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Yost

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[45] **July 1, 1975**

[54] **METHOD FOR FORMING A CORED CONCRETE SLAB**

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[73] Assignee: **Joseph J. Dues,** Dayton, Ohio

[22] Filed: **Sept. 14, 1971**

[21] Appl. No.: **180,442**

Related U.S. Application Data

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[52] **U.S. Cl.** **264/72;** 264/228; 264/308; 264/DIG. 57

[51] **Int. Cl.** **B28b 1/08**

[58] **Field of Search** ..... 264/33, 34, 228, 229, 256, 264/308, DIG. 71, 72; 249/20, 21, 22; 425/63, 64, 111, 130, 427, 429, 134, 262

[56] **References Cited**

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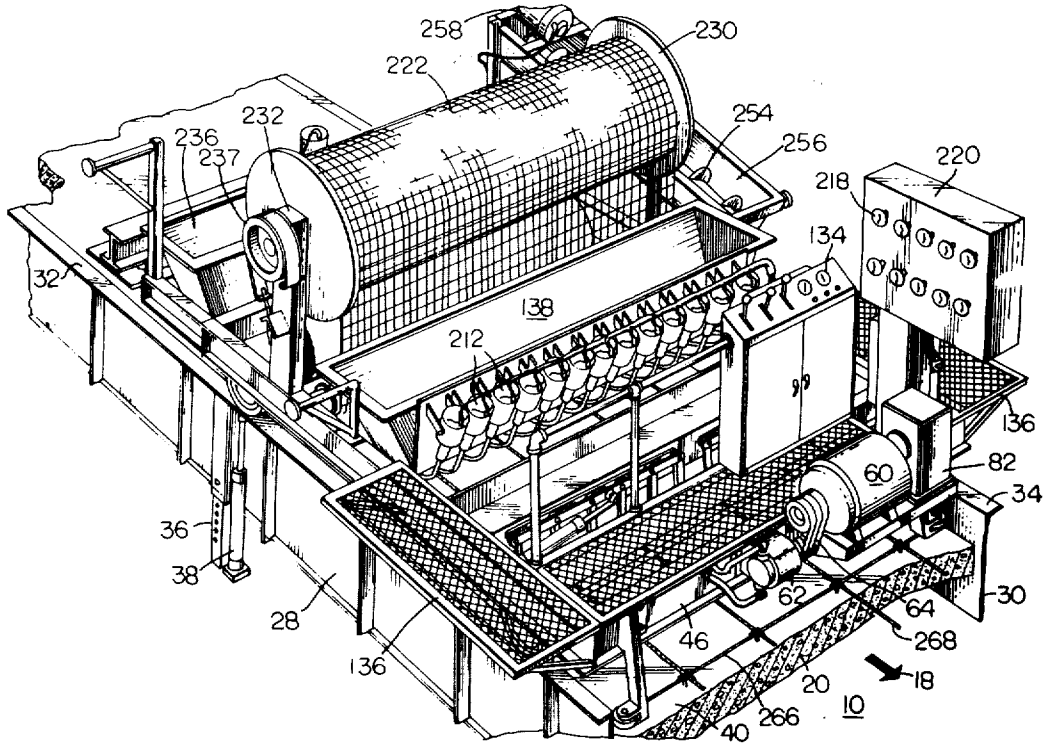
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Assistant Examiner—Thomas P. Pavelko

[57] **ABSTRACT**

A method for forming cored concrete slab utilizing an elongated fixed mold for forming the opposite sides and bottom surface of the slab. A concrete depositing and core forming assembly moves longitudinally over the mold, the assembly including a plurality of elongated core forming mandrels and a hopper which deposits a first layer of concrete in the mold generally to the top of the mandrels. A length of metal mesh is provided having its free end attached at one end of the mold, the mesh being coiled on a reel mounted on the assembly which lays the mesh over the mandrels and the first layer, applying tension thereto, as the assembly moves toward the other end of the mold. Another hopper is mounted on the assembly which deposits a second layer of concrete over the first layer and mesh. The concrete has a slump of from 1 to 2 inches and the mesh is chosen so as to act as a concrete supporting material so as to allow removal of the mandrels at a rate faster than the concrete becomes self supporting whereby the mesh prevents collapsing of the cores. The mandrels may be rotated as they are withdrawn from the concrete and the method may also be utilized to form prestressed cored slabs.

7 Claims, 8 Drawing Figures



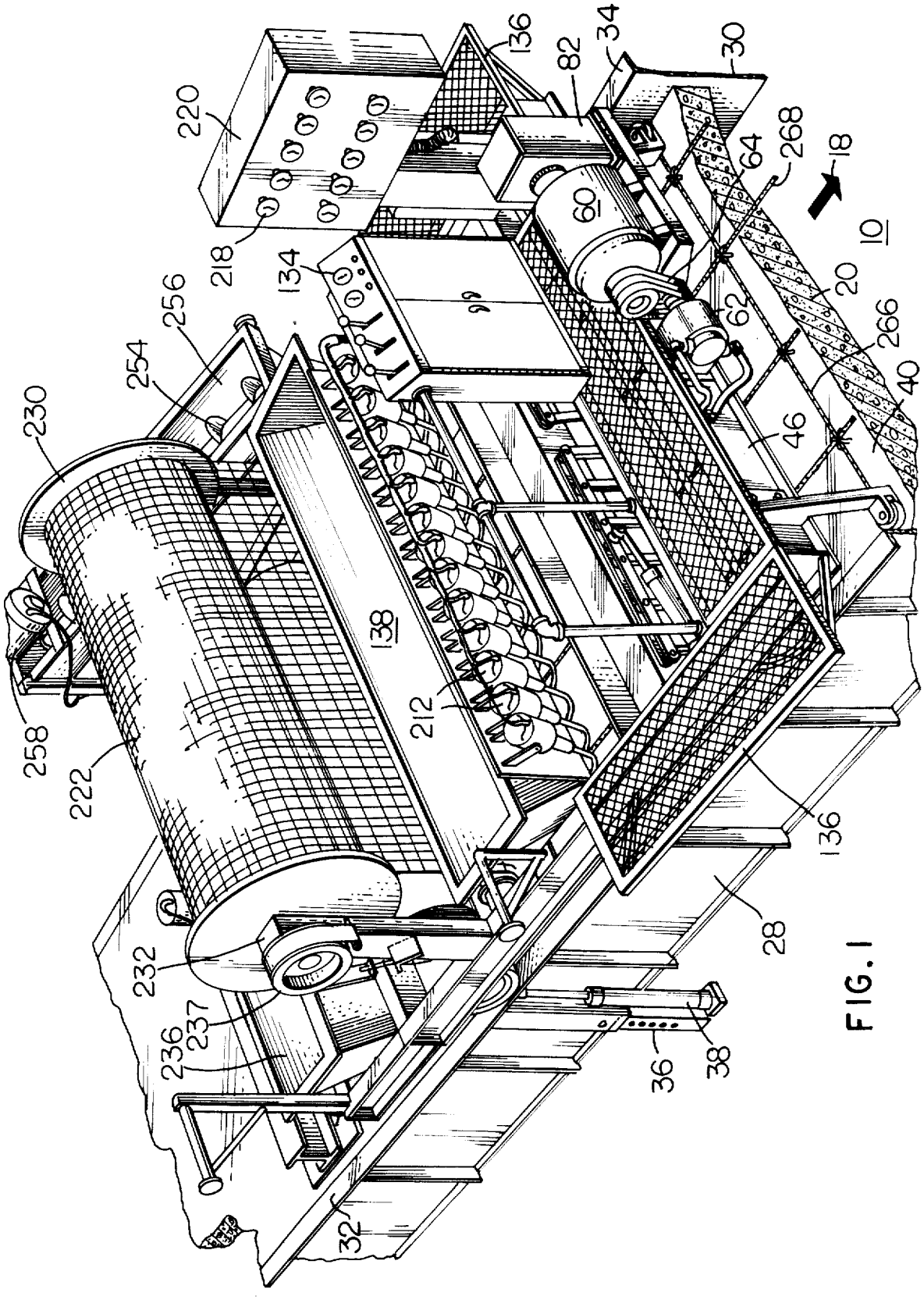

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FIG. 1

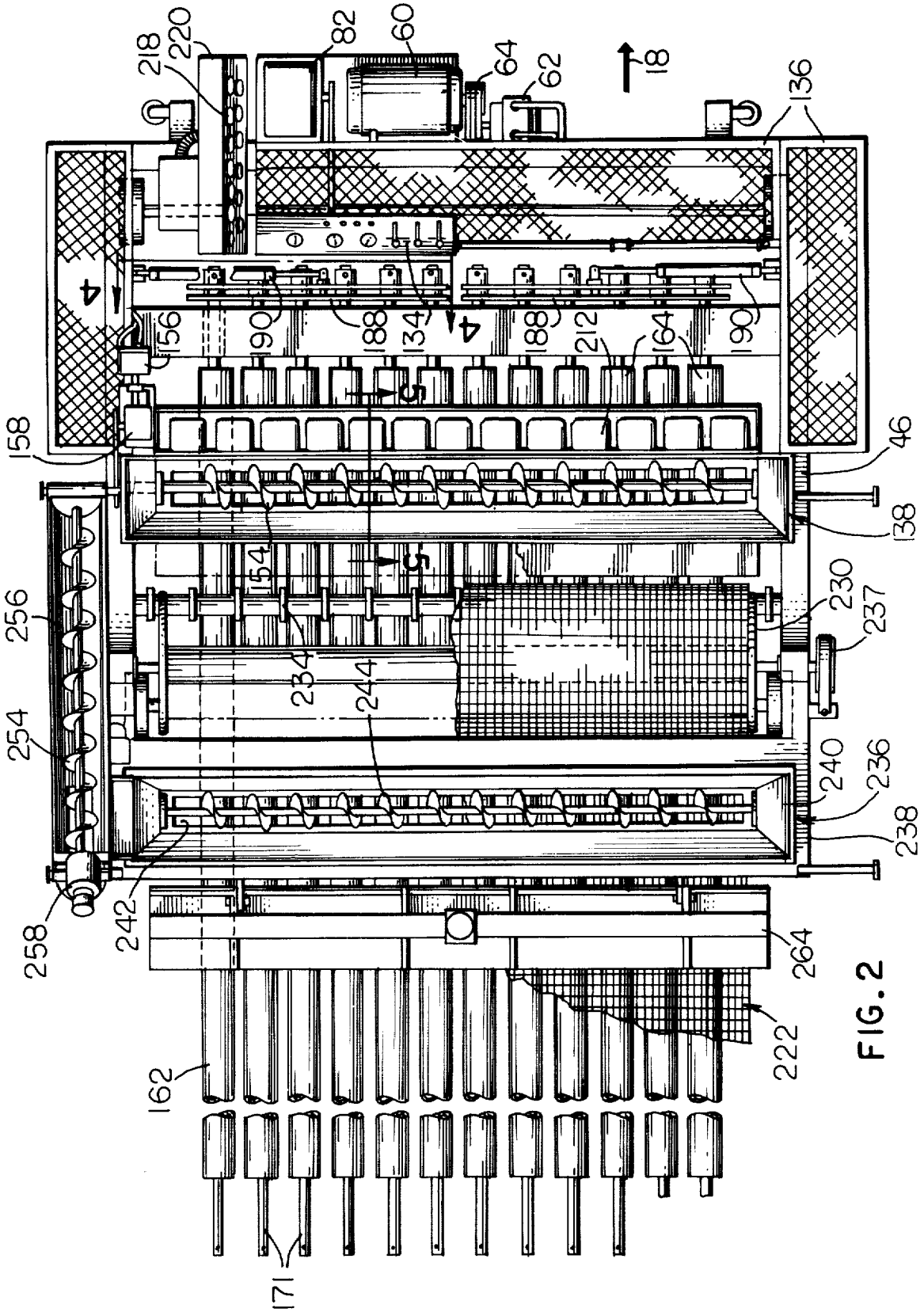
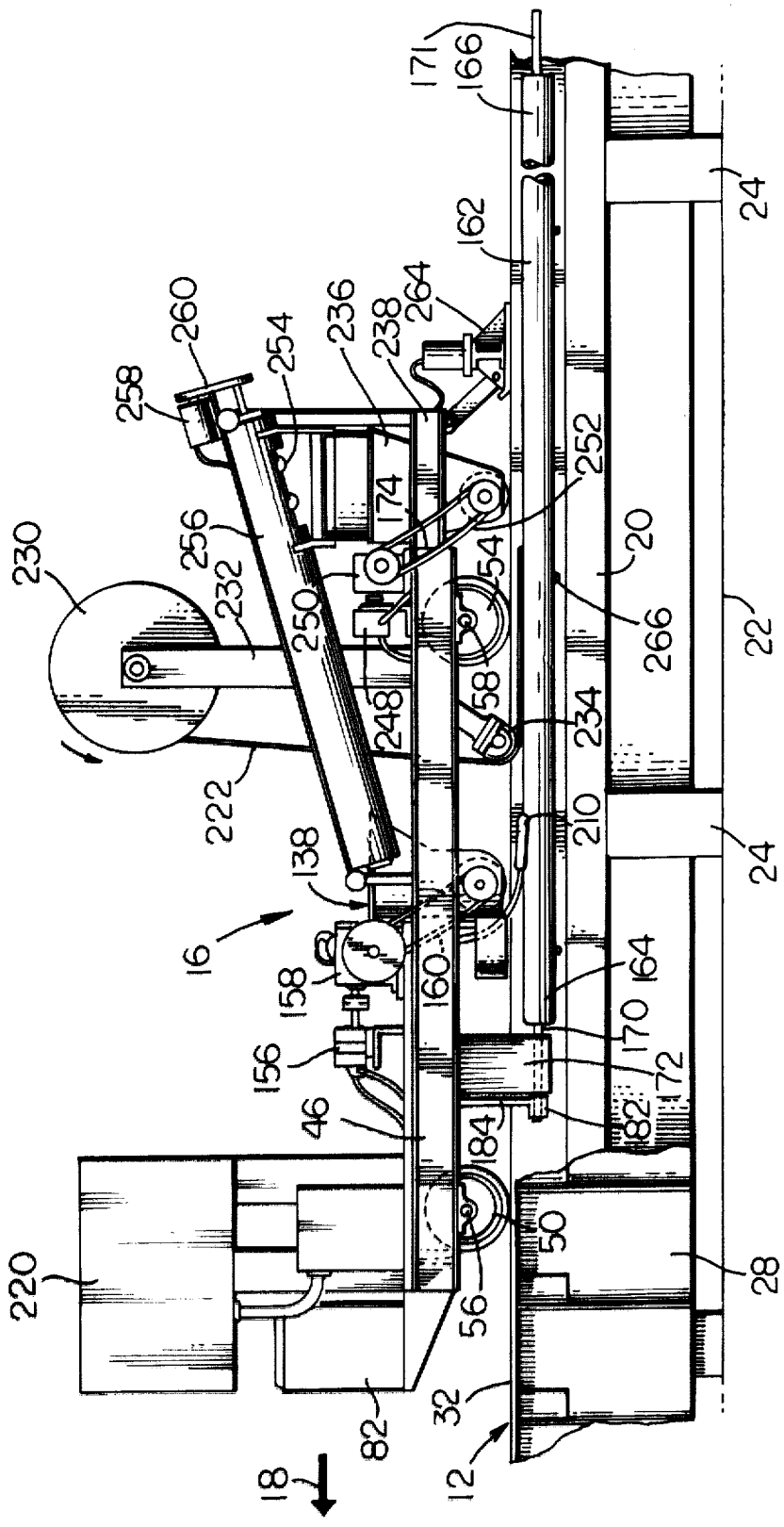

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FIG. 2

FIG.3


171
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162
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238
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174
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256
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266
22
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248
234
222
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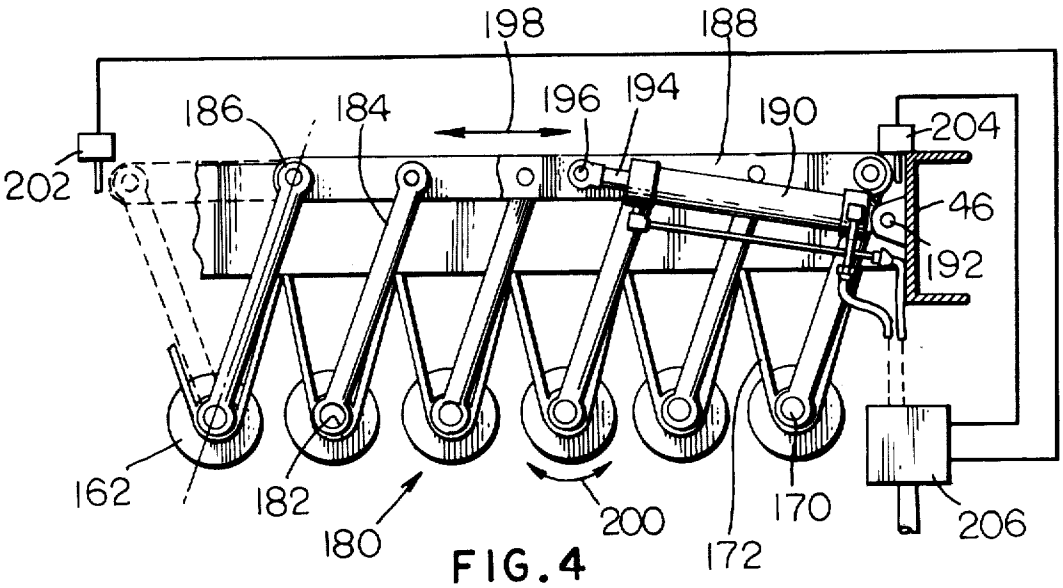

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FIG. 4

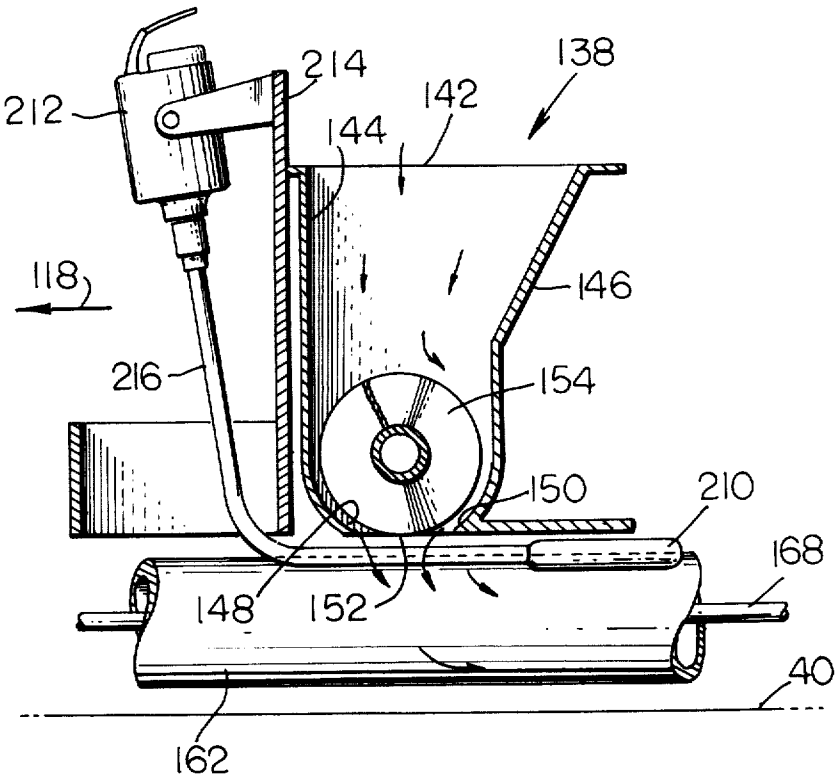

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FIG. 5

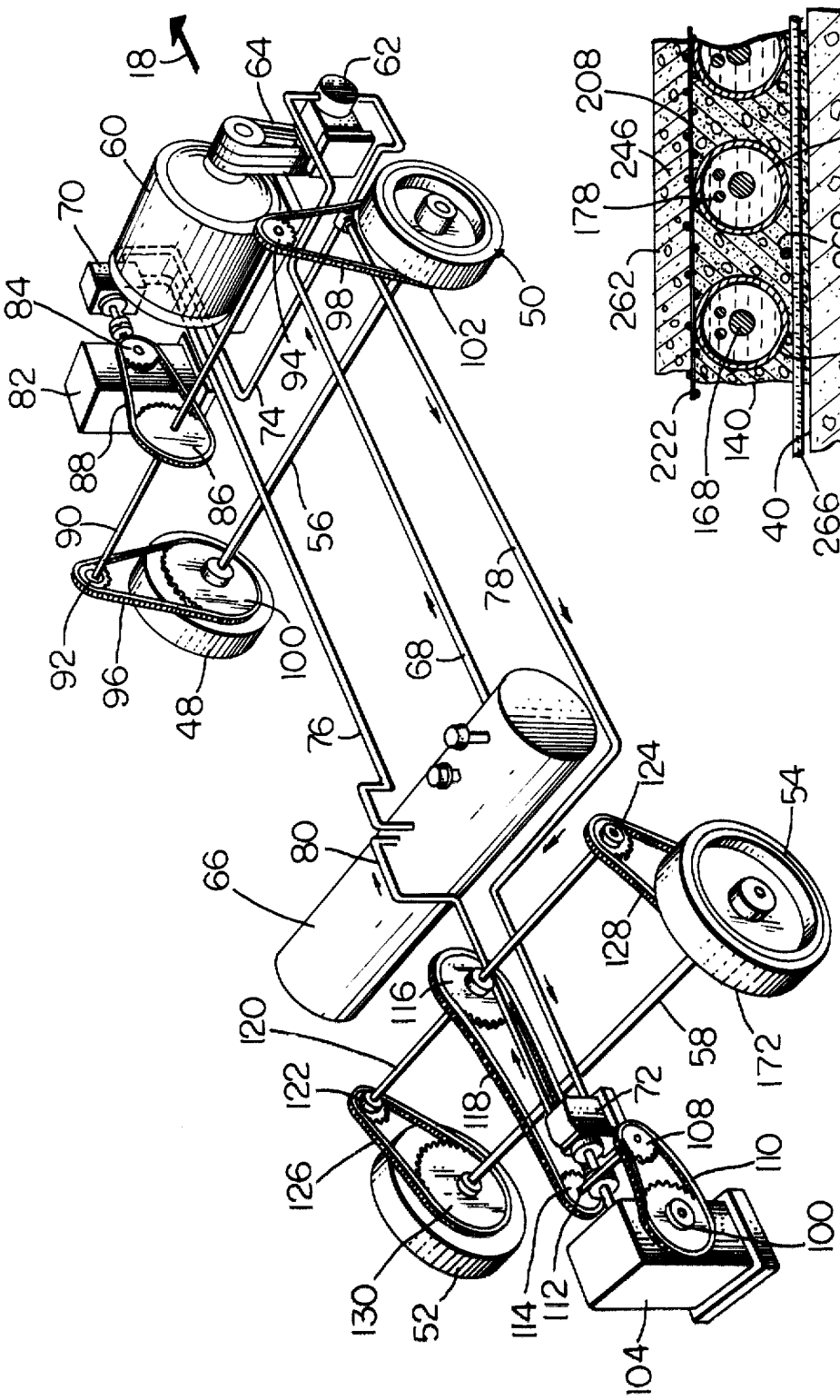

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128
116
120
122
118
72
108
110
126
130
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114
112
100
104
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172

FIG. 6

208
246
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262
176
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162
222
140
168
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266
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FIG. 8

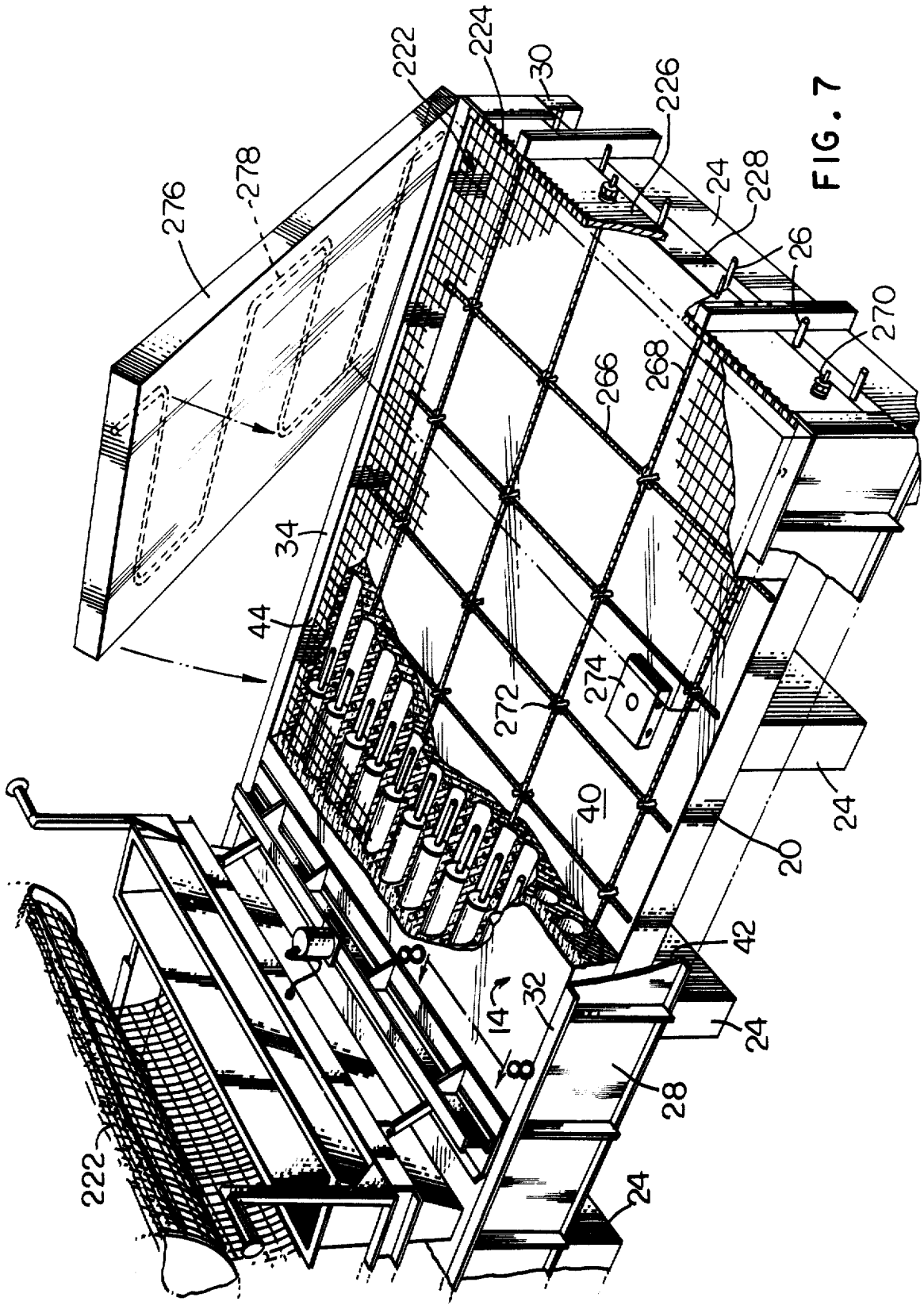

222
224
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226
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228
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274
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14
8
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222
24

FIG. 7

METHOD FOR FORMING A CORED CONCRETE SLAB

This is a Divisional application of application Ser. No. 771,152 filed Oct. 28, 1968 now U.S. Pat. No. 3,647,308.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to apparatus and methods of forming reinforced concrete structural elements, and more particularly to an apparatus and method for forming a cored concrete slab from low slump concrete.

2. Description of the Prior Art

Prestressed reinforced concrete beams, slabs, panels and other structural elements are extensively employed in the construction industry. Many of such elements are of the cored type, i.e. having cavities or cores therein for reducing the overall weight.

Such cored concrete structural elements are commonly formed by one of two different processes. The first process, employs a concrete mixture having no slump. This mixture is pressure formed into the desired shape. In one form of apparatus utilizing no slump concrete, an elongated stationary mold is employed which forms the sides and bottom surface of the element. An extruding device moves along the mold carrying a top plate which completes the mold cavity, and the relatively dry concrete mixture is forced into the cavity by rotating augers which also respectively form the cores in the product. In another apparatus utilizing no slump concrete an extruding assembly moves over a bed successively depositing three layers of relatively dry concrete mix, each layer being compacted by reciprocating tamping devices. The middle layer surrounds a plurality of reciprocating mandrels which form the cores, and the sides of the slab are formed by a slip form device which advances with the assembly. Both of the above-described types of apparatus for performing the dry process possess certain disadvantages. One such disadvantage is that it has not been possible to incorporate inserts, such as electrical junction boxes, conduits and the like, into slabs formed in this manner.

In the second method of forming prestressed cored concrete structural elements, concrete having a low slump is poured in the mold, cured and removed therefrom. There is a preference in the industry for using concrete having a low slump rather than concrete having no slump, particularly where it is desired to include various types of inserts in the product. In one comparatively simple form of apparatus employing low slump concrete, a stationary mold is provided which forms the sides and bottom surface of the product. Elongated inflated mandrels are positioned in the mold and the relatively fluid or wet concrete is then poured into the mold covering the mandrels. After curing, the mandrels are deflated and removed leaving the cores in the product. In another type of apparatus employing low slump concrete, referred to as a slip form machine, an assembly is moved over a bed. The slip form machine forms the sides of the product; the bed forms the bottom surface of the slab. This assembly also carries a plurality of elongated mandrels or core tubes which form the cores in the product, the relatively wet concrete being poured over the mandrels into the mold cavity formed by the slip form machine and the stationary bed. The speed of operation of the slip form machine is necessarily limited by the fact that the moving assembly carries a portion of the mold and thus can travel only as fast as the concrete cures so as to be self-supporting.

SUMMARY OF THE INVENTION

It is desired to provide an apparatus and method for forming a prestressed, cored concrete slab employing low slump concrete which incorporates all of the advantages of such a process.

In accordance with the broader aspects of the invention, a longitudinally elongated mold is provided for forming the opposite sides and bottom surface of the slab. Means are provided for progressively laying a layer of cementitious material in the mold and including means disposed over the mold for receiving cementitious material in relatively fluid form and depositing the same in the mold, and means are provided for relatively longitudinally moving the depositing means with respect to the mold in the direction of elongation thereof. A plurality of elongated mandrels are provided disposed in the mold in spaced, parallel relationship and extending in the direction of relative movement for forming the longitudinally extending cores in the slab, the mandrels having spaced opposite ends and having portions intermediate their ends disposed under the depositing means. Means are provided for attaching the leading ends of the mandrels which face in the direction of relative movement to the laying means so that the mandrels are relatively moved with the depositing means. In the preferred embodiment, the layer of cementitious material is deposited to a level generally even with the tops of the mandrels and an elongated length of mesh reinforcing material is provided having its free end attached to the mold, the laying means laying the mesh, under tension, over the previously deposited layer, the laying means including means for depositing a second layer of cementitious material in relatively fluid form over the first layer and mesh.

It is accordingly an object of the invention to provide improved apparatus for forming a cored concrete product.

Another object of the invention is to provide an improved apparatus employing concrete having a low slump, in contrast to no slump, for forming a prestressed, cored concrete product.

A further object of the invention is to provide an improved method for forming a cored concrete slab from concrete having a low slump in contrast to no slump.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary view in perspective, partly broken away, illustrating the apparatus of the invention;

FIG. 2 is a top view of the apparatus illustrated in FIG. 1;

FIG. 3 is a side view of the apparatus illustrated in FIG. 1, partly broken away;

FIG. 4 is a fragmentary cross-sectional view, partly schematic, taken generally along the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary cross-sectional view, taken generally along the line 5—5 of FIG. 2;

FIG. 6 is a generally schematic diagram showing the propulsion system of the apparatus;

FIG. 7 is a fragmentary view in perspective, partly in cross-section, useful in explaining the method of the invention, and further illustrating certain features of the apparatus; and

FIG. 8 is a fragmentary cross-sectional view taken along the line 8—8 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The Apparatus

Referring now to the drawings, the apparatus of the invention, generally indicated at **10**, comprises a mold assembly **12** for forming the parallel opposite sides and bottom surface of slab **14**, and an assembly **16** which travels on the mold depositing cementitious material therein, forming the core openings in the slab, and finishing the top surface as its forward movement in the direction shown by the arrow **18** progresses.

Mold **12**, only a short section of which is shown, but which may be several hundred feet in length, comprises a bed **20** supported upon a supporting surface **22**, such as the ground, by a plurality of longitudinally spaced-apart support elements **24**. Bed **20** may have conduits **26** formed therein for circulating a heating medium, such as heated oil, in order to accelerate the curing of the slab in the mold. A pair of side mold elements **28**, 30 are provided on the opposite sides of bed **20** and extend longitudinally the entire length thereof. Side mold elements **28** and **30** have rails **32** and **34** formed on their upper extremities for supporting the assembly **16** for longitudinal movement with respect to the mold **12**. Side mold elements **28** and **30** are supported upon the supporting surface **22** by a plurality of spaced-apart, vertically adjustable supports **36**, and are adapted to be vertically raised and lowered between upper and lower positions by a plurality of conventional hydraulic jacks **38**. In their upper positions, side mold elements **28** and **30** extend upwardly above the upper flat surface **40** of bed **20**. The inner surfaces **42** and **44** of side mold elements **28** and **30** thus define a mold cavity having an open top. The elements **28**, **30** with upper surface **40** of base **20** form the opposite parallel sides and bottom surface of the slab **14**. In the lower positions of side mold elements **28** and **30**, rails **32** and **34** are flush with the upper surface **40** of base **20**, or lower, thereby to assist in the removal of the slab **14** from the mold cavity and to permit transverse sawing of the elongated slab **14** in the mold into shorter elements of desired length by a conventional concrete sawing apparatus (not shown).

The assembly **16** comprises a supporting frame **46** supported on the rails **32** and **34** of the side mold elements **28** and **30** for longitudinal movement thereon by means of a forward pair of wheels **48** and **50** and a rear pair of wheels **52** and **54**. The forward pair of wheels **48** and **50** are respectively mounted on an axle **56** and the rear pair of wheels **52** and **54** are likewise mounted on an axle **58**, axles **56** and **58** being mounted on frame **46**, as shown.

The assembly **16** is moved longitudinally over the mold **12** in the direction shown by the arrow **18**. The assembly **16** is guided to move on the rails **32** and **34** by the guides **47**. The guides **47** are located at each corner of the frame **46** and engage the facing surfaces **42** and **44** of elements **28** and **30**.

The wheels **48**, **50**, **52** and **54** are driven by the propulsion system shown in FIG. **6**. A suitable electric motor **60** is mounted on frame **46** and drives a conventional hydraulic pump **62** through a conventional belt drive **64**. Pump **62** receives hydraulic fluid from hydraulic tank **66** through supply line **68**. Hydraulic pump **62** independently drives the forward pair of wheels **48** and **50**, and the rear pair of wheels **52** and **54**, respectively, through conventional hydraulic motors **70** and **72**. Pump **62** is connected to the forward hydraulic motor **70** by pressure line **74**, hydraulic motor **70** having a discharge line **76** which is returned to the tank **66**. Pump **62** likewise drives the hydraulic motor **72** through pressure line **78**, motor **72** having discharge line **80** which is returned to the tank **66**. The forward hydraulic motor **70** drives a suitable gear box **82** which, in turn, drives the forward wheels **48** and **50** through sprockets **84** and **86**, drive chain **88**, jack shaft **90**, sprockets **92** and **94**, and drive chains **96** and **98** respectively driving the forward wheels **48** and **50** through sprockets **100**, **102** thereon. The rear hydraulic motor **72** similarly drives gear box **104** which drives the rear wheels **52** and **54** through sprockets **106** and **108**, drive chain **110**, jack shaft **112**, sprockets **114** and **116**, drive chain **118**, jack shaft **120**, and sprockets **122**, **124** which respectively drive rear wheels **52**, **54** through drive chains **126** and **128**, driving sprockets **130**, **132** thereon.

Motor **60** may be energized by suitable flexible cables, or more preferably by a conventional third rail and sliding contact system (not shown). Suitable motor controls **134** are provided for controlling the speed of motor **60** and thus the linear speed at which the assembly **16** moves in the direction **18**. Suitable catwalks **136** are supported on frame **46** for the operator and provide access to the motor controls **134**.

An elongated hopper **138** is mounted on frame **46** and extends transversely thereacross over the mold **12** for depositing cementitious material in the mold cavity to form a first layer **140** therein as the assembly **16** moves forwardly in the direction **18**. Hopper **138** has an open upper end **142** for receiving the cementitious material, and forward and rear side walls **144** and **146** having converging lower extremities **148** and **150** which define an elongated, transversely extending discharge opening **152** for depositing the cementitious material in the mold over the top surface **40** of base **20**. An elongated force feeding and distributing auger **154** is positioned in hopper **138** adjacent opening **152**. Auger **154** is selectively driven in opposite directions by means of a conventional hydraulic motor **156** which drives gear box **158** which, in turn, drives auger **154** through drive chain **160**. Hopper **138** may be continuously filled with cementitious material by means of a conventional readymix truck (not shown) which moves along the side of the mold **12** as the assembly **16** moves forwardly in direction **18** or by like means.

A plurality of elongated core-forming mandrels **162** are provided in the mold cavity and extending in spaced, parallel relationship in the direction of movement. Mandrels **162** are in the form of hollow metal tubes closed at their opposite ends **164**, **166** and have elongated rod portions **170** and **171** secured to the mandrels **162** at their opposite ends, rod portions **170** and **171** respectively project beyond opposite ends **164**

and **166**. The portions **170** which project forwardly from the forward or leading ends **164** of mandrels **162**, which face toward the direction of movement **18**, are connected to frame **46** for rotational movement by downwardly extending brackets **172**. It will thus be seen that portions of mandrels **162** as adjacent their leading ends **164** extend under the discharge opening **152** of hopper **138**, the rear or trailing ends **166** of mandrels **162** extending substantially rearwardly of the rear end **174** of frame **46**. In a specific embodiment of the apparatus of the invention, mandrels **162** were each 30 feet long and extended 20 feet beyond rear end **174** of frame **46**.

It will thus be seen that the mandrels **162** are mounted for rotational movement about their longitudinal axes which extend between their leading and trailing ends **164, 166**, rod portions **170, 171** being coaxial therewith, and leading ends **164** of mandrels **162** being pulled by brackets **172** as the assembly **16** moves forwardly in direction **18**, the trailing ends **166** being unsupported by the frame **46** and floating in the layer **140** of cementitious material so as to form the core openings therein. In order to keep the mandrels **162** submerged in the cementitious material, of the layer **140** and to keep the mandrels **162** generally parallel to the surface **40**, mandrels **162** are wholly or partially filled with liquid **176**, preferably a mixture of water and alcohol, so that the weight of mandrels **162** is such that the trailing ends **166** will not float upwardly or sink from the afore-mentioned desired position in the layer **140**. In a preferred embodiment, conventional electrically energized immersion heaters **178** are provided within mandrels **162** for heating the same thereby to accelerate curing of the cementitious material.

Mandrels **162** have a limited rotary oscillatory troweling motion imparted thereto about their axes by the arrangement now to be described. Referring specifically to FIG. **4** in the illustrated embodiment, one group **180** of the mandrels **162** respectively have ends **182** of lever members **184** secured to projecting portions **170** of rods **168**. The upper ends **166** of lever members **184** are respectively pivotally connected together by members **188**. A conventional hydraulic cylinder **190** is provided having its rear end pivotally connected to a side of frame **46**, as at **192**, and having its piston rod **194** connected to members **188**, as at **196**. It will thus be seen that protractile movement of piston rod **194** of cylinder **190** will result in movement of members **198** and levers **184** to the position shown in dashed lines in FIG. **4**, whereas retractile movement of piston rod **194** will move members **188** and levers **184** to the position shown in solid lines. Thus, reciprocatory motion of piston rod **194** results in reciprocatory motion of members **188**, as shown by the arrows **198**, in turn resulting in rotary, oscillatory troweling motion of mandrels **162**, as shown by the arrows **200**. Suitable limit switches, schematically shown at **202** and **204**, respectively sense the two extremities of the reciprocatory movement of members **188** and are coupled to a suitable solenoid reversing valve **206** for controlling the reciprocatory action of hydraulic cylinder **190**. In the illustrated embodiment of the apparatus which incorporates twelve mandrels **162**, the mandrels are divided into two groups **180** each having the rotary, oscillatory troweling motion imparted thereto by a cylinder **190**, as best seen in FIG. **2**.

In the preferred embodiment of the assembly **16**, mandrels **162** rotate about one-fourth revolution, and hopper **138** is disposed and auger **154** is driven so as to deposit layer **140** of cementitious material to a level so that its upper surface **208** is substantially even with the tops of the mandrels **162**, as best seen in FIG. **8**. In this connection, it will be observed that the edge **150** of sidewall **146** of hopper **138** will provide a bulldozing action to assist in depositing the layer **140** to the level **208**.

A plurality of vibrating devices **210** are disposed between mandrels **162** and adjacent to side mold elements **28, 30**, closely adjacent rear edge **150** of discharge opening **152** of hopper **138**, vibrating devices **210** being further disposed adjacent the tops of mandrels **162**, as best seen in FIGS. **3** and **5**. Vibrating devices **210** are individually driven by variable speed electric drive motors **212** mounted on frame element **214** forwardly of front wall **144** of hopper **138**, each motor **212** being connected to and supporting its respective vibrating device **210** by conduit **216** enclosing a conventional flexible drive shaft. The vibrating devices **210** function to continuously pack the cementitious material between the mandrels **162** and side elements **28, 30** as it is deposited by the auger **154** from the hopper **138**. The speeds of the drive motors **212** and thus of the vibrating devices **210** are individually selectively controlled by speed controls **218** mounted on control panel **220**.

In accordance with the invention, an elongated length of metal mesh material **222** is provided having a width slightly less than the width of the mold **12** between the side mold elements **28, 30**. As will be hereinafter more fully described, free end **224** of mesh **222** is initially secured to a member **226** which is mounted adjacent the rear or starting end **228** of mold **12**. Mesh **222** extends forwardly over mandrels **162** and is accommodated on and payed-out by a reel **230** rotatably supported by members **232** extending upwardly from frame **46**, reel **230** being disposed rearwardly of the hopper **138**. Mesh **222** is trained around guide rollers **234** which are respectively disposed in alignment with the spaces between the mandrels **162**, rollers **234** pressing the mesh **222** downwardly against the tops of mandrels **162** and into the top surface **208** of cementitious material layer **140** between the mandrels, as best seen in FIG. **8**. Mesh **222** is maintained in tension as the assembly **16** moves forwardly in direction **18** by means of a suitable brake device **236** acting upon reel **230**. It will thus be seen that as the forward movement of assembly **16** progresses in direction **18**, mesh **222** is laid, under tension, over cementitious material layer **140** and mandrels **162**, being pressed into the top surface **208** of layer **140** by roller **234**.

A second elongated hopper **236** is mounted on extension portion **238** of frame **46** which extends rearwardly from the rear end **174**, hopper **236** extending transversely across mold **12** over mandrels **162**, cementitious material **140** and mesh **222**, and being similar in construction to hopper **138**. Hopper **236** has an upper open end **240**, a lower discharge opening **242**, and a force feeding and distributing auger **244** therein adjacent the discharge opening **242**. Hopper **236** receives cementitious material and in conjunction with auger **244** deposits a second layer **246** over mandrels **162**, the first layer **140** and mesh **222**, as best seen in FIG. **8**. Auger **244** is selectively driven in opposite directions

by another hydraulic motor **248** which drives gear box **250**, which, in turn, drives auger **244** through a drive chain **252**.

Hopper **236** is preferably continuously filled by means of an elevating auger **254** and an open trough **256** which is inclined upwardly from adjacent the forward hopper **138** toward the rear hopper **236**, as best seen in FIG. **3**. Elevating auger **254** is driven by a conventional electric motor **258** through a belt **260**. Thus, by employing two separate chutes from a readymix truck or two separate like devices, one for depositing the cementitious material into the hopper **138**, and the other for depositing cementitious material in the trough **256** for elevation by auger **254** and depositing in the rear hopper **236**, both hoppers **138** and **236** can be supplied with cementitious material.

The second layer **246** of cementitious material is compacted and its top surface **262** is finished by a vibratory screed **264** supported on frame extension portion **238**. Various inserts, hardware or the like (not shown) may be placed in slab **14** after the mesh has been laid on top of the mandrels before the mandrels have been removed from the slab portion in which the inserts are desirably placed. Adjacent to side elements **28**, **30** and around such inserts, surface **262** must be finished by hand.

Ends **166** of mandrels **162** also may be secured to brackets **172** by means of projecting portions **171** of rods **168**, both of the projecting portions **170** and **171** being adapted to be removably rotatably mounted in brackets **172** and removably connected to ends **182** of levers **184**. With this arrangement, when the apparatus **16** has advanced to the far end of mold **12**, remote from the starting end **228**, and a slab has been completed and the resulting elongated slab has been sawed into shorter sections and the sections removed projecting ends **170** may be disconnected from brackets **172** and levers **184**, the assembly **16** can be turned end-for-end, and the projecting ends **171** can be connected to brackets **172** and ends **182** of levers **184**, thereby making ends **166** of mandrels **162** the leading ends. The assembly **16** may then be advanced back to the former starting end of the mold to form another slab, thus eliminating the necessity for conveying the entire assembly back to the starting end of the mold prior to forming another slab.

THE METHOD

Prior to commencing motion of the assembly **16** on the rails **32** and **34** of the side mold elements **28** and **30**, transversely extending, longitudinally spaced-apart reinforcing strands **266** are placed in the mold cavity, and longitudinally extending, transversely spaced-apart prestressing strands **268** are placed thereover and extending the length of the mold. Strands **268** have their ends **270** secured to member **226** and their other ends (not shown) suitably tensioned, as by the use of appropriate hydraulic tensioning jacks. Transverse and longitudinally extending reinforcing strands **266** and **268** are held in assembled relation and spaced from the top surface **40** of base **20** by conventional spacers **272**. Other hardware such as junction boxes **274**, window frames, conduits and the like may also be positioned within the mold cavity if desired. Assembly **16** is positioned on rails **32** and **34** with trailing ends **166** of mandrels **162** adjacent mold end **228**, and end **224** of mesh **222** is secured to member **226**. If desired, cementitious material may be placed by hand in the mold rearwardly from the front hopper **138** to the level of the tops of the mandrels **162**, and to the desired level **262** rearwardly of the rear hopper **236**. Relatively fluid, wet cementitious material, for example concrete having a low slump, is then deposited from a readymix truck or like device in the hopper **138** and trough **256** and forward movement of the assembly **16** in the direction shown by the arrow **18** is commenced. As the forward movement progresses, the bottom layer **140** of cementitious material is deposited by trough **138** and auger **154** to a level substantially even with the tops of the mandrels **162**, that layer is tamped between the mandrels and adjacent side elements **28**, **30** by vibratory devices **210**, the mesh **222** is payed-out from the reel **230**, under tension, and is pressed onto the tops of the mandrels **162** and into the top surface **208** of layer **140** by rollers **234**, the second layer **246** is deposited over the mandrels **162**, mesh **222** and the bottom layer **140** by hopper **236** and the auger **244**, and that layer is compacted and its top surface **262** finished by the vibratory screed **264**.

It will be observed that the floating mandrels **162** have their leading ends **164** pulled forwardly in the direction **18** by the forward motion of the assembly **16** thereby forming the core openings in the resulting slab. The mesh **222** serves not only as reinforcing material in the finished slab, but further, in combination with the cementitious layer **140**, supports the top layer **246** of wet cementitious material so that the core openings formed by the advancing mandrels **162** do not collapse. It will be observed that the rotary oscillatory motion imparted to the mandrels **162** provides a troweling action for the interior surfaces of the core openings formed by the mandrels **162** as the mandrels advance in the direction **18**.

There are a number of factors which must be correlated in order to form a satisfactory slab. These include the linear rate of speed of the assembly **16** in direction **18**, the formulation of the cementitious material used, including in one specific embodiment the cement-aggregate-sand ration, the moisture content and curing time of the concrete mixture, the consistency or slump of the mixture, which is applied in wet or fluid form, the aggregate size and weight, and the size of the mesh **222** which must support the upper cementitious layer **246** in a wet condition. More particularly, the linear rate of speed, curing time, consistency and mesh size must be correlated so that the core openings formed by the mandrels **162**, as they advance forwardly in direction **18**, do not collapse, and the linear rate of speed, moisture content and curing time must further be correlated so that the requisite smooth finish is formed on the top surface **262** by the vibratory screed **264**.

In a specific embodiment of the apparatus and method for forming slabs 8 inches thick and 8 feet wide, 12 mandrels respectively 30 feet long and having a 6 inch outside diameter were employed. A concrete mix having a slump from about 1 inch to about 2 inches is employed, preferably using a formula comprising from about 1000 lbs. to about 1300 lbs. of No. **9** stone; from about 1700 lbs. to about 2000 lbs. of No. **14** sand; from about 650 lbs. to about 760 lbs. of high early cement; from about 18 to about 25 ounces of a water dispersing agent (100N, as sold by Master Builders); and from about 30 to about 40 gallons of water (correcting for moisture in gravel and sand, humidity, etc.). Using a formula within this range, the assembly **16** can be

moved at a linear forward speed within the range from about 1 foot per minute to about 6 feet per minute.

Particularly satisfactory results have been provided with a linear forward speed of about 2 feet per minute and a formula comprising about 1052 lbs. of No. **9** stone, 1933 lbs. of No. **14** sand; 752 lbs. of high early cement, 23 ounces of the above-identified water dispersing agent, and 40 gallons of water.

After formation of the slab **14** in the mold, curing may be further accelerated by the use of cover members **276** removably positioned on the top rails **32** and **34** of the side mold elements **28** and **30**, and extending over the slab **14** and enclosing the mold cavity, cover members **276** having suitable electrical heating elements **278** therein.

What is claimed is:

1. The method of making a cored cementitious slab comprising the steps of providing an elongated mold having a bottom and upstanding sides for forming the bottom and side surfaces of a slab, placing a plurality of elongated mandrels in said mold adjacent to one end thereof and in a spaced and parallel relationship with respect to each other and said mold sides so as to extend longitudinally of said mold, and sequentially performing the following steps, depositing a first layer of cementitious material in relatively fluid form having a slump from about 1 inch to about 2 inches in said mold to a level generally even with the tops of said mandrels, laying elongated cementitious material supporting material in said mold over said mandrels and said first layer, depositing a second layer of cementitious material in relatively fluid form having a slump from about 1 inch to about 2 inches in said mold over said first layer and said cementitious material supporting material while continuously imparting troweling motion to each of said mandrels, moving said mandrels from adjacent to said one end of said mold toward the other end of said mold to remove the mandrels from the slab at a rate in excess of about 1 foot per minute and faster than said cementitious material becomes self-supporting, and leaving said mold bottom and sides and said cementitious material supporting material behind said mandrels to support said cementitious material until self-supporting.

2. The method of claim **1** comprising the further step of applying tension to said cementitious material supporting material during said laying thereof.

3. The method of claim **1** wherein said cementitious material is a mixture of aggregate, sand, cement and water, and a water dispersing agent, said cementitious material having a low slump, said slump is from about 1 inch to about 2 inches, said aggregate comprises from about 1000 lbs. to about 1300 lbs. of No. **9** stone, said sand comprises from about 1700 lbs. to about 2000 lbs. of No. **14** sand, said cement and water comprises from about 650 lbs. to about 760 lbs. of high early cement and from about 30 gallons to about 40 gallons of water.

4. The method of claim **1** wherein said laying step and said depositing steps are performed at positions which are fixed with respect to said mandrels and move with said mandrels toward said other end as said slab is formed, each of said positions being between the opposite ends of said mandrels.

5. The method of claim **4** wherein said first layer depositing step is performed adjacent to said leading ends of said mandrels, said position at which said second layer depositing step is performed being spaced and remote from said position of said first layer depositing step, said laying step being performed at a position spaced from and between said depositing steps, both said depositing steps and said laying step being performed simultaneously.

6. The method of claim **1** wherein each of said mandrels has a longitudinal axis between its ends, and said imparting step includes the step of imparting a limited rotary oscillatory motion to said mandrels about their respective axes.

7. The method of claim **1** further comprising the step of packing said first layer between each of said mandrels.

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