Oct. 12, 1971 N. F. LARSSON 3,611,519

MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

Filed June 6, 1969 9 Sheets-Sheet 1

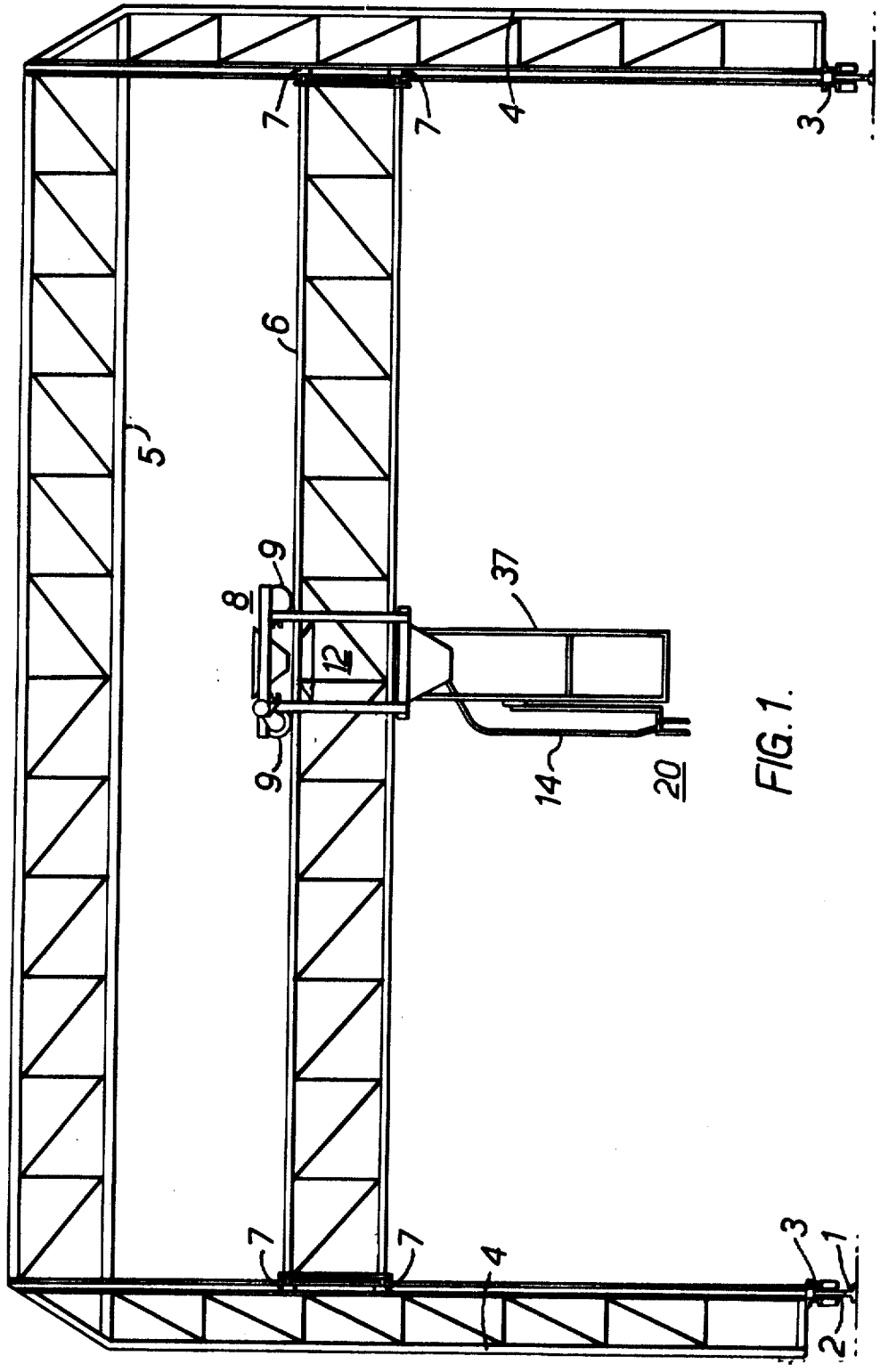

FIG. 1.

MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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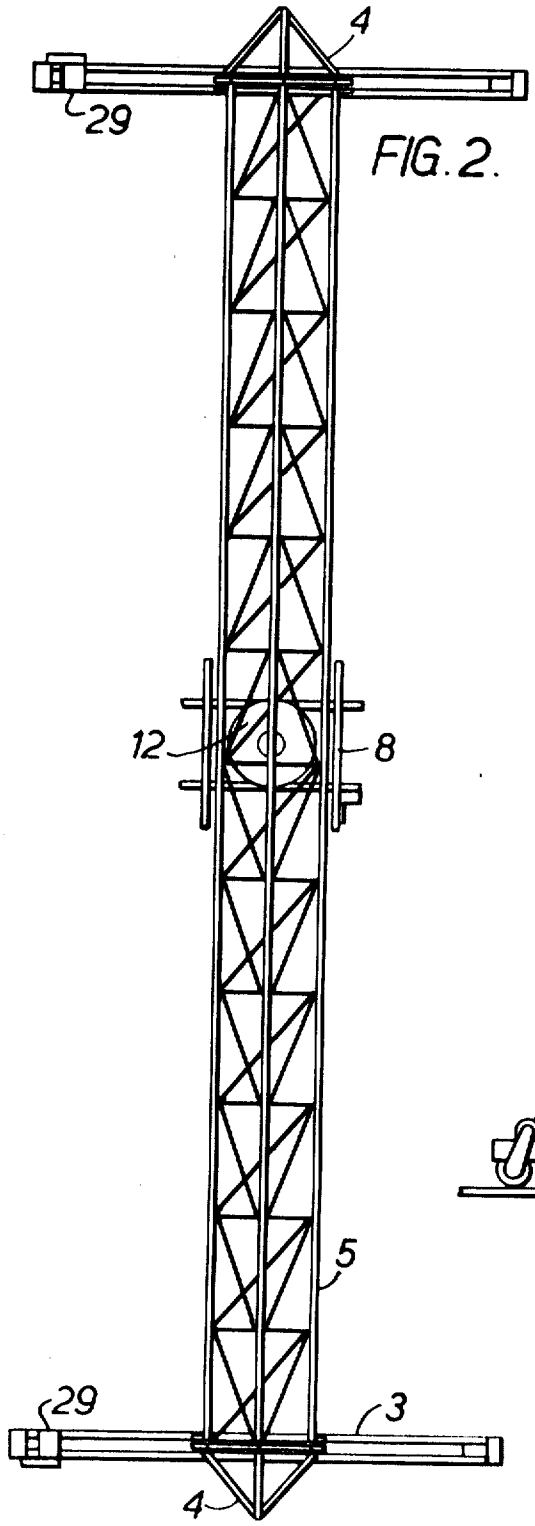
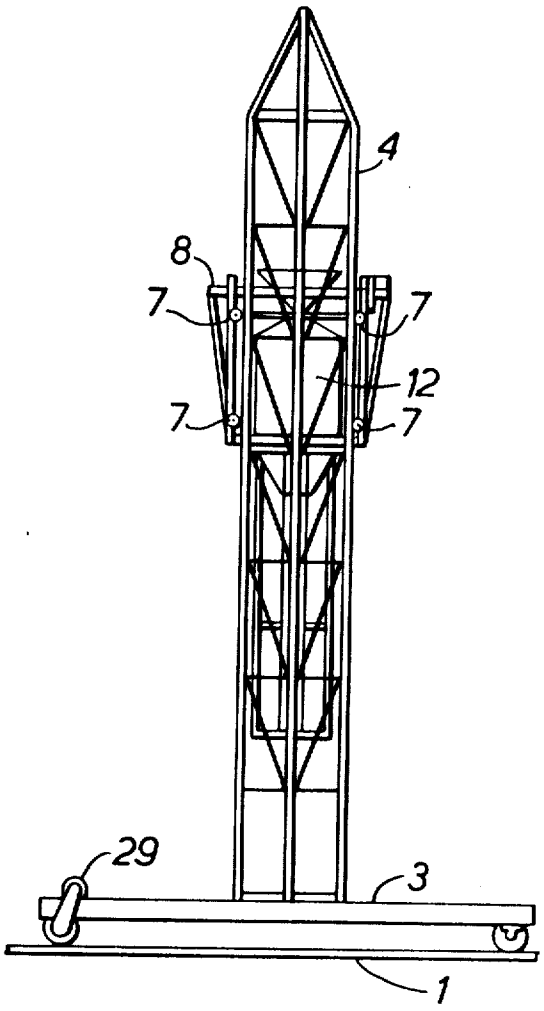


FIG. 2.

FIG. 3.



MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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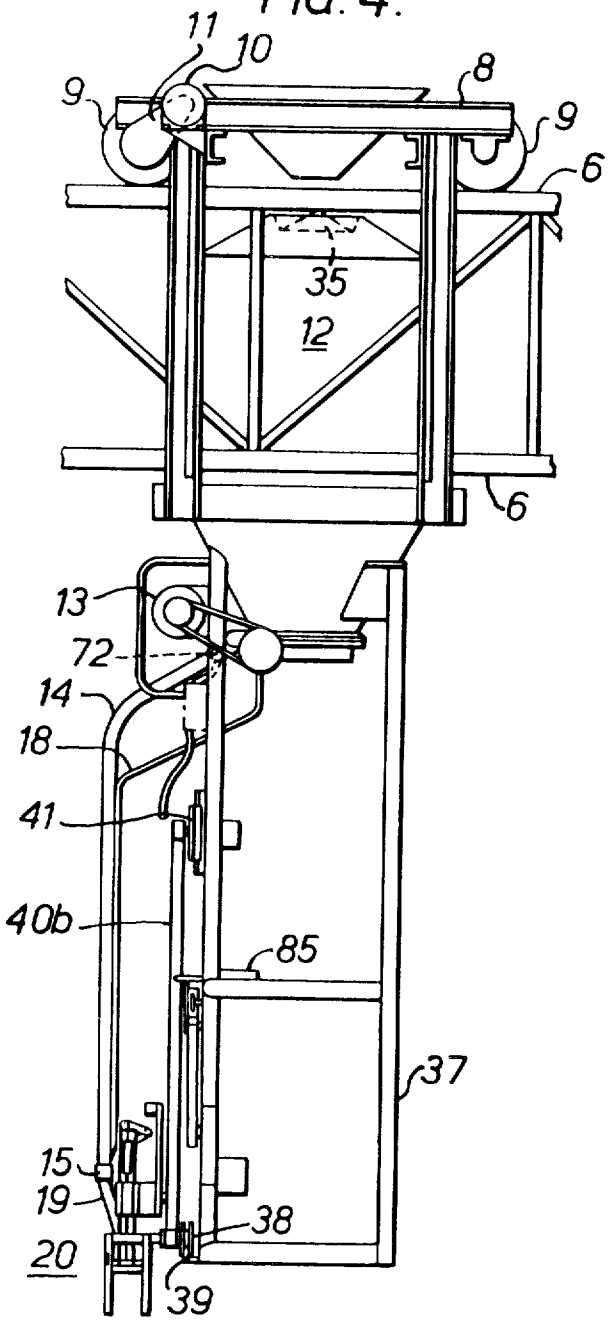
FIG. 4.



MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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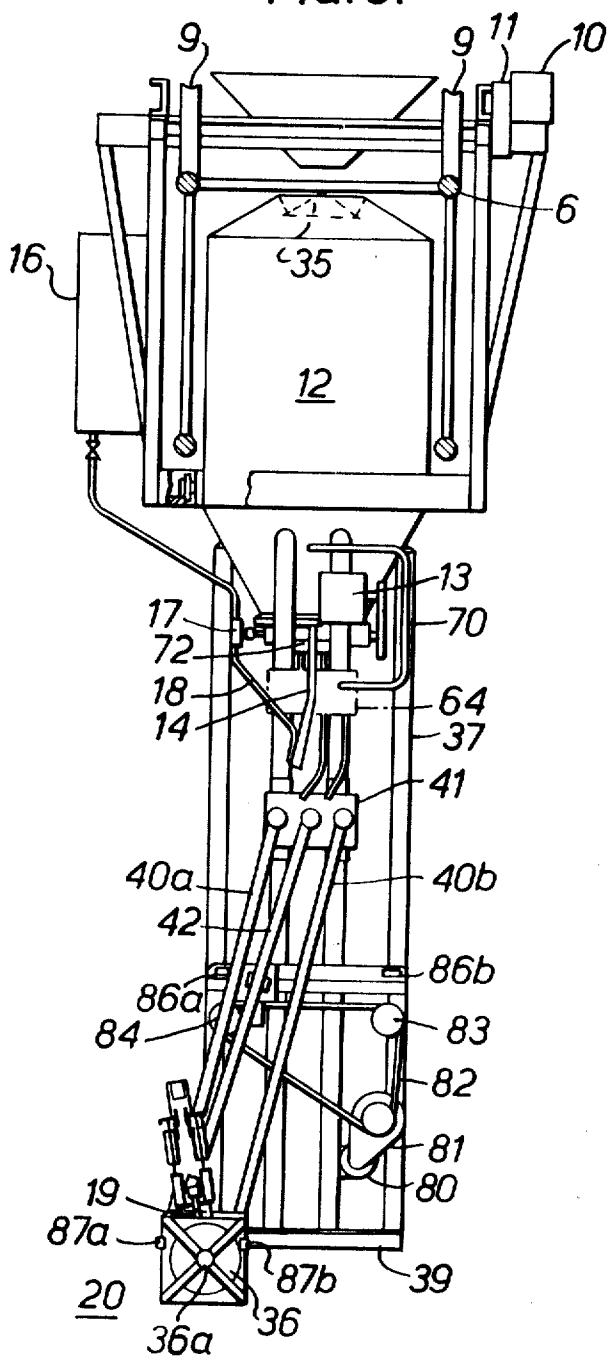
FIG. 5.



MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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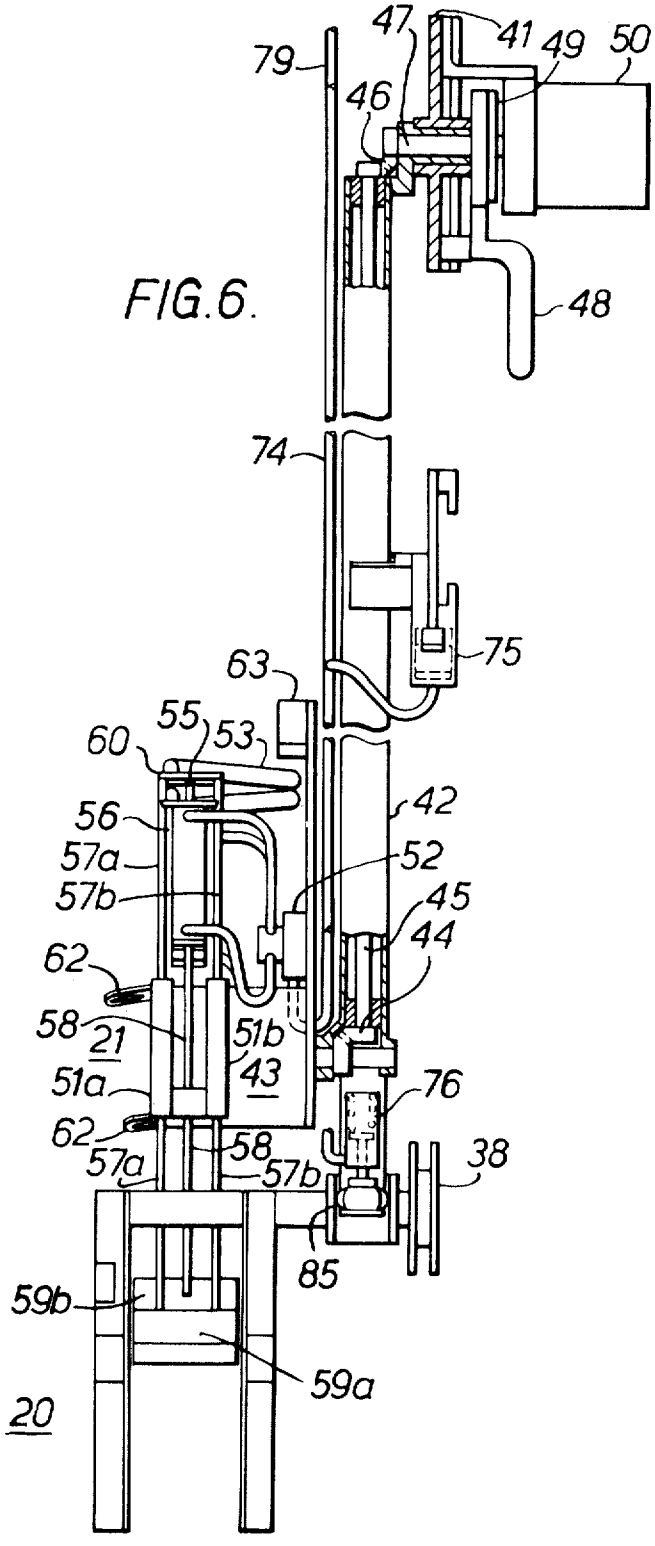
FIG.6.



MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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FIG. 7.

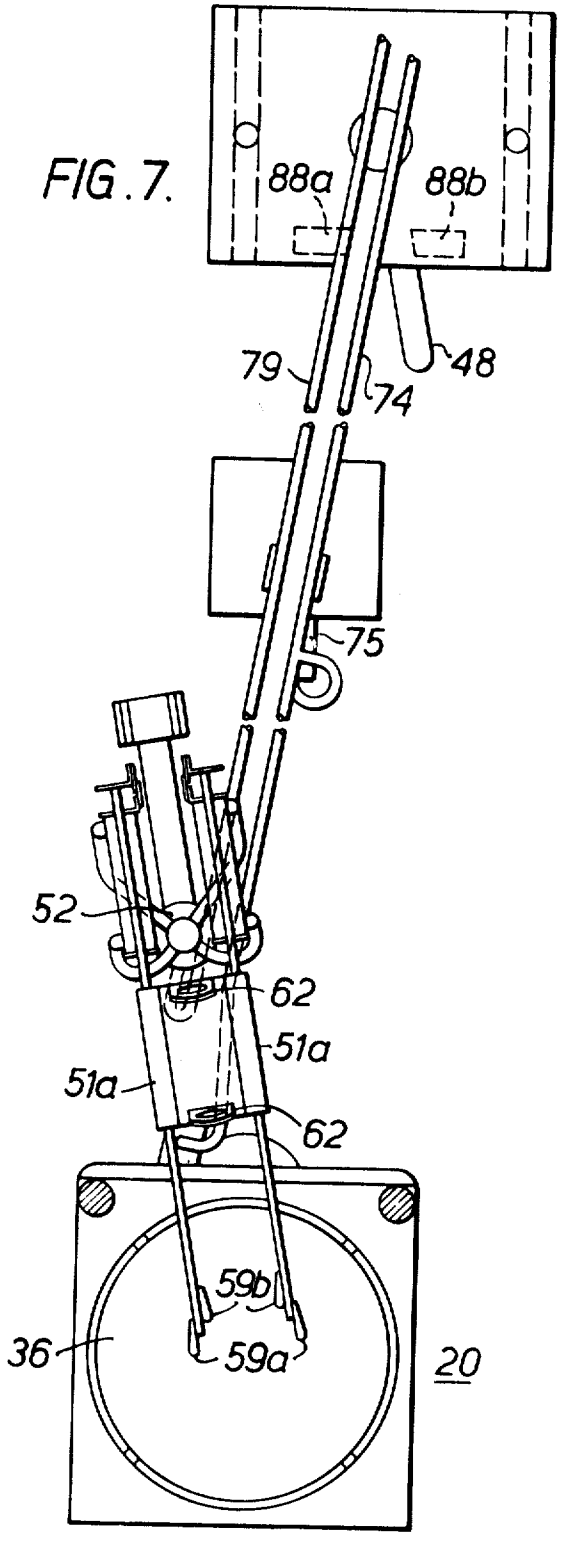

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FIG. 8.

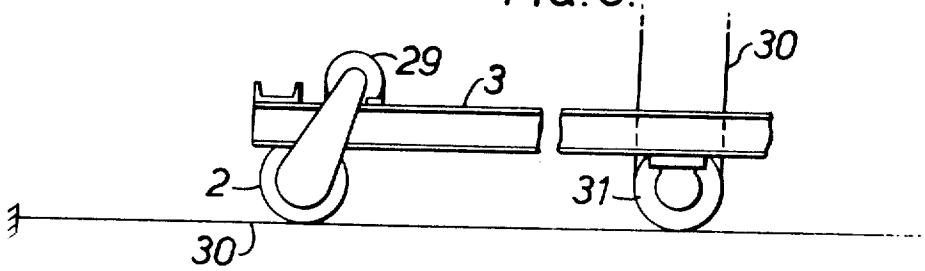


FIG. 9.

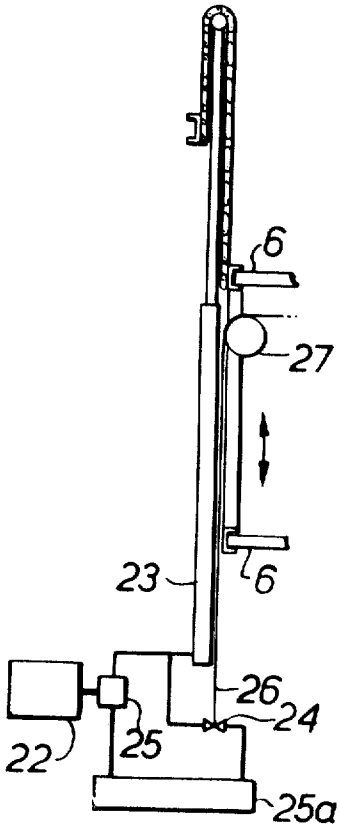


FIG. 10.

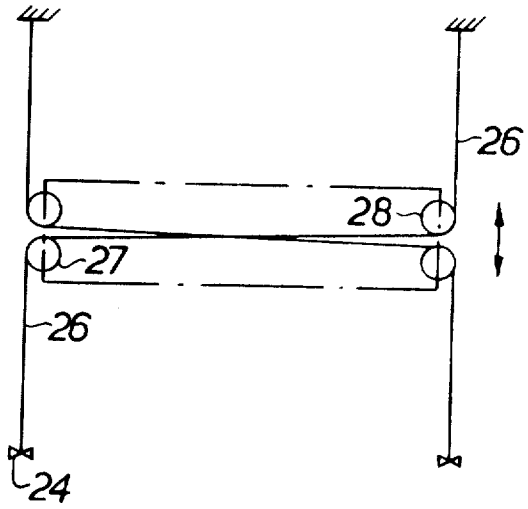


FIG.12.

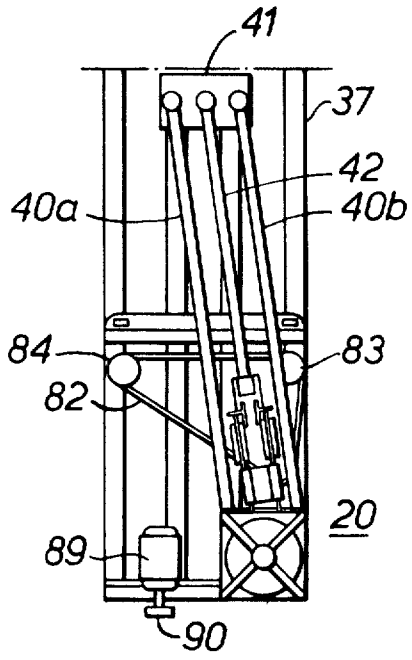
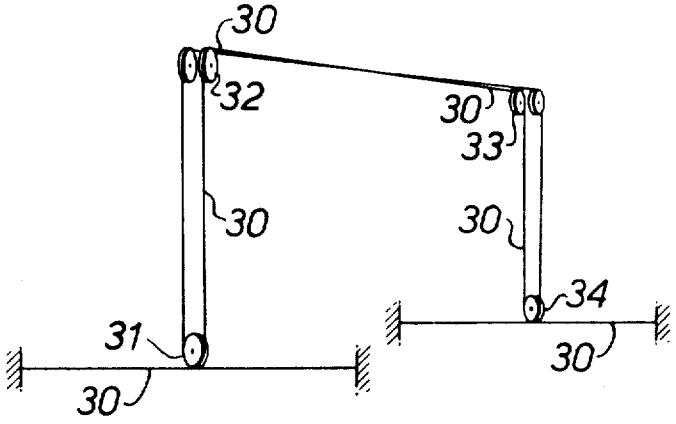


FIG.11.



MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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FIG.13

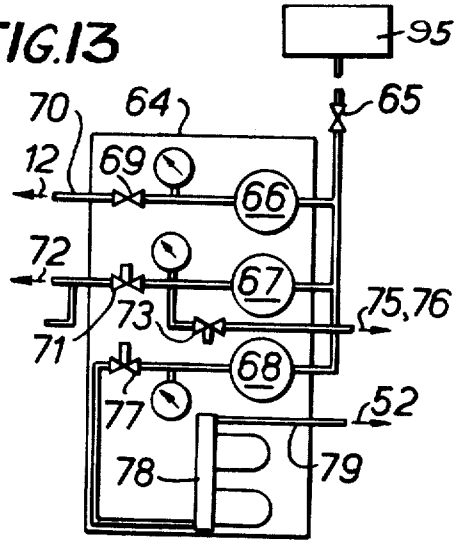


FIG.15.

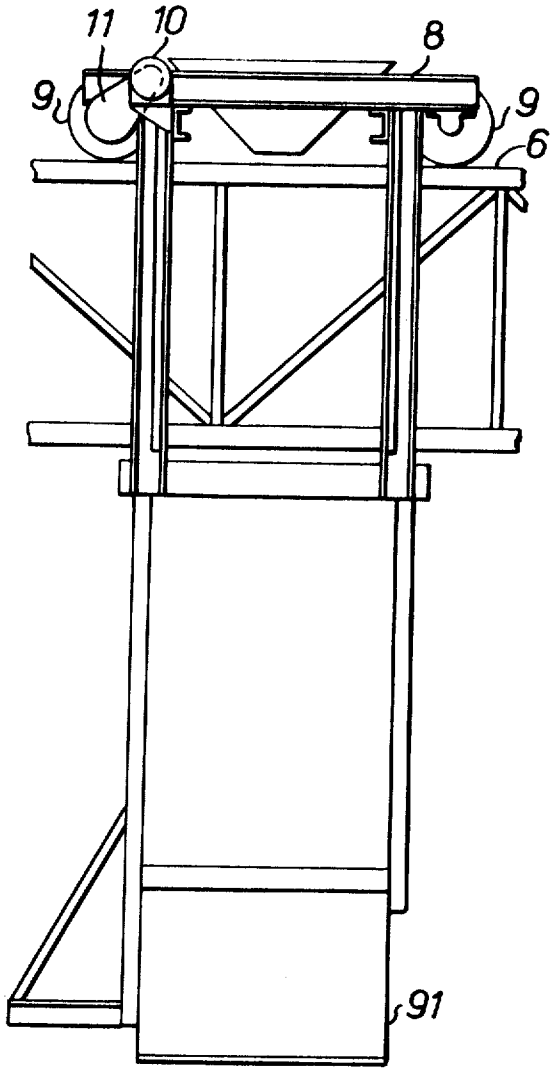
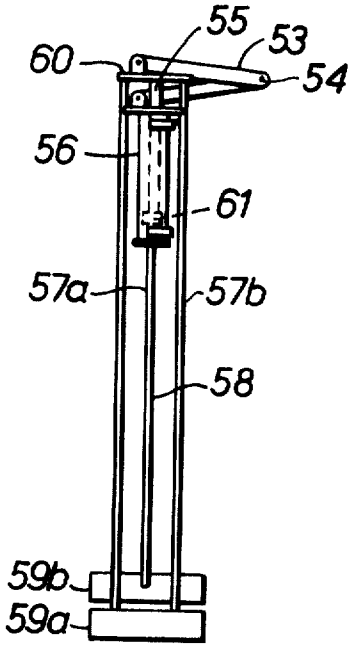


FIG.14.



United States Patent Office

3,611,519
Patented Oct. 12, 1971

3,611,519

MACHINE FOR DIRECT AND CONTINUOUS CASTING OF CONCRETE WALLS

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Filed June 6, 1969, Ser. No. 830,976
Claims priority, application Sweden, June 17, 1968, 8,150/68
Int. Cl. E04g *11/34*
U.S. Cl. 25—131 SC 8 Claims

ABSTRACT OF THE DISCLOSURE

A method and a machine for casting concrete walls by introducing concrete into a mold comprising two parallel discs having comparatively small dimensions and being continuously reciprocated along the wall being cast by means of a traveling crane so as to deposit a thin strip of concrete each time it passes along the wall, with said deposited strip of concrete simultaneously being rammed to compactedness.

BACKGROUND OF THE INVENTION

Field of the invention

This invention refers to a method for direct and continuous casting of concrete walls by means of introducing concrete between two parallel, continuously movable, positively controlled discs and ramming the concrete to compactedness, as well as to a machine for applying the method.

Description of the prior art

In the field of construction of buildings investigations are continuously being made with regard to new methods and means intended to make it possible to erect buildings faster and preferably also at lower cost than is possible at present. Various suggestions for casting concrete while utilizing molds have been made, but according to these suggestions the molds are usually required to remain in one and the same position until the concrete has hardened.

SUMMARY OF THE INVENTION

The instant invention discloses an entirely new method of erecting buildings as well as a machine for applying said method, and the advantages achieved hereby in comparison to known technology are both economical, namely lower construction costs, and technical, namely a higher construction rate. The means that are necessary for achieving these advantages will become apparent from the following description and claims.

Generally speaking, in the method for direct and continuous casting of concrete walls disclosed by the invention, concrete is introduced between two parallel, continuously movable, positively controlled discs, whereupon the concrete is rammed until it becomes compact. For example a machine for applying the method might be utilized for erecting small houses of the size of family homes in concrete cast in one process. The machine has the form of a bridge structure straddling the entire contemplated house and running on two horizontal rails laid out on either side of the house and parallel to the latter

and to each other. The machine may preferably be designed in the following manner. A wheeled support provided with two wheels runs on each rail, and each wheeled support carries a tower. The two towers are interconnected at their upper portions by a transverse member in such manner that the device forms a rigid bridge structure. Between the towers there is an additional transverse member which is mounted and guided on the towers. This transverse member is displaceable vertically and is supported by hydraulic cylinders positioned in each tower. A carriage runs on the last-mentioned transverse member, forming a yoke over said transverse member and carrying a container for material, with said container being housed within the trannsverse member to a greater extent, as the result of the member having the shape of an inverted U. A cabin is affixed to the container and both serves as an operator's cabin for the operator of the machine and also carries the actual casting mold or molding head. The container and consequently the operator's cabin and the molding head as well are rotatable and may be clamped in four individual positions at angles of 90° with respect to each other, and hence the molding head may be positioned parallel to the wall to be erected.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be disclosed more specifically below with reference to the accompanying drawings, which illustrate an embodiment of the invention, wherein FIG. 1 shows an elevational view of the machine as viewed longitudinally, FIG. 2 shows the machine in a plan view, FIG. 3 shows the machine in a transverse view, FIG. 4 shows the transversely displaceable carriage, the material container and the operator's cabin with the molding head as viewed in the longitudinal direction of the machine, FIG. 5 shows the transversely displaceable carriage, the material container and the operator's cabin with the molding head as viewed in the transverse direction of the machine, FIG. 6 shows an elevational view, partly in section, of the ramming device, FIG. 7 shows another elevational view of the ramming device, with the view of FIG. 7 being taken at 90° with respect to the elevational view of FIG. 6, FIG. 8 shows a portion of the wheeled support of the machine, FIG. 9 shows a hydraulic cylinder unit including a piston, a chain, a pump, a valve and a motor for elevating the overhead crane member, FIG. 10 illustrates the principle of maintaining the overhead crane member horizontal by means of two hydraulic cylinder units of the type illustrated in FIG. 9, FIG. 11 shows a device for maintaining the entire machine parallel when displacing the same longtiudinally, FIG. 12 shows a device for flat face milling window openings and the top portions of the walls, FIG. 13 schematically illustrates a control panel for compressed air, FIG. 14 shows a ram, and FIG. 15 shows a device for coating floors. Similar designattions have been utilized for identical portions in the figures. Furthermore, certain portions have been omitted from the figures so as to avoid complicating the latter unnecessarily.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1, 2, and 3, respectively, illustrate the machine schematically and without any great number of parts.

Wheels **2** that are mounted in beam units **3** run on rails **1** and are designed in such manner as to be guided laterally on each rail. A tower **4** is erected on each beam unit **3**, and a transverse member **5** is secured to the top portions of the two towers **4** for instance by means of nuts and bolts. A traveling crane member **6** is mounted to the towers **4** at its two ends by means of rollers **7** designed for guided engagement with the towers **4** without play, and the traveling crane member **6** is displaceable vertically. Said traveling crane member may be displaced upwards or downwards, respectively, by means of two hydraulic devices, one of which is illustrated in FIG. 9, with one hydraulic device of this type being mounted in each of the two towers **4**. When the traveling crane member **6** is to be elevated, motors **22** (one of which is illustrated in FIG. 9) are started simultaneously in each of the two hydraulic devices so as to pump oil by means of an oil pump **25** from an oil tank **25***a* into a hydraulic cylinder **23** in each of the hydraulic devices, thereby elevating the crane member **6**. When the traveling crane member **6** is to be lowered, the direction of rotation of the motors **22** is reversed so that oil is expelled from the cylinders **23**, resulting in crane member **6** descending. The traveling crane member **6** may for instance be maintained horizontal in the manner indicated in FIG. 10, namely by a valve **24** being connected to each cylinder **23**, with said valve being opened and providing a leak between the oil pump **25** and the cylinder **23** at any end where the crane member may be positioned at too high a level. Valve **24** is actuated by means of a belt or a wire **26** (FIGS. 9 and 10, respectively) that extends from valve **24** up to crane member **6** over a pulley wheel **27**, further on over to the other tower, over a pulley wheel **28** and up to the top of this tower, with said wire being secured there. As each tower is provided with a device of this type complete symmetry and hence full balance with respect to the horizontal position of the traveling crane member **6** is achieved.

As is illustrated by FIGS. 2, 3 and 8, respectively, motors **29** for propelling the machine along the rails **1** are disposed on each of the two beam units **3**, with each of said motors being connected to an individual wheel **2** over an appropriate transmission. The two motors **29** are started simultaneously when the machine is to be moved along the rails **1**. In order to ensure that the towers **4** are maintained exactly parallel to one another the machine is provided with an arrangement that is schematically illustrated in FIG. 11. A wire **30** is secured at one end of one of the rails (on the left side in FIG. 11). The wire **30** follows the rail to the middle of the tower **4** and then turns off over a pulley wheel **31** (also illustrated in FIG. 8, which shows one of the beam units **3** from one end and forward to slightly past the tower) and runs up into the tower **4** to the upper transverse member **5**, turning off there over a pulley wheel **32** and continuing along the transverse member **5** to the other tower **4**, then turning off over a pulley wheel **33** and going down into the tower to the wheeled support that runs on the other rail, turning off over a pulley wheel **34** and finally running along the last-mentioned rail towards the opposite end as compared to the end of the first rail where said wire has started, with said wire being secured to the end of the second rail. In the same manner a wire runs from the other end of the second rail to the opposite end of the first rail and is secured there.

As may be seen from FIG. 1, a carriage **8** runs on wheels **9** on the traveling crane member **6**. This is illustrated more specifically in FIG. 4, which shows that the wheels **9** are adapted to be guided on the traveling crane member **6** and are driven by a motor **10** over an appropriate transmission **11**. The transmission is dimensioned in such manner that carriage **8** will move at the same rate along the traveling crane member **6** as that at which the entire machine in accordance with FIGS. 1, 2, and 3, respectively, will move along the rails.

FIGS. 4 and 5, respectively, are elevational views taken at 90° from each other, and these figures show that carriage **8** carries a pressurized container **12**, which is intended for dry concrete and which at its top has a sealing cover **35** that may be opened inwardly into the container. At its bottom, container **12** is provided with a feed-out wheel which is driven by a motor **13**. Said feed-out wheel continuously feeds dry concrete to an output opening having a hose **14** connected thereto, through which dry concrete is blown out by means of compressed air.

A pump **17**, for example an adjustable deplacement pump, is driven by the same shaft as said feed-out wheel and urges water from a container **16** through a hose **18** out into an annular nozzle **15** which opens into said hose **14**. At the nozzle **15** the water is mixed with the dry concrete so as to provide the latter with desired consistency, whereafter the completed concrete is blown out through a nozzle **19** down into a molding head **20** comprising two parallel sides that are connected at the top but are open at the bottom. Simultaneously with the concrete flowing down into the molding head **20**, the concrete is packed by a ramming device which is illustrated more specifically in FIGS. 6 and 7, respectively. For example, the machine may be provided with two rams, each comprising a two-way operative compressed air cylinder having two hammers being alternately displaced upwards and downwards, respectively, between the two sides of the molding head **20** so as to pack the concrete. The ramming device will be disclosed more specifically below.

As said molding head **20** moves forwardly, it leaves behind a strip of packed concrete having a rectangular cross-section. In order to decrease the friction between the concrete and the sides of molding head **20**, the latter sides are designed such, that the greater part of their area is composed of a round disc **36** (FIGS. 5 and 7, respectively), which may rotate around a shaft **36***a*. As may be seen from FIGS. 4 and 5 the molding head **20** is adapted to be displaced in a horizontal and straight path along the lower edge of an operator's cabin **37** positioned below container **12** by means of a wheel **38** running along a track **39**, with said wheel **38** being mounted on molding head **20**. In addition, molding head **20** is guided by linkage arms **40***a* and **40***b*, respectively, which are connected to said molding head **20** and to a plate **41**, which latter is displaceable vertically on guides in the operator's cabin **37**. A pivot arm **42** is also connected to plate **41**. Said pivot arm may pivot between the linkage arms **40***a* and **40***b* and in the same plane as the latter. The pivot arm **42** is shown on an enlarged scale in FIG. 6, in which it may be seen that a support **43** for the above-mentioned ramming device **21** is rotatably mounted at the lower portion of pivot arm **42**. A rotational movement of a handle **48** may be transferred to support **43** over a bevel gear **44**, a shaft **45**, a gear **46** and a shaft **47**. The handle **48** is prevented from moving freely as the result of friction against a disc **49**, which over a transmission is connected to a motor **50** provided with a magnetic brake. As the result of said handle **48** being clamped to motor **50** and the latter being secured to plate **41**, pivot arm **42** may pivot without the angle of the support **43** being altered with respect to plate **41**. Support **43** is provided with guides **51***a* and **51***b*, respectively, for the hammers of the ramming device, which latter thus may move upwards and downwards in consequence of said guides. A rotatable distribution valve **52** for supplying compressed air to the ramming device **21** alternately flows compressed air into a cylinder (FIGS. 6 and 14, respectively) through upper and lower leads so as to make a piston **61** in said cylinder move back and forth (upwards and downwards, respectively) in said cylinder. Piston **61** draws along a piston rod **55**, a crosspiece **60**, parallel rods **57***a* and **57***b*, respectively, and one hammer **59***a* in its motion. Cylinder rod **58** and the other hammer **59***b* accompany cylinder **56** in its motion. As the respective masses of the two hammers are approximately equal, the two hammers **59***a* and **59***b*,

respectively, will be displaced equal distances but in different directions. One arm in a linkage **53** is mounted to the crosspiece **60**, whereas the other arm is mounted to the cylinder top. As the result of the two arms of said linkage **53** moving the same distances, the pivot point **54** will only move horizontally with respect to the center of gravity of the ram. Support **43** also carries a switch **63** (FIG. 6) as well as mounts **62** for nozzle **19** (FIG. 5).

Compressed air means **95** supplies air in appropriate manner to a control panel **64** illustrated more specifically in FIG. 13 and is introduced through a valve **65**. Three relief valves **66**, **67**, and **68**, respectively, are connected in parallel behind valve **65**. From relief valve **66** the compressed air flows through a valve **60** and a tube **70** to the container **12** (FIG. 5) for material. From relief valve **67** the air flows through a magnetic valve **71** to a shut-off device **72** for hose **14** (FIG. 4) and over a magnetic valve **73** through a tube **74** to cylinders **75** and **76** in FIGS. 6 and 7, respectively. From relief valve **68** the air flows through a magnetic valve **77** and an oil mist lubricating device **78** through a tube **79** to valve **52** and from there onto ramming device **21** (compare FIGS. 6 and 7, respectively).

An additional motor **80** is provided at the lower portion of the operator's cabin **37** (FIG. 5) and runs a belt or a band **82** over rollers **83** and **84** by means of a transmission **81**.

A control panel **85** indicated in FIG. 4 is provided with a control for longitudinal movement forwards and backwards, a control for transverse movement forwards and backwards, a control for elevation and descent, and a main control for enabling a plurality of functions to be carried out simultaneously.

In FIG. 5 the operator's cabin **37** is illustrated with the molding head **20** in position for moving leftwards in the figure. The device is in the same position when starting for operation rightwards with the exception that the ramming device then slants in the other direction, i.e. towards the direction of motion.

When utilizing the pertinent machine for molding and ramming, the extent of a wall may be defined by another wall or an upright plank or similar, and the mode of operation of the machine will now be described.

When the machine is to be started to the right, the ramming device is rotated to the right from its position as illustrated in FIG. 5 by means of the handle **48** of FIG. 7. Container **12** (FIG. 5) should then be filled with a dry mixture of sand and cement. However, the sand should be slightly moist so as to avoid raising dust. Container **16** should be provided with water. Container **12** is placed under pressure (approximately 28 p.s.i.g.). When the main control of control panel **85** (FIG. 4) is displaced to the right (all directional indications refer to FIG. 5) the following will occur: (a) motor **13** starts and operates the feed-out wheel in the bottom of container **12** as well as pump **17** (FIG. 5); (b) magnetic valve **71** (FIG. 13) opens and passes compressed air to shut-off device **72** (FIG. 4), thereby opening hose **14** for flow-through so as to eject concrete into molding head **20** through nozzle **19**; (c) magnetic valve **73** (FIG. 13) opens and passes compressed air through tube **74** (FIGS. 13 and 7, repsectively) so as to make the piston of cylinder **75** (FIGS. 6 and 7, respectively) urge belt **82** (FIG. 5) into engagement, and furthermore the piston of cylinder **75** (FIG. 6) releases a catch **85** (FIG. 6) which clamps the pivot arm **42** to the molding head **20**; (d) magnetic valve **77** (FIG. 3) opens and passes compressed air through valve **52** to ramming device **21** (FIGS. 6 and 7, respectively); (e) motor **80** starts and makes pivot arm **42** move rightwards until it is stopped by the right linkage arm **40***b*, with the entire molding head following along until said linkage arm **40***b* strikes a limit switch **86***b* that stops motor **80** and starts motors **29** (FIG. 8) so as to make the entire machine move forward. As the result of motor **80** being provided with a magnetic brake, the molding head will be maintained in its set position until either the main control is reset or the molding head **20** strikes a wall or some other limitation, resulting in a limit switch **87***b* stopping motors **29** and starting motor **50** (FIG. 6), which in turn results in the ramming device beginning to be rotated in the other direction and being stopped by a limit switch **88***b* cutting off the current to motor **50**, motor **13**, magnetic valve **71**, and magnetic valve **77**, respectively. Simultaneously with limit switch **87***b* stopping motors **29**, the current to magnetic valve **73** is also cut off, thereby releasing pivot arm **42** from belt **82** as well as making catch **85** lock pivot arm **42** to molding head **20**. However, said pivot arm is displaceable in its longitudinal direction with respect to the molding head. As the external position of said molding head lies outside of the outer edge of the operator's cabin to some extent and the molding head is released completely from the cabin, the molding head may stop immediately, whereas the machine will have ample time to be retarded by the magnetic brakes of motors **29** before the operator's cabin reaches the wall. The machine will now be in position for starting leftwards. After the machine has run back and forth a few times the concrete strip will have reached approximately half the height of the molding head. The ramming device floats on top of the packed concrete during the entire process and now begins to actuate switch **63** (FIG. 6) so as to start motors **22** and elevate traveling crane member **6**, thereby raising the molding head and stopping motors **22**. When the operator's cabin is rotated for transverse operation limit switches **86***a* and **86***b*, respectively, actuate motor **10** instead of motors **29**.

A motor **89** operating a milling disc **90** for flat face milling window openings and the tops of walls may be mounted on the operator's cabin as illustrated in FIG. 12. The motor is rotatable for slanting or vertical planes. Molding head **20** is raised in this case.

In FIG. 15 material container **12** and operator's cabin **37** have been removed and replaced by a concrete container **191** having a vibrating device for coating floors.

The invention is not limited to the embodiment described above and illustrated in the drawings, and this embodiment only comprises an example of the invention and its application.

What is claimed is:

1. Apparatus for casting concrete walls from concrete mix comprising a pair of movable towers; a crane member connecting the two towers; hydraulic means attached to the crane member and the towers for providing relative vertical displacement; carriage means supported by the crane member and including an operator's cabin; means for generating compressed gas; pressurized container means for feeding a relatively dry concrete mix pressurized by compressed gas and supported by the carriage means; means for receiving the relatively dry concrete mix from the pressurized container means and mixing it with water; means for compacting the damp concrete mix and a molding head controlled from the operator's cabin.

2. Apparatus as in claim **1** where the means for compacting the damp concrete include a pair of alternatively activated rams.

3. Apparatus as in claim **2** further including control means in the operator's cabin, for controlling the molding head including pivot arms, a magnetic valve and magnetic brake.

4. Apparatus as in claim **3** including a motor on each tower.

5. Apparatus as in claim **3** including switch means for raising the support member activated by the molding head means.

6. Apparatus as in claim **3** where the means for compacting the damp concrete is rotatable, and lockable in four positions 90° apart.

7. Apparatus as in claim **3** wherein the molding head means includes a pair of rotatable round discs.

8. Apparatus as in claim 5 wherein the molding head means is displaceable in a straight and horizontal path along the lower edge of the operator's cabin.

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U.S. Cl. X.R.

25—41 J; 249—20; 264—33