United States Patent

Hudis

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[45] **Apr. 25, 1972**

[54] APPARATUS FOR PLACING CONTINUOUS REINFORCING IN CONCRETE PAVING

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[52] **U.S. Cl.** **94/39**

[51] **Int. Cl.** **E01c 19/00**

[58] **Field of Search** 94/39, 46

[56] **References Cited**

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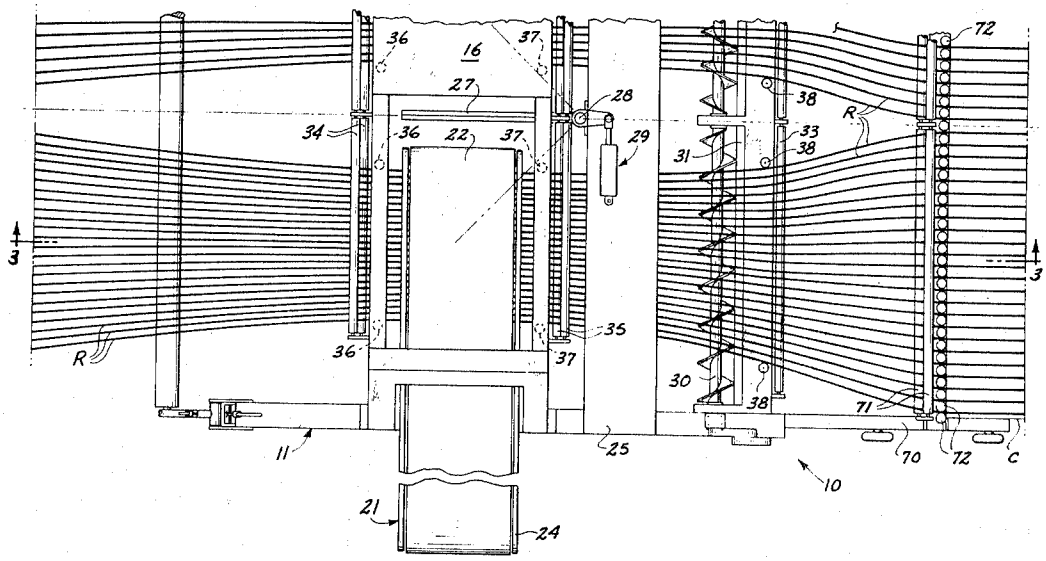
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[57] **ABSTRACT**

Spacing and depressing continuous reinforcing rods in concrete paving allows this reinforcing to be continuously positioned. Continuous reinforcing rods are positioned on the grade to be paved and are lifted over a first machine which receives and spreads the concrete. While supported by the first machine, the rods are separated laterally into two groups which define a center opening through which the concrete is delivered by a conveyor positioned above the rods. Rearwardly of the conveyor, the rods are guided inwardly to close the center opening and are maintained in a predetermined parallel relationship. Tie-bars or full-width cross-bars are then placed on top of the concrete in such a manner as to be beneath the continuous reinforcing rods. The rods are then guided and depressed below the surface of the concrete by a second concrete finishing machine and in turn depress the tie-bars or cross-bars to their proper position immediately therebeneath.

8 Claims, 6 Drawing Figures



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SHEET 1 OF 3

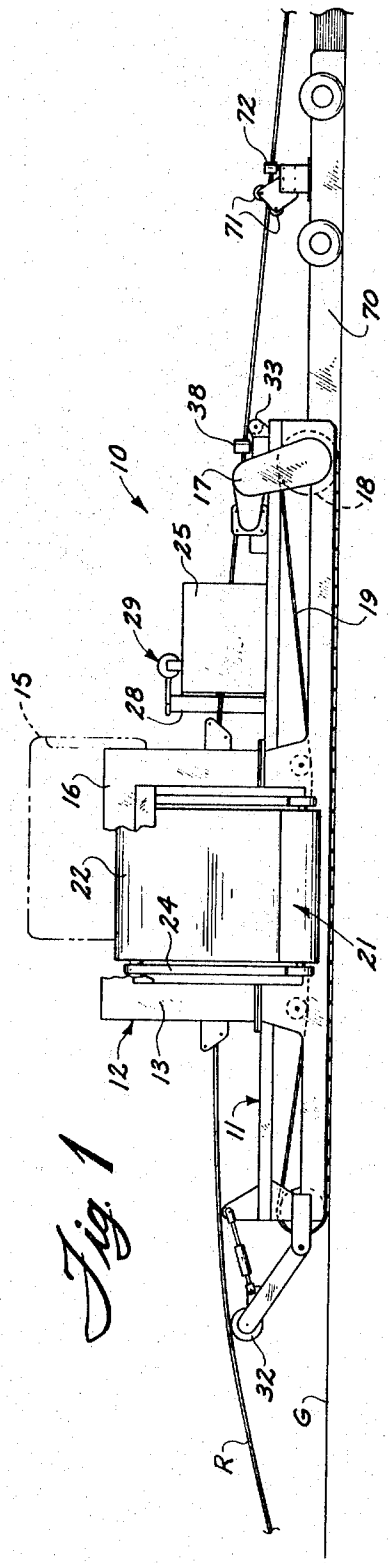


Fig. 1

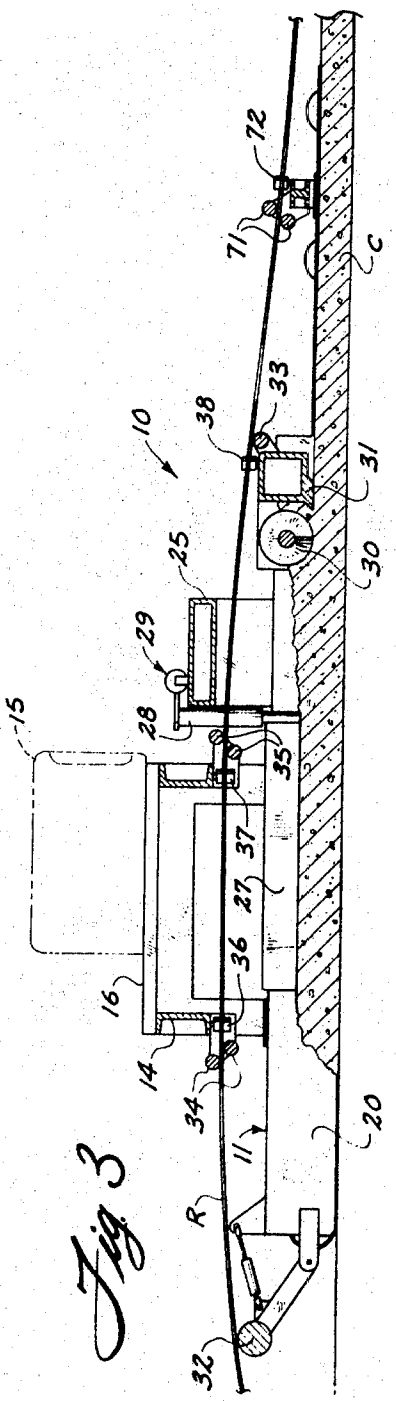


Fig. 3

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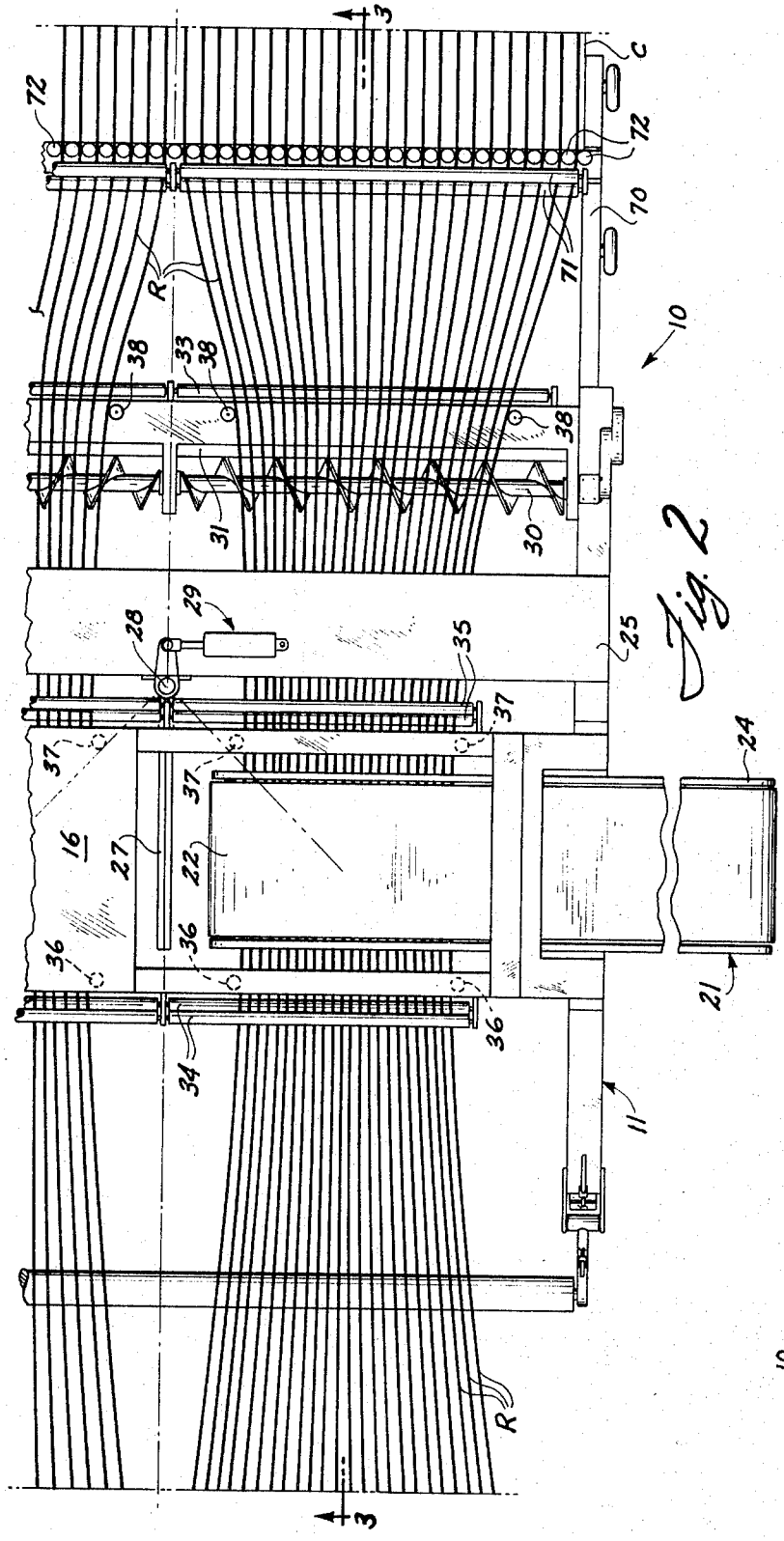


Fig. 2

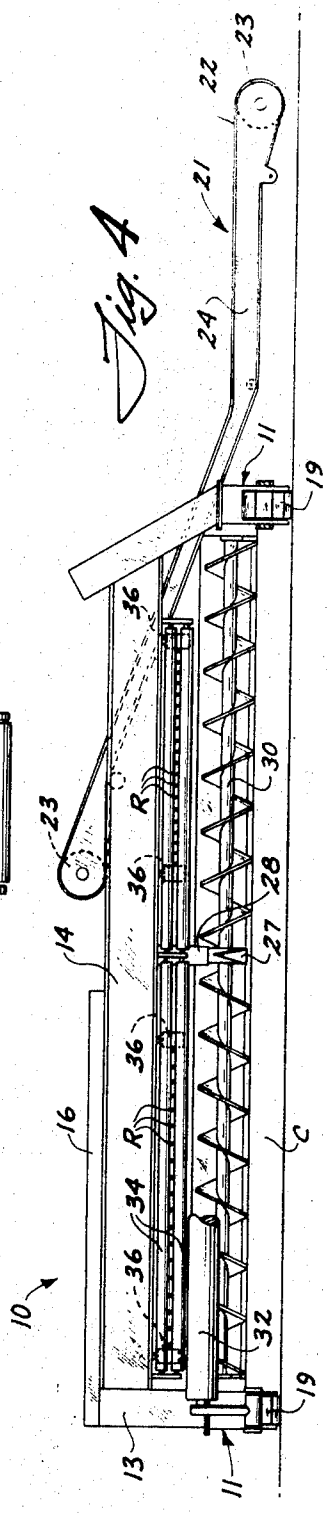


Fig. 4

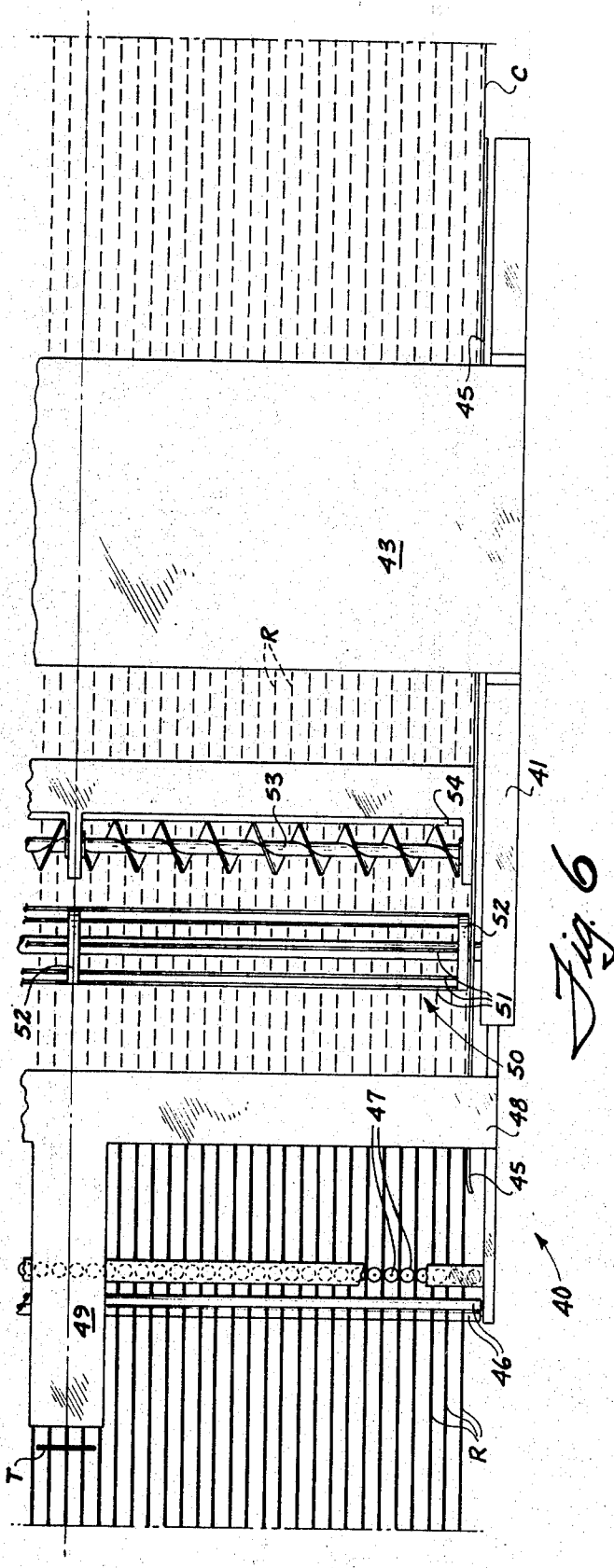

C
45
43
R
53
54
41
52
51
50
48
47
45
49
46
R
T
40

Fig. 6

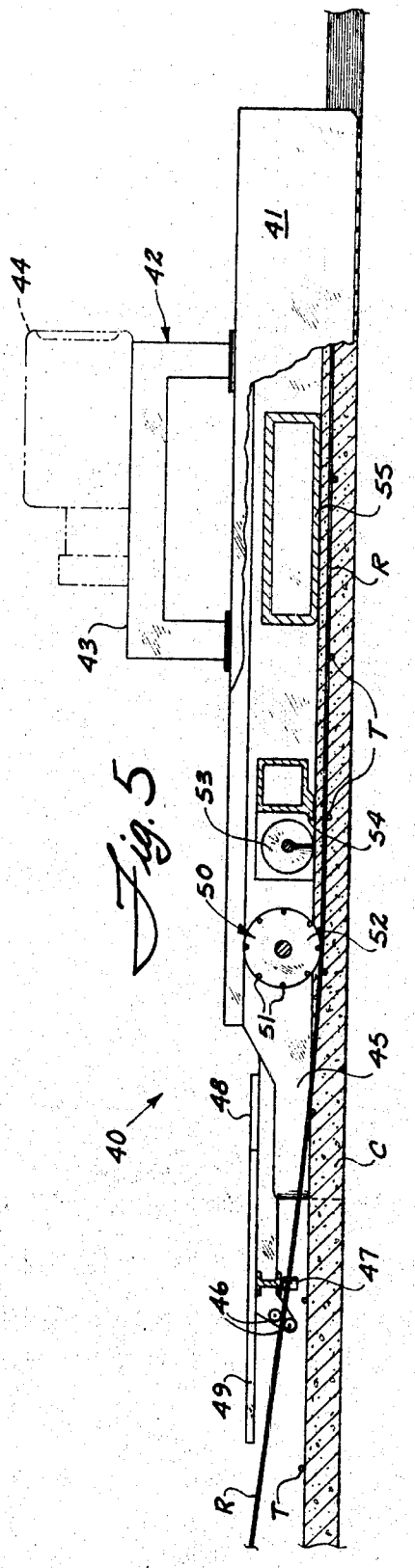

44
42
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Fig. 5

APPARATUS FOR PLACING CONTINUOUS REINFORCING IN CONCRETE PAVING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of and apparatus for placing continuous reinforcing rods in concrete paving.

2. Description of the Prior Art

The laying of concrete paving is accomplished generally by two methods. These methods are: (1) the fixed-form method, whereby forms are placed along both sides of a roadway to be paved prior to the pouring of the concrete. The concrete is then poured into these fixed forms and allowed to set prior to the removal of the forms; (2) the slip-form method, which incorporates the use of moving forms located on either side of the paving machine and corresponding to the sides of the roadway to be paved. Concrete is placed on the grade and is distributed between the forms, smoothed over and struck off by the paving machine, thus leaving behind a finished surface which needs only to harden to constitute a finished, paved roadway. The slip-form method requires no removal of forms from the roadway after the pavement has set.

Various reinforcing means are used with both the fixed-form and slip-form type of paving to strengthen the concrete pavement. These reinforcing means include the use of continuous reinforcing rods or wire mesh placed beneath the surface of the concrete pavement. Various methods have been used to locate such reinforcing means in the concrete pavement. These methods have included pouring a first layer of concrete of the desired thickness, manually placing the reinforcing rods or wire mesh upon the first-poured layer, and then pouring a second layer of concrete over the reinforcing rods. Another method involves the supporting of the continuous reinforcing rods at the desired height by the slip-form paving machine while simultaneously pouring and finishing the concrete around the rods and their supporting means. In the latter method, the closely spaced rods and their supporting means tend to interfere with the uniform settlement of the concrete onto the roadbed and tend to cause voids under the reinforcing rods.

SUMMARY OF THE INVENTION

According to the present invention, continuous reinforcing rods are supported above and pass over a first machine or spreader which distributes the concrete onto the roadbed to a full depth from a conveyor located above the rods. While supported by the first machine, the rods are separated laterally into two groups which define a center opening through which concrete is delivered by the conveyor. Rearwardly of the conveyor the rods are guided inwardly to close the center opening and are maintained in a predetermined parallel relationship. The continuous reinforcing rods are then guided and depressed into the plastic concrete to a predetermined level by a second paving machine or finisher which respreads the concrete over the depressed reinforcing rods and forms a finished surface on the plastic concrete. Although the preferred embodiment of the invention utilizes the slip-form method of paving, it is equally suitable for use with the fixed-form method.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a side elevational view of a preferred embodiment of the first machine or spreader;

FIG. 2 is a partial top plan view of the first machine;

FIG. 3 is a sectional view, with parts broken away, taken substantially along line 3—3 in FIG. 2;

FIG. 4 is a front elevational view of the first machine, with parts broken away;

FIG. 5 is a side elevational view of a preferred embodiment of the second paving machine or finisher; and

FIG. 6 is a partial top plan view of the second machine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As seen in FIGS. 1–3, the first machine or spreader **10** comprises a pair of endless track-laying carriages **11** which operate on the grade G at each side of the roadway to be formed. A support frame **12** is mounted on the carriages **11** and comprises upwardly extending beams **13** and transverse beams **14**. Power means **15** and an operator control deck **16** are supported by the frame **12**. The power means **15** is drivingly connected by any suitable drive transfer means **17** to the sprockets **18** for driving the endless tracks **19** of the carriages **11**.

Each carriage **11** includes a slip-form **20** which extends rearwardly of the spreader **10** to form the side of the concrete slab C as it is laid on the grade G. As is well known, the spreader **10** may be guided by probes (not shown) which move along a guide wire (not shown).

Any suitable type of conveyor or delivery means **21** is mounted on the frame **12** to receive fresh concrete from a delivery vehicle (not shown) to be distributed onto the grade G. As an illustrative example, the conveyor means **21** may comprise a belt conveyor **22** mounted on rollers **23**, one of which is drivingly connected to the power means **15** in any suitable manner. The rollers **23** are supported by a frame **24** which may be rigidly mounted on the frame **12** in any suitable manner. Alternatively, the frame **24** may be movably mounted on the frame **12** in any suitable manner to enable the belt conveyor **22** to be moved inwardly to allow a concrete delivery vehicle (not shown) to pass closely adjacent to the spreader **10** when travelling alongside the roadway to be paved, and to enable the belt conveyor **22** to be moved outwardly to the position shown in FIGS. **2** and **4** to receive concrete from a delivery vehicle (not shown) parked next to the spreader.

The belt conveyor **22** comprises a first concrete-receiving section that is substantially horizontally disposed when the conveyor is in the position shown in FIGS. **2** and **4**, and a second section that is inclined upwardly toward the spreader **10** and terminates at approximately the middle of the roadway to discharge concrete onto the center portion of the roadway.

It is noted that any suitable type of concrete conveyor means may be used with the spreader **10** without departing from the spirit or scope of the present invention.

The discharged concrete is initially spread laterally over the roadway by a substantially horizontally disposed, elongated blade member **27** that is secured at one end to a vertically extending rod **28** that is rotatably mounted on a frame portion **25** extending across the carriages **11**. The rod **28** and the blade member **27** are caused to oscillate by any suitable power means such as the piston and cylinder fluid drive unit **29** connected to the rod **28**, as shown in FIG. **2**.

The concrete is further spread and distributed evenly over the roadway by an auger **30** that is rotatably mounted on and extends across the carriages **11**. The auger **30** is rotatably driven by the power means **15** in any suitable or conventional manner. A "strike-off" member **31** is mounted on and extends across the carriages **11** immediately behind the auger **30** and serves to "strike-off" the spread concentrate at a predetermined height, as shown in FIG. 3. The "strike-off" member **31** may be adjustably mounted on the carriages **11** in any suitable or conventional manner.

As shown in FIGS. **2** and **3**, continuous reinforcing rods R are supported and guided on the spreader **10** by front and rear lift rolls **32** and **33** mounted on the carriages **11**; by pairs of supporting rolls **34** and **35** mounted on the front and rear of the frame **12**; by pairs of guide rolls **36** and **37** mounted on the front and rear of the frame **12** adjacent to the support rolls **34** and **35**, respectively; and by guide rolls **38** disposed adjacent to the rear lift roll **33**. In this manner, the reinforcing rods R are supported beneath the concrete conveyor **21** as the spreader **10** moves forwardly along the roadway to be paved.

The guide rolls **36** and **37** serve to separate the rods R laterally into two groups which define a center opening posi-

tioned beneath the discharge end of the conveyor **22** so as to receive the discharged concrete therethrough, as shown in FIGS. **2** and **4**. The pairs of guide rolls **38** are spaced farther apart laterally than the pairs of guide rolls **36** and **37**, and serve to allow the spreading of each laterally separated group of rods R to gradually reduce the size of the center opening rearwardly of the conveyor **22**.

Rearwardly of the rear lift roll **33** on the spreader **10**, there are provided wheeled extensions **70** of slip forms **20** which support a pair of support rolls **71** for the rods R and a plurality of spacer rolls **72** extending across the extensions **70**. The spacer rolls **72** serve to close the center opening and to guide and maintain the rods R into a predetermined, equally spaced parallel relationship, as shown in FIG. **2**.

As shown in FIGS. **5** and **6**, a second machine or finisher **40** trails the spreader **10** and may be of any suitable construction such as that shown in U.S. Pat. No. 3,331,296. In the preferred embodiment, the finisher **40** comprises a pair of endless track-laying carriages **41** which operate on the Grade G at each side of the concrete slab C formed by the spreader **10**. A support frame **42** is mounted on the carriages **41** and serves to support an operator deck **43** and power means **44** for the finisher **40**.

Each carriage **41** includes an inwardly facing slip form **45** which defines a side edge of the finished concrete slab C. The finisher **40**, like the spreader **10**, may be guided by probes (not shown) which move along a guide wire (not shown), or in any other conventional or suitable manner.

The continuous reinforcing rods R are supported and maintained in the predetermined spaced relationship at the front end of the finisher **40** by a pair of support rolls **46** and spacer rolls **47** that are mounted on the carriages **41**. A walkway **48** extends across the carriages **41** and the slab C and joins a forwardly extending platform **49** that is disposed above the support rolls **46** and spacer rolls **47**. The purpose of the platform **49** is to enable a workman to place tie-bars T on the concrete and under the reinforcing rods R in transverse relation therewith, as shown in FIGS. **5** and **6**. Alternatively, suitable apparatus (not shown) could be provided on the platform **49** for automatically placing tie-bars T at a predetermined spacing under the rods R. Also, such a platform could be provided at the rear of the spreader **10** instead of the front of the finisher **40** to enable tie bars or full-width cross bars to be positioned on the concrete under the rods R.

Rearwardly of the walkway **48**, a rod depressor **50** extends across and is rotatably mounted on the carriages **41**. The depressor **50** is drivingly connected to the power means **44** in any suitable manner. The depressor **50** comprises a plurality of rod members **51** extending across the carriages **41**. The rod members **51** are secured at their ends to circular support members **52** and are spaced evenly about the periphery thereof. The rods members **51** are positioned to engage the upper surface of the reinforcing rods R and to depress the rods R and the underlying tie-bars T a predetermined depth into the poured plastic concrete slab C as the finisher **40** moves forwardly. The rod members **51** further serve to agitate the concrete as the depressor **50** is rotated and the rods R and bars T are depressed into the concrete.

A rotatable auger **53**, drivingly connected to the power means **44**, and a "strike-off" member **54** extend across and are mounted on the carriages **41** rearwardly of the depressor **50** for the purpose of spreading and "striking off" the agitated concrete at a predetermined height. A finishing member **55** is mounted on the carriages rearwardly of the "strike-off" member **54** and serves to finally finish the upper surface of the concrete slab C.

In the method of the present invention, the continuous reinforcing rods R are placed on the grade G to be paved in a parallel manner. Such reinforcing rods R are typically provided in 40 to 60-foot lengths and are joined end to end by welding or by wrapping with wire (not shown) to provide continuous rods. As the spreader **10** is moved forwardly, the continuous reinforcing rods R are supported over the grade to be paved and guided under the concrete conveyor **21** by the lift rolls **32**, **33** and the pairs of support rolls **34**, **35**. The rods R are separated laterally by the guide rolls **36**, **37** into two groups defining a center opening beneath the conveyor **21** through which the concrete is discharged from the conveyor. Rearwardly of the conveyor **21**, the guide rolls **38** and spacer rolls **72** guide the rods R inwardly to close the center opening and to direct the rods R into a predetermined, equally spaced, parallel relationship. The concrete deposited on the roadway by the conveyor **21** is spread by the oscillating blade **27** and the auger **30**, and the upper and side surfaces of the concrete slab C are formed by the "strike-off" member **31** and the slip forms **20**, respectively.

Tie-bars T are then placed on the poured concrete slab C under the reinforcing rods R by a workman or by suitable apparatus (not shown) on the front platform **49** of the second machine or finisher **40**. The reinforcing rods R and underlying tie-bars T are then depressed a predetermined depth into the plastic concrete by the rotating depressor **50** as the finisher **40** moves forwardly. The agitated concrete is thereafter spread by the rotating auger **53**, "struck-off" at a predetermined height by the "strike-off" member **54**, and finished by the finishing member **55** and the slip forms **45** as the finisher **40** continues to advance.

I claim:

1. First and second concrete paving machines for laying a concrete roadway having continuous longitudinal reinforcing rods embedded therein at a predetermined depth and spacing, each machine having propelling means for travel over the grade on which the rods are preassembled and on which the concrete is to be laid; said first machine comprising a forward series of rolls disposed to elevate and guide the rods into two laterally, well-spaced groups defining an opening therebetween as the machine travels, a concrete conveyor disposed over the rods to discharge concrete through said opening and onto said grade, concrete distributing and spreading means disposed below the elevated rods and rearward of said conveyor, and a rearward series of rolls disposed to uniformly space and lower the rods toward the spread concrete; said second machine comprising forward means to guide and depress the rods into the concrete and intermediate and rearward means to respread and finish the surface thereof.

2. The concrete paving machines as in claim **1** wherein said concrete conveyor projects outwardly from the side of said first machine to receive delivered concrete and extends inwardly over one of said two groups of elevated rods to discharge the concrete through said opening.

3. Apparatus for laying a reinforced concrete roadway section having a series of continuous longitudinal reinforcing rods embedded therein at a predetermined depth and substantially uniformly spaced across the section, said apparatus having propelling means for travel over the grade on which the rods are preassembled and on which the concrete is to be laid, said apparatus including: forward guide means disposed to elevate and guide the rods in a group which is spaced laterally from a reference plane extending longitudinally of the roadway so that a space is formed between said plane and said group of rods, a concrete conveyor disposed to discharge concrete through said space and onto said grade, concrete distributing and spreading means disposed below the elevated rods and rearward of said conveyor, guide means disposed to lower the rods and uniformly space the same across said roadway section in parallel relation to said reference plane, means to depress the rods to said depth in the concrete, and means to respread and finish the surface of the concrete.

4. Apparatus as in claim **3** for laying two adjoining roadway sections having a common reference plane and wherein the forward guide means is disposed to elevate and guide the rods in two groups which are oppositely spaced from said common reference plane and are well spaced from each other to define an opening therebetween.

5. Apparatus as in claim **3** wherein said concrete conveyor may be projected laterally of the roadway section being laid to receive concrete as from a delivery vehicle operating alongside the grade and the roadway section.

6. Apparatus as in claim 5 wherein at least some of said guide means comprise support rolls moving under the rods and laterally spaced vertically disposed spacing rolls moving between the rods.

7. Apparatus as in claim 3 wherein some of the guide means disposed to lower the rods are carried by a wheeled structure which is propelled by the apparatus having propelling means. position immediately

8. Apparatus as in claim 3 further including a platform disposed forwardly of the means to guide and depress the rods and rearwardly of the concrete distributing and spreading means and from which transverse reinforcing bars may be positioned on the concrete below the elevated rods so that said bars will be depressed by the rods to a positioned in the concrete immediately beneath the rods.

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