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

(57) A press for moulding clay articles driven by an electric motor (2) wherein the means (13) for controlling the motor are adapted to change the rotation speed of the motor, by accelerating at the end of the moulding step and decelerating at the start of the moulding, so as to modify the moulding law of the press in accordance with a predetermined desired profile. The press is either a cam actuated press (9) or an eccentric-shaft (19), and the control of the speed of the electric motor (2), preferably a D.C. brushless motor, employs at least one encoder (7).

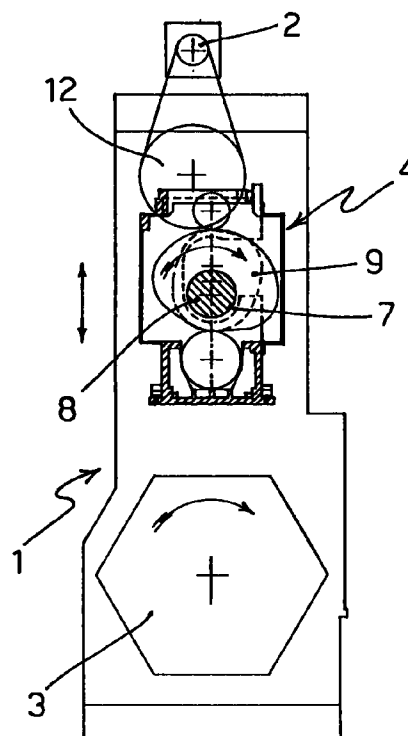


FIG. 1

Description

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).

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.

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.

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.

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.

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.

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

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 D.C. 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.

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.

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 opti-

mum curve, similar to that of a cam press.

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.

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.

With reference to Figs. 1 and 3, there is illustrated a press 1 of the cam-actuated type for moulding clay articles, such as tiles and the likes. 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.

Figs. 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.

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.

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.

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 greater speed during the inactive step, will decelerate 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.

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.

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.

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.

It is evident that the invention is not limited to the embodiments that have been described and illustrated, and that several modifications and further improvements can be made that fall within the scope of the invention.

Claims

1. A press (1, 1 $\emptyset$) for moulding clay manufactured articles, particularly tiles, comprising an electric motor (2), a mould (3) and 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), and a unit (13) to control the speed of said electric motor (2), characterized in that it provides at least one device (7) fitted to the shaft of the 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, to increase the rotation speed of said motor (2) when said half-mould (5) is being lifted, and to decrease it while said half-mould (5) is being lowered so as to reach a predetermined optimum speed when the mould starts the moulding of an article.
2. A press as claimed in claim 1, characterized in that said kinematic chain (4) comprises a cam (9).
3. A press as claimed in claim 2, characterized in that said means (7) for detecting the angular position comprises at least an encoder mounted to the shaft (9) of said cam (9) for detecting the angular position of said shaft.
4. A press as claimed in claim 1, characterized in that said kinematic chain (4) comprises an eccentric shaft (19).
5. A press as claimed in claim 4, characterized 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.
6. A press as claimed in preceding claims, characterized in that said electric motor (2) is a D.C. electric motor.
7. A press as claimed in preceding claims, characterized in that said electric motor (2) is of the "brushless" type.
8. A press as claimed in preceding claims, characterized in that said press (1, 1 $\emptyset$) is a barrel press.

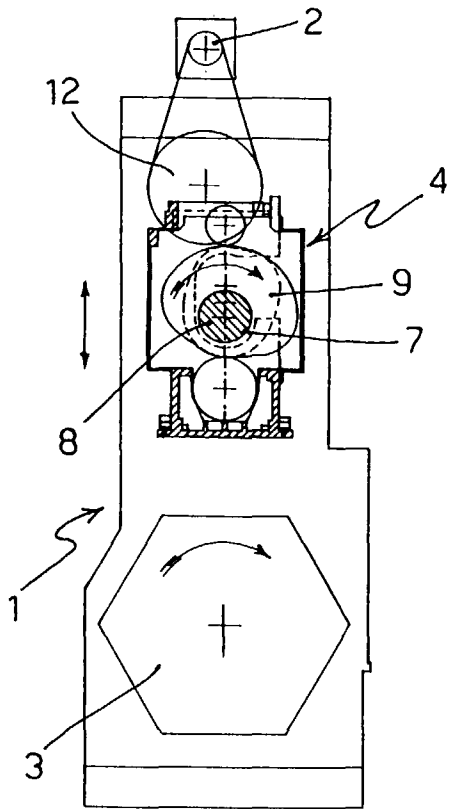


FIG. 1

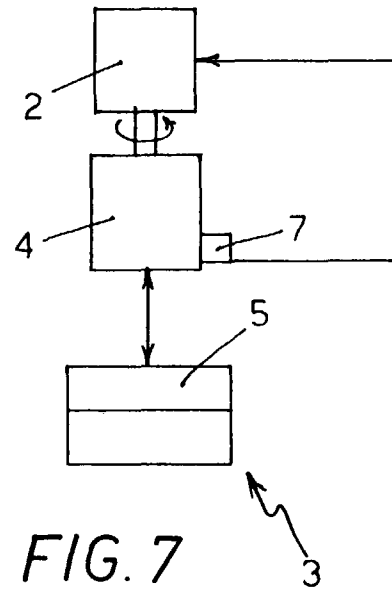


FIG. 7

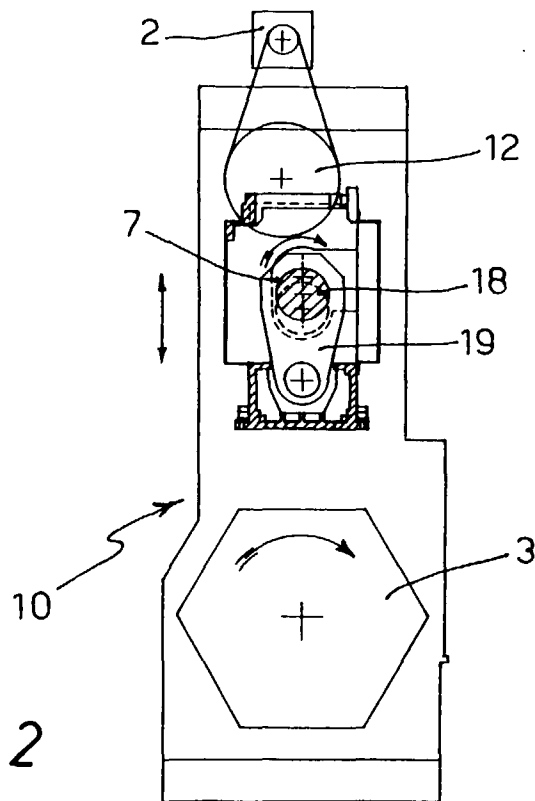
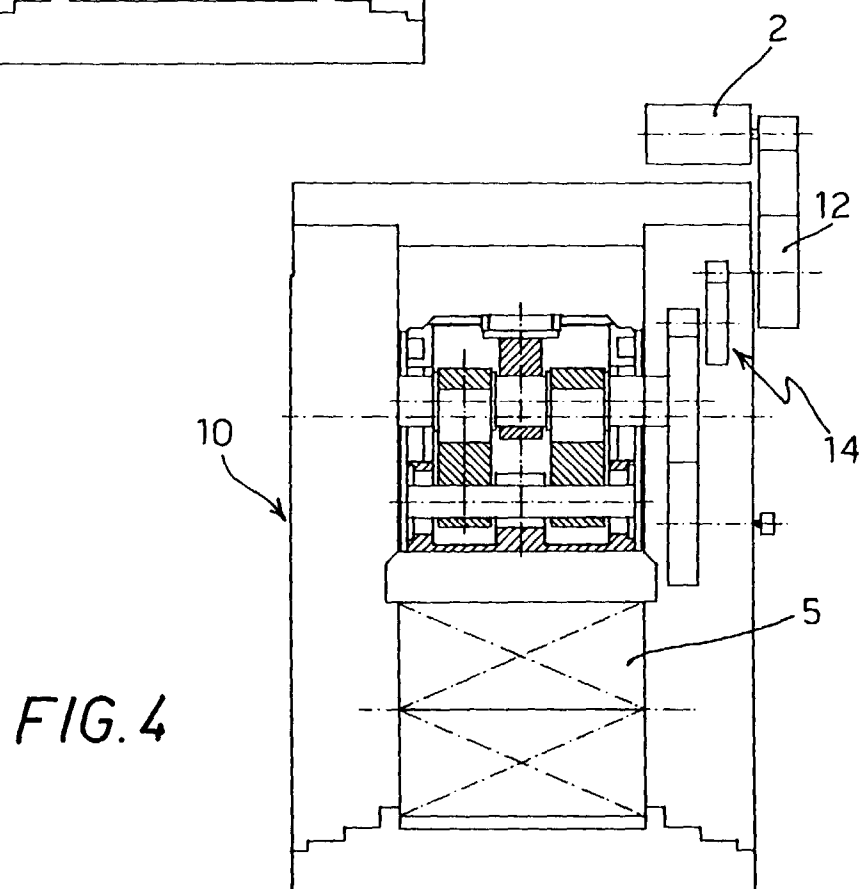
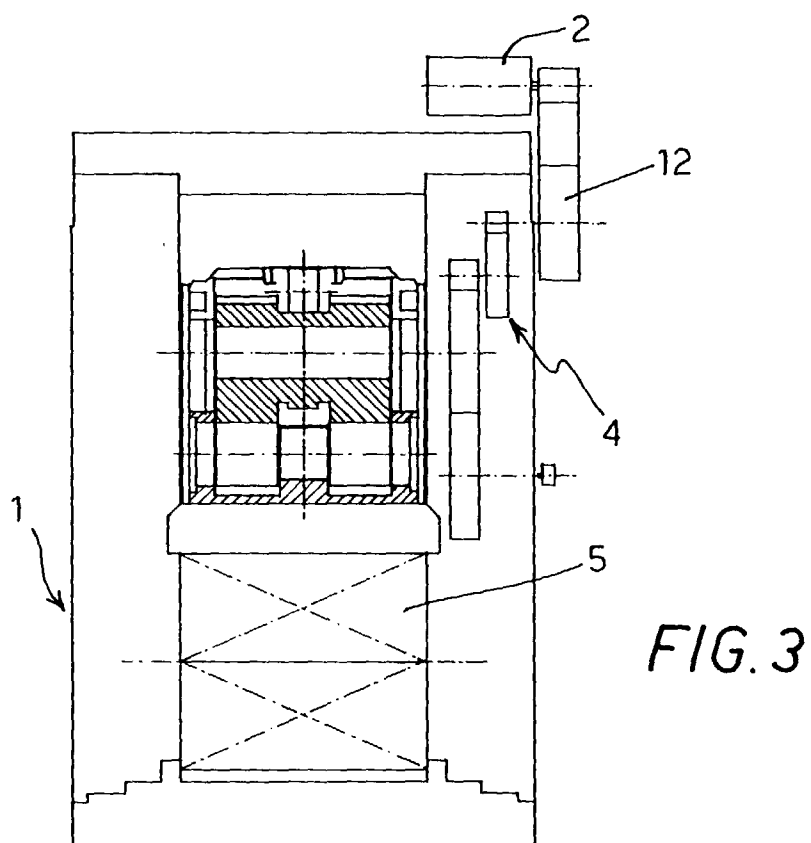


FIG. 2



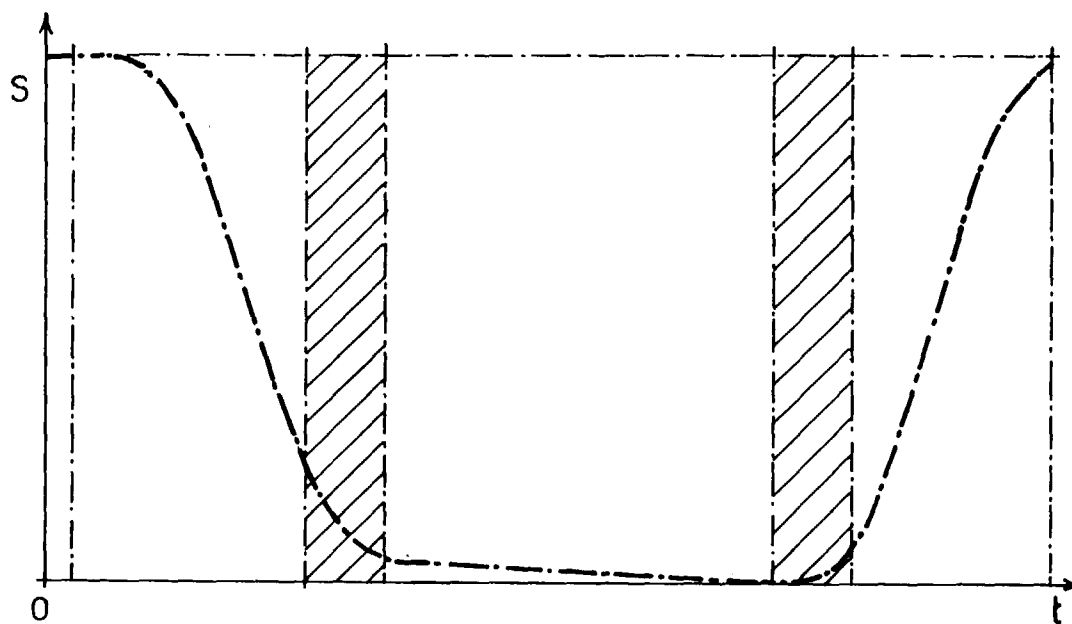


FIG. 5

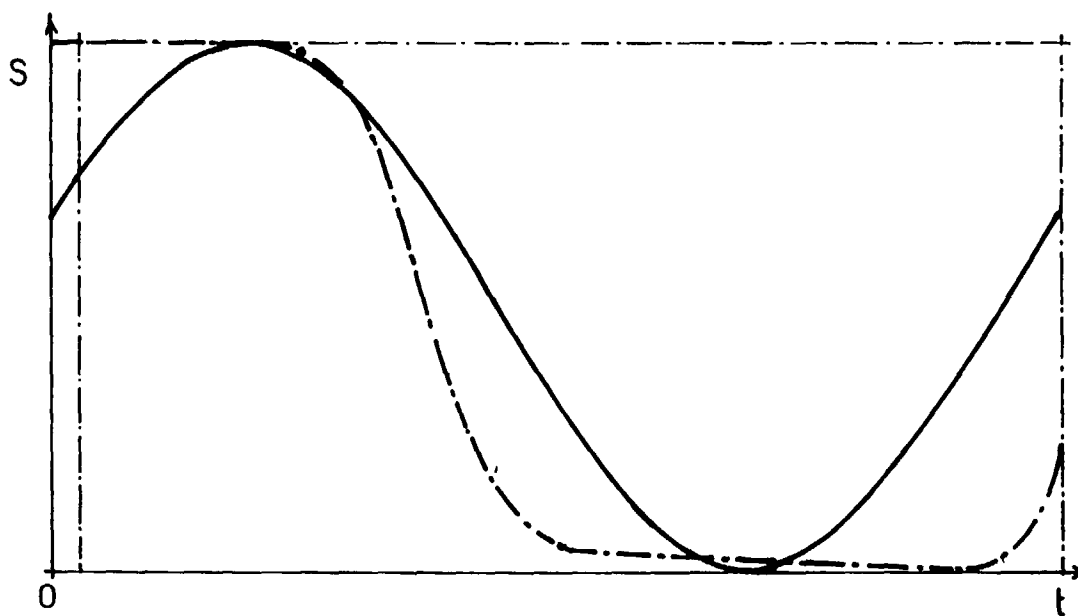


FIG. 6