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

(11) EP 1 719 491 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.11.2006 Bulletin 2006/45

(51) Int Cl.:
A61J 3/07 *(2006.01)*

(21) Application number: **05021324.8**

(22) Date of filing: **29.09.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **06.05.2005 IT fi20050094**

(71) Applicant: **MULTIGEL S.R.L.**
50141 Firenze (IT)

(72) Inventor: **Senesi, Mario**
50019 Sesto Fiorentino (FI) (IT)

(74) Representative: **Strasser, Wolfgang**
Innere-Wiener Strasse 8
81667 München (DE)

(54) Improved capsule filling machine

(57) Capsule filling machine comprising a bearing structure(1), a unit (2) for filling and orienting the capsules to be treated, a unit (3) for opening the capsules and closing them when they have been filled, said unit (3) being associated with the bearing structure (1) and positioned below the unit (2) for filling and orienting the capsules, characterised in that said unit (2) for filling and orienting the capsules is anchored to the structure (1) by means of a constraint with several degrees of freedom.

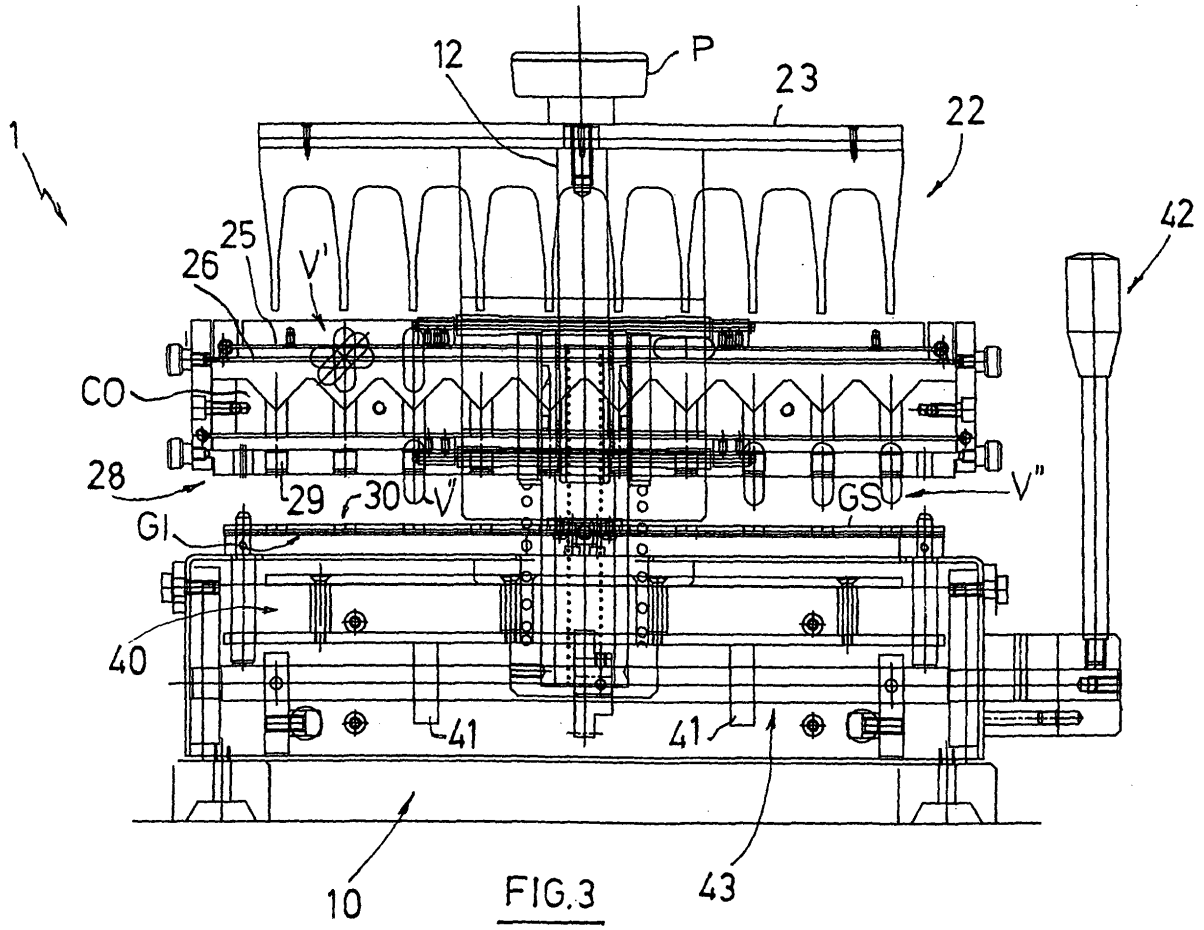


FIG.3

EP 1 719 491 A1

Description

[0001] The present invention concerns an improved capsule filling machine.

[0002] It is known that manual capsule filling machines are used in chemist's shops and in small pharmaceutical laboratories for the preparation, that is the filling, of relatively small quantities of medicinal capsules.

[0003] Generally, a manual capsule filling machine presents a structure with a series of overlapping horizontal grills. Together these form an orienting system, suited to allow vertical positioning of the capsules, so that the head of each capsule is facing upward, while the body is below the head. Associated with this structure is a second system of perforated plates, with a central guillotine, for the temporary blocking of the bodies of the vertically placed capsules in a corresponding plurality of housings below, for separating the heads from the bodies in order to allow them to be filled with the chosen substance and for the subsequent closing of the filled capsules.

[0004] An inconvenient aspect linked with the use of conventional manual capsule filling machines lies in the necessity to detach the capsule orienting grills from the base structure when the bodies have to be filled and to reposition said grills once filling has been completed. This manoeuvre is rather laborious, as well as rather difficult if the operator does not possess sufficient experience, and it requires a certain degree of attention from the operator, especially in the phases of detaching and repositioning the orienting grills.

[0005] The main aim of the present invention is to propose an improved capsule filling machine, which allows the elimination of the above-mentioned inconveniences and the obtaining of better operative results.

[0006] This result is achieved, according to the present invention, by adopting the idea of realising a capsule filling machine having the characteristics indicated in claim 1. Other characteristics of the invention are the object of the dependent claims.

[0007] Thanks to the present invention, all the phases involved in the preparation of the capsules, that is their filling with the chosen substance, are highly simplified, as the dismantling of the grill for orienting the capsules is avoided. Besides this there is the fact that the closing of the filled capsules is improved and it is possible to ensure a more precise vertical positioning of the capsules to be filled. Moreover, a capsule filling machine according to the invention is relatively simple to make, inexpensive and reliable even after a prolonged period of use.

[0008] These and other advantages and characteristics of the present invention will be clearer to any technician in the field, thanks to the following description and to the enclosed drawings, supplied as an example without limitation, in which:

- Fig.1 represents a schematic perspective view of a capsule filling machine according to the invention;
- Fig.2 represents a schematic front view of the machine in Fig.1, with parts not in scale and with parts omitted so as to show others better, in which are represented an empty capsule in the phase of vertical positioning (V'), a vertically placed capsule (V"), as well as a head (VT) and a body (VC) of a capsule;
- Fig.3 represents a schematic front view of the machine in Fig. 1, in which is illustrated as an example the movement of the capsules during their vertical positioning;
- Fig.4 represents a schematic side view in vertical section of the machine in Fig. 1 in which the cams (41) are shown in several different positions and some parts of the machine have been omitted for the sake of simplicity;
- Fig.5 represents a schematic layout view of the plate (25);
- Fig.6 represents a schematic layout view of the plate (26);
- Fig.7 represents a schematic front view of the machine in Fig.1 with the pushing needles lowered;
- Fig.8 represents a schematic front view of the pushing needles;
- Figs.9A and 9B represent a schematic side view and a schematic front view of a capsule filling machine according to the present invention in a first operative state;
- Figs. 10A and 10 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.9A and 9B in a further operative state;
- Figs. 11A and 11 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.10A and 10B in a further operative state;
- Figs. 12A and 12 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.11A and 11B in a further operative state;
- Figs. 13A and 13 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs. 12A and 12B in a further operative state;
- Figs. 14A and 14 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.13A and 13B in a further operative state;
- Figs. 15A and 15 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.14A and 14B in a further operative state;
- Figs. 16A and 16 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.15A and 15B in a further operative state;
- Figs. 17A and 17 B represent a schematic side view and a schematic front view of the capsule filling machine of Figs.16A and 16B in a further operative state.

[0009] Reduced to its essential structure and with reference to the figures in the enclosed drawings, a capsule filling machine according to the present invention comprises:

- a bearing structure (1);
- a unit (2) for filling and orienting the capsules to be treated, said unit (2) being associated with the aforesaid structure (1);
- a unit (3) for opening the capsules and closing them when they have been filled, also said unit (3) being associated with the bearing structure (1) and positioned below the unit (2) for filling and orienting the capsules.

[0010] Advantageously, in conformity with the present invention, the unit (2) for filling and orienting the capsules is anchored to the structure (1), with the possibility of rotation around a vertical axis of the structure (1) and of movement along the same vertical axis.

[0011] In this way, the unit (2) may assume a position of vertical overlapping with the other unit (3) of the machine, close to it or at a distance, and respectively an offset position, to free the area above the unit (3) for opening and closing the capsules without being detached from the structure (1) or dismantled.

[0012] In other words, the unit (2) for filling and orienting the capsules is anchored to the structure (1) by means of a constraint with several degrees of freedom (in the example, rotation around a vertical axis and two-directional movement along that axis).

[0013] More particularly, with reference to the example shown in the enclosed drawings, said structure (1) comprises a base (10) on which the unit (3) is fitted; from said base emerges a column (12) on which the unit (2) is fixed.

[0014] The column (12) presents a bottom portion housed in a tubular sleeve with a vertical axis (13) emerging from said base (10) and the bottom part of which is inserted in a corresponding seat (14) created in the same base (10). Said bottom portion of the column (12) is hollow and on it rests the upper base of a spring (15) the bottom base of which rests on the bottom base of the aforesaid seat (14). Moreover, on said sleeve (13) is fitted, coaxially and externally, a bush (16). A second vertical spring with a vertical action (17), coaxial and external to the first (15), is inserted between the bottom base of the bush (16) and a ring-shaped groove (18) presented by said seat (14). Said groove (18) is developed coaxially and externally to the space destined to hold the bottom part of the sleeve (13). In this way, the column (12), and with it the unit (2) for filling and orienting the capsules, is free to rotate around its own longitudinal axis (coinciding with the longitudinal axis of the seat 14 and of the bush 16) and to move along said axis from and to the base (10) of the structure (1).

[0015] The unit (2) for filling and orienting the capsules comprises a bracket (20) fixed in a projecting position, with the aid of screwing means (21), on said bush (16). In other words, the bracket (20) is integral with the bush (16). The unit (2) also comprises a set of vertical pushers or "needles" (22), each of which presents a free bottom end and a top end fixed to a corresponding support plate (23) which is fixed in a projecting position on the top base of the column (12). Moreover, on the same plate (23) are fixed two identical side cams (24), each of which presents a top end fixed to the plate (23) and a free bottom end. Each of said cams (24) is positioned between the set of needles (22) and the column (12) and presents, on the front facing the needles (22), two ramps descending obliquely towards the respective bottom end. The function of said cams (24) is described below.

[0016] On the top base of the bracket (20) are positioned two overlapping horizontal grills (25, 26), each of which is provided, as in the manual capsule filling machines of a known type, with a plurality of slots (250, 260). The slots (250) in the top grill (25) are substantially rectangular, with the long side parallel to the front (200) of the bracket (20). The slots (260) in the bottom grill (26) are substantially similar to those (250) in the top grill but they present a higher central part (261), the profile of which corresponds to the layout profile of the capsules to be treated. The bottom grill (26) is fixed whereas the top grill (25) is mobile, that is it is fitted with a possibility of moving on its own plane. Advantageously, the top grill (25) is provided with rollers (27) thanks to which, as further described below, the cams (24) drive the movement of the same grill.

[0017] On the bottom base of said bracket (20) is fitted, in such a way as to be facing the base (10) of the structure (1), a horizontal head-holding plate (28) which, as in the manual capsule filling machines of a known type, presents a plurality of through holes (29) which act as a pass-no-pass gauge. In practice, the vertically positioned capsules which enter the holes (29), coming from above after vertical positioning carried out in the top part of the bracket (20) by the needles (22) cooperating with the plates (25) and (26), are suspended from the plate (28), with the head at the top and the body at the bottom, since the diameter of the holes (29) is such as to let the bodies of the capsules pass freely but to hold back the heads, the edge of which has a diameter larger than the output section of the holes (29) .

[0018] Between the top base and the bottom base of the bracket (2), that is in an intermediate position between the pair composed of the grills (25) and (26) and the head-holding plate (28), there is a conveyer (CO). In practice, this is composed of a block in which are made several vertical channels (VCO), equal in number to the holes (29) in the head-holding plate (28) .

[0019] The head-holding plate (28) is provided, at its bottom base, with a horizontal dish (280) sliding along the plane of the same base. Said dish (280) is provided with several holes, equal in number to the holes in the head-holding plate (28), and it is provided with rollers (281) interlocked with the cams (24), similar to those provided for the aforesaid plate (25). As further and better

described below, the holes in the dish (280) are aligned with the channels of the conveyer (CO) when the cams (24) command the advance movement of the dish (280) by acting on the corresponding rollers (281).

[0020] Said bush (16) may be locked to the sleeve (13). For this purpose, a hook (160) is provided, hinged onto the same bush (16) by means of a transverse pin (161) and interlocked with a corresponding thrust spring (162). Said hook is intended to engage a corresponding notch (130) in the sleeve (13). The use of said hook is described below. Moreover, the bush (16) is provided with a rear appendix (163).

[0021] On the base (10) of the structure (1) is fitted a unit (3) which comprises a body-holder (30). This is composed of a pair of overlapping horizontal grills, each of which is provided with several through holes, equal in number to the holes (29) in the head-holding plate (28). The top grill (GS) of said pair is mobile, that is apt to move along its own plane, whereas the bottom grill (GI) is fixed. In particular, the movement of said top grill is commanded by a screw control (CV).

[0022] In a position below the body-holding plate (30), inside said base(10), is located a double horizontal plate (40) interlocked with corresponding lifting/lowering means. In the example shown in the figure, said lifting/lowering means of the plate (40) comprise two cams (41) which may be activated by a corresponding control lever (42). Each of said cams (41) is fitted on a respective horizontal shaft (43), lying parallel to the front (100) of the base (10). Said shafts (43) are connected to each other by means of two toothed wheels (44) engaging each other externally, each of which toothed wheels (44) being keyed coaxially onto a respective shaft (43). To one of said shafts (43) is connected the bottom end of the lever (42). Therefore, by commanding the rotation of the shaft (43) connected to the lever (42), the opposite rotation of the other shaft (43) is obtained through the effect of the transmission realised by the toothed wheels (44). In this way, the discordant and simultaneous rotation of the two cams (41) is obtained, which cams, acting with their respective profiles on the plate (40) cause it to be lifted or lowered depending on whether the lever (42) is lifted or lowered.

[0023] The operation of the device described above is as follows.

[0024] The empty and closed capsules (CC) are placed on the top grill (25) of the unit (2), similarly to the procedure used in manual capsule filling machines the known type. Then, exerting a manual downward thrust on the appendix (163) of the bush (16), the entire unit (2) is lowered, placing the bottom base of the head holder (28) close to the unit (3 below). At the end of this lowering stroke of the unit (2), the hook (160), pushed by the spring (162), engages with the sleeve (13). Therefore, in this phase, the unit (2) is lowered and integral with the sleeve (13). At this point, by pushing the knob (P) located on the top end of the column (12), the descent of the cams (24) and of the needles (22) is obtained. With the descent of the cams (24), the plates (26) and (280) move forward, because the respective rollers (27, 281) are pushed forward (that is in the direction of the front 200 of the unit 2) by the two inclined ramps of the cams (24). In relation to this, the slots in the grills (25) and (26) are correspondingly aligned with each other, just as the holes in the plates (28) and (280) are aligned with the channels of the conveyer (CO). To this corresponds the vertical positioning of the capsules previously placed on the slots in the grill (25), so, thanks also to the action of the needles (22), all said capsules are arranged vertically, with the heads held by the head-holder (because, as said previously, the output section of the holes presented by the plate 28 has a slightly smaller diameter than the diameter of the heads of the capsules being processed) and with the body protruding outside the head-holder (28) and introduced in the holes in the grills (GS, GI) of the body-holding unit (30), arranged with the respective holes aligned with each other. Next, by operating the control knob (CV), the central grill of the body-holding unit (3) is moved forward, so that the bodies of the capsules result blocked on the same unit. The unit (2) is then released from the sleeve (13) and the lifting of the whole unit (2) is obtained by means of the upward thrust exerted by the springs (15) and (17). In relation to this, the heads of the capsules are removed from the respective bodies (held by the body-holding unit 30). Then the unit (2) is moved away, making it rotate around the axis of the column (12), and thus the space above the unit (3) is freed, without disassembling the capsule filling machine (as is necessary in traditional manual capsule filling machines). At this point the bodies of the capsules are filled (with conventional methods), after which the unit (2) is brought back to its starting position, and is lowered and reattached to the sleeve (13). Then, shifting the control (CV) in the opposite direction to previously, the capsule bodies are released and, shifting the lever (42) and then the cams (41), the unit (3) is raised. In this way the bodies of the capsules are pushed towards the waiting heads above them and the capsules filled with the chosen substance are closed. Releasing the unit (2) again, it is lifted and the closed and filled capsules are correspondingly taken away from the unit (2). The closed and filled capsules are then manually detached from the unit (2) just as occurs in manual capsule filling machines of a known type.

[0025] The above disclosed operation is also shown in Figs. 9A-17B. In particular, Figs.9A and 9B show the closed capsules (CC) placed on the top grill (25), the latter being shown detached from the unit (2).

[0026] Figs.10A and 10B show the unit (2) being lowered to the position where the inclined ramps of the cams (24) have caused the forward pushing of the rollers (27,28)and the needles (22) interact with the capsules (CC). Figs. 11A and 11 B show the subsequent lifting of the needles (22). Figs. 12A and 12B show the subsequent lifting of the unit (2). Figs. 13A and 13B show the unit (2) being rotated about the axis of the column (12).

Figs.14A and 14B show the unit (2) being brought back to its starting position after having filled the capsule bodies with the chosen substance. Figs. 15A and 15B show the lever (42) and cams (41) being rotated to raise the plate (40) and cause the closing of the filled capsules. Figs. 16A and 16B show the cams (41) brought back to their starting positions. Figs.17A and 17B show the head-holder (28) detached from the structure (1).

[0027] The free end of needles (22) shown in Figs.9A-17B features two side arc-shaped recesses (220)intended to provide a more effective vertical positioning of the empty closed capsules (CC) placed on the slots of the grill (25): the concavity of said arc-shaped recesses (220) being turned downwardly.

[0028] In practical terms, the details described may vary in an equivalent manner without departing from the idea of the solution adopted and thus remaining within the limits of the protection afforded by the present patent for an industrial invention.

Claims

1. Capsule filling machine comprising a bearing structure(1), a unit (2) for filling and orienting the capsules to be treated, a unit (3) for opening the capsules and closing them when they have been filled, said unit (3) being associated with the bearing structure (1) and positioned below the unit (2) for filling and orienting the capsules, **characterised in that** said unit (2) for filling and orienting the capsules is anchored to the structure (1) by means of a constraint with several degrees of freedom.

2. Capsule filling machine according to claim 1 **characterised in that** the unit (2) for filling and orienting the capsules is anchored to the structure (1) by means of a constraint with the possibility of rotating around a vertical axis and of bidirectional movement along the same vertical axis.

3. Capsule filling machine according to claim 1 **characterised in that** the unit (2) assumes a position of vertical overlapping with the other unit (3) of the machine, close to it or at a distance, and respectively an offset position, to free the area above the unit (3) for opening and closing the capsules without being detached from the structure (1) or dismantled.

4. Capsule filling machine according to claim 1 **characterised in that** said structure (1) comprises a base (10) on which is fitted the unit (3) and from which emerges a column (12) on which is fixed the unit (2), the column (12) presents a bottom portion housed in a tubular sleeve with a vertical axis (13) emerging from said base (10) and the bottom part of which is inserted in a corresponding seat (14) created in the same base (10), said bottom portion of the column (12) is hollow and on it rests the upper base of a spring (15) the bottom base of which rests on the bottom base of the aforesaid seat (14), on said sleeve (13) is fitted, coaxially and externally, a bush (16), and a second spring with a vertical action (17), coaxial and external to the first (15), is inserted between the bottom base of the bush (16) and a ring-shaped groove (18) presented by said seat (14), said groove (18) is developed coaxially and externally to the space destined to hold the bottom part of the sleeve (13).

5. Capsule filling machine according to claim 1 **characterised in that** the unit (2) comprises a set of vertical pushers or needles (22), each of which presents a free bottom end and a top end fixed to a corresponding support plate (23) which is fixed in a projecting position on the top base of the column (12), on the same plate (23) are fixed two identical side cams (24), each of which presents a top end fixed to the plate (23) and a free bottom end, each of said cams (24) is positioned between the set of needles (22) and the column (12) and presents, on the front facing the needles (22), two ramps descending obliquely towards the respective bottom end, on the top base of the bracket (20) are positioned two overlapping horizontal grills (25, 26), each of which is provided with a plurality of slots (250, 260), the slots (250) in the top grill (25) are substantially rectangular, with the long side parallel to the front (200) of the bracket (2), the slots (260) in the bottom grill (26) are substantially similar to those (250) in the top grill but they present a higher central part (261), the profile of which corresponds to the layout profile of the capsules to be treated, the bottom grill (26) is fixed whereas the top grill (25) is mobile, that is it is fitted with a possibility of moving on its own plane, the top grill (25) is provided with rollers (27) by means of which the cams (24) command the movement of the same grill.

6. Capsule filling machine according to claim 1 **characterised in that** on the bottom base of said bracket (20) is fitted, in such a way as to be facing the base (10) of the structure (1), a horizontal head-holding plate (28) which presents a plurality of through holes (29) which act as a pass-no-pass gauge.

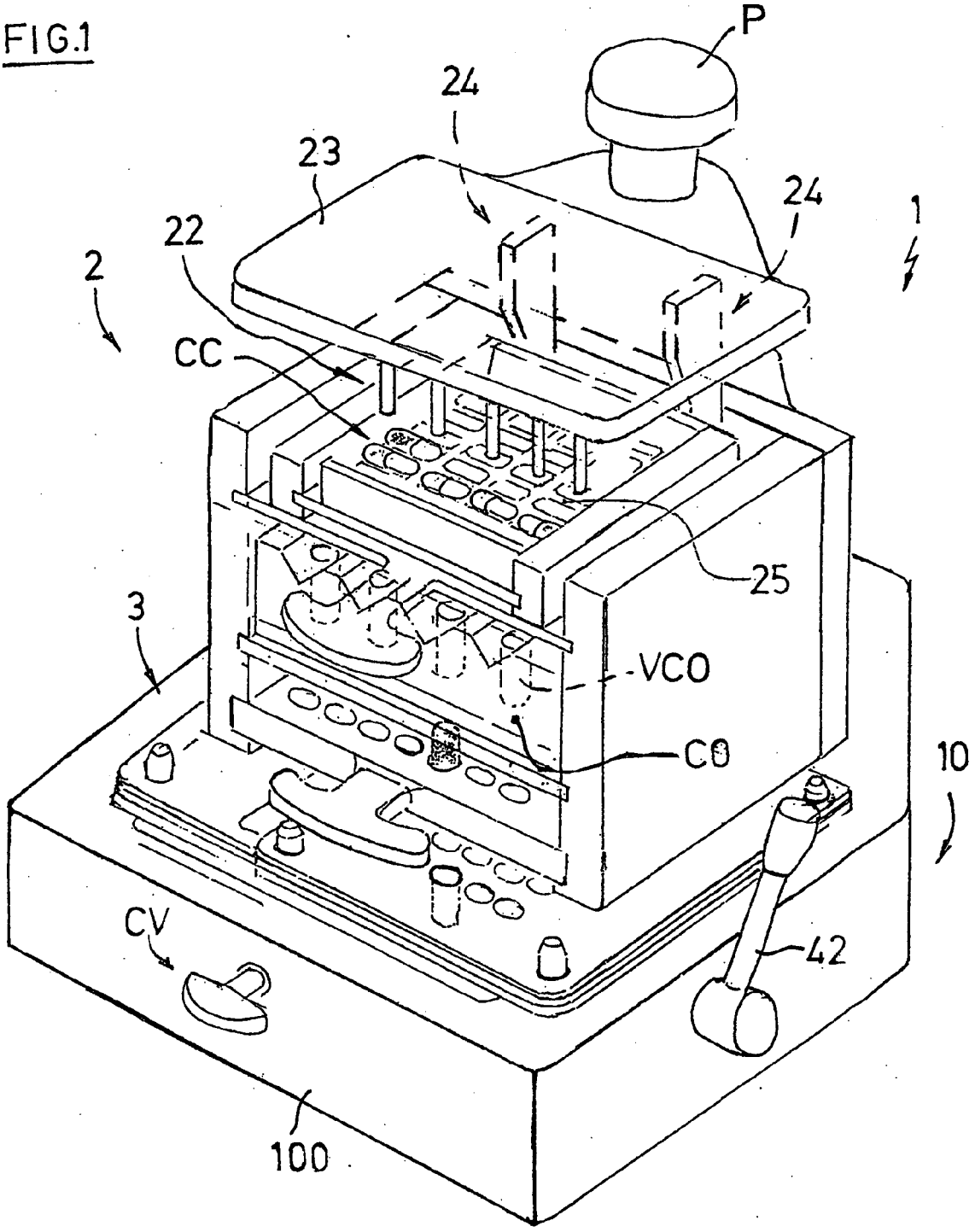
7. Capsule filling machine according to claim 1 **characterised in that** said unit (3) comprises a body-holder (30), this being composed of a pair of overlapping horizontal grills, each of which is provided with several through holes, the top grill (GS) of said pair is mobile, that is fitted with the possibility of moving along its own plane of development, the bottom grill- (GI) is fixed, the movement of said top grill being commanded by a screw control (CV).

8. Capsule filling machine according to claim 7 **characterised in that** in a position below the body-holding plate (30), inside said base(10), is located a horizontal plate (40) interlocked with corresponding means for lifting/lowering.

9. Capsule filling machine according to claim 8 **characterised in that** said lifting/lowering means of the plate (40) comprise two cams (41) which may be activated by a corresponding control lever(42), each of said cams (41) is fitted on a respective horizontal shaft (43), lying parallel to the front (100) of the base (10), said shafts (43) are connected to each other by means of two toothed wheels (44) engaging each other externally, each of which toothed wheels (44) being keyed coaxially onto a respective shaft (43), to one of the two shafts (43) is connected the bottom end of the lever (42) so that, by commanding the rotation of the shaft (43) connected to the lever (42), the opposite rotation of the other shaft (43) is obtained through the effect of the transmission realised by the toothed wheels (44), and the discordant and simultaneous rotation of the two cams (41) is obtained, which cams, acting with their respective profiles on the plate (40) cause it to be lifted or lowered depending on whether the lever (42) is lifted or lowered.

10. Capsule filling machine according to claim 5 **characterised in that** the free end of said pushers or needles (22) features two side arc-shaped recesses (220): the concavity of said arc-shaped recesses (220) being turned downwardly.

FIG.1



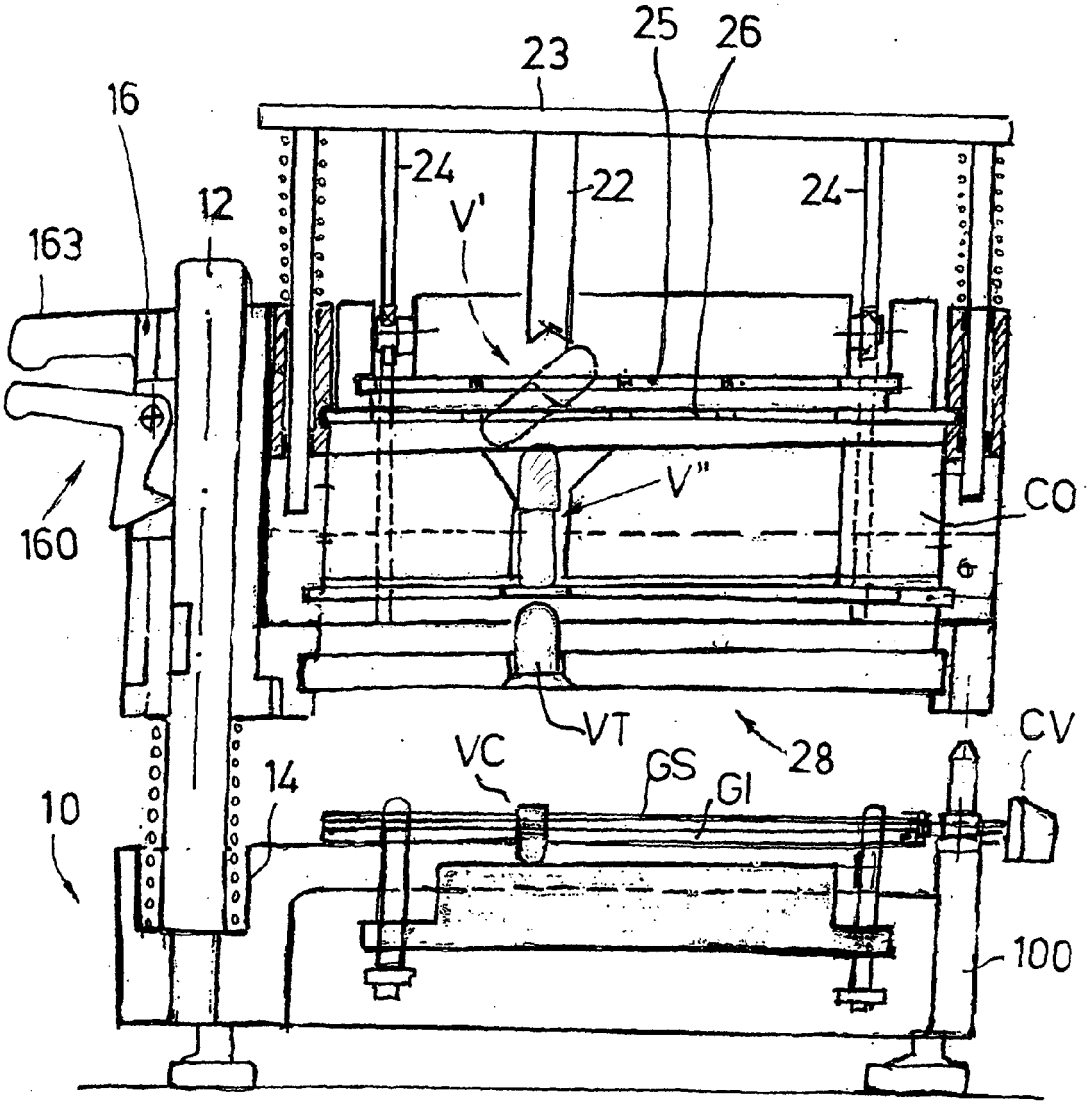


FIG.2

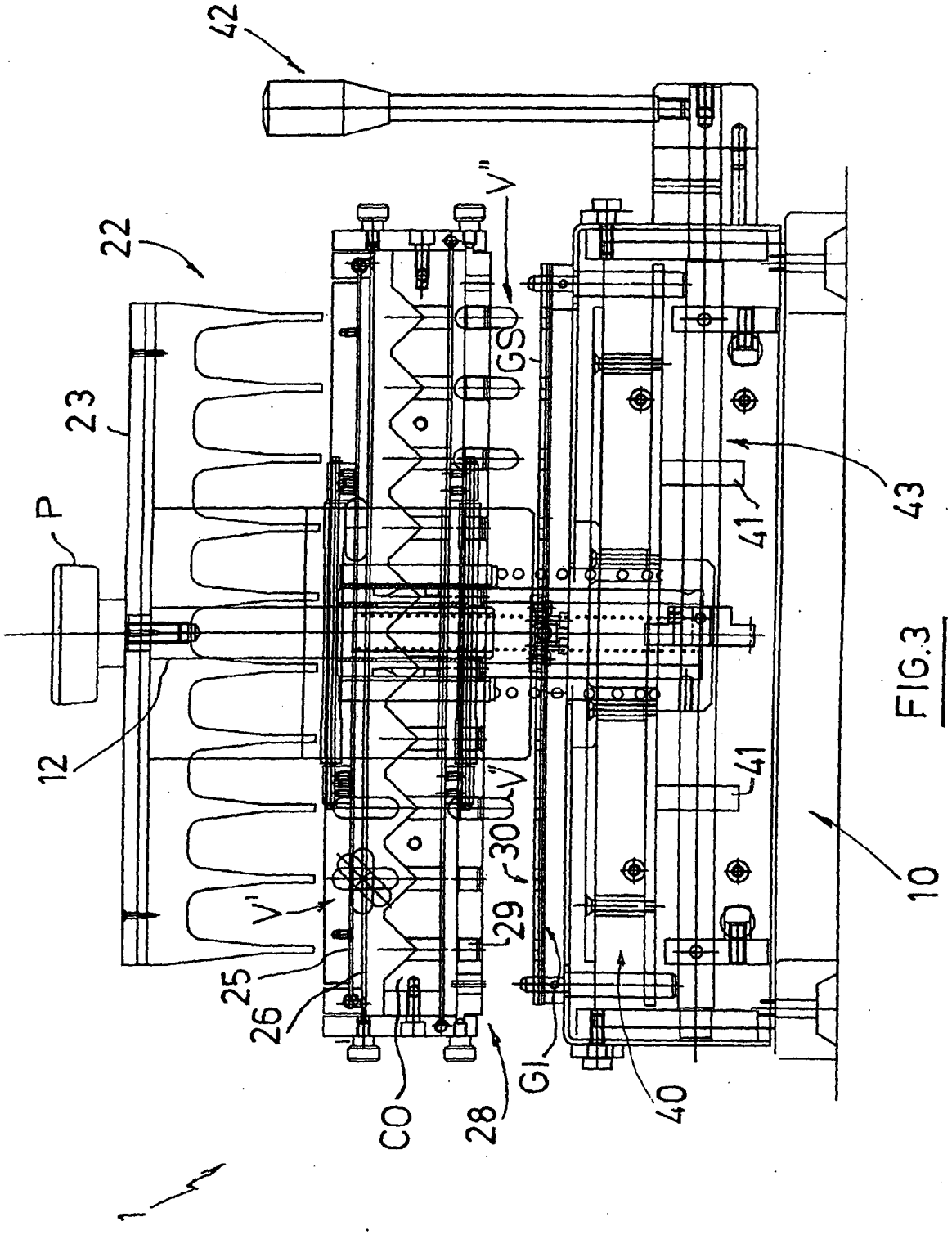
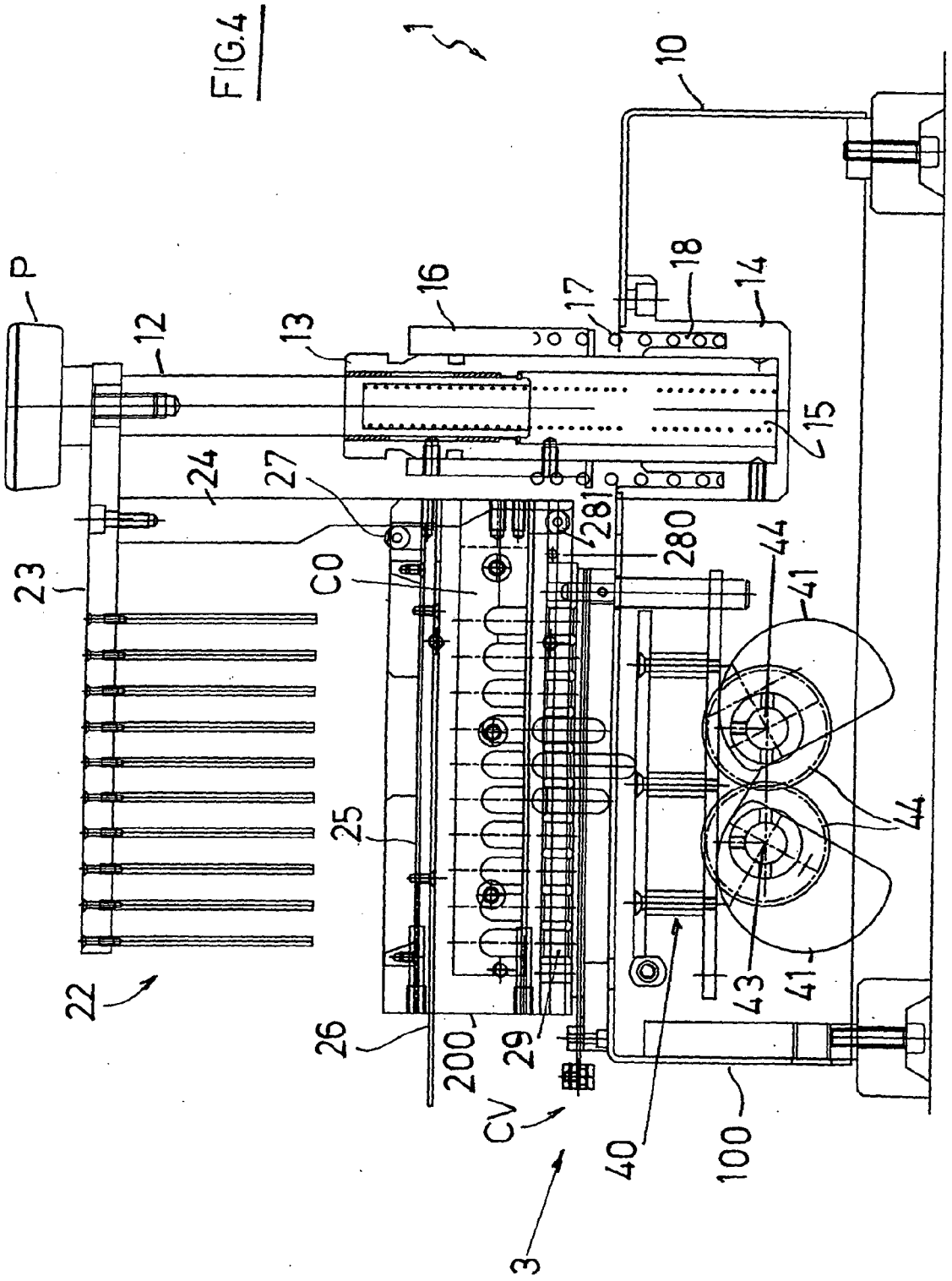


FIG.3

FIG.4


1
10
P
12
13
16
17
18
14
15
24
27
281
280
44
41
23
CO
25
22
26
200
29
CV
40
100
43
3

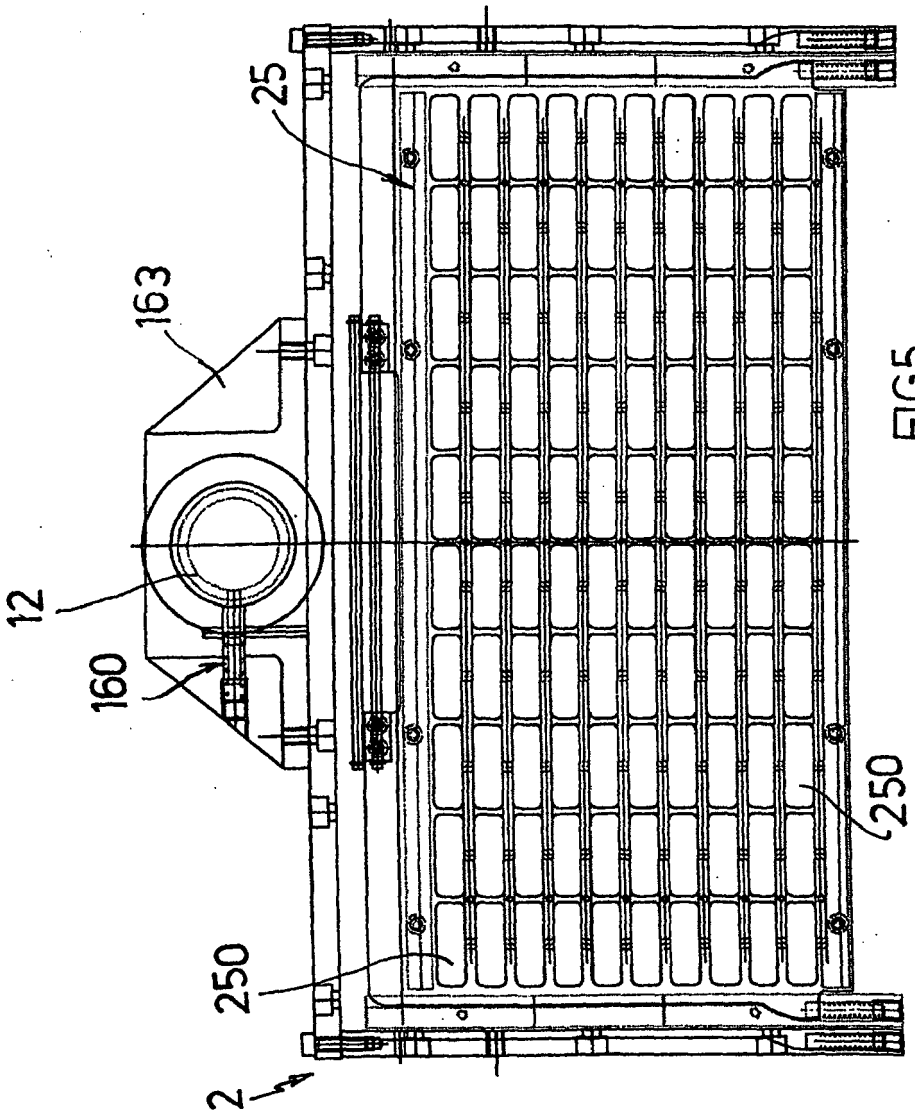


FIG.5

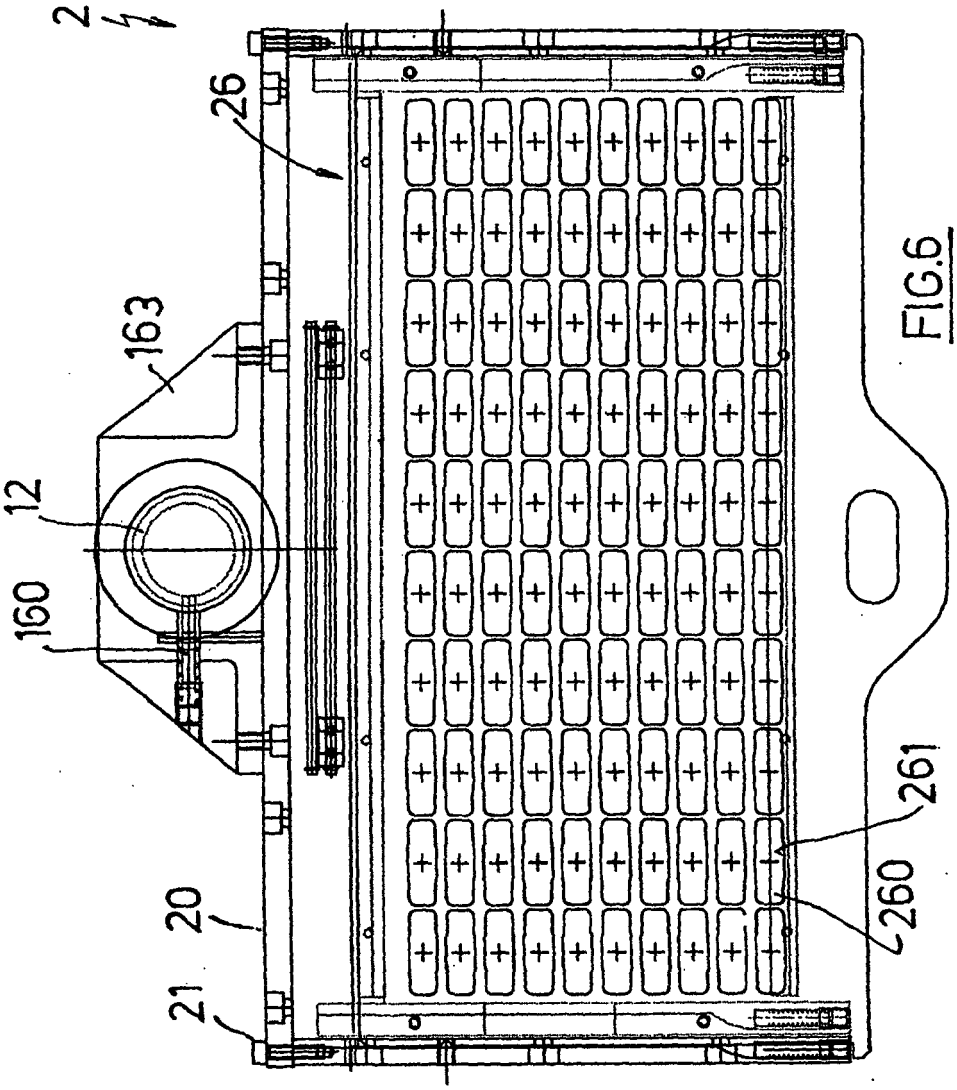


FIG.6

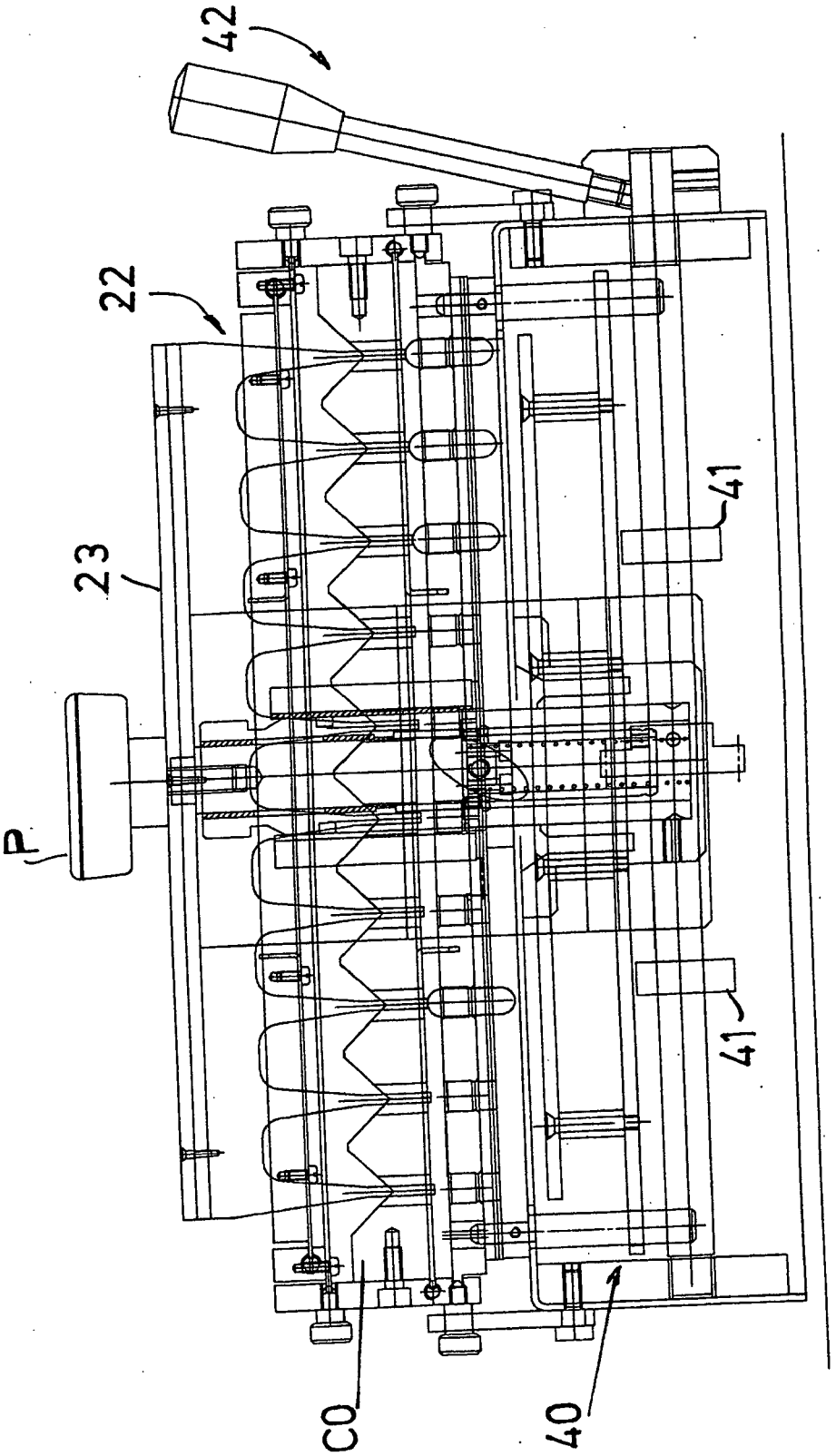


FIG.7

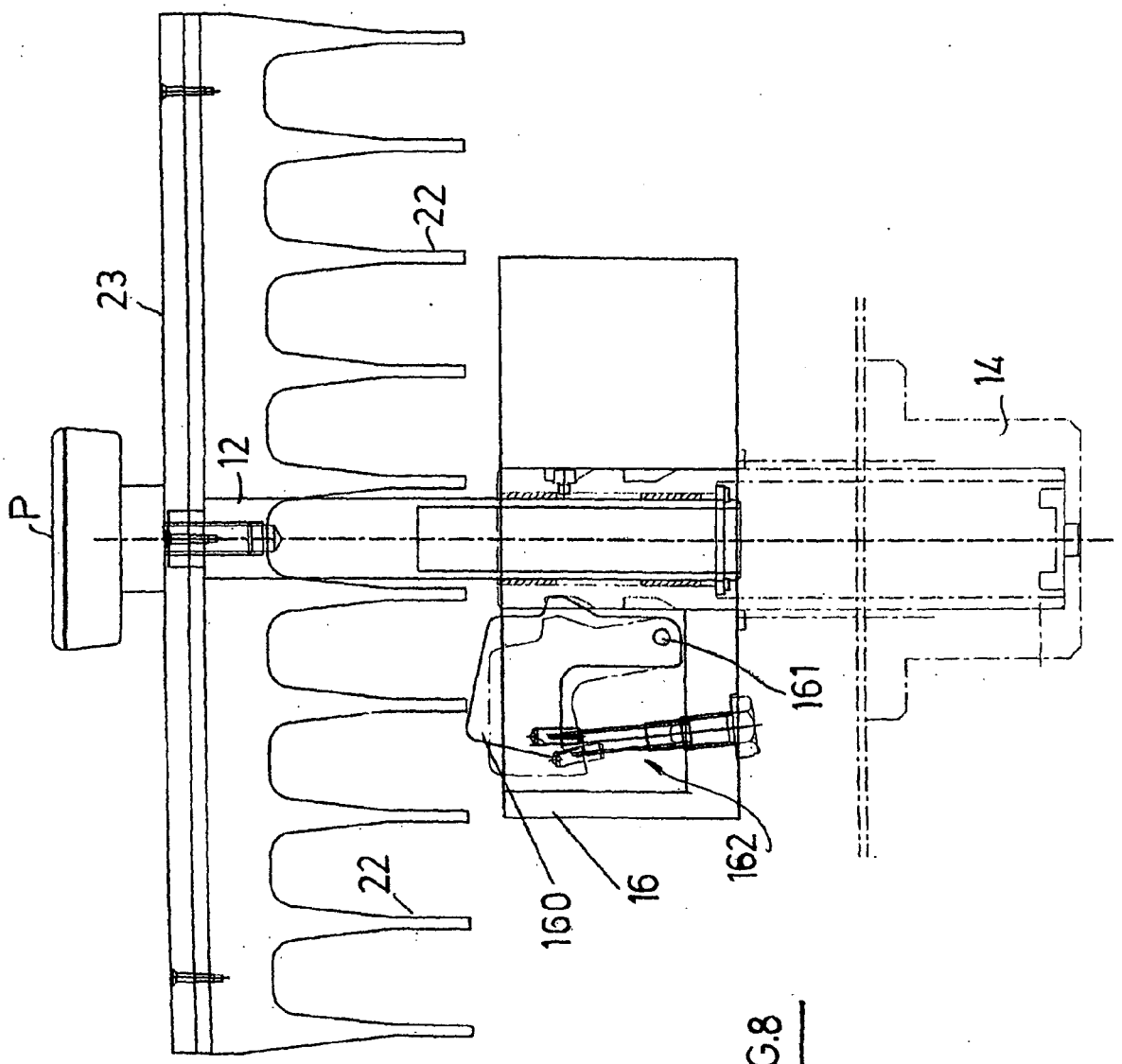


FIG.8

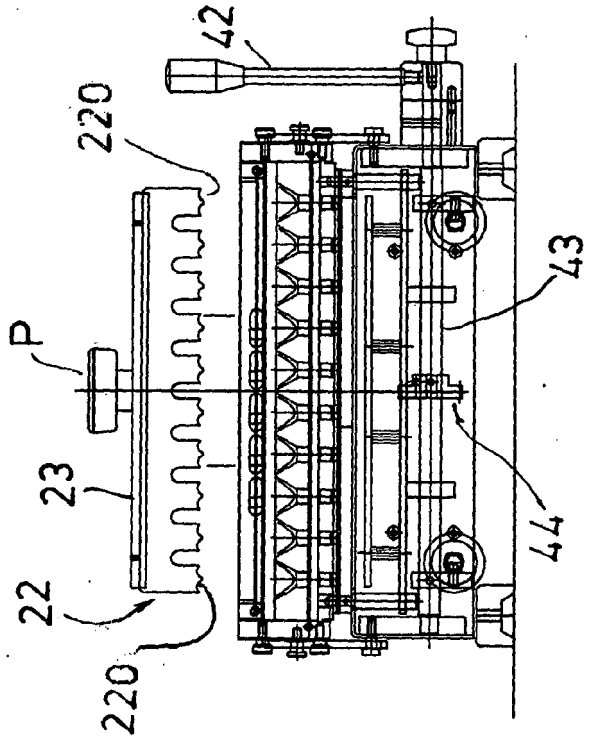


FIG.9B

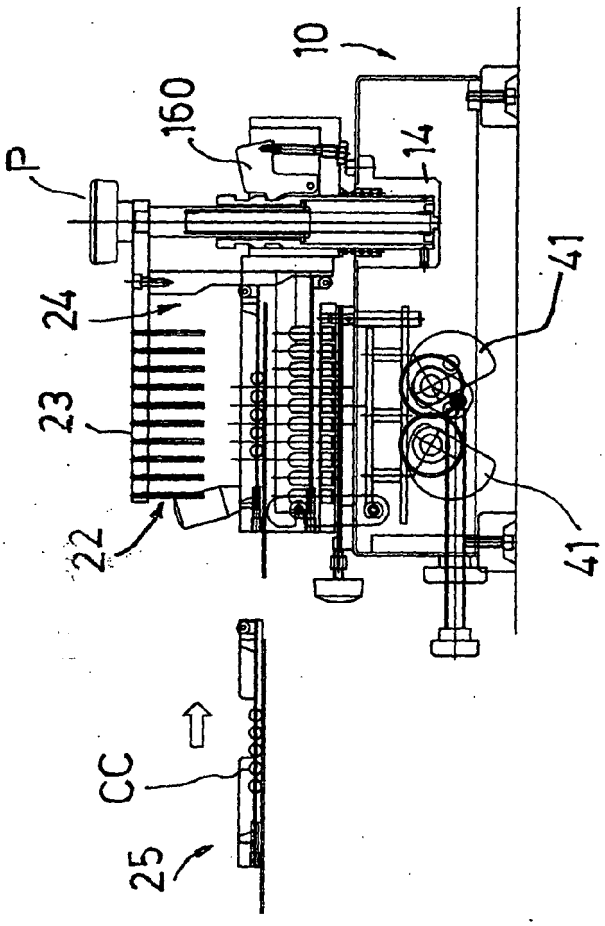


FIG.9A

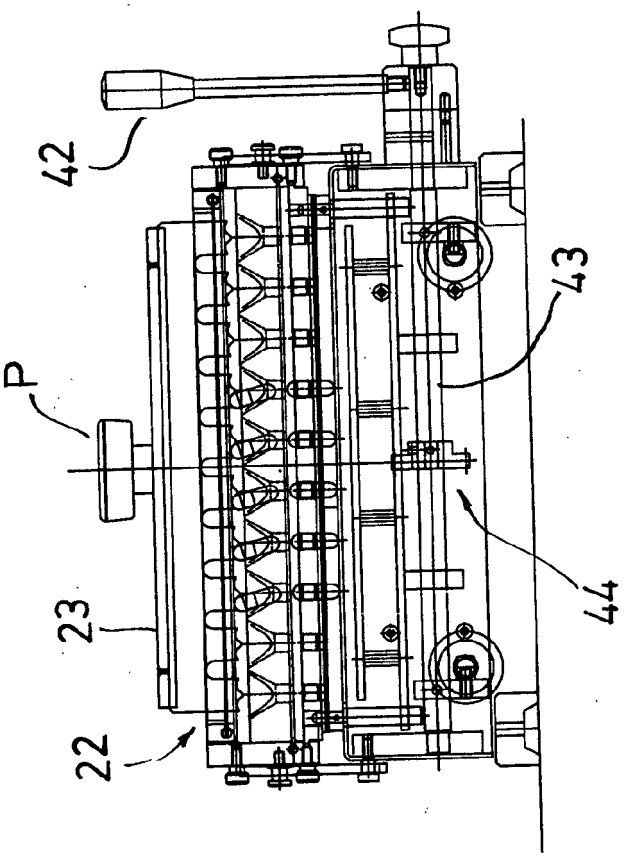


FIG.10B

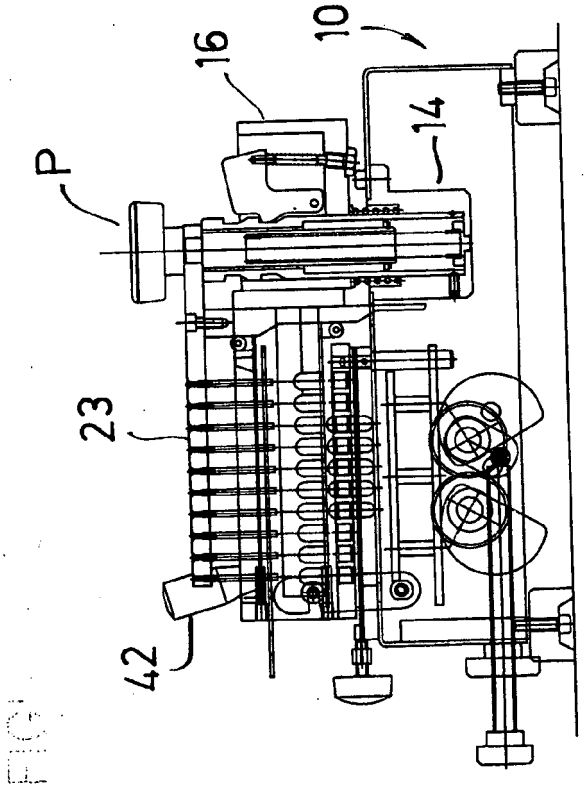


FIG.10A

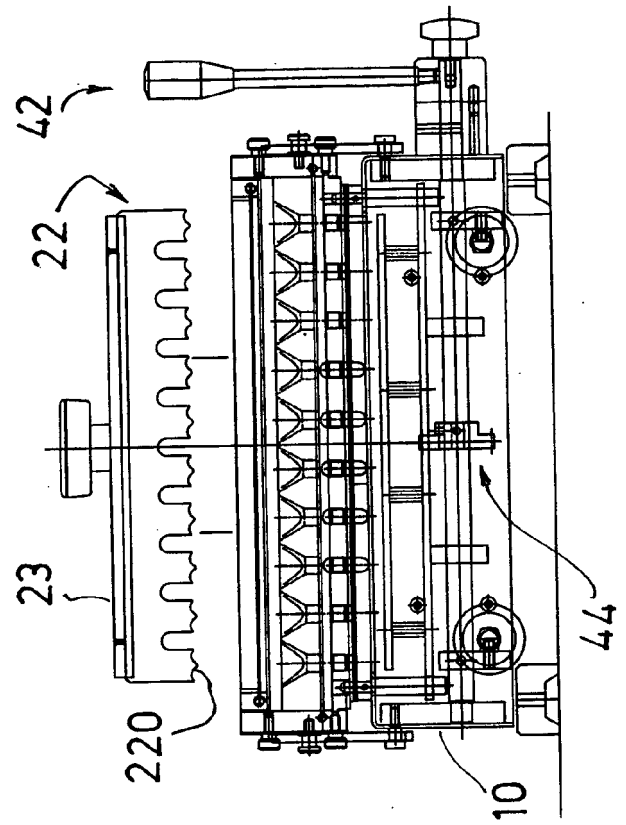


FIG.11B

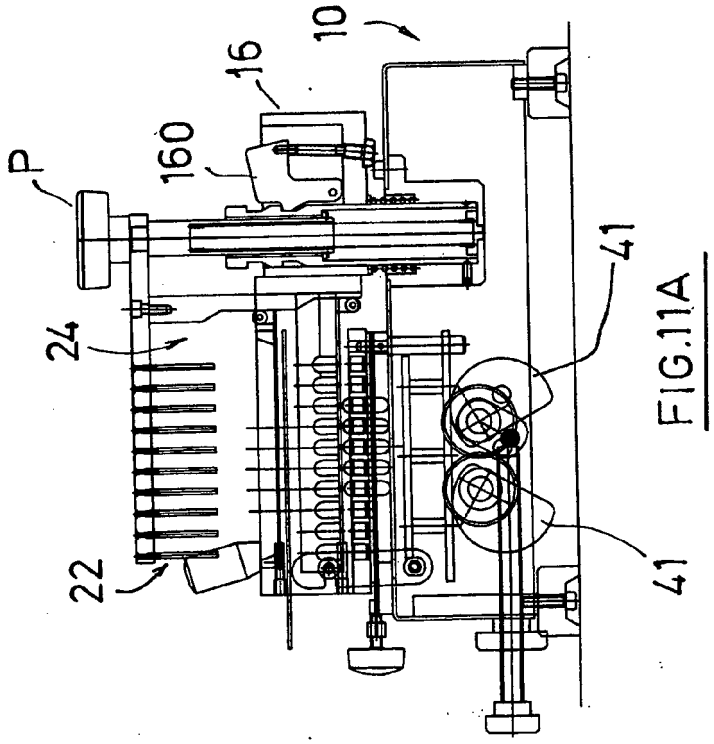


FIG.11A

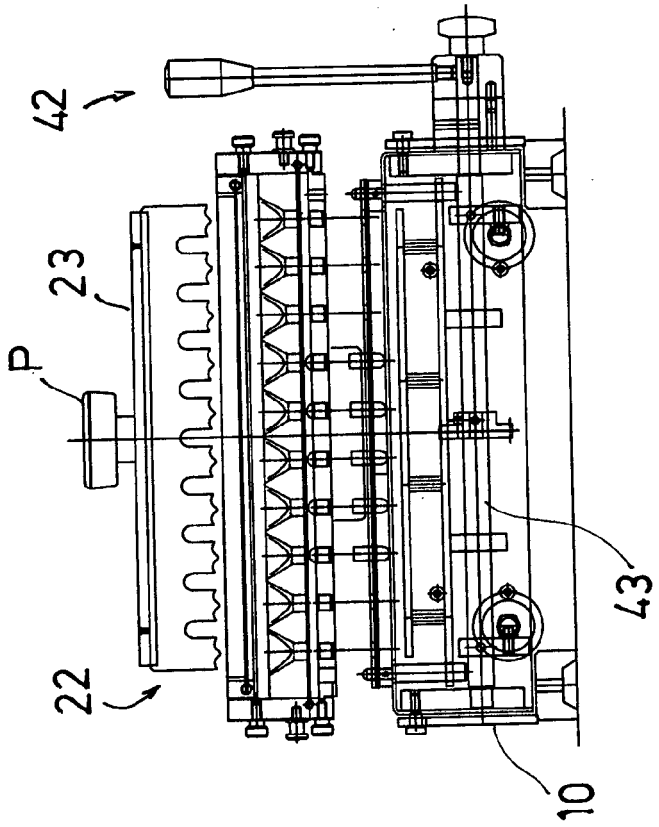


FIG.12B

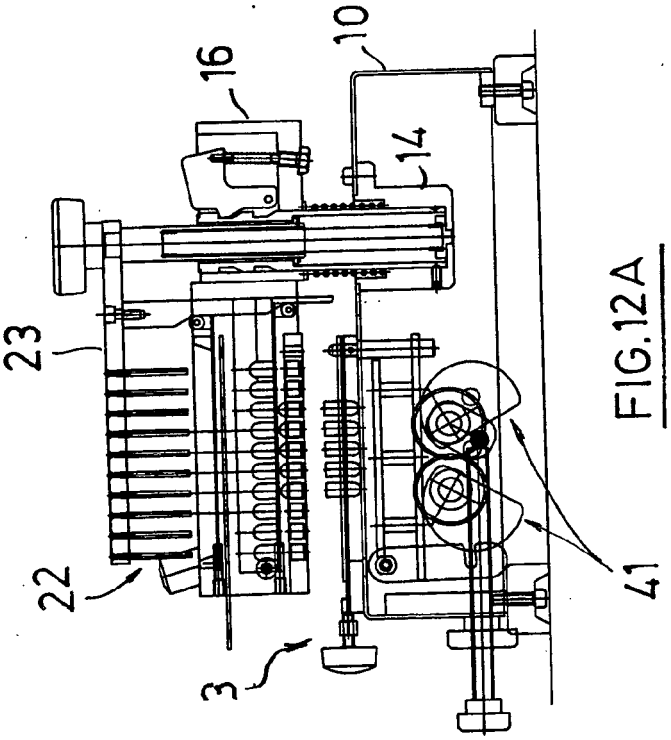


FIG.12A

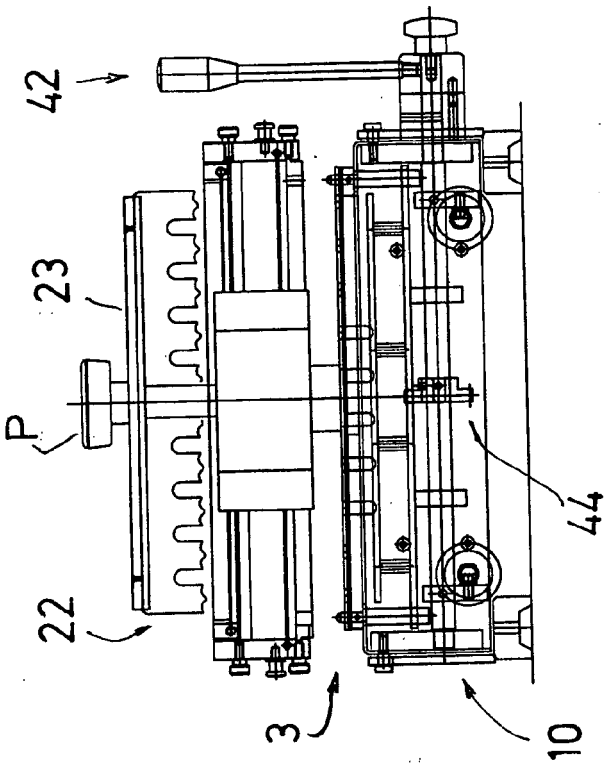


FIG 13B

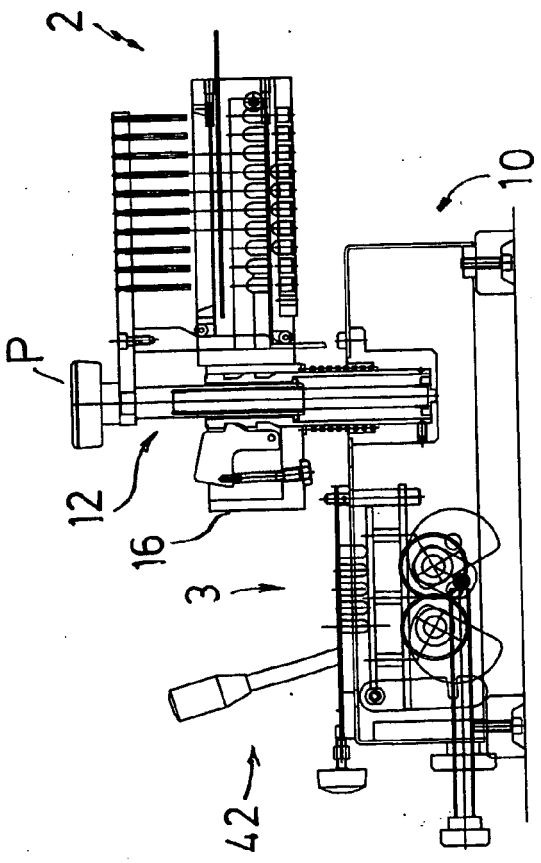


FIG.13A

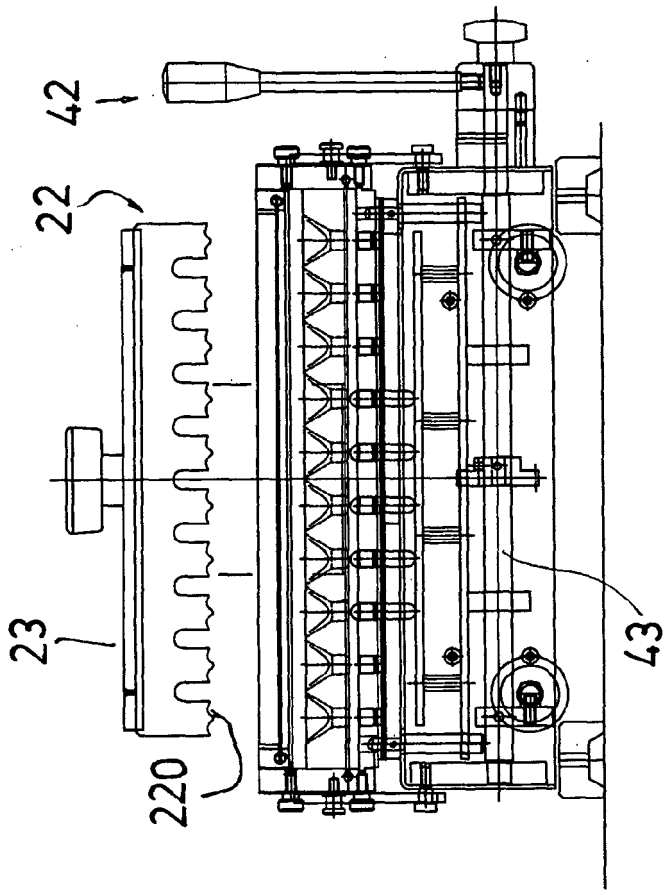


FIG.14B

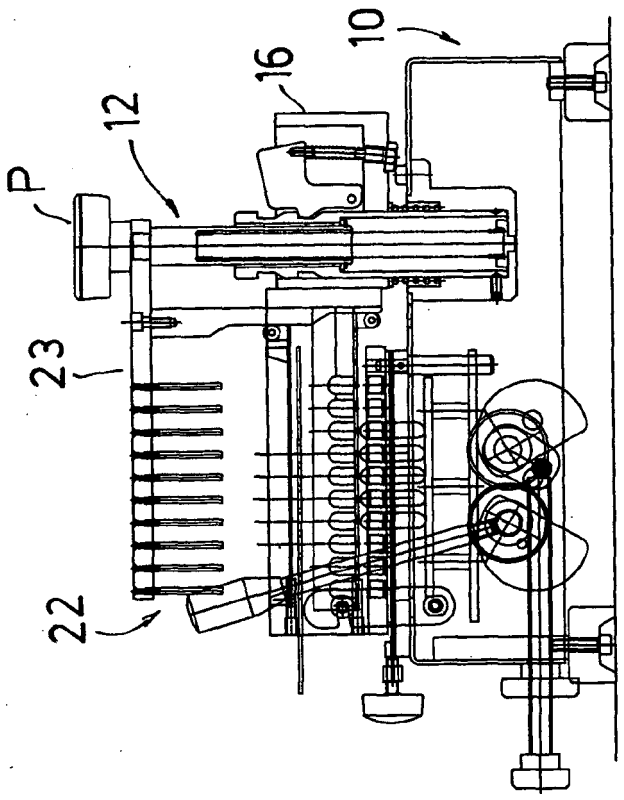


FIG.14A

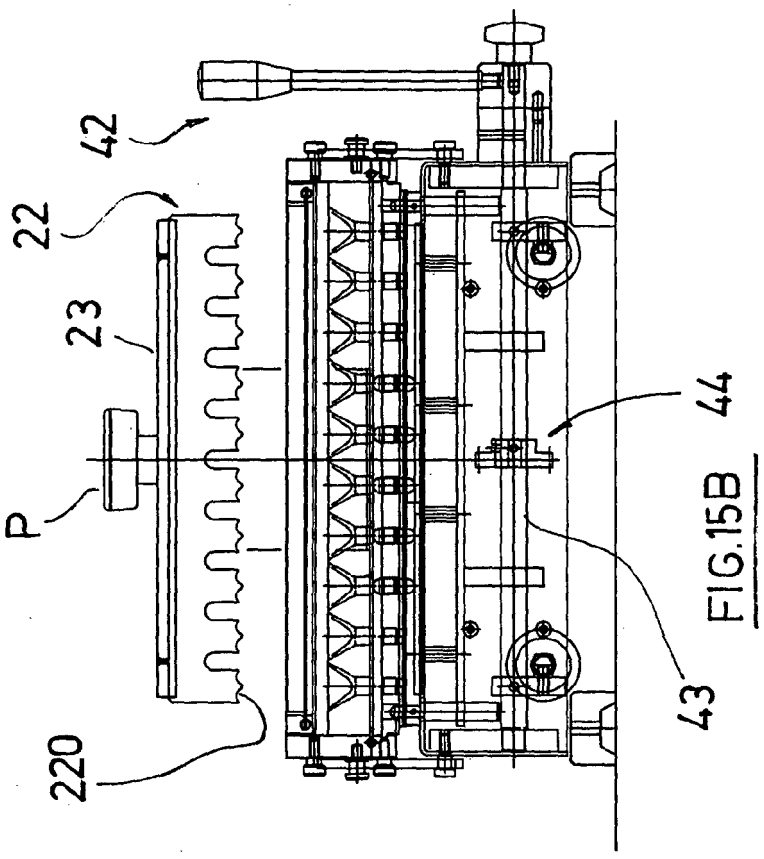


FIG.15B

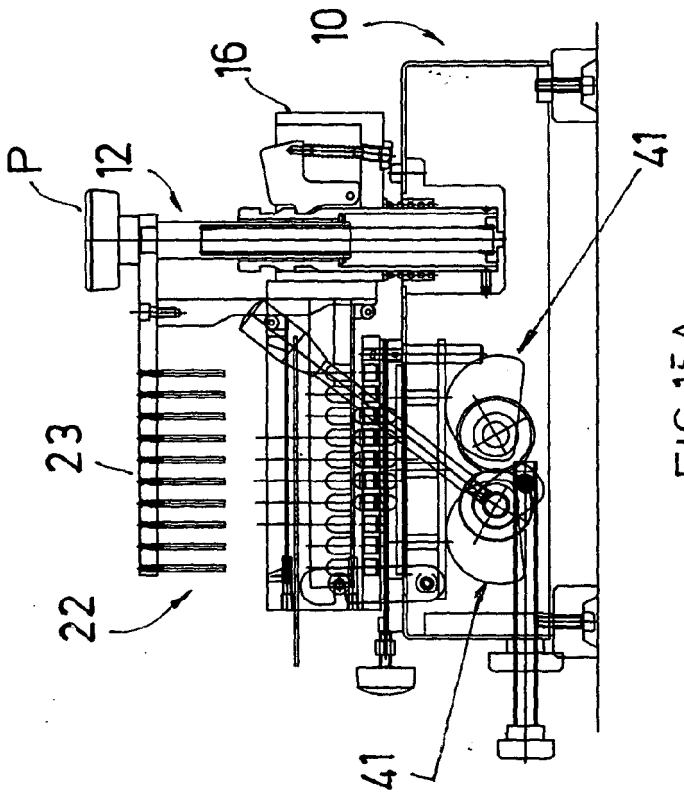


FIG.15A

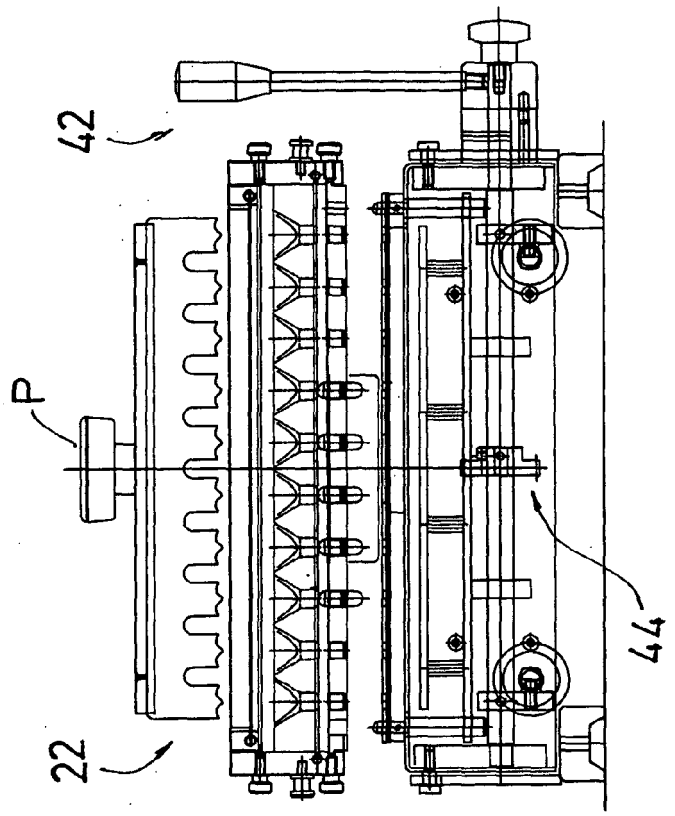


FIG.16B

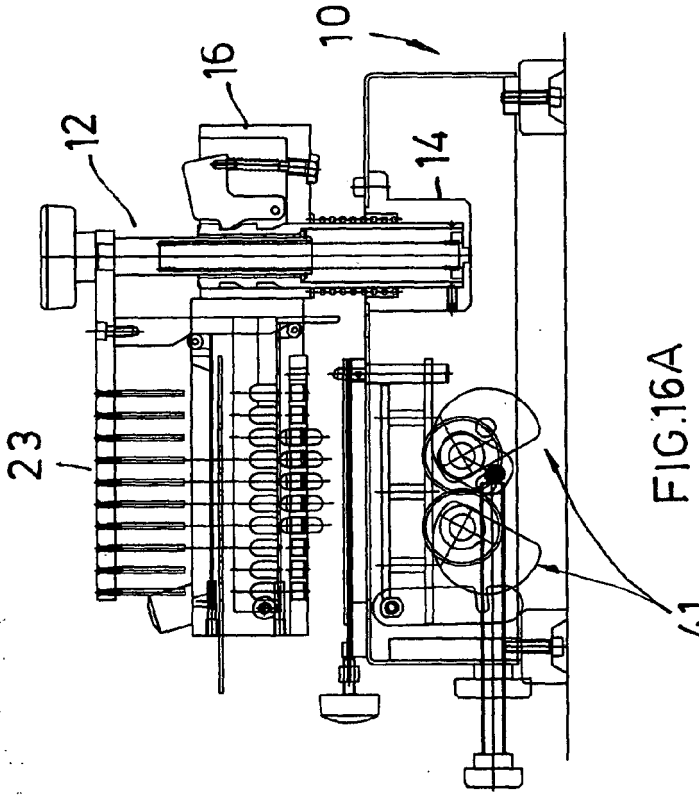


FIG.16A

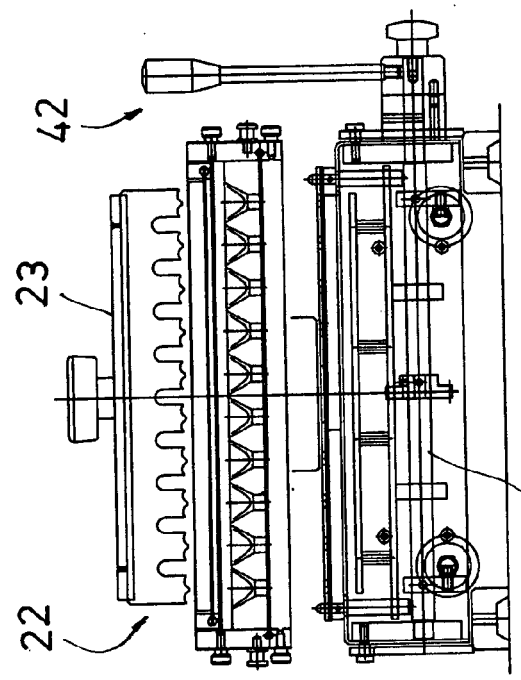


FIG.17B

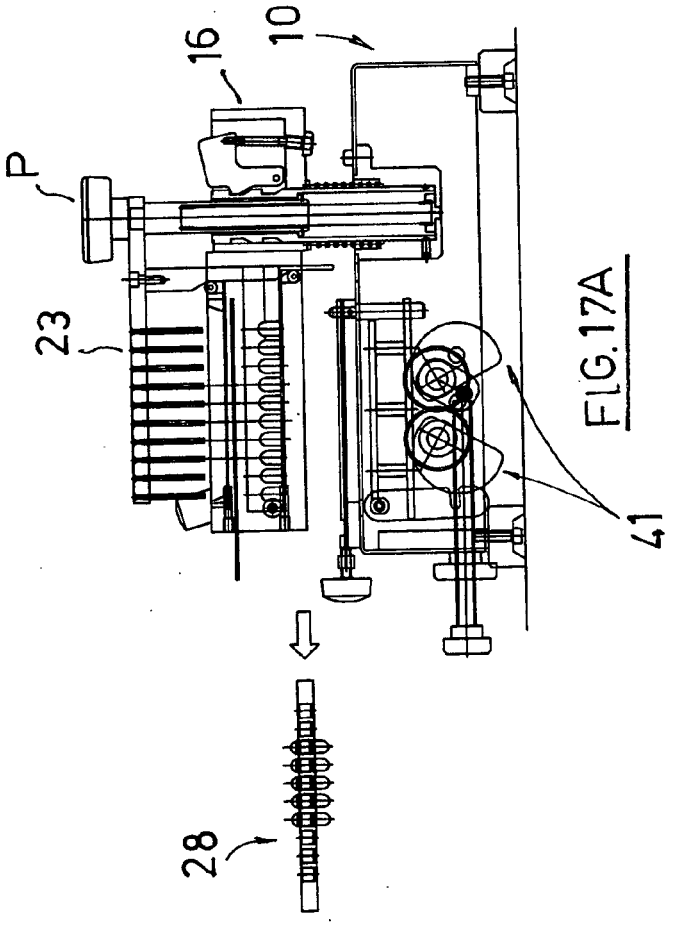


FIG.17A

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 1324

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 440 679 A (MG2 S.R.L) 28 July 2004 (2004-07-28) * paragraphs [0010] - [0038]; figures 1-4 * -----	1,2	INV. A61J3/07
A	US 5 836 141 A (SUNDBERG ET AL) 17 November 1998 (1998-11-17) * the whole document * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

A61J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 August 2006	Birlanga Pérez, J-M

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 02 1324

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-08-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1440679 A	28-07-2004	JP 2004224443 A	12-08-2004
		US 2004149769 A1	05-08-2004
US 5836141 A	17-11-1998	US 5321932 A	21-06-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82