(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 405 687 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90201694.8**

(51) Int. Cl.5: **B65B 69/00**

(22) Date of filing: **26.06.90**

(30) Priority: **30.06.89 NL 8901674**

(43) Date of publication of application:
02.01.91 Bulletin 91/01

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

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(54) Process for opening and emptying drums with chemical waste, and a device for carrying out said process.

(57) A device for opening and emptying drums (4) with chemical waste comprising a frame (1), a conveyor element (3) for the supply and discharge of drums (4), a bell (5) which can be placed over a drum to be treated, a cutting element (9) for making a large hole in the top wall of the drum and a suction tube (12) for draining the drum.

A bar (10) to which the cutting element (9) is fixed and the suction tube (12) run through holes in the top side of the bell (5). The cutting element (9) and the suction tube (12) are driven by piston/cylinder assemblies (11) and (13) respectively.

For emptying a drum (4) the bell (5) is placed over the drum and a low oxygen environment is created inside the bell. With the cutting element (9) a large hole is made in the top wall of the drum. Through this hole a suction tube (12) is introduced into the drum and the drum is drained.

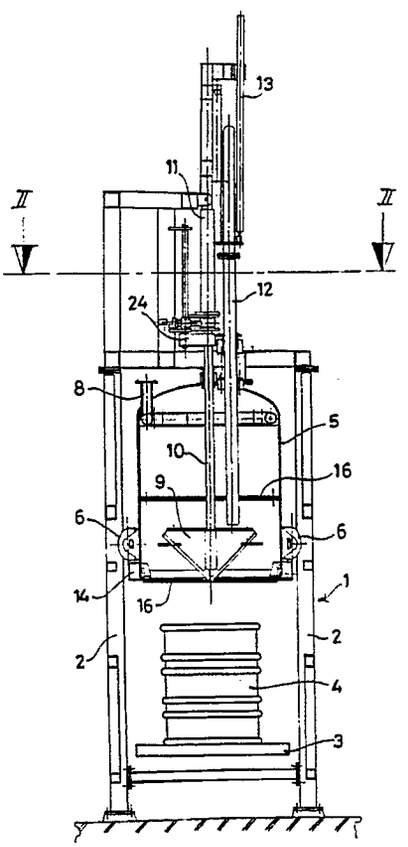

Fig. 1.

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PROCESS FOR OPENING AND EMPTYING DRUMS WITH CHEMICAL WASTE, AND A DEVICE FOR CARRYING OUT SAID PROCESS

The present invention relates to a process for opening and emptying drums with chemical waste. In particular, the invention relates to the treatment of drums with chemical waste which have to be incinerated in a waste incinerator.

It has hitherto been common for such drums with chemical waste to be conveyed unopened into the incinerator. This has the disadvantage that the drums could possibly explode in the incinerator and thereby damage it. Besides, the furnace temperature in the incinerator cannot be controlled accurately, since the contents of the drums are generally not known, and these contents are not fed in metered quantities into the incinerator.

A number of attempts have already been made to open amd empty such drums with chemical waste first, and then to burn the empty drums with any residue in the incinerator and feed the chemical waste in metered quantities into the incinerator. The opening of such drums is, however, a dangerous job, for which detailed precautionary measures have to be taken in order to protect the operating personnel. Besides, the drums are generally dented and deformed, so that attempts at automatic opening and emptying of the drums have not yet led to the desired result.

The object of the present invention is to provide a process by which such drums of chemical waste can be opened and emptied automatically, without the operating personnel running the risk of coming into contact with the contents of the drums, while the risk of explosion is adequately prevented.

These objects are achieved according to the invention in that the drum to be treated is placed in a low-oxygen environment; a hole is punched in the central area of the top wall of the drum; a number of incisions, extending radially from the punched hole to near the outer periphery of the top wall, are made in the top wall; the wall parts situated between the incisions are bent inwards; and a suction tube is introduced into the drum through the hole thus formed in order to drain the drum.

This process has the advantage that the punching of the hole and making of the incisions and subsequently the bending of the wall parts of the drum present between the incisions can be carried out by a single cutting element which is inserted into the top wall of the drum. Opening of the drum is thus not impeded by possible deformations of the drum, while the place on which the cutting element acts on the top wall need not be determined accurately.

The invention is also embodied in a device for carrying out the process, said device being characterized by:

- a frame through which a conveyor element runs for the supply and discharge of drums to be treated;
- a vertically movable bell which is guided in the frame, is open at the bottom side, and can be lowered over a drum to be treated, said bell having at the top side a connector for feeding an inert gas into the bell;
- a cutting element which is movable in the bell, and which is connected by means of a bar running through a hole in the bell to drive means disposed in the above-mentioned frame;
- a suction tube running through a hole in the bell, said tube being connected to drive means disposed in the frame in order to take the suction tube into and remove it from an opened drum.

By means of this device the drums can be opened and emptied automatically inside the bell, without the operating personnel running the risk of coming into contact with the contents of the drums. After being drained, the empty drums are taken immediately to the incinerator, while the contents of the drums can be stored in a storage tank and subsequently conveyed in metered quantities into the incinerator, so that the furnace temperature can be maintained at the desired level.

According to the invention, the cutting element comprises a piercing punch having a number of cutters extending essentially radially from the piercing punch, the cutting edges of said cutters defining a conical surface, and the piercing punch forming the tip of the cone which comes into contact first with the top wall of a drum to be opened. A hole is first made in the top wall of the drum by means of the piercing punch, following which by further lowering of the cutting element the cutters make the radial incisions from this hole. The bending inwards of the material parts present between the incisions can be carried out by the same cutting element.

According to the invention, the drive means of the cutting element are provided with a device for turning the bar carrying the cutting element through a predetermined angle. This makes it possible to withdraw the cutting element from the drum again after the incisions are made, and then to turn it through an angle which is equal to half the angle which the cutters enclose between them and to move it down again. The cutters now come into contact with the parts of the top wall of the drum lying between the incisions, and these parts will bend inwards, thereby producing a relatively large hole through which the suction tube can be in-

serted into the drum.

Preferably an annular suction channel is disposed along the bottom edge of the bell for extracting vapours during the opening and emptying of the drum. In this way vapours are prevented from escaping from the drum into the environment.

The invention is explained in greater detail with reference to the drawing, in which:

Fig. 1 shows a vertical section of the device according to the invention;

Fig. 2 shows on a larger scale a section along the line II-II in Fig. 1;

Fig. 3 shows a top view of the cutting element of the device of Fig. 1;

Fig. 4 shows on a larger scale a section along the line IV-IV in Fig. 3.

As can be seen from Figs. 1 and 2, the device comprises a frame 1, which is essentially formed by four uprights 2 which are connected to each other by cross bars, and which in the embodiment shown together enclose a square.

Running through between the uprights 2 is a conveyor element 3, which can be composed of a conveyor chain or the like which carries the drums 4 with chemical waste to be treated by the device.

Guided inside the four uprights 2 is a bell 5 which on the outside is provided with guide wheels 6, each of which is in contact with one of the uprights 2 in order to fix the bell in such a way that it can be moved in the vertical direction inside the uprights. The bell 5 is driven in the vertical direction by means of two piston/cylinder assemblies 7 (see Fig. 2). The bell 5 is open at the bottom side and can be lowered by means of the piston/cylinder assemblies 7 over a drum 4 fed in on the conveyor chain 3. A connector 8 is present at the top side of the bell for feeding an inert gas into the bell.

The bell 5 contains a cutting element 9, which will be described below with reference to Figs. 3 and 4. This cutting element 9 is fixed to a bar 10 which is guided so that it is vertically slidable through the top side of the bell 5. This bar is connected to a piston/cylinder assembly 11 which is supported in the frame 1, in order to allow the cutting element 9 to be moved up and down in the vertical direction.

A suction tube 12, which likewise is movable in the vertical direction by means of a piston/cylinder assembly 13 supported in the frame, is also supported in the frame.

For carrying out the process according to the invention, a drum 4 to be opened and emptied is placed on the conveyor chain 3 until it is below the bell 5 standing in its highest position. The bell 5 is then lowered over the drum 4, following which an inert gas, such as, for example, nitrogen, is fed through the connector 8 into the bell. The feeding of an inert gas into the bell can, if desired, be accompanied by an oxygen measurement inside the bell. If the oxygen content inside the bell is lower than a predetermined value of, say, 8%, the cutting element 9 is moved down by means of the piston/cylinder assemblies 7, so that said cutting element comes into contact with the top wall of the drum and makes a hole in it in the manner to be described below. The suction tube is lowered through this hole by means of the piston/cylinder assembly 13 until it is inside the drum, said suction tube virtually draining the drum. After the drum is emptied, the cutter and the suction tube are moved up again, as is the bell 5. The opened and emptied drum 4 is conveyed further by the conveyor belt, while another drum to be opened and emptied is conveyed in.

During the opening and emptying of the drum it is desirable to extract any vapours there may be at the bottom side of the bell, in order to prevent them from escaping into the atmosphere. For this, an annular suction channel 14 is provided along the outer periphery of the bell at the bottom, with two connectors 15.

Flexible partitions 16 are fitted both at the open bottom side of the bell and half way up, said partitions to some extent shutting off the space between the inside wall of the bell and the drum when the bell is lowered over the drum.

The way in which the drum is opened and in which the cutting element used in the process works will now be described with reference to Figs. 3 and 4. As can be seen from these figures, the cutting element is composed of a central shaft 17 which lies in line with the bar 10. The central shaft 17 is provided at its bottom end with a piercing punch 18. Running out from the piercing punch 18 are six cutters 19, extending essentially radially, and the cutting edges of which define a conical surface, while the piercing punch forms the tip of the cone and the base of the cone is a supporting ring 20. The cutters 19 enclose between them angles which are equal to each other.

The supporting ring has, distributed over its periphery, a number of holes through which slidable pins 21 are guided. These pins carry at their bottom end a pressure ring 22, a coil spring 23 being fitted around each pin between the supporting ring 20 and the pressure ring 22 to press the pressure ring from the supporting ring 20.

The drum is now opened in the following manner:

When a drum to be opened is placed below the cutting element, said cutting element moves down vertically, the piercing punch 18 coming into contact first with the top wall of the drum. This piercing punch presses a hole in the top wall in question, while through further lowering of the cutting ele-

ment the cutters 19 make radial incisions running radially to the outside wall of the drum from the hole made by the piercing punch 18. The cutting element is then moved up again, while the pressure ring 22 ensures that the cutting element is disengaged from the drum. Outside the drum, the cutting element is turned about the axis of the bar 10 through an angle which corresponds approximately to half the angle which the cutters enclose between them. The cutting element is then moved down again, in which case the cutters now come into contact with the material parts of the top wall of the drum lying between the incisions. These material parts are now pressed inwards by the cutters, thereby producing a relatively large hole. The open structure of the cutting element also allows the suction tube 12 to be lowered through the cutting element into the drum, as shown schematically by dashed lines in Fig. 3.

The conical shape of the cutting element also has the advantage that a certain centring effect is produced in this way if the cutting element does not end up in the centre of the drum. If cutters come into contact with the sturdier outside edge of the drum, the drum will be pressed sideways by the cutting element, as a result of which it will still assume the correct position relative to the cutting element.

In order to be able to turn the cutting element about the bar 10, the bar 10 is provided with an arm 24 which is moved by a piston/cylinder assembly 25 which is supported in the frame 1.

Since the cutting element first punches a hole in the top wall of the drum, a common starting point is produced for the cutters for making the incisions, without exceptionally great forces having to be exerted on the drum.

With the device just described it is possible to open and empty drums with chemical waste in successive cycles, so that said drums can be incinerated in a waste incinerator. The capacity of the device is about 30 drums per hour.

The device can be equipped with the usual safety and control equipment. For example, the suction tube is protected, by three position sensors disposed along the periphery, against lateral deflection due to hard residues in the drum or possible dents in the drum.

Claims

1. Process for opening and emptying drums (4) with chemical waste, **characterized in that**
- the drum (4) to be treated is placed in a low-oxygen environment;
- a hole is punched in the central area of the top wall of the drum (4);
- a number of incisions, extending radially from the punched hole to near the outer periphery of the top wall, are made in the top wall;
- the wall parts situated between the incisions are bent inwards;
- a suction tube (12) is introduced into the drum (4) through the hole thus formed in order to drain the drum.

2. Process according to Claim 1, **characterized in that** at least six incisions, enclosing angles which are equal to each other between them, are provided.

3. Device for carrying out the process according to the preceding Claims 1 and 2, **characterized by:**
- a frame (1) through which a conveyor element (3) runs for the supply and discharge of drums (4) to be treated;
- a vertically movable bell (5) which is guided in the frame (1), is open at the bottom side, and can be lowered over a drum (4) to be treated, said bell having at the top side a connector (8) for feeding an inert gas into the bell;
- a cutting element (9) which is movable in the bell (5), and which is connected by means of a bar (10) running through a hole in the bell to drive means (11) disposed in the frame (1);
- a suction tube (12) running through a hole in the bell (5), said tube being connected to drive means (13) disposed in the frame (1) in order to take the suction tube into and remove it from an opened drum (4).

4. Device according to Claim 3, **characterized in that** the cutting element (9) comprises a piercing punch (18) having a number of cutters (19) extending radially from the piercing punch, the cutting edges of said cutters defining a conical surface, and the piercing punch forming the tip of the cone which comes into contact first with the top wall of a drum (4) to be opened.

5. Device according to Claim 3 or 4, **characterized in that** the cutting element (9) has at least six cutters (19) which enclose angles which are equal to each other between them.

6. Device according to the preceding Claims 4 or 5, **characterized in that** the drive means (11) of the cutting element (9) are provided with a device (24, 25) for turning the bar (10) carrying the cutting element through a predetermined angle.

7. Device according to the preceding Claims 3 to 6, **characterized in that** an annular suction channel (14) is disposed at the bottom edge of the bell (5) for extracting vapours during the opening and emptying of the drum (4).

8. Cutting element obviously intended for a device according to the preceding Claims 3 - 7.

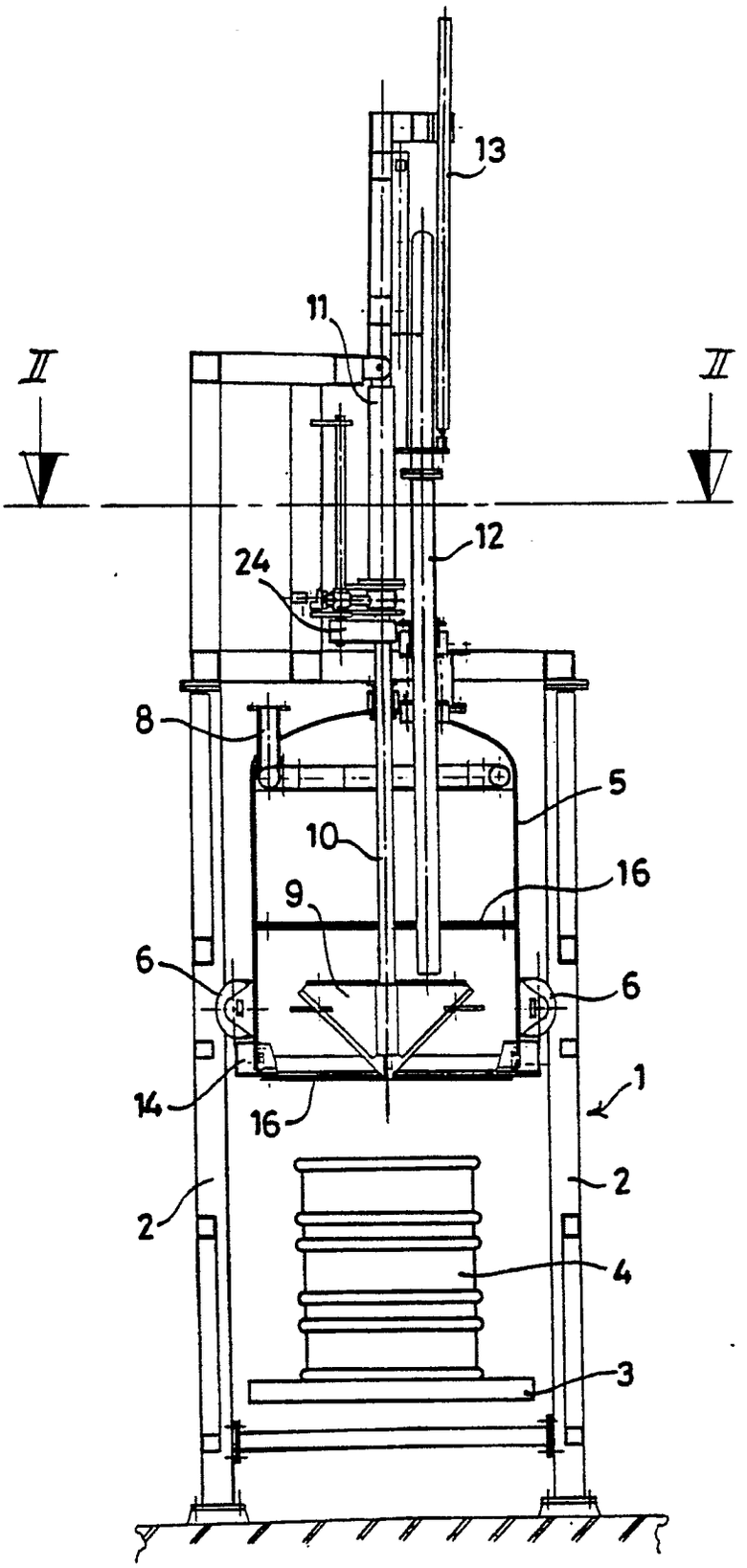

Fig.1.

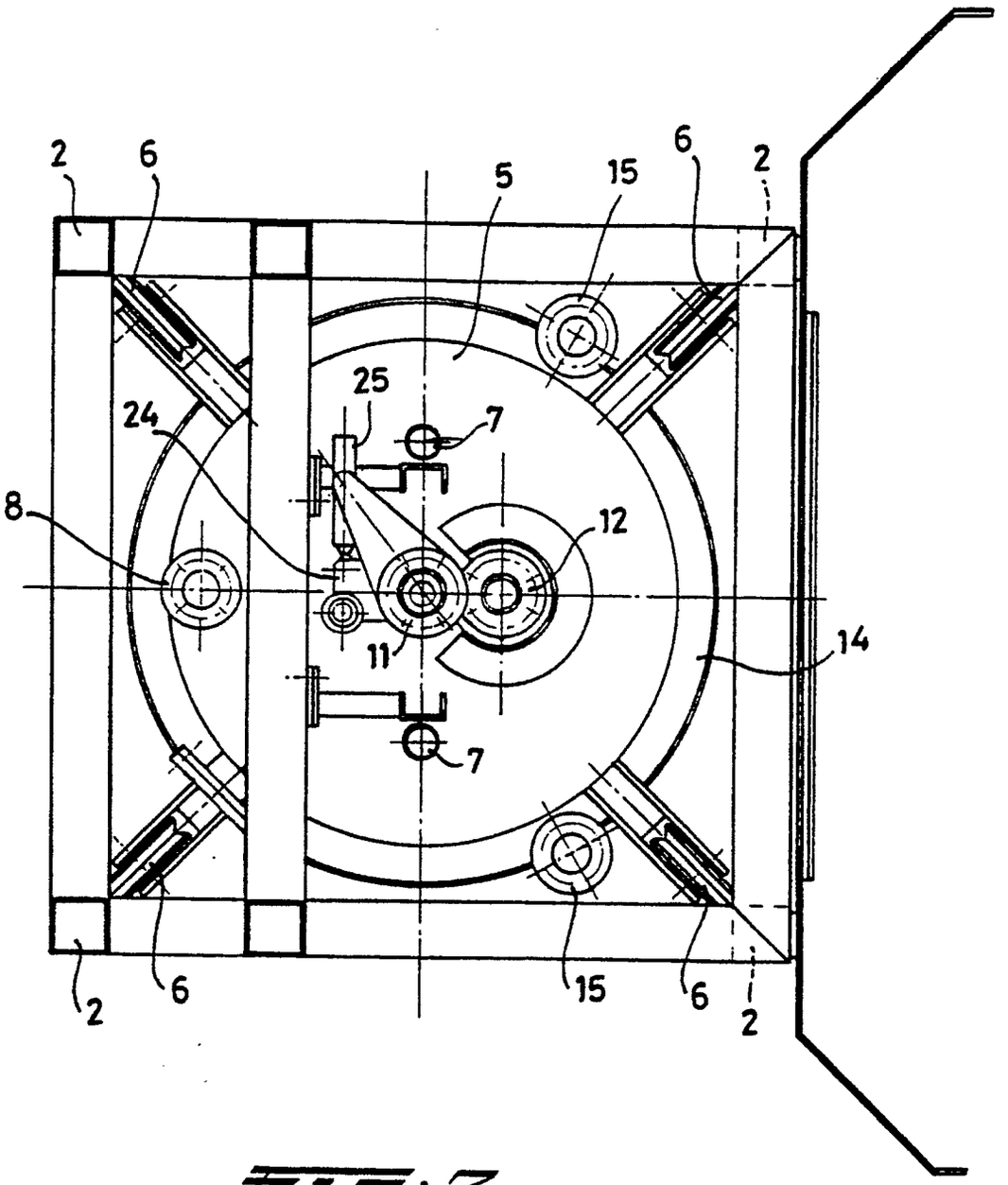

Fig. 2.

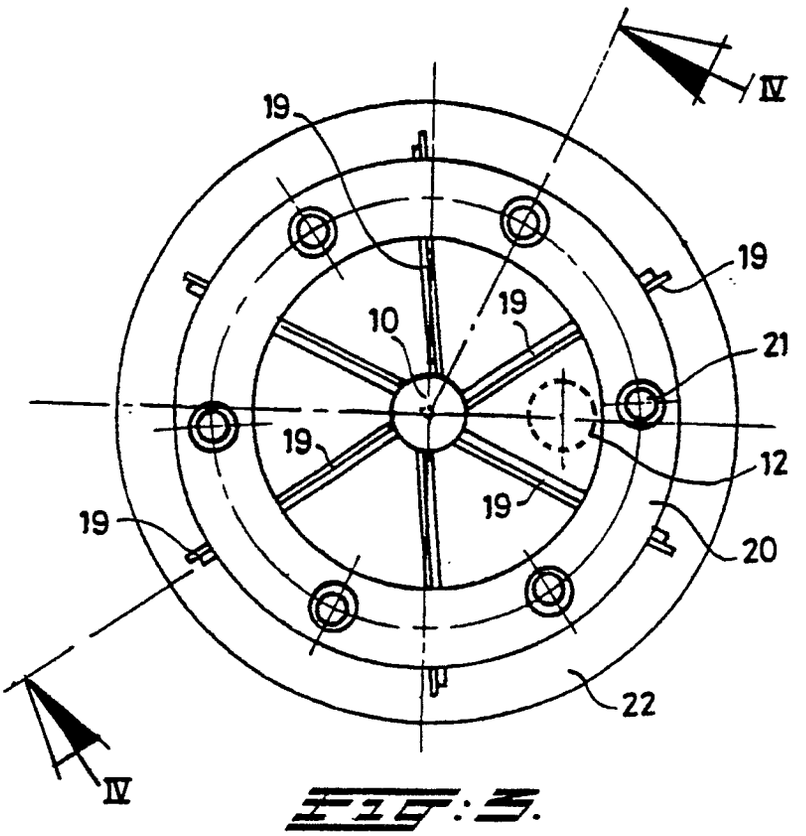

Fig. 3.

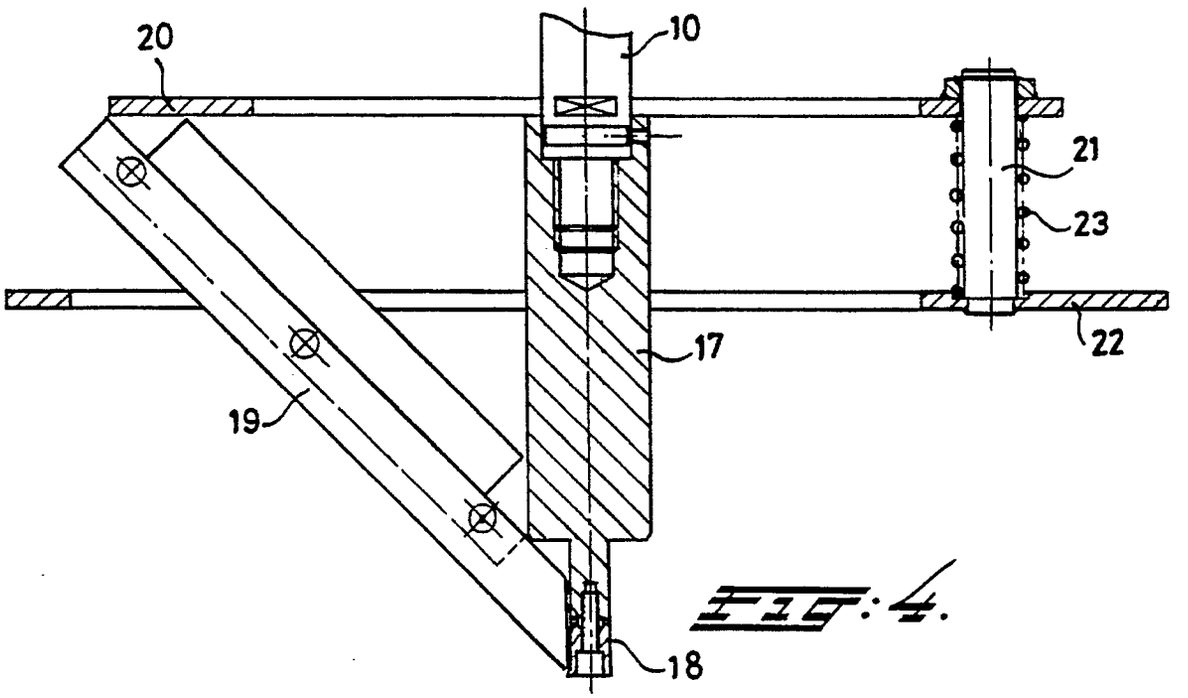

Fig. 4.

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PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application number: EP 90 20 1694

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.4)
A.	GB-A-2 082 540 (MID-ANGLIA PROJECT) * Abstract; page 1 lines 63-122; page 2, lines 49-105; figures 1,3,4 * --	1,3	B 65 B 69/00
A	US-A-4 690 180 (GOLD) * Column 7, lines 15-67; figure 1 * ----	1,3	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 65 B

INCOMPLETE SEARCH

The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely: 1-7

Claims searched incompletely:

Claims not searched: 8

Reason for the limitation of the search:

Rule 29 (6) EPC

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-09-1990	CLAEYS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
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