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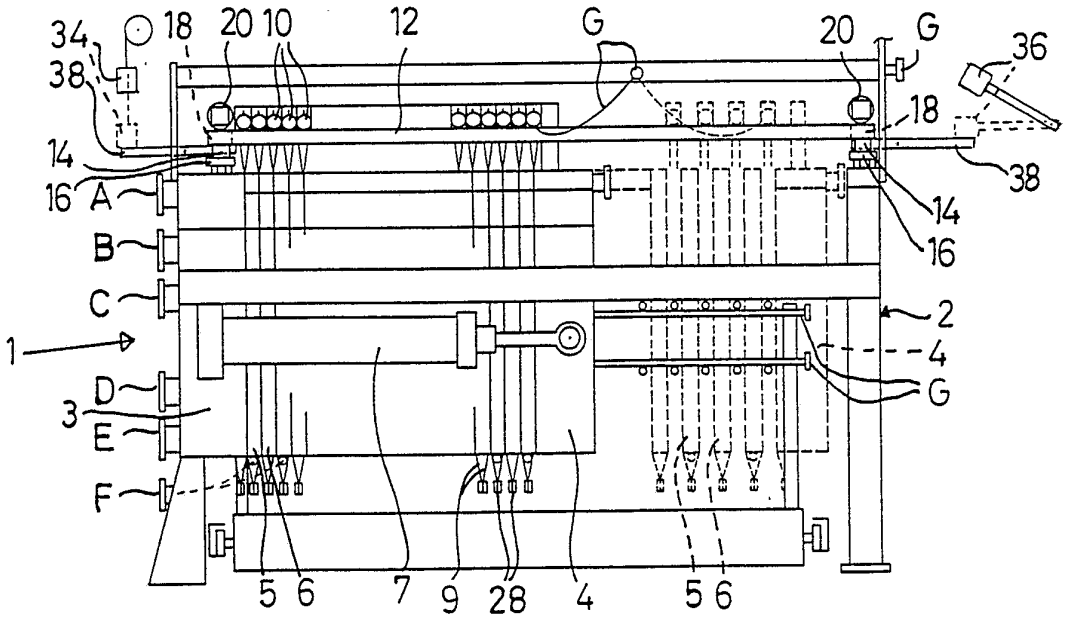
(54) Title: METHOD FOR PRESSURE FILTERING AND DEVICE FOR CARRYING OUT SAME



(57) Abstract

The present invention relates to a method of pressure filtering, the pressure filter (1) used comprising pressure plates (3, 4, 5, 6), which can be pressed against each other. Pressure chambers (8) are formed between the pressure plates and in each one of the pressure chambers two substantially vertical filter cloths are mounted. In order to loosen the filter cakes (32) from the filter cloths (9) means are used to produce sudden acceleration forces, e.g. directly or indirectly acting blow devices (34, 36, 38) or blow devices or lifting means, cooperating with stop surfaces, which devices and means are designed to drop the guide rails (12) from a lifted position.

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Method for pressure filtering and device for carrying out same.

The present invention relates to a method for pressure filtering of the kind set forth in detail in the preamble of patent claim 1. Also, the invention relates to a device used to carry out said method according to the preamble of the first device claim.

The invention relates particularly to solutions of problems of loosening and discharging the filter cake from such pressure filters. For this purpose it has already been suggested that the filter cloths be subjected to vibrations. DE-C 3 341 636 and DE-A 3 527 735 describe already known pressure filters, in which the filter cloths are suspended from slewing brackets and springs which are raised on the pressure plates. The pressure chambers are opened up one at a time and the filter cake is loosened by means of a movable vibration device, which directly influences the suspension rod of the respective filter cloths. However, these constructions have a drawback. The discharge is very time-consuming, since the filter chambers are emptied one at a time.

In order to empty all the filter chambers simultaneously it is suggested in Applicant's patent application PCT/SE87/000321, that the suspension rods of the filter cloths be movably suspended in a horizontal direction in the longitudinal direction of the pressure filter on two flexibly or elastically suspended guide rails, which are provided with vibration devices in order to vibrate all of the suspension rods and the corresponding filter cloths at the same time. The positions of the suspension rods when the pressure plates are brought apart are obtained by means of flexible and/or pivotable distance means fastened to the ends of the suspension rods, which distance means connect the suspension rods to each other and to the movable gable plates of the pressure filter. Such a pressure filter allows a very fast loosening of the filter cakes from the filter cloths and

consequently short filtering cycle times.

This already known pressure filter functions very satisfactorily for most types of materials, with an excellent cake loosening effect. However, as far as certain quite adhering or in other ways difficult to loosen types of materials are concerned vibrations of filter cloths produced in this already known pressure filter are not adequate, since they do not always result in a reliable and complete discharge of the filter cakes. Consequently, portions of or even entire filter cakes may remain in one or several of the filter chambers after a terminated filter cake discharge. Such remaining filter cake portions are particularly found in the upper parts of the filter chambers. This results in an inferior filtering capacity, because during the next filtering cycle portions of the available filter chamber space already are occupied by the remaining filter cake residues. Such remaining filter cake residues usually will remain also during the subsequent filtering cycles and increasingly stick to the walls of the filter chamber, i.e. the filter cloths. Thus, the deterioration of the filtering capacity of the pressure filter will be permanent.

Said remaining filter cake residues can at least be partly removed by spraying a rinsing fluid onto the filter cloths, at least during certain filtering cycles. The filter cake residues will then be brought back to a container or the like for a liquid suspension of filter materials. The filter cake residues which have been loosened by washing will then form a circulating load on the pressure filter, which worsens the filtering capacity of the system. Also, large loosened and washed away filter cake residues may lead to shutdowns and/or other disturbances in the rinsing liquid circulation system.

Due to the above-mentioned drawbacks of already known pressure filters the purpose of the present invention is to suggest a method of efficiently and completely loosening the filter cakes from the filter cloths in the filter chambers during the cake discharge period. An additional purpose of the invention is to suggest a device to carry out said method.

In accordance with the invention this purpose is achieved by proceeding according to what is set forth in the characterizing clause of patent claim 1 when using a pressure filter of the kind described above. A device for carrying out this method is characterized by the features set forth in the characterizing clause of the first device claim.

The method according to the present invention advantageously can be combined with a vibration of all of the filter cloths at the same time according to what is set forth in PCT/SE87/000321. The main part of the filter cakes can then be loosened and discharged according to the known method by means of vibrations, while the method according to the present invention is used to loosen possibly remaining filter cake residues.

In a first embodiment of the invention the filter cakes are subjected to shearing forces, because the lower part of the filter cloths are moved laterally in their plane direction. When the filter cloths are moved laterally, folds are formed where the filter cakes or the filter cake residues are located and consequently substantial shearing forces are produced in those parts of the filter cakes located closest to the filter cloths and the filter cakes are loosened from the filter cloths.

According to a second embodiment of the invention the filter cakes are subjected to sudden acceleration forces by

lifting the rail guides which support the filter cloths and letting them fall against stationary stops. When the falling filter cloths suddenly are braked particularly the larger remaining residues of the filter cakes are loosened. Thus, this method is principally different from the already known method with vibrations to loosen the filter cakes. Large amounts of remaining filter cake residues have a pronounced suppressing influence on the amplitude of the vibrations. A lower vibration amplitude of course lessens the cake loosening effect of the vibrations.

Also, the vibration amplitude can be different in different parts of the pressure filter. The vibration amplitude can be smaller particularly in the central filter cells due to various damping effects. Such a difference in motion amplitude does not exist when the guide rails are lifted and then fall against stationary stops.

In accordance with another advantageous embodiment of the invention the suspension means of the filter cloths are subjected to blows, preferably in an upward direction, e.g. by means of a blow device and/or a drop hammer, acting directly or indirectly. These blow devices produce an effect, which resembles a lifting and a falling of the guide rails.

According to an additional advantageous embodiment of the invention a presence of possibly remaining filter cakes is detected by means of load sensors, which transmit a signal to the process control unit. The process control unit may be designed, in case remaining filter cake residues are present, to transmit a control signal to start one or several of the above-mentioned cake loosening processes and/or to transmit a warning signal and/or interrupt the filtration process in favor of a manual cleaning. If such a load sensor is used, one may confine oneself to using

said above-mentioned cake loosening processes at those occasions when there really are remaining cake residues present. In this way the mechanical stresses on the suspension means of the filter cloths are reduced.

The invention will now be described in more detail by means of a few embodiments, reference being made to the attached, partly schematic drawings, in which:

Fig. 1 shows a pressure filter according to the invention, provided with blow devices;
Fig. 2 a schematic cross section of a pressure filter in a closed position;
Fig. 3 a section which corresponds to Fig. 2 but showing an open position and also showing remaining filter cake residues;
Fig. 4a and 4b a detail of an embodiment showing eccentric lifting devices and stationary stop surfaces;
Fig. 5 a cross section of a filter according to the invention showing means for moving the lower part of the filter cloths;
Fig. 6 a detail of the above-mentioned moving means; and
Fig. 7 a cross section of a guide rail and a blow device fastened to the guide rail.

Fig. 1 shows a pressure filter 1, known per se. This pressure filter corresponds to the pressure filter, which is described in our copending PCT patent application PCT/SE87/000321, reference expressly being made to this specification as regards its design and function, with the exception of those instances which are directly connected with the present invention. The pressure filter comprises mainly a frame 2 , which supports a fixed gable plate 3, a movable gable plate 4 and pressure plates 5,6 arranged between said gable plates. The pressure plates can be pressed against each other and brought apart from each other by means of

hydraulic cylinders 7. Pressure plates 3,4,5,6 form in pairs between each other pressure chambers 8, in each of which two filter cloths 9 are placed.

The filter cloths are supported by suspension rods 10, which are movable in a horizontal direction on two flexibly or elasticly supported guide rails 12. The rails are at their two ends supported by flexible or elastic supporting elements 14, e.g. rubber blocks or helical springs. Elements 14 are carried by supports 16, which can comprise separate posts fixed to the floor or a portion of frame 2 or consoles projecting from the frame. Guide rails 12 are connected to each other at their ends by means of transversal yokes 18, which support vibrators 20. The pressure filter is also provided with an inlet conduit A for material and outlet conduits B,C,D,E for filtrate as well as an inlet conduit F for a pressure fluid.

Fig. 2 and 3 show the pressure plates and the filter cloths in detail. Hollow suspension rods 10 are connected to rinsing water inlets G and are provided with upwardly directed positioning ribs 22 and rinsing nozzles 24. The filter cloths are provided with a divisible inlet sleeve 26 and rods 28 inserted in the lower hems. The rods on the respective sides of each pressure plate 5,6 are connected at their ends by rubber bands 30. Fig. 3 illustrates also how residues of filter cake 32 stick to filter cloths 9 in various manners, when the pressure filter is in an open position.

In order to loosen such residues of filter cakes 32, which could not be loosened solely by vibrations, sudden acceleration forces are produced by means of drop hammers 34,36, which fall from an elevated position onto pivotally mounted arms 38. Arms 38 abut yokes 18 of guide rails 12 with their opposite ends. However, it is also possible to, in other ways, subject suspension means 10,12 of filter cloths 9 to

preferably upwardly directed blows by means of drop hammers or other types of hammers.

Fig. 4 shows a detail of one end of the guide rails according to another embodiment of the invention, which includes eccentric lifting means 40 and stop surfaces, onto which the guide rails can drop. In this case supports 16 carry a cross bar 42 on top of elastic support elements 14, which cross bar is designed to carry the guide rails when they are in a not lifted position. A vibrator 20 (not shown) suitably is fastened to the center of the lower side of the cross bar and consequently is protected from blow stresses. Four guide rods 44 project upwardly fron cross bars 42 or supports 16 and run through guide sleeves 46 fastened to the guide rails. Between support elements 14 and supports 16 load sensors, e.g. pressure transmitters, are mounted, which are connected to the process control unit (not shown) of the pressure filter.

Eccentric lifting means 40 are mounted in pairs on shafts 50 and designed to abut the projecting ends of guide rails 12 or yokes 18 which connect them. They are mounted in an arbitrary way on supports 52 (not shown in detail), e.g. posts erected on the floor. Shafts 50 are designed to be rotated jointly with one or several driving means (not shown in detail), e.g. by means of chain driving or gear motors. Eccentric means 40 are provided with an elevated part 54, from which matching guide rail 12 or yoke part 18 is to drop onto a semi-elevated part 56, which functions as an anvil or stop surface. The lowest part of eccentric lifting means 40 is designed to normally be directed upwardly and then does not abut guide rails 12. The latter are carried by cross bars 42 during the filtration period and during the vibration. When filter cakes are discharged the eccentric lifting means are rotated one revolution, the guide rails being lifted and then dropping. This lifting

cycle possibly can be repeated, in case load sensors 48 detect remaining residues of filter cakes 32. In case there are no filter cake residues from the start, the process control unit can transmit a signal that a lifting is not to take place.

Fig. 4 b shows an alternative embodiment, in which the ends of the guide rails or the tranversal yokes are designed to fall onto separate movable anvils 60, which are designed to be moved to a position below the ends of the guide rails or the yokes in a lifted position. This can e.g. be accomplished by means of pull rods 62, the other end of which is mounted on eccentric discs 64 on shafts 50. Eccentric discs 64 preferably are placed outside corresponding eccentric lifting means 40 in order not to interfere with them.

Fig. 5 and 6 show a device designed to loosen residues of filter cakes 32 by agitating the filter cloths and in this way produce shearing forces. This device comprises two longitudinal bars 66 and fingers 68, which project therefrom and are positioned just opposite every second pair of rods 28 in the lower hem of filter cloths 9. Said fingers can be pushed towards the ends of the rods by means of e.g. hydraulic cylinders 70 and thus every second cloth pair will be pushed to the right and every second to the left in the figure. Additional control means possibly can be used to move the bars in a longitudinal direction in order to move the lower part of the cloths in an opposite direction. The means which are used to control the ends of rods 28 can according to the invention also be controlled in another way, e.g. manually. This can be done when an alarm signal has been transmitted by load sensors 48 due to remaining filter cake residues in the filter. This device, designed to control the ends of rods 28, advantageously can be combined with the rest of the methods

for filter cake loosening described above.

Fig. 7 shows a device according to the invention designed to produce sudden acceleration forces. In this device guide rails 10 are below provided with a transversal reinforcement flange 72. A few blow devices, so called "rappers", are attached to this flange and designed to jointly produce blows directed upwards against the guide rails. Such blow devices are already known and are used i.a. to loosen adhering material from arched screens and slanting, inoperative screens and in this way to prevent a clogging of the screens.

The present invention is not limited to the illustrated embodiments, but it is possible to combine, in an arbitrary manner, various characterizing features of the invention, as the latter is set forth in the description and the attached drawings and as it is defined in the following patent claims.

Patent claims

1. A method of using a pressure filter (1) of the kind, which comprises a number of pressure plates (3,4,5,6), which can be pressed against each other and are provided with discharge conduits (not shown) and in pairs form between each other at least one pressure chamber (8), in each of which two substantially vertical filter cloths (9) are positioned, which filter cloths are carried by means of suspension rods (10), which are movable in a horizontal direction on flexibly or elasticly supported guide rails (12), a suspension of solid particles in a liquid being fed through an inlet conduit (A) under pressure into the respective pressure chambers (8) and the liquid being forced to pass through the filter cloths (9) due to the inlet pressure and due to the pressure exerted by means of membranes and/or due to gas blow-through and being removed through said discharge conduits and outlet conduits (B,C,D,E) connected to the same, and the solid particles, which remain in the respective pressure chambers between the filter cloths (9) and form a filter cake, after a taking apart of the pressure plates (3,4,5,6) being discharged from said pressure chambers (8), and the suspension means (10,12) of the filter cloths (9) being subjected to a mechanical agitation in order to loosen the filter cakes (32) from the filter cloths (9), c h a r a c t e r i z e d in that the filter cakes (32) are loosened from the filter cloths (9) by subjecting them to sudden acceleration forces by lifting the guide rails (12), which carry the filter cloths (9), and by dropping the rails against stationary stops (56,60) and/or shearing forces by moving the lower part of the filter cloths (9) laterally in the plane direction of the filter cloths.

2. A method according to claim 1, characterized in that the suspension means (10,12) of the filter cloths are subjected to preferably upwardly directed blows, e.g. by means of blow devices (74) and/or drop hammers (34,36), acting directly or indirectly.

3. A method according to claim 1, characterized in that the presence of remaining filter cakes (32) or filter cake residues are detected by means of load sensors, e.g. pressure transmitters (48), which transmits a signal to the process control unit (not shown) of the pressure filter (1).

4. A method according to claim 1, characterized in that all of the filter cloths, in a way known per se (9), are forced to vibrate jointly by means of vibration means (20), positioned on the guide rails (12) during the discharge of the filter cakes (32).

5. A pressure filter used to carry out the method according to claim 1, which pressure filter (1) comprises a frame (2), which carries pressure plates (3,4,5,6), which can be pressed against each other and be brought apart from each other and in pairs form at least one pressure chamber (8) having two substantially vertical filter cloths (9) and being connected to an inlet (A) for material and outlets (B,C,D,E) for the filtrate, said filter cloths (9) being designed to be suspended from suspension rods

(10), which are movable in a horizontal direction on flexibly or elasticly supported guide rails (12) and in an open position it being possible to subject the suspension means (10,12) of the filter cloths to a mechanical agitation in order to loosen filter cakes (32), formed in the pressure chambers (8), from the filter cloths (9), c h a r a c t e r i z e d by means designed to subject the filter cloths (9) and the filter cakes (32) to sudden acceleration forces and/or shearing forces.

6. A pressure filter according to claim 5, c h a r a c t e r i z e d in that said means comprise elements (66, 68,70), designed to engage rods (28), mounted in the lower hem of the filter cloths, and consequently to push the lower part of the filter cloths laterally in the plane direction of the filter cloths (9) in order to produce shearing forces between the filter cloths (9) and the filter cakes (32).

7. A pressure filter according to claim 5, c h a r a c t e r i z e d in that said means comprise blow devices, which act directly or indirectly on the suspension means (10,12) of the filter cloths, e.g. drop hammers (34, 36) or electrically or pneumatically driven blow devices, so called "rappers", and/or lifting devices (40) designed to lift the guide rails (12) and adhering filter cloths and to drop them against stop surfaces (56,60), at least stationary in a vertical direction, in order to produce sudden acceleration forces.

8. A pressure filter according to claim 5, c h a r a c t e r i z e d in that it also comprises means (20) for vibrating the guide rails (12) and the adhering filter cloths (9) and/or that it includes load sensors (48), e.g. pressure transmitters, for detecting possibly existing, remaining filter cake residues (32) and/or that it includes control means (44,46), designed to fix the guide rails (12) in a horizontal direction.

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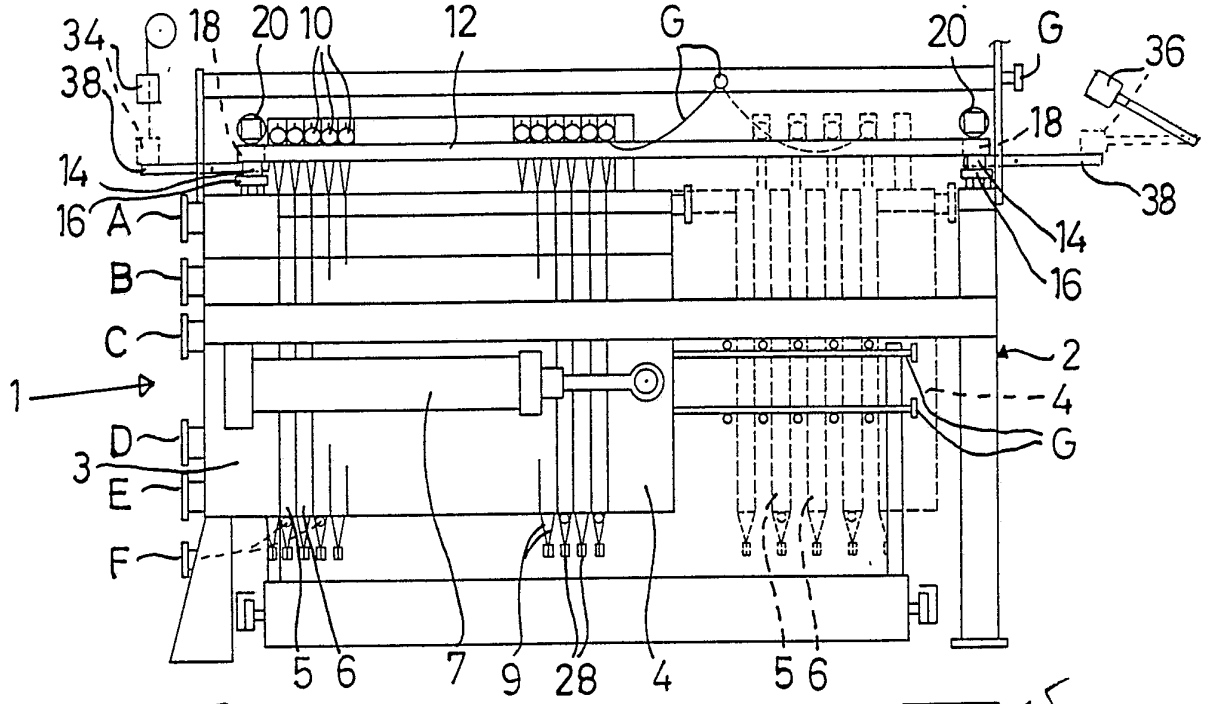
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Fig. 1

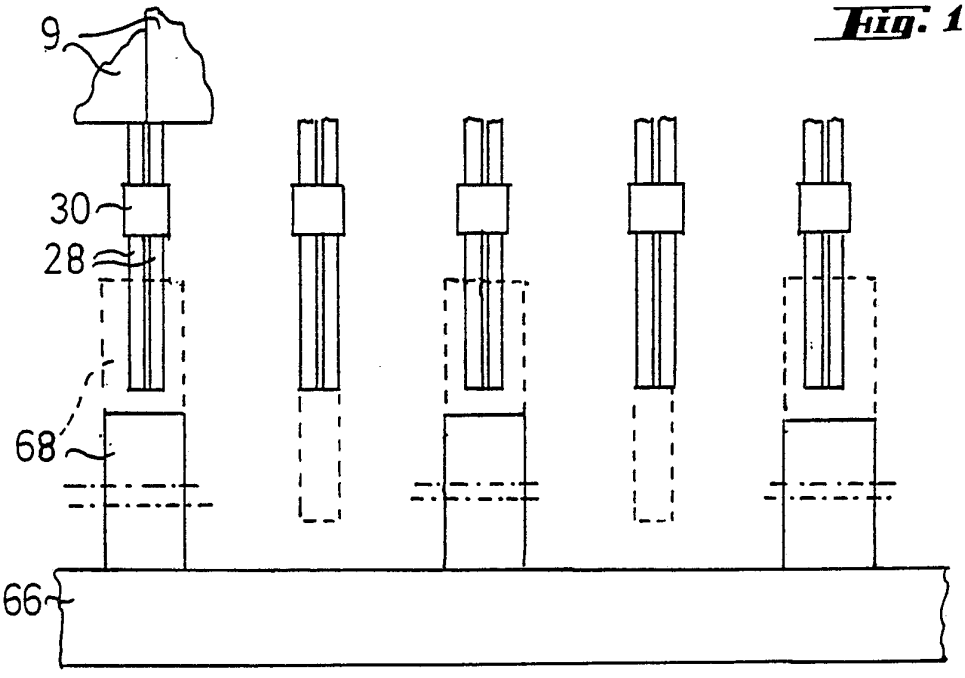
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Fig. 6

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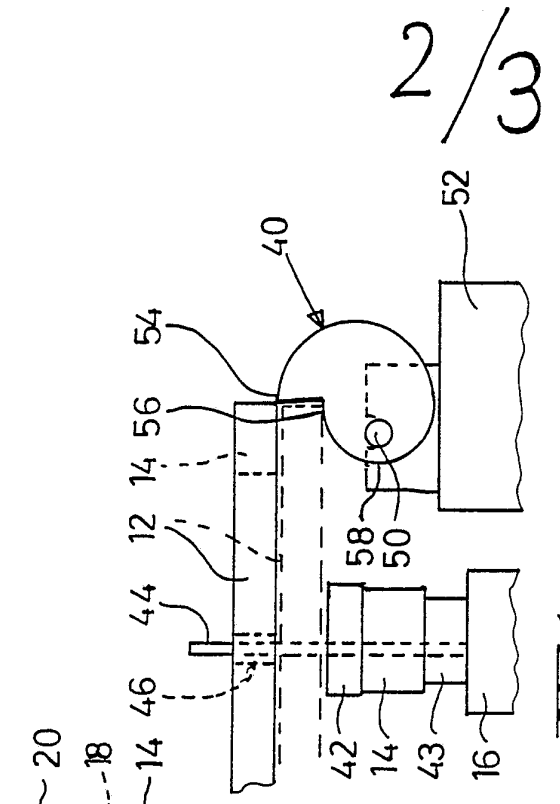

Fig. 4a

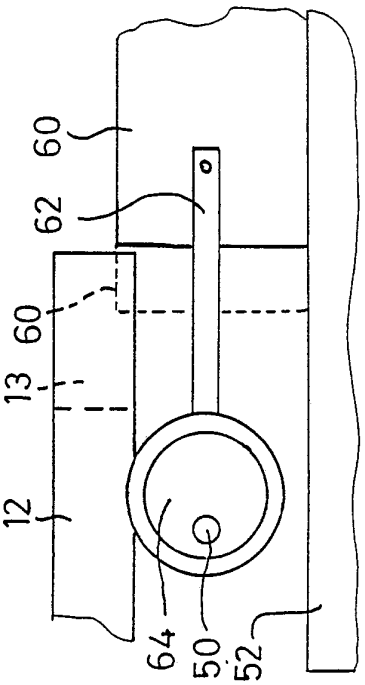

Fig. 4b

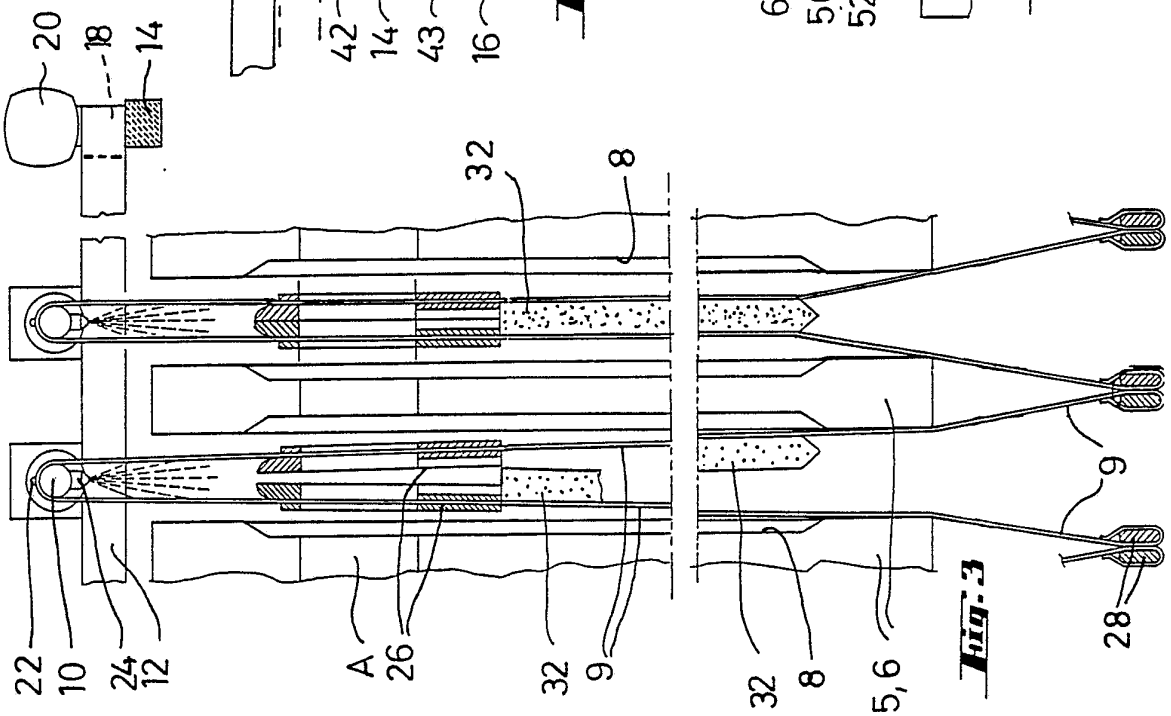

Fig. 3

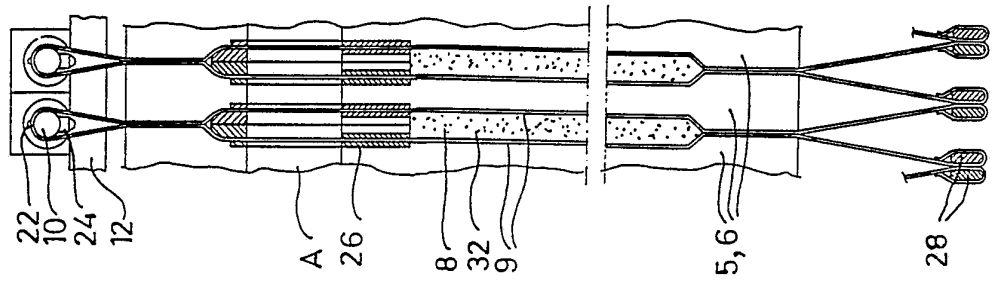

Fig. 2

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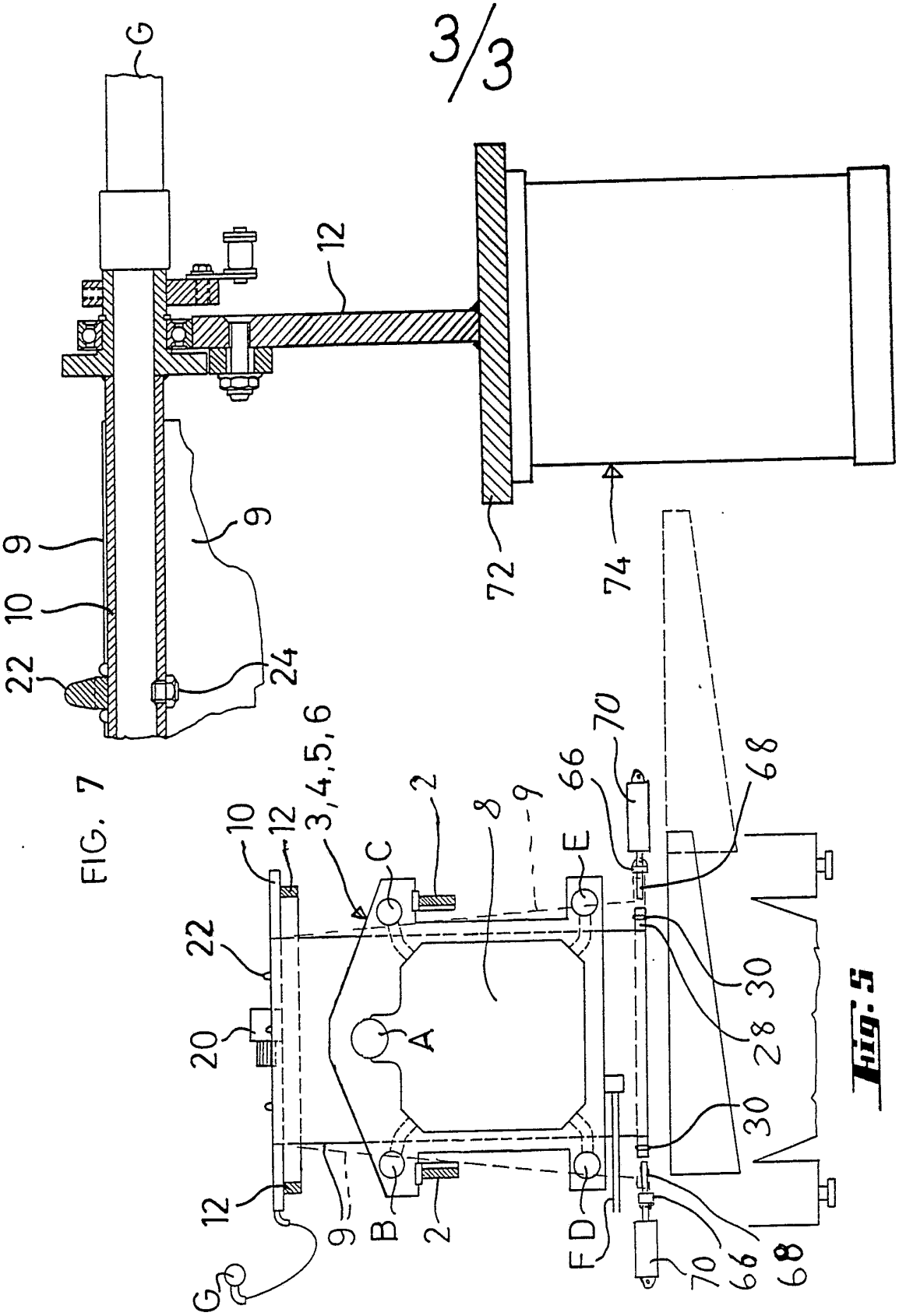

FIG. 7

Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE88/00676

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

B 01 D 25/34

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	B 01 D 25/12, /32, /34, /38
US Cl	210: 224, 225, 791

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
E	WO, A1, 88/00495 (SALA INTERNATIONAL AB) 28 January 1988 & SE, 453726	1, 5, 4
A	DE, B, 1 064 029 (OTTO EMELE) 27 August 1959 see especially fig 7 & SE, 184688	1, 6
A	GB, A, 2 175 817 (GEORGY MIKHAILOVICH KOCHKIN ET AL) 10 December 1986	7

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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