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CLAY DRAIN TILE MANUFACTURE

Filed June 17, 1963

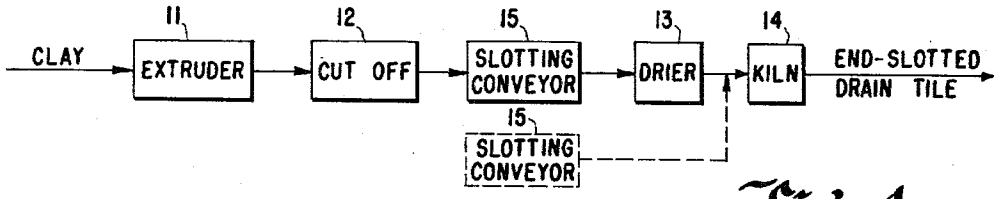


Fig. 1

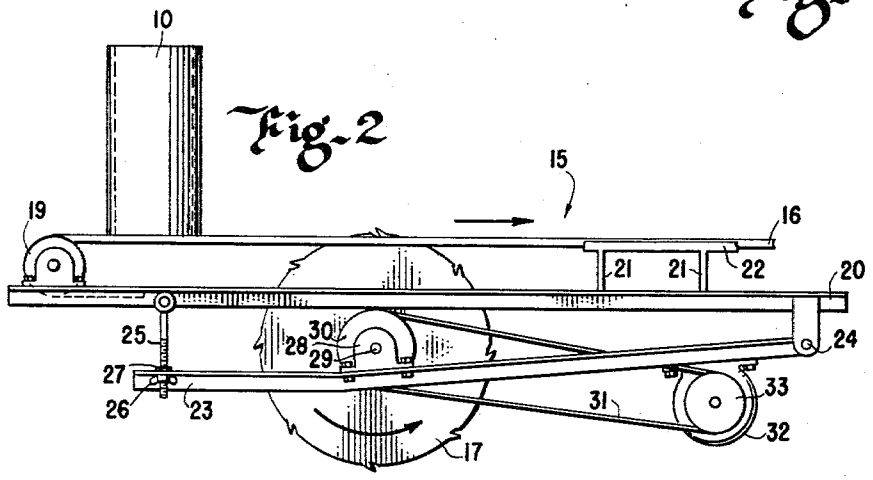


Fig. 2

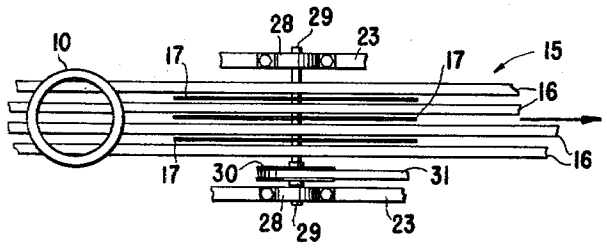


Fig. 3

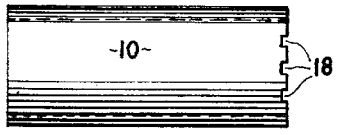


Fig. 4

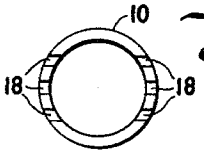


Fig. 5

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CLAY DRAIN TILE MANUFACTURE

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This invention relates to clay drain tiles and more particularly to a method for slotting or notching an end of each tile to provide openings for the admission of water into the tiles when they are butted tight.

Heretofore, clay drain tiles have been spaced in a line by hand to allow water to run into the tiles. This procedure was necessary because the prior drain tiles were not slotted at their ends and all known machines for laying tiles place the tiles in the ground butted tightly together.

It was discovered more than three hundred years ago that wet farm land could produce greater crops if the excess water were removed by tile drainage. This discovery was promptly but to profitable use and through the years more and more tile drainage systems were installed. Today, tile drainage is a major soil conservation practice. Because it increases yields, creates new productive acreage, and permits better soil conservation practices, a good drainage system of hard-burned, durable clay drain tile is one of the safest money-making investments a landowner can make. Many soils are acid or alkali, and clay drain tile is the only commonly used drain tile not deteriorated by such soil conditions. Also, clay drain tile has a very small rate of expansion due to changes of temperature and moisture. Clay drain tile was used in the first tile drainage system installed in United States and it is still serving perfectly.

The excess water enters the tile line at the juxtaposed ends of the tiles and not through the individual tile walls. Since there is no known machine which will lay the tiles in spaced-apart positions, it is the usual practice to space the unslotted clay tiles of the prior art by hand. Hand labor of this type is undesirable under modern economic conditions. It has been discovered that if the prior clay drain tiles are slotted each at one end they can be laid in the ground butted tight by tile laying machines and the water will enter the tile line through the slots. This procedure eliminates the need for hand-spacing of the tiles, produces a tile line that functions normally, and still produces tiles which can be handled throughout the manufacture of the tiles in a normal manner. For example, end-slotted tiles can be stacked on end in a kiln and hard-burned in the conventional manner.

Such discovery of the desirability of end-slotting the tiles led to the problem of how to slot or notch the tiles in an economic manner. Clay drain tiles are delivered at a price of around only twenty dollars a ton and any change in the conventional process of their manufacture must add little or nothing to the cost of manufacture to be practicable.

Accordingly, the objects of this invention are to improve clay drain tiles by slotting or notching their ends and to provide a method for end-slotting or end-notching such tiles which adds little or nothing to their normal cost of manufacture.

One embodiment of this invention enabling the realization of these objects is a method of end-slotting or end-notching clay drain tiles while they are being conveyed preferably between a conventional green-tile cut off machine and a conventional drier. It is the usual practice to carry the green tiles from such cut off machine to such drier on a conveyor and, hence, slotting the tiles at this point in their manufacture adds nothing to their manufacturing cost, except for the cost of the slotting equipment which has a nominal cost. The tiles, also, can be slotted after they are dried but before they are burned in a kiln.

The tiles to be slotted are stood upright upon a conveyor consisting of several relatively narrow parallel belts. As each tile is carried along it passes over a series of cutters which extend upward between the narrow belts and which cut slots in the bottom end of each tile.

In accordance with the above, one feature of this invention resides in producing clay tiles which are end-notched in such a way that they can be stacked on end one above the other in the usual manner for firing.

Another feature resides in providing clay tiles which are suitable for mechanical laying. Even though laid butted together, water enters the tile line through the notches, i.e., the notches insure the proper functioning of the drain tiles when laid in ordinary clay soil.

Still another feature resides in notching the clay tiles while they are being conveyed in such a manner that little or no cost is added to the usual cost of manufacture.

The above and other objects and features of this invention will be appreciated more fully from the following detailed description when read with reference to the accompanying drawing wherein:

FIG. 1 is a block diagram showing a conventional method for making clay drain tiles modified by the incorporation of a tile slotting step at one of either of two places in the process;

FIG. 2 is an enlarged, fragmentary, side elevational view of the slotting conveyor shown in block form in FIG. 1;

FIG. 3 is a fragmentary, plan view of the conveyor shown in FIG. 2;

FIG. 4 is a side elevational view of an end-slotted or end-notched clay drain tile produced by the slotting conveyor shown in FIGS. 2 and 3; and

FIG. 5 is an end elevational view of the tile shown in FIG. 4.

Referring to the drawings, end-slotted clay drain tiles, one of which is shown in FIGS. 2 and 3 prior to being end slotted or notched and identified by the numeral 10 and one of which is shown after being end slotted or notched in FIGS. 4 and 5, are made from wet clay extruded from any suitable extrusion apparatus 11, such as an ordinary auger brick machine. The clay is extruded in the form of a firm cylindrical column which is easily cut and which has substantially the required hollow cross section (the column may be flat-sided instead of being in the form of a cylinder). Green tiles each about twelve inches long are cut from the clay column in a cut off machine 12. The above steps of extrusion and cut off are conventional in the usual practice of making clay drain tiles.

Heretofore after being cut off, the green tiles were placed upon a single wide endless conveyor belt and carried to a drier 13. The green tiles were removed by hand from the conveyor belt and placed on a four-wheeled car which was guided on tracks into the drier 13. The green tiles were dried for forty-eight hours and then were removed from the car and stacked in a kiln 14 and burned. The above steps of drying and burning which are conventional in the usual practice of making clay drain tiles are used in an unchanged form in making the end-slotted drain tiles of the invention. The new step in the process of the invention is slotting one end of each of the tiles while they are being conveyed. Prior clay drain tiles were not slotted. After the tiles are removed from the drier 13 they have the consistency of dried clay. The dried tiles are stacked on end one above the other eleven high in the kiln 14. The tem-

perature then is raised in the kiln 14 to 1900 degrees F. over a period of one and one-half days and then the temperature is held at 1900 degrees F. for another day to form durable, hard-burned tile. Because the tiles soften in the kiln, lugs or bumps around the ends of the stacked tiles would crush. Accordingly, although there has been a need for clay tiles which can be laid butted tightly together for many years, the fact that the tiles soften in the kiln has prevented the problem from being solved by providing such lugs or bumps on the ends of the tiles to provide openings for the admission of water into the tile line when the tiles are butted tight.

As indicated above, the method and the structures shown in FIG. 1 are old except for the substitution of a slotting conveyor 15 in place of the above single wide endless conveyor belt. Since it is the usual practice to stand the green tiles 10 upright on a conveyor belt running between the cut off machine 12 and the drier 13, slotting or notching the green tiles automatically while they are being conveyed between the cut off machine 12 and the drier 13 by the slotting conveyor 15 adds nothing to the normal cost of manufacture except for the small cost of the slotting conveyor 15. Alternatively although not preferred, the dried tiles 10 can be carried from the drier 13 to the kiln 14 on the slotting conveyor 15 which as indicated in broken lines in FIG. 1 can be located between the drier 13 and the kiln 14.

The tiles 10 are notched by sawing or milling notches in one end of each tile. As indicated above, the preferred point for performing the sawing or milling operation is the point immediately following the cutting of the continuous cylinder into twelve inch lengths. This is the preferred point because it is now customary to stand each green tile, immediately after it is cut off, in an upright position on a belt conveyor. Hence, automatically slotting the tiles at this point in the process adds nothing to the labor cost of the prior method, yet a superior product is obtained, i.e., one that can be laid mechanically. The tiles 10 are notched automatically while they are being conveyed on the slotting conveyor 15 which includes four relatively narrow V-belts 16 instead of the single wide belt heretofore used. As each tile 10 is carried along in an upright position on the four parallel belts 16, it passes over three rotary carbide tipped saws 17 which extend upward between the narrow belts and which cut notches 18 in the bottom end of each tile 10. The cutters each may consist of a milling cutter or a saw blade which travels back and forth laterally of the tile so as to produce a relatively wide notch. In actual practice, the notches 18 are about one-eighth inch deep and one-half inch wide. As indicated above, it also is possible to cut the notches 18 in each tile 10 after it is dried and before it is fired. One of the features resides in notching the clay tiles while they are being conveyed in such a manner that little or no cost is added to the usual cost of manufacture.

The notches 18 which are cut in one end of each of the tiles are important to insure the proper functioning of the drain tiles when laid in ordinary clay soil. Heretofore, it has been necessary to lay ordinary unnotched tile in such soil with a small space between adjacent tiles. Such a small space can be provided when the tile is laid in a ditch by hand. The most modern practice, however, is to lay the tiles mechanically, and in laying the tiles mechanically it is much more convenient to butt the tiles. There is no convenient way of laying tile mechanically with a space between adjacent tile. The notches 18 provide openings for the admission of water into the tiles when they are butted tight after being laid mechanically, i.e., the slotted end of one tile is butted tight against the unslotted end of the next tile in the line. One of the features resides in providing clay tiles which are suitable for mechanical laying.

The four parallel belts 16 each is driven by a driving

sheave (not shown) and each runs around an idler 19, there being a driving sheave and an idler 19 for each belt 16. The upper runs of the belts 16 move in the direction indicated by the straight arrow in FIG. 2. The driving sheaves and the idlers 19 are mounted for rotation on a stationary frame 20 which also supports a series of posts 21 that carry supporting guides 22 in which the upper runs of the belts 16 slide, there being one elongated guide 22 for each of the belts 16. The stationary frame 20 also carries a flat-bottomed, U-shaped frame 23 which is pivoted at 24 at one end and which is connected by means of two bolts 25 and two wing nuts 26 to the stationary frame 20 (only one bolt 25 and nut 26 are shown). Lock nuts 27 (only one shown) hold the frame 23 in its adjusted position, the end of the frame 23 at the bolts 25 being adjustable up and down to adjust the depth of the cuts in the tiles 10 made by the saw wheels 17.

The U-shaped frame 23 carries two bearing blocks 28 in which a shaft 29 is journaled, the shaft 29 having mounted thereon the three carbide tipped saw wheels 17, that extend upward between the narrow belts 16, and a pulley 30 around which a belt 31 runs. The U-shaped frame 23 also carries a motor 32 which drives a sheave 33 that in turn drives the belt 31. Hence, the motor 32 drives the saw wheels 17 through the belt 31, the direction of saw rotation being indicated by the curved arrow in FIG. 2.

In operation, the green tiles 10 are stood, immediately after they are cut by the cut off machine 12, in upright positions on the four narrow belts 16 which form a conveyor. No guides or hold downs are needed for the tiles 10 to be notched because of their great weight (about eight pounds each). As each tile 10 is carried along in an upright position on the four parallel belts 16, it passes over the three saw wheels 17 which cut the notches 18 in the bottom end of each tile 10. The saw wheels 17 are thin relative to the width of the desired notches, the saw wheels traveling back and forth laterally of the tiles so as to produce a relatively wide notch. This motion is attained by making the saw wheels 17 wobble (dado mounting). However, non-wobbling saw wheels can be used if wider saw wheels are used. It also is possible to cut the notches 18 in each tile 10 after it is dried and before it is fired. The notches 18 do not interfere with stacking the tile on end one on top of the other in the kiln 14. One of the features resides in producing clay tiles which are end-notched in such a way that they can be stacked on end one above the other in the usual manner for firing.

It is to be understood that the above description is illustrative of this invention and that various modifications thereof can be utilized without departing from its spirit and scope.

Having described the invention, we claim:

1. A method for making end-notched clay drain tiles comprising the steps of standing the tiles before they are fired in upright unrestrained positions on a plurality of relatively narrow parallel conveyor belts, notching the bottom terminal end of each tile while it is being conveyed in upright unrestrained position by carrying the tiles on the conveyor belts over a series of rotating saws extending upwardly between the narrow belts, and carrying the tiles on the conveyor belts to a remote position.

2. A method for making end-notched clay drain tiles comprising the steps of extruding clay in the form of a hollow column, cutting green tiles from the hollow column, standing the green tiles in upright unrestrained positions on a plurality of relatively narrow parallel conveyor belts, and notching the bottom terminal end of each tile while it is being conveyed by carrying the green tiles in upright unrestrained position on the conveyor belts over a series or rotating saws extending upwardly between the narrow belts.

3. A method for making end-notched clay drain tiles comprising the steps of drying green tiles, standing the dried tiles in upright unrestrained positions on a plurality of relatively narrow parallel conveyor belts, notching the bottom terminal end of each tile while it is being conveyed by carrying the tiles in upright unrestrained positions on the conveyor belts over a series of rotating saws extending upwardly between the narrow belts, and stacking the end-notched dried tiles on end one above the other in a kiln to be fired.

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