March 16, 1954 A. MAGNANI 2,672,076

APPARATUS FOR FEEDING REINFORCING ELEMENTS FOR INCORPORATION IN CEMENTITIOUS SHEETS

Filed July 9, 1951 4 Sheets-Sheet 1

Fig. 1,

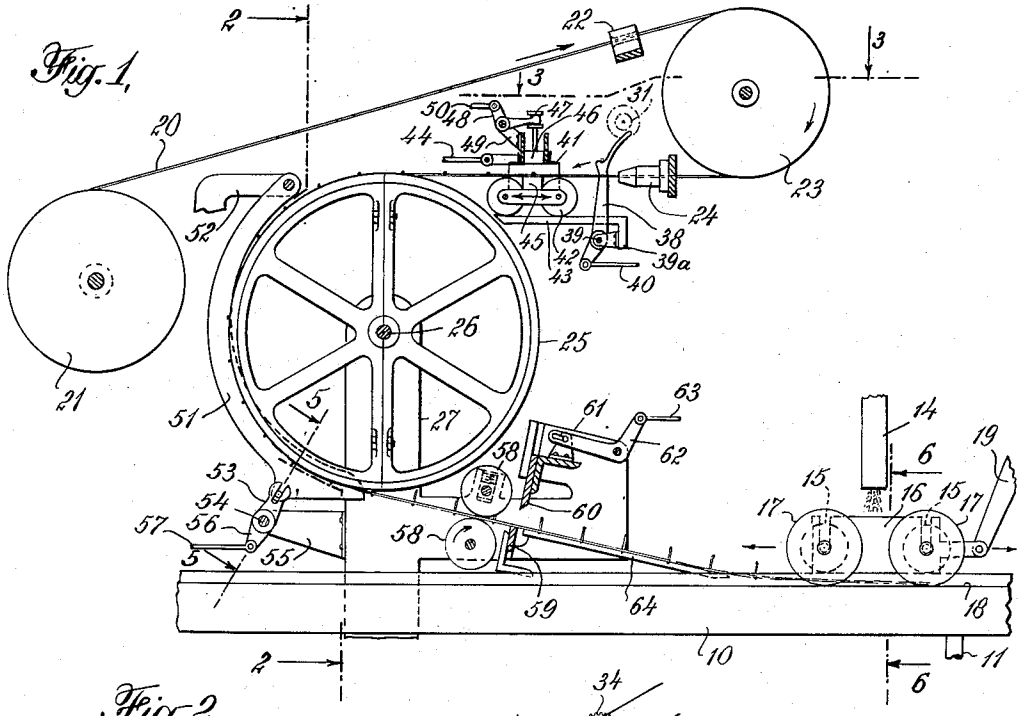


Fig. 2,

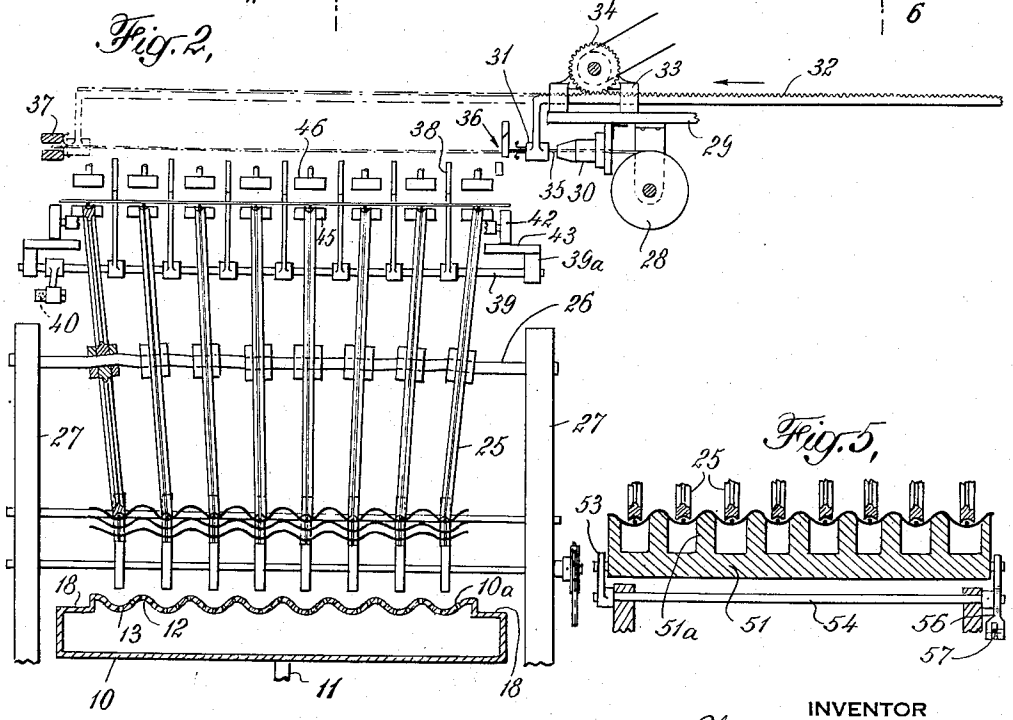


Fig. 5,

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Fig. 3,

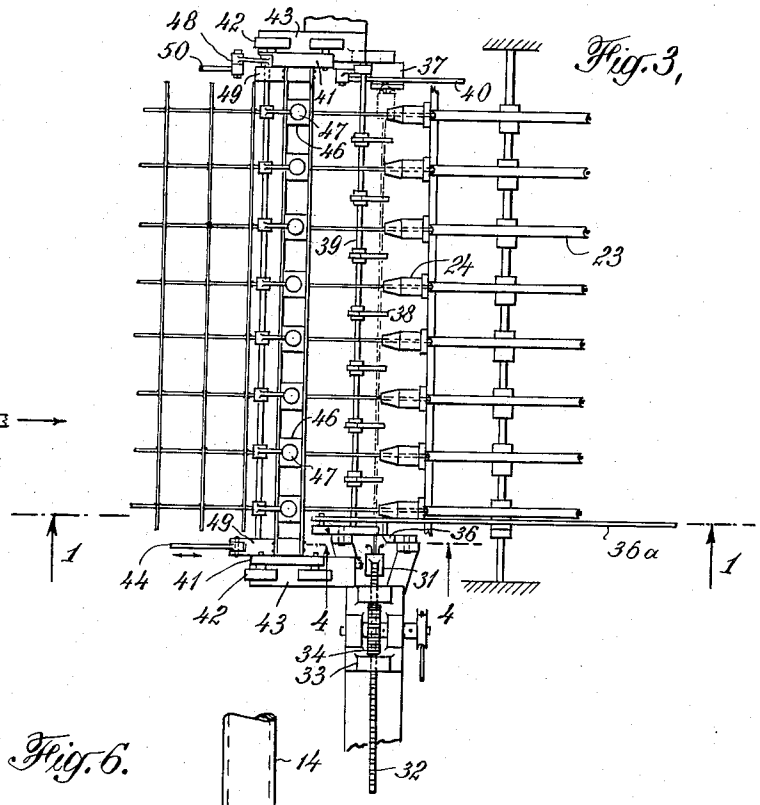


Fig. 4,

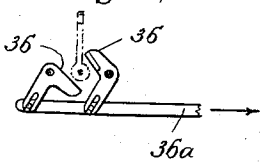
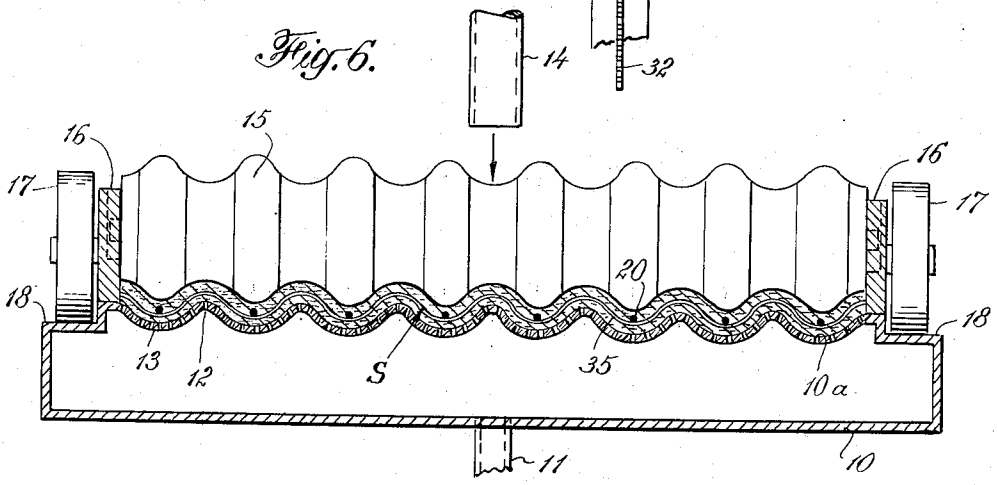


Fig. 6.



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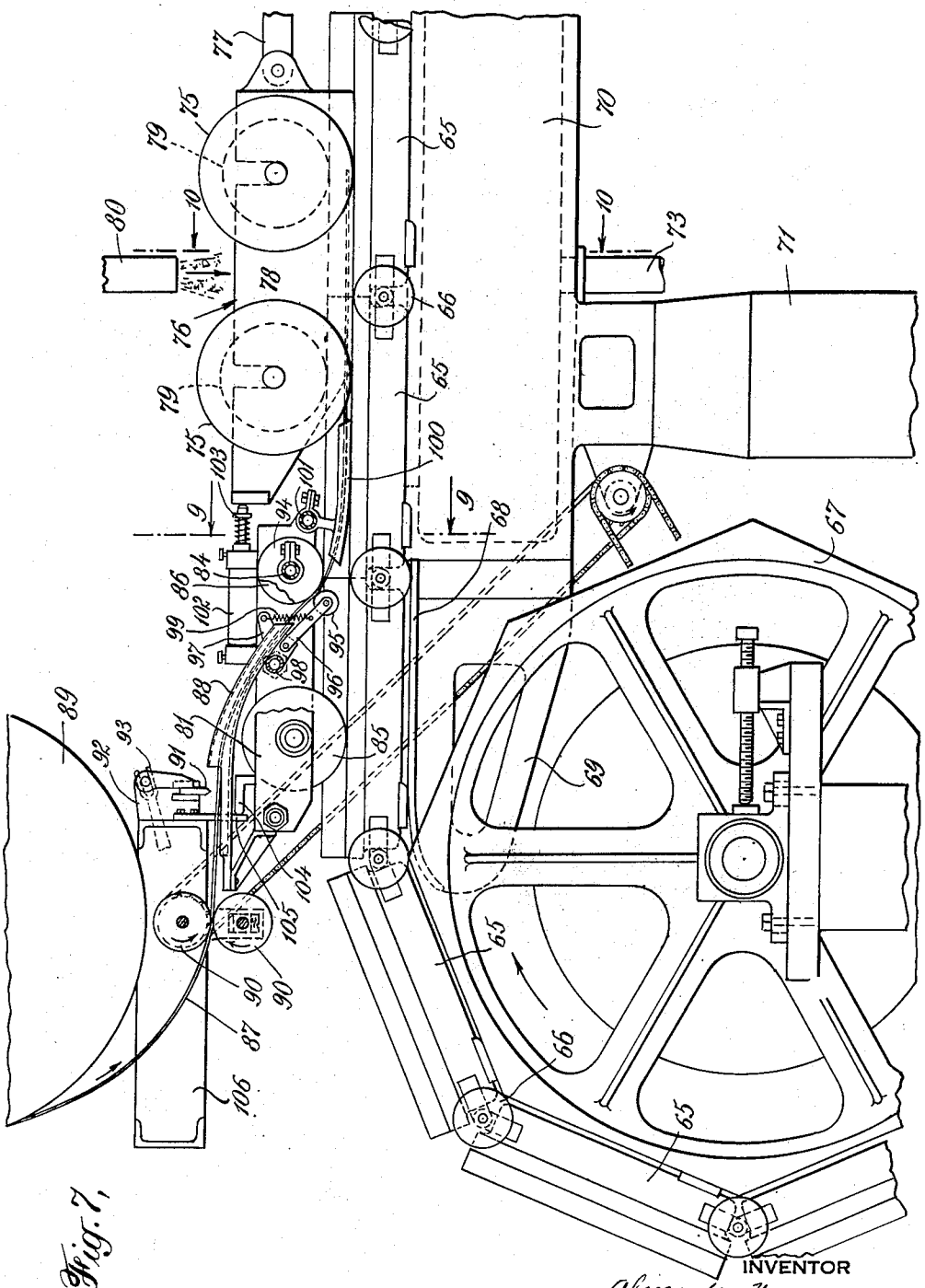


Fig. 7.

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Fig. 8,

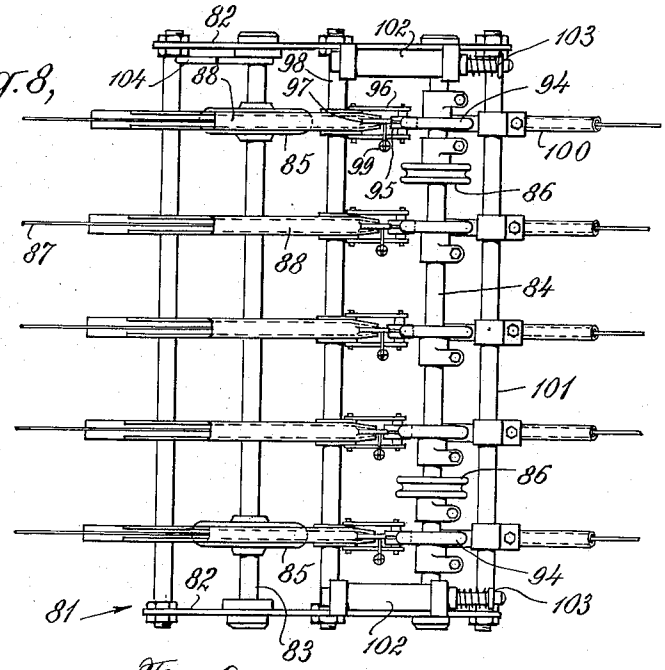


Fig. 9,

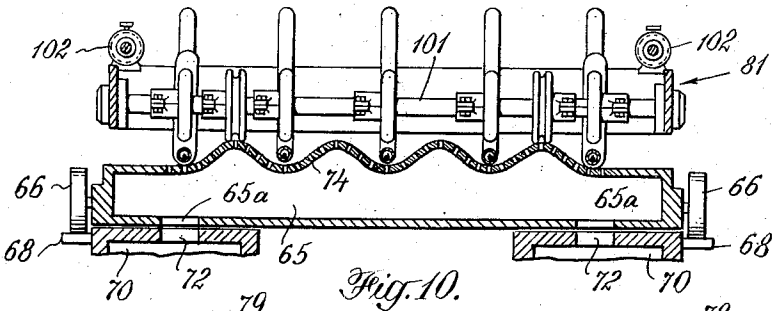
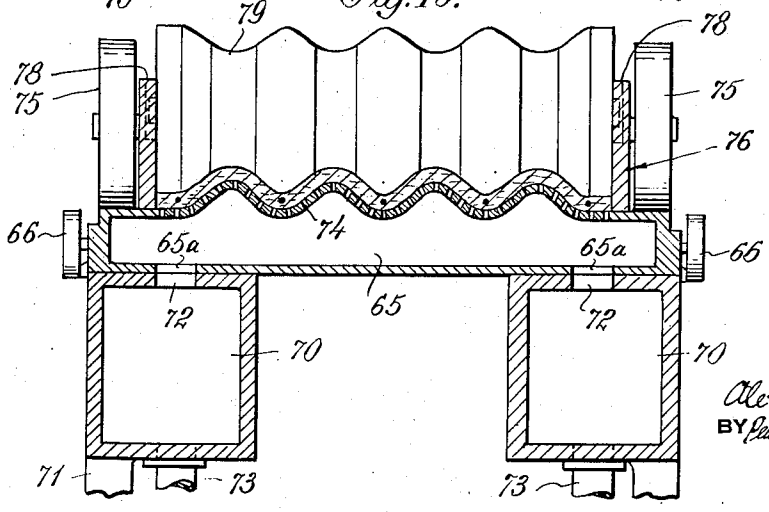


Fig. 10.



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UNITED STATES PATENT OFFICE

2,672,076

APPARATUS FOR FEEDING REINFORCING ELEMENTS FOR INCORPORATION IN CEMENTITIOUS SHEETS

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Application July 9, 1951, Serial No. 235,853

2 Claims. (Cl. 92—40)

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This invention relates to the production of reinforced cementitious sheets and is concerned more particularly with an apparatus for producing such sheets, which includes novel means for feeding the reinforcing elements to the sheet material, as the latter is being formed.

In the production of reinforced fibrous cementitious sheets, one method employed heretofore involves forming the sheets in the usual way and pressing them against the reinforcing elements to enclose the latter. This method is not satisfactory, because it has not been possible in sheets made as described to obtain the desired close contact between the sheet material and the reinforcement. In an alternative method, the reinforcement is applied on the size roller on the board machine after the cementitious material has been deposited on the roller. This method is also unsatisfactory, because, when the sheet is unfolded to lie flat, the attachment between the reinforcement and the cementitious material is weakened.

The present invention is directed to the provision of a novel apparatus for incorporating reinforcing elements in cementitious sheets being produced by distribution of slurry on a traveling suction support by means of a reciprocating carriage. In the new apparatus, the reinforcing elements are drawn from a supply by a pair of continuously driven feeding rollers and they pass between gripping rollers mounted on a second carriage, which is movable along a support. When the distributing carriage moves in the same direction as the support, the second carriage moves with the support and the gripping rollers thereon are stationary. When the distributing carriage returns to its initial position, it moves the second carriage ahead of it and, during such return movement of the second carriage, the gripping rollers are rotated at the proper rate by a roller on the carriage, which lies in contact with and is rotated by the support. The second carriage is provided with guides for the individual elements, which direct them, so that they will be imbedded in the cementitious material between the upper and lower surfaces thereof.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a vertical sectional diagrammatic view of one form of the apparatus on the line 1—1 of Fig. 3;

Figs. 2 and 3 are sectional views on the lines 2—2 and 3—3, respectively, of Fig. 1;

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Fig. 4 is a sectional view on the line 4—4 of Fig. 3;

Figs. 5 and 6 are sectional views on the lines 5—5 and 6—6, respectively, of Fig. 1;

Fig. 7 is a diagrammatic view in side elevation of a modified form of the apparatus;

Fig. 8 is a plan view on an enlarged scale of the carriage employed in the apparatus of Fig. 6 for feeding the reinforcing elements; and

Figs. 9 and 10 are sectional views on the lines 9—9 and 10—10 of Fig. 7.

The apparatus shown in Fig. 1 comprises a suction support 10 of conventional construction, the support being hollow and having a porous top 10a and one or more suction connections 11. The support is for the production of a corrugated sheet, and its top surface is formed with a series of longitudinal crests 12 separated by longitudinal furrows 13.

The cementitious material in slurry form is discharged upon the support through a nozzle 14 between a pair of distributing rollers 15 on a carriage 16. The carriage is provided with rollers 17 resting on the flat margins 18 of the top of the support and, during the operation of the apparatus, the carriage is reciprocated lengthwise of the support by an arm 19 oscillated by suitable means. The distributing rollers 15 of the carriage are shaped to conform with the corrugations in the top of the support and, as the carriage is reciprocated, the cementitious slurry is formed into layers, one upon another, to build up a sheet of the desired thickness on the support.

The reinforcing elements in the form of wires 20, are drawn from coils 21 thereof and pass through tensioning devices 22, around guide rollers 23, and then through straightening devices 24, which remove irregularities from the wires. From the straightening devices, the wires pass to grooved idler wheels 25 mounted on a shaft 26 supported in bearings on a suitable structure 27. The wheels 25 are mounted with their planes of rotation convergent, so that the wires passing down and around the wheels are closer together leaving the wheels than when approaching them.

The reinforcement to be applied to the sheet formed on support 10 in the apparatus of Fig. 1 is made up of a plurality of longitudinal wires 20 connected by wire cross strands. The wire for the cross strands is supplied from a coil 28 mounted on a suitable support 29, and the wire is drawn from the coil through a straightening device 30 by gripping means 31 on a rack 32 mov-

able in guides 33 and longitudinally advanced and retracted by a driven gear 34. As the gear 34 rotates in one direction, it advances the rack 32 in the direction of the arrow and the gripping device pulls a length of the cross strand wire from coil 28 across the series of wires 20 leaving the guides 23. When a cross strand 35 has thus been drawn across the longitudinal wires 20, the cross strand is cut by cutting means, including a pair of co-operating pivoted blades 36 operated by a pull rod 36*a*, and, at about the same time, the gripping device 31 engages a stop 37 and is sprung open. The cross strand is thus released and drops into notches in a plurality of arms 38 fast on a rock shaft 39 mounted in a support 39*a* and operated by a connecting rod 40 driven by suitable means. The levers receive the cross strand before it reaches the longitudinal strands and swing forward to deposit it upon those strands.

A carriage 41 is mounted on rollers 42 traveling on rails 43 lying parallel to the lengths of the wires 20 extending from the straightening devices 24 to wheels 25, and the carriage is reciprocated on the rails by a suitably driven connecting rod 44. The carriage is provided with means for connecting each cross strand 35 to the group of longitudinal strands 20 and such means may be electric welding devices, comprising a plurality of stationary electrodes 45, lying beneath respective longitudinal strands 20 and cooperating with movable electrodes 46 attached to a bar 47 carried by bell cranks 48 supported on brackets 49 on the carriage. The bell cranks are operable by connecting rods 50 to lower electrodes 46 toward stationary electrodes 45. As the carriage 41 moves toward levers 38, the levers swing to deposit a cross strand 35 on wires 20 above the stationary electrodes 45. The carriage then moves along the wires 20 and, during such movement, the electrodes 46 move down against the cross strand 35 lying on top of strands 20 and weld the cross strand to the longitudinal strands. When the welding has been completed, the movable electrodes rise and carriage 41 returns to receive the next cross strand.

The reinforcement, in the form of the network made up of longitudinal strands 20 connected by cross strands 35, is to be introduced into the cementitious sheet formed on support 10 in such manner that the longitudinal strands lie at the bottom of the furrows of the sheet. As the longitudinal strands are spaced farther apart than the adjacent furrows at the time the cross strands are connected thereto and the cross strands are to conform to the cross-sectional shape of the sheet, the cross strands are bent between adjacent longitudinal strands so that the network, as supplied to the sheet, will have a corrugated form corresponding to that of the sheet. The bending of the cross strands is effected by a plate 51 pivoted at its upper end on a support 52 and carrying forming members 51*a* extending between adjacent wheels 25 at the side of shaft 26 where the wheels have their smallest separation. The plate 51 is swung toward and away from shaft 26 by levers 53 mounted in a shaft 54 on brackets 55 in a suitable support, the shaft 54 having an arm 56 operable by a suitably driven connecting rod 57. As the reinforcement network passes around wheels 25, the forming members 51*a* are moved in and out between the wheels and gradually bend the cross strands to the desired form.

The reinforcing network leaving wheels 25 passes between suitably formed friction rollers 58 driven by appropriate means and, beyond the rollers, the network passes through a cutting device comprising a fixed shearing blade 59, with which cooperates a shearing blade 60 mounted for movement in guides in brackets 61 and actuated by a bell crank 62 operated by a connecting rod 63 driven by suitable means. At intervals in the operation of the device, the movable blade 60 is lowered to sever the longitudinal strands of the network between adjacent cross strands.

The network enters a plurality of fixed guides 64 beyond the cutting device, and the guides extend down between the crests of the support in such position that the longitudinal strands of the network are delivered to the sheet in the furrows and in such position as to lie between the upper and lower surfaces of the sheet. The cross strands then lie within the crests and furrows of the sheet between the surfaces thereof.

In the operation of the apparatus, the support 10 is gradually advanced in the direction of its length beneath the reciprocating distributing carriage 16, so that the successive layers of cementitious material build up on the support to form a sheet of the desired thickness. The forward end of the reinforcing network initially lies beneath the distributing carriage and, as the sheet is built up and fluid is withdrawn therefrom through the support, the material becomes compacted about and in contact with the reinforcement. As the support moves along, the reinforcement moves with it partly by reason of the reinforcement being embedded in the sheet and partly by the feeding action of friction rollers 58. At the desired intervals, the reinforcement is cut by the cutting blades 59, 60 and the reinforcement is again introduced into the sheet beneath the distributing carriage 16 with the cut ends of the reinforcement spaced so that the sheet is formed with the sections without reinforcement.

If desired, the support 10 may be stationary, in which event the distributing carriage 16 is both reciprocated and gradually advanced along the support. Also, the other elements of the machine, such as the straightening devices 24, the means for connecting the cross strands to the longitudinal strands, the wheels 25, forming plate 51, and rollers 58, are mounted on a carriage advancing along the support at the same rate of advance as the distributing carriage 16.

In the machine shown in Figs. 1–5, inc., the reinforcing network made up of longitudinal strands 20 and cross stands 35 includes only as many longitudinal strands as there are furrows in the finished sheet S, and the longitudinal strands lie at the bottoms of the furrows. It will be evident that more longitudinal strands may be employed in producing the network, so that these strands will lie both at the bottoms of the furrows and at the tops of the crests within the sheet, if desired.

In the machine shown in Figs. 7–10, inc., the suction support is of the endless type and is made up of a plurality of hollow boxes 65 pivotally connected end to end with the connections provided with rollers 66. The support is trained about driving wheels 67 of polygonal form and, in the upper stretch of the support leaving the top of one wheel and traveling to the other, the rollers 66 at first run on rails 68 on suitable brackets 69 attached to the ends of suction chambers 70 mounted on standards 71. There are two suction chambers lying beneath the opposite edges of the upper horizontal stretch of the endless support, and each chamber is formed with one or

more longitudinal slots 72 in its top surface. The boxes 65 are similarly provided with slots 65a through their bottom walls, which register with the slots in the suction chambers as the boxes move along them. When the rollers 66 on the support run off rails 68, boxes 65 drop down slightly to rest upon the top of the suction chambers 70, from which air is continuously withdrawn through pipes 73 attached to suitable suction means.

The machine disclosed is for the purpose of making longitudinally corrugated sheets, and the top wall 74 of each box 65 is corrugated in the direction of the length of the support. The corrugated area of the top of each box 65 is porous and, at the sides of the porous area, the top of the box has flat margins, on which travel the rollers 75 on a distributing carriage 76 reciprocated lengthwise of the support by a suitably driven connecting rod 77. The carriage is formed with side walls 78 having slots to receive the shafts of distributing rollers 79, which are corrugated to correspond with the corrugations in the top wall 74 of the boxes 65 of the support. The cementitious slurry is discharged upon the support between rollers 79 through a nozzle 80 and, as the carriage 76 reciprocates, the slurry is distributed in layers on the top of the support until a sheet of the desired thickness is built up. During the building up of the sheet, moisture is continuously withdrawn through the porous tops of boxes 65.

The mechanism for feeding the reinforcement comprises a second carriage 81, in the side walls 82 of which are mounted shafts 83 and 84. Shaft 83 carries a pair of wheels 85, which run in the furrows in the top of the suction boxes 65, and shaft 84 carries wheels 86, which rest on the tops of the crests of the top walls of the boxes. The machine is constructed for producing a corrugated sheet having longitudinal reinforcing elements 87 in the furrows and the carriage is provided with guides 88 lying above the furrows in the suction boxes.

The reinforcing elements 87 are drawn from a supply roll 89 by driven friction rollers 90 and pass to the guides 88 beneath a reciprocable cutting blade 91 movable in guides in a bracket 92 and operated by a driven lever 93. The portions of the guides beneath the blade are formed as anvils, with which the blade may cooperate to sever the elements 87. The reinforcing strands leaving the guides pass beneath rollers 94 on shaft 84 and are pressed against those rollers by rollers 95 (Fig. 8) mounted in arms 96 pivoted on plates 97 rigidly attached to a cross bar 98 connecting the side members 82 on carriage 81. Springs 99 attached to arms 96 and to plates 97 urge rollers 95 toward rollers 94, so that each strand is gripped between a pair of the rollers. The strands passing beneath rollers 94 enter lower guides 100 mounted on a cross bar 101 of the carriage. The guides 100 terminate close to the adjacent distributing roller 79 on carriage 76, and lie in contact with the bottoms of the furrows in boxes 65 so as to feed the elements at the right elevation in relation to the sheet to be formed.

The carriage 81 is provided adjacent one end with a pair of dashpots 102, having spring pressed plungers 103 engageable by a part of carriage 76. At its other end, carriage 81 is provided with a bracket 104 engageable with a stop 105 on a part 106 of the frame structure.

In the operation of the apparatus shown in Figs. 7–10, inc., the endless set of boxes 65 is advanced continuously beneath nozzle 80 and the carriage 76 which is continually reciprocated to distribute the cementitious slurry on the porous top surfaces of the boxes in the upper stretch of the support to form overlapping layers making up the final sheet. The reinforcing wires are fed from the supply roll and ultimately pass out through guides 100 so that they are embedded in the sheet as the latter is being built up. When the wires have been caught within the sheet and the distributing carriage 76 moves in the same direction as the sheet, the second carriage 81 having its rollers 85, 86 resting on top of the suction support moves forward with the support. During such movement of carriage 81, the friction rollers 90 feed the reinforcing wires at the rate, at which carriage 81 moves forward. The carriage 76 moves faster than the support in the direction of travel of the latter and, during the return of carriage 76, it engages plungers 103 on carriage 81 and moves carriage 81 along the support in a direction opposite to the travel thereof. During such return movement of carriage 81, rollers 86 on the carriage roll on the support and simultaneously rolls 94, which are of the same diameter as rolls 86 and fast on the same shaft 84, are turned counterclockwise at such speed that the wires 87 are fed in the direction of travel of the support and at the same speed. The wires are, accordingly, fed to the sheet being formed on the support at the proper rate regardless of the direction of movement of carriage 81.

At suitable intervals during the operation of the carriages and at the time that carriage 81 has made its full movement in the direction of travel of the support, the cutting blade 91 is lowered to sever the wires. The severed lengths of the wires are fed along with the support by reason of the portions thereof embedded within the sheet and the ends of the wires to the rear of the blade are advanced by rollers 90 and ultimately issue through guides 100 to be embedded again within the sheet. If desired, the operation of the friction rollers 90 may be interrupted briefly by momentarily separating them as by cam action, so that a section of the sheet is formed without reinforcement and may be used for severing the sheet into smaller units. Alternatively, the rolls 90 may be driven at such a speed as to advance the wires 87 at a rate somewhat slower than the rate of travel of the suction support. After the wires have been embedded in the sheet, the difference between the speed of travel of the sheet and the rate, at which the wires are fed, causes the wires to be tensioned and, whenever the wires are cut, a section of the sheet without reinforcement is automatically formed.

In the apparatus shown in Figs. 7–10, inc., the reinforcing wires are fed only to the furrows within the sheet, but, if desired, carriage 81 may be provided with additional guiding means, so that the wires may be fed for embedding in the sheet both at the tops of the crests and at the bottoms of the furrows. Also, the apparatus may include the means employed in the apparatus of Fig. 1 for connecting cross strands to the longitudinal strands to form a network reinforcement which, if the sheet is of corrugated form, will be given a corresponding corrugated form by the use of wheels similar to wheels 25, and forming members similar to members 51a.

In the apparatus illustrated and described, the reinforcement made up of longitudinal strands,

with or without cross strands connected thereto at intervals, is fed from a source of supply, introduced into the sheet as the latter is being built up on the suction support, and then severed at intervals. If desired, pre-cut lengths of the reinforcement may be deposited upon the sheet at the proper time during the formation of the sheet. In an apparatus operating to supply such pre-cut lengths of the reinforcement, the cementitious slurry is supplied to the support at spaced points by separate nozzles and a distributing carriage reciprocating along the support is provided at each nozzle. The carriages are spaced a distance such that the lengths of reinforcement may be advanced from a supply and deposited upon that part of the sheet formed by the action of the first carriage, after which the remainder of the sheet is formed above the reinforcement by the action of the second carriage.

I claim:

1. An apparatus for producing a reinforced cementitious sheet, which comprises a suction support, means for advancing the support in the direction of its length, means for depositing cementitious material upon the support, and means for feeding a plurality of reinforcing elements lengthwise and depositing them in spaced relation upon the sheet lengthwise thereof including guides for the respective elements spaced laterally across the support, pairs of rollers gripping the elements and rotatable to advance them through their guides, and a set of rollers connected to one gripping roller of each pair and rotatable therewith, the rollers of said set being in contact with the suction support in advance of the depositing means and being rotated through said contact.

2. An apparatus for producing a reinforced cementitious sheet, which comprises a suction support, means for advancing the support in the direction of its length, means for depositing cementitious material upon the support, and means for feeding a plurality of reinforcing elements lengthwise and depositing them in spaced relation upon the sheet lengthwise thereof including guides for the respective elements spaced laterally across the support, a shaft extending transversely of the suction support, a set of rollers fast on the shaft and engaging respective elements, a plurality of spring-pressed rollers cooperating with those on the shaft to grip the elements, and a second set of rollers fast on the shaft and in contact with the suction support, the rollers of said second set being rotated through said contact with the support.

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