CONCRETE REINFORCING STEEL HANDLING AND PLACING DEVICE
Carl J. Heltzel, 525 Country Club Drive, NE.,
Warren, Ohio 44484
Filed Nov. 29, 1967, Ser. No. 686,526
Int. Cl. E04c 19/00, 11/02
U.S. Cl. 94—39
13 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure illustrates and describes an apparatus for supplying to a plastic concrete road under construction a succession of reinforcing bars originally immovably mounted on a rack adjacent to the end of the conveyor in which the conveyor carries means for segregating and picking up the bars from the rack, carrying the same out over the concrete and then releasing such bars for deposit upon the concrete surface after which, by appropriate means, the reinforcing bars may be depressed below the surface of the concrete slab at various selected intervals to act as tie-bars for center joints, dowel rods for transverse joints and/or use in connection with continuous reinforcing and wire mesh reinforcing; the bars being picked from the rack by one or more means for advancing the rods along the rack, for relatively moving the means to receive the bars in a supporting relation where the bars are carried over the concrete and involving also release means by which the bars may be ultimately deposited under the slabs.

The present invention relates to concrete reinforcing steel handling and placing device and has for an object to entrain reinforcing bars, whether they be single bars such as tie-bars, or dowel bars, or bars involved in the construction of continuous reinforcing or wiremesh reinforcing, which bars are originally carried by a rack with which an endless conveyor connects to remove the bars, carry the same over the plastic slab of a road under construction and ultimately freeing the bars for deposit upon the surface of the slab into which they are depressed to desired subsurface positions.

Another object of the invention is to provide an apparatus as above described with both apparatus and bar support rack adapted for mounting upon a mobile unit adapted to travel along the side forms or by slip paver in order that the installation of reinforcing may be conducted as a part of general operations laying the slabs and conducting other incidental road operations.

A further object of the invention is to provide appropriate form of endless conveyor involving units comprising pusher member and spring loaded latches carried by the conveyor and having appropriate relative conformations to segregate bars from the rack, automatically enclosing the bars in spaces provided therefor between pusher and clamp devices and actuating to free the bars for deposit on the concrete in a gang movement.

With respect to the deposit of reinforcing in plastic concrete roads under construction there are generally three methods as follows:

(A) Mesh or steel can be originally supported from the subgrade on chains, wire baskets or similar devices and the concrete poured through the reinforcing to the full depth of the slab. With this method of construction the steel must be placed on the subgrade ahead of the concrete machine train and the concrete must be handled from outside the slab area.

(B) both types of reinforcing can be placed by using the two course method. The bottom course of concrete is laid to within 21/4" or 3" of the top of the slab. The mesh or continuous reinforcing is then laid on top of the bottom course, and the second or top course is then poured over the steel, completing the slab. With this method the reinforcing is either pulled or handled from a mesh or steel carrier to the top of the bottom course; or the mesh or steel is strung out along the right-of-way on the berm or shoulder and is carried into the slab area by hand as required. In either instance, although there is no steel in front of the paving train, it is necessary for the workman to walk in the concrete and in many instances carry mud or dirt from the berm or shoulder into the concrete slab area, thus contaminating the concrete. Also, in many instances, there is a considerable distance between the placement of the bottom course and the placement of the top course, which can result in poor bonding between the courses and in many cases, cold joints. Also this is true on extremely hot and dry days when the concrete tend to set up quicker. It is also necessary to handle the concrete for the second course from outside the slab area in any event.

(C) The third method is to pour the concrete slab to the full depth and the mesh or continuous reinforcing is forced in position from the top of the freshly poured concrete slab to the prescribed depth. This method eliminates any chairs or steel on the subgrade, permits the concrete to be handled in front of the paving train on the prepared subgrade, eliminates the possibility of any cold joints because of its homogeneous complete depth pour and vibration forcing the reinforcing into the slab, and eliminates any voiding around the reinforcing steel, which does occur on many occasions when the concrete is poured through the steel as outlined in method A.

The reinforcing slab usually has tie-bars down the center or longitudinal joint and dowel bars at transverse joints. The tie-bars are located usually just below the reinforcing steel, but the dowel bars are usually located at one-half the depth of the slab. Both types of bars can and have been supported on chairs from the subgrade or can be vibrated into place from the top surface.

A method and device for installing tie-bars to the required depth is illustrated in Patent No. 2,596,206.

The purpose and object of the present invention is to provide a unit which will permit either continuous reinforcing or steel mesh to be handled from outside the slab area, mechanically moved into position, and deposited on the top of the freshly poured full-length slab. This method and apparatus eliminates the use of any superfluous steel or chairs on the subgrade, permits the handling of concrete directly in front of the first spreading device, and eliminates the necessity of handling the concrete from outside on the berm area or shoulder. It also eliminates the possibility of cold joints, giving a homogeneous slab at the same time eliminating the possibility of any voiding around the reinforcing steel. The improved method also ensures that no workman would walk through the poured concrete, carrying any type of contamination into the slab area. The invention minimizes the number of machinery units required and saves considerable manpower. The invention further ensures continuous operation because the reinforcing steel is dropped to the top surface of the freshly poured slab the apparatus can immediately be reloaded while the machinery is moving forward so that continuous forward movement is assured.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

FIGURE 1 is a vertical sectional view of a plain concrete slab as deposited on the subgrade indicating depth,
width and the side area termed "berm" or "shoulder.

FIGURE 2 is a similar view showing a center or longitudinal joint with a tie-bar in place across the same.

FIGURE 3 is a similar view showing, in addition to center joint and tie-bar, traverse dowel bars and continuous reinforcing.

FIGURE 4 is also a vertical sectional view through a concrete road slab showing center joint, tie-bar and wire mesh reinforcing.

FIGURE 5 is a fragmentary longitudinal section through the concrete slab showing a transverse joint and dowel bar extending across the same.

FIGURE 6 is a top plan view of an apparatus for carrying out the invention.

FIGURE 7 is a vertical sectional view taken on the line 7—7 of FIGURE 6.

FIGURE 8 is an end elevational view with the conveyor in stopped position with a full complement of reinforcing bars held above the concrete slab.

FIGURE 9 is a similar view showing the release of the reinforcing bars and of the deposit by gravity of the same upon the plastic concrete slab.

FIGURE 10 is an enlarged detailed view of the descending end of the conveyor with the pusher and clamp shown in an initial position relative to the reinforcing bars as cast in an adjacent rack.

FIGURES 11, 12 and 13 are similar views showing a succession of positions from that of FIGURE 10 illustrative of sequential movements of the conveyor, the pusher bar and the spring loaded clamp bar culminating in the entrapment and support by the conveyor of the reinforcing bar prior to leaving the rack and moving out over the plastic slab.

FIGURE 14 is an end elevational view taken from the clamp end showing the unit for engaging and supporting the reinforcing bars.

FIGURE 15 is a vertical sectional view of the same taken on the line 15—15 of FIGURE 14.

FIGURE 16 is a cross-sectional view taken through the conveyor and its track showing the unit comprising the pusher and clamp in connection with a means for driving the reinforcing bar out of the pusher-clamp unit.

FIGURE 17 is a fragmentary side elevational view taken from the right-hand side of FIGURE 16 and showing the clearing bar in uppermost position with the reinforcing bar held by the pusher-clamp unit.

FIGURE 18 is a similar view showing the clearing bar depressed and the reinforcing bars freed to drop upon the slab.

Referring more particularly to the drawings, 25 designates the main frame of a machine mounted on powered wheels 26 for travelling along road forms 27, although the frame may, as in the case of slip pavers, be supported by endless tracks running along the prepared subgrade.

Endless conveyors 28 are carried on the main frame and are at least two in number, spaced apart at appropriate distances in accordance with the lengths of the reinforcing bars to be lifted and moved thereby. At one end the conveyors run around drive sprockets 29 affixed to a drive shaft 30 driven by suitable motor 31.

Carried by the main frame 25 are also supported space members 32 shown to be three in number in FIGURE 6, constituting a rack for holding a supply of reinforcing bars 33.

The support members 32 are spaced apart horizontally and the reinforcing bars 33 are placed crosswise thereof. The sections 28 are offset from the support members 32, as shown in FIGURE 6, so that the reinforcing bars 33 may be picked up off center and at two points between the center and ends of the bars.

An operator's platform 34 may also be carried by the machine frame 25 adjoining the rack, whereby the operators carry on the operation of the equipment to it that a succession of the reinforcing bars 33 are in position to be picked up and transported by the pick-up devices on the two conveyor sections. The bars are shown in FIGURE 8 as round in cross section, and as laid in a single row on the support members 32.

As shown more particularly in FIGURE 16, the conveyors are each enclosed in channel tracks 36 which are substantially C-shaped. The conveyors are preferably formed of chain links 39 connected by pins 38 upon which rotate the rollers 37.

Around the endless chains are provided a succession of pick-up devices each of which comprises generally a trailing pusher bar 42 and a leading clamp 43. The pressure bars are fixedly carried by the chain links while the clamps 42 are pivoted as at 44 to such links.

As shown more particularly in FIGURE 15 a tension spring 45 accommodated in tunnels of the two members 42 and 43 exerts a constant elastic tension tendency to rotate the clamp 43 rearwardly against a stop 46 projecting from the said fixed pusher member 42. This pusher member 42 is longer than the clamp 43 and has a forward pusher face or front wall 47 with a squared-off free end 49 which in the descending position of FIGURE 13 presents a wedge formation 53 adapted to engage the first-in-line of the reinforcing bars 33.

The clamp 43 has a front wall sloped outwardly in a rearward direction as indicated at 47 for clearance, and the lower free edge 48 of the clamp 43 is inclined outwardly and forwardly from edge 60 to provide a cam surface 48. Adjoining the inner rear end of the cam surface 48 is a second cam surface 50 sloping inwardly and forwardly from edge 60. The two cam surfaces 48 and 50 combine to form a projection 52 on the trailing face of the clamp member which extends in the closed position of FIGURE 15 toward the face 47 of the pressure member 42 through a distance less than the diameter of an embraced reinforcing bar 33, as seen in FIGURE 13, so that above this projection 52 is a reinforcing bar cavity 51 adapted to accommodate a reinforcing bar when in position of FIGURE 13.

Beside the lower run of each C-channel track 36 is movably mounted an ejection bar device 54, which is adapted to be driven down by hydraulic or air cylinders 55.

In operation, FIGURE 10 shows the pick-up couple 42, 43 moving down the conveyor, the descending end with the spring 45 contracted and the leading clamp member 43 occupying its rearmost position. The wedge end 53 of the fixed pusher member 42 is in line to engage the first-in-line of the round reinforcing bars 33 on the rack 32. The shorter clamp member 43 easily clears the first-in-line bar 33.

FIGURE 11 shows the further movement of the conveyor with the pusher member 42 and clamp member 43 in substantially the same relative positions. However, the first-in-line reinforcing bar 33 has been singled out from the line of bars on the rack 32 by action of the wedge end 53 of the pusher member 42 and the front flat face 47 of the pusher member 42 has moved the first-in-line reinforcing bar 33 horizontally along the supporting bars 32 of the rack in a sliding descending movement of the front face 47 of the pusher member 42 over the rear portion of the first-in-line reinforcing bar 33.

Referring to FIGURE 12, the pusher member 42 and the clamp member 43 have reached a further lower position with respect to the rack, in consequence of which the cam lower edge 48 of the clamp encountered the forward face of the first-in-line reinforcing bar 33 and in its descending movement the cam face 48 has reacted with the reinforcing bar 33 to cause the clamp 43 to swing out about its pivotal connection 44 and in doing so to expand the spring 45, such action opening up the gap leading to the inner space 51.

FIGURE 13 shows that in the further descent of the members 42 and 43 the rearwardly projecting point 60 has cleared the bar and the coil spring 45 has pulled the clamp member 43 back against the stop 46. This point 60 is now
3,443,495

disposed below the entrained reinforcing bar 33. The pick-up device now supports the reinforcing bar 33 without further aid from the rack and further movement of the lower run of the conveyor moves the reinforcing bar 33 off the rack and in its suspended position carries this reinforcing bar over the plastic slab. As the same action is taking place by the companion conveyor the reinforcing bar is held at two spaced points to opposite sides of its center.

In like manner as the conveyors move in the direction of the arrow shown in FIGURE 13 subsequent pairs of the pick-up members entrap subsequent reinforcing bars 33 from the rack 32 and carry same in a line over the concrete slab as shown in FIGURE 8.

FIGURE 9 shows that the hydraulic or air devices 55 have been actuated to drive the two ejection bars 54 downwardly to release the reinforcing bars 33 from the pick-up members and to permit the same to drop to the surface of the concrete.

FIGURE 17 shows the raised position of the ejection bar 54 and the entrained position of the reinforcing bar 33.

FIGURE 18 shows the partial descending movement of one of the ejection bars 54 which drives the reinforcing bar 33 downwardly along the upper cam surface 50, thus causing pivotal movement of all clamp bars 43 about their pivots 44 in a direction forwardly so as to free simultaneously all clamp bars 43 from the reinforcing bars 33 by reason of which the reinforcing bars 33 are permitted to drop by gravity as shown in dotted lines in FIGURE 18 and in full lines in FIGURE 9.

Subsequently, these reinforcing bars 33 are depressed through the plastic concrete by suitable mechanism for taking up positions at desired depth therein.

After the release of the reinforcing bars 33 by action of the ejection or clearing bars 54 the several springs 45 will pull the clamp bars 43 back to the normal position of FIGURE 15 so that when the pick-up members have traveled the upper runs of the conveyors back to the descending ends of the conveyors above the rack 32 the pick-up devices will be ready for a subsequent load of the reinforcing bars.

While FIGURES 6, 7, 8 and 9 show the conveyors disposed to move transversely of the road under construction, to further illustrate the adaptability of this particular unit there is illustrated in FIGURE 6 at the forepart of the machine a tie-bar installer in which 61 designates tie-bars adapted to extend across the center joint as shown in FIGURE 2.

The same device or similar unit can handle transverse reinforcing rods 62 as also shown in FIGURE 6.

At this position of FIGURE 6 there could be installed a mechanical dowel bar installer as covered by our patent aforesaid.

The pitch of the pick-up members can be varied and the chain would be built so that the reinforcing bar or mesh cavity would be pitched exactly as requirements for the spacing of the steel.

The handling of steel mesh would not require that each longitudinal bar be held in a cavity or inner space of the pick-up devices of the chain and a sheet of mesh five or six feet wide could be handled at each edge and in the middle only, that is at three points.

This device can be operated as a completely independent unit or as one portion of a complex, consisting of a spreader, steel placer or positioner and a reinforcing steel or mesh installer of the continuous type as covered by Patent 3,319,544.

Although I have disclosed herein the best forms of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims:

What is claimed is:

1. For use with spaced support members of a supply rack for concrete road reinforcing bars, an endless conveyor positioned to travel above a concrete road under construction with its descending end disposed above a delivery end of the rack, dependent means on and traveling with the conveyor for singling out and separating the first in line of the reinforcing bars on the rack and automatically grasping the bars in a supporting relation for moving the bars out over the road to a position where, when released, the bars will be deposited on the plastic concrete.

2. The combination of claim 1 in which said dependent means comprises pusher means having a lower end shaped to enter between adjacent reinforcing bars on the rack and to push the forward bar forwardly, and clamp means associated and cooperating with the pusher means for supporting the bar from the conveyor.

3. The combination of claim 2, further comprising yieldable means urging the clamp means toward the pusher means.

4. The combination of claim 3, in which the clamp means has a part projecting toward the pusher means affording a space inwardly of said part to receive a bar, said part having a sloping inner surface engaged by the bar when depressed to cam the clamp means out of the path of the bar to free the bar for descent upon the plastic concrete.

5. The combination of claim 1 in which said dependent means comprises a pusher member having an outer free end adapted to enter between the first and second bars on the rack and to push the forward bar forwardly, a clamp pivoted to the conveyor forwardly of the pusher member, said clamp having a projection extending rearwardly from the clamp and forming with the pusher member an inner space for receiving a bar and supporting the bar for movement with the conveyor, and yieldable means biasing the clamp to a bar supporting position.

6. The combination of claim 5 in which the projection has an inclined inner surface sloping rearwardly in an outward direction toward the pusher member, and means for depressing the bar against the sloping surface to cam the clamp out of the path of downward movement of the bar.

7. The combination of claim 5 in which the projection has an inclined outer surface sloping rearwardly and inwardly for receiving a bar on the rack thereagainst to cam the clamp forwardly and admit the bar to the space inwardly of the projection.

8. The combination of claim 5 in which said pusher member has an outer free end substantially wedge-shaped to facilitate entry between adjacent bars on the rack and a substantially flat forward face presented to a forward bar for sliding down on said forward bar as the pusher member moves downwardly and forwardly between the adjacent bars and between the spaced support members of the rack acting to propel the forward bar forwardly on the support members.

9. The combination of claim 8 in which the associated clamp has an outer inclined surface sloping rearwardly and inwardly and toward the companion pusher member which incident to the forward and downward movement of the clamp rides on the forward bar and camming forwardly the clamp and admitting the forward bar to said inner space.

10. The combination of claim 1 in which the conveyor is in two sections disposed one section to each side of a support member of the rack, means coordinating the conveyor sections for movement together, both conveyor sections having said dependent means for grasping the bars at spaced points along the lengths of the conveyor sections.

11. The combination of claim 10 further comprising a mobile frame carrying said conveyor sections and said dependent means.

12. The combination of claim 10 in which the conveyor sections are chain link roller conveyors, enclosed loop tracks for the conveyors having slots through which project said dependent means, said tracks at the descending ends of the conveyor sections being arranged at an
13. The combination of claim 12 in which the dependent means is repeated a plurality of times around the conveyor sections and comprise trailing pusher members and leading clamp members, said pusher members being of a length whereby their free ends in descending the descending ends of the tracks encounter outer portions of the bars on the rack and in succession push the bars forwardly, while the clamp members encounter forward portions of the bars by which the clamp members are opened to admit the bars to inner spaces between the pusher and clamp members.