Apr. 10, 1923.

1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921

12 sheets-sheet 1

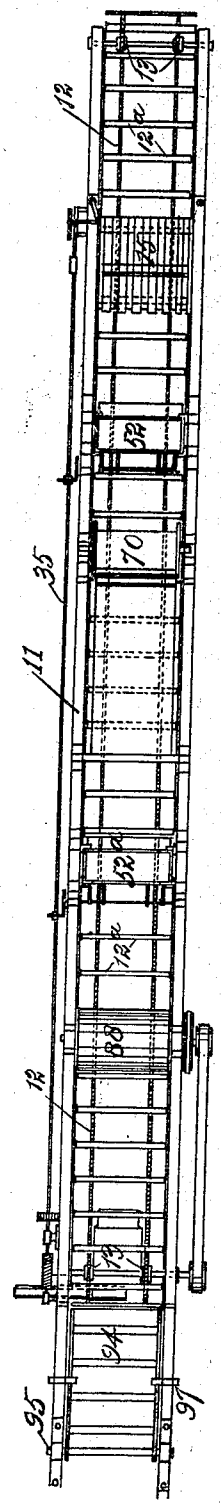


Fig. 1.

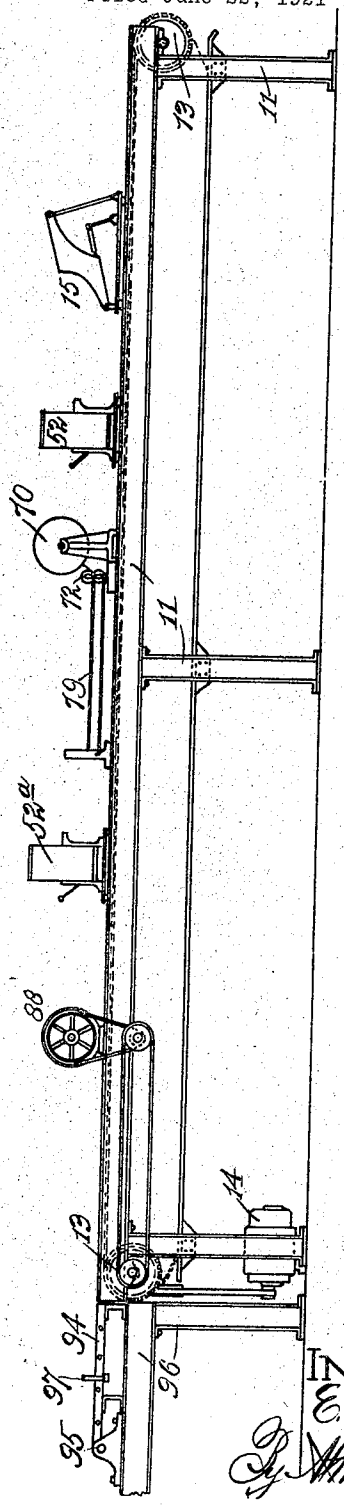


Fig. 2.

INVENTOR;
E. L. Loudenslager,
By Wm. Hall Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 2

FIG. 3

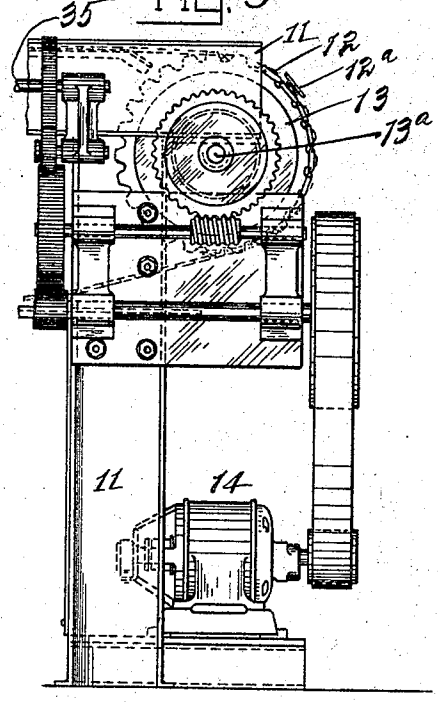


FIG. 4

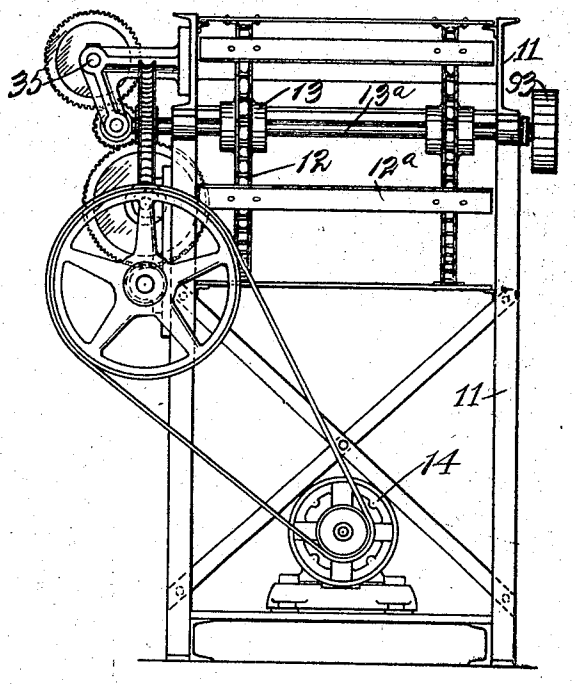


FIG. 5.

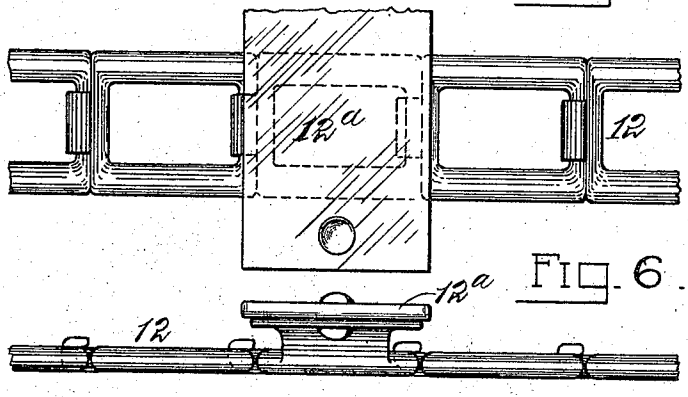


FIG. 6.

INVENTOR:
E. L. Loudenslager,
By Hmon Hall, Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 3

Fig. 7.

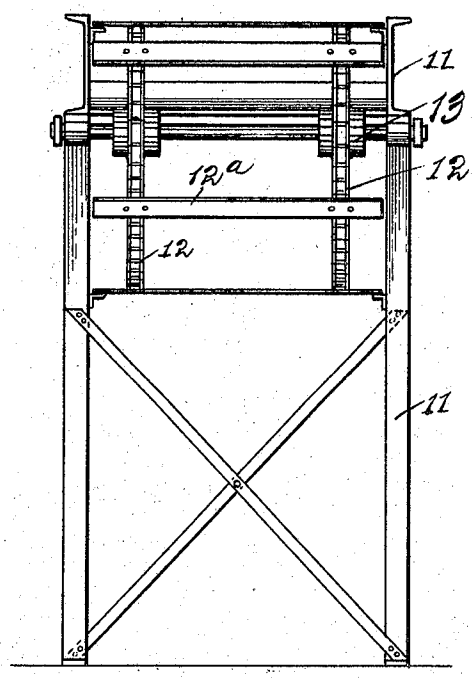
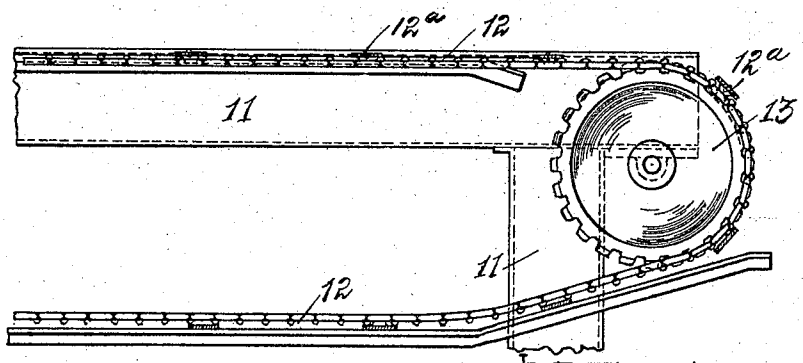


Fig. 8.



INVENTOR:
E. L. Loudenslager,
By Thomson Hall, Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 4

Fig. 9.

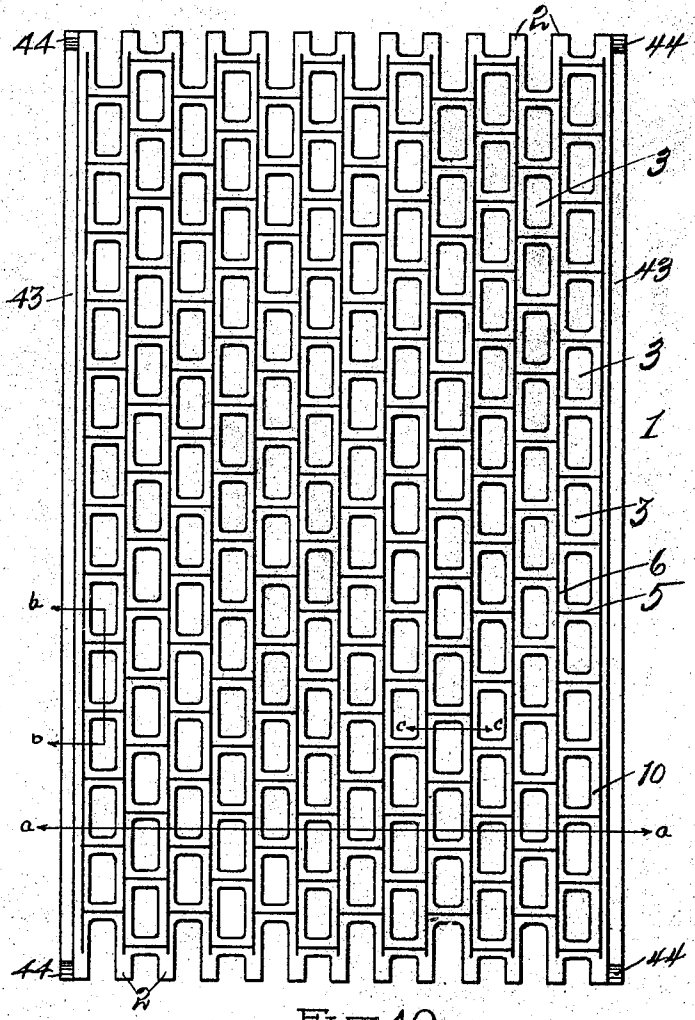


Fig. 10.

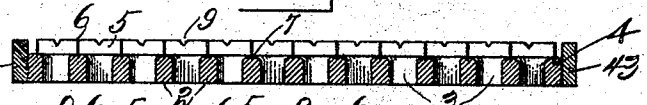


Fig. 11

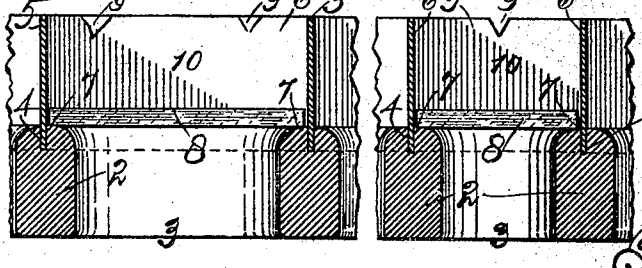


Fig. 12.

INVENTOR:
E. L. Loudenslager
By Simon Hallam

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 5

Fig. 13

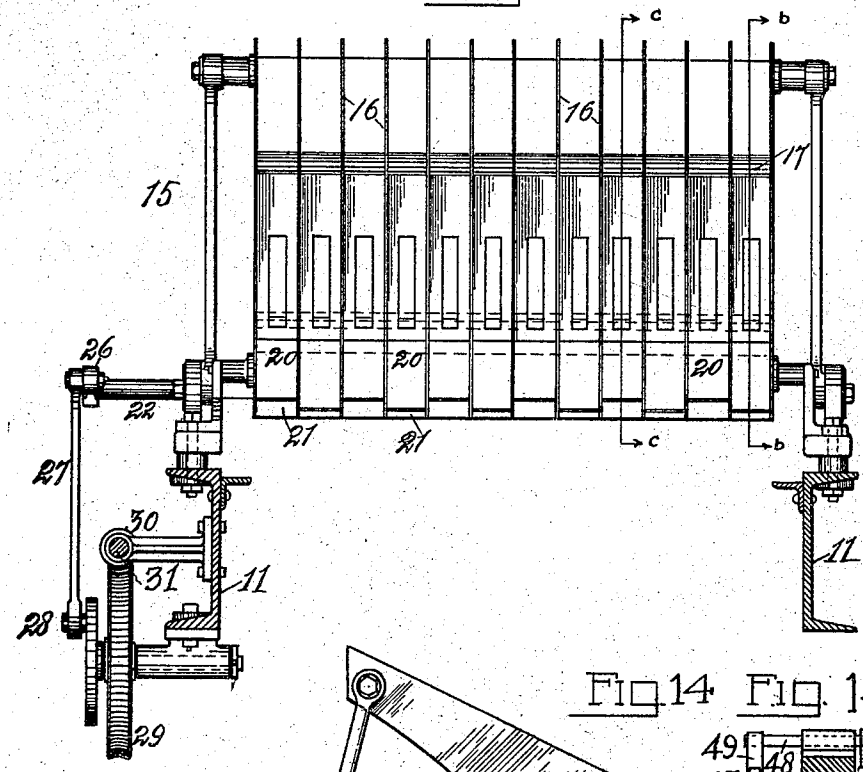


Fig. 14

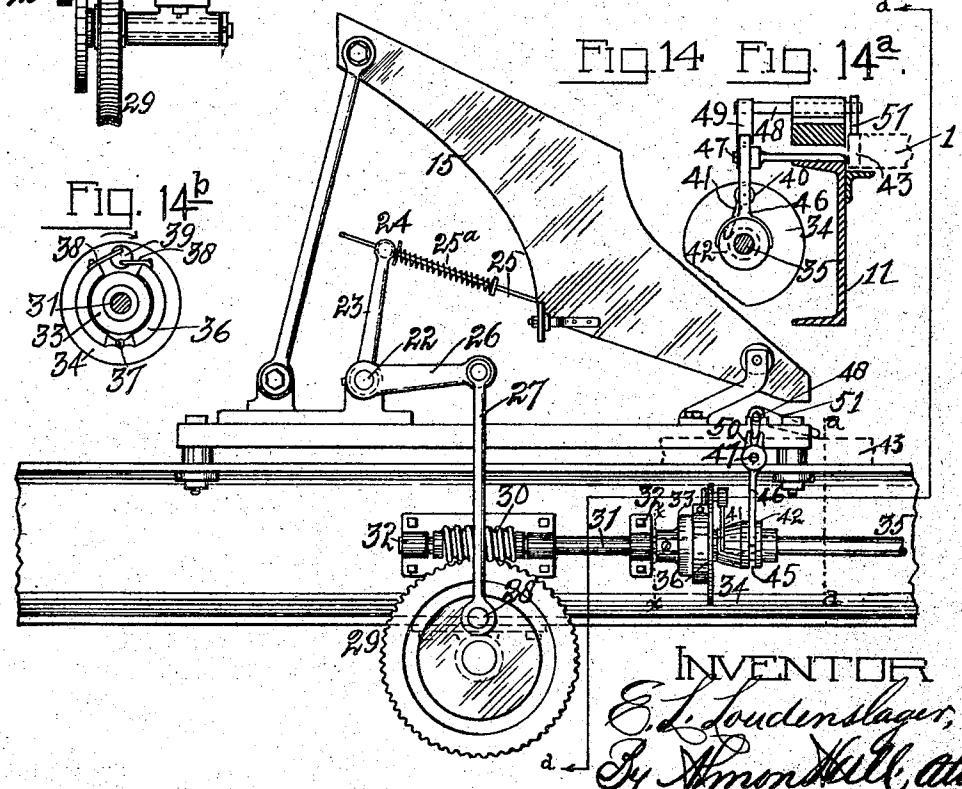


Fig. 14a.

Fig. 14b

INVENTOR

E. L. Loudenslager,

By Simonds Hill Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 6

Fig. 15

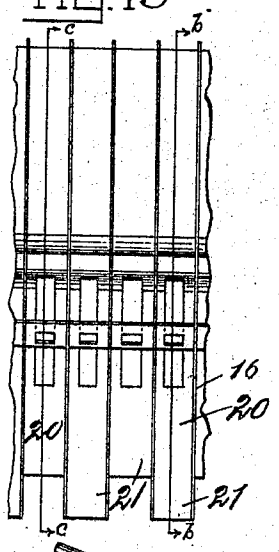


Fig. 16

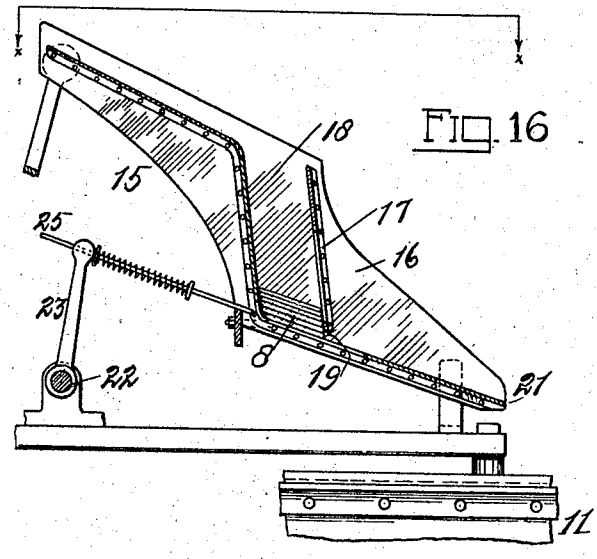


Fig. 18

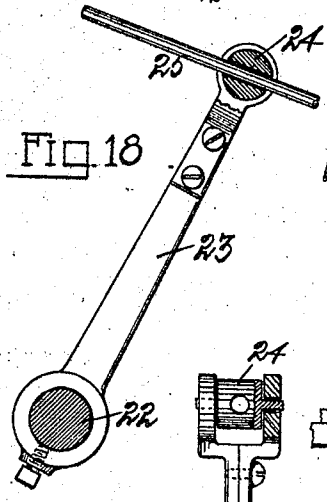


Fig. 17

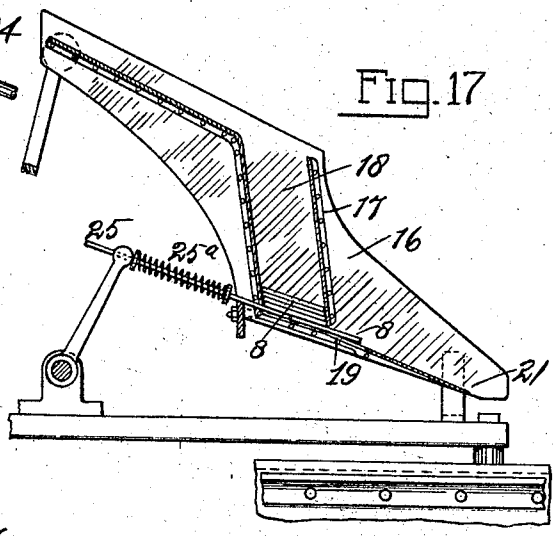


Fig. 19

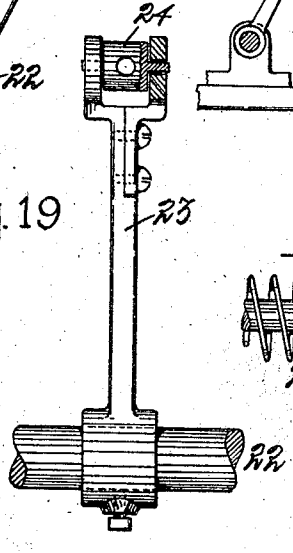


Fig. 20

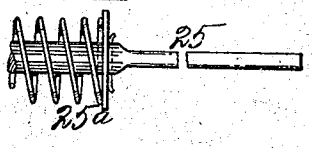
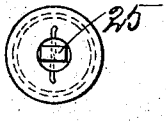


Fig. 21.



INVENTOR;
E. L. Loudenslager,
By Thomas Hall, Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 7

FIG. 22

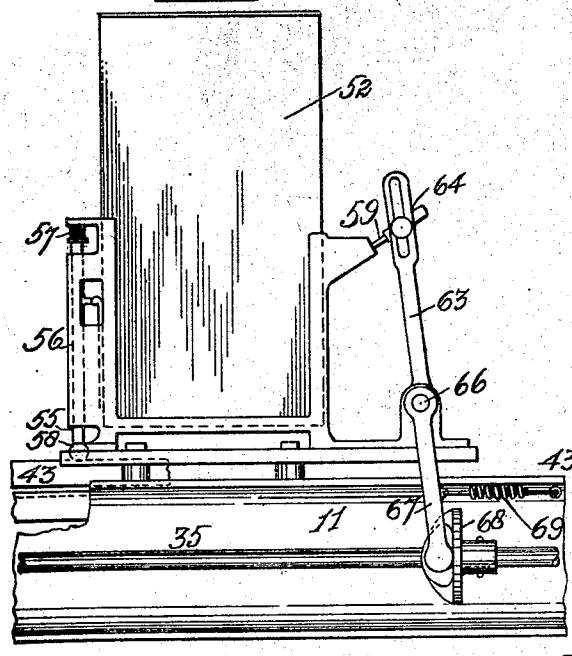


FIG. 23

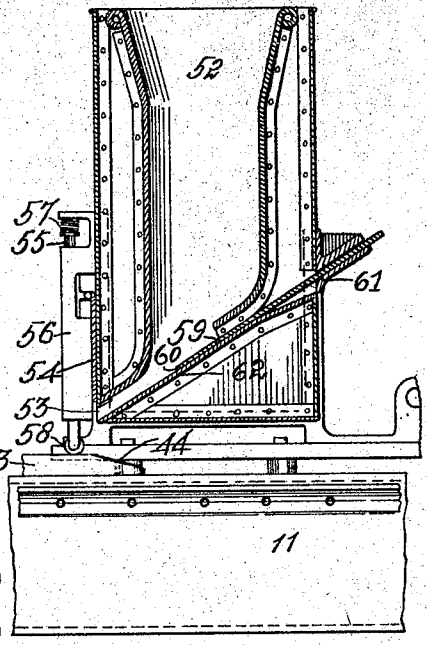


FIG. 24

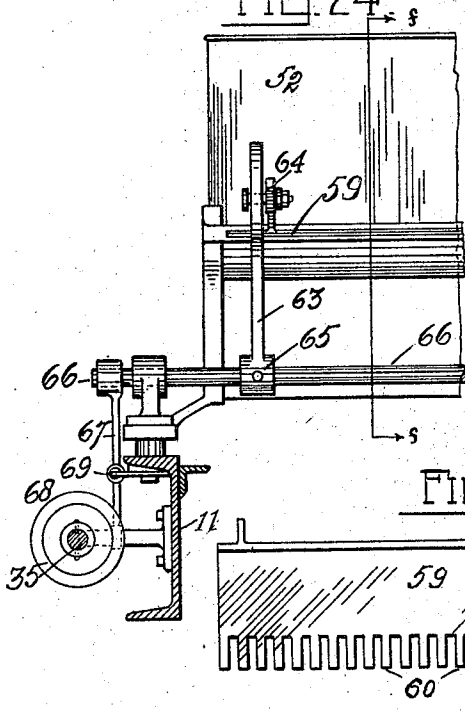


FIG. 25

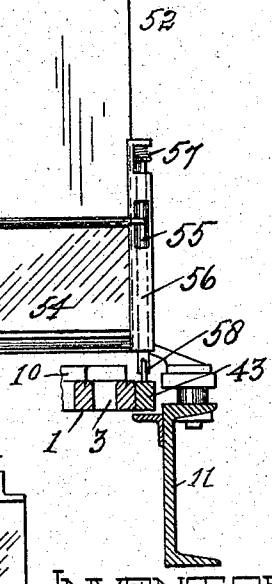


FIG. 26

INVENTOR:
E. L. Loudenslager,
By Thurston Hall Atty

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 8

Fig. 27.

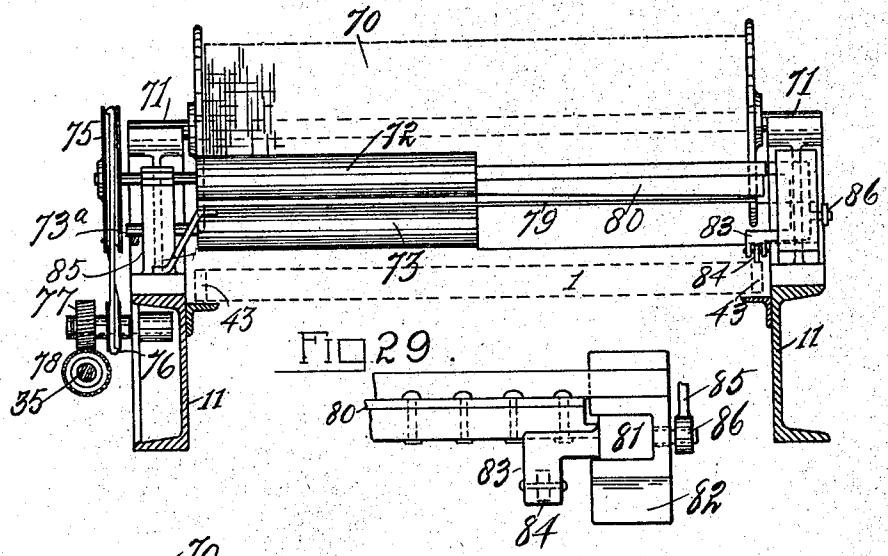
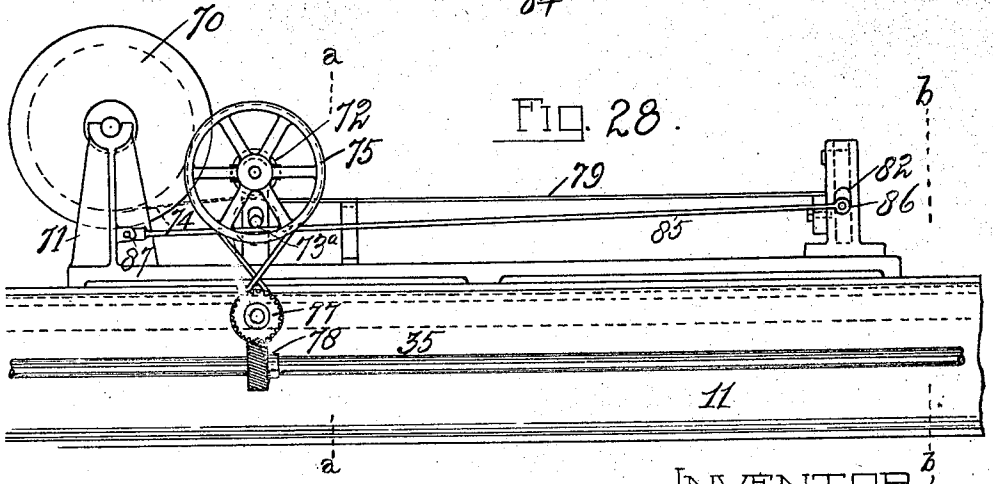


Fig. 29.

Fig. 28.



INVENTOR,
E. L. Loudenslager,
By Munn Hall Attys

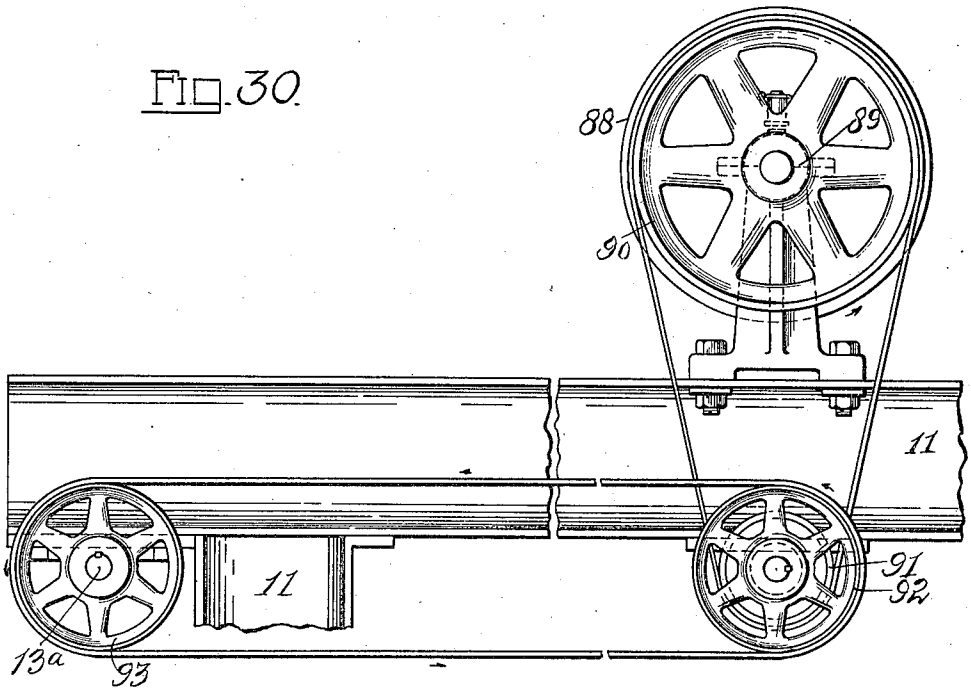
Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 9

Fig. 30.



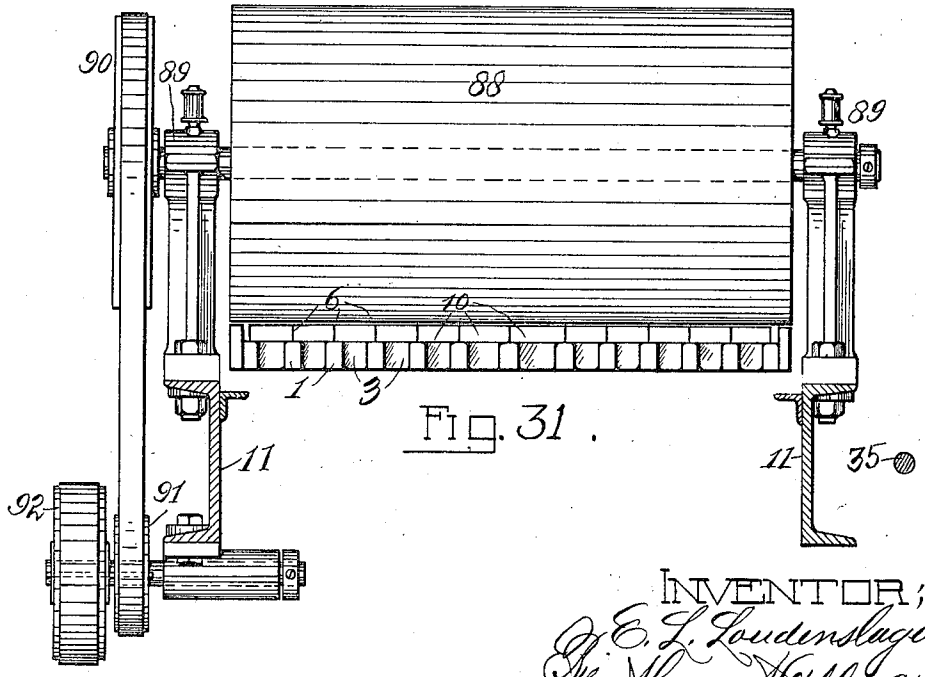


Fig. 31.

INVENTOR;
E. L. Loudenslager.
By Mason Hall & Atty

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 10

Fig. 32.

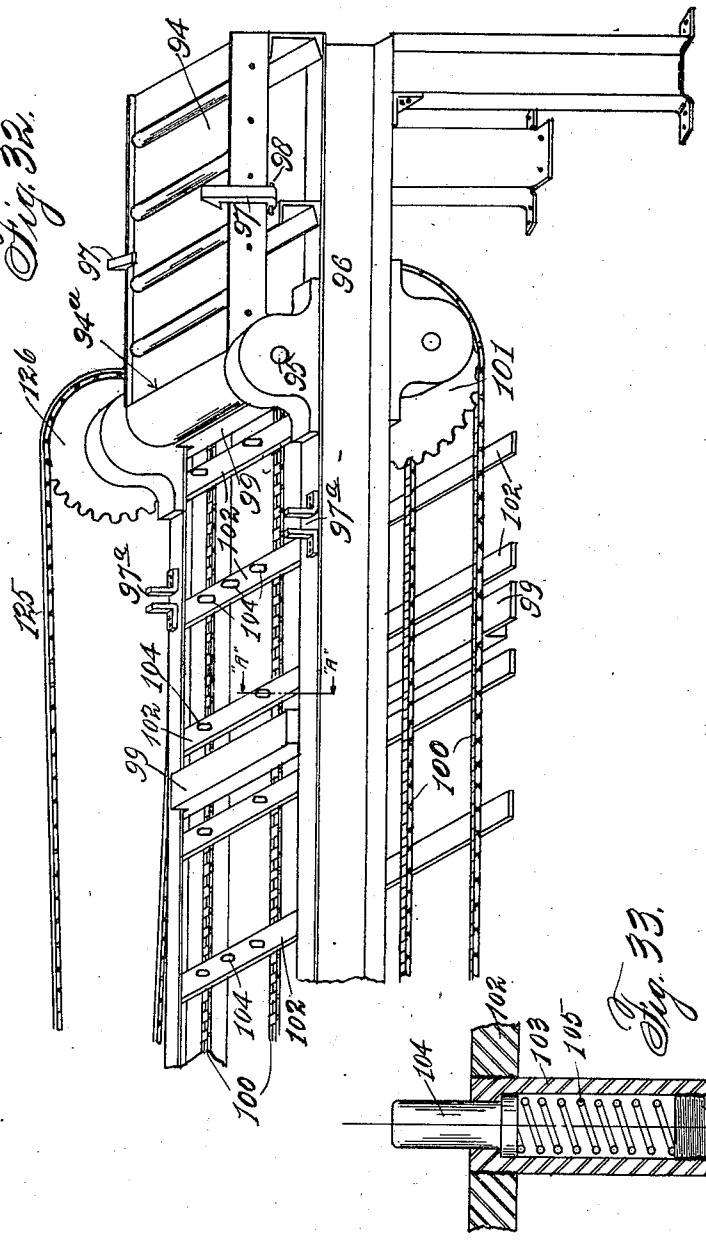


Fig. 33.

INVENTOR:
E. L. Loudenslager,
By Simon Hall, Atty.

Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 11

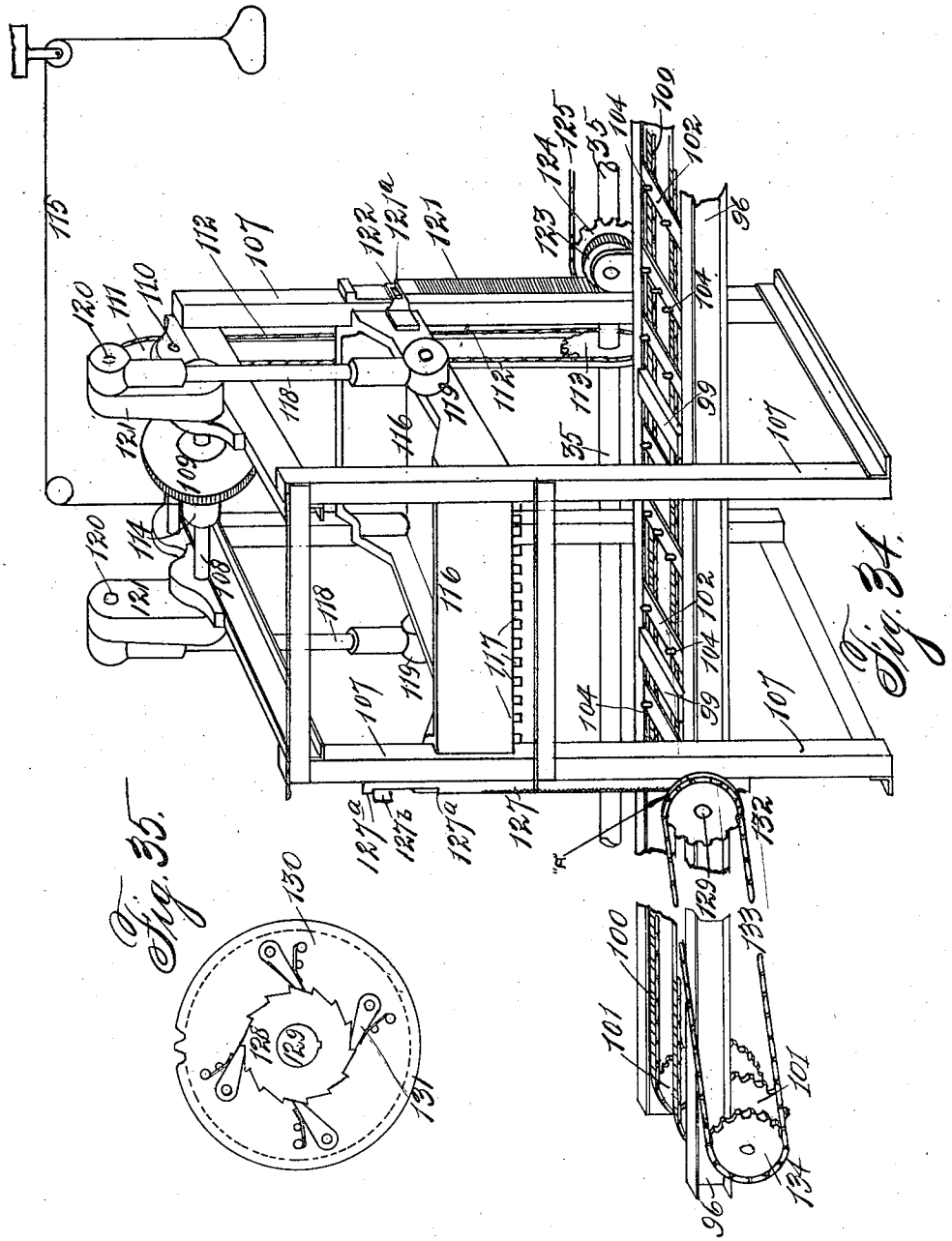


Fig. 34.

Fig. 35.

INVENTOR:
E. L. Loudenslager,
By Almon Hall Atty.

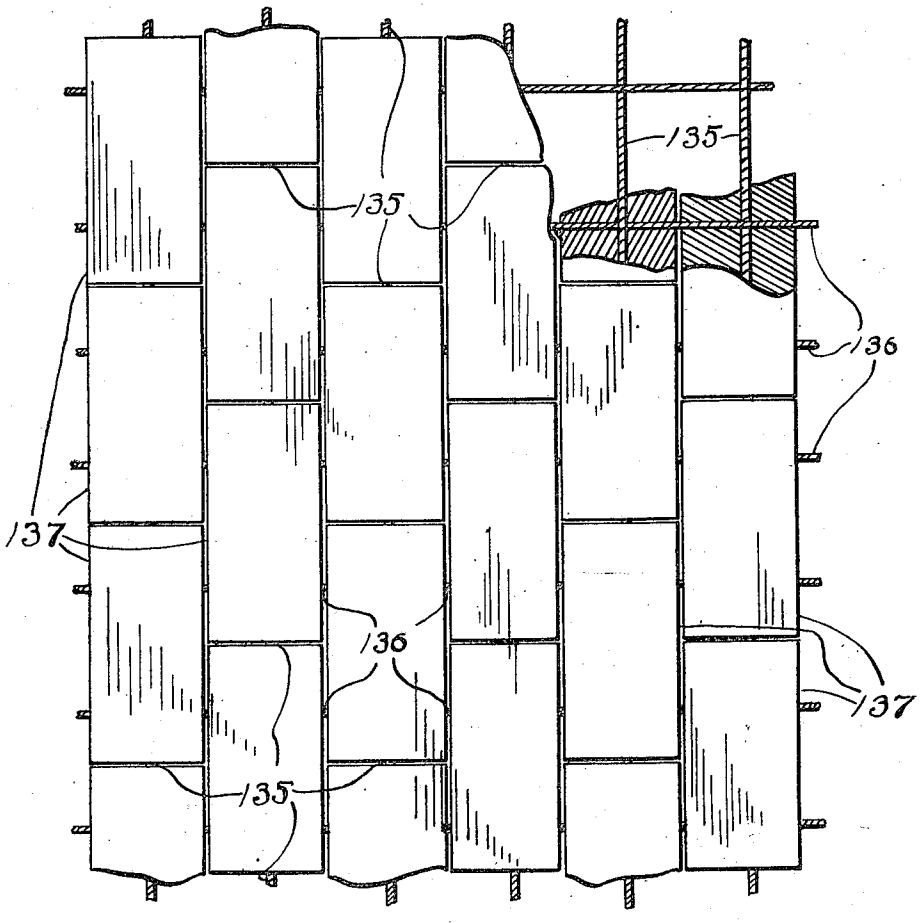
Apr. 10, 1923. 1,451,229

E. L. LOUDENSLAGER

TILE MANUFACTURE

Filed June 22, 1921 12 sheets-sheet 12

FIG. 36



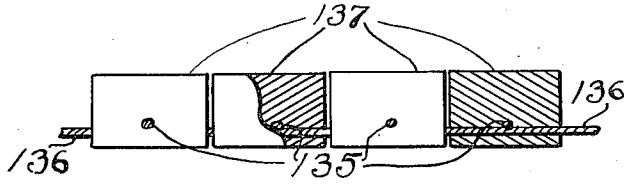


FIG. 37

Edgar L. Loudenslager
INVENTOR
BY
ATTORNEY

Patented Apr. 10, 1923. 1,451,229

UNITED STATES PATENT OFFICE.

EDGAR LEROY LOUDENSLAGER, OF TOLEDO, OHIO.

TILE MANUFACTURE.

Application filed June 22, 1921. Serial No. 479,527.

To all whom it may concern:

Be it known that I, EDGAR LEROY LOUDENSLAGER, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Tile Manufacture; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

While in many structures tile flooring would be highly desirable, it happens in most cases that its cost is prohibitive. The high cost of such flooring is due largely to the expense of producing tiles by the ceramic art and to the time, labor and skill requisite in the assembling and laying of the individual tiles in proper formal and ornamental relation. The present invention is designed to furnish a method and a machine or apparatus by means of which the objections and difficulties here indicated are, to a great extent, overcome. More particularly, my invention is intended to furnish means by which a strong durable satisfactory inexpensive substitute for the usual burned tile is rapidly produced, and by which the cost of laying the tiles is reduced to a minimum. These results are attained by flexibly connecting, in suitable sections or groups, many of the tiles, all arranged in proper order, so that many tiles may be simultaneously placed, and whereby considerable areas may be rapidly covered, and without the exercise of much skill.

The broad inventive idea here outlined may find expression in a variety of forms. One illustrative embodiment of an apparatus for producing the flexibly connected groups of tiles above referred to, which I find efficient in practice, is illustrated in the accompanying drawings, in which—

Figure 1, is a plan-view of a portion of my apparatus; Fig. 2, a side-elevation of the same; Fig. 3, a side-elevation of the rear end of that portion of the apparatus indicated in Figs. 1 and 2; Fig. 4, an end elevation of the same; Fig. 5, a top plan-view of part of an endless chain-belt hereinafter referred to; Fig. 6, a side-elevation of the same; Fig. 7, a front elevation of the front end of the machine; Fig. 8, a central vertical sectional elevation of the chain-belt and its guides and sprocket-wheel; Fig. 9, a top-plan view of the mold-plate hereinafter referred to; Fig. 10, a cross-section of the same taken on line *a*—*a*, Fig. 9; Fig. 11, a cross-section of the same taken on line *b*—*b*, Fig. 9; Fig. 12, a cross-section of the same taken on line *c*—*c*, Fig. 9; Fig. 13, an elevation, seen from the rear end of the machine, of the device for feeding to the mold-plate the removable knock-out plates which form bottoms for the matrices of the mold-plate, being partly in section taken on line *d*—*d*, Fig. 14; Fig. 14, a side-elevation of the same; Fig. 14^a, a sectional elevation taken on line *a*—*a*, Fig. 14; Fig. 14^b, a sectional elevation taken on line *x*—*x*, Fig. 14; Fig. 15, a plan-view of a portion of the same viewed from line *x*—*x*, Fig. 16; Fig. 16, a section taken on line *b*—*b*, Fig. 15; Fig. 17, a section taken on line *c*—*c*, Fig. 15; Fig. 18, a side-view of a detail of the rocker-arm and push-rod for feeding the knock-out plates hereinafter referred to; Fig. 19, a front view of the same; Fig. 20, a detail of the same, showing the accompanying spring; Fig. 21, an end-view of the same; Fig. 22, a side-elevation of the hopper for "mud" and the feeding mechanism accompanying the same; Fig. 23, a central vertical sectional elevation of the same taken on line *f*—*f*, Fig. 24; Fig. 24, an elevation, seen from the rear of the machine, of one-half of the same; Fig. 25, a front-elevation of the other half of the same; Fig. 26, a plan-view of the finger-plate for feeding "mud" to the matrices of the mold-plates (Figs. 9 to 12,); Fig. 27, an elevation of the mechanism designed to supply a netting or fabric to the form-plate illustrated in Fig. 9, the left half of this view being seen from the right on line *a*—*a*, Fig. 28, the right half being seen from the right on line *b*—*b*, Fig. 28; Fig. 28, a side-elevation of the same seen from the left in Fig. 27; Fig. 29, a top plan-view, on an enlarged scale, of one of the sliding bearings for the shear blade hereinafter referred to; Fig. 30, a side-elevation of a roller adapted and arranged for smoothing and trowelling the "mud" in the mold plates; Fig. 31, a front-elevation of the same; Fig. 32, a perspective view of the mechanism which receives from the endless chain-belt, indicated in Figs. 1 and 2, the successive mold-plates and which inverts and delivers the same to the appara-

tus for extracting the molded tiles from their matrices; Fig. 33, an enlarged sectional elevation of one of the spring supports; hereinafter referred to, for holding the inverted mold-plate during the operation of the knock-out plugs hereinafter referred to; Fig. 34, a perspective view of the device for extracting the freshly molded tiles from their matrices; Fig. 35, a side-elevation of a ratchet-wheel hereinafter referred to; Fig. 36 is a plan view, with parts broken away, of a pavement or tile unit or group as produced thereunder; and Fig. 37 is a partial section therethrough.

Corresponding reference-characters represent like parts throughout the drawings.

While the word "tile," as generally used, means an article of burned clay, or sometimes, metal, in this specification the word means a tileshaped article or plaquette composed of a cementitious substance, such as a suitable mixture of Portland cement and a fine crystalline granular substance, such, for instance, as ground marble, which has been wetted to a partially liquefied state and then cast in suitable molds. In the course of their manufacture my tiles are allowed to remain in their molds or matrices until sufficiently hardened to retain their shape but not sufficiently to adhere to the mold. The partly hardened casts are next removed from their matrices and are allowed to harden and are subjected to such further treatment as may be deemed needful to fit them for use. The cementitious substance here referred to, while in its wet state, will, for the sake of brevity and clearness, be termed "mud."

In the drawings, 1 is a form or mold-plate in which a number of tiles or plaquettes may be simultaneously cast. (See Figs. 9 to 12, inclusive.) This plate consists of a metal casting 2, in the present instance, for illustration, rectangular in outline, and having therethrough series of openings 3, shown in the drawings, for convenience of illustration, as oblong rectangles, symmetrically arranged in straight rows, the ends of the openings in alternate rows falling opposite the middle of the openings of the adjoining rows. It will be understood, of course, that these shapes may vary as occasion may require. The tops of the dividing walls which separate the openings 3 are accurately kerfed, as at 4, and into these kerfs are tightly fitted thin longitudinal spacing-strips and cross-pieces 5—6. On each side of each of the pieces 5—6 there is formed by the tops of the walls of the chambers 3 narrow shoulders or ledges 7. These ledges form supports for the margins of thin plates 8 which fit loosely in the spaces bounded by the pieces 5—6. The plates 8 may be of glass or polished steel or other suitable material, and if desired the upper faces of these plates may be either polished or ornamentally engraved or embossed. These plates 8, termed herein "knock-out plates," form removable bottoms for the cells or matrices the sides of which are formed by the thin strips 5—6. The upper exposed surface of the plates 8 give corresponding surfaces to the faces of the finished tiles or plaquettes. The pieces 5—6 are preferably notched, as at 9, for the purpose presently to be explained.

Assuming that the cells or matrices 10, illustrated in Figs. 11 and 12, are filled with mud and that the upper part of the mud has embedded therein stout crossed cords which rest in the notches 9, it will be seen that when the mud has become sufficiently set to retain its shape, the form may be inverted and the contents of the chambers 10 may be forced out by means of suitable plungers moving against the plates 8 through the openings 3. The knock-out plates 8 will now be uppermost and will be readily removable, leaving a surface on the tile corresponding to the surface, smooth or otherwise, of the knock-out plate. The half hardened plaquettes or tiles having been discharged upon a flat plate or tray are removed to suitable racks where they are given such treatment as may be required and where they are allowed to harden. It will be seen that the cords above referred to as resting in the notches 9, are embedded in the tiles and hold groups of tiles,—150 in number in the present illustrative form,— flexibly connected in the same relation as when in the mold-plate.

In the production of the flexibly connected series or groups of tiles by my method or process, certain steps may be performed manually, but for the sake of economy of time and labor the several steps necessary to effect the results above indicated, should, in the main, be performed automatically by instrumentalities, substantially such as are now to be described.

An elongated table or bench 11, carries an endless belt or apron 12, running over and under the table upon pulleys 13, journaled at opposite ends of the table. For details of the table, belt and pulleys, see Figs. 5, 6, 7 and 8. The endless belt is actuated, preferably, by an electric motor 14, belted and geared to the rear pulleys 13, as illustrated in Figs. 3 and 4. The endless belt 12, is provided at intervals with cross-pieces 12^a spaced apart such distance as to conveniently support the mold-plates 1. A mold-plate being placed upon the moving apron at the front end of the machine, it becomes necessary to furnish the matrices 10 with knock-out plates 8 to form complete molds for the reception of the mud. To this end there is provided for the plates 8 a receptacle 15, secured across the top of the table and directly above and close to

the belt 12. The bottom of the receptacle 15 is inclined downwardly in the direction of the travel of the belt and is divided by thin narrow longitudinal partitions 16 and cross-partitions 17 into box-like chambers 18, into which the plates 8 may loosely fit flatwise. Beneath the lower edges of the cross partitions 17 are slots 19, through which single plates 8 may slip edgewise. The bottom of the receptacle 15 forms, with the partitions 16, rows of ways or chutes 20, corresponding in number and width to the rows of matrices 10 in the mold-plate 1. The discharge ends 21 of the chutes 20 are located directly above the matrices 10 as they are carried along by the belt 12 and are arranged with one half of the series of discharge points in advance of the other half, so that they correspond with the staggered relation of the matrices. At the rear and beneath the elevated part of the receptacle 15 is a shaft 22, journaled on the opposite sides of the frame 11, and having adjustably secured thereto a series of upright arms 23, corresponding in number to the several receptacles 18. Each of these arms carries at its upper end a swiveled piece 24, through which passes a push-rod 25, arranged to reciprocate in the bottom of the receptacle 18 and in alinement with the slot 19. At each forward movement, each push-rod will engage the rear edge of a plate 8 in its box-like receptacle 18, and will project the plate through the slot 19 into its appropriate matrix 10 in the mold-plate 1 as it moves from beneath the receptacle 15. This reciprocatory movement of the push-fingers is effected through the rocking of the shaft 22, which has secured to it, at one end, an arm 26, the outer end of which is pivoted to one end of a connecting rod 27, having a crank-connection, as at 28, with a worm-wheel 29. This worm-wheel is journaled at the side of the frame 11, and is in engagement with a worm 30, on shaft 31, journaled, as at 32, lengthwise of the frame 11. 33 is a friction-clutch-member fastened upon the shaft 31. 34 is a companion clutch-member fastened upon shaft 35, which extends along the side of the frame 11 and which is driven in harmony with the movement of the belt 12 by suitable associated gears, as indicated in Figs. 3 and 4. Brake-bands 36 are at their meeting ends pivotally connected together and to the member 34, as at 37. At their opposite ends these bands are connected by toggles 38, with opposite margins of a disc 39, fixed on one end of a short shaft 40, extending through and mounted in the member 34. The opposite end of the shaft 40 carries an arm 41, the free end of which rides upon a conical sleeve 42, revoluble with and slidable upon the shaft 35. The forward movement of the cone 42 swings the arm 41 and the toggles 38 so that the brake-bands 36 are caused to clasp tightly the clutch-member 33, and so that the shafts 31 and 35 now revolve together. It will be seen that when the clutch-members are engaged, the push-fingers 25 will be caused to reciprocate by means of the rocking of the arms 23 and 26 and their connection 27, with the gears 29 and 30. Springs 25[a], coiled about the push-rods, prevent breakage of machinery in case of failure of a plate 8 to feed properly. In order that the feed of the plates 8 to the mold-plate 1, as here described, shall begin and terminate with the passing of the mold-plate, and that the clutch for the shafts 31 and 35 may be thrown into and out of gear at the proper moment, I provide my mold-plate with a side-rail 43, beveled as at 44 at its front and rear ends. The conical sleeve 42 (Fig. 14) has a groove 45 which loosely receives the lower end of a bifurcated lever 46, fulcrumed as at 47, on the frame of the machine. 48 is a short horizontal shaft having at its outer end a depending arm 49 engaged with a crotch 50 in the top of the lever 46. At the other end of the shaft 48 is an arm 51, lying in the path of the rail 43 on the mold-plate 1. When the beveled part 44 of the rail comes in contact with the arm 51, the arm slides up on top of the rail and there rides until it slides off the rail with the passing of the mold-plate. The upward swing of the arm 51 gives a part turn to the shaft 48, causing the arm 49 to swing the lever 46 and to shift the conical sleeve into working position. As the arm 51 slides off the rail 43 the clutch is disengaged and the operation of the feed-fingers ceases until again set in motion by the passing of the succeeding mold-plate.

The several matrices of the mold-plate having been supplied with their knock-out plates 8, it moves steadily forward until it comes into operative relation to the devices illustrated in Figs. 22 to 26, inclusive, showing the mechanism by which mud is supplied to the cells or matrices of the mold-plate 1.

52 is a box or hopper secured directly above and across the path of the mold-plates, and having an open top adapted for the convenient charging of the hopper with mud. The narrow elongated outlet 53, through which the mud escapes onto the moving mold-plate, is supplied with a gate 54, secured at each end to a rod 55, vertically movable in guides 56. The rods are held normally depressed by spring 57. The rods 55 have at their lower ends rollers or casters 58 directly in the path of the rails 43 on the mold-plates. As the mold plate approaches, the rolls 58 ride up on the forward beveled parts 44 of the rails 43, thus opening the gate 54 and permitting the semi-liquid contents of the container 52 to flow into the matrices of the mold-plate. As the mold-plate recedes, the reverse action of the rollers, riding down off of the rails 43, automati-

cally closes the gate. To insure the uniform flow of the more or less liquid mud and to prevent the clogging of the outlet 53, I provide a plate 59,—illustrated in Fig. 26,—having fingers 60 at its forward edge, which plate extends across the interior of the receptacle 52, and which, through a narrow opening 61 reciprocates upon the inclined bottom 62, into and out of the contracted mouth 53. This movement of the plate 59 is effected by means of arms 63, toggled at their upper ends, as at 64, to the upper rear edge of the plate 59, and at their lower ends secured, as at 65, to a shaft 66 which is journaled on the sides of the frame 11. The shaft 66 has secured to one of its ends a downwardly projecting arm 67, the lower end of which rides upon a cam 68 fixed upon the shaft 35. A spring 69, holds the arm in engagement with the cam. The rotation of the cam swings the arm 67, rocks the shaft 66, and,—through the arms 63 and the connections 64,—causes the reciprocation of the plate 59. This motion of the plate keeps the bottom part of the contents of the container constantly stirred and, when the gate is open, insures a steady flow of the mud during the passing of the mold-plate and until the hopper is empty.

The next step in pursuing my method and in the operation of my apparatus is to supply to the mud-laden matrices a fabric which shall be permanently embedded in the tiles when completed. This fabric may consist of a cloth loosely woven from yarns of any textile strong enough to hold the finished tiles together, when being laid, in the same relation and series or groups as when moulded in their associated matrices. Instead of a cloth, a stout netting may be employed. In the present instance, for illustration, the netting is so coarse that but three lengths of a stout cord or flexible wire are embedded in each tile,—two crosswise and one lengthwise of the tile,—the cords being knotted together at their intersections. These cords when in place rest in the notches 9, illustrated in Figs. 10 and 11. The net or fabric referred to, made in considerable lengths, is wound upon a reel or spool 70, loosely journaled upon standards 71, secured to opposite side-members of the frame 11. A pair of rolls 72, (shown in half-length in Fig. 27,) are journaled on standards secured to the frame 11, one above the other, across the frame, near to the reel 70, and are arranged to draw from the reel, at intervals, the fabric indicated by the dotted line 74. A pulley 75, on the shaft of the upper roll 72, is belted to and is driven by a pulley 76, on the shaft of a worm-wheel 77, engaged and driven by a worm 78, on shaft 35. (See Figs. 27 and 28.) A table 79, consisting of a smooth sheet of metal, extends forwardly from close to the rolls and in horizontal alinement with the opening between the rolls 72—73, and is arranged to receive from the rolls the netting or fabric 74 as it is pulled from the reel 70. 80 is a knife extending across the frame of the machine and having a slanting shear edge. The knife is at each end secured to a block or frame 81, which slides vertically in a guide in a standard or pillar 82, mounted on a side member of the frame 11. The blade 80 is disposed in such relation to the table or plate 79 that the edge of the plate serves as a stationary member of a pair of shear-blades. The blocks or frames 81 have, respectively, an inwardly projecting arm 83, which carries on its under side a roller 84, arranged to mount and ride upon the rail 43 of the mold-plate as it travels beneath the table 79. 85 indicates a rod or bar pivoted at one end, as at 86, to the sliding block or frame 81 and pivoted at its other end, as at 87, to the standard 71. There are two of the rods or bars 85, located at opposite sides of the frame 11 and immediately beneath the projecting ends of the shaft 73^a of the lower roll 73. Before starting the machine a length of the fabric or netting is pulled between the rolls and stretched along the length of the table 79. When the rollers 84 mount the rails 43 of the moving mold-plate the knife 80 is lifted by the upward movement of the blocks 81. At the same moment, by the same movement, the pivoted ends 86 of the rods 85 are also lifted, thus engaging and lifting the ends of the shaft 73^a, so that the fabric 74 is now pressed between the upper revolving roll 72 and the lower roll. The fabric is thus pulled from its reel and fed along the table over and upon the mud-laden mold-plate, the driving mechanisms for the plate and the fabric being timed to move in unison. As the mold-plate moves from the beneath the table 79, the rollers 84 descend from the rails 43, lowering the blocks 81 and, by the downward swing of the rods 85, permitting the roll 73 to fall away from the upper roll thus stopping the feed of the fabric. The downward movement of the blocks 81 also lowers the knife 80 which, in conjunction with the edge of the plate or table 79, shears the netting or fabric at the rear of the departing mold-plate, leaving the fabric in position for a repetition of the operation here described.

The fabric or netting which is to hold the molded articles in proper relation, being now applied upon the top of the more or less liquid mud, it is necessary that the retaining strands be partly or wholly embedded in the material. The extent or depth of the burial of the several strands will depend somewhat upon the kind of surface to be given to the finished tile. If the exposed surface of the tile is to show bits of colored marbles or is to include other substances than mere sand and Portland cement, it

will, as a matter of economy, be found advisable to first partly fill the matrices of the mold-plate with the more expensive surfacing material, then to apply the netting or fabric, and to then complete the filling of the matrices with the cheaper material. Should this method be followed, the netting or fabric will, of course, be more deeply embedded than if it were applied to filled matrices and then by pressure or troweling sunken into the mud. In Figs. 1 and 2 are indicated a means, marked 52^a, for supplying the matrices with an additional layer of mud after the fabric or netting has been applied. In case two kinds of mud are to be employed then the second hopper, feeding devices and gears will be the same as hereinbefore described. (See parts indicated by the reference characters 52 to 69, inclusive.)

88 is a roll journaled in bearings 89, mounted on the side-members of the frame 11, and of the same length as the width of the mold-plate. The roll is disposed directly above and across the track of the mold-plates and so close to the plates that the bottom of the roll barely touches the tops of the spacing-strips 5—6. The roll is designed to contact lightly with the surface of the mud in the matrices of the mold-plates and to have a troweling effect upon such surface. To this end, the surface of the roll is given a greater speed than the travel of the mold-plates, the rotation of the roll being in the direction of such travel. The roll is revolved through a band-wheel 90, on the shaft of the roll, belted to a pulley 91, on the shaft of which is another pulley 92, belted in turn to a pulley 93 fixed on the shaft 13^a, of the sprockets 13 which drive the endless belts for the mold-plates. (See Figs. 4, 7, and 28.) It will be seen that if the fabric or netting 74 rests on top of the mud,—not having been buried by a second application from the hopper 52^a,—this "troweling" by the roller 88 will so mingle the strands of the netting or fabric with the mud that such strands will be partly or wholly incorporated in the body of the tile.

The contents of the matrices 10 having been subjected to the action of the roll 88, should now be carefully inspected, since after the next step it will be impracticable to correct any imperfections in any of the soft molded articles. This inspection may take place during the passage of the mold-plate to the point where the endless carrier 12 turns downwardly for its return beneath the bench or table. At this point the mold-plate slides onto a table 94, one end of which is pivoted, as at 95, upon the top of an elongated bench or frame 96 which may be a continuation of the bench or frame 11. The table 94 has at each side an inwardly turned hook 97, pivoted at its lower end to the edge of the table, as at 98, the top of the hook being beveled inwardly. The pivoted end of the hook is provided with a spring—not shown—which holds the hook pressed inwardly to slightly overhang the table. The mold-plate having been fed onto the table and against the stop or shoulder 94^a, the operator covers the mold-plate with a flat tray or plate of sheet metal which conforms in outline to the filled portion of the mold-plate. The hooks 97 yield to the pressure of the edges of the tray upon the beveled tops of the hooks and immediately snap into engagement with the opposite edges of the tray when it is pressed down upon the mold-plate and against the plastic tiles or plaquettes. Now the table 94 may, with its attached mold-plate, be swung over upon its pivot 95 into inverted position, so that the tray will now be underneath the mold-plate. This movement of the mold-plate places its ends upon the cross-bars 99, the ends of which are supported upon endless chains 100, which run upon sprockets 101 and 101^a at opposite ends of the frame 96. These chains and their connecting cross-pieces move step-by-step from the table 94 over the top of the frame or table 96 and return beneath the frame. When the table 94 is turned over into inverted position, the beveled ends of the hooks 97 strike stops 97^a, causing the hooks to swing outwardly and to release the mold-plate from the table so that the table is now free to swing back to its original position.

The two endless chains 100, carry—besides the cross-bars 99—intermediate cross-bars 102, of less thickness than the bars 99. The bars 102 are bored and threaded at suitable intervals for the reception of sleeves or socket-pieces 103. (See Fig. 33.) Protruding from each of these socket-pieces is a short pin 104, which is held normally projected by a coiled spring 105, interposed between the pin and a screw-plug 106, by means of which the tension of the spring is adjusted as may be desired. When the table with its load is inverted, the tray above referred to now rests upon the projecting pins 104, while the ends of the mold-plate rest upon the cross-bars 99. The tension of the springs 105 is such that the tray is yieldingly held up against the surfaces of the plaquettes.

A stout frame 107, (see Fig. 34), bestrides the chain-belt 100 and has journaled across its top a shaft 108 which carries a loose gear-wheel 109. This gear is engaged by a pinion on shaft 110, which shaft also carries a sprocket 111, which is connected by chain 112, with a sprocket 113, on the shaft 35, the constant rotation of which gives corresponding rotation to the gear 109. A

clutch 114, controlled by a cord or similar device 115, within convenient reach of the operator, throws the gear into operative engagement with its shaft 108. The clutch is of the familiar sort which is automatically disengaged with each rotation of its shaft and needs not be here more specifically described.

116 is a horizontal plate, which I shall term a knock-out, and which is vertically movable between the corner posts of the frame and which serve as guides for the knock out. The bottom side of the knock out, which is preferably of cast metal, has downwardly projecting pins 117, corresponding in number and arrangement with the openings 3 in the mold-plate. The knock out is suspended by two pitmans 118, pivoted at their lower ends, as at 119, to opposite sides of the knock out, and pivoted at their upper ends, as at 120, to cranks 121 on the ends of the shaft 108. A rack-bar 121^b, which moves in harmony with the knock out is secured to the knock out by means of a shackle 122 and a clamping screw 121^a, and is guided vertically upon one of the corner posts of the frame 107. The teeth of the rack-bar are in engagement with a pinion 123 on the shaft of which is a sprocket 124, which carries and drives an endless chain 125. This chain runs upon another sprocket, 126, (see Fig. 32,) fast upon the pivot-shaft 95 of the table 94.

127 is a rack-bar which slides vertically in guides,—not shown,—on one of the corner posts of the frame 107. This rack-bar is connected with the knock out by means of a shackle 127^b which embraces the rack-bar between the stops 127^a. While these stops cause the rack-bar to reciprocate vertically with the knock out, they permit a limited movement of the knock out without moving the rack-bar. 128 is a ratchet-wheel fixed on shaft 129. Loose on the same shaft and in engagement with the rack-bar 127 is a gear 130, having pawls 131 engaged with the teeth of the wheel 128 in such manner that the gear 130 can drive the ratchet-wheel and its shaft only when the rack 127 is moving upwardly. On the shaft 129 is a sprocket wheel 132, connected by chain 133 with a sprocket 134 fixed on the shaft of the sprockets 101.

Assume that a mold-plate with its charge of flexibly connected plastic tiles has been fed to and rests upon the table 94; also that an inverted mold-plate 1 rests upon the cross-bars 99 of the conveyor 100, immediately beneath the knock out 116; that another mold-plate in like manner rests upon the conveyor end-to-end with the one under the knock-out, and that there is a space left on the conveyor for the reception of the mold-plate lying on the table. Now, the operator throws the clutch 114 into engagement with the revolving gear 109, causing the cranks 121 to describe a complete revolution which lowers the knock out to its lowest position and returns it to its upper position where the clutch is automatically disengaged. In the descent of the knock out, the downwardly projecting pins 117 enter the upturned holes 3 in the metal casting 2, and strike the several plates 8 and push them and the plastic tiles out of the matrices 10, the several pins 104, upon which the receiving tray rests, yielding to this pressure of the knock out. The mold-plate is thus freed from its tiles which now rest upon the tray beneath the mold-plate. In the descent of the knock out, the rack 121^b, through the gears 123, 124, 126 and chain 125, causes the table 94 to swing on its pivot and to deposit its load on the conveyor 100. The ascent of the knock out, reversely, restores the table to its original position. The descent of the knock out with the rack 127 causes the gear-wheel 130 to revolve idly, but the upward stroke of this rack, through the ratchet-wheel 128, the sprockets 132—134 and the chain 133, moves the conveyor forward one step, thus bringing another mold-plate into operative relation to the knock out and presenting the emptied mold-plate and the filled tray to be disposed of. It will be seen that by reason of the lost motion of the shackle 127^b between the two stops 127^a, the conveyor 100 does not begin to move until the knock out has been lifted clear of the mold-plate.

The empty molds are cleaned and sent back to the head of the machine. The plates 8 are carefully removed from the tiles, leaving an unbroken surface, and the tray carrying the tiles is removed to a suitable curing chamber. The product from this apparatus is a flexibly connected pavement unit having a continuous surface. The fabric 74 has warp 135 intersecting woof 136 in the tile or block 137. Accordingly, the tile is fully assembled in the grouping for installation as a continuous pavement surface and has but to be flushed with the anchoring cement for completing the installation. These tile units may be kept in storage and readily transferred with minimum danger of fracture.

Having described my invention, what I claim and desire to secure by Letters Patent of the United States is,—

1. The method of producing tiles of the described character, which consists in forming of partially liquefied cement a plurality of closely adjoining symmetrically arranged tile-shaped plaquettes, then, while said material is still soft, connecting such plaquettes by embedding therein a suitable flexible fabric, and then supporting the plaquettes, so connected, in undisturbed relation until sufficiently hardened for use.

2. The method of producing tiles of the described character, which consists in charging into series or groups of symmetrically arranged matrices a partially liquefied cement, then embedding in such cement flexible material which connects the adjoining plastic tiles or plaquettes thus formed and then, when said tiles or plaquettes have become partially hardened, simultaneously expelling them from their matrices onto a receiver adapted to hold said tiles in undisturbed relation until sufficiently hardened for use.

3. The method of casting blocks comprising charging a plurality of adjacent molds with plastic material, and extending strands in intersecting directions to be anchored with said material in said molds, and troweling the material to anchor the strands therein.

4. The method of casting blocks comprising grouping semi-plastic casts in staggered relation in a form, anchoring a mesh fabric therewith, turning over a group of said blocks as a unit, and separating the casts from the form.

5. The method of producing tiles of the described character, which consists in charging into series or groups of closely adjoining matrices sufficient partially liquefied cement to partly fill the matrices, then, while the cement is still soft, flexibly connecting the contents of such matrices, then adding enough more partially liquefied cement to completely fill the matrices, then, when the cement is sufficiently hardened, simultaneously expelling from the matrices the material so molded onto a suitable tray, and then retaining upon said tray the tiles or plaquettes so formed in undisturbed relation until hard enough to be used.

6. In an apparatus of the described character, a mold-plate having therethrough series of symmetrically arranged openings in communication with corresponding series of matrices conforming to the tiles or plaquettes to be formed, and in each of said matrices a knock-out plate carried by the mold-plate, which knock-out plate forms the bottom of the matrix and which is adapted by movement into the matrix to expel therefrom a tile cast therein.

7. In an apparatus of the described character, a mold-plate having series of closely adjoining matrices arranged in rows, the matrices of alternate rows being in staggered relation to the matrices of the intervening rows and provided with knock-out plates, the bottoms of said matrices having shoulders or stops for the support of knock-out plates, the mold-plate having therethrough openings which coincide with the matrices and through which such knock-out plates may be actuated.

8. In an apparatus of the described character, a mold-plate having therethrough series of symmetrically arranged openings in communication with corresponding series of matrices conforming to the tiles or plaquettes to be formed and provided with knock-out plates, the upper edges of the walls which separate said openings being kerfed, thin metal strips having their lower edges held in such kerfs and forming the sides and ends of said matrices, the tops of said separating walls at the sides of the thin metal strips forming shoulders adapted for the support of knock-out plates which form bottoms for the matrices.

9. In an apparatus of the described character, a mold-plate having a series of matrices, detachable knock-out plates forming bottoms for the matrices, and carried by the mold-plate, a conveyor support for the mold-plate, and automatic devices disposed directly above the path of the mold-plate and operable in harmony with the movement of the conveyor for containing and supplying to each of said matrices one of such knock-out plates.

10. In an apparatus of the described character, a mold-plate having series of matrices, knock-out plates which form bottoms for the matrices and carried by the mold plate, a conveyor support for the mold-plate, and automatic devices disposed directly above the path of the mold-plate and operable in harmony with the movement of the conveyor for supplying partially liquefied cement to said matrices, said material being sustained by the mold plate as carrying the matrices and the knock-out plates.

11. In an apparatus of the described character, a mold-plate having a series of matrices, detachable knock-out plates which form bottoms for said matrices, and carried by the mold-plate, a conveyor support for the mold-plate, automatic devices disposed directly above the path of the mold-plate for containing and supplying to each of said matrices one of such knock-out plates to be supported by the mold-plate, automatic devices disposed directly above the path of the mold-plate for supplying partially liquefied cement to the matrices, and means for actuating said two automatic supply devices in harmony with the movement of said conveyor support.

12. In an apparatus of the described character, a mold-plate having closely adjoining matrices, means for charging said matrices with partially liquefied cement, means for embedding in the partially liquefied cement contained in said several matrices a suitable fabric, and means for expelling from said matrices such cement—when sufficiently hardened—together with the connecting fabric.

13. In an apparatus of the described character, a mold-plate having series of closely adjoining matrices, means for feed-

ing to said matrices knock-out plates which form bottoms for the matrices, means for charging into the matrices a partially liquefied cement, devices for embedding in such cement a fabric capable of holding the casts so formed—when hardened—against separation, means for smoothing the exposed surfaces of the unhardened cement in the matrices, devices for expelling simultaneously and in undisturbed relation the several knock-out plates and the casts so connected.

14. In an apparatus of the described character, a mold-plate having therethrough a series of openings and a corresponding series of matrices, for each of said matrices a knock-out plate carried by the mold-plate which knock-out plate forms the bottom of the matrix, means for charging into said matrices a partially liquefied cement, devices for investing in such cement a fabric capable of holding the casts so formed—when hardened—in assembled relation, devices for detachably securing a tray upon the mold-plate in contact with the cement and as a closure for the matrices, means for inverting the mold-plate, and means operating through said openings in the mold-plate for actuating the knock-out plates and for expelling the contents of the matrices.

15. In an apparatus of the described character, a mold-plate having matrices conforming to proposed groups of tiles and adapted for the reception of partially liquefied cement, means for investing in cement contained in said matrices a fabric which flexibly connects in assembled relation the casts so formed,—when hardened,—and devices for simultaneously expelling such casts, so connected, from their said matrices, in undisturbed relation.

16. In an apparatus of the described character, a mold-plate having therethrough series of openings and having corresponding matrices adapted for the reception of partially liquefied cement, knock-out plates supported in and which form bottoms for the matrices, means for investing in cement contained in said matrices a suitable fabric, a reciprocable knock-out having projections corresponding in number and arrangement with the several openings in the mold-plate and adapted to expel the several knock-out plates and casts from said several matrices, and gears which move the mold-plate into and out of operative relation to the reciprocable knock-out plate in harmony with the movement of such knock-out plate.

17. An apparatus of the described character, comprising a mold-plate having therethrough series of openings and corresponding series of matrices conforming to a proposed group of tiles or plaquettes, knock-out plates supported in and which form bottoms for the matrices and which may be actuated through said openings, a conveyor support for said mold-plate, gears connected with a suitable source of power for actuating said conveyor, devices disposed above the path of the mold-plate and actuated in harmony with the movement of the conveyor for supplying such matrices with said knock-out plates, devices disposed above the path of the mold-plate and operated in harmony with the movement of said conveyor for charging said matrices with partially liquefied cement, devices disposed above the path of the mold-plate and actuated in harmony with the movement of the mold-plate for supplying to the exposed surface of the cement in the matrices a flexible fabric capable of holding the several casts—when hardened—against separation, a smoothing device for the surface of the cement in the matrices, a knock-out having projections which correspond to the openings in the mold-plate, means for moving said projections and said openings into operative relation, and means for actuating said knock-out, whereby the projections enter said openings and expel from the matrices the flexibly connected casts and said knock-out plates.

18. A casting machine embodying a conveyor, a series of bottomless molds actuable by the conveyor, and removable bottom plates for the molds carried by the molds for holding the material in the molds against movement relatively to the molds.

19. An apparatus for the production of pavement units comprising a traveling open bottom mold series, bottoms for said molds of a series, means for putting the bottoms in said molds, means for feeding plastic material upon the mold bottoms in said molds, warp and woof material supply means to said molds, and means for effecting embedding of the warp and woof in the plastic material.

20. An apparatus for the production of pavement units comprising a traveling open bottom mold series, bottoms for said molds of a series, means for putting the bottoms in said molds, means for feeding plastic material upon the mold bottoms in said molds, warp and woof material supply means to said molds, means for effecting embedding of the warp and woof in the plastic material, and means for simultaneously expressing the warp and woof material and the plastic material as casts from the mold series as a unit.

21. An apparatus for the production of pavement units comprising a traveling open bottom mold series, bottoms for the molds of said series, means for feeding the bottoms into said molds, means for feeding plastic material upon the bottoms in said molds, a warp and woof material supply means to said molds, and means for supplying ad-

ditional plastic material upon said warp and woof material into said molds for embedding the warp and woof material in the plastic material.

22. An apparatus for the production of pavement units comprising a traveling open bottom mold series, bottoms for said molds of a series, means for putting the bottoms in said molds independent of each other to be supported by the molds, and means for feeding plastic material upon the mold bottoms in said molds.

23. An apparatus for the production of pavement units comprising a traveling open bottom mold series, bottoms for said molds of a series, means for putting the bottoms in said molds independent of each other to be carried thereby, means for feeding plastic material upon the mold bottoms in said molds to form casts thereof in said molds, and means for expressing the plastic material as casts from the mold series as a unit.

24. An apparatus for the production of pavement units comprising a traveling open bottom mold series provided with bottom supporting ledges, disconnected independently movable bottoms for said molds of a series, stationary guiding means for feeding the bottoms into said molds to said ledges as traveling past the said means, means for feeding plastic material upon the mold bottoms as sustained by the molds, and means coacting with the mold bottoms for expressing the plastic material as casts from the mold series as a unit together with the mold bottoms for such molds.

In testimony whereof I affix my signature in presence of two witnesses.

EDGAR LEROY LOUDENSLAGER.

Witnesses:

E. L. SKIDMORE,

MARK WINCHESTER.