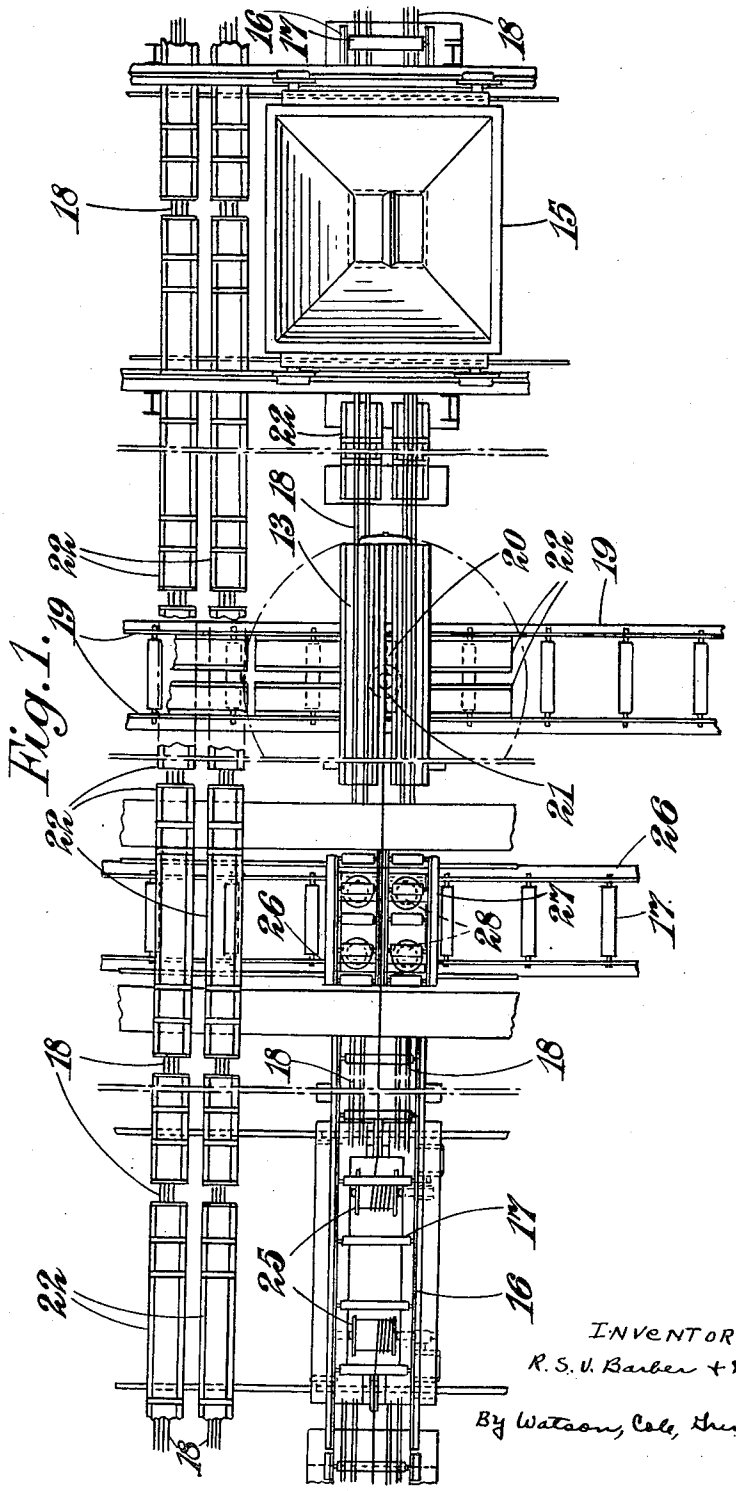
Feb. 5, 1946. R. S. V. BARBER ET AL 2,394,228

APPARATUS AND METHOD FOR THE PRODUCTION OF PRESTRESSED CONCRETE SLEEPERS

Filed April 25, 1944 3 Sheets-Sheet 1

Fig. 1.



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Filed April 25, 1944 3 Sheets-Sheet 2

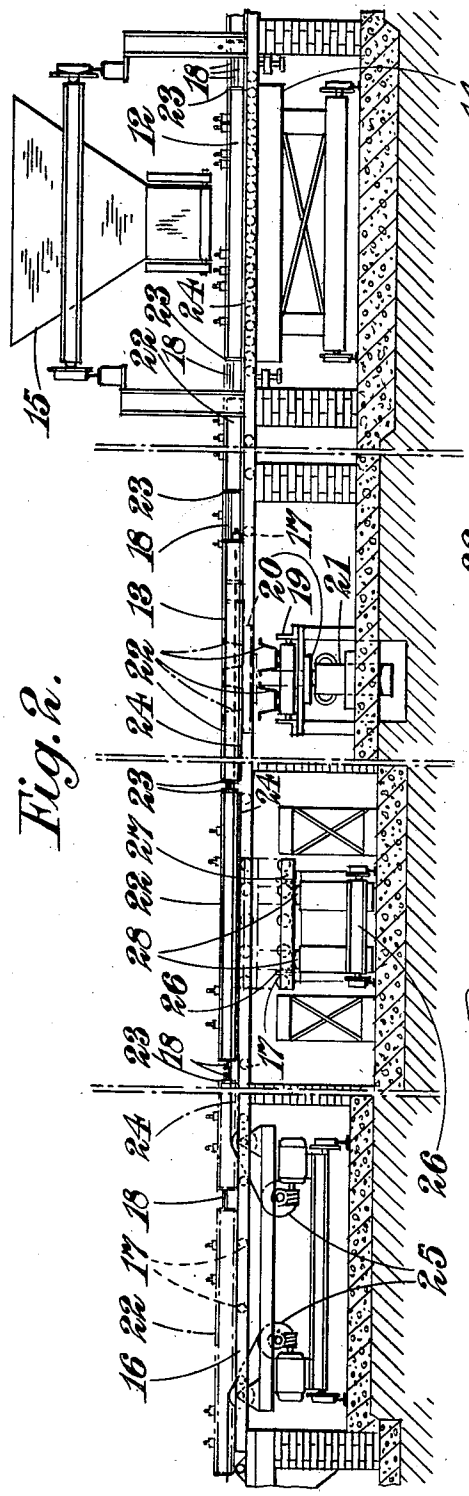

Fig. 2.

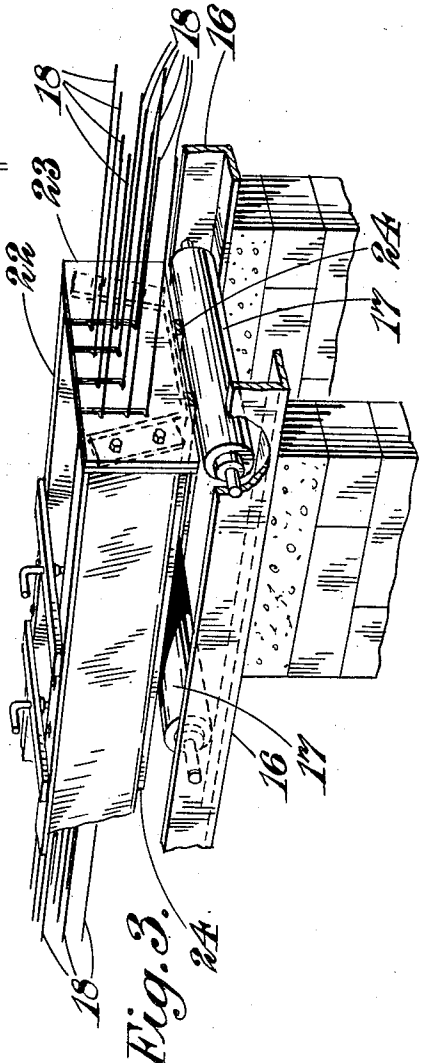

Fig. 3.

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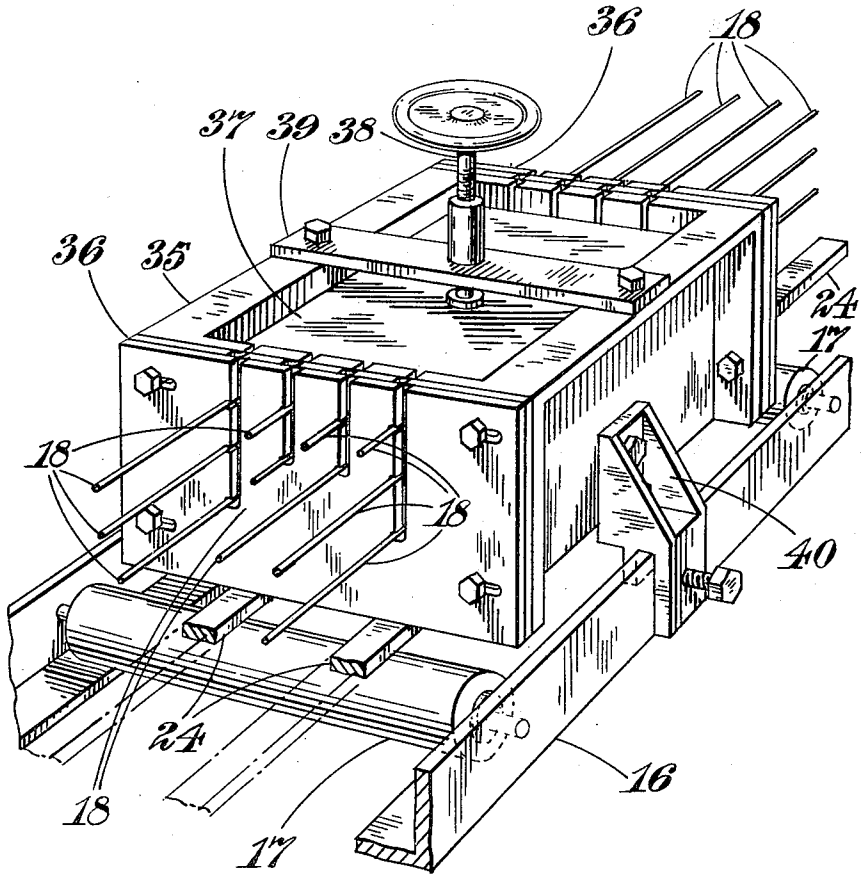
Fig. 4.



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APPARATUS AND METHOD FOR THE PRODUCTION OF PRESTRESSED CONCRETE SLEEPERS

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Application April 25, 1944, Serial No. 532,624
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11 Claims. (Cl. 25—41)

This invention consists of improvements in or relating to the production of pre-stressed concrete sleepers, and in this specification the expression "sleepers" includes similar beams.

There are two governing factors in the large scale production of such sleepers: the first is that the reinforcing wires under high tension extend along the production lines and pass through the end plates of the sleeper moulds arranged in series: the second is that when a mould has been filled with concrete there is a short period (e. g. 30 to 150 minutes) during which the concrete "sets" or loses its mobile quality and then a long period (somewhat indefinite but generally a matter of days) during which the concrete hardens and can be handled and transported. The resulting problems or requirements include (*a*) the supply of clean and empty moulds (open-ended troughs) to the production lines containing the stretched wires,

(*b*) the positioning of each mould in relation to the stretched reinforcing wires,

(*c*) the fixing of the end plates to the mould so that the reinforcing wires pass through slots in said end plates,

(*d*) the filling of the mould with concrete while subjecting the mould to vibration,

(*e*) the completion of mould movement or manipulation before the concrete has set,

(*f*) the rest period of the moulds in the production lines until the concrete is hardened or cured sufficiently for handling or transport,

(*g*) the severing of one mould from its series without losing control of the remainder of that series,

(*h*) the removal of that mould from the production lines to a dismantling bay.

In addition to these mechanical or impersonal requirements there are the equally important human problems especially the arrangements that manual operations either of skilled or unskilled labour shall be carried out at appropriate places where there is room to work. In describing the invention it will be assumed that the sleeper bed is about 500 to 600 feet long and has a number of parallel production lines each accommodating long series of moulds, say 2 pairs side by side.

According to one feature of this invention the supply of clean and empty moulds to the production lines and the removal of moulds containing hardened concrete sleepers or the moulds and the sleepers separately are effected by means of transverse conveyors or run-ways.

Gravity conveyors or run-ways may be used for the supply of empty moulds. The removal of the full moulds to the dismantling bay or the removal of finished sleepers is preferably effected by power-driven conveyors.

This invention further includes an arrangement in which the supply of empty moulds, the assembling of the moulds and end plates in proper relation to the reinforcing wires, the filling of the moulds with concrete and the vibration of the moulds as well as the severing of individual moulds from their series at completion and the removal of the severed moulds to the dismantling bay all take place in the middle portion of the production lines.

As a consequence, the supply of concrete (i. e. the movements of the feed hopper) and the movement of the vibratory platform to the different production lines are also effected by transverse conveyors or run-ways.

This invention further includes a duplex arrangement for the mass production of prestressed concrete sleepers of the kind above referred to in which two transverse conveyors for empty moulds are used, one on each side of a central filling station. In using this arrangement the moulds, e. g. a pair of moulds, having been brought into a production line and assembled on the stretched wires are filled with concrete and vibrated at the filling station and then moved along the stretched wires to their setting and hardening positions on one side of the filling station (i. e. towards one end of the production line). When the production line at that side of the filling station is filled up with moulds in series, it is shut off by a transverse gate or partition which may be provided with means for gripping the stretched wires. Then the other supply conveyor is brought into play and the operation of assembly, filling, vibrating and moving another series is carried out for the other side of the central filling station, i. e. towards the other end of the production line. Then the removal of completed moulds may likewise be carried out in duplex fashion, the moulds between the mid-position and one end being first brought up in succession to the severing point and to the transverse removal conveyor after which the moulds between the mid-position and the other end of the line are brought up in succession to the severing point and to the transverse removal conveyor.

The nature of this invention and of subsidiary features thereof will be appreciated from the following description of a specific example without repeating the features above described.

The production lines are nearly on ground level

i. e. the filled moulds run to their setting and hardening positions on roller run-ways at bench height so that the operations of filling and vibrating the moulds as well as the operations of cutting the wires at the ends of a mould on completion, all take place at bench height.

The reinforcing wires supplied from reels at one end of the production lines pass through jack heads or pedestals arranged at each end of the production lines and the stretching and securing of the wires is carried out in known manner, the wires being of course above the run-ways of the production lines.

The transverse gravity conveyors for supply of clean empty moulds pass (from a mould-cleaning bay) under the main run-ways of the production lines. The empty moulds in pairs side by side travel along these transverse conveyors with their axes at right angles to the production lines, so when a pair of moulds reaches its own line it engages a little hoist like a compressed air or pneumatic hoist which turns the moulds through 90° about a vertical axis and raises them to the run-way level where an operator places the empty mould in proper relation to the stretched wires and also assembles the slotted end plates so as to fit the various wires and close the ends of the mould. The mould when assembled is moved to the filling station where it is brought on to a vibratory platform; and while vibration is proceeding the concrete from a transverse travelling hopper is fed into the mould which is then passed along the run-way (and along the wires) until it reaches its setting position.

After the hardening period the operation of removing the moulds begins. Under the run-way is a power-driven winch or windlass having wire cables adapted to engage with a mould in the series and pull the series along the run-way. The mould to be severed is thus pulled up to the severing point and the wires are burnt off. The cable is then coupled to the next mould of the series which is moved forward by one stage. One effect is to push the severed mould (or pair of moulds) into line with the transverse conveyor for removing the severed moulds and these moulds are brought above a pneumatic lift (with roller top) so that the moulds can be lowered on to the removal conveyor. The dismantling of the moulds and their cleaning do not form part of this invention.

In the specific example described above the filling and removal of moulds is carried out at the middle portion of the production lines but it will be understood that the transverse conveyors or run-ways may also be used in cases where the assembly bay and/or the dismantling bay is at or near an end of the production lines.

In the same way the employment of the transverse gate or partition provided with means for gripping the stretched wires (so as to keep the stretched wires undisturbed during the final set or definite hardening of the concrete) may be resorted to with advantage in cases where the assembly bay and/or the dismantling bay is at or near an end of the production lines.

It will be understood also that the operation of "de-tensioning" or releasing the tension on the reinforcing wires involves a shrinkage in those parts of the reinforcing wires which are not embodied in the hardened concrete and this involves actual movement of many moulds which are in series with the mould for which the reinforcing wires are to be severed first. This illustrates the practical importance of mounting the moulds on rollers.

It is an important practical feature of the present process for the production of pre-stressed concrete sleepers that the reinforcing wires are arranged in pairs and that the correct tension is applied to such a pair or to a series of pairs by means of screw-jacks, i. e. screw-operated tensioning devices which can adjust the tension in a single pair of reinforcing wires or in a series of pairs; so that while the reinforcing wires of that series are in tension, the stress in the said wires may be brought to the desired amount, but when the concrete sleepers of that series have set hard so that it is safe to release the external tension in the wires of that series, the screw jacks can be released.

An example of the practical application of this invention is illustrated in the accompanying drawings in which:

Figure 1 is a plan of the production lines, transverse mould conveyors and other parts,

Figure 2 is an elevation of the same,

Figure 3 is a perspective view of part of an assembled mould, and

Figure 4 is a perspective view of a transverse gate or partition for gripping stretched wires at an intermediate point in the production line.

Referring to Figures 1 and 2, an assembly platform 12 is adapted to receive a mould 13 and to be brought into contact with a vibratory platform 14 which imparts vibration to the mould 13; and concrete grout is supplied to the mould through a filling device 15. As will be clear from the drawings there are a number of parallel production lines and each production line has a track 16 with a succession of rollers 17 arranged at spaced intervals transversely to the track. Each production line has a series of parallel reinforcing wires 18 stretched right along the production line and so arranged as to be accommodated within all the moulds in that line so that the reinforcing wires will be embedded in the concrete in each mould. In practice the reinforcing wires are placed in a state of very high tension, but the means for supporting the wires and for applying the high tension are not shown as they form no part of this invention.

The general intention is that each assembled mould 13 shall be filled with concrete at the assembly platform 12 and then pass along the production line (and along the reinforcing wires) to its position in the production line to allow the concrete to set and harden.

The particular feature of this invention lies in the means for introducing the empty moulds to the production lines and for removing the moulds from the production lines after the concrete has set and hardened and after the reinforcing wires have been severed therefrom. The transverse track for introducing the empty moulds is shown at 19; a turn-table for turning the empty moulds from alignment with the track 19 into alignment with the production line 16 is indicated at 20 and an elevator for raising the moulds up to the level of the production line is shown at 21.

Referring to Figure 3, it will be seen that the mould is a hollow trough 22 open at its ends and arranged to embrace the reinforcing wires 18. Each end of the mould is provided with slotted end plates 23 which form the subject of a separate patent application. The mould 22 is provided with bars or runners 24 which engage with the rollers 17 so that each mould is capable of running freely on the collars 17 along the track 16.

A winch 25 is shown in Figures 1 and 2 and this winch may be used to move the filled mould from the platform 12 to the setting position for that mould. It will be readily appreciated from Figures 1 and 2 that the empty moulds for each production line are brought to that line over the track 19, that the moulds thus introduced (generally in pairs) are turned (on turn-table 20) parallel with the production line and are then raised to the level of the production line by the elevator 21, the rollers 17 at that point being temporarily removed.

The moulds are pulled along the tracks 16 on to the platform 12 in turn where they are fitted with the end plates and thereby fully assembled. Concrete grout is filled into the assembled mould which is vibrated and after completion of the operations of filling and vibrating, the filled mould is pulled away from the platform 12 along the production line to its setting position. After the concrete in the moulds has set and hardened, the moulds may be moved along the production lines and at that stage the reinforcing wires themselves form the haulage means or couplings between moulds in series. Here again the winch 25 is utilized so that the moulds in turn may be pulled into position for the severing of the reinforcing wires and for the removal of the moulds from the production line.

It is an important feature of this invention that a transverse discharge conveyor 26 is arranged under the tracks 16.

In the arrangement illustrated, a power driven conveyor 26 is diagrammatically shown and in this case the finished moulds are brought on to a vertically movable platform 27 and lowered by the elevator 28 into a position where they can be transferred to the power driven conveyor 26. It will be understood that the finished moulds can be brought to the platform 27 from either end of the production line.

In the arrangement shown the concrete filling device 15, the vibratory platform 14 and the elevators 21 and 28 can all be individually moved laterally into register with any production line.

Referring to Figure 4, a device is shown in the nature of a transverse gate or partition which can be used to shut off one side of a production line when it has been fully supplied with filled moulds so that no vibration shall be transmitted to the filled moulds while further moulds are being filled and vibrated on these same reinforcing wires.

The device consists of a trough-shaped box 35 having slotted end plates 36 constructed and operated like the end plates 23 of the moulds. The box is conveniently filled with sand and the sand is covered by a lid 37 which can be screwed down by a threaded spindle 38 engaging a transverse bar 39 across the top of the box 35. The bottom of the box has clamps 40 which can be firmly secured to the track 16.

In the duplex arrangement above referred to, two transverse conveyors 19 for empty moulds are used, one on either side of the concrete-filling station. Then while one side of a production line is being filled up, the transverse conveyor 19 on the other side of the filling station is utilized and vice versa. This makes it possible for the introduction, assembly, filling, and disposal of the moulds to be carried on continuously for one side of a production line and thereafter the same operation can be carried out for the other side of the production line.

We claim:

1. A method for the production of pre-stressed concrete sleepers in which parallel reinforcing wires under high tension are arranged in long production lines having roller tracks for the movement of trough-shaped moulds, empty moulds are supplied to said production lines by a transverse conveyor track below said production line track, each empty mould is elevated from the transverse track to the level of the appropriate production line and moved to a concrete-filling station and filled with concrete which surrounds the wires in the moulds, the mould is moved to a concrete-setting position in said production line and left till the concrete is hard, the finished mould is brought to a discharge position in the production line, the projecting wires are severed, the mould is lowered on to the level of a transverse discharge track and the mould is moved on said discharge track away from the production line.

2. A method for the production of pre-stressed concrete sleepers in which parallel reinforcing wires are arranged in long production lines and subjected to high tension, trough-shaped moulds are arranged to run on roller tracks along said production lines each mould surrounding the reinforcing wires of that line, empty moulds are introduced to said production lines over a transverse conveyor passing under said roller tracks each empty mould in its turn is elevated from said transverse conveyor to the level of said roller track and moved to a concrete-filling station and filled with concrete, the filled mould is moved along said roller track to a concrete-setting position in the production line and left until the concrete is hard, each mould containing hardened concrete is brought in turn to a discharge position in its production line, the projecting wires are severed and the mould is lowered to the level of a transverse discharge conveyor on which the said mould is removed, the two transverse conveyors and the filling stations being arranged near the mid point of the long production lines.

3. A method for the production of pre-stressed concrete sleepers as claimed in claim 1 in which the mould at the concrete-filling station is supported on a vibratory platform and vibrated during filling.

4. Apparatus for the mass production of prestressed concrete sleepers or the like comprising, in combination, an elongated rectilinear trackway, means for supporting a plurality of reinforcing wires under tension in parallel relationship to each other and to the trackway, means for moving a mould transversely of the trackway into such position that the reinforcing wires extend through the concrete receiving space thereof, and means for depositing concrete in a mould so positioned.

5. The combination set forth in claim 4 in which a further means, spaced from said mould moving means, is adapted to successively withdraw moulds from said trackway.

6. The combination set forth in claim 4 in which means including a power driven conveyor, spaced from said mould moving means, is arranged to successively withdraw moulds from said trackway.

7. The combination set forth in claim 4 in which a vibratory platform is provided, said platform receiving and supporting each mould when in position to be charged.

8. The combination set forth in claim 4 in which the mould filling station is located midway of the trackway, so that a series of filled moulds may be moved to one side of said filling station

and a second series moved to the other side of said filling station.

9. Apparatus for the mass production of prestressed concrete sleepers or the like comprising, in combination, two elongated parallel rectilinear trackways, means associated with each trackway for supporting a plurality of reinforcing wires under tension in parallel relationship to each other and to that trackway, a single means for moving a mould transversely with respect to either trackway into such position that the reinforcing wires adjacent that trackway extend through the concrete receiving space thereof, and means for depositing concrete in a mould so positioned.

10. Apparatus for the mass production of prestressed concrete sleepers or the like comprising, in combination, two elongated parallel rectilinear trackways, means associated with each trackway for supporting a plurality of reinforcing wires under tension in parallel relationship to each other and to that trackway, a single means for moving a mould transversely with respect to either trackway into such position that the reinforcing wires adjacent that trackway extend through the concrete receiving space thereof, and a single means movable laterally with respect to said trackways for depositing concrete in a mould positioned on either trackway.

11. Apparatus for the mass production of prestressed concrete sleepers or the like comprising, in combination, two elongated parallel rectilinear trackways, means associated with each trackway for supporting a plurality of reinforcing wires under tension in parallel relationship to each other and to that trackway, a single means for moving a mould transversely with respect to either trackway into such position that the reinforcing wires adjacent that trackway extend through the concrete receiving space thereof, means for depositing concrete in a mould so positioned, and a vibratory device movable laterally of said trackways to engage and vibrate a charged mould positioned to be advanced along either.

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