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Publication number:

0 286 156
A1

12

EUROPEAN PATENT APPLICATION

21 Application number: 88200488.0

51 Int. Cl.4: **F23H 15/00** , **F23H 1/02**

22 Date of filing: 17.03.88

30 Priority: 24.03.87 IT 1981987

43 Date of publication of application:
12.10.88 Bulletin 88/41

64 Designated Contracting States:
AT BE CH DE ES FR GB GR LI LU NL SE

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54 **Grate with pushers for the combustion of solid materials.**

57 Grate comprising stationary elements (21) supporting a material with a relatively large surface area, and moving elements (12) offering a relatively small contact area to the material. Air channels (29) are provided inside the stationary elements (21) for cooling the stationary elements (21) and for feeding combustion air to outlets (33). Projections (35) provided in an upper portion of the moving elements (12) leave the outlets (33) free in the reposition of the moving elements (12).

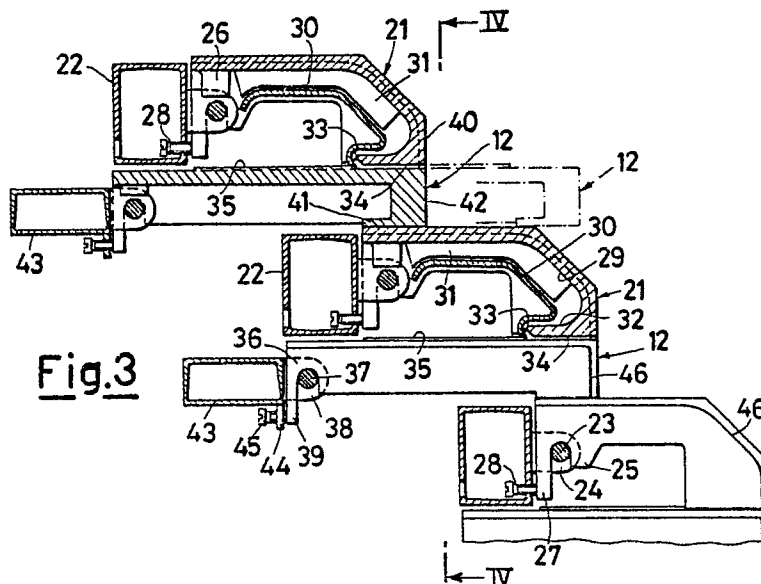


Fig.3

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"GRATE WITH PUSHERS FOR THE COMBUSTION OF SOLID MATERIALS"

The present invention relates to a grate with pushers for the combustion of solid materials.

It is known that the grates for the combustion of solid materials, in particular, e.g., solid town wastes, have, above all, the function of supporting and moving the materials to be treated which, from the inlet end up to the outlet end of the same grate lose their combustible portion.

Besides performing the function of supporting and moving forwards the material treated, the grate must make it possible the combustion air to be injected, and at the same time carefully distributed, inside said material. This, in particular, for the purpose of preventing bridges or preferential chimneys, which cause an irregular combustion of the material, to form, causing localized temperature excesses (hot spots) to occur.

The grates known from the prior art show furthermore faults due to the ease of occlusion of the air feed openings, to the penetration of dusts composed by fine material particles under the same grate, to the adhesion of low-melting metal materials and to the wear occurring in the moving and stationary components, caused by the operation type, and by the same structure thereof.

A purpose of the present invention is to provide a grate with pushers capable of solving all of the above problems, while remaining extremely flexible as to its function, and able to treat solid material types of very different nature.

These purposes according to the present invention are achieved by providing a grate with pushers for the combustion of solid materials, in particular solid urban wastes, of the step type, comprised stationary elements of box-like shape, for supporting the material, and moving elements performing the function of moving forwards the material to be treated, wherein the surface area in contact with said material of said stationary elements is considerably larger than that of said moving elements, inside said stationary elements a combustion air feed channel being provided for feeding the combustion air towards a hollow provided at the bottom on a front outwards-facing portion thereof, inside said hollow a complementary projection being slidably guided, which is provided in an upper portion of said moving elements in such a way as to leave free, in its rest position, an opening acting as an outlet for said channel.

A grate with pushers according to the present invention, its construction and its assemblage, together with the characteristics and advantages thereof are better understood from the following exemplifying and non-limitative disclosure, referred to the related schematic drawings, wherein:

Figure 1 shows an elevation view of a group of some grate sectors according to the invention in an incinerating furnace;

Figure 2 shows an enlarged, partially sectional view of a sector of the grate of Figure 1,

Figure 3 shows a partially sectional view of a detail of the grate of Figure 2, in a rotated position,

Figure 4 shows a sectional view according to path IV-IV of Figure 3,

Figure 5 shows a partially sectional view of a detail of a further form of practical embodiment of a grate according to the invention, and

Figure 6 shows a partially sectional front view according to arrow 6 of Figure 5.

Referring to Figure 1, the solid material is fed above a set of sectors 11 of grates with pushers having a structure according to the present invention.

Each grate sector 11 is fed at its bottom with combustion air from a hopper 13 of its own, the flow rate of air streaming through which is adjustable according to as needed by the individual sector wherein a specific step of the incinerating or combustion process takes place.

In Figure 1, the means are furthermore shown, which are provided for the purpose of moving the whole of movable pusher elements 12 of each individual sector 11, interposed and alternated with as many step elements 21 also denominated stationary elements.

Said moving means are schematically shown in the form of a cylinder 14, e.g., an oleodynamic cylinder, fastened through a pin 15 onto a frame 16 of the incinerating furnace, said cylinder moving, by means of a stem 17, with the interposition of a bell crank 18 and of relevant guide rollers 19 (Figure 2), a longitudinal support beam 20, with which the pusher elements 12 are integral.

Specifically referring now to Figures 2, 3 and 4, the elements composing the grate with pushers are shown in greater detail. In particular, as already said, on the frame 16 inside each individual sector 11, an equal number of stationary step elements 21 are positioned on each one of a plurality of stationart beams 22, transversal relatively to the travelling direction of the material, and essentially parallel to the upper surface of the grate.

The connection between each individual beam 22 and each step element 21 is accomplished by means of an end bar 23 which is engaged inside a perforated bracket 24, integral with the beam 22, and which receives bent, hook-like shaped portions 25 which extend downwards under the step element 21.

A couple of appendices 26 too extend under

the step element 21 in a central portion thereof, so as to come to place themselves on opposite sides relatively to the perforated bracket 24, thus acting as centering members.

The bent, hook-like shaped portions 25 extend, on their side close to the beam 22, into a further portion 27 having a length nearly equalling the width of the same beam, so to interact with an adjustment element 28, such as a screw, provided inside the beam 22, and which acts as a stop. By adjusting the position of the element 28, the stationary element 21 can be kept in a cantilevering position, or, on the contrary, it can rest on pusher 12.

The step element 21, of box-like shape, is provided, in its interior, with a channel 29, defined by a wall 30 which runs parallelly to the outer profile of the same step element, and which contains in its interior a set of heat-diffusion fins 31, which extend downwards from said outer profile, parallelly to the direction of channel 29.

Channel 29 extends up to come in the nearby of a flat portion 32, bent inwards from a front wall 40 of the step element 21 parallelly to the pusher element 12, which defines, with the wall 30, an opening 33 acting as an air outlet.

In its front face, the step element 21 is provided, in a central portion thereof, a hollow 34 capable of receiving, and allowing the sliding of, a projection 35 of complementary shape, provided above each pusher element 12.

More precisely, the projection 35 is provided only in an upper central portion of the pusher element 12, so to be aligned with the outlet opening 33, leaving it completely free when the pusher element is in its rest position.

The pusher element 12, which too results to be of box-like shape, but of a height much lower than of the step element 21, has preferably a flattened parallelepipedal shape. At its bottom, it is provided with a flat front portion, bent rearwards, 41, which extends from a front wall 42 lined-up with the front wall 40 of the step element 21. In a rear portion thereof, the pusher element 12 is provided with portions bent to a hook-like shape 36, which engage themselves above an end bar 37 inserted inside a perforated bar 38 integral with the stationary beam 43 in a way analogous to the step element 21.

Also the pusher element 12 is provided with a couple of appendices 39, whose bottom portion extends downwards inside the pusher element 12, said appendices 39 being parallel to the hook-like bent portions 36 and coming to position themselves on opposite sides relatively to the perforated bracket 38, so to keep the pusher element 12 centered.

The hook-like bent portions 36, in correspon-

dence of their side placed in the nearby of further beams 43 integral with the longitudinal support beam 20, extend into a further portion 44 which has a dimension larger than the width of the further beams 43, so to interact with an adjustment element 45, e.g., a screw element, positioned integral with the same beams 43, and acting as an adjustable stop element.

The presence of the adjustment elements 28 and 45 both in correspondence of the step elements 21, and of the pusher elements 12, allows the sliding interaction between them to be reduced, and discharges their weight directly onto the beams 22 and 43.

Both the pusher elements 12 and the step elements 21 are provided with perimetral undercuts or surmount elements 46 of complementary shape, capable of securing a tight sealing between the various elements, thus preventing undesired flows of air and dust materials.

In the nearby of the step elements 21 positioned at the beginning and at the end of each individual sector 11, a shaped metal sheet 47 is provided for acting as a closure element; it, together with further closure elements 48, e.g., elastic metal sheet, or waterproof cloth, positioned between the beams 22 and the upper end portion of the step element 21 facing the same beams, secure the separation of the air streams fed to the individual sectors.

As shown in Figure 2, the pusher elements 12 and the step elements 21, e.g., in a number of six, define a sector of treatment of the solid materials to be incinerated, wherein the pusher elements 12, supported by the beams 43 and by the beam 20, essentially perform the function of moving the material, whilst the step elements 21, integral with the beams 22, act as supports for the material. In this way, a clear functional distinction is evidenced between the step elements 21, which have a large surface area in contact with the material to be treated, and the pusher elements 12 which, besides having a minimum surface area in contact with the material, in their rest position expose to said material only their small push surface area, and are hidden under the stationary elements 21.

The geometry of the step element/pusher element assembly, which in Figure 2 results inclined by 45° relatively to the support beam 20, can be also varied according to other indications for the push angle defined between the same beam 20 and the direction of the pusher element.

The particular canalization of the combustion air, which licks up the whole surface of the step element 21, also thanks to the presence of the fins 31, suitably cools the same step element, and at the same time heats the combustion air improving the incinerating treatment.

The channel 29 and the projection 35 make it also possible to control the flowrate of the combustion air.

It must be observed in fact how the projection 35 constitutes a rear closure element for the channel 29 when the pusher element 12 is in its rest position. It is thus evident how, by adjusting the position of the projection 35 relatively to the outlet opening 33, the amount of combustion air being fed can be varied as desired.

A grate is thus obtained, which make it possible to change as desired the pressure drop occurring in the air stream, so that the distribution of air on the grate can be controlled mainly as a function of the geometry of the grate, rather than of the distribution of the solid material on the grate. Thus, the very important result is achieved of having very high pressure drops also in the presence of small air flowrates under the grate, thus the air waste being avoided, which is caused by the forming of preferential chimneys, above all when the combustion requires low thicknesses of materials to be incinerated on the grate.

Another function of paramount importance of the projection 35 is that of keeping clean the outlet opening 33 of the channel 29, as well as the hollow 34, securing the flow of air, and at the same time generating a compact and powerful air jet.

Furthermore, the projection 35, as said, is of such a length as to prevent material from being entrained into the inside of the channel 29 during the movement of return of the pusher element 12.

Of not lesser importance is the function of the projection 35 as an element for stopping the flow of air coming through the channel 29 during the operative movement of the pusher element 12 for moving the solid material to be incinerated.

In fact, such a material generally occurs as a dust, and the air flow during the movement tends to cause the raising of a considerable dust amount.

The position of the jet of combustion air defined by each individual step element 21 and by the related pusher element 12 in its rest position is furthermore detached and raised relatively to the following step element 21.

This positioning offers the advantage of not causing flames to be generated in the nearby of the metal parts constituting the grate, which result hence protected exactly by the same solid material which is being treated.

Referring on the contrary to Figures 5 and 6, one can observe how this further practical embodiment, applying the same innovative concept of the invention used in the grate of the first example, limits the outer surface of the stationary step element 21 in contact with, and supporting, the solid material being treated.

On the contrary, the pusher element 12 posi-

tioned nearly in correspondence with the end surfaces of the two step elements between which it is comprised, shows a small surface area of sliding contact and friction on the same step element, so that both the elements 12 and 21 undergo a lower wear.

During the combustion of materials containing low-melting metals, molten masses occur often, which adhere to the stationary elements 21 supporting surfaces. These molten masses, which result in the formation of nodules strongly adherent to the plates, disturb, or even sometimes prevent the regular movement of the movable elements 12. For that purpose, a projection 55 (Figure 5) is provided, which protrudes outwards, frontally, and atop, from the stationary element 21, so that, thanks to such a shaping of the stationary element 21, the moving pusher element 12 moves forwards in a cantilevering position in the material, so to prevent such a drawback.

One can furthermore observe how the pusher element 12 can act on a layer of solid material to be treated larger than that treated by the grate as shown in Figures from 2 to 4, by protruding from two consecutive step elements by a considerable length, in its extracted pushing position.

For the sake of simplicity, the component elements common to the two examples have been indicated with the same reference numerals.

One can observe how the surmount elements 46 of the practical embodiment of Figure 4 show, in the example shown in Figure 6, hollows 49 and complementary projecting portions 50 which engage with each other in adjacent and coupled step elements 21 and pusher elements 12, thus securing an optimum tightness for air and possible material penetrations. For the purpose of improving the tightness, inside the hollows 49 a gasket (not shown) can be applied.

One should furthermore observe how the front wall 40 has an extremely small surface area, and how the elimination of the inwards-bent flat portion 32 connects the channel 29 directly with the hollow 34, so to accomplish a more immediate air exiting.

The opening cross surface area of the hollow 34 can be limited by means of shimming elements 51 to be integrally positioned above the underlying pusher elements 12 in the free area in front of the projection 35, so to keep constant the outflow speed, also in grate sections with reduced air flowrates.

Also for the further practical embodiment of the grate of the present invention, the stationary elements 21 can be preferably provided with appendices 27, as shown in Figure 3, whilst for the moving pusher elements 12, the limitation of the angular movement on the vertical plane, whose

adjustment takes place during the assemblage step, is achieved by means of two rear appendices 36 which come to stop against a side of beam 43.

Claims

1. Grate with pushers for the combustion of solid materials, in particular solid urban wastes, of the step type, comprised stationary elements of box-like shape, for supporting the material, and moving elements performing the function of moving forwards the material to be treated, wherein the surface area in contact with said material of said stationary elements is considerably larger than that of said moving elements, inside said stationary elements a combustion air feed channel being provided for feeding the combustion air towards a hollow provided at the bottom on a front outwards-facing portion thereof, inside said hollow a complementary projection being slidably guided, which is provided in an upper portion of said moving elements in such a way as to leave free, in its rest position, an opening acting as an outlet for said channel.

2. Grate with pushers according to claim 1, characterized in that said air feed channel is defined by a wall positioned inside said stationary element, which runs parallelly to the outer profile of the same stationary element, inside said channel a set of heat dispersion fins being provided.

3. Grate with pushers according to claim 1, characterized in that said movable elements are pusher elements operatively linked with a set of beams integrally positioned on a longitudinal support beam, actuated by a moving means causing the whole of said pusher elements to move.

4. Grate with pushers according to claim 1, characterized in that both said stationary elements and said moving elements are connected to respective support beams, respectively stationary and moving relatively to a frame of the incinerating furnace, by means of portions bent to a hook-like shape, which engage themselves on end bars positionable, with possibility of removal, on said stationary and moving support beams.

5. Grate with pushers according to claim 4, characterized in that adjustment means are provided, for adjusting the mutual position of said stationary and moving beams, and said stationary and moving elements interacting between said beams, and appendices extending from said bent to a hook-like shape portions.

6. Grate with pushers according to claim 2, characterized in that from a front wall of said stationary elements, an inwards-bent portion extends parallelly to said moving element, which defines,

together with said wall of said channel, an outlet opening for air, in correspondence of an end portion of said projection of the moving element.

7. Grate with pushers according to claim 1, characterized in that both said stationary elements and said moving elements show, along their perimeter, undercuts complementary with each other, which define tightly-sealing surmount elements.

8. Grate with pushers according to claim 7, characterized in that said undercuts are respectively provided with hollows and complementary projecting portions, which couple with each other, possibly provided with a gasket for the purpose of improving the tight sealing action.

9. Grate with pushers according to claim 1, characterized in that at the beginning and at the end of a furnace sector, defined by a set of stationary and moving elements, interposed and alternating between each other, a shaped closure element is constrained, which extends from a lower air-feed hopper up to a position in correspondence of said stationary elements, so that no air streams can flow from a sector of the grate to another sector thereof.

10. Grate with pushers according to claim 1, characterized in that said complementary projection is centrally provided on an upper portion of said moving element, so to be lined up with said outlet opening of said combustion air feed channel.

11. Grate with pushers according to claim 10, characterized in that in front of said projection, shimming elements are positioned.

12. Grate with pushers according to claim 1, characterized in that said moving elements move in a cantilevered position without sliding on said stationary elements.

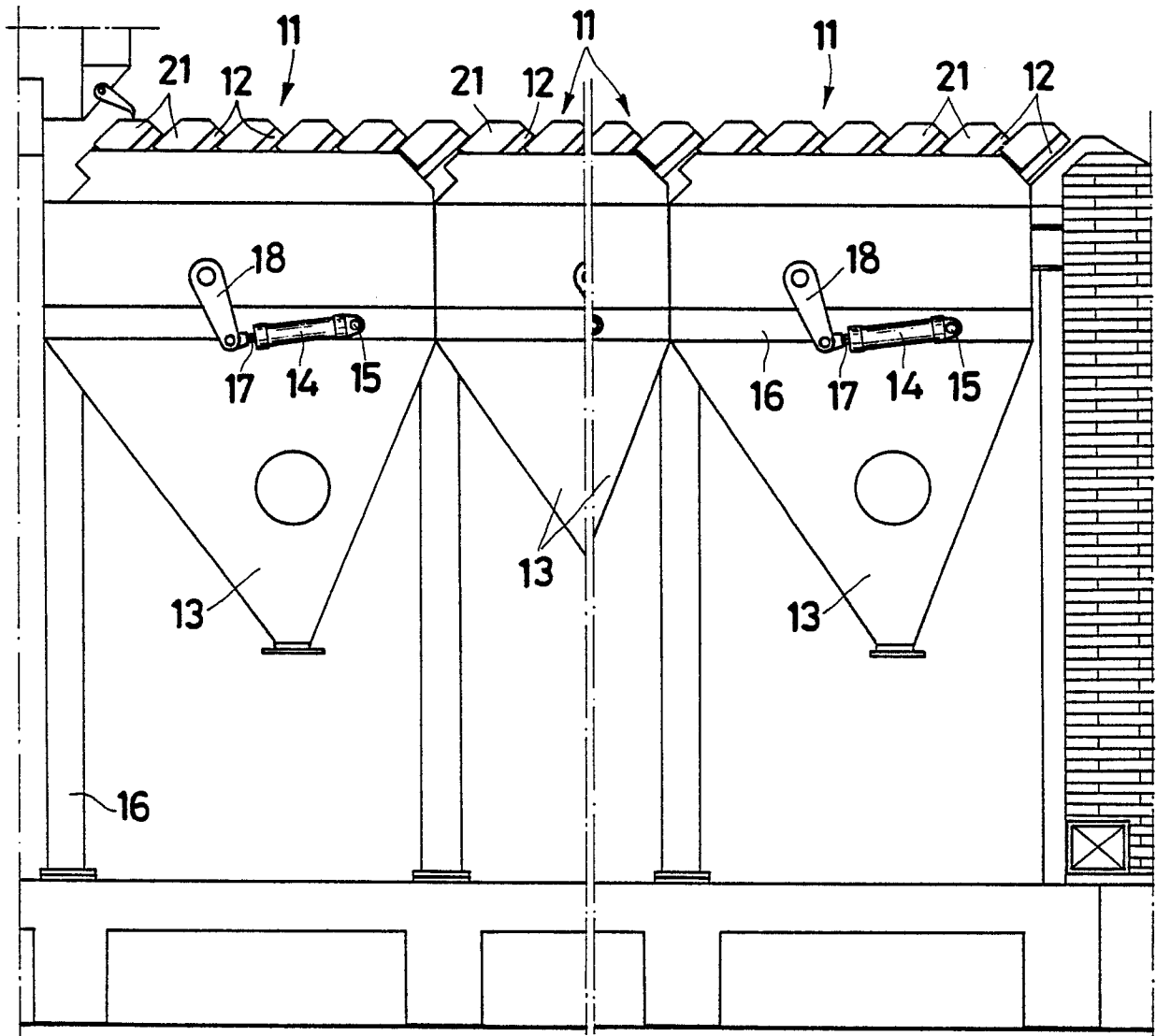
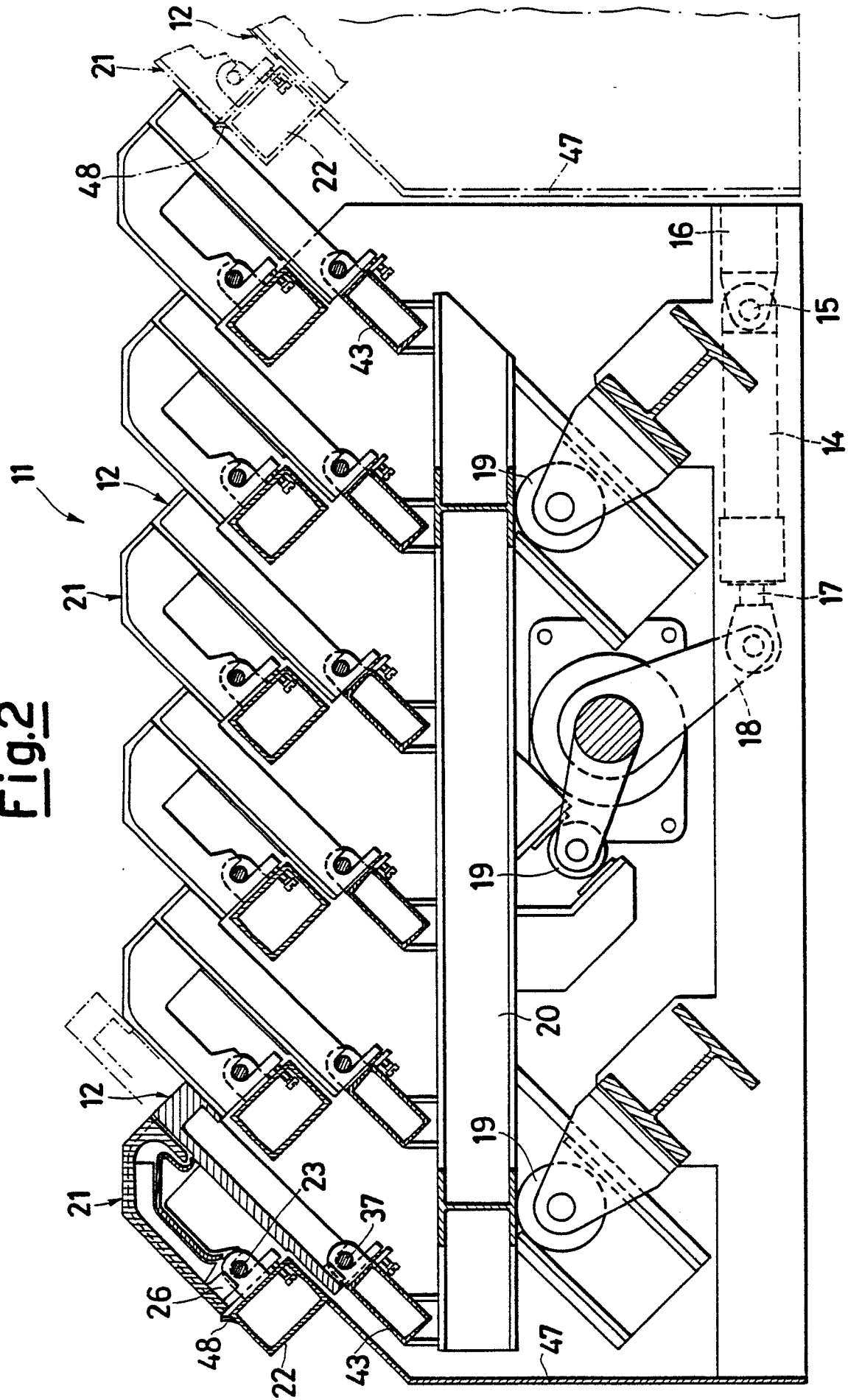
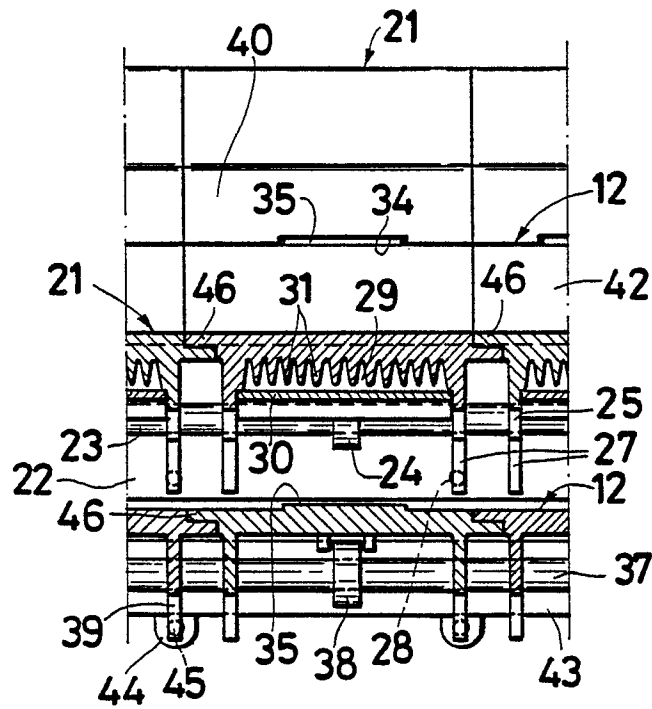
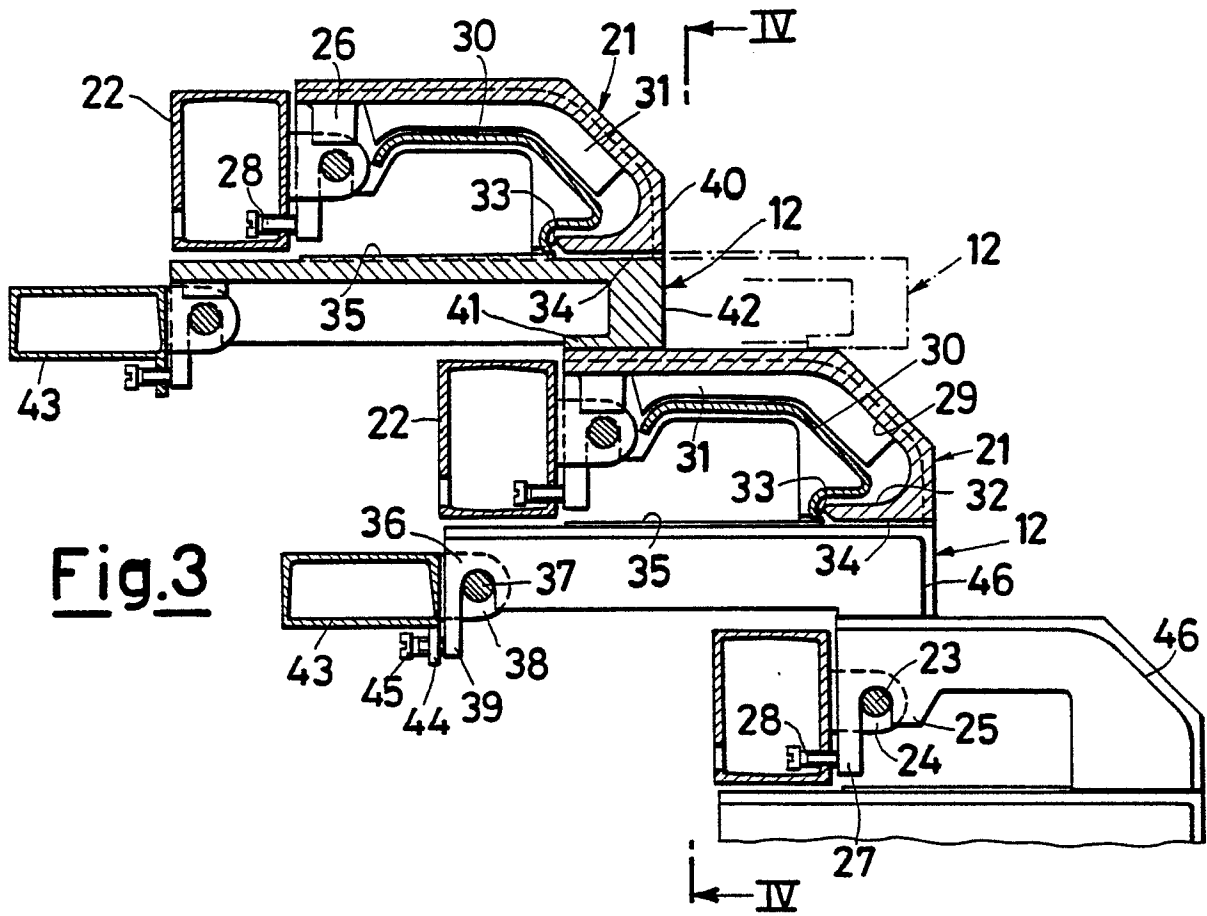
Fig.1

Fig.2





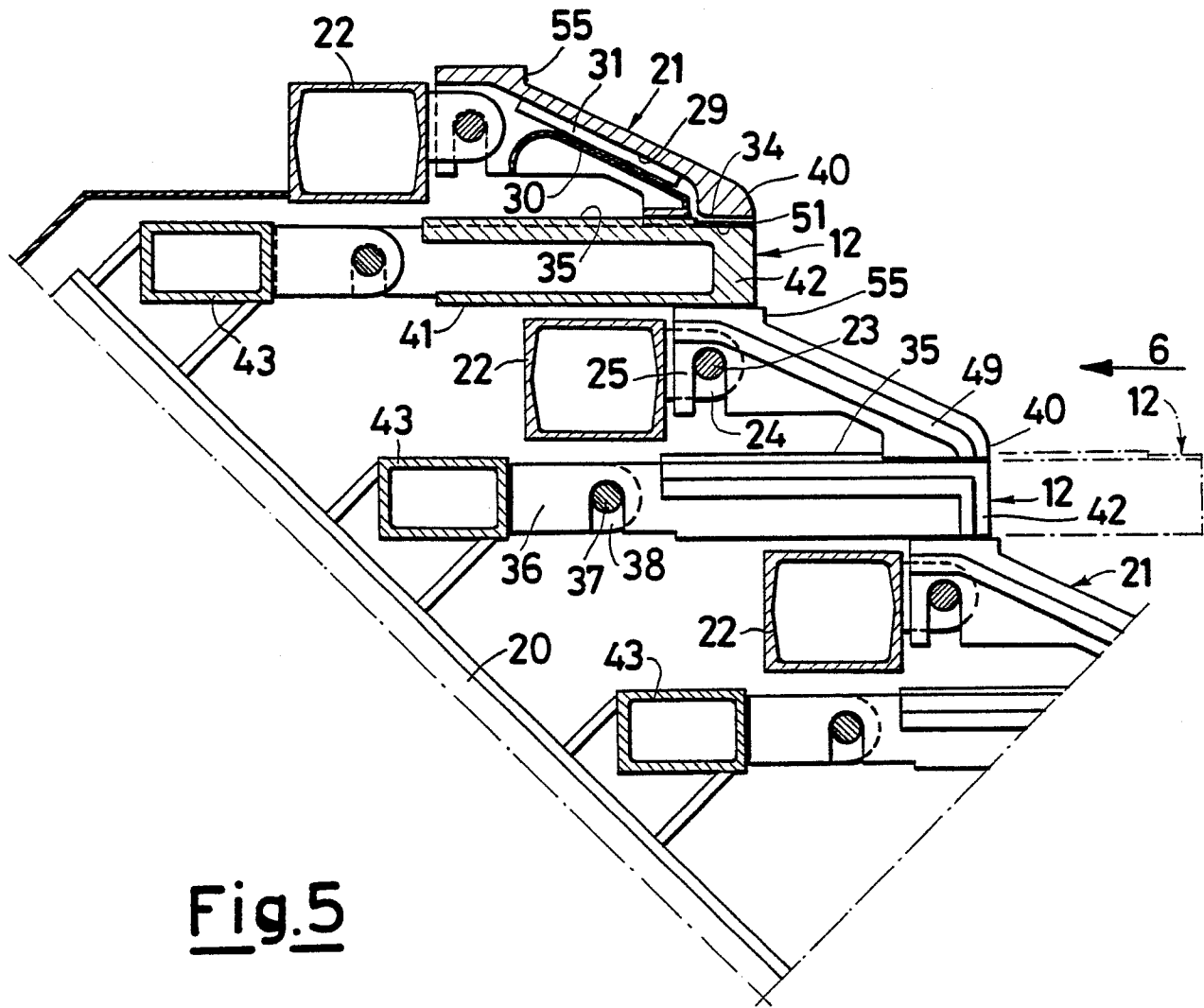
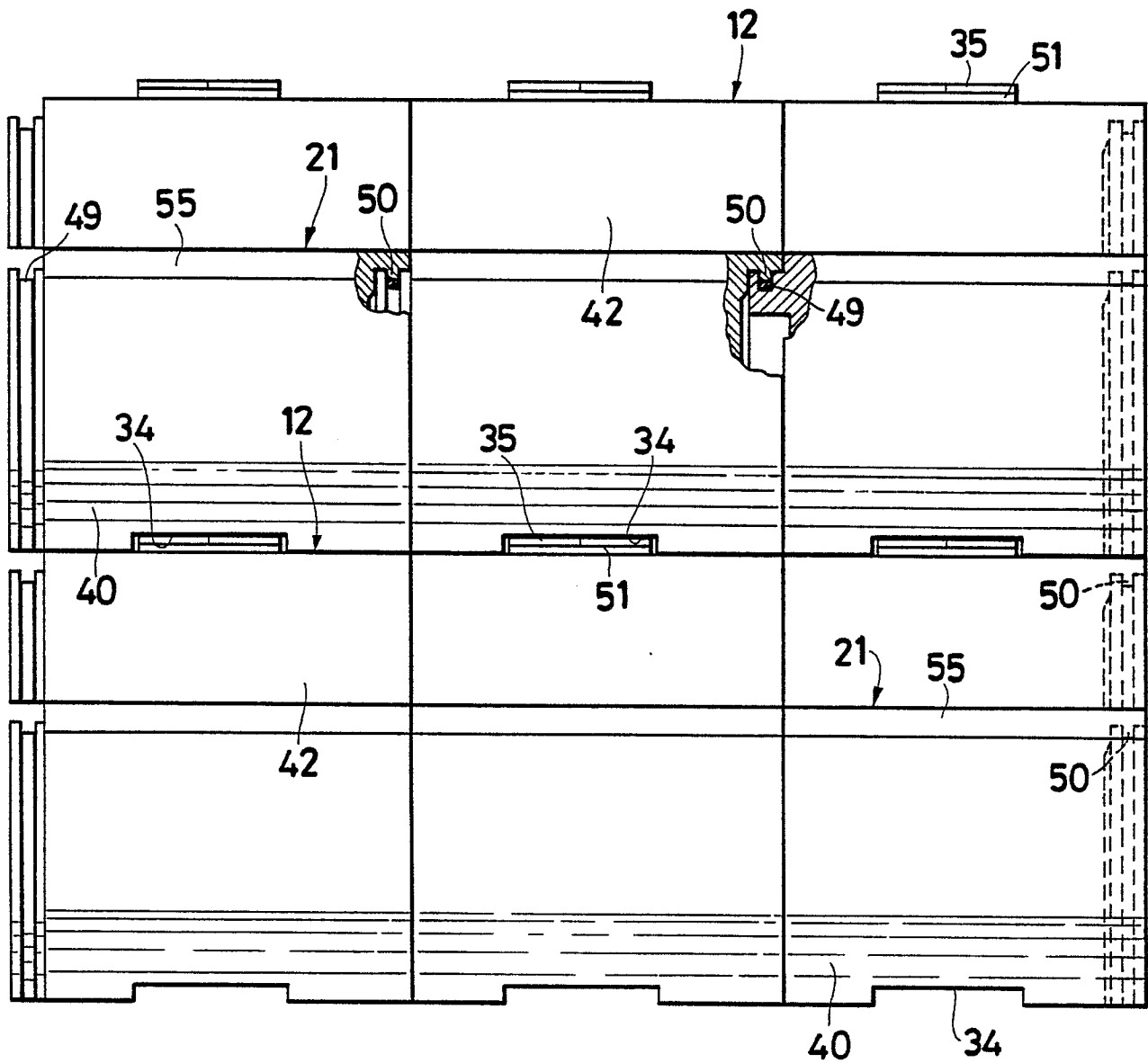


Fig. 5

Fig.6



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EUROPEAN SEARCH REPORT

Application Number

EP 88 20 0488

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- 164 914 (MARTIN) * Page 2, lines 59-89; page 3, lines 9-24; figures 1-3 * -----	1	F 23 H 15/00 F 23 H 1/02
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 23 H F 23 G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21-07-1988	Examiner PESCHEL G.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	