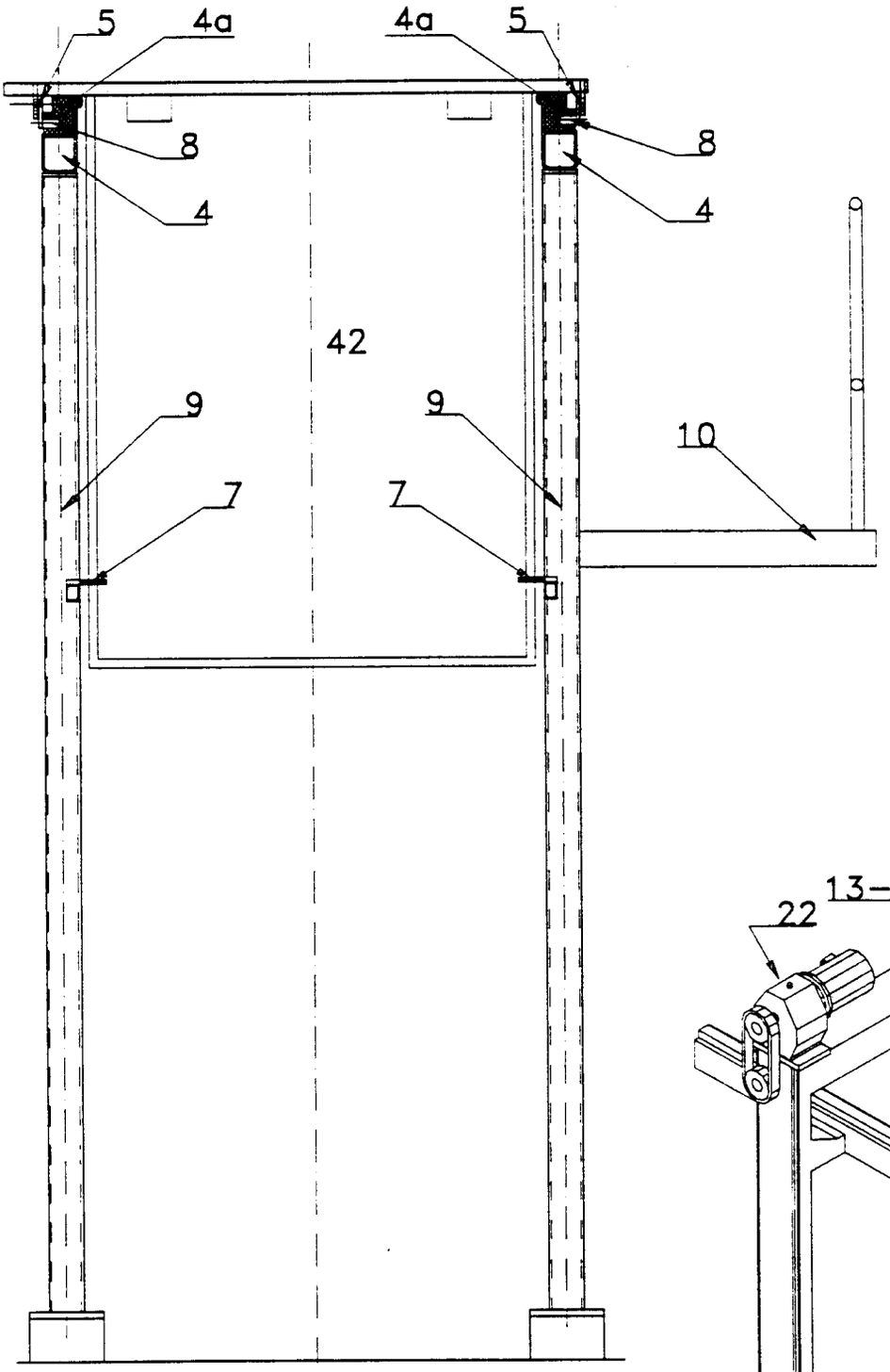


Fig. 3

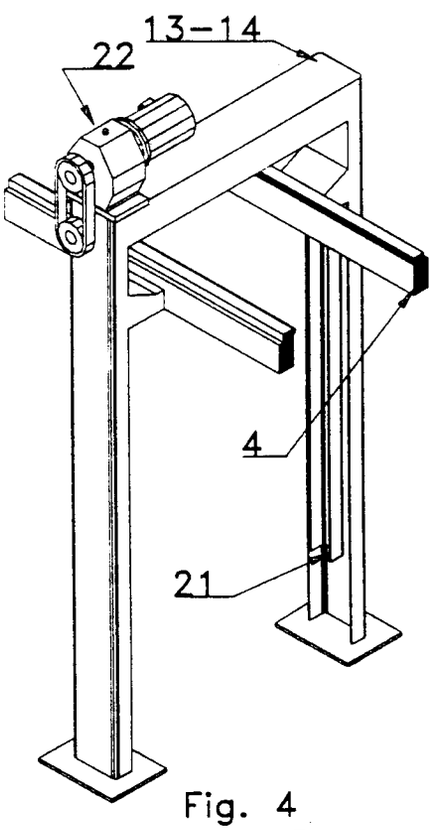
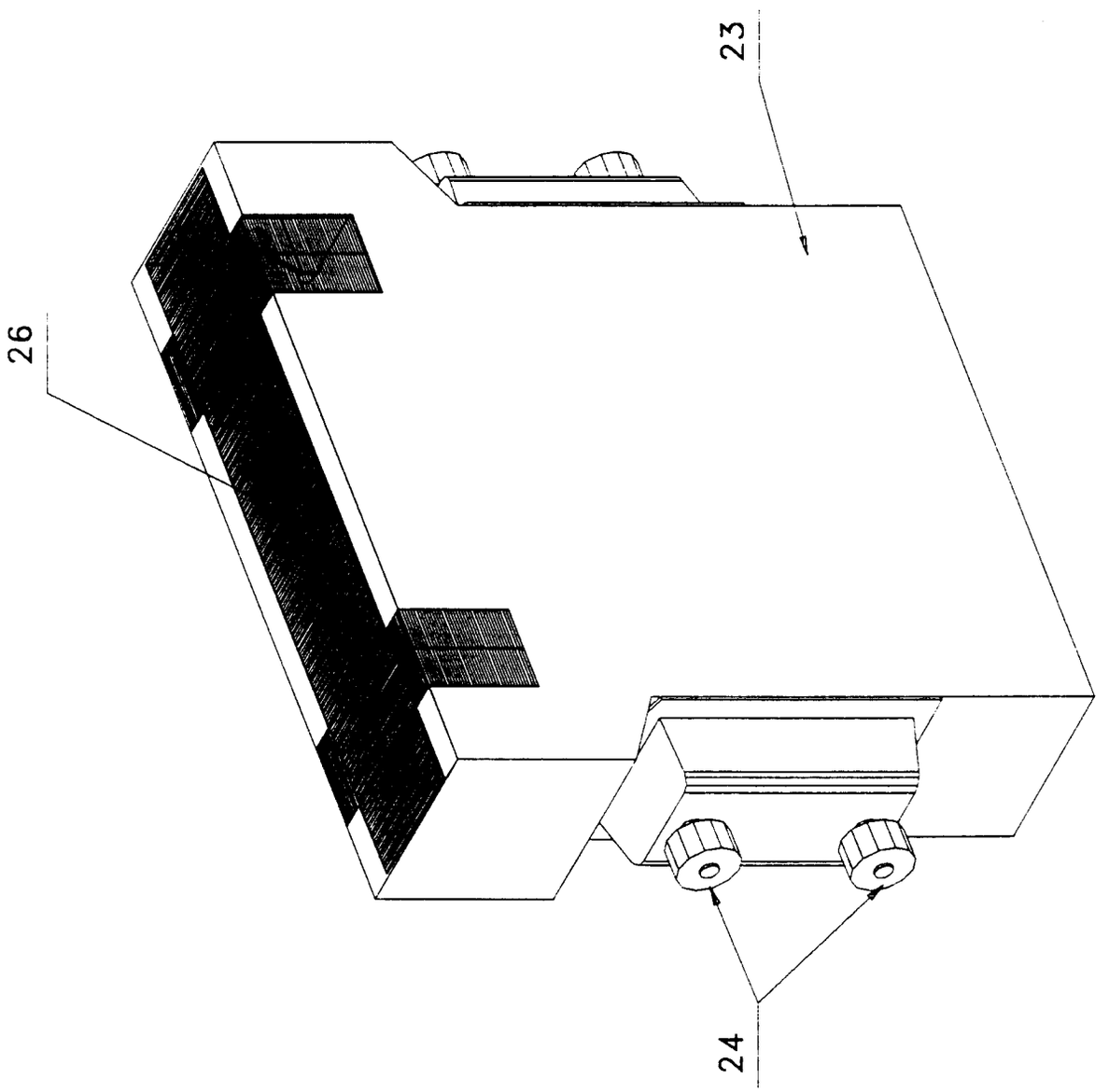


Fig. 4

Fig. 5



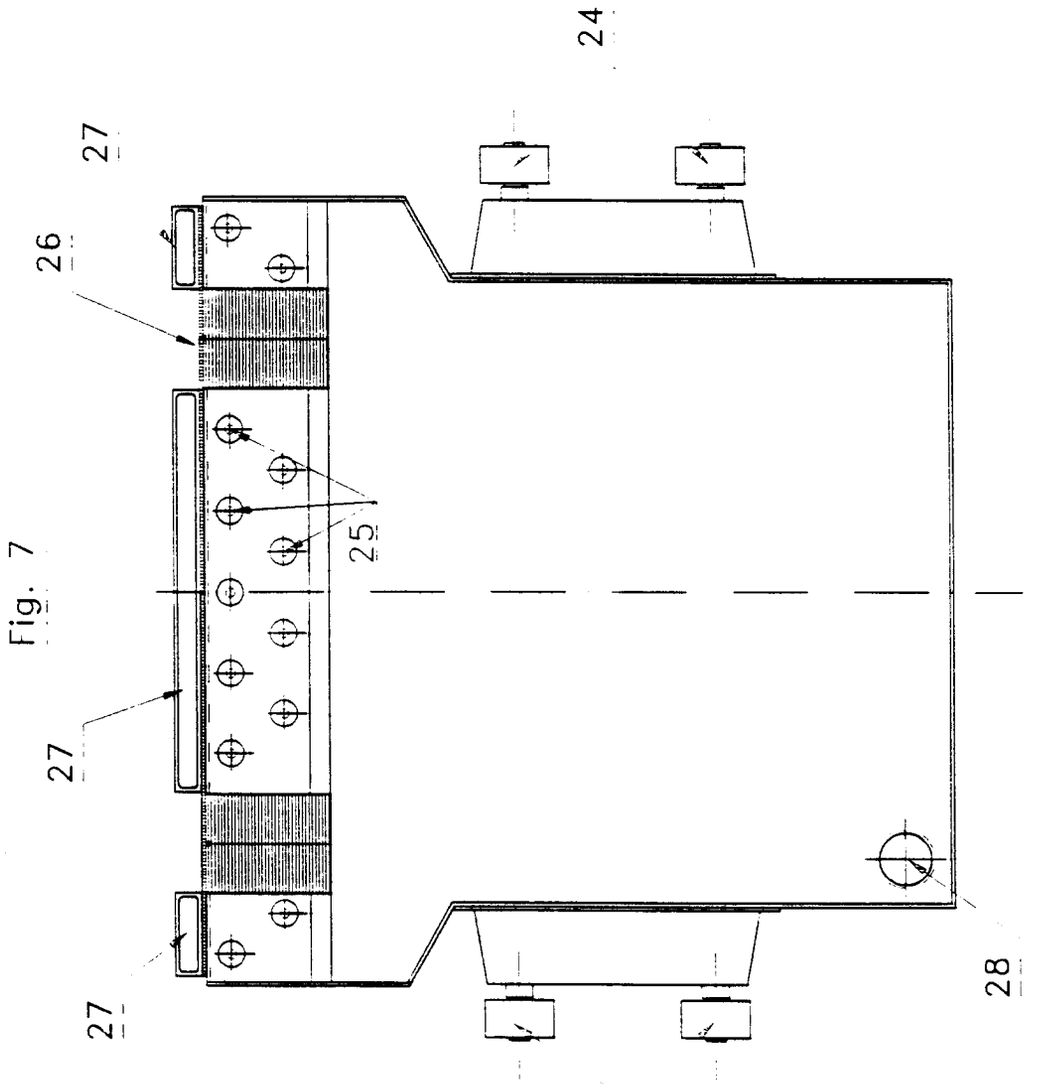


Fig. 7

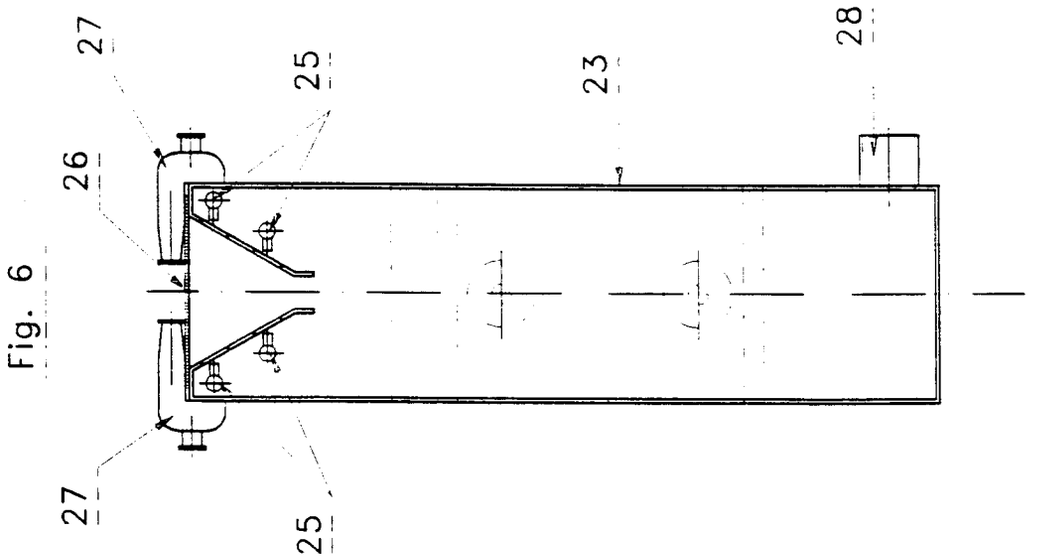


Fig. 6

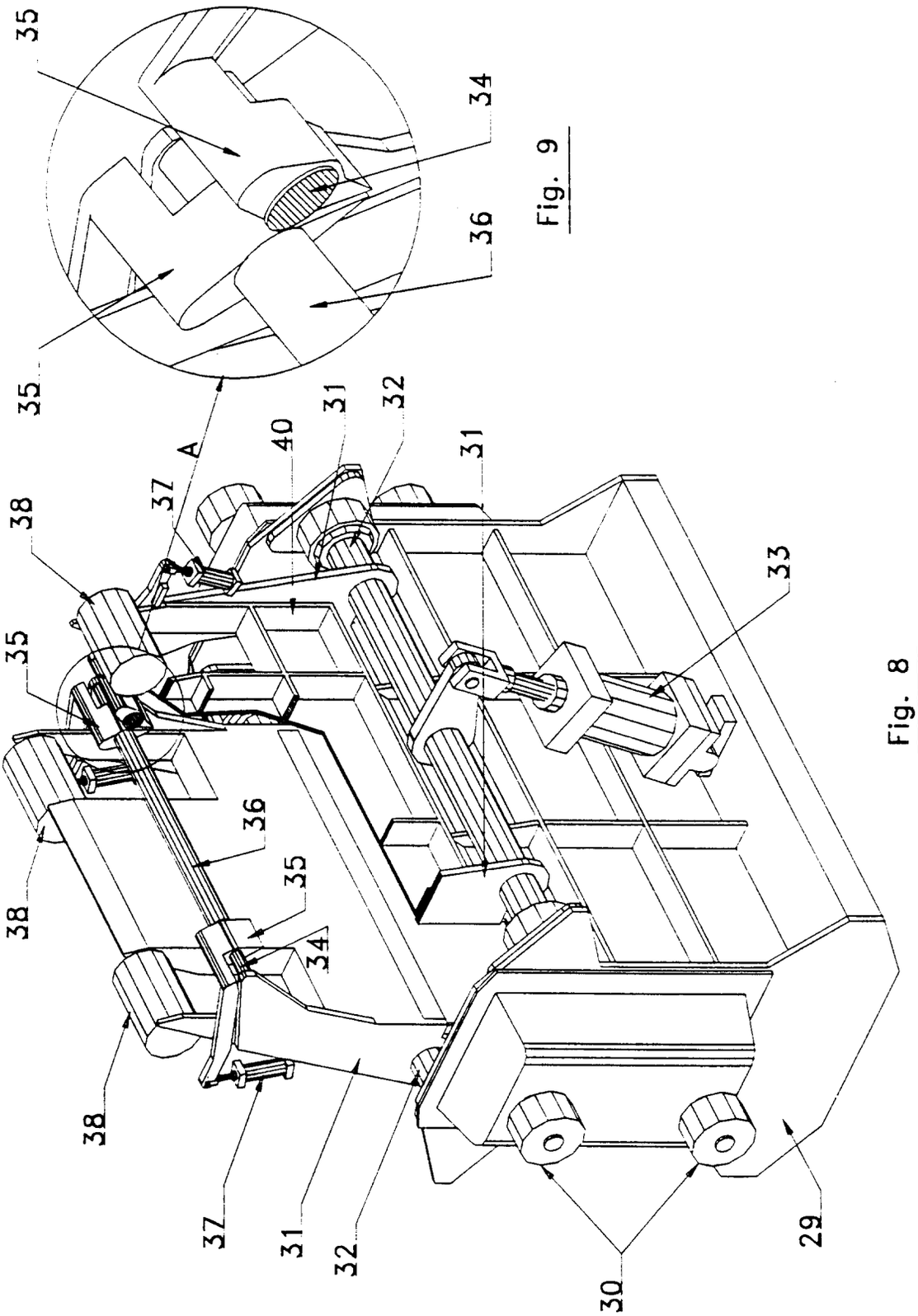


Fig. 9

Fig. 8

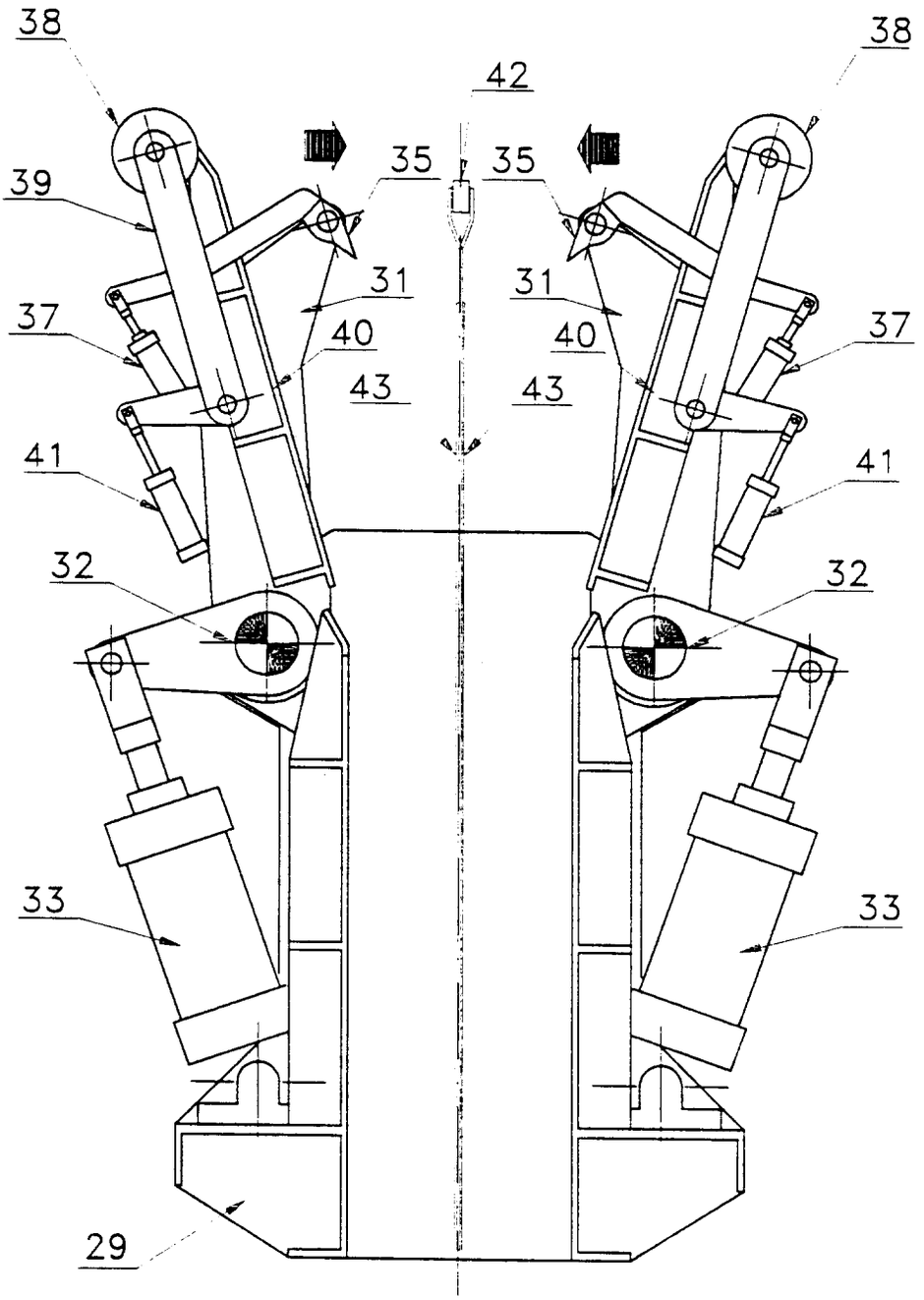


Fig. 10

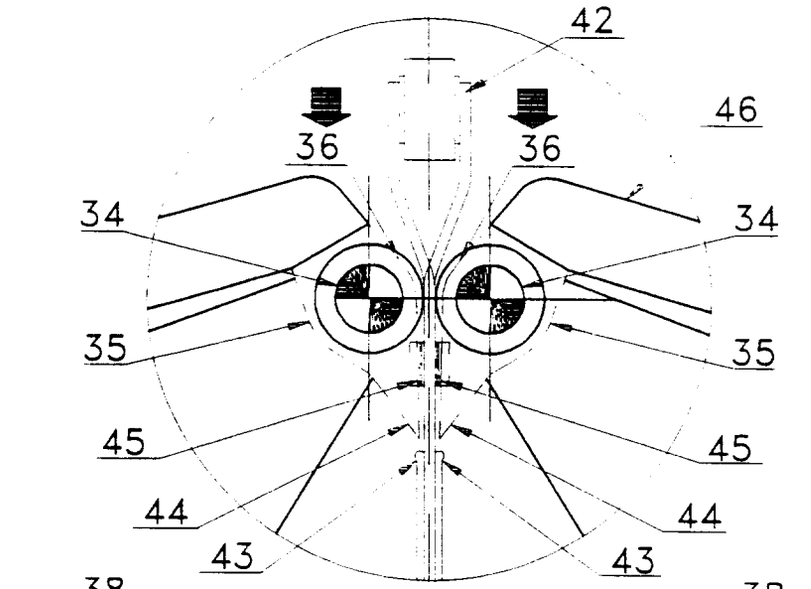

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Fig. 12

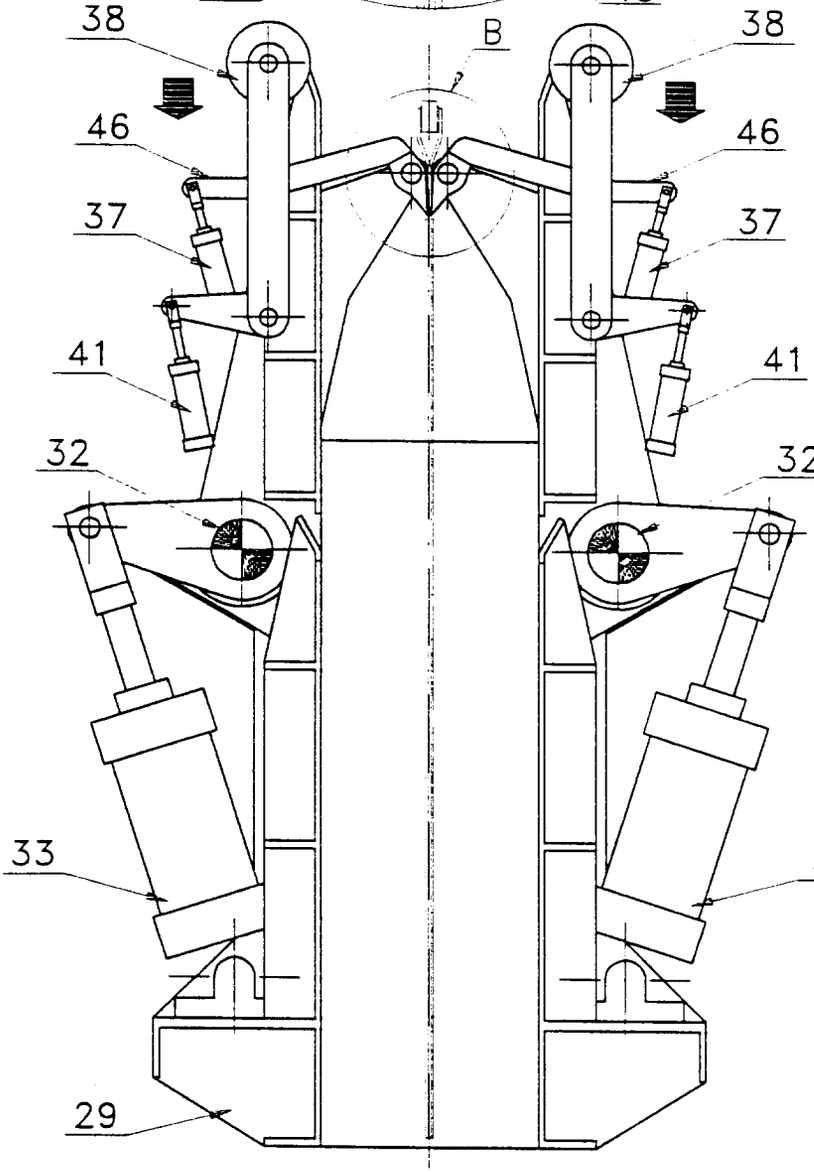
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Fig. 11

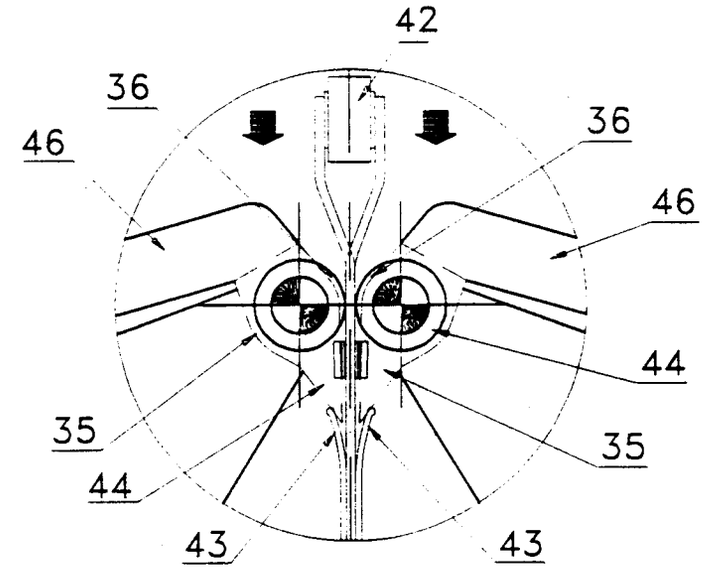

Fig. 13

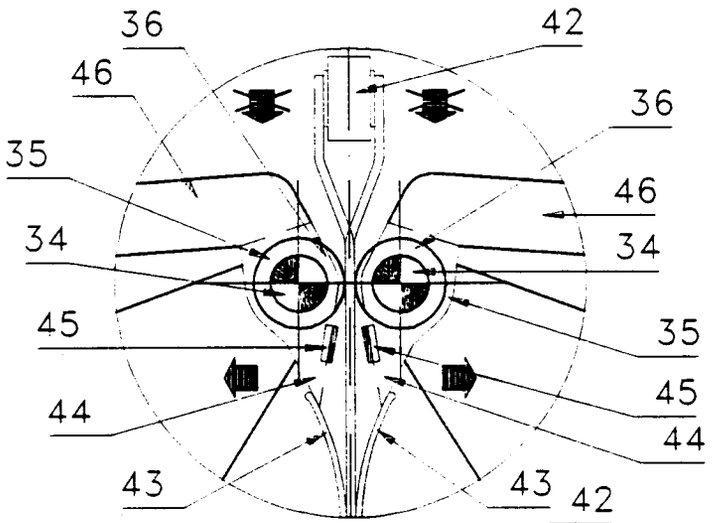

Fig. 14

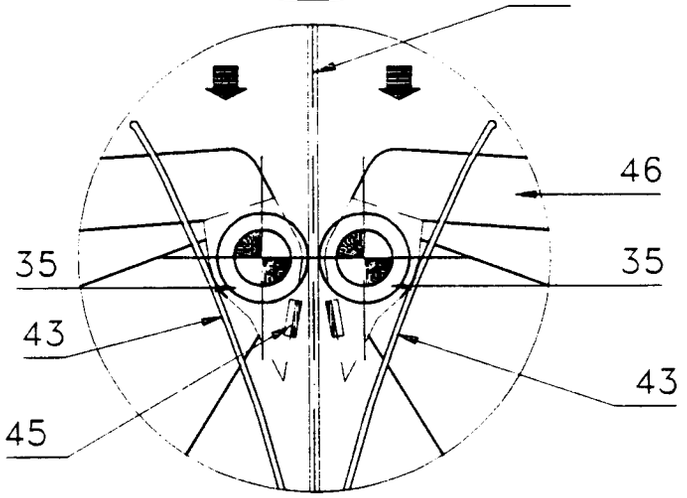

Fig. 15

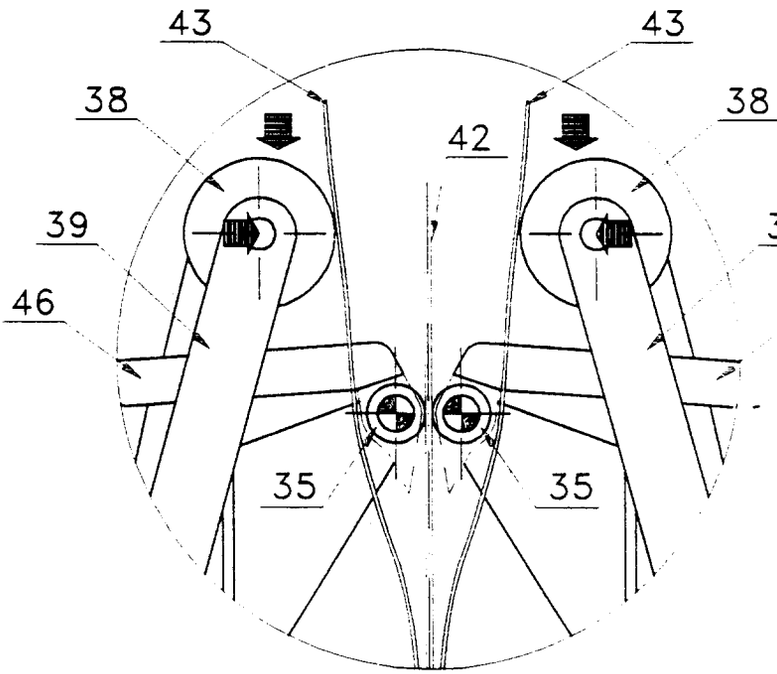

Fig. 17

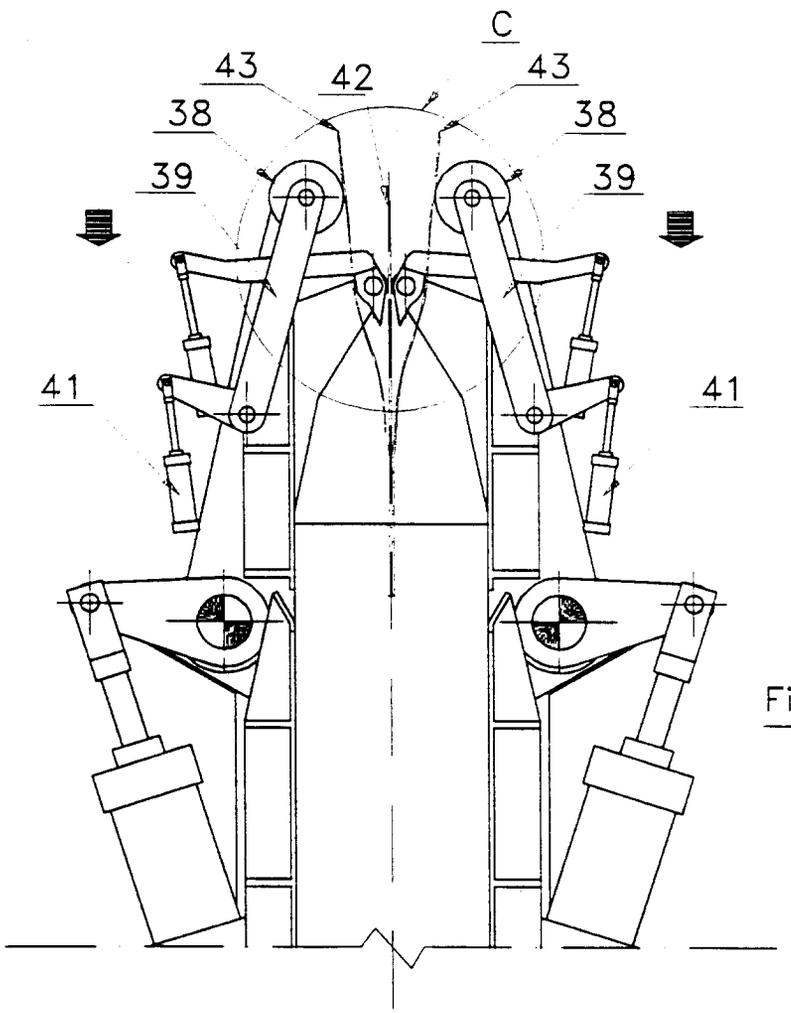

Fig. 16

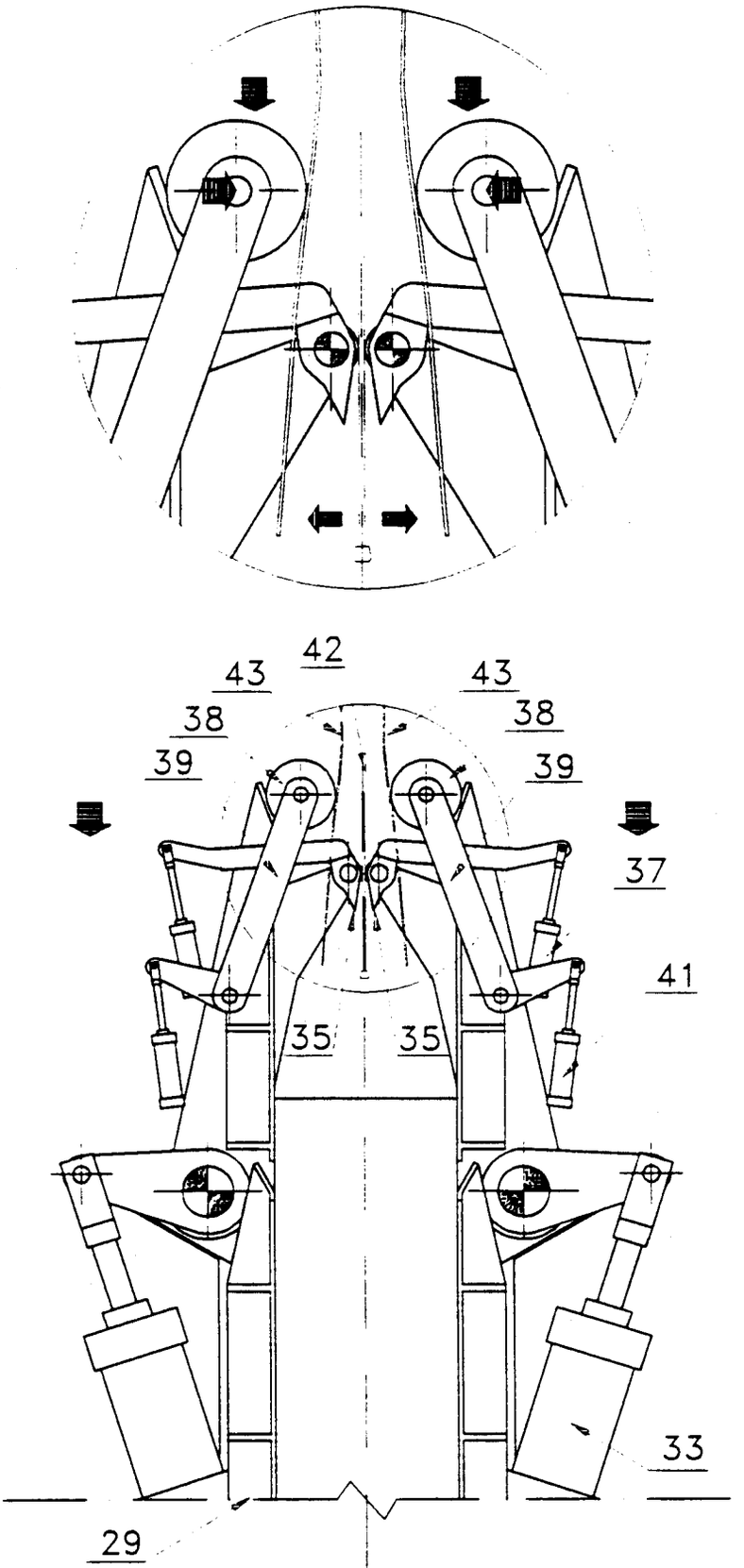

Fig. 18

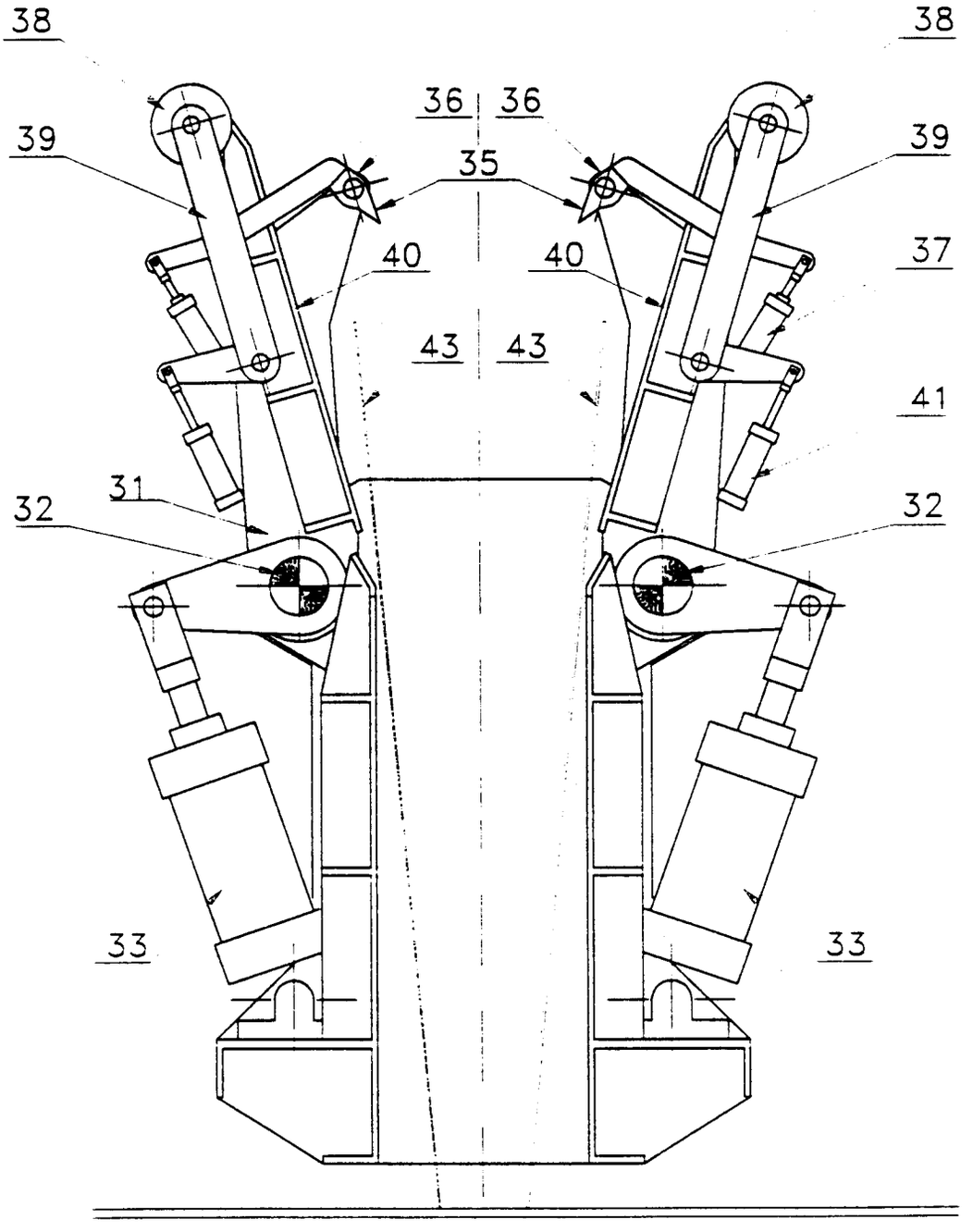

Fig. 19

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 50 0137

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE-A-30 35 019 (MITSUI MINING & SMELTING CO. LTD.) 9 April 1981 * page 2 - page 4; claims 4,5,8,10 * * page 11, line 1 - page 12, line 19 * * page 26, line 4 - page 28, line 16 * * figures 15-19 *	1	C25C7/08
A	DE-A-37 33 683 (OUTOKUMPU OY) 16 June 1988 * column 1; claims 1-8 * * figure 1 *	1	
D,A	EP-A-0 470 033 (ASTURIANA DE ZINC, S.A.) 5 February 1992 * column 12 - column 16; claims 1-15 * * figures 1-14 *	1	
A	US-A-4 479 854 (COMINCO LTD.) 30 October 1984		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

C25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 February 1996	Groseiller, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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