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(54) System for automatic correction of the pressing density in the manufacture of tiles.

(57) The clay in the form of granular material or wet powder which is poured into a mold (4) is swept by different independent scrapers (2) connected to the feed slide (7) and capable of being situated at a different height with regard to the free edge of the mold (4) for the purpose of accepting a larger load in the squared portions (16) in which each tile (15) is imaginatively divided, which do not attain the density of the rest. These areas of a lesser density are detected by the density testing apparatus, which are known and wherein previously obtained portions of the tiles are treated with a distribution identical to the one referred to.

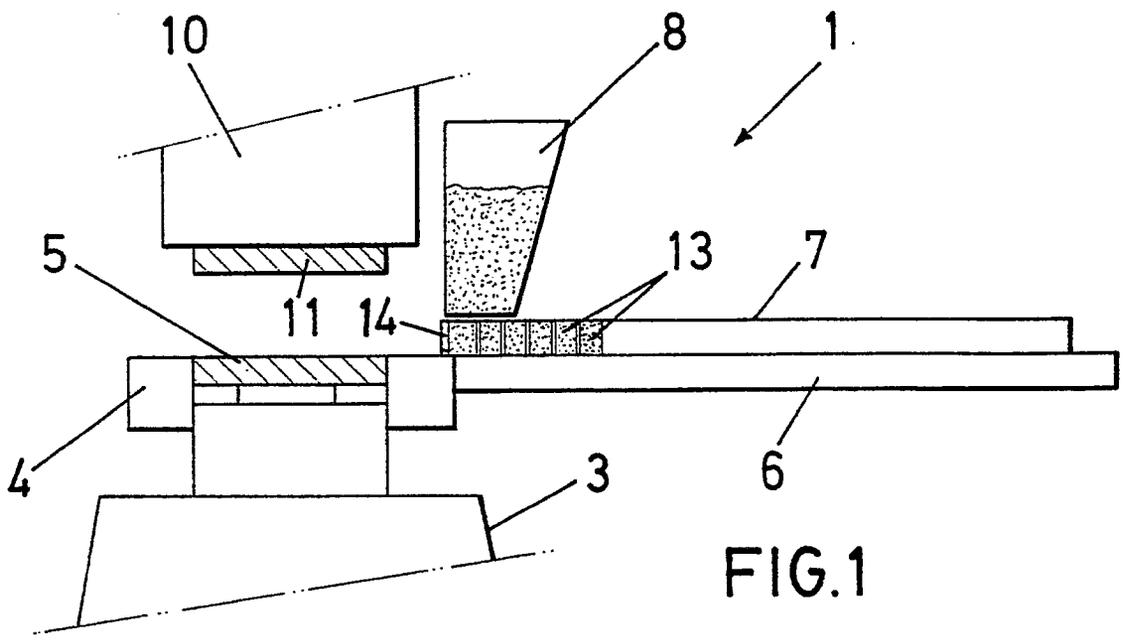

FIG.1

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OBJECT OF THE INVENTION

As is expressed in the title of this specification the present invention refers to a system for automatic correction of the pressing density in the manufacture of tiles.

In the ceramics industry it becomes necessary to test the density of tiles, in different points or areas of the same, after the pressing of the material they are made of, in presses defined for this purpose.

The importance of this control of density, lies in the fact that for the firing of the ceramic products it is necessary that the distribution of the density is homogeneous, since the following factors have a big influence: stress in the piece, porosity, absorption, mechanical resistance and shrinkage.

The fact that when the pressed pieces do not have the same density in their different areas, or in other words, pieces are not pressed homogeneously and have high differences of density, they are less resistant to the entire manufacturing process and especially to the drying and firing, is well known. These poorly pressed pieces have incorrect physical characteristics for applying enamel, as well as insufficient mechanical resistance and variations of size once the firing process has ended.

Different pressing control systems are presently known and used in the ceramics industry, such as the use of the penetrometer, or else, the one that establishes a control by selenium absorption, or submerging the piece in mercury.

Therefore, an object of the invention is attainment of automatic correction in pressing, the differences of density found in different areas of a ceramic tile, so that it is as uniform as possible.

BACKGROUND OF THE INVENTION

Presently, the pressing of the granular or wet powder ceramic product is done in presses which are comprised of a mold holder bed, the mold being prolonged into a platform upon which a slidable slide related to some screens which fill up with wet granular clay, contained in a hopper, rests.

The feed slide moves forward with its screens full of granular material until it is over the mold, where it will be subsequently compacted once a scraper bar connected to the slide cleans the surface of the mold so that the clay is leveled with the mouth of the mold.

This mold filling process is a dynamic process which is carried out at a high speed, since a press can operate at a rate of more than 20 pressings per minute. This means that the feed slide hardly has one second to effect its path forward to fill the mold and to return. When the granular material falls, this granular matter tends to fall horizontally forward and therefore falls according to the inertia of its mass in an inclined manner. The variables: speed of the slide, falling point of the plate that defines the bottom of the mold, height of the slide, separation and amount of screens between which the product to be pressed is situated, are used by the specialists in presses to obtain the most uniform possible filling though it is never obtained perfectly, since any variation of the granulometry or wetness of the clay, speed of the slide, or soiling of said screens, alter the filling conditions.

As a result of an irregular filling, neither can the formed tile be pressed homogeneously, therefore, it is denser in the points where the clay was the most concentrated.

Other factors also intervene in the variation of density of tiles, such as the ones defined by manufacturing defects of the compacting plates, with thicknesses which are not totally identical; the surface of the bed or movable transversal support can also have defects or maladjustments which entails unequal pressings. For this reason it is essential to supplement the plates with fine sheets in certain points to prevent pressing defects.

The above means that in the pressing process there are multiple interruptions in order to be able to make the corrections of the load and conditions of the mold, and due to the complexity of this work many hours of production are lost. The high maintenance cost of the specialized personnel must also be taken into account. This means that a certain percentage of defective production is almost always obtained, since it is impossible to correct presses as frequently as necessary.

DESCRIPTION OF THE INVENTION

In order to avoid the above cited problems, in accordance with the invention, the scraper bar that removed the excess material from the mold, during the return of the slide, is replaced by a support for a series of independent scrapers, whose height can be adjusted.

These independent scrapers coincide in their width with the theoretical bands which divide the piece into identical portions longitudinally to the movement of the slide. The position of these independent scrapers can also be detected, when they pass by theoretical transversal lines, with all of which a squared division of the piece is obtained. Precisely the number of identical squares into which the mold is imaginatively divided coincides with the cut portions in which one of the pressed

pieces, or a sampling thereof, is divided, in order to correctly effect the density control.

In this way, when one of the squares, or several of them, has (have) a smaller density upon effecting this control, a larger load of material may be given rise to so that, after compacting, the density is identical or very similar to that of the rest of the tile.

Each independent scraper is hung vertically and can move thus upon the slide moving back, those square portions of the piece that would have a qualitative and quantitative compacting defect have a larger amount of product placed in them. The electronic control of the tester, sends the information to the control of the slide so that the scrapers compensate for these defects, upon moving vertically during the return of the slide, occupying the highest position upon exceeding the squares of the mold where there would be the least compacting.

In order to make the understanding of the features of the invention easier and as an integral part of this specification, some sheets of drawings in whose figures the following has been represented in an illustrative and nonrestrictive manner are attached:

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1 to 4. They schematically represent different stages of the mold filling process and subsequent pressing of the product for the forming of ceramic tiles, as is done at the present time.

Figure 5. It is a schematic plan view of the slide of the press which holds the independent scrapers and whose height can be adjusted. With them the automatic correction of the pressing density is obtained.

Figure 6. It is a longitudinal raised view of what has been shown in figure 5.

Figure 7. It shows in rectangular coordinates the curve that represents the density values of the piece in the different squares into which the tile has been divided, longitudinally to the movement of the slide.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the numbering that is indicated in the above cited figures, we can see that the system for automatic correction of the pressing density in the manufacture of tiles is carried out by providing the press used at this time and generally referred to as no. 1 in figures 1 to 4 with a series of independent scrapers referred to as no. 2 in figures 5 and 6, with some features that we will explain later on and with which it is obtained that in those parts of the tile that after compacting have a density smaller than that of the rest of the tile more material is accepted so that after the pressing operation the density is uniform in the entire piece.

In the presses used nowadays to obtain ceramic tiles there is a bed 3 which supports the mold 4 and the bottom plate 5. The mold 4 is prolonged in accordance with a platform 6 upon which the feed slide 7 rests. Above this feed slide 7 there is the feed hopper which contains the wet granular clay (with a certain degree of wetness), which fills the space between the screens 9.

Above the mold 4 there is the transversal support 10 to which the top plates 11 fixed in its bottom surface are connected.

A single press can therefore include an aligned series of bottom plates 5, top plates 11 and screens 9 which are capable of being confronted so that they simultaneously form a repeated series of tiles 12, once the material which descends the transversal support 10 has been compacted.

With this arrangement, the feed slide 7 moves forward with its screens 9 full of wet granular material, until this screen is over the bottom plate 5. At a certain moment the bottom plate 5 moves downward to form a chamber that is to be filled with granular material 13 which falls by gravity and is drawn by the vacuum that the descent of the bottom plate 5 causes, as is clearly observed in figure 2. The slide 7 returns and since it has a scraper bar 14 it cleans the surface of the mold 4 leaving only the clay contained in it, leveling with the top edge of the mold.

Next the transversal support 10 of the press descends and the top plate 11 is inserted in the recess of the mold 4 in order to compress the granular material 13 and convert it into a tile 12.

Upon the transversal support 10 withdrawing, and the bottom plate 5 rising simultaneously, the tile 12 remains situated in such a way that it levels with the top edge of the mold. In another advance movement of the feed slide 7, the tile 12 is pushed forward and after this the bottom plate 5 drops again, repeating the pressing process in a way similar to the cited one, as is shown in these figures 1 to 4. In figure 1 the filling process starts; in figure 2 the slide has moved forward and the mold is filled with the product; in figure 3 the tile rises in order to be withdrawn with another advance of the slide, as is shown in figure 4.

Although with this present arrangement, the most uniform possible filling of the mold 4 can be attained, as we have said at the beginning of this specification, any variation of granulometry wetness, speed of the slide, soiling of the screens,

etc., appreciably modifies the filling conditions and therefore the density after pressing is not uniform.

In order to conduct a correct control of the density that an already pressed piece has, such as a square tile referred to as 15 in figure 5, it is cut into a certain number of equal parts, following longitudinal and transversals alignments. In this example shown in the drawings, the number of parts into which the tile 15 is divided is sixteen, forming a square of four by four individual portions, each one of which has been referred to as no. 16. In the case at hand, the ceramic piece 15 is ideally divided into this same number of portions 16, each one of which has to have the same density. Therefore it has means that can make it vary during the return stage of the feed slide 7, which we specify in detail hereinafter.

In order to obtain the aim sought by the invention, the feed slide 7 that had a continuous scraper bar 14 connected to it in order to level the granular material with the mold 4, during the return of the slide 7, now has this bar 14 alone as a support for a series of independent scrapers 2 (four in the case shown in figures 5 to 7) and has a length equivalent to the corresponding dimension of each one of the portions 16, as is clearly seen in figure 5 The bar 14 remains situated above the mold 4 so that it does not act as a scraper.

The independent scrapers 2 coincide in their width and position with the theoretical separation of piece 15 longitudinally, in other words, the end scrapers sweep the end longitudinal bands of piece 15 divided into sixteen portions, while the intermediate scrapers 2 sweep the respective center bands of piece 15 or recess of the mold 4. Each scraper 2 can move vertically with its corresponding cylinder head 17 that contains a valvular system and hydraulic piston for movement thereof, not represented in the figures as they are already known.

The advance and return of the feed slide 7 is achieved by means of a motor 18 to which the lever 19 whose free end holds a roller 20 which moves in a transversal groove 21 of said slide, is connected. During a complete rotation of the lever 19, the mold is filled and the screen 9 withdraws, starting another cycle in the following turn.

In order to locate when the slide 7 has its scrapers 2 over the transversal lines 22 of separation of the portions 16 of the tile 15, it has a detector of the angle corresponding to each one of these positions. The length of the independent scrapers 2 defines the longitudinal readings or those of the distance between the longitudinal lines 23 of the square of the tile 15.

Each cylinder head 17 contains a distance detector in order to also know the individual vertical position of each scraper, this position being automatically selected by the electronic control of the apparatus.

With this arrangement, when the density tester detects in each test, which of the squares or portions 16 of the tile 15, have a compacting defect, its electronic control sends to the control of slide 7 the information needed for the independent scrapers 2 to compensate for the difference observed, by vertical movements during the return of the slide, permitting a larger or smaller load of product in the detected area.

As is shown in the diagram of figure 7, if in the portions or squares 16 of a same alignment longitudinal to the movement, it is verified that there are different compacting densities, the scrapers 2 located in the corresponding longitudinal band, will have to rise or descend consequently. In figure 7 the different squares 16 indicated are under the dominion of the same scraper 2.

The corresponding scraper 2 will move vertically each time that the slide moves backward after having filled the mold 4, as is indicated in the curve 24 of this figure 7, rising in the squares with a density less than the stipulated one and descending in the ones with a greater density, proportionally. In this figure 7, portion 16 located on the left, taken as "zero", is the one with the greatest density and remains situated over the abscissa axis.

The more divisions 16 or squares are placed in each piece or tile 15, for the tester as well as for the press, all controlled with independent scrapers 2, the greater solution of adjustability of density will be attained. Of course, there is an interesting optimum, defined by the minium amount of squared portions 16 necessary for a required quality.

Claims

1.- System for automatic correction of the pressing density in the manufacture of tiles, whereby the load of the mold in different areas of the same is adjusted, prior to compacting, characterized because the load of the mold (4) with the clay in granular or wet powder form is carried out by means of different independent scrapers (2) of an adjustable height and which sweep longitudinal areas of the mold, controlling the position of the scrapers (2) over the transversal lines (22) that divide the mold into equal parts, by means of detectors of the angle formed by the lever (19) transmitting alternating advance and return movement of the feed slide (7) of the clay.

2.- System for automatic correction of the pressing density in the manufacture of tiles, according to claim 1, wherein each independent scraper (2) moves vertically and has a cylinder head (17) which contains the valve and hydraulic

piston for electronically adjusted movement thereof, as well as a distance detector with which the vertical position of the corresponding scraper is recognized.

3.- System for automatic correction of the pressing density in the manufacture of tiles, according to claim 2, wherein the electronic control is established in the compacting tester itself, whose electronic control sends the feed slide (7) control the information needed for the independent scrapers (2) to compensate the defects found in the different squared portions (16) into which a piece or tile (15) is divided.

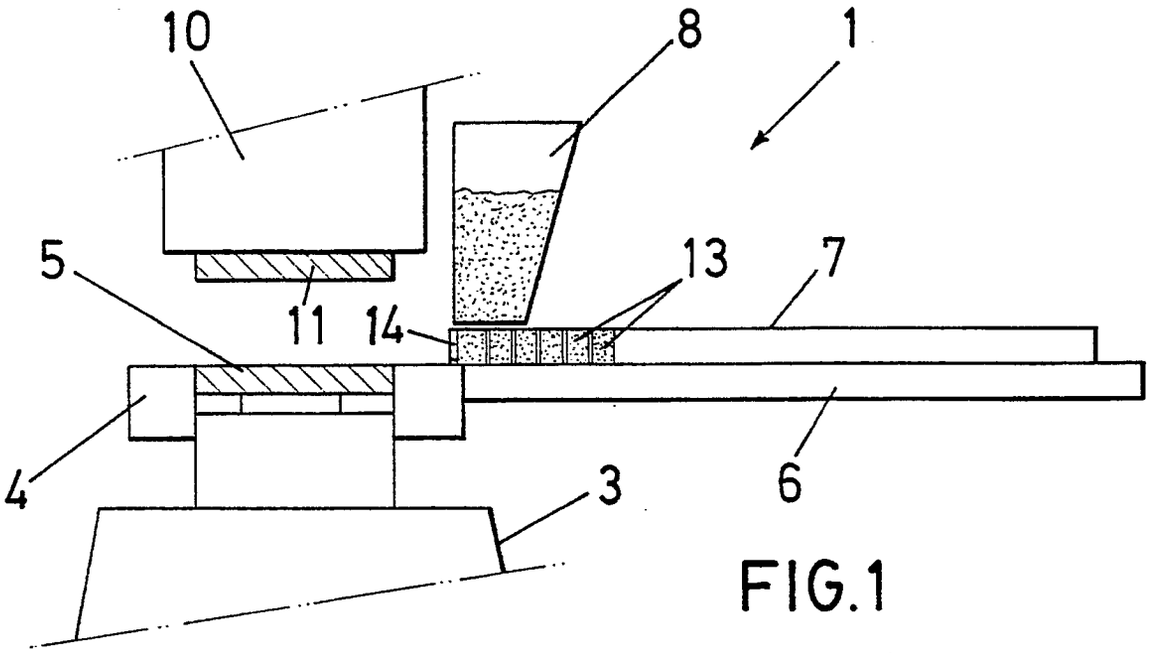

FIG.1

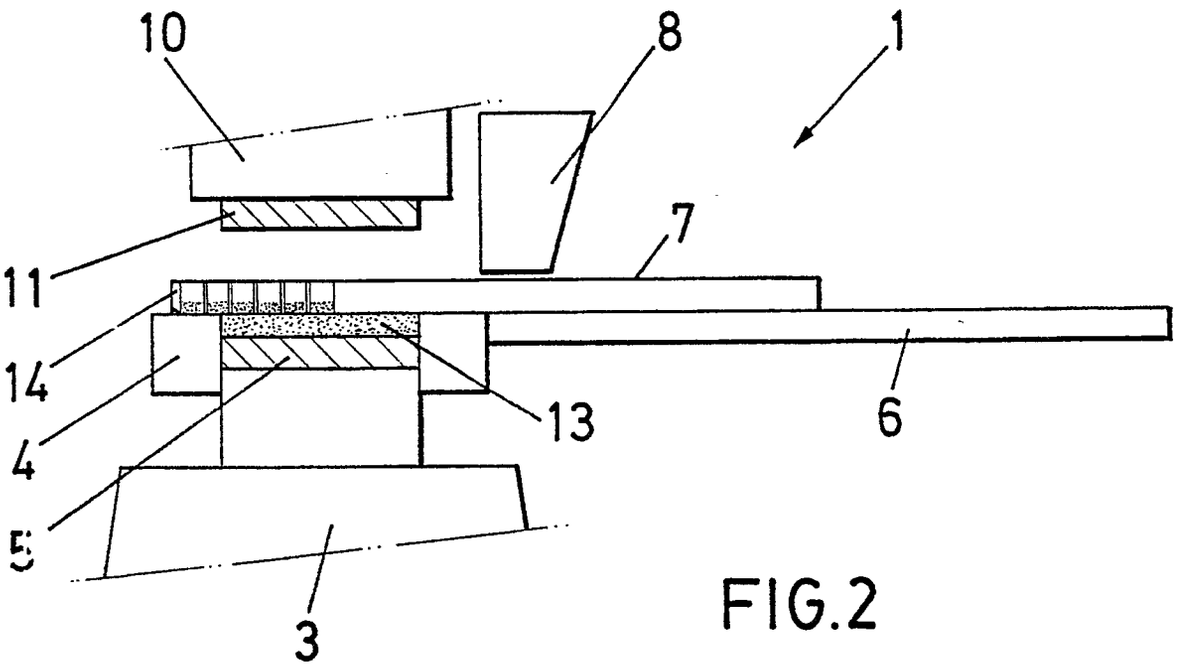

FIG.2

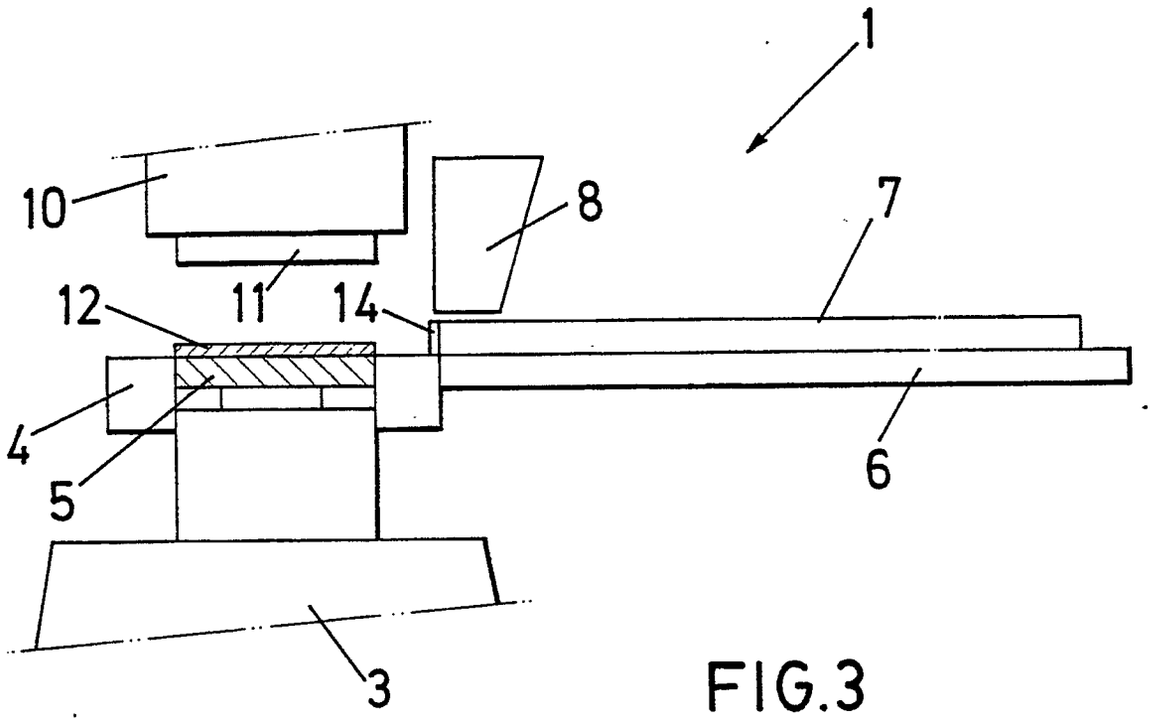

FIG.3

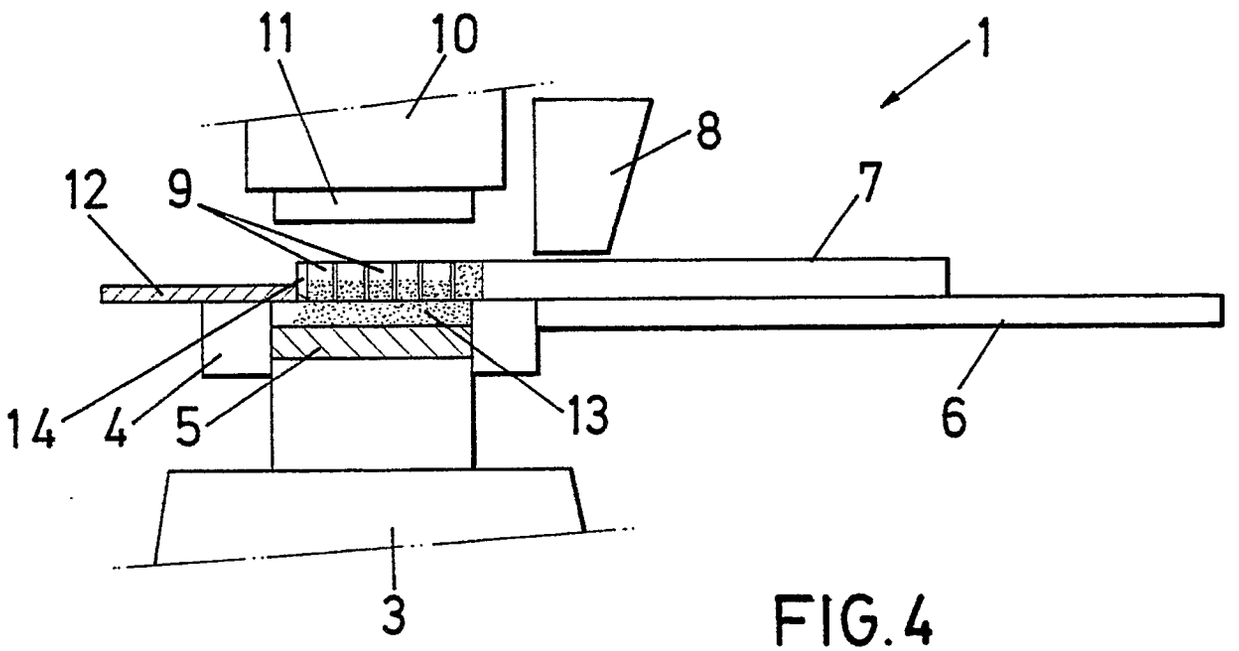

FIG.4

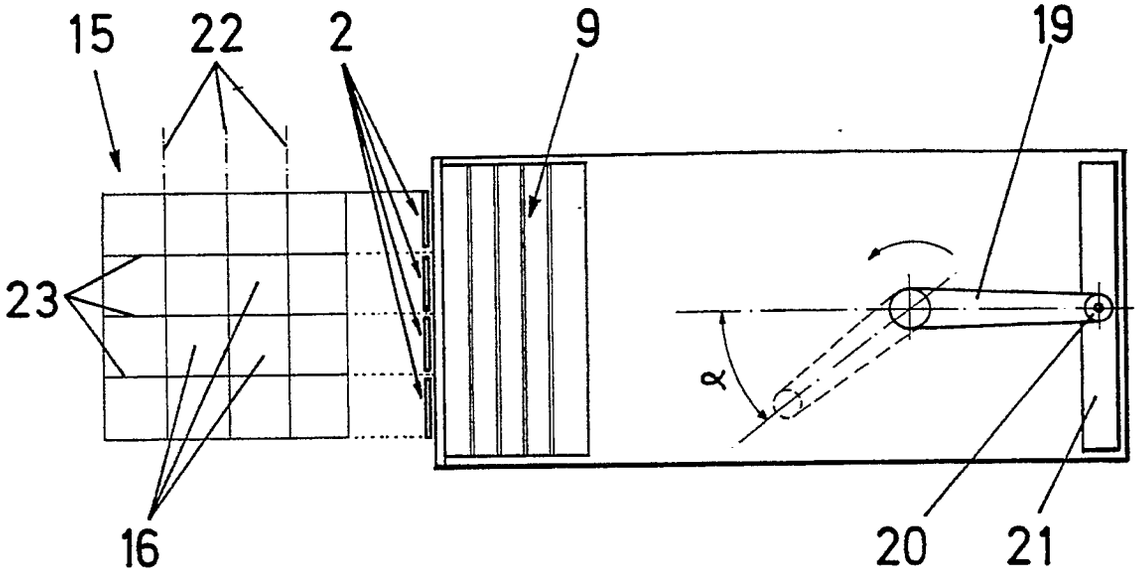

FIG.5

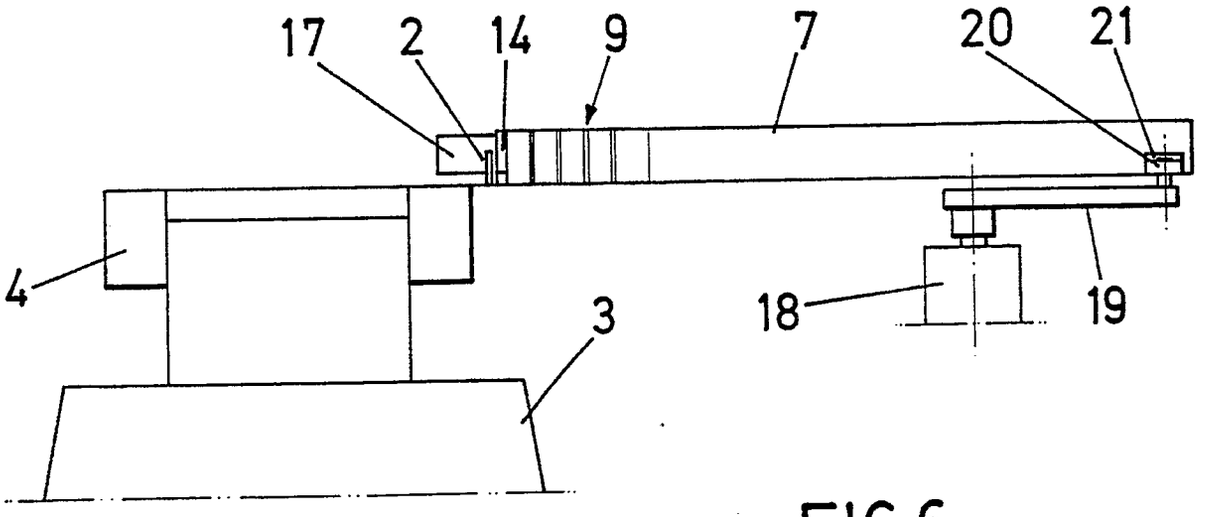

FIG.6

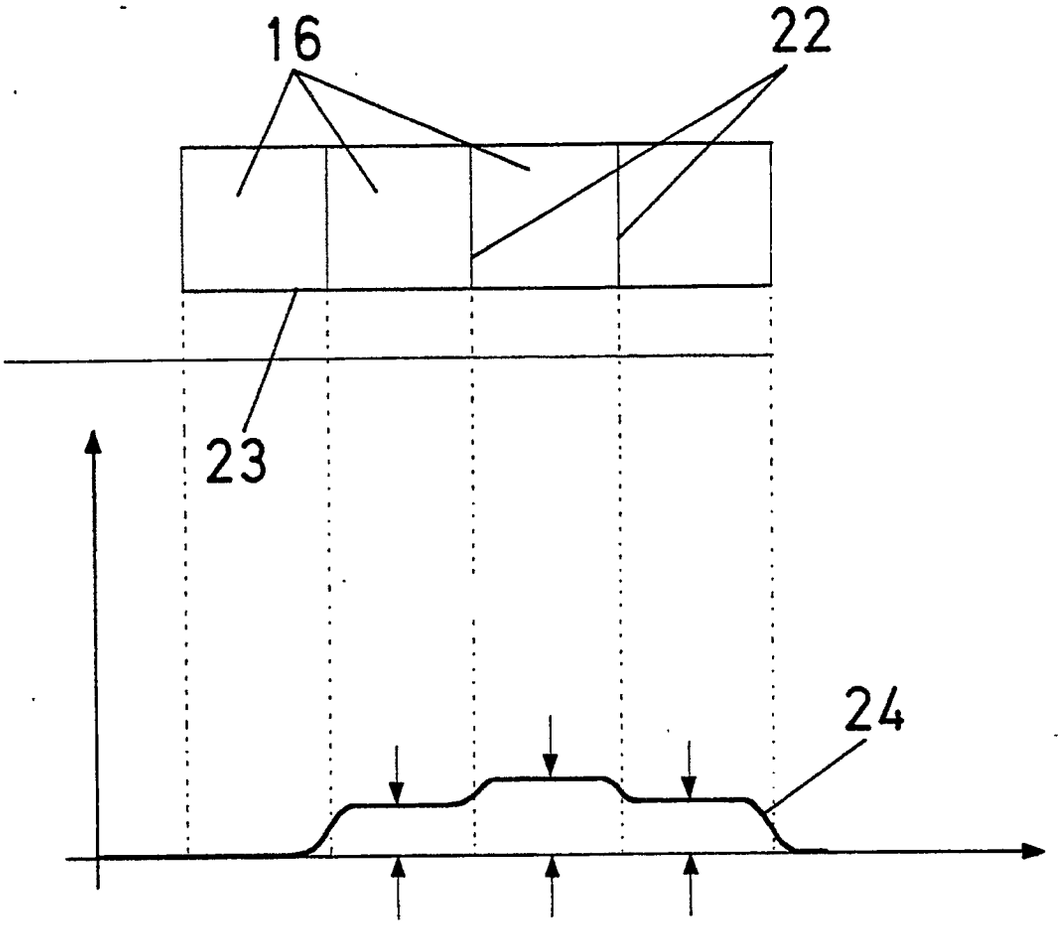

FIG.7