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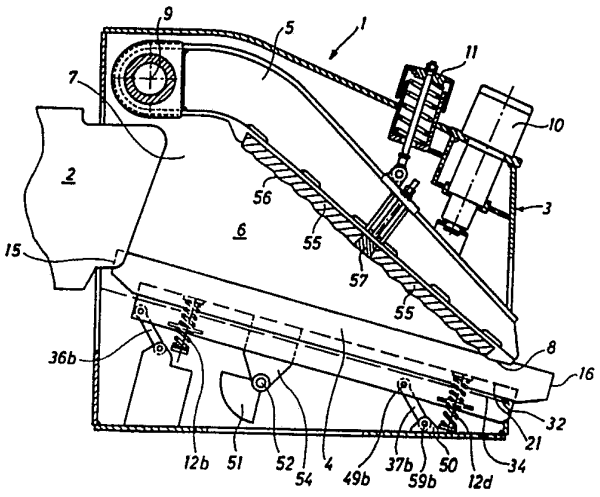
(54) Title: A CRUSHER FOR CRUSHING STONES, CONCRETE AND THE LIKE MATERIALS

(57) Abstract

A crusher (1) for crushing stones, concrete and the like materials and comprising a frame (3) and an upper and a lower jaw (5, 4) obliquely arranged relative to vertical in said frame, said jaws defining therebetween a crushing chamber (6) with an inlet opening (7) and a discharge opening (8). At least one (5) of the jaws is movably arranged relative to the frame (3) so as to be moved towards and away from the other jaw (4) for crushing material in the crushing chamber (6). The lower jaw (4) is supported relative to a support by means of a resilient means in order to keep a contact surface (31, 32) on said jaw (4) spaced from a contact surface (33, 34) on the support at light loads of the jaw and in order to allow contact between the contact surfaces (31, 32 and 33, 34) at heavy loads of the jaw (4) during the crushing of the material. The lower jaw (4) is furthermore connected to a vibrator for subjecting said jaw to a vibrating movement. As a result, material crushed on the lower jaw is continuously thrown forwards on said jaw due to the vibration of the vibrator and is consequently carried through the crusher when no crushing of material is carried out. When material is being crushed, the contact surface (31, 32) of the jaw (4) is pressed into contact with the contact surface (33, 34) of the frame (3) with the result that the crushing is carried out like in known crushers.



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Title: A Crusher for Crushing Stones, Concrete and the Like Materials.

Technical Field

The invention relates to a crusher for crushing stones, concrete and the like materials and comprising a frame and an upper and a lower jaw obliquely arranged relative to vertical in said frame, said jaws defining therebetween a crushing chamber with an inlet opening and a discharge opening, and where at least one of said jaws is movably arranged relative to the frame so as to be moved towards and away from the other jaw for crushing material in the crushing chamber.

Background Art

The conventional jaw crusher is structured such that the crushing chamber is substantially vertically arranged. Such a structure involves, however, a high height of construction and a correspondingly high feeding height for the material to be crushed. In addition, such crushers must be placed at a high level above the ground when they are to be used for crushing reinforced concrete with the effect that the feeding height is additionally increased.

EP-PS No. 0 015 992 discloses furthermore a mobile crusher of the above type and which comprises an upper fixed jaw and a lower movable jaw. The jaws or the crushing chamber are inclined substantially 45° in downward direction when seen from the feeding opening to the discharge opening. Such a crusher is, of course, of a smaller height of construction than conventional crushers.

Finally, NO-PS No. 12 22 16 discloses a crusher with two vertically arranged crushing jaws. The crushing jaws can be moved towards and away from one another in a horizontal

plane and define a horizontally extending crushing chamber. The resulting height of construction is very low, but a separate conveyor is necessary for carrying the material through the crushing chamber.

Disclosure of Invention

The object of the invention is to provide a crusher of the above type which is of a low feeding height and capable of carrying the crushed material through the crushing chamber without risk of clogging, and which can be used for crushing a wide range of materials.

The crusher according to the invention is characterised in that the lower jaw is supported relative to a support by means of a resilient means in order to keep a contact surface on said jaw spaced from a contact surface on the support at light loads of the jaw and in order to allow contact between the contact surfaces at heavy loads of the jaw during the crushing of a material, and that the lower jaw is connected to a vibrator for subjecting said jaw to a vibrating movement. As a result, crushed material is continuously thrown forwards on the lower jaw due to the vibration of the vibrator and is consequently carried through the crusher when no crushing of material is carried out. When material is being crushed, the contact surface of the jaw is pressed into contact with the contact surface of the support with the result that the crushing is carried out like in known crushers. Accordingly a perfect transport of material through the crusher is achieved without reducing the crushing capacity, said transport being achieved even when the crushing chamber extends substantially horizontally, i.e. a crusher with the smallest possible feeding height.

According to the invention the lower jaw and the support may be interconnected by means of two oscillating members

spaced apart in the longitudinal direction of said jaw, each of said oscillating members being pivotally connected about a horizontal axis to the jaw and the support with the result that a reliable guiding of the oscillating movement of the lower jaw is obtained.

Furthermore according to the invention each oscillating member may comprise two oscillating arms. The resulting embodiment turned out to be particularly advantageous in practice for achieving a reliable guiding of the oscillating movement of the lower jaw.

Moreover according to the invention the resilient means may comprise an adjustment member for adjusting the distance between the contact surface on the support and the jaw. In this manner it is possible to maintain the force by which the contact surface of the lower jaw impacts on the contact surface of the support within a predetermined maximum force independent of the amount of material on said lower jaw.

In addition according to the invention the resilient means may comprise two sets of helical springs spaced apart in the longitudinal direction of the jaw, said helical spring sets including an upper helical spring situated between the jaw and a bracket on the support and a lower helical spring situated between said bracket and a clamping part, and the adjustment member may comprise an elongated member interconnecting the jaw and the clamping part and threadedly engaging the latter. As a result, the resilient means is adjustable so as to change the distance between the contact surfaces of the support and the jaw without simultaneously involving a change of the resilience thereof.

Moreover according to the invention the support may be formed by the frame of the crusher with the result that the lower jaw is fixed and the upper jaw is movable, which

at present is considered the most advantageous embodiment of the invention.

Furthermore according to the invention the vibrator may comprise an oscillating body rotatably arranged on the lower jaw and with an eccentric mass centre, said oscillating body being adapted to be caused to rotate about a horizontal axis of rotation by means of a motor.

In addition according to the invention the vibrator may be an electromagnetic vibrator mounted on the jaw.

Finally according to the invention the vibrator may be a hydraulic cylinder/piston unit coupled between the jaw and the support.

Brief Description of Drawings

The invention is described in greater detail below with reference to the accompanying drawings, in which

Fig. 1 is a diagrammatic side view, partly in section, of a crusher according to the invention,

Fig. 2 is a diagrammatic cross-sectional view of the crusher of Fig. 1, and

Fig. 3 is a sectional view on a larger scale of a spring arrangement for supporting the lower jaw of the crusher.

Best Mode for Carrying Out the Invention

The crusher 1 comprises two crusher jaws 4 and 5 arranged in a frame 3, said jaws defining therebetween a wedge-shaped crushing chamber 6 with an inlet opening 7 and a discharge opening 8. Laterally, the crushing chamber is defined by wear members 58 mounted on the inner side of

the side walls 24, 35 of the frame. The material to be crushed is fed to the crushing chamber through the inlet opening by means of a feeding device 2, preferably of the vibration type. The upper crushing jaw 5 is rotatably journalled adjacent the inlet opening 7 about a horizontally extending axis 9 and can be moved towards and away from the lower crushing jaw 4 by means of a cylinder/piston unit 10 and a returning unit 11. The cylinder/piston unit is adapted to move the upper jaw 5 towards the lower jaw, and the returning unit is adapted to move the upper jaw 5 away from the lower jaw 4.

Both the upper jaw 5 and the lower jaw 4 are provided with a plurality of identical crushing plates 55 with a corrugated surface 56. The plates are arranged in the upper jaw in such a manner that the crests and the troughs of the corrugations extend transversely to the moving direction of the material through the crushing chamber. The plates are arranged such in the lower jaw that their crests and troughs extend along the moving direction of the material. The crushing plates 55 are fixed by means of wedges 57 fastened by means of screws.

The lower jaw 4 is resiliently suspended relative to the frame 3 by means of four resilient means arranged in pairs opposite one another adjacent the sides 13, 14 of the lower jaw and spaced from the ends 15, 16 of said lower jaw. Three of the resilient means 12a, 12b, 12d appear from the drawing. Each resilient means 12a, 12b, 12d comprises, cf. Fig. 3, an upper helical spring 17 and a lower helical spring 18 as well as a tension wire 19 for biasing the springs 17, 18. The upper helical spring 17 abuts at the top an upper wire holder 20, the upper end of the tension wire 19 being secured to said wire holder. The wire holder 20 is screwed onto the bottom side 21 of the lower jaw 4 by means of screws 22. At the bottom the upper spring 17 abuts a bracket 23 extending inwards from

the side wall 24 of the frame and being provided with a through bore 25 surrounding the steel wire 19. The lower helical spring 18 abuts at the top the bottom side of the bracket 23 and at the bottom a lower adjustable wire holder 26. The wire holder 26 comprises a contact portion 27 in contact with the lower spring 18 and a threaded portion 28. The threaded portion is permanently connected to the lower end of the wire 19 and provided with an outer thread 29 engaging a mating inner thread in the contact portion 27. In addition, the threaded portion 28 comprises a slot at its lower end.

The springs 17, 18 of the resilient means 12a, 12b, 12d are dimensioned such that together they are capable of keeping lower contact surfaces 31, 32 spaced a predetermined distance a from upper contact surfaces 33, 34 when the lower jaw 4 is loaded by a predetermined maximum amount of material. The lower contact surfaces 31, 32 are placed at their respective side of the lower jaw 4, and the upper contact surfaces 33, 34 are provided in the side walls 24, 46 of the frame. The distance desired in a predetermined crushing situation between the lower contact surfaces 31, 32 on the jaw 4 and the upper contact surfaces 33, 34 in the side walls 24 and 35 of the frame is adjustable by a turning of the threaded portion 28 of the lower adjustable wire holder 26 so as to allow an adjustment of the length of the resilient means and consequently of said distance.

The lower jaw 4 and the frame 3 are furthermore interconnected by means of a pair of front oscillating arms 36a, 36b and a pair of rear oscillating arms, only one rear oscillating arm 37b appearing from the drawing. Each front oscillating arm 36a, 36b is at its upper end pivotally connected to a shaft 38a, 38b in turn secured to two bearing plates 39, 40 and 41, 42, respectively. The two bearing plates 39, 40 and 41, 42, respectively, are spaced

apart and extend downwards from the bottom side 21 of the lower jaw 4. Each front oscillating arm 36a, 36b is at its lower end pivotally connected to shafts 43a, 43b permanently secured to lower front brackets 44, 45 and 46, 47, respectively. The front brackets 44, 45 and 46, 47, respectively, are spaced apart and extend upwards from the bottom 48 of the frame 3. The rear oscillating arms 37b are at their upper end pivotally connected to shafts 49b permanently secured to the bearing plates 39, 40 and 41, 42, respectively. At their lower end the rear oscillating arms 37b are pivotally connected to shafts permanently connected to lower rear brackets, the shaft 59b appearing from Fig. 1. The lower rear brackets extend upwards from the bottom of the frame 3 on line with the lower front brackets. A lower rear bracket 50 appears from Fig. 1.

An oscillating body 51 with an eccentric mass centre is permanently mounted on a horizontal oscillating body shaft 52. The oscillating body shaft 52 is rotatably journalled in two brackets 53, 54 extending downwards from the bottom side 21 of the lower jaw 4. The oscillating body shaft 52 is caused to rotate by means of a motor not shown. The rotation of the shaft 52 and consequently of the oscillating body 51, for instance at approximately 960 r.p.m., causes the lower jaw 4 to vibrate at a corresponding frequency. As a result at least small material parts on the lower jaw are thrown forwards towards the discharge opening 8 of the crushing chamber in the same manner as by a shaking conveyor. Accordingly, material is continuously discharged from the crushing chamber 6 with the effect that clogging is prevented. The oscillating body 51 is dimensioned such that it generates a rotating force capable of vibrating the lower jaw 4 by an amplitude in the magnitude of a few millimetres, i.e. less than the previously described specific distance between the contact surfaces 31, 32 on the lower jaw 4 and the contact surfaces 33, 34

in the side walls 24, 35 of the frame. Accordingly, no impacts occur between the contact surfaces during the vibrating movement.

When the upper jaw 5 is pressed against the lower jaw by means of the cylinder/piston unit 10 so as to crush the material in the crushing chamber, the contact surfaces 31, 32 on the lower jaw 4 are, however, forced into contact with the contact surfaces 33, 34 in the side walls 24, 35 of the frame so as to completely support the lower jaw 4 during the crushing procedure. As the upper jaw 5 is typically driven at a frequency lower than the vibrating frequency, the lower jaw vibrates a few times between each impact of the upper jaw so as to transport crushed material through the crushing chamber.

The invention may be varied in many ways without thereby deviating from the scope thereof. Thus in addition to the embodiment of the invention the lower jaw can for instance also be the movable jaw moved towards and away from a fixed or movable upper jaw.

Claims.

1. Crusher for crushing stones, concrete and the like materials and comprising a frame and an upper and a lower jaw obliquely arranged relative to vertical in said frame, said jaws defining therebetween a crushing chamber with an inlet opening and a discharge opening, and where at least one of said jaws is movably arranged relative to the frame so as to be moved towards and away from the other jaw for crushing material in the crushing chamber, c h a r a c t e r i s e d in that the lower jaw (4) is supported relative to a support by means of a resilient means (12a, 12b, 12d) in order to keep a contact surface (31, 32) on said jaw (4) spaced from a contact surface (33, 34) on the support at light loads of the jaw (4) and in order to allow contact between the contact surfaces (31, 32 and 33, 34) at heavy loads of the jaw (4) during the crushing of a material, and that the lower jaw (4) is connected to a vibrator for subjecting said jaw to a vibrating movement.

2. Crusher as claimed in claim 1, c h a r a c t e r - i s e d in that the lower jaw (4) and the support are interconnected by means of two oscillating members spaced apart in the longitudinal direction of said jaw (4), each of said oscillating members being pivotally connected about a horizontal axis to the jaw (4) and the support.

3. Crusher as claimed in claim 2, c h a r a c t e r - i s e d in that each oscillating member comprises two oscillating arms (36a, 36b and 37a and 37b).

4. Crusher as claimed in claim 1, c h a r a c t e r - i s e d in that the resilient means comprises an adjustment member for adjusting the distance between the contact surface (33, 34 and 31, 32) on the support and the jaw (4).

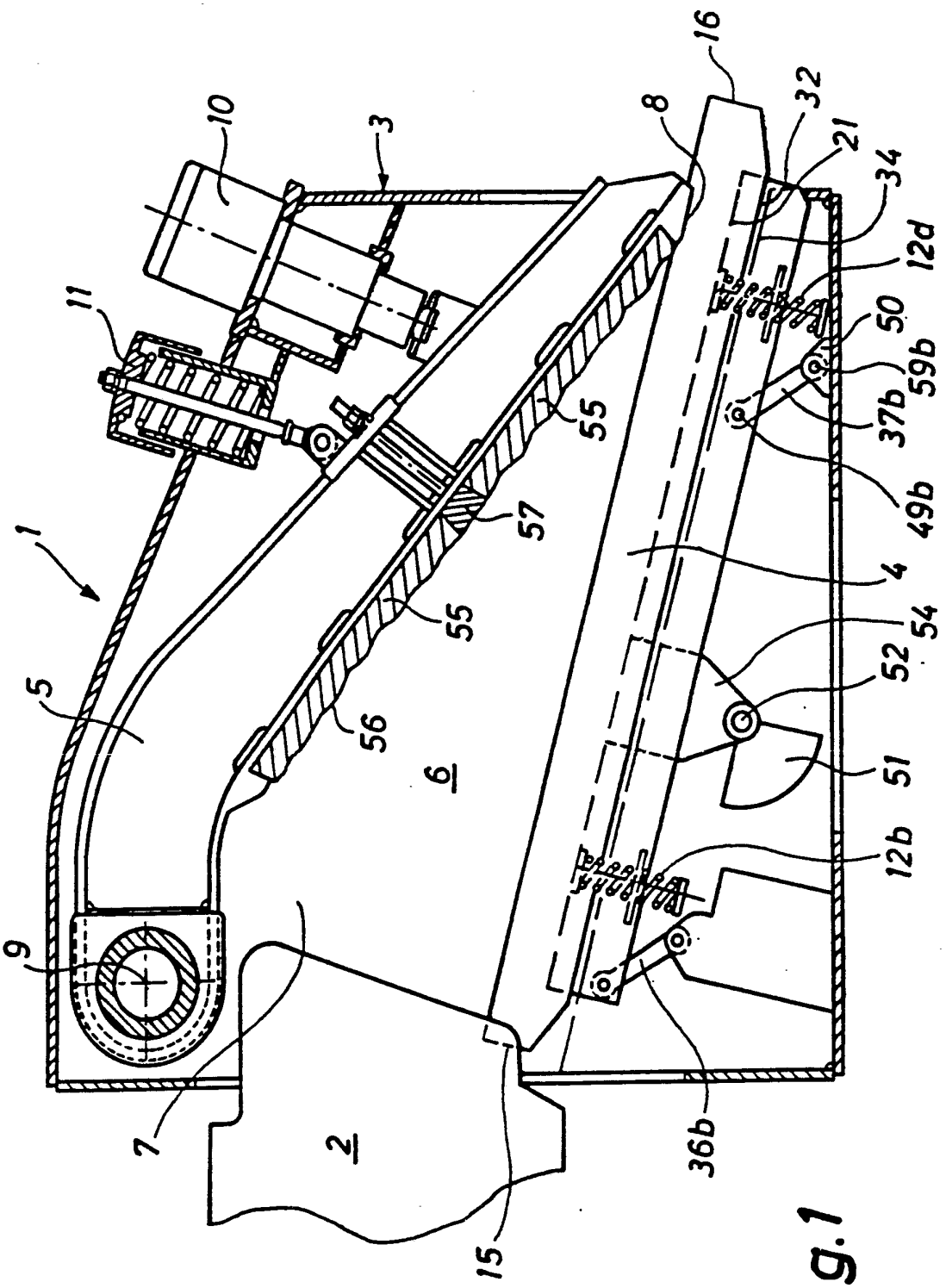
5. Crusher as claimed in claim 4, c h a r a c t e r - i s e d in that the resilient means comprises two sets of helical springs spaced apart in the longitudinal direction of the jaw (4), said helical spring sets including an upper helical spring (17) situated between the jaw (4) and a bracket (23) on the support and a lower helical spring (18) situated between said bracket (23) and a clamping part (27), and that the adjustment member comprises an elongated member (19) interconnecting the jaw (4) and the clamping part (27) and threadedly engaging the latter.

6. Crusher as claimed in one or more of the preceding claims, c h a r a c t e r i s e d in that the support is formed by the frame (3) of the crusher.

7. Crusher as claimed in claim 1, c h a r a c t e r - i s e d in that the vibrator comprises an oscillating body (51) rotatably arranged on the lower jaw (4) and with an eccentric mass centre, said oscillating body being adapted to be caused to rotate about a horizontal axis of rotation by means of a motor.

8. Crusher as claimed in claim 1, c h a r a c t e r - i s e d in that the vibrator is an electromagnetic vibrator mounted on the jaw.

9. Crusher as claimed in claim 1, c h a r a c t e r - i s e d in that the vibrator is a hydraulic cylinder/piston unit coupled between the jaw and the support.


16
32
21
34
12d
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59b
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49b
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6
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12b
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2
36b
15

Fig.1

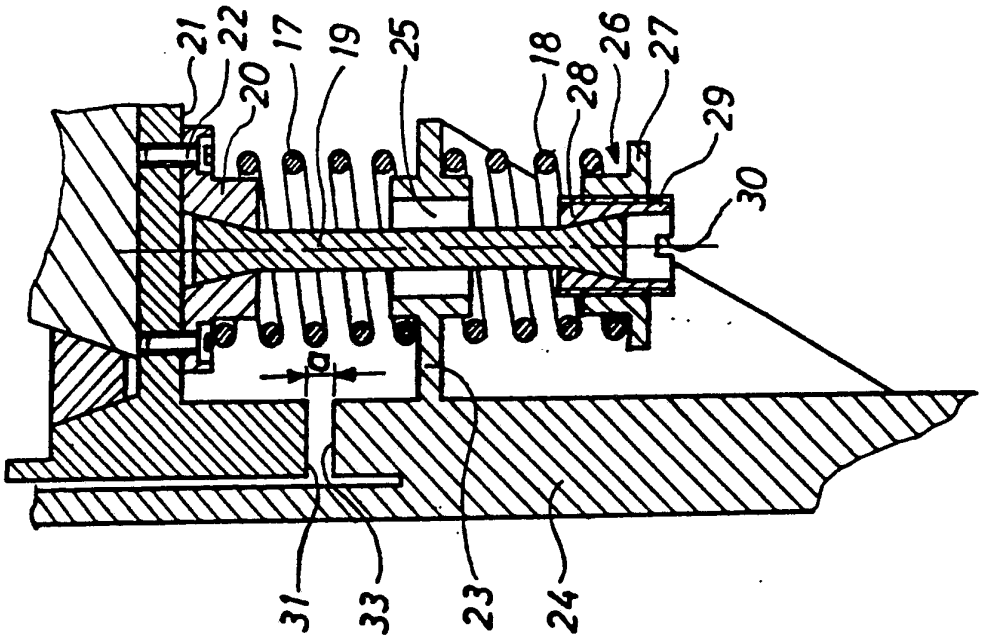
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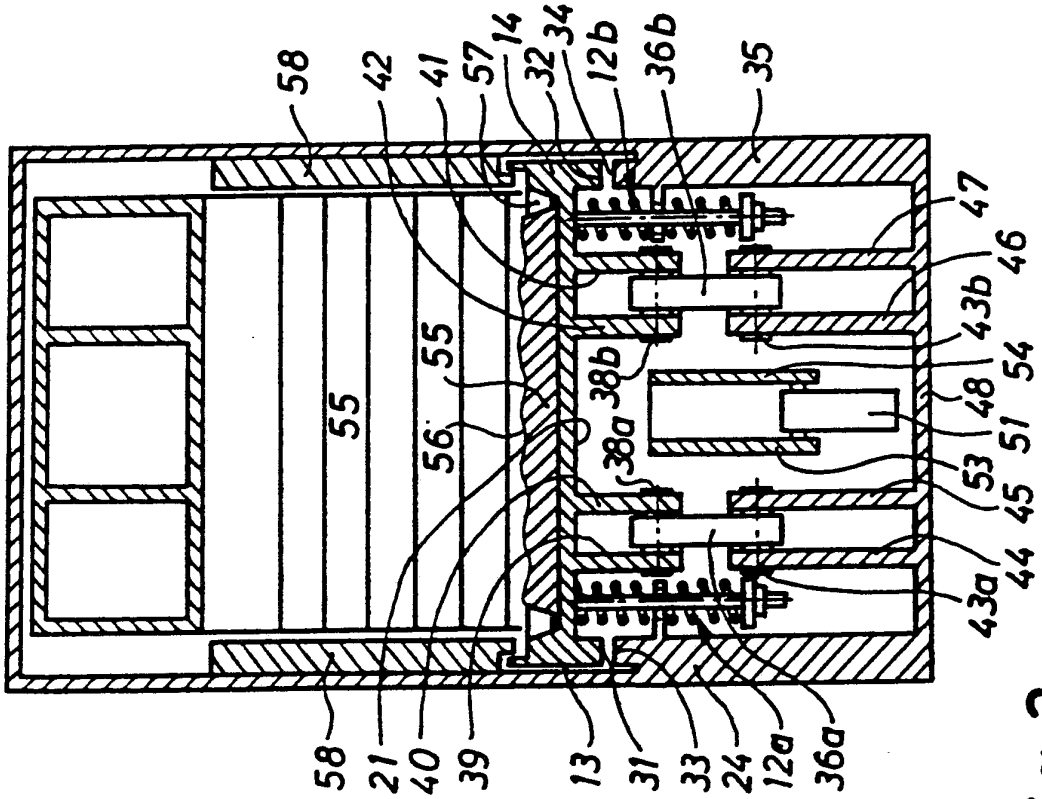
Fig.3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43a
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38b
38a
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12a
36a

Fig.2

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 91/00095

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

IPC5: B 02 C 1/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 02 C

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

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	EP, A1, 0312625 (INSTITUTE PO TCHERNA METALURGIA) 26 April 1989, see abstract; figure 1 -- --------	1

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
5th July 1991	1991 -07- 09
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Wiva Asplund

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0312625	89-04-26	NONE	