Jan. 14, 1936. J. E. HARVEY, JR 2,027,907

CONCRETE ROAD BUILDING MACHINE

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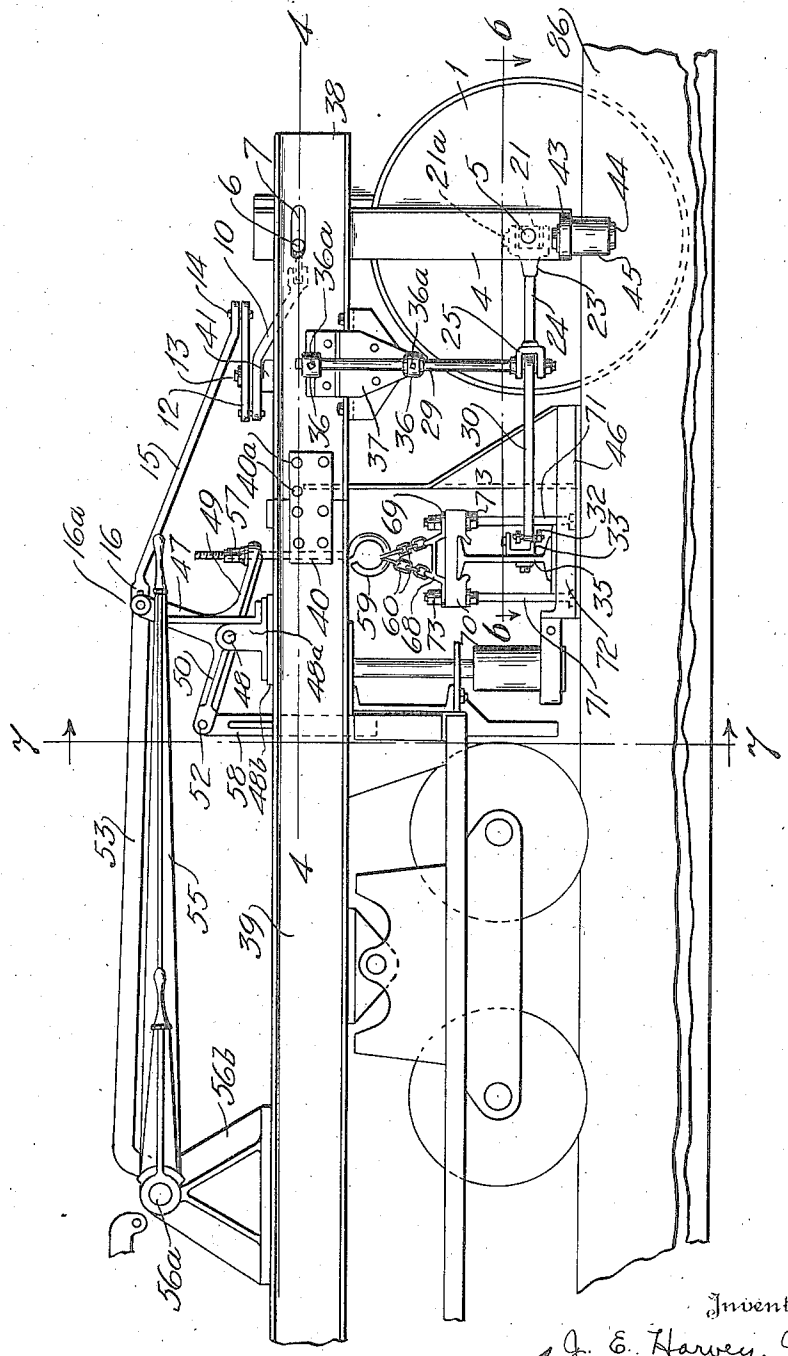


Fig. 1.

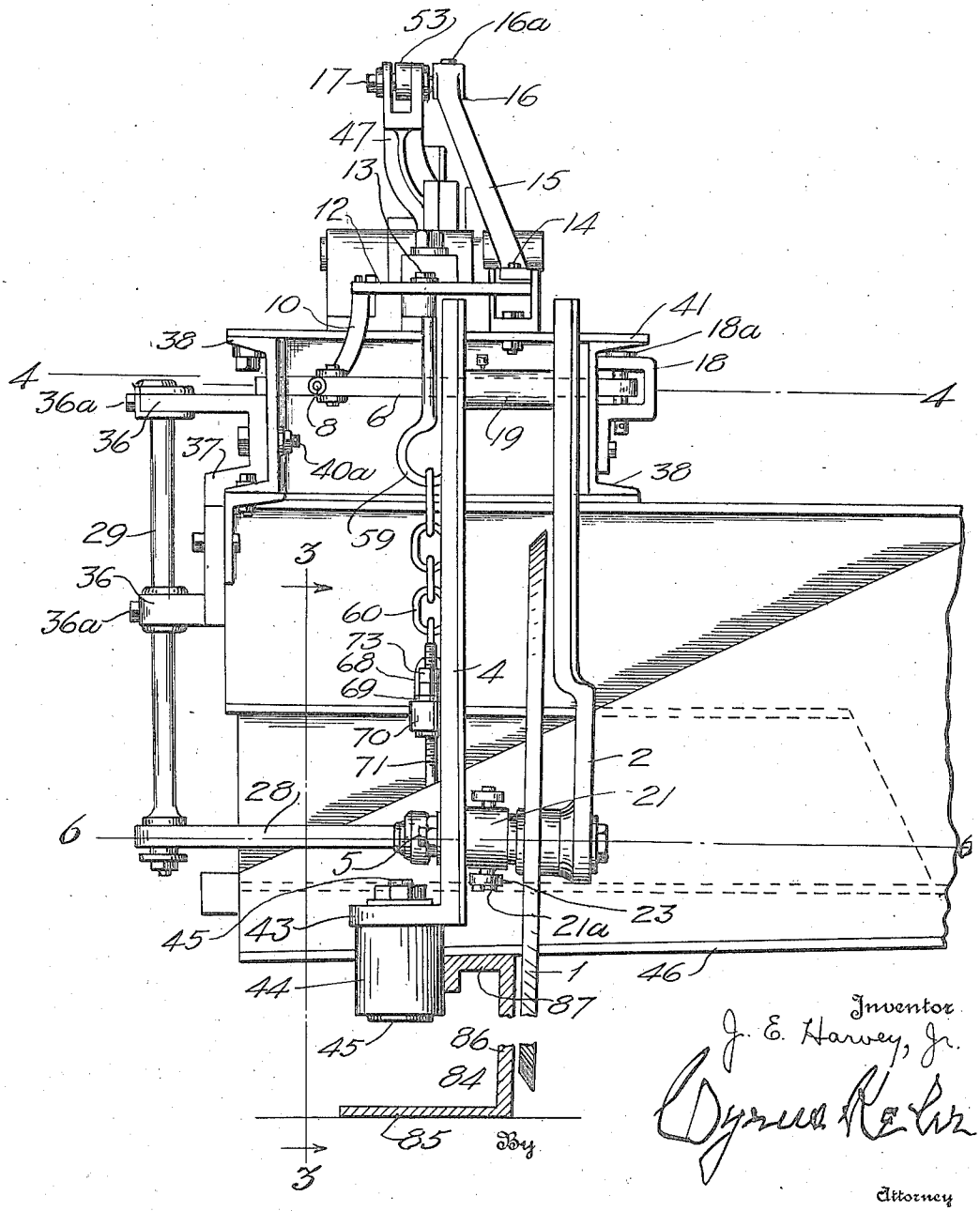
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CONCRETE ROAD BUILDING MACHINE

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Fig. 2.



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CONCRETE ROAD BUILDING MACHINE

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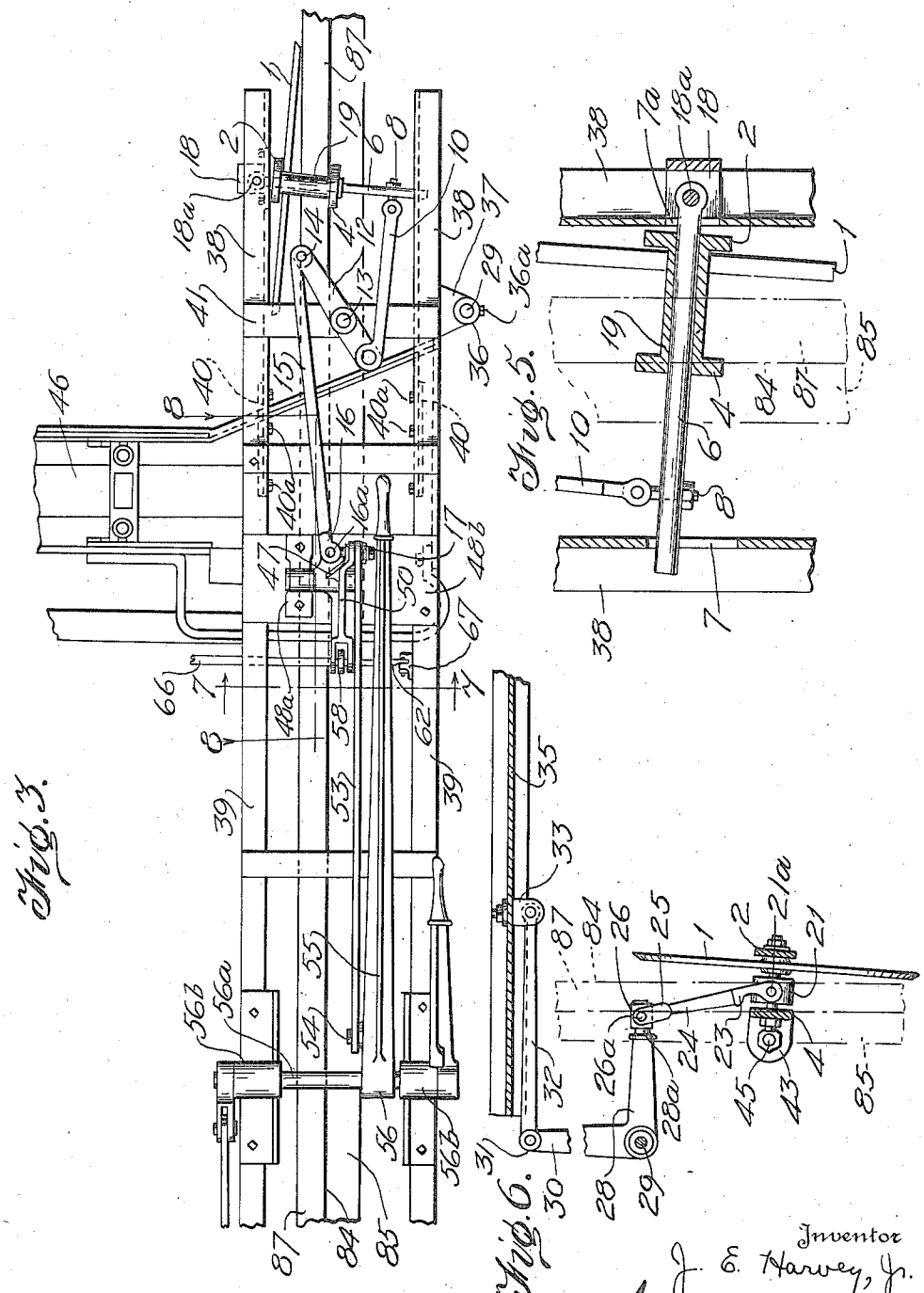


Fig. 3.

Fig. 5.

Fig. 6.

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CONCRETE ROAD BUILDING MACHINE

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Fig. 9.

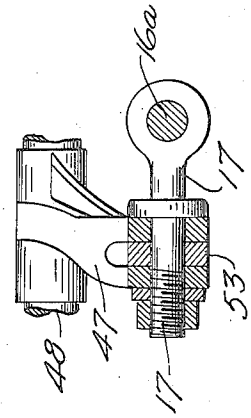


Fig. 4.

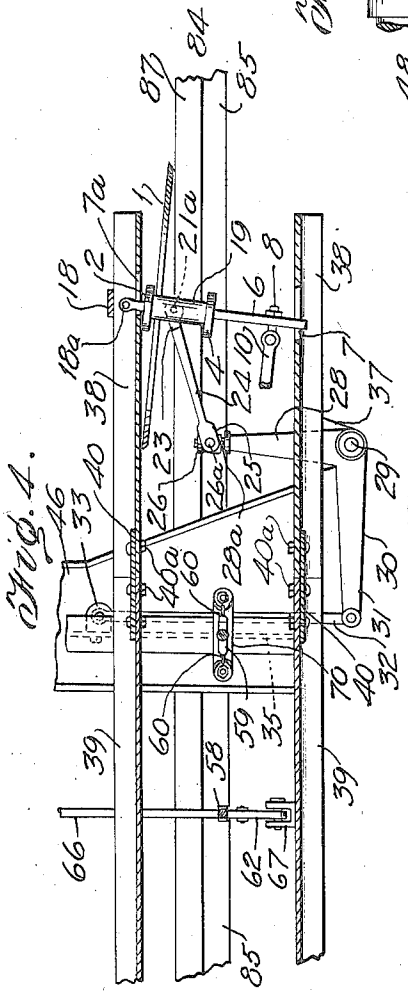
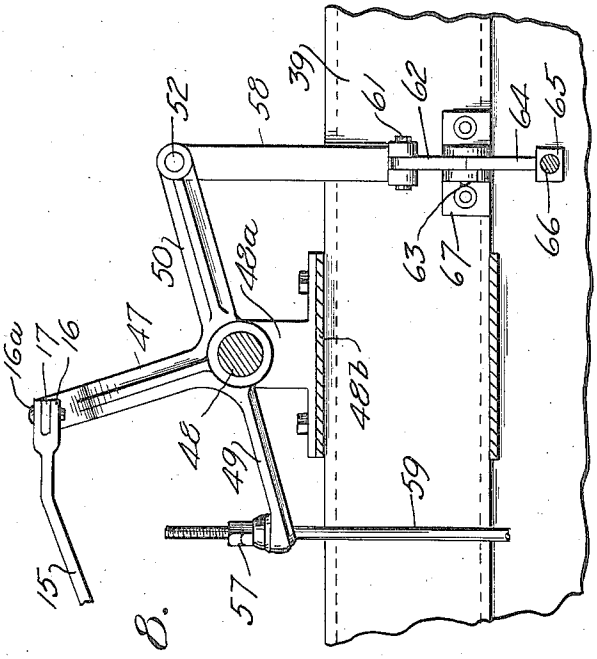


Fig. 8.



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CONCRETE ROAD BUILDING MACHINE

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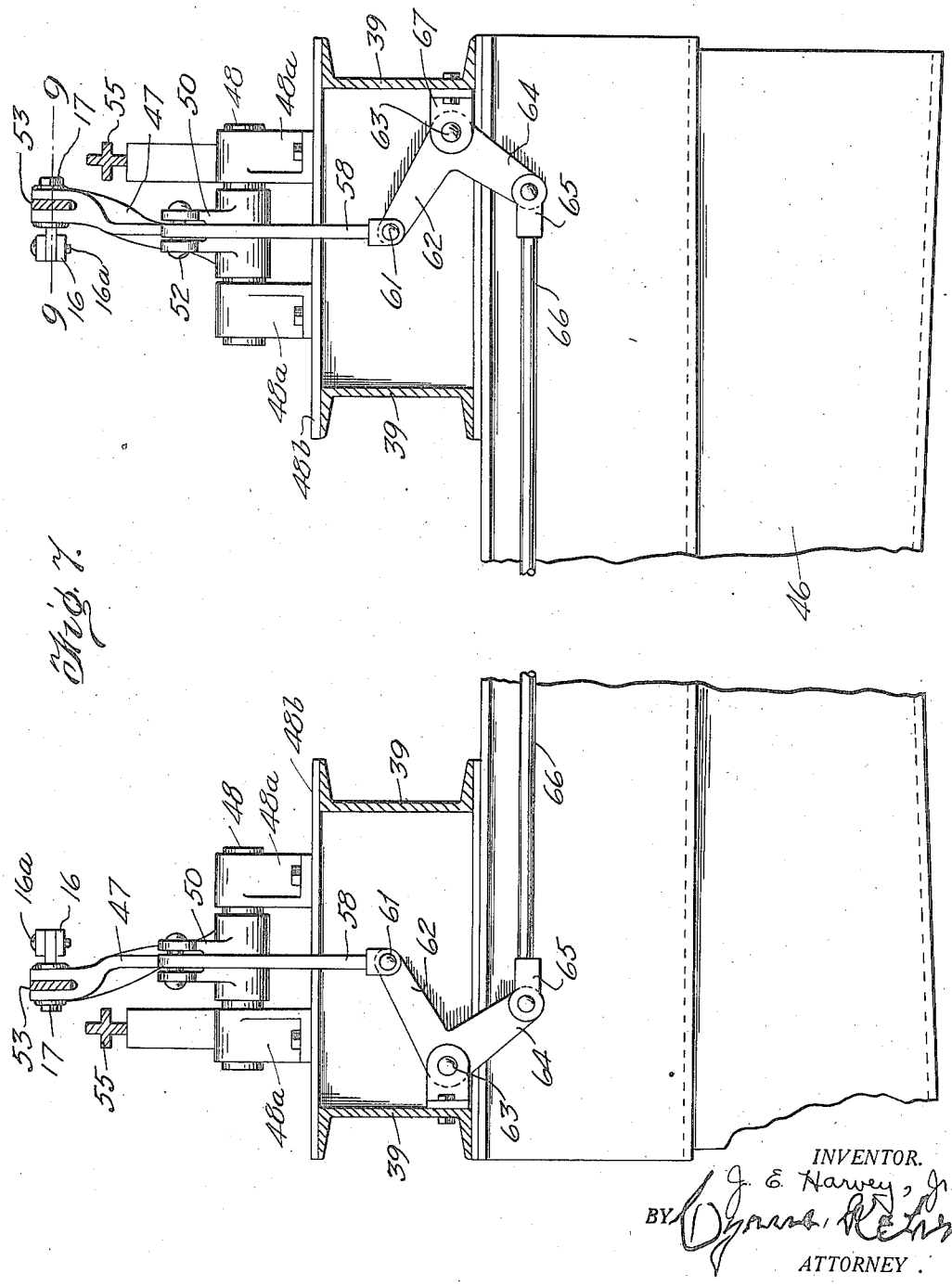


Fig. 1.

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Patented Jan. 14, 1936

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UNITED STATES PATENT OFFICE

2,027,907

CONCRETE ROAD BUILDING MACHINE

Jacquelin E. Harvey, Jr., Valdosta, Ga., assignor to Cyrus Kehr, Washington, D. C.

Application August 30, 1933, Serial No. 687,493

29 Claims. (Cl. 94—39)

This invention relates to means for mechanically "spading" at road forms in connection with the operation of concrete road finishing machines, such as are now in use for applying the final surface to a concrete road, the finishing machine being supported and traveling on the "forms" placed at each side of the road to limit and shape the borders of the road structure. Usually the finishing layer of concrete is placed upon a coarser concrete aggregate extending from form to form and not yet hardened, this coarser body and the finishing layer together forming a thickness equalling the height of the forms.

The hand spading consists in repeatedly, in advance of the arrival of the finisher, driving a spade blade downward into said body adjacent the inner face of each form; that being done repeatedly and with a view to packing the coarser body to avoid the presence of air spaces or "honeycomb" or "blow holes" in the borders of the body after the finishing layer has been applied, in order that the body may be as dense along the borders of the road as in other parts.

In practice it has been found necessary to employ spading men in advance of the finisher, along each form, and it has been found difficult to train men to do this work thoroughly.

Former practices have proven that this manual spading operation leaves much to be desired because the human equation enters too largely into an operation that should be accomplished perfectly. If two or three men are working along the same form, there may be gaps between the parts which the men are spading, and the part done by each man may be deficiently done.

My improved spading mechanism operates automatically and avoids necessity for relying upon men. The part of my mechanism which penetrates the concrete is moved along the inner face of the forms in a manner to crowd the parts of the concrete downward and sidewise to eliminate spaces and give the border of the structure the same density as in other parts.

This mechanical spading device may be made as an integral part of a road finishing machine of types now in use, or this spading device may be formed for attaching and detaching to and from a road finisher, or it may in any manner be put into operative relation with a road finisher. In any such form, the spading mechanism would function the same.

Such a machine is long enough to extend from one road form to the other and be supported on each form by power-driven wheels which may be controlled by the operator at a chosen location. This calls for providing the machine with means for simultaneously delivering propelling power to the supporting wheels at each end of the machine.

And, because the machine must be adapted to be propelled forward and backward at the will of the operator, it is necessary that the transmission of power to the supporting wheels at each end of the machine may be reversible under the control of the operator. Furthermore, in such a machine a concrete spreading member, called a "screed", extends from one "form" to the other form, forward of the middle upright transverse plane of the machine and being sufficiently long to reach over the upper faces of the forms and allow endwise reciprocation of the screed during forward movement of the machine; and the screed being associated with means under the control of the operator to effect such endwise reciprocation and also associated with means for lifting and supporting the screed at a height to place that screed out of action. Such lifting means must engage the screed at each end of the machine, and between the lifting means at each end there must be connection whereby said two means are made to act in unison. Usually such a screed, adapted to operate during rearward movement of the machine is placed rearward of the upright transverse middle plane of the machine and similarly associated with means for reciprocating the screed and for raising and lowering it. Thus the two ends of the machine are mainly duplicates in structure and function. Accordingly description and illustration will be directed mainly to the right hand end of the machine, it being understood that the parts so illustrated and described are also present in the left hand end of the machine, unless otherwise stated.

In the accompanying drawings:

Fig. 1 is an elevation of a portion of the right hand end of a concrete finishing machine embodying my improvement;

Fig. 2 is a front elevation of the structure shown by Fig. 1;

Fig. 3 is a plan of the machine shown by Figs. 1 and 2;

Fig. 4 is a horizontal section on the line, 4—4 of Figs. 1 and 2;

Fig. 5 is an enlarged detail of the forward end of Fig. 4;

Fig. 6 is a horizontal section on the line, 6—6 of Figs. 1 and 2;

Fig. 7 is a transverse upright section across both ends of the machine on the line, 7—7 of Figs. 1 and 3, looking toward the right, in the direction of the arrow;

Fig. 8 is an upright section on the line, 8—8 of Fig. 3, looking in the direction of the arrow and forming a left hand elevation of the rocking member and associated parts;

Fig. 9 is a section on the line, 9—9, of Fig. 7.

Referring to said drawings, 1, is a disk or wheel-form member which is the chief spading element, its lower part extending downward along the inner face of the usual form, 84, such as are located along each border of what is to become the road structure or slab. In cross-section, said form is shown as comprising a horizontal base flange, 85, an upright web, 86, and an upper flange, 87, said flanges being directed outward away from the road structure.

The wheel or disk is supported on an approximately horizontal axle, 5, which extends through an upright yoke member, 2, and the hub of the wheel and through an upright yoke member, 4. The yoke members, 2 and 4, are rigid on an intermediate sleeve-form member, 19, which loosely surrounds a bar, 6, whereby the yoke is made free to slide along the length of said bar, as will appear further on. The purpose of this sliding is to allow the yoke and the spading wheel, 1, to maintain their relation to the road form during such slight bodily endwise shifting of the machine as may occur during travel on the forms.

The bearing for the axle, 5, in the yoke member, 2, is a little lower than the corresponding bearing in the yoke member, 4, in order that the axle, 5, will be somewhat inclined, the right hand end being the lower. This causes a slight tilting of the wheel, 1, the upper part leaning toward the adjacent yoke bar, 2, and toward the road structure. The purpose of this inclination of the wheel is to make its lower part stand approximately parallel to the adjacent face of the upright web, 86, of the form, 84, that web in ordinary practice inclining somewhat toward the road structure.

The bar, 6, on which the sleeve, 19, is endwise slidable, as above described, is supported on two horizontal channel-form extensions, 38, supported on the horizontal channel-form side members, 39, which constitute parts of the ordinary finishing machine at each end (the right hand end and the left hand end) of the machine, said members being horizontal and parallel to each other and to the course of travel of the machine, and supporting operating parts of the machine, as will be described further on. Each extension member, 38, is applied endwise to the forward end of one of the side members, 39, and rigidly secured thereto by splicing plates, 40, by the aid of binding bolts, 40a (see Figs. 1, 3 and 4). The said members, 38 and 39, are shown of channel-form, each having horizontal flanges directed away from the companion member.

When a new finishing machine is being built, the side members, 39, may be extended forward a distance approximately equalling the length of the extension members, 38, those members being then omitted.

The bar-form, yoke-supporting cross member, 6, reaches horizontally from each extension member, 38, to the other and has its left hand end extending through a slot, 7a, in the left hand extension member, 38, while the right hand end of the bar, 6, extends through a longer horizontal slot, 7, in the right hand extension member. The left hand end of the bar, 6, extends into a stationary bracket, 18, which is secured to the left hand face of the left hand extension, 38, and is folded to extend above and below the bar, 6. A coupling pin 18a extends through the upper part of said bracket and through the adjacent end of the bar, 6, and through the lower part of the bracket, thus making a joint adapted to allow the bar, 6, to turn horizontally with the pin 18a as an axle, that horizontal movement being in the slots 7 and 7a already mentioned.

As an aid to preventing the yoke and the wheel, 1, from bodily moving transversely of the road form to excessively separate the wheel, 1, from the road form, a member supported by the yoke extends downward over the outer face of the upper flange of the form, 84. In the means shown by the drawings (Fig. 2), the lower end, 43, of the yoke member, 4, is bent horizontally outward. An upright bolt, 45, extends downward through the part, 43, and loosely through a guide roller, 44, which bears against the adjacent face of the upper flange, 87, and serves to limit movement of the yoke toward the road structure.

From the foregoing, it will now be seen that the yoke, 2, 4, 19, may oscillate backward and forward, pendulum-fashion, on the bar, 6, the means for causing that oscillation being independent of the means for horizontally shifting of the bar, 6, in the horizontal slots, 7 and 7a.

This pendulum-fashion oscillation of the yoke is controlled by means of connection between the yoke and the web, 35, of the I-beam member of the front screed, 46, of the finishing machine. For this see particularly Figs. 1 and 6.

Between the hub of the wheel, 1, and the yoke bar, 4, a coupling member, 21, loosely surrounds the shaft, 5. A connecting bar, 24, has a fork, 23, surrounding the coupling member, 21, and receiving radial studs, 21a. Said connecting bar extends rearward and has a fork, 25, which extends above and below a coupling member, 26, and receives radial lugs, 26a, which are supported on said coupling member. Said coupling member surrounds a wrist, 28a, on the free end of a bell-crank arm, 28, which arm is approximately transverse to the line of draft of the machine, the other arm, 30, being directed rearward approximately parallel to the line of draft, and the bell-crank being pivotally supported on an upright stationary axle, 29.

Said upright stationary axle, 29, is supported in a bracket, 37, which is supported on the right hand extension member, 38, and extends downward from said member. Said bracket has bearings, 36, which receive the axle, 29. Set-bolts, 36a, seated in the bearings, 36, engage the axle, 29. The axle extends downward from the lower bearing, 36, into the plane of the connecting bar, 24.

To the free end, 31, of the bell-crank arm, 30, is coupled one end of a link, 32, the other end of that link being coupled to a bracket, 33, seated on the forward face of the upright web, 35, of the I-beam member of the front screed, 46, of the finishing machine.

As has already been said, the screed in such a machine is given an endwise reciprocal movement during forward movement of the machine. Thus the link, 32, will be reciprocated endwise and will rock the bell-crank, 30, 28, whereby the connecting bar, 24, will be reciprocated and so made to move the coupling member, 21, and the lower part of the yoke, 2, 4, and 19, and the entire spading wheel, 1, forward and backward simultaneously with the usual endwise reciprocations of the screed.

This pendulum-fashion oscillation of the yoke

gives to the wheel a bodily movement approximately parallel to the road form.

During that movement the spading wheel may also partially rotate on its axle, 5, due to frictional engagement with the road form and with the aggregate adjacent the road form.

It is also to be noted that the pendulum-form oscillation of the spading wheel may be omitted and the yoke held stationary. Then during the travel of the finishing machine, either forward or backward, the spading wheel will have only rotation on its axle, 5, due to frictional engagement with the concrete aggregate and with the adjacent face of the road form.

As already herein explained, the leaning of the wheel to make it conform to the leaning of the adjacent face of the road form is accomplished by tilting the axis of the wheel in a plane which is upright and approximately perpendicular to the length of the road form, the left hand end (the end toward the body of the road) being slightly lowered.

Now, attention is directed to another slant of the wheel, the wheel axis then being somewhat oblique to the course of the road form. This slant serves to separate either the forward or the rearward part of the wheel from the adjacent face of the form, depending upon the direction in which the bar, 6, is placed in the slots, 7 and 7*a*, whereby the yoke, 2, 4, 19, is turned in an arc with the coupling pin, 18*a*, as an upright axis.

To place the spading wheel to bring the forward part of the wheel toward the adjacent face of the form and bring the rear part of the wheel away from the road form, the axial line of the wheel is continued transverse to the course of travel, but placed slightly out of right angles to that course.

During forward travel of the machine, the wheel is to be inclined to bring its forward part near the road form, the rear part of the wheel being turned from the form. During rearward travel of the machine, this position of the wheel is to be reversed, the forward part being separated from the road form and the rear part being against or near the form.

The means for placing the wheel into one or the other of these positions will now be described.

It has already been described how the yoke, 2, 4, 19, is suspended on the horizontal bar, 6, which has one end extending through a slot, 7*a*, in the left hand channel member, 38, and is engaged by an upright coupling pin, 18*a*, that pin forming an axle on which the bar, 6, moves in an arc in a horizontal plane, the free end of the bar, 6, resting in a longer horizontal slot, 7, in the right hand channel member, 38. When the bar, 6, is moved in that arc, in that plane, the yoke, 2, 4, 19, and the wheel are turned on an upright axial line which may be said to cut the bar, 6, midway between the yoke members, 2 and 4, that axial line being carried forward or backward according to the short movement of the bar, 6, at that point.

For giving the bar, 6, its arc movements, connection is made between that bar and a hand lever controlled by the operator of the machine.

Rearward of the yoke, a stationary cross plate, 41, has its ends supported on the upper flanges of the side members, 38, 38. An arm, 12, is pivoted midway between its ends on an upright stud, 13, rising from the cross plate, 41. One end of the arm, 12, is coupled to the rear end of a link, 10, the forward end of which is coupled to the rear part of a bolt, 8, extending through the bar, 6. The forward end of a link, 15, is coupled at 14 to the forward end of the arm, 12.

On the rear end of link, 15, is a fork, 16, through the arms of which extends a cross pin, 16*a*, which is supported on a horizontal shaft or bolt, 17. That bolt also extends through the arm, 47, of the rocking member, 47, 49, 50, which is rockable on a horizontal shaft, 48, which is seated in bearings, 48*a*, resting on a cross plate, 48*b*, which rests on the side members, 39, (see Figs. 1, 7, 8 and 9). The bolt, 17, also extends through the forward end of a long link, 53, which extends rearward parallel to a hand lever, 55, which has a hub, 56, surrounding a horizontal shaft, 56*a*, supported in bearings, 56*b*, seated on and suitably secured to the upper flanges of the side members, 39, 39.

Adjacent the hub, 56, on the hand lever, 55, is a horizontal stud, 54. The link, 53, extends from the shaft or bolt, 17, rearward to the stud, 54, the shaft or bolt, 17, extending loosely through the forward end of said link and the stud, 54, extending loosely through the rear end of said long link.

The finishing machine being set for forward travel, and the forward screed being down, and the spading wheel having its forward part turned toward the road form, and it is desired to adjust the machine for rearward movement, the hand lever, 55, is turned rearward, the stud, 54, being thereby carried rearward, whereby the link, 53, is carried rearward, whereby the link, 15, is carried rearward, and the member, 12, is turned on the stud, 13, whereby the link, 10, is pushed forward. That causes the forward movement of the free end of the bar, 6, whereby the forward part of the wheel is turned from and the rear part of the wheel is turned toward the road form. This movement of the wheel is co-ordinated with the lifting of the forward screed, 46, free from the road forms, as will next be described.

The screed is supported by two chains, 60, which converge and have their upper links engaged in the eye of an eye-bolt, 59, extending upward through the forward end of the arm, 49, (one of the arms of the rocking member, 47, 49, 50), the threaded part of said eye-bolt extending upward above the arm, 49, and being surrounded by nuts, 57. The lower ends of the links, 60, are joined to a bridge piece, 68, at each end of which is a foot, 69, resting on a yoke, 70. At each end of the yoke, an upright bolt, 71, extends through the adjacent foot, 69, and the adjacent part of the yoke, 70, and extends downward into the base, 72, of the screed structure. Above each foot, 69, and below each end of the yoke, 70, nuts, 73, surround said bolt, 71, to engage the bolts to the bridge piece and the yoke.

When the hand lever, 55, is turned rearward, the link, 53, is moved rearward, as above described. That link being joined to the arm, 47, of the rocking member, the rocking member is tilted rearward and the arm, 49, lifted, whereby the eye-bolt and the screed are lifted, this lifting of the screed and the horizontal movement of the bar, 6, for the changing of the slant of the wheel, being simultaneous, because the movement of said bar comes from movement of the same rocking member.

At the opposite or left hand end of the machine there is another rocking member, 47, 49, 50, by which the adjacent end of the screed, 46, may be lifted away from the adjacent road form, 84. And at the left hand end of the machine there

are a spading wheel, 1, and a yoke, 2, 4, 19, and a yoke-supporting bar, 6, and the associated parts, 12, 13, and 15, connected to the rocking member arm, 47, through the link, 15.

When the two rocking members, 47, 49, and 50, at the two ends of the machine, are rocked in unison, the spading wheels, 1, will be shifted in unison. The two rocking members are controlled by connection between those members as follows: At the right hand end of the machine, an upright link, 58, has its upper end coupled at 52 to the arm, 50, of the adjacent rocking member. The lower end of that link is coupled at 61 to the arm, 62, of the bell-crank, 62, 64, which is pivoted at 63 to a bracket, 67, supported on the adjacent side member, 39, (see Figs. 1, 3, and 7). At the other end of the machine, another link, 58, is similarly coupled at 52, to the arm, 50, of the adjacent rocking member, while the lower end of that link, 58, is coupled at 61 to the arm, 62, of the adjacent bell-crank, 62, 64. The arms, 64, of the bell-crank, 62, 64, at each end of the machine, are coupled at 65 to a long connecting rod, 66. Thus the rocking of the rocking member at the right hand end of the machine will cause transmission of motion to the rocking member at the left hand end of the machine, whereby at each end of the machine the rocking member arm, 47, will move the adjacent link member, 15, for shifting the yoke-supporting bar, 6, horizontally; and simultaneously with the movement of the links, 15, by the two rocking members, the arm, 49, of each rocking member will move up or down for raising or lowering the screed, 46.

It is to be observed that the finishing machine serves as a traveling carriage or structure for supporting and carrying the rotary spading member or structure, 1. It will also be seen that in the finishing machine, the screed is a spreading member horizontal and transverse to the course of travel of the carriage and endwise reciprocable.

I claim as my invention:

1. The combination with a carriage structure adapted to travel parallel to a road form, of an upright spading member, and means for supporting the spading member, said supporting means being partially turnable bodily on an approximately upright axial line to position the forward part and the rear part of the spading member relative to the road form, one of said parts being placed near and the other away from the form.

2. The combination with a carriage structure adapted to travel parallel to a road form, of an upright wheel-form spading member, and means for supporting the spading member for rotation on said carriage on an axial line transverse to the road form, said supporting means being partially turnable bodily on an approximately upright axial line to position the forward part and the rear part of the spading member relative to the road form, one of said parts being placed near and the other away from the form.

3. The combination with a carriage structure adapted to travel parallel to a road form, of an upright spading member, means for supporting the spading member, said supporting means being partially turnable bodily on an approximately upright axial line to position the forward part and the rear part of the spading member relative to the road form, one of said parts being placed near and the other away from the form, and operator-controlled means for turning said supporting member on said approximately upright axial line.

4. The combination with a carriage structure adapted to travel parallel to a road form, of an upright spading member, means for supporting the spading member, said supporting means being partially turnable bodily on an approximately upright axial line to position the forward part and the rear part of the spading member relative to the road form, one of said parts being near and the other away from the form, and means including a rocking member for partially turning said spading member supporting means on said approximately upright axial line.

5. In combination with a structure adapted to travel parallel to a road form, of a pendulum-form support suspended on said structure, a spading member supported on said pendulum structure approximately upright and parallel to the upright longitudinal plane of the road form and said spading member being on an axis which is tilted in an upright plane, its upper part being away from said upright longitudinal plane of the road form, and means for oscillating said pendulum structure, whereby the spading member is reciprocated approximately horizontally and parallel to the upright plane of the road form and rotatable on said tilted axis during said reciprocation.

6. In combination with a carriage structure adapted to travel parallel to a road form, of a pendulum-form support partially turnable on an upright axial line, and a spading member supported on said pendulum-form support.

7. The combination with a carriage structure extending from one road form to a companion road form, of a spading member at each end of said carriage, means for supporting each spading member, said supporting means being partially turnable bodily on an approximately upright axial line to position the forward part and the rear part of the adjacent spading member relative to the road form, one of said parts being near and the other away from the form, and operator-controlled means for simultaneously partially turning each of said spading member supporting means.

8. The combination with a carriage structure adapted to extend from one road form to a companion road form, of a spading member at each end of said carriage and turnable on an axial line approximately horizontal and transverse to the course of the adjacent road form and bodily reciprocable horizontally relative to the length of said road form, a reciprocatory horizontal member extending from one end of said carriage structure to the other, and means intervening said horizontal member and each spading member for reciprocating said spading member.

9. The combination with a carriage structure adapted to extend to each of two parallel road forms, a spading member adjacent each road form, means supporting each spading member for alternately partially bodily turning the spading member on an approximately upright axial line to position the forward part and the rear part of the spading member relative to the road form, one of said parts being placed near and the other away from the form, a rocking member on each end of said structure, means placing each rocking member into operative relation with the adjacent spading member supporting means, and means intervening said two rocking members for transmitting motion from one rocking member to the other.

10. The combination with a concrete road finishing machine carriage structure adapted to travel parallel to a pair of road forms, of an endwise reciprocatory screed, screed raising and low-

ering means at each end of the screed, a spading member supported at each end of said carriage structure and turnable on an axial line approximately horizontal and transverse to the course of the road forms, spading member supporting means reciprocable approximately parallel to and adjacent each road form, means in operative relation with each spading member and the adjacent part of the screed and said screed raising and lowering mechanism for causing reciprocation of the reciprocable spading member supporting means and the screed, and operator-controlled means for transmitting motion from the mechanism at one end of the carriage structure to the mechanism at the other end.

11. In a concrete finishing machine adapted to travel parallel to a road form, the combination of a spading member turnable on an axial line approximately horizontal and transverse to the course of the road form, and said spading member being partially turnable on an approximately upright line.

12. The combination with a carriage structure adapted to travel parallel to a road form, of an approximately horizontal member upward of and transverse to the upright longitudinal plane of the road form, a pendulum-form structure supported oscillatable and slidably on said transverse member, and a spading member supported on the lower part of said pendulum structure.

13. The combination with a carriage structure adapted to travel parallel to a road form, of an approximately horizontal member upward of and transverse to the upright longitudinal plane of the road form, a pendulum-form structure supported oscillatable and slidably on said transverse member, an axle supported on the lower part of the pendulum form structure and being approximately horizontal and transverse to the course of the road form, and a rotary spading member on said axle.

14. The combination of a carriage structure adapted to travel parallel to a road form, a supporting member on said carriage upward of the road form and horizontal and transverse to the course of the road form and partially turnable on an upright axial line, a pendulum form structure supported on said transverse member to permit rocking on said structure approximately parallel to the upright plane of the road form and to be partially turned on an upright axial line by the turning of said supporting member on its upright axis, and a spading member supported on the lower part of the pendulum form structure relative to the position of the road form.

15. The combination of a carriage structure adapted to travel parallel of a road form, of an approximately horizontal member upward of and transverse to the upright longitudinal plane of the road form, a pendulum-form structure supported on said horizontal member and having an extension to overlap the outer face of the road form, and a spading member supported on the pendulum-form structure adapted to be beside the inner face of the road form.

16. The combination with a carriage structure adapted to travel parallel to a road form, of a spading member, means for supporting the spading member adjacent the inner face of a road form, also moving said spading member bodily toward and from said face, also moving the spading member parallel to the length of said face, and also partially turning said spading member on an approximately upright axial line.

17. The combination with a carriage structure adapted to travel parallel to a road form, of a spading member, means for supporting the spading member, said means being reciprocable approximately parallel to the course of the road form, a horizontal screed perpendicular to the course of the form and reciprocable endwise, and coupling mechanism joining the screed and the spading member support for transmitting motion to the spading member support for reciprocating said support during the reciprocation of the screed in either direction.

18. The combination with a carriage structure adapted to travel parallel to a road form, of a spading member, means for supporting a spading member, said means being partially turnable on an upright axis, a screed adapted for raising and lowering, and operator-controlled means for partially turning said spading member support and for raising and lowering the screed.

19. The combination with a carriage structure adapted to travel parallel to a road form, of a spading member, means extending from the carriage and supporting the spading member in inclined position, the lower part of said spading member being toward the upright longitudinal plane of the road form while the upper part of the spading member is away from said plane.

20. The combination with a carriage structure adapted to travel parallel to a road form, of a rotary spading member, means extending from the carriage and supporting an axle on which is supported the spading member, said axle being directed toward the position for the road form and inclined, its part toward the road form being the lower part, whereby the lower part of said spading member is toward the upright longitudinal plane of the road form while the upper part of the spading member is away from said plane.

21. The combination with a carriage structure adapted to travel parallel to a road form, of a rotary spading member, means extending from the carriage and supporting an axle on which is supported the spading member, said axle being directed toward the position for the road form and inclined, its part toward the road form being the lower part, whereby the lower part of said spading member is toward the upright longitudinal plane of the road form while the upper part of the spading member is away from said plane, and the axle support being partially turnable on an upright line.

22. The combination with a carriage structure adapted to travel parallel to a road form, of means supporting a spading member for rotation on a line which is approximately horizontal and transverse to the travel course of the machine and for changing said rotation line out of perpendicular relation with said travel course to bring either the forward part or the rear part of the spading member toward the road form.

23. The combination with a carriage structure adapted to travel parallel to a road form, of means supporting a spading member for rotation on a line which is approximately horizontal and transverse to the travel course of the machine and for changing said rotation line out of perpendicular relation with said travel course to bring either the forward part of the rear part of the spading member toward the road form, and means for imparting bodily forward and backward movement to the spading member relative to the travel course.

24. The combination with a carriage structure adapted to travel parallel to a road form, of

means supporting a spading member for movement along the inner side of a road form and partially turning said spading member to bring either its forward part or its rear part toward the road form.

25. The combination with a carriage structure adapted to travel parallel to a road form, of means supporting a spading member for movement along the inner side of a road form and partially turning said spading member to bring either its forward part or its rear part toward the road form, and means for imparting bodily forward and backward movement to the spading member relative to the travel course.

26. In combination with a carriage structure adapted to travel parallel to a road form, of a support partially turnable on an upright axial line and movable forward and backward relative to said travel course, and a spading member on and turnable with said partially turnable support and said spading member being bodily inclined, its lower part being toward and its upper part being from the adjacent upright longitudinal plane of the road form.

27. In combination with a carriage structure adapted to travel parallel to a road form, of a spading member, a spading member support, a lever, means in operative relation with said lever and said spading member support for partially turning said support on an upright axis, and a screed and means in operative relation with said screed and said lever for raising and lowering said screed.

28. In combination with a carriage structure adapted to travel parallel to a road form, of a spading member, a spading member support, a lever, means in operative relation with said lever and said spading member support for partially turning said support on an upright axis, a screed, means in operative relation with said screed and said lever for raising and lowering said screed, and means in operative relation with the screed and the spading member support for imparting bodily forward and backward movement to said support during endwise reciprocation of the screed.

29. In a road finishing machine, the combination of a supporting member reciprocable relative to the travel course of the machine, a spading member on said supporting member, said supporting member having a downward extension and said downward extension and said spading member being spaced from each other a distance approximately equal to the transverse dimensions of a road form, and means for reciprocating said supporting member approximately parallel to the travel course of the machine.

JACQUELIN E. HARVEY, JR.