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(71) Applicant: **CFS Weert B.V.**
6000 AG Weert (NL)

(72) Inventors:
- **F.T.C. Caris**
  6002 CT Weert (NL)
- **R.A. Van Gulik**
  6051 CJ Maasbracht (NL)
- **P.J. Hendriks**
  6005 KJ Weert (NL)

(74) Representative: **Brosch, Oliver et al**
Kutzenberger & Wolff,
Theodor-Heuss-Ring 23
50668 Köln (DE)

(54) **Apparatus and process for producing a tabular bag**

(57) The present invention relates to a process for the cyclic production of packaging bags (3) from a planar web (7), on a bagging machine which comprises detection means (19) for the detection of print-marks (18,18', 18") which are located on the web and control means to control the motion of the film-web (7), whereas:
- the web is formed into a film tube (10),
- the web is transported by transportation means intermittently, so that the velocity of the web is zero between at the beginning and at the end of each motion of the film-web (7).

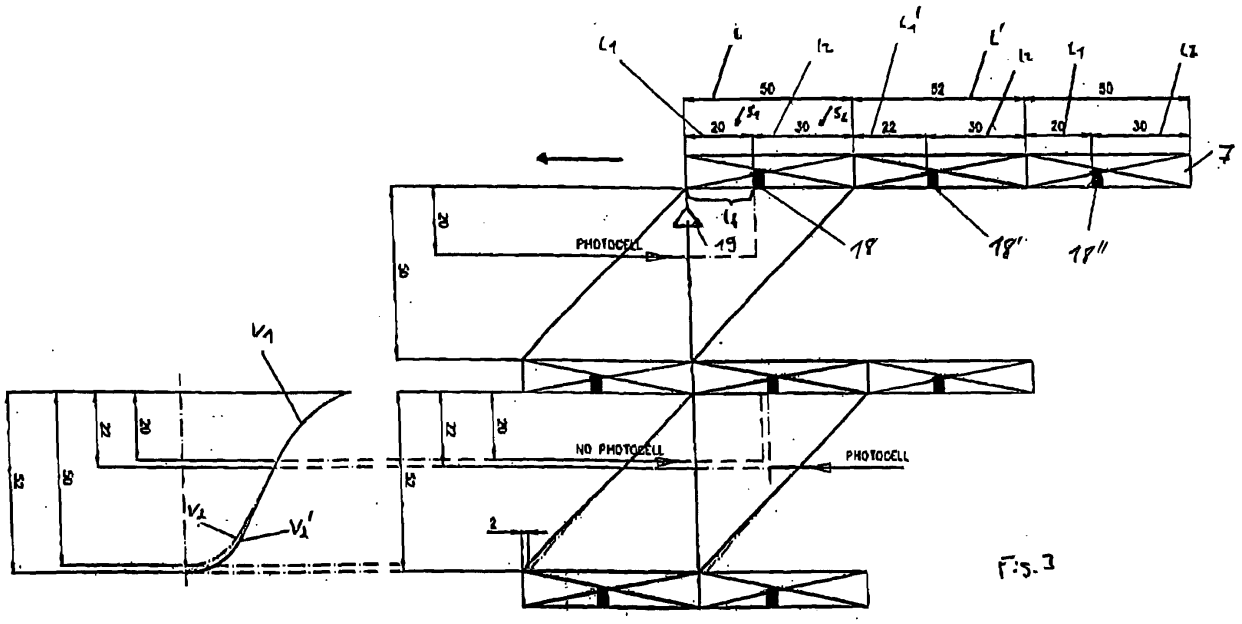

Fig. 3

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Description

[0001] The present invention relates to a process for the cyclic production of packaging bags from a planar web, on a bagging machine which comprises detection means for the detection of print-marks which are located on the web and control means to control the motion of the film-web, whereas:

- the web is formed into a film tube,
- the web is transported by transportation means intermittently, so that the velocity of the web is zero between at the beginning and at the end of each motion of the film-web.

[0002] Food stuff, especially sweets and snacks are nowadays merchandised in packaging bags made of a plastic material. The packaging bags are produced by forming a planar web, whereas the planar web is drawn from a roll, formed into a tube and a longitudinal seal is applied. Subsequently, the tube is cross-sealed at the bottom, the food stuff is inserted and another cross seal is applied at the top of the packaging bag and the completed packaging bag is cut from the tube. In many cases, these packaging bags are produced intermittently; i.e. the web is advanced and stopped in cycles. In many cases the produced packing items have imprints and print-marks to control the packaging process. These print-marks determine the respective length of each bag. Theoretically, the distance between two print-marks is always identical. However in practice, there is a slight deviation in this distance between two print marks. Additionally, the length of the produced packaging bag can change slightly from cycle to cycle, so that the print marks shift; i.e. the distance between the print mark and the detection means changes. As a consequence, there is a tendency that imprints are not located correctly on the packaging bag, which means that the imprint is either not in the center of the packaging bag or, even worth, cut off, when the packaging bag is separated from the film-web,

[0003] It is therefore the problem of the present invention to provide a process, in order to avoid the above mentioned problems.

[0004] The problem is solved by a process according claim 1. Preferred embodiments of the inventive process are claimed in the subclaims 2-10.

[0005] It was totally surprising and could not have been expected by a person skilled in the art that the inventive process allows the reproducible production of bags with a length deviation within a small bandwidth. The regulation of the production process does not take place after defective packaging bags have been produced, but during the production process of each packaging bag. i.e. if the print-mark is not located as expected, the production of this packing item will be altered such that this and the following packaging bags are not defective goods. Additionally, the inventive process allows, at the end of each motion of the film-web, a controlled reduction of the motion of the film-web to zero without any shock. Thus, oscillations of the packaging machine on which the inventive process is carried out are minimized. Additionally, the web stability is improved, which improves the quality and the reproducibility of the produced packaging bags and allows higher production rates.

[0006] The inventive process can be carried out on every intermittently operating packaging machine, regardless how the film-web is transported along the packaging machine. The inventive process is preferably carried out on a vertical packaging machine, for example a vertical flow-wrapper. On such a packaging machine, a flat film-web is drawn off a role, formed into a tube. At this tube a longitudinal seal and at the bottom a cross -seal is applied. After the packing bag has been filled via a filling tube, another longitudinal seal is applied at the top of the packaging bag and the completed packaging bag is cut off the film-web. In many cases, the cross-seals at the top of one packaging bag and the cross seal at the bottom of the next packaging bag are applied simultaneously and then cut apart. The film-web is moved by transportation means. These transportation means can be endless bands, which are positioned adjacent to the filling tube and which draw the film preferably downwards. Additionally or alternatively, the film web is moved by the cross sealing means, which apply the cross-seals to the film-tube. These cross sealing means comprise two jaws, between which the film is clamped during the sealing. While the film is clamped, the sealing jaws are moved for example downwards and thus draw the web from the role. After the sealing/drawing is completed, the sealing jaws are moved apart and back to their starting position and start the next cycle. Additionally, the packaging machine comprises detection means, for example a photocell, to detect print marks which are located on the web. These print marks can be printed on the web. However, the print mark can be any other means that is detectible, for example a transponder, a metal strip or the like. The print-marks are theoretically located at set intervals in the direction of motion of the web. However, the distance between two print marks is not always identical so that the actual distance between two print marks is different from the theoretical distance The distance between two print-marks determines the length of the respective packaging bag.

[0007] According to a preferred embodiment of the inventive process the set length of the packaging bag l is virtually divided into two segments s_1 and s_2, comprising the set length l_1, l_2, respectively. The two segments are separated by a print-mark. In the first segment s_1, the velocity profile v_1 of the film-web is always identical for a given packaging bag. At the beginning of the motion of the film-web, the velocity v_1 is zero and then increases until it reaches a certain value. The velocity preferably remains at this certain or another value until the print mark is detected by the detection means. Once the detection means have detected the print mark, the control means calculate the actual length l_1' between the begin-

ning of the motion and the detection of the print-mark and if l_1' differs from l_1 the velocity profile v_2 in the second segment s_2 is altered to the velocity profile v_2'. The velocity profile starts right after the detection of the print-mark and reduces the velocity of the film-web from the certain value to zero. If l_1' is equal to l_1, this will be achieved by a predetermined velocity profile v_2. However, if l_1' is not equal to l_1, due to tolerances during the production of the web or due to length tolerances of the packing bags produced previously, the velocity profile v_2' is altered accordingly. Preferably, the velocity profile v_2' is altered such that the length of the respective packaging bag is equal to the sum l_1'+l_2.

[0008] Preferably, the length l_2 of segment s_2 is constant for a given packaging bag.

[0009] At the beginning of each cycle the detection means preferably measure the length l_1' until it detects the next print-mark, which is the actual length l_1' of segment s_1 and the control means compares l_1' with the set length l_1 and if l_1' and l_1 are not equal, the velocity profile v_2 is modified such that the velocity of the web is zero at the end of segment s_2.

[0010] Preferably, the actual length l' of the packaging bag is different from the set length l, if l_1' differs from l_1.

[0011] According to another embodiment or according to a preferred embodiment of the above mentioned invention, at the beginning and the end of each motion of the film-web, the acceleration of the web is zero. More preferably, at the beginning and the end of each motion of the film-web, the impulse of the web is zero.

[0012] The following refers to both inventions of the present application.

[0013] Preferably, at the beginning and/or the end of each cycle cross seal are applied.

[0014] In another preferred embodiment of the present invention, cross seals are applied by cross-sealing means during the motion of the web, whereas even more preferably, the cross sealing means are also the transportation means. In this preferred embodiment of the present invention, the film is clamped during the sealing by sealing jaws. While the film is clamped, the sealing jaws are moved and thus draw the web from the role. After the sealing/drawing is completed, the sealing jaws are moved apart and transported back to their starting position again and the next cycle starts. Thus, the sealing means are also the transportation means for the film web.

[0015] However, the person skilled in the art understands that the inventive process can also be carried out on a packaging machine with transportation belt or any ozher means to transport the film intermittently.

[0016] The inventions are now described in greater details hereinafter in connection with drawings 1-4 which illustrate exemplary embodiments of the present invention. The illustrations are applicable to both inventive concepts. The drawings show:

Figure 1 a packaging bag.

Figure 2 a scheme of a vertical form fill packaging bag machine.

Figure 3 an illustration of the inventive process.

Figure 4 curves regarding the motion of the film.

[0017] **Figure 1** shows a packaging bag 3 which can be filled with a packaging item (not depicted). The person skilled in the art understands that a large variety of different packaging bags can be produced according to the inventive process. The packaging is made from a film tube 10 and comprises a longitudinal seal 4 and a cross-seal 1 at its top and a cross-seal 2 at its bottom.

[0018] In **Figure 2**, a vertical form-fill-seal packaging machine, i. e. a vertical flow rapper is systematically depicted, which allows for example the production of the packaging bag 3 according to Figure 1. A web of a film 7, especially a sealable plastic film 7, is supplied by rolls (not shown) of film material. The film-web 7 is then shaped by a forming shoulder 6 to provide a rather tubular form to the material. According to the present invention, "tubular form" of the packaging bags or of the film means any cross-sectional form including a circular form or another form, and especially a rectangular or generally a polygonal form. The film tube 10 is shaped around a filling tube 8 through which the packaging items are filled into the packaging bags 3. The vertical flow wrapper further comprises longitudinal sealing means 11 in order to produce the longitudinal seal 4 of the bag. Finally, cross seals 1, 2, extending perpendicularly (or transversally) to the direction of flow of the film, are applied, especially by means of cross-seal jaws 12, 13. The cross seal jaws 12, 13 further comprises cutting means which separate the completed bags. Thus the top cross seal 1 of one packaging bag and the bottom cross seal 2 of the next packaging can be applied as one cross seal and is then cut apart. The cross sealing means 12, 13 can be moved horizontally as depicted by arrows 14 and vertically, as depicted by arrow 15 from a upper dead center 16, to a lower dead center 17 and back. In the top- and in the lower dead center the velocity of the sealing means is zero, respectively. During one cycle, the cross sealing jaws 12, 13 are first vertically moved and then pressed together until enough pressure is applied to apply the cross seal and to clamp the film tube. Subsequently, the sealing jaws are moved downwards as depicted by arrow 15, from its upper dead center to its lower dead center. Since the film tube is clamped and due the downward movement of the cross seal jaws, the film is pulled downwards. At the lower dead center, the cross seal jaws are opened and moved upwards again, so that the next sealing/transportation-cycle can begin. During the clamping and the downward motion, the tube 10 is cross sealed.

[0019] In Figure 3, the inventive process is depicted. The film web 7 is transported from the right to the left. On the web 7, there are three print-marks 18, 18', 18" depicted. The direction of the motion of the film-web

7 is depicted by the arrow. A photocell 19 is located in a distance l_f, which is in the present example 20 mm, downstream of the next print-mark 18; i.e, after the web has started to move the photocell expects to see a pint-mark after the film has moved 20 mm. The length l of the film material needed is separated into two segments s_1, s_2, which have a set length l_1, l_2, respectively and which are separated by a printmark (18, 18', 18"). The first, very left, example shows an ideal situation; i.e. the set-parameters and the actual parameters match perfectly. Especially the distances l_f and l_1 are equal. The film-web 7 moves according to the preset velocity profile v_1; i.e. the velocity increases gradually until it reaches a certain speed. After the film web has moved 20 mm (set-length l_1), the photocell 19 detects the print-mark 18. This situation is illustrated with the word "photocell". Right after the photocell 19 has detected the print-mark 18, the film is advanced according to the preset velocity profile v_2; i.e. the speed is maintained at a certain value for a while and then reduced asymptotically to zero after the film web has by-passed the distance l_2, which is in the present example 30 mm. More details regarding the velocity profile are given in Figure 4 and the respective explanations. At the next cycle the photocell 19 does not detect the print-mark 18'after the set-length l_1 (20mm), but only after the actual length l_1' (22 mm). This situation is illustrated with the word "no photocell". In this case, the velocity of the the film-web 7 is maintained constant at a certain value and the photocell waits until it detects the print-mark 18'. Subsequently, the control means (not depicted) calculates the difference between l_1 and l_1'. Based on this information the control means know that the packaging bag presently under production cannot have the set length l, but must have the actual length l', which can be longer or shorter. In the present example it is 2 mm longer, than the set length l. This result is used to calculate a new velocity profile v_2', which maintain the velocity of the film-web at a certain value for a while and then reduces it asymptotically to zero after the film web has by-passed the distance l_2; i.e. after the film has advanced 52 mm (22mm + 30mm). The inventive control process has the advantage, that the adjustment of the length of the packaging bag takes place, while it is produced and that the control means calculate a new velocity profile v_2' to reduce the velocity to zero in a controlled manner at the adjusted length l' of packaging bag. The adjustment of the velocity profile is depicted in the graph on the lower left-hand aide. The inventive process allows a significant reduction of the oscillations in the system and thus higher production rates and an increased film stability. The next example shows an ideal situation again; i.e. the set-parameters and the actual parameters match perfectly.

[0020] In Figure 4 the motion of the film-web is depicted, whereas in Figure 4a the position of the web versus time from the beginning until the end of the motion of the film-web 7 is depicted. The end-position of the web is equivalent to the length of the packaging bag. In the Figure 4b, the speed of the film versus time is depicted; i.e. the first derivative of the curve according to Figure 4a, As can be seen the speed is zero at the beginning and at the end of each transportation of the film-web and reaches a certain speed in the middle. At the beginning of the downward movement, the speed of the film-web increases gradually and at the end of the downward movement, the velocity of the film-web is reduced to zero asymptotically. In Figure 4c the acceleration versus the time during the motion of the film-web is depicted. The acceleration is the second derivate of the curve according to Figure 4a, In the vicinity of the beginning and at the end of the downward movement, the acceleration is zero, respectively. The same is true for the impulse, which is the third derivative of the curve according to Figure 4a and which is depicted in Figure 4d. Due to this design of the motion of the film web according to Figures 4a-d, there is very little oscillation in the system due to the intermittent operation of the packaging machine on which the packaging bags are produced. Thus the production rate can be increased.

Reference signs

[0021]

1	top cross seal
2	bottom cross seal
3	Packaging bag
4	longitudinal seal
6	form shoulder
7	web, film-web
8	filling tube
9	direction of flow
10	film tube
11	longitudinal sealing
12,13	cross sealing means
14	horizontal motion of the cross sealing jaws
15	horizontal motion of the cross sealing jaws
16	upper dead center
17	lower dead center
18, 18', 18"	print marks
19	photocell
l	set length of the packaging bag
l'	actual length of the packaging bag
s_1	first segment
s_2	second segment
1_1	set length first segment
l_1'	actual length second segment
l_2	set length second sement
v_1	velocity profile in the first segment
v_2	set velocity profile in the second segment
v_2'	actual velocity profile in the second segment

Claims

1. Process for the cyclic production of packaging bags (3) from a planar web (7), on a bagging machine which comprises detection means (19) for the detection of print-marks (18, 18', 18") which are located on the web and control means to control the motion of the film-web (7), whereas:

   - the web is formed into a film tube (10),
   - the web is transported by transportation means intermittently, so that the velocity of the web is zero at the beginning and at the end of each motion of the film-web(7).

2. Process according to claim 1, **characterized in, that** for control purposes the set-length l of one packaging bag is divided into a first segment s_1 with the set length l_1 and a second segment s_2 with the length l_2, which are separated by a print-mark (18, 18', 18") and that the velocity profile v_1 in the first segment s_1 is always identical while the velocity profile v_2 in the second segment s_2 is altered to v_2', in the case that the actual length l_1' differs from the set-length l_1.

3. Process according to claim 1 or 2, **characterized in, that** the length l_2 of segment s_2 is constant for a certain bag length.

4. Process according to one of the preceding claims, **characterized in, that** at the beginning of each motion of the film-web (7) the detection means (19) measure the length luntil it detects the next print-mark (18, 18', 18"), which is the actual lengh l_1' of segment s_1 and compares it with the set length l_1 and if l_1' and l_1 are not equal, the velocity profile v_2 is modified such that the velocity of the web is zero at the end of segment s_2.

5. Process according to one of the preceding claims, **characterized in, that** the actual length l' of the packaging bag is different from the set length l, if l_1' differs from l_1.

6. Process according to one of the preceding or the preamble of claim 1, **characterized in, that** at the beginning and the end of each motion of the film-web (7) the acceleration of the web is essentially zero.

7. Process according to one of the preceding claims, **characterized in, that** at the beginning and the end of each motion of the film-web (7), the impuls is essentially zero.

8. Process according to one of the preceding claims, **characterized in, that** at the beginning and/or the end of each movement of the film-web, a cross seal is applied.

9. Process according to claim 1 - 7, **characterized in, that** during the motion of the web a cross seal is applied by cross-sealing means (12, 13).

10. Process according to claim 8, **characterized in, that** the cross sealing means (12, 13) are also the transportation means.

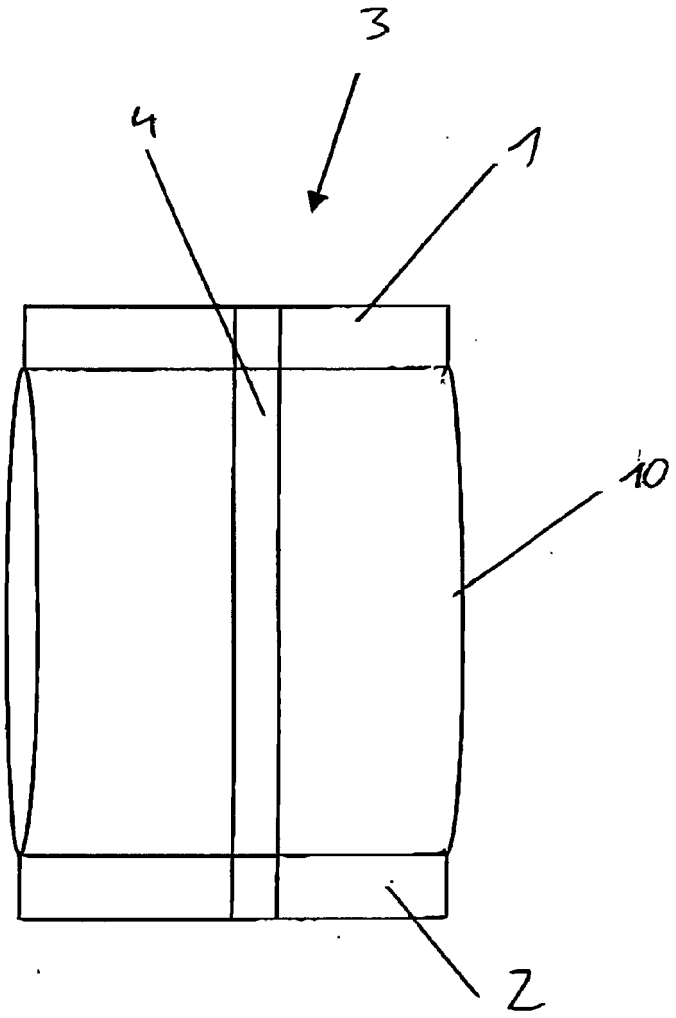


Fig. 1

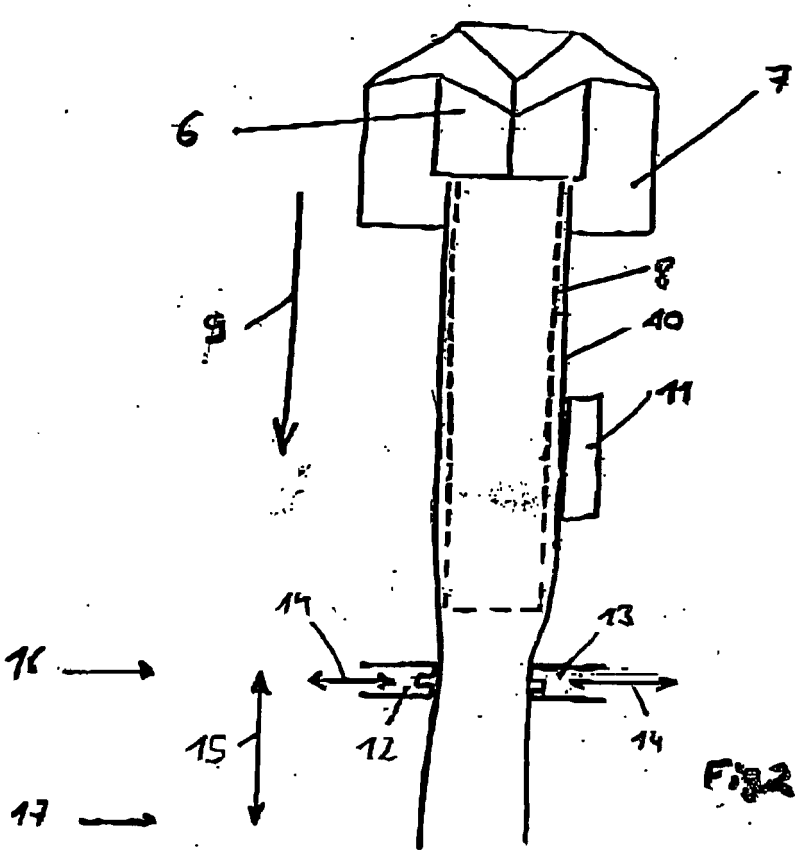


Fig.2

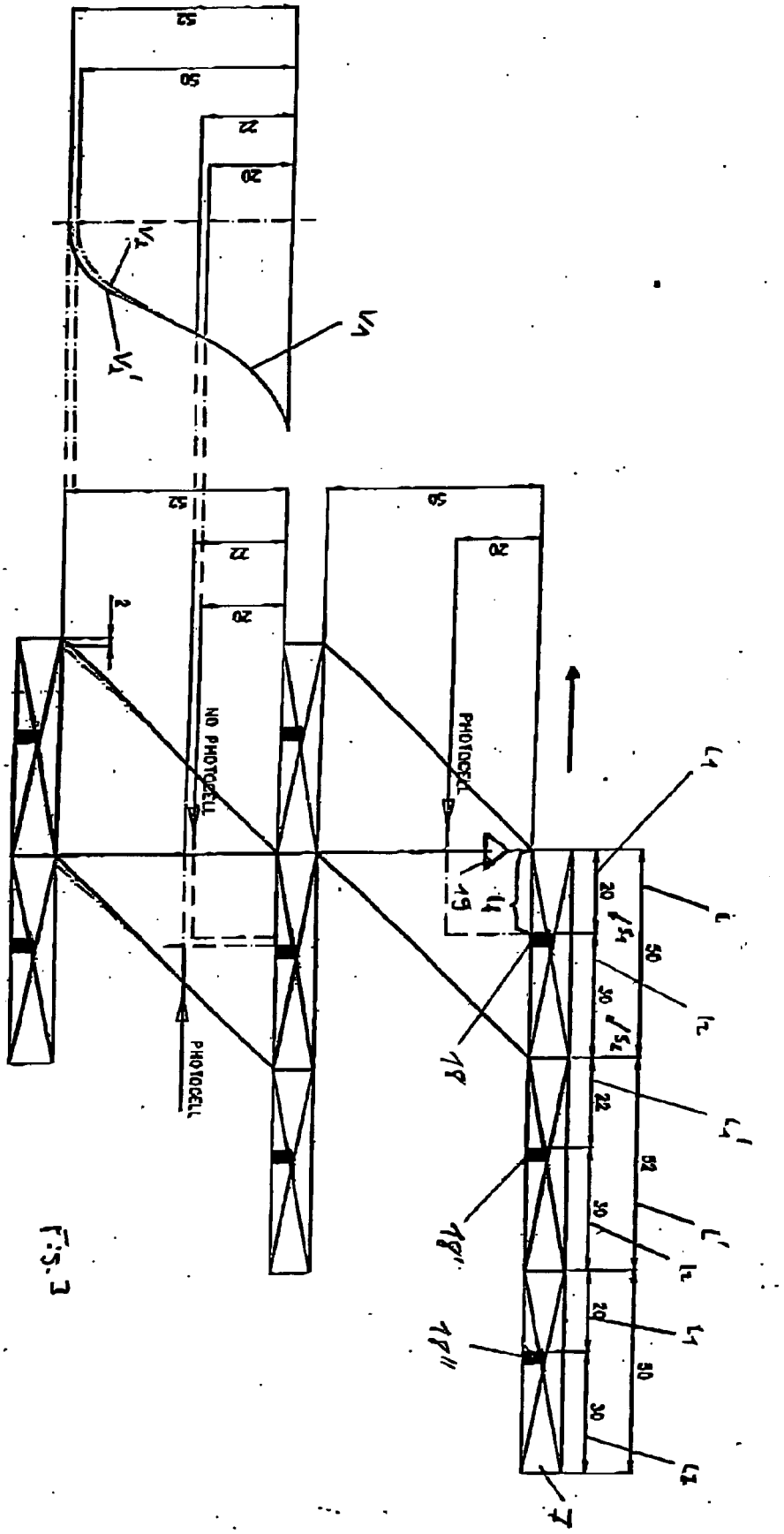


Fig. 3

Fig. 4a

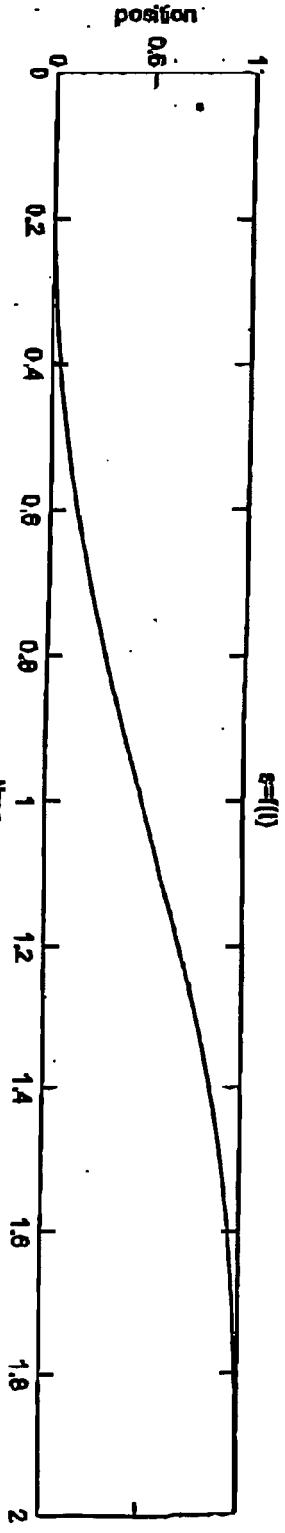


Fig. 4b

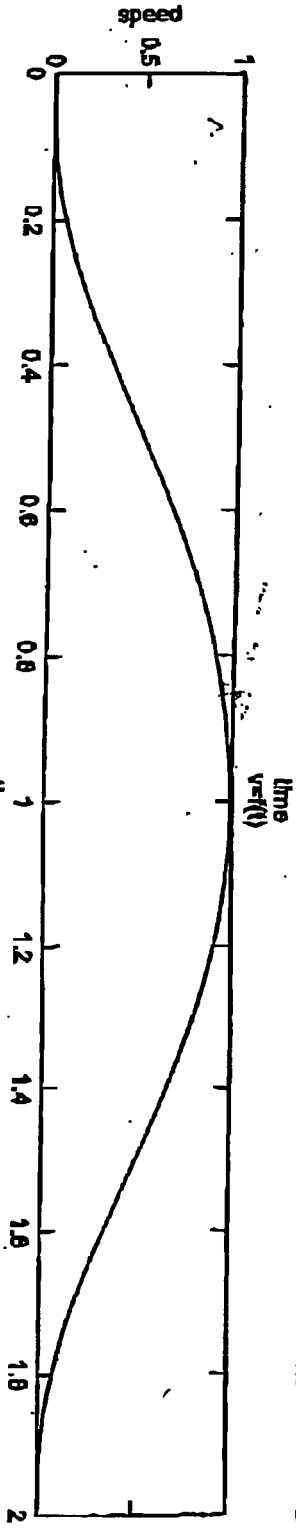


Fig. 4c

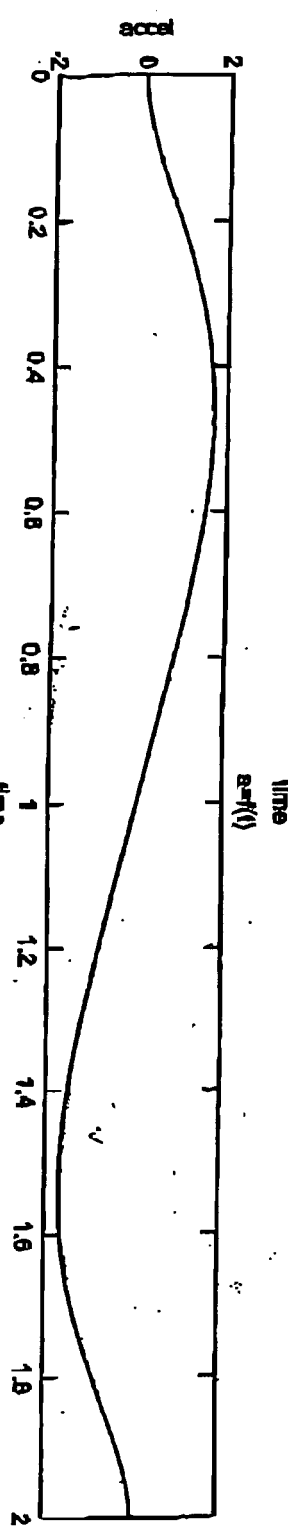
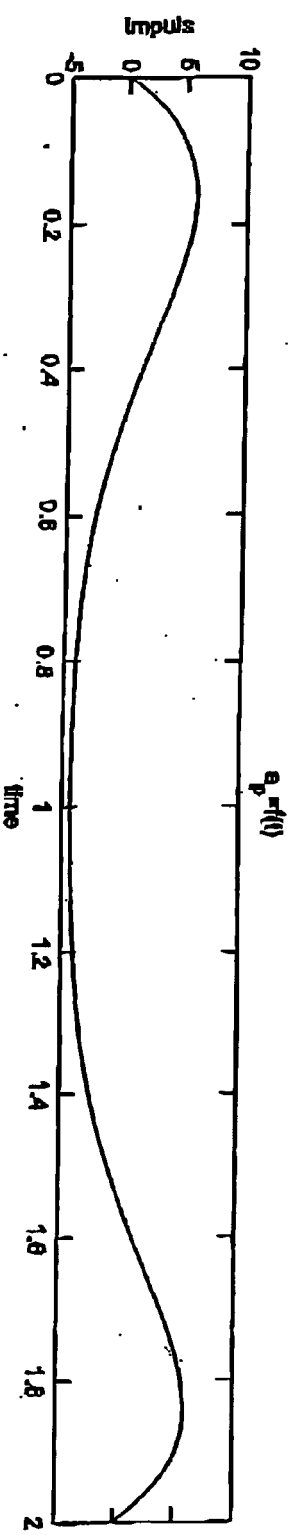


Fig. 4d



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EUROPEAN SEARCH REPORT

Application Number
EP 05 02 5729

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 September 2006	Grentzius, Willem

CATEGORY OF CITED DOCUMENTS

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