Feb. 18, 1941. E. I. LINDMAN 2,232,122

APPARATUS FOR DIVIDING SEMISOLID PLASTIC MATERIALS

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Fig. 1.

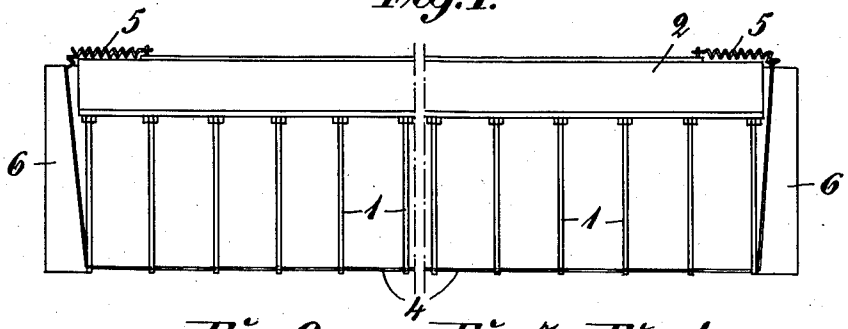


Fig. 2.

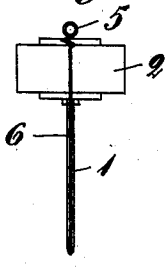


Fig. 3.

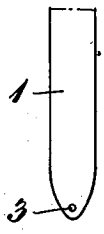
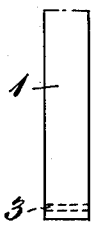


Fig. 4.



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APPARATUS FOR DIVIDING SEMISOLID PLASTIC MATERIALS

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In Sweden October 18, 1938

4 Claims. (Cl. 30—115)

This invention relates to process of and apparatus for dividing semisolid plastic materials; and it comprises a process of dividing partially set concrete and semisolid materials of like properties into blocks or other shapes, said process comprising punching at least one row of spaced holes through a slab or mass of such a material and simultaneously cutting said slab by means of a wire aligned with said holes, said wire being usually attached to the ends of the punching elements employed for producing said holes, whereby said punching elements and said wire cooperate to divide the mass and to shape the surface of the cut. The invention also includes a cutting apparatus, which can be employed for conducting the said process and which comprises a cutting head, at least one row of spaced cutting standards mounted in said cutting head at one of their ends and having their opposite ends bored, said standards having a length corresponding substantially to the thickness of the mass to be cut, a cutting wire supported by said standards and passing through said bores and means for holding said cutting wire taut during the cutting operation; all as more fully set forth and as claimed.

In the manufacture of blocks, slabs, etc., from aqueous self-hardening masses or similar masses which are hardened by heat-treatment, the common practice has previously been to either cast the mass in moulds of such dimensions that the objects have immediately received their final shape (compartment moulding), or to cast the mass in large units which, after sufficient hardening, have been divided into pieces having the desired shape and size by cutting with steel knife blades or heavy wires, supported at their ends only, or by means of fine wires which have been cast in the mass and subsequently pulled up, following which the pieces have been subjected to a final hardening in the air or by heat-treatment, e. g. by steam-curing in an autoclave.

The method of compartment moulding yields a product with a uniform and smooth surface, but this method suffers from many disadvantages among which the following may be mentioned. Casting in individual moulds makes it necessary to keep a large and expensive set of moulds. It is also less easy to adjust the size of the slabs to varying needs, since their dimensions are obviously determined by the dimensions of the moulding box or the compartments. Owing to the necessity for lubricating the walls of the moulds to prevent the mass from sticking it often happens that the mechanical strength of surfaces of the moulded slabs are reduced or else unfavorably affected by the action of the lubricants, e. g. in such a way that the adhesion of the mortar is impaired by the lubricants remaining on the surfaces.

Compared with compartment moulding the methods of cutting with knives or wires have the advantage that large and, consequently, simpler and cheaper moulding units may be used and that the manufacture is not dependent on certain fixed dimensions as is the case when individual casting in compartments or moulds is used, for which reason these methods make it easy to adjust production to the actual requirements for different dimensions. The methods of cutting with knives or heavy wires, however, also entail important disadvantages of a different nature. It has been found that surfaces produced by cutting with knives or heavy wires show a lower mechanical strength in the surface layer and unite less satisfactory with a plaster or mortar coating applied thereto than surfaces formed by compartment moulding. The lower mechanical resistance is due to the fact that the knife blades or heavy wires which, in order to have the necessary stiffness, must possess a certain thickness, destroy the structure in the surface layer when pressed through the mass owing to the shearing stresses produced and thereby considerably impair the mechanical strength of the surface layer of the hardened product. The inferior adhesion of mortar applied to surfaces produced by knife-cutting is due to the fact that the sliding of the knife blade along the cut produces a smooth surface owing to the thixotropic character of the mass. In other words, the product acquires a surface having properties inferior to those of the rest of the body. When a mortar of greater mechanical strength than the underlying material is united with a surface cut by a heavy wire or a knife and when this unit is subjected to shearing stresses, e. g. those produced by a severe temperature change, the mortar may be shorn loose either due to rupture in the surface layer, which has been previously damaged by the cutting operation or because the adhesion of the mortar is unsatisfactory. In the use of blocks and slabs of light weight concrete the mortar employed usually has a greater mechanical strength than the light weight concrete itself. It is in this case of great importance that the surface strength of the blocks and slabs, as well as their capacity for retaining the mortar, should not be impaired by

cutting with knives or heavy wires, which operation injures the surface layer, or by lubricants which have an unfavorable action on the surfaces formed by the walls of the mould, as is the case in compartment moulding. The destruction of the surface layer structure which results from a cutting operation with knives or heavy wires also lowers the resistance to frost; a fact of great importance in the case of exterior structures built of blocks or slabs of light weight concrete for heat insulating, for example.

In the method wherein fine wires are imbedded in the plastic mass and then subsequently pulled up for dividing the same when it has attained a suitable consistency, the main disadvantages of knife-cutting are eliminated, because these wires cut the mass practically without damaging it in the surface layer of the cut. This method of cutting, however, entails other disadvantages, such as an increased amount of manual labor and unsatisfactory precision in the moulding of the slabs. Greater precaution must also be exercised for preventing the wires stretched in the mould from becoming displaced during the casting of the mass. The practical disadvantages connected with this cutting method are in fact so great that it cannot be applied in commercial production.

The present invention possesses all the advantages of the previously known knife and wire cutting methods, with respect to ease of manipulation and high rate of production, while eliminating the disadvantages of these known methods. This result is attained by carrying out the cutting operation with a cutting device consisting of three or more rigid cutting standards and one or more relatively fine strings or cords stretched between them, these cords usually being very thin steel wires or thin steel bands, for example. This cutting device is pressed through the semisolid mass, whereby the surfaces of the cut are shaped by the combined action of the standards and the string stretched between them. The standards serve the double purpose of acting as supporting members for the cord as well as forming channels or grooves in the surfaces of the cut. This method of cutting thus yields surfaces which for their main part consist of areas produced by the wire-cut and for a smaller portion of the above-mentioned grooved sections produced by the standards. It has been found that these wire-cut surfaces, produced in accordance with this invention, possess a substantially higher strength than surfaces produced by cutting with knives or with the heavy wires of the prior art, and that the cut surfaces key to a mortar applied thereto much more firmly than to the smoother surfaces produced by compartment moulding or by knife cutting, for example. In addition it has been found that the grooves produced by the standards, when filled with mortar, produce a dowel action which materially increases the shearing strength and also the adhesion of the mortar to the light weight concrete material underneath. If desired, it is possible, by a suitable selection of the dimensions of the standards and their mutual distances, to produce a cut with such a surface and shape that the lower shearing strength of the light weight concrete and the higher shearing strength of the mortar will both be fully utilized.

The manufacturing advantages gained by the method of the present invention are quite obvious. The cutting operation can be conducted at least as quickly as this can be accomplished in the usual knife cutting method. It is possible to make the cuts one at a time or several parallel cuts can be made simultaneously. It is also possible within the present invention to complete the cutting in a single operation, that is, to make longitudinal and transverse cuts simultaneously. In addition it has been found that it is possible to divide the mass into the desired blocks, etc. at an earlier stage of the setting, when use is made of the method of the present invention, than is possible when the cutting is conducted with knives. The surfaces obtained are more suited to their purpose and have more uniform characteristics; they may also be easily adjusted to different needs, and a greater length of time is available for carrying out the cutting operation than when the cutting is conducted with knives. In this latter case the mass must be stiffer in order to prevent sticking to the knife blade and owing to the fact that the setting mass offers a greater resistance to the passage of the knife than to the passage of the fine wire used in the present invention, it is necessary to time the knife cutting much more carefully which is obviously a great disadvantage from a manufacturing point of view. The power consumption is also less in the process of the present invention than in the knife cutting method.

This invention may be described in somewhat more detail by reference to the accompanying drawing which shows, more or less diagrammatically, an illustrative cutting device within the present invention which has been found useful for conducting the present process. In this showing

Fig. 1 is a side elevation of a cutting device, provided with auxiliary cutting standards at both ends,

Fig. 2 is an end view with the auxiliary standards removed,

Fig. 3 is a detail, on an enlarged scale, of the end of one of the cutting standards, taken in the direction of the cutting wire, while

Fig. 4 is a similar view taken at right angles to that shown in Fig. 3.

In the various figures like parts are designated by like reference numerals. The cutting device shown in the figures comprises a number of standards or wire holders **1** arranged at suitable mutual distances and consisting e. g. of round steel bars, the standards being connected in a suitable manner to a cutting head **2** or equivalent frame construction. The length of the standards is adjusted to the depth of the mold or to the thickness of the moulded mass in the vertical direction, respectively, if the mould is cut in its horizontal position, so that the mass is cut through when the frame is in its lowered position. As the standards act as cutting members their lower ends are advantageously chisel-shaped, as shown in Figs. 3 and 4, and are provided with a hole **3** adapted to receive the steel wire **4**. This wire is stretched between the standards as shown and may be fastened by its ends to the cutting head **2**. This is preferably done with the aid of springs **5** by which the wire, which usually expands due to the chemical heat of the mass, may be kept taut during the cutting operation. In those cases wherein the cutting is carried out in moulds with fixed side walls, the ends of the cutting head are preferably provided with auxiliary cutting standards **6**, as shown in Fig. 1. These auxiliary standards may be secured to the cutting head by any suitable means. They serve as ex-

tensions to the cutting device and split up the mass adjacent the wall of the mould. In most cases the cutting operation is conducted on a mass which is sufficiently hard to remove the side walls of the mould before cutting, and the above mentioned auxiliary standards may then obviously be wholly dispensed with. The arrangement shown in the figures forms a fork-like device the points of which carry the cutting wire.

While the above description contains a disclosure of what are considered to be the best embodiments of the present invention, it is obvious, of course, that various modifications can be made in the specific procedures set forth and in the various devices described without departing from the purview of this invention. It is evident, for example, that several parallel rows of cutting standards may be mounted in a single cutting head in order that several spaced parallel cuts may be made simultaneously. It is also possible to provide a single cutting head with both longitudinal and transverse cutting wires and rows of standards in order to cut block-shaped pieces at a single cutting operation. The blocks cut in this fashion may be made of rectangular or diamond shape, for example. If desired, the standards of the cutting device may be spaced a distance apart which corresponds to the width of the blocks in order that holes may be punched only at the corners of the blocks but a closer spacing is more advantageous. The standards must, of course, be sufficiently close to properly support the wires and to prevent displacement or deformation of the same during the cutting operation. It has also been found that best results are produced when the spacing and the dimensions of the standards are so chosen that from about 70 to 97 per cent of the surface is cut by the wire while about 30 to 3 per cent is cut by the standards. If desired certain of the standards may be so positioned and shaped that they will shape the edges of the produced units while taking part in the cutting operations. The cutting head with its standards and cutting wires may be either suspended overhead in a crane carriage or similar device, from which it can be vertically lowered in order to cut through the mass by its own weight, or it may be pressed down and lifted, e. g. by means such as screwjacks or air- or oil-actuated pistons.

While the present invention is particularly adapted for use in the cutting of light weight concrete blocks, it is evident that the cutting device described can be employed in the cutting of various types of semi-solid materials. It is also evident that the process described may be conducted by devices other than those which have been specifically described. The auxiliary cutting standards are, of course, advantageously provided with sharp cutting edges. The cross section of these standards may correspond substantially to the cross section of wire-holding standards or they may have a thickness only sufficient to provide the necessary stiffness. Other modifications of this invention which fall within the scope of the following claims will be immediately evident to those skilled in this art.

What is claimed is:

1. An apparatus for cutting semisolid, plastic materials which comprises a cutting head, at least one row of spaced cutting standards secured in said cutting head at one of their ends, the other ends being chisel-shaped, and a wire stretched between and supported by said cutting standards adjacent said chisel-shaped ends.

2. The apparatus of claim 1 which includes means for holding said wire taut during the cutting operation.

3. The apparatus of claim 1 which includes auxiliary cutting standards mounted at the ends of said cutting head and aligned with said wire, said auxiliary standards being adapted to cut the edges of a molded plastic mass adjacent the mold.

4. An apparatus for cutting semisolid, plastic materials which comprises a cutting head, at least one row of spaced cutting standards having one of their ends mounted in said head, the other ends being provided with cutting edges and being bored with the bores being in alignment, a fine cutting wire passing through said bores and being supported by said standards, and springs mounted on said cutting head attached to the ends of said wire and adapted to keep said wire taut during the cutting operation.

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