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(54) **Press for moulding clay manufactured articles**

Presse zum Formen von aus Ton hergestellten Gegenständen

Presse pour le moulage d'articles fabriqués en argile

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DE-A- 4 401 499
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EP 0 847 849 B2

Description

[0001] The present invention refers to improved presses for clay manufactured articles, such as tiles and the like, and particularly to so-called barrel presses. Presses of this kind include both presses actuated by a cam and presses actuated by an eccentric-shaft (gear crank).

[0002] Such barrel presses, both cam-actuated and eccentric-shaft presses, are driven by an A.C. electric motor, a D.C. or "brushless" electric motor, and have a well defined production rate (rotation per minute) which is dictated by the requirements of the article to be moulded, with an angular speed that is substantially constant, both during the proper moulding step and during the approaching and withdrawing paths.

[0003] In other words, at each rotation of the cam or the eccentric shaft there are associated a downward motion and an upward motion of the mould, more precisely the upper half-mould, and one article, for example a tile, is being moulded at each rotation.

[0004] The time required for moulding a single article is fixed by well defined technological conditions and cannot be shortened below a given limit: a moulding time shorter than the limit imposed by the technological practice would give defectively moulded articles.

[0005] On the other hand such defined rate implies rather long dead times that would be desirable to reduce in order to increase the productivity of the press.

[0006] An object of the present invention is to overcome the above mentioned drawbacks and limitations, and particularly to increase the press productivity without altering the article quality.

[0007] This object is accomplished through a press as claimed in claim 1. Further advantageous characteristics are recited in the dependent claims.

[0008] EP-A-536 804 discloses a press machine for performing plastic deformation of a workpiece, such as punching metallic sheet material blanks in order to produce lead frames for IC. In order to reduce the press noise, a servomotor controlled by a computer and receiving from a sensor information data concerning the ram position, provides for moving the tool at an approaching speed in which the tool is moved at a set high speed until it starts to contact the workpiece, at a working speed substantially lower than said approaching speed and such as not to generate high noise while working on the workpiece, and at a separating speed substantially larger than said working speed.

[0009] EP-A-404 350 discloses a press for crimping electrical terminals to leads, comprising an electric motor connected to a slide ram of the press by way of reduction gearing and an eccentric drive shaft, and a control circuit associated with an encoder supplying the angular position of the drive shaft in order to control the speed of the drive motor for ensuring a proper retum of the ram to home position.

[0010] US-A-5 588 344 which is prior art to the present application under Art. 54 (3) EPC, discloses a punch press ram drive with a reversible electrical servo motor coupled to a crankshaft having an eccentric journal driving a pitman arm connected to the ram.

[0011] In the press according to the invention, the rotation speed of the cam (or the eccentric shaft) is changed by means acting on the rotation speed of the motor driving such member, the motor being preferably a DC. motor or a "brushless" motor. The rotation speed is kept substantially low and anyhow adapted to the moulding of the article, e.g. a tile, along the rotation arc when the moulds are in contact with the clay, and is then increased to a maximum during the lifting of the upper mould, and then decreased when the upper mould is lowered so as to reach the point at which the moulding starts with an optimum speed for moulding the article.

[0012] The means for controlling the motor rotation speed employs positional references of the encoder type, fitted to the cam shaft, that supplies suitable information to the control and command unit of the motor (an A.C. or "brushless" motor) in accordance with the press type, in order to modify the moulding cam timing in a predetermined optimum way.

[0013] In a press driven by an eccentric-shaft said encoder supplies the angular position of the eccentric-shaft to allow a change of the sinusoidal moulding curve, typical of an eccentric-shaft press, into a predetermined optimum curve, similar to that of a cam press.

[0014] The solution provided by the invention to modify the rotation speed of the motor depending on, the information supplied by the encoder means, without altering the operating characteristics, renders the press simpler by eliminating expensive mechanical members such as additional cams, supports, rolls, and so on.

[0015] Further characteristics and advantages of the invention will become evident from the following description with reference to the attached drawings, only for exemplary purposes, in which:

- Figure 1 is a schematic side view of a cam press;
- Figure 2 is a schematic side view of an eccentric-shaft press;
- Figure 3 is a schematic front view of a cam press;
- Figure 4 is a schematic front view of an eccentric-shaft press;
- Figure 5 illustrates the position of the upper half-mould in a cam press with the motor driven at a variable speed in accordance with the present invention;
- Figure 6 shows two curves illustrating the position of the upper half-mould in an eccentric-shaft press, with a motor driven at a constant speed and a speed changed in accordance with the invention, respectively; and
- Figure 7 schematically shows an arrangement for controlling the motor speed in accordance with the invention.

[0016] With reference to Fig.s 1 and 3, there is illustrated a press 1 of the cam-actuated type for moulding

clay articles, such as tiles and the like. The press 1 comprises a structure on which an electric motor 2 is mounted and through a kinematic chain 4 such motor drives with a reciprocating motion the upper half-mould 5 of a mould 3. In the press illustrated in Figs. 1 and 3 the motor drives a pulley or barrel 12 and the press is also known as a barrel press. The kinematic chain further comprises a suitably shaped cam 9 rotatable about a shaft 8. At least an encoder 7 is mounted to the shaft 8, and is adapted to detect the shaft angular position and supply such information to a unit 13 (Fig. 7) controlling the speed of the motor 2.

[0017] Fig.s 2 and 4 illustrate a press 10 for producing clay articles in which the kinematic chain 14 comprises an eccentric shaft 19 rotatably mounted on a shaft 18. The other components of the press 10 substantially correspond to the components of the press 1 and are indicated by the same numeral references. At least an encoder 7 is mounted to the shaft 18, and is adapted to measure the angular position of such shaft and supply such information to unit 13 for controlling the speed of the motor 2.

[0018] Fig. 7 is a block diagram illustrating the arrangement of the invention. Through the kinematic chain 4 (or 14) the motor 2 applies a reciprocating motion to the upper half-mould of the mould 3. The rotation of the motor 2 is controlled by the device 13 that receives information about the angular position of the shaft and through known control devices, typically a programmed microprocessor, accelerates the shaft rotation when the half-mould starts to be lifted, and decelerates the shaft rotation at a properly selected point during the lowering step, typically in the first portion of the downward path, so that the upper half-mould reaches the position at which the moulding starts with an optimum speed for moulding the article.

[0019] As it is clear from Figure 5, illustrating the stroke or displacement s of the half-mould in the cam press of Fig. 1 as a function of the time, the effective working step of the press is that represented by the lowermost line indicating that the movable upper mould is in the lowermost position, and this portion of the curve is almost horizontal. In Fig. 5 the speed of the half-mould is proportional to the slope of the curve. The moulding or working step is preceded by an inactive step (mould being raised) and by an approaching step, shown by the dashed area. A similar displacement in the contrary direction takes place after the working step, this step being followed by a withdraw (or lifting) of the mould as shown by the dashed area, and then by a new approaching step.

[0020] Thanks to the electronic means for controlling the speed of the motor and to the references obtained by means of properly located encoder(s), the electric motor of the press will turn at a geater speed during the inactive step, will decelerare when approaching to the working step, will mould the article at a desired speed, and will be again accelerated to the greater speed during the next inactive step.

[0021] In the mentioned example the motor speed during the inactive step is about 23 r.p.m., and during the working step is of about 17 rpm.

[0022] Due to the different lengths of the working and inactive steps, the present invention accomplished a remarkable increase in the production rate, without altering the quality of the moulded article.

[0023] Figure 6 shows two curves illustrating the stroke or displacement s of the half-mould as a function of the time in an eccentric-shaft press. The solid line corresponds to a constant speed of the motor, while the dash and point line depicts a mould displacement in accordance with the present invention. It is evident the longer duration of the mould closing when the half-mould moves at a low speed for a much longer time than in a conventional eccentric-shaft press.

Claims

1. A press (1,10) for moulding clay manufactured tiles, comprising:

- an electric motor (2);
- a mould (3) consisting of an upper half-mould and a lower half-mould for moulding a tile when closed;
- a kinematic chain (4,14) for imparting a vertical reciprocating motion to the upper half-mould (5) of said mould (3) driven by the rotation of the said electric motor (2), said vertical reciprocating motion comprising a moulding phase, during which said upper half-mould is in contact with the clay and the article is moulded, an inactive phase immediately following said moulding phase during which said half-mould is raised with respect to said clay and an approaching phase immediately following said inactive phase and immediately preceding said moulding phase;
- a control unit (13);
- at least one device (7) fitted to a shaft of said kinematic chain (4,14) for detecting the angular position thereof and coupled to said control unit (13) to modify the rotation speed of said electric motor (2) as a function of said angular position;

characterised in that said control unit (13) comprises electronic means programmed for controlling the rotation speed of said electric motor so as to carry out the following steps:

- during said moulding phase driving said electric motor (2) to a first predetermined positive optimum speed;
- during said inactive phase driving said electric motor (2) to a second speed substantially larger than said first speed; and
- during said approaching phase decelerating

said electric motor (2) so as to reach said moulding phase at said first positive speed.

2. A press as claimed in claim 1, **characterised in that** said first speed is about 17 r.p.m. and said second speed is about 23 r.p.m.

3. A press as claimed in claim 1, **characterised in that** said kinematic chain (4) comprises a cam (9).

4. A press as claimed in claim 3, **characterised in that** said means (7) for detecting the angular position comprises at least an encoder mounted to the shaft (8) of said cam (9) for detecting the angular position of said shaft.

5. A press as claimed in claim 1, **characterised in that** said kinematic chain (4) comprises an eccentric shaft (19).

6. A press as claimed in claim 5, **characterised in that** said means (7) for detecting the angular position comprises at least an encoder mounted to the shaft (18) of said eccentric (19) for detecting the angular position of said shaft.

7. A press as claimed in preceding claims, **characterised in that** said electric motor (2) is a D.C. electric motor.

8. A press as claimed in preceding claims, **characterised in that** said electric motor (2) is of the "brushless" type.

9. A press as claimed in preceding claims, **characterised in that** said press (1, le) is a barrel press.

Patentansprüche

1. Presse (1, 10) zum Formen von aus Ton hergestellten Fliesen, umfassend:

- einen Elektromotor (2);
- eine Form (3), bestehend aus einer oberen Halbform und einer unteren Halbform, um, wenn geschlossen, eine Fliese zu formen;
- eine kinematische Kette (4, 14), um die obere Halbform (5) der Form (3) in eine vertikale hin- und hergehende Bewegung zu versetzen, die durch die Rotation des Elektromotors (2) angetrieben ist, wobei die vertikale hin- und hergehende Bewegung eine Form-Phase umfasst, während der sich die obere Halbform in Kontakt mit dem Ton befindet und der Gegenstand geformt wird, eine der Form-Phase unmittelbar folgende inaktive Phase, während der die Halbform in Bezug auf den Ton angehoben wird, und eine der inaktiven Phase unmittelbar folgende und der Form-Phase unmittelbar vorausgehende Annäherungs-Phase;
- eine Steuereinheit (13);
- mindestens eine Einrichtung (7), die auf einen Schaft der kinematischen Kette (4, 14) zur Erfassung von dessen Winkelposition aufgepasst ist und die an die Steuereinheit (13) gekoppelt ist, um die Umdrehungsgeschwindigkeit des Elektromotors (2) als eine Funktion der Winkelposition zu ändern,

dadurch gekennzeichnet, dass die Steuereinheit (13) Elektronikmittel programmiert zur Steuerung der Umdrehungsgeschwindigkeit des Elektromotors umfasst, um die folgenden Schritte durchzuführen:

- während der Form-Phase den Elektromotor (2) auf eine erste vorbestimmte positive Optimalgeschwindigkeit zu bringen;
- während der inaktiven Phase den Elektromotor (2) auf eine zweite Geschwindigkeit zu bringen, die wesentlich größer als die erste Geschwindigkeit ist; und
- während der Annäherungs-Phase den Elektromotor (2) abzubremsen, um die Form-Phase mit der ersten positiven Geschwindigkeit zu erreichen.

2. Presse nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste Geschwindigkeit ungefähr 17 Umdrehungen/Minute und die zweite Geschwindigkeit ungefähr 23 Umdrehungen/Minute beträgt.

3. Presse nach Anspruch 1, **dadurch gekennzeichnet, dass** die kinematische Kette (4) einen Nocken (9) umfasst.

4. Presse nach Anspruch 3, **dadurch gekennzeichnet, dass** das Mittel (7) zur Erfassung der Winkelposition mindestens eine auf den Schaft (8) des Nokkens (9) montierte Kodiereinrichtung zur Erfassung der Winkelposition des Schafts umfasst.

5. Presse nach Anspruch 1, **dadurch gekennzeichnet, dass** die kinematische Kette (4) einen exzentrischen Schaft (19) umfasst.

6. Presse nach Anspruch 5, **dadurch gekennzeichnet, dass** das Mittel (7) zur Erfassung der Winkelposition mindestens eine auf den Schaft (18) des Exzenters (19) montierte Kodiereinrichtung zur Erfassung der Winkelposition des Schafts umfasst.

7. Presse nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Elektromotor (2) ein Gleichstrom-Elektromotor ist.

8. Presse nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Elektromotor in (2) vom bürstenlosen Typ ist.

9. Presse nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Presse (1, 10) eine Fasspresse ist.

Revendications

1. Presse (1,10) servant à mouler des tuiles manufacturées en argile, comprenant :

- un moteur électrique (2) ;
- un moule (3), constitué par une moitié supérieure de moule et une moitié inférieure de moule, pour mouler une tuile lorsqu'elles sont serrées ;
- une chaîne cinématique (4,14) destinée à communiquer un mouvement de va-et-vient vertical à la moitié supérieure (5) dudit moule (3) entraînée par la rotation dudit moteur électrique (2), ledit mouvement de va-et-vient vertical comprenant une phase de moulage, pendant laquelle ladite moitié supérieure de moule se trouve au contact de l'argile et pendant laquelle l'article est moulé, une phase inactive suivant immédiatement ladite phase de moulage pendant laquelle ladite moitié de moule est relevée par rapport audit argile et une phase d'approche suivant immédiatement ladite phase inactive et précédant immédiatement ladite phase de moulage ;
- une unité de commande ;
- au moins un dispositif (7) ajusté à un arbre de ladite chaîne cinématique (4,14) pour détecter sa position angulaire et couplé à ladite unité de commande (13) afin de modifier la vitesse de rotation dudit moteur électrique (2) en fonction de ladite position angulaire,

caractérisée en ce que ladite unité de commande (13) comprend des moyens électroniques programmés pour contrôler la vitesse de rotation dudit moteur électrique de façon à réaliser les phases suivantes :

- pendant ladite phase de moulage, entraîner ledit moteur électrique (2) à une première vitesse positive optimale prédéterminée ;
- pendant ladite phase inactive, entraîner ledit moteur électrique (2) à une seconde vitesse sensiblement supérieure à ladite première vitesse ; et
- pendant ladite phase d'approche, faire décélérer ledit moteur électrique (2) de façon à atteindre ladite phase de moulage à ladite première vitesse positive.

2. Presse selon la revendication 1, **caractérisée en ce que** ladite première vitesse est d'environ 17 tours par minute et ladite seconde vitesse d'environ 23 tours par minute.

3. Presse selon la revendication 1, **caractérisée en ce que** ladite chaîne cinématique (4) comporte une came (9).

4. Presse selon la revendication 3, **caractérisée en ce que** lesdits moyens (7) de détection de la position angulaire comprennent au moins un codeur fixé sur l'arbre (8) de ladite came (9) pour détecter la position angulaire dudit arbre.

5. Presse selon la revendication 1, **caractérisée en ce que** ladite chaîne cinématique (4) comprend un arbre d'excentrique (19).

6. Presse selon la revendication 5, **caractérisée en ce que** lesdits moyens (7) de détection de la position angulaire comprennent au moins un codeur fixé sur l'axe (18) dudit excentrique (19) pour détecter la position angulaire dudit arbre.

7. Presse selon les revendications précédentes, **caractérisée en ce que** ledit moteur électrique (2) est un moteur électrique à courant continu (CC).

8. Presse selon les revendications précédentes, **caractérisée en ce que** ledit moteur électrique (2) est du type « sans balai ».

9. Presse selon les revendications précédentes, **caractérisée en ce que** ladite presse (1,10) est une presse à tambour.

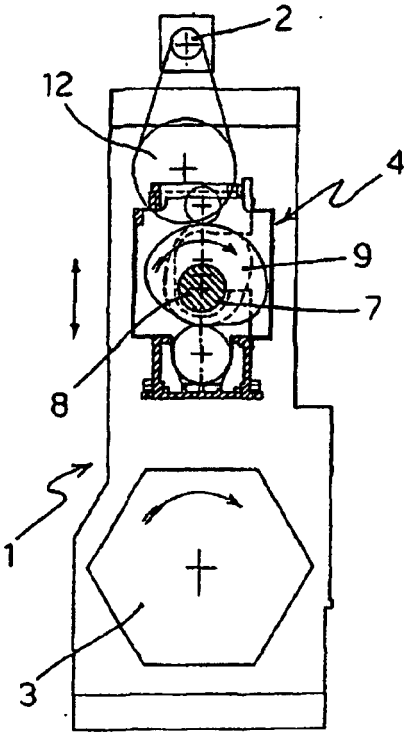

FIG. 1

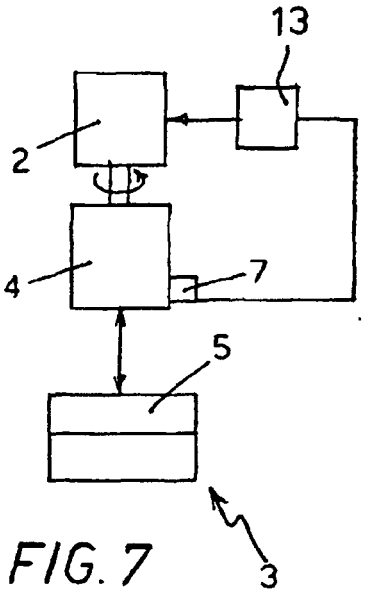

FIG. 7

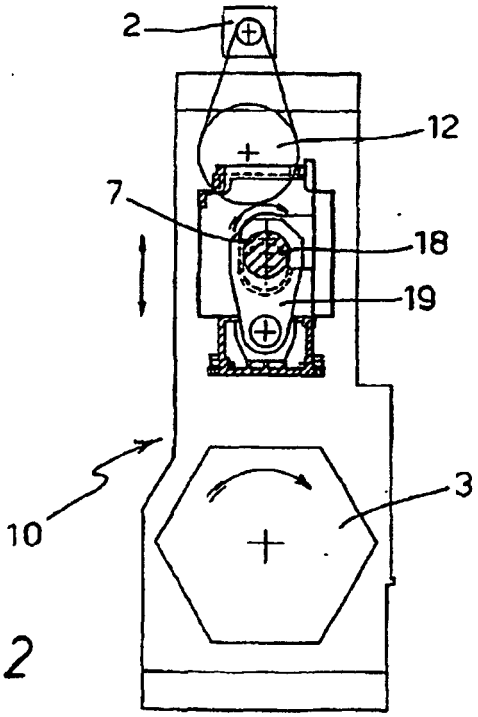

FIG. 2

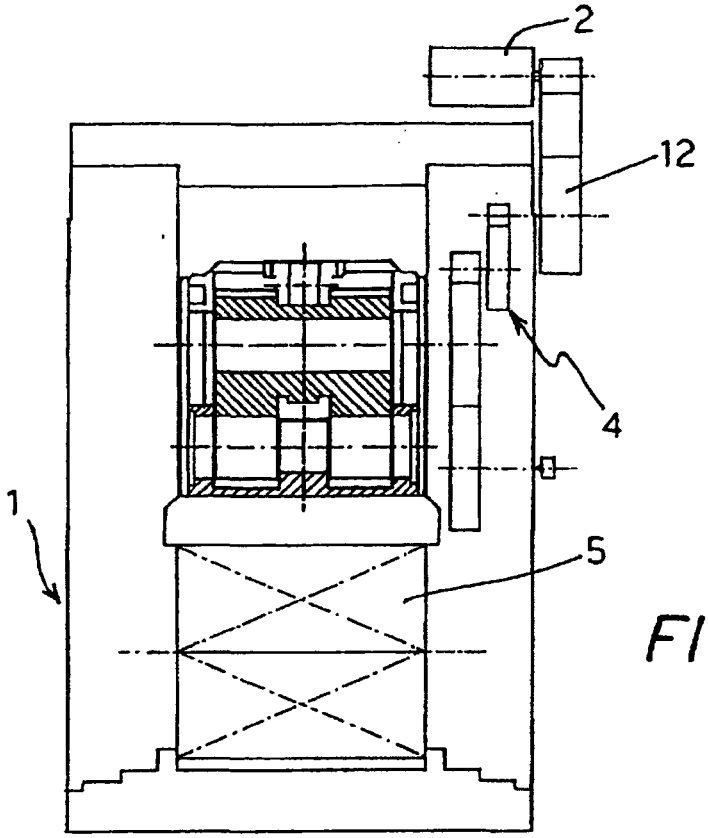

FIG. 3

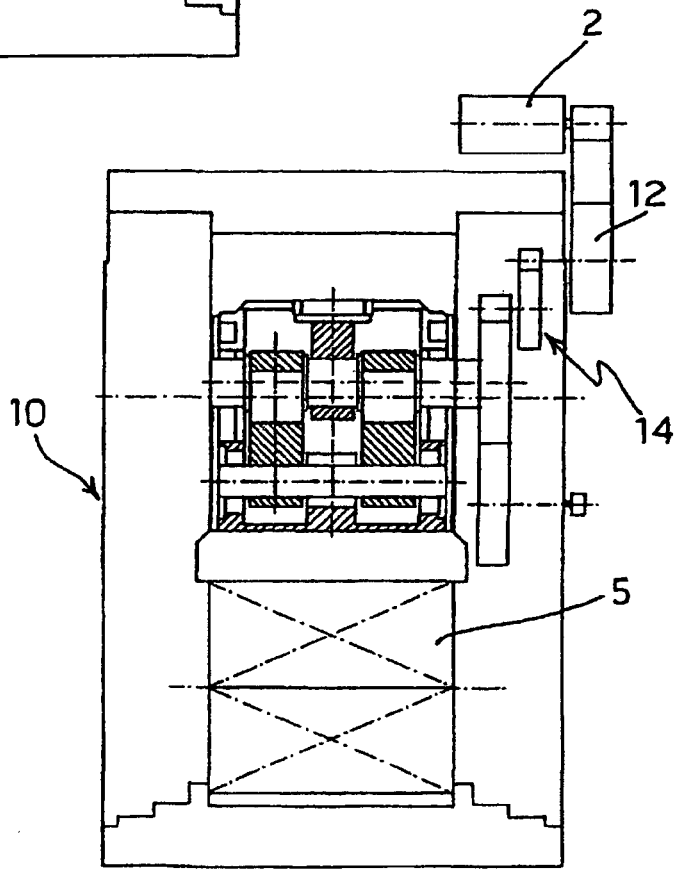

FIG. 4

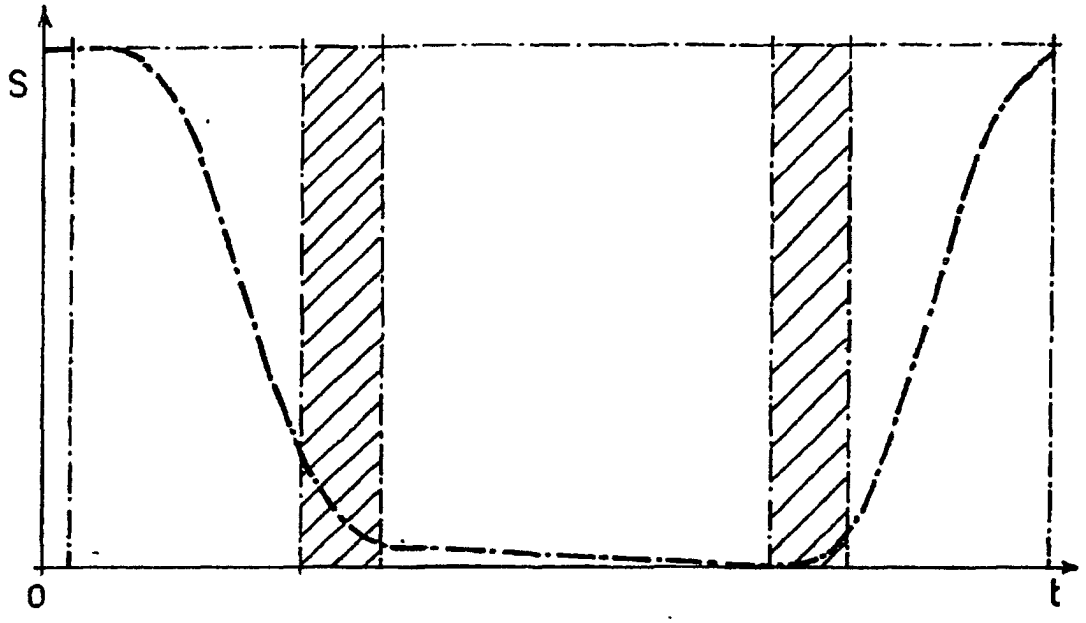

FIG. 5

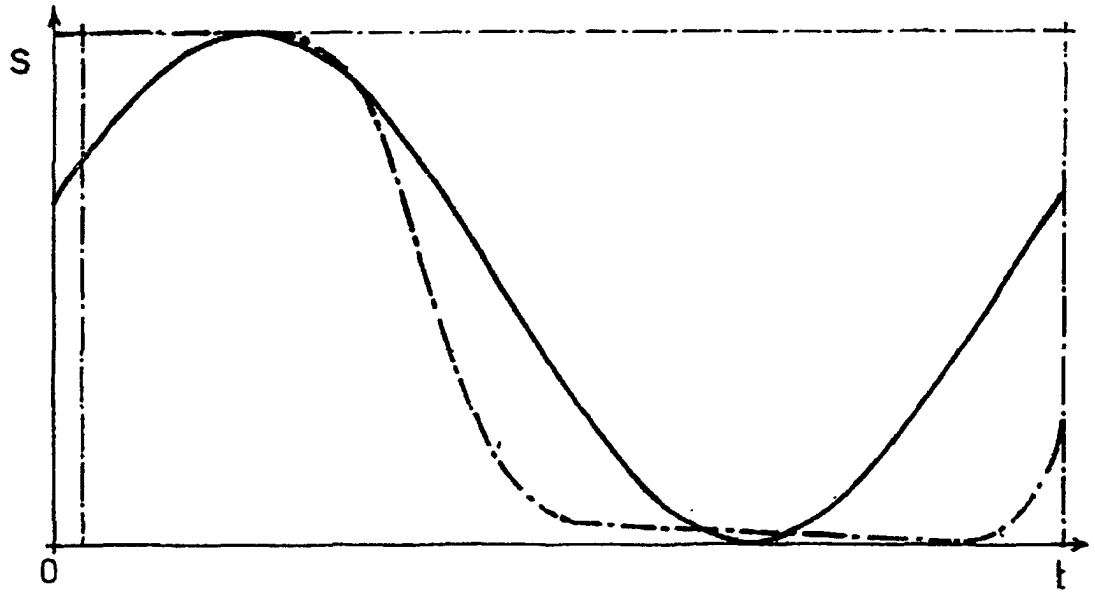

FIG. 6