

July 11, 1967

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3,330,188

ROAD WIDENER

Filed Dec. 31, 1964

2 Sheets-Sheet 1

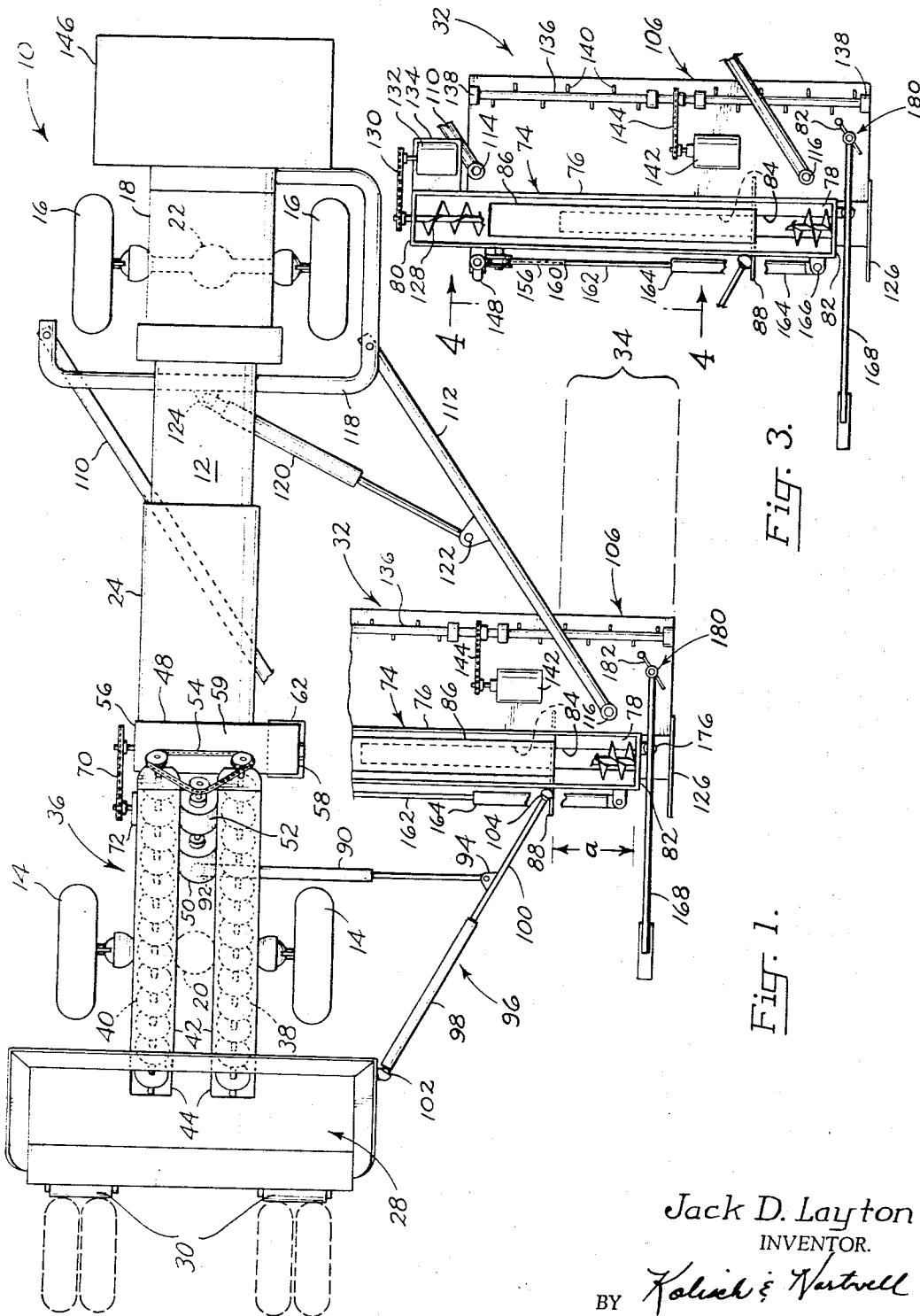


Fig. 1.

Fig. 3.

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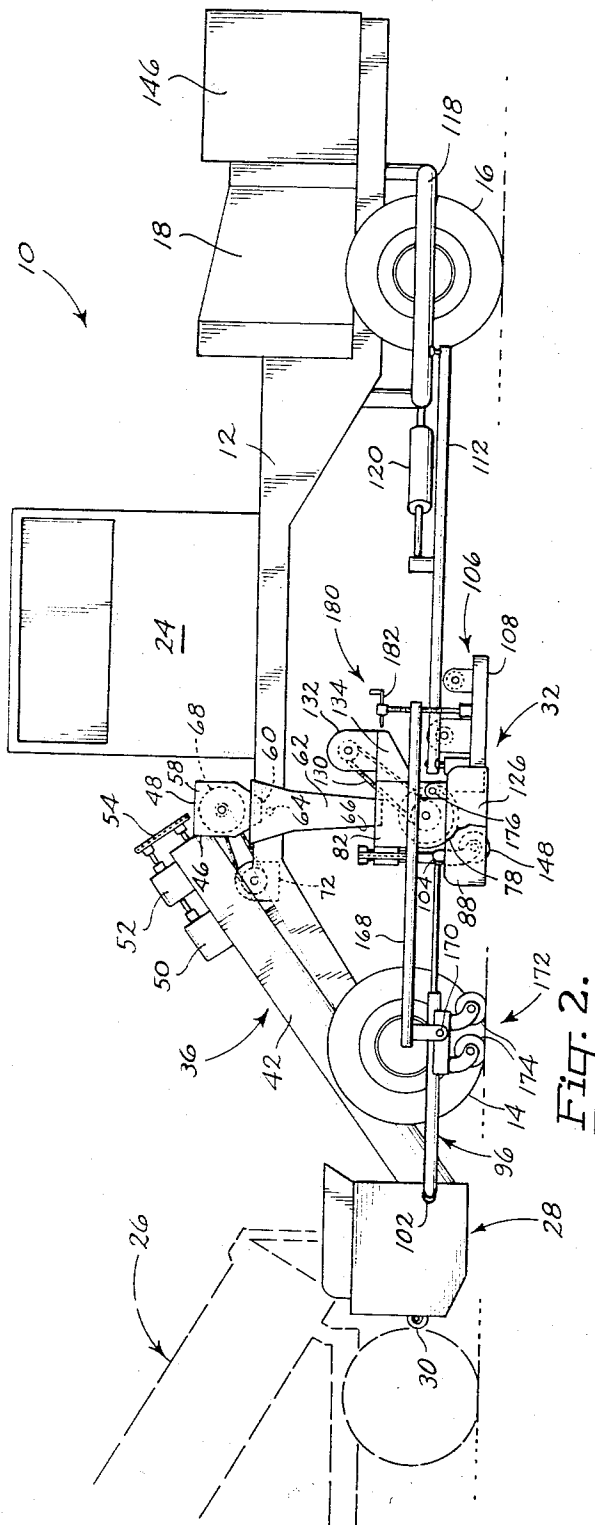


Fig. 2.

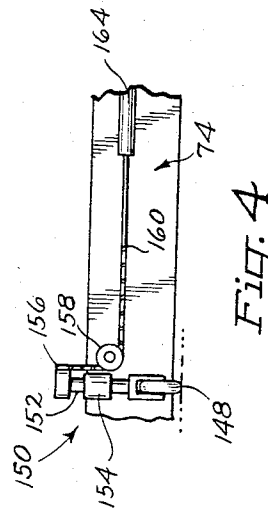


Fig. 4

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Filed Dec. 31, 1964, Ser. No. 422,674
7 Claims. (Cl. 94-46)

This invention relates generally to paving machines, and more particularly to paving machines adapted to spread aggregate over a surface, where such spreading is done in a region offset laterally to one side of the principal ground supports for the paving machine.

In recent years, a job more frequently required of road contractors is the paving of strip regions bordering elongated expanses of already paved surfaces. Thus, in the construction of a modern highway, to make for greater safety, it is common to pave shoulders and other portions of the highway that formerly were left unpaved. Another example of such a paving operation is in the widening of an existing road, where it is desired to increase the width of lanes or add additional lanes to the road. In these and similar paving operations, the job is done most easily, and a more uniformly leveled surface results, if the paving be done by a machine which may travel down the already paved surface while distributing and spreading paving material over the unpaved region that adjoins. In general terms, this invention contemplates as an object an improved paving machine of this description, which is practical in operation and easily operated to produce superior pavements.

In paving an elongated strip adjoining an already paved region, by a machine which travels down the already paved region, it is important that it be possible to make adjustments quickly in the width of the strip and in the general placement of the strip. A more specific object of the invention, therefore, is to provide a paver with laterally carried spreader mechanism, featuring a novel construction which facilitates such adjustments.

Aggregate for paving commonly is carried to the paving site by dump trucks, which one after another supply the aggregate while such is spread out into pavement form. Another object of the invention is to provide an improved paving machine with a laterally offset spreader, having novel means for receiving aggregate from a dump truck and then transferring such aggregate to a region generally disposed to one side of the paving machine proper.

As an object related to the above, it is contemplated by this invention that aggregate be dumped into a supply hopper which is carried by the paving machine in a position to receive aggregate flowing from a dump truck while such truck travels along an already paved surface in front of the paver. Cooperating with this supply hopper is a lifting conveyor, which elevates aggregate dumped into the supply hopper to an elevated discharge end. The paver further features novel means whereby such aggregate is then distributed to a collector and spreader mechanism carried generally laterally of the paver proper, where such aggregate is then finally spread out over a surface as a layer of pavement.

Yet another object of the invention is to provide an improved collector and spreader mechanism adapted to be carried laterally of the longitudinal axis of a paver featuring means for distributing aggregate within a hopper which forms a part of the collector and spreader mechanism, whereby uniform spreads are produced, novel means for adjusting the angular position of a screed plate, whereby the thicknesses of spreads are controlled, and novel means for making changes in the effective length of an opening at the base of the hopper whereby the widths of spreads may be varied.

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Another object is to provide a paver having a laterally offset collector and spreader mechanism which includes mechanism for vibrating the screed plate as such travels over freshly laid material, whereby a more compacted paved area is produced.

A still further object is to provide a paver with a laterally carried collector and spreader mechanism constructed in such a manner that adjustments in the mechanism are readily controlled by an operator remote from the mechanism.

A further more specific feature and object is the provision in a paver of such a laterally offset collector and spreader mechanism, where the mechanism is mounted on the main frame of the paver by means accommodating lateral side shifting of the mechanism to vary the degree of lateral offset therein. This is important in taking care of slight changes in the course that the paver travels in, whereby these are not reflected in a change in the direction of the pavement being spread, so as to produce overlap with already paved surface, or a gap separating already paved and freshly paved surfaces.

In a specific and preferred embodiment of this invention the paver is self-propelled, in that it is provided with power-operated means for moving itself over the ground. The supply hopper mentioned is mounted at the forward end of the paver whereby with the paver abutted against a dump truck leading the machine such paver may travel down a highway or other surface with the dump truck dumping its contents into this supply hopper. The collector and spreader mechanism is carried between the ends of the paver, off to one side, in a position where its operation and the pavement laid thereby is readily observed by an operator of the paver. The paver further features novel conveyer means for transferring aggregate from such supply hopper rearwardly in the machine and thence laterally to one side thereof whereby such aggregate reaches the collector and spreader preparatory to being spread out on the surface.

It is not intended by this enumeration of certain specific objects to be limited entirely thereto, as the above-indicated feature and improvements as well as other objects and advantages will become more fully apparent as the following description is read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a top plan view of a paving machine constructed according to an embodiment of the invention, showing a wheel-supported paving machine frame and collector and spreader mechanism positioned laterally of the support wheels;

FIG. 2 is a side elevation of the paving machine shown in FIG. 1;

FIG. 3 is a plan view of the collector and spreader mechanism with such removed from the paving machine proper; and

FIG. 4 is an elevational view, taken generally along the line 4-4 in FIG. 3.

Referring now to the drawings, and first of all more particularly to FIGS. 1 and 2, the paving machine is indicated generally at 10, and includes an elongated paving machine frame 12 which in the embodiment of the invention illustrated resembles the frame of the usual road grader machine. Supporting the frame above the ground, and accommodating movement of the paving machine, are front and rear lateral support wheels 14 and 16, respectively.

The paving machine preferably is self-propelled, and thus mounted on one end of the frame, between support wheels 16, is a motor or engine 18 providing the power to drive wheels 14, 16. Power is transmitted from the motor to the front and rear support wheels through the usual power transmission mechanism including differentials housed within the housings indicated generally

at 20, 22. Both sets of wheels ordinarily are steerable, to afford maximum maneuverability in the paving machine. Steering of the machine and other operating functions are performed by an operator stationed within a cab 24 which contains the usual controls for the paving machine.

In paving an area using the machine of the invention, paving material or aggregate is dumped from a dump truck (such a truck being shown in dashed outline in FIG. 2 at 26) into a supply hopper 28 mounted at the forward end of the paving machine, at an elevation low to the ground, whereby it is under the rear end of the usual dump body in the dump truck. The supply hopper, as may be seen in FIG. 1, extends transversely of the longitudinal axis of the paving machine, and is approximately centered with respect to this longitudinal axis. Thus, the hopper is in position to receive aggregate from a dump truck in front of and traveling over the same surface as the paving machine which is behind it. It is convenient to mount rollers, such as those shown at 30, on forward portions of the hopper, which engage rear portions of the rear wheels in the dump truck with the paving machine crowded against the dump truck and while receiving aggregate from the body of the truck.

Before finally being spread over the ground in the form of pavement, aggregate is transported upwardly and rearwardly on the paving machine, and thence conveyed laterally, to a collector and spreader mechanism or unit indicated generally at 32. This collector and spreader unit paves a strip region such as that indicated generally at 34, which is disposed laterally of the surface over which the paving machine frame and dump truck travel.

The elevating of the aggregate received in the supply hopper is performed by lifting conveyor 36, which comprises a pair of elongated conveyor screws 38, 40 mounted within housings 42 forming conveyor tunnels for the conveyor screws. Housings 42 open up to the interior of the supply hopper at 44, and these openings constitute the feed end of the lifting conveyor. The upper ends of housings 42 open up into the interior of a trough 48, through the left side of the trough in FIG. 2, at 46. The two conveyor screws discharge material at 46, the discharge end of the conveyor, into a trough 48 mounted on the top of the paving machine frame, and extending transversely of the frame. Conveyor screws 38, 40 are driven by means of a motor which may be an electric motor such as is shown at 50, speed reduction gearing 52, and chain and sprocket assembly 54.

As probably best illustrated in FIG. 1, trough 48 has a wall 56 closing off one end and a wall 58 closing off the other end. Top 59 closes off the top of trough 48. Adjacent wall 58 and at the base of the trough is an opening 60 (see FIG. 2) through which aggregate may flow from the trough into a funneling device 62. Funneling device 62 is pivoted at 64 on the paving machine frame whereby its spout 66 may move in longitudinal direction.

Aggregate moves along the length of trough 48 under the urging of a conveyor screw 68 (shown in dotted outline in FIG. 2) mounted within the trough and driven by chain and sprocket assembly 70 and motor 72. On moving over opening 60, the aggregate cascades through the opening and into the funneling device, which functions to direct such material into a collector or hopper 74 forming part of collector and spreader mechanism or unit 32.

Unit 32 has had portions thereof removed in FIG. 1 for reasons of clarity, but it is shown in its entirety in FIG. 3. With reference to these two figures, it will be noted that hopper 74 extends generally transversely of the longitudinal axis of the paving machine, and one end is normally positioned under spout 66 of the funneling device. The other end of the hopper is positioned relatively far out laterally to one side of the paving machine. The hopper includes sides 76, a bottom or floor 78, and end walls 80, 82. Extending along the length of a portion of the hopper floor, and starting at end wall 82 is

an elongated slot 84 used to discharge aggregate from the hopper onto the region to be paved.

Indicated at 86 is a cut-off gate comprising an elongated plate superimposed over slot 84 in bottom 78, and generally conforming in shape to the shape of bottom 78. The gate where it overlies slot 84 closes off the slot, and the gate is shifted longitudinally of the hopper, to vary that portion of the length of the slot which is uncovered or exposed, or the effective opening at the base of the hopper. Thus, in FIG. 1 the length of the effective opening at the base of the hopper is indicated at *a*, and extends from end wall 82 to the edge of the cut-off gate.

Mounted so as to occupy a substantially vertical plane paralleling end wall 82, and extending underneath and somewhat forwardly of hopper 74 is an edger plate 88. This plate is joined to the cut-off gate 86, so that the edger plate and gate are movable as a unit in a direction extending longitudinally of hopper 74. The edger plate functions to form an edge of the pavement prepared from aggregate flowing through the opening at the base of the hopper, and the cut-off gate functions to define the length of such opening.

Means is provided for moving the edger plate and cut-off gate, and for controlling such movement at a point remote from the collector and spreader unit. In the embodiment illustrated, such means comprises a ram 90 pivoted at 92 on the frame of the paving machine, and having its other end pivoted at 94 to a link 96 including cylinder and rod 98, 100. The link is extensible by the rod moving lengthwise within the cylinder. Cylinder 98 is pivoted at 102 to the paver at a point adjacent one end of the supply hopper, and connected by a ball and socket joint accommodating universal movement, at 104, to the edger plate. From this it should be obvious that on extension of ram 90, the extensible link 96 has its outer end swung downwardly in FIG. 1 to shift the edger plate and cut-off gate toward wall 82, and on contraction of the ram, movement of the edger plate and cut-off gate in the opposite direction occurs.

In addition to the hopper or collector 74, unit 32 includes a screed plate or means 106 which trails the hopper and functions to smooth and compact aggregate flowing from out the base of the hopper. As seen in FIG. 2 this screed plate is an expansive flat lower surface 108 which performs this compacting and smoothing function.

The collector and spreader unit is advanced over the ground, with the unit occupying a position approximately midway between the ends of the paver unit (whereby it is fully in view of an operator within cab 24) by arms 110, 112 which are pivotally connected through connections 114, 116, respectively, to the screed plate. The other ends of the arms are similarly connected to a mounting bracket 118 secured in suitable manner to the paving machine frame. Extending between arm 112, at a point intermediate the ends thereof, and mounting bracket 118, is a ram 120, journaled at 122 and 124 to the arm and bracket, respectively. On extension of the ram, arms 110, 112 are caused to swing downwardly in FIG. 1 to shift the collector and spreader unit farther laterally out with respect to the paver frame, and on contraction of the ram the arms swing to a position more paralleling the axis of the paving machine, with the unit moving laterally inwardly.

This movement of the collector and spreader unit is accommodated with material all the while being transferable from the trough 48 to hopper or collector 74 by funneling device 62. The bottom end of the spout of this device rides along the length of the hopper, with lateral movement of the unit 32 with respect to the paving machine, and swings back and forth to compensate for any movement longitudinally of the paver frame in unit 32 which takes place when the arms which push the unit are swung with respect to bracket 118.

Further describing the collector and spreader unit, co-operating with edger plate 88 is another edger plate 126, occupying a vertical plane and paralleling plate 88, which

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is fastened to screed plate 106. This edger plate functions to form the margin or edge of the newly laid pavement which is opposite the margin formed by plate 88. Material on falling through the opening at the base of hopper 74 generally distributes itself against edger plate 126 prior to being smoothed over by the screed.

Distribution of material within hopper 74 is performed by conveyor screw 128 extending generally along the length of the hopper. The screw is rotated under power by means of chain and sprocket assembly 130 and motor 132, which also may be an electric motor, mounted on platform 134 which is part of the collector and spreader unit 32.

It is desirable when laying pavement that some tamping action be performed, and with the construction of this invention this is easily done. Shown at 136 is an elongated shaft extending generally along the rear margin of the screed plate, journaled at 138. This shaft has bolts 140 mounted therein which extend transversely of the shaft and have protruding ends. On rotation of the shaft, the bolt ends, which are circumferentially distributed about the shaft, are rapidly and successively pounded against the screed plate below, to produce a vibrating action in the screed plate. This vibration in turn functions to tamp the pavement material, and produce densification therein. The shaft is rotated by means of a motor 142, which may be an electric motor, and chain and sprocket assembly 144.

In describing the paving machine several motors have been identified, which have been indicated as electrically powered. A source of electric current may be provided by a motor generator unit, shown at 146, which may be mounted at the rear end of the machine, as shown in the embodiment illustrated.

As can be seen in FIG. 3, one end of the collector and spreader unit (the upper end shown in FIG. 3 and the part has been removed in FIG. 1) is supported by a wheel 148, and this wheel normally rides over the paved surface along with the wheels supporting the paving machine. With reference now also to FIG. 4, this wheel, which may comprise a castor wheel, is mounted on a swivel assembly 150 including a post 152 which extends upwardly through a sleeve 154 joined rigidly to hopper 74. Attached to the upper end of post 152 is a chain 156 which, from its point of attachment to the post, extends over a sheave 158 and thence is attached at 160 to rod 162 of a ram 164. This ram is connected at 166, through the cylinder of the ram, to the hopper adjacent the opposite end of the collector and spreader unit from the location of wheel 148. With contraction of the ram, post 152 is urged downwardly relative to sleeve 154, to shift wheel 148 to a lower position relative to the base of the collector and spreader unit, thus to raise the unit, and with extension of the ram, reverse movement occurs. This adjustment may not be used too frequently, but is provided to afford vertical adjustment in the height of the collector and spreader unit, in those portions that overlie the already paved surface over which the paver frame travels.

The principal mechanism relied upon to vary the thickness of the pavement spread by unit 32 comprises a boom 168 extending generally parallel to the axis of the paving machine, mounted at the end of the collector and spreader unit opposite the end having wheel 148. This boom at the forward extremity thereof is journaled, at 170, to a truck 172 including swiveled wheels 174. Intermediate the ends of the boom, the boom is journaled at 176 on a portion of the frame of the collector and spreader unit. Extending between the rear end of the boom and the screed plate is screw adjusting mechanism 180, including a turn handle 182 which may be turned to actuate the screw adjusting mechanism to change the spacing between the rear end of the boom and the top of the screed plate.

During operation of the paving machine and the collector and spreader unit therein, the screed plate or means 106 tends to float on the material being laid while assuming a substantially horizontal position. If the distance be-

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tween the rear end of boom 168 and the screed plate is shortened by suitable adjustment of mechanism 180, this has the effect of producing a thinner spread of pavement, since the screed plate on reaching a substantially horizontal position occupies a lower position relative to the front of boom 168. On the other hand, if screw adjusting mechanism 180 is adjusted to increase the distance between the rear end of the boom and the screed plate, this produces a thicker spread by causing the screed plate, when it rides in a substantially horizontal position, to be elevated relative to the front of the boom.

When screw adjusting mechanism 180 is turned, as for example to lengthen the distance between the rear end of boom 168 and the rear edge of screed plate 106, this initially might produce some inclination of the screed plate, especially adjacent the outboard end thereof, but as soon as the paving operation starts, and because the screed plate tends as already indicated to assume a substantially horizontal position, this inclination substantially disappears. When the paving machine is used to widen a road, ordinarily the outboard end of the collector and spreader unit (the end with the boom) travels over rough unpaved terrain, whereas the inboard or opposite end travels over a relatively smooth, already paved surface. Adjustment of turn screw mechanism 180 is done to control thickness of spread (this spread of aggregate occurring for the most part near the outboard end of the collector and spreader unit). Shift wheel 148 earlier described (and shown in FIGS. 3 and 4) which rides over already paved surfaces, is raised or lowered when it is desired bodily to raise and lower the inboard end of the unit.

Generally describing the operation of the paving machine herein illustrated, normally the machine would be operated with the paving machine frame and its wheels traveling over already laid pavement behind a dump truck, which would also travel over this pavement. The supply hopper at the front of the machine is repeated fed aggregate from successive dump trucks traveling in advance of the paving machine, with the paving machine pushing against the rear wheels of the truck through rollers 30. Aggregate cascading from a dump truck and dropping into the supply hopper is elevated by the lifting conveyer mechanism, and thence transferred laterally into the funneling device, whence it cascades into collector or hopper 74. Material having fallen into this hopper is advanced by screw conveyer mechanism 128 to be distributed along the length of the hopper.

The strip which is paved is that region which the exposed portion of slot 84 travels over as the machine advances. This may be changed in length (to vary the width of the strip) by adjustment of the shutoff gate at the base of the hopper. The position of the strip being paved relative to the axis of the vehicle may be adjusted by swinging arms 110, 112 to shift unit 32 in a lateral direction. The thickness of the spread may be controlled by suitable adjustment screw adjusting of mechanism 180.

Aggregate flowing from the base of the hopper and under the screed plate is smoothed and at the same time compacted by operation of the vibrator mechanism described. A narrow compacted strip of pavement is produced which lies to one side of the region over which the paving machine travels.

While there has been described an embodiment of the invention, it should be obvious that changes and variations are possible without departing therefrom. It is intended to cover all modifications of the invention as would be apparent to one skilled in the art, and that come within the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In a paving machine, a paving machine frame supported for movement over the ground, and a supply hopper mounted on said paving machine frame adjacent one of its ends in a position to receive aggregate dumped from a dump truck,

a lifting conveyer mounted on the paving machine frame with an inlet end communicating with said supply hopper and an elevated discharge end located above said inlet end for elevating aggregate dumped into said supply hopper,
 a collector disposed laterally of said paving machine frame relative to said supply hopper, said collector including an elongated hopper for receiving aggregate extending generally transversely of the longitudinal axis of the paving machine, and an elongated slot in the base of the hopper extending longitudinally of the hopper accommodating flow of aggregate from the hopper,
 means mounting said collector on said paving machine frame enabling the hopper while occupying said transverse relative position with respect to the longitudinal axis of the paving machine to be shifted in a lateral direction relative to said axis thus to change the lateral placement of the slot in the hopper relative to the paving machine frame, and
 power-operated means interposed between the collector and paving machine frame for so shifting the hopper.

2. The apparatus of claim 1, wherein the collector further includes screed plate means defining a leveling plane trailing the slot in said hopper for moving aggregate, such screed plate means being shiftable laterally together with the hopper on lateral shifting of the collector, an arm mounted on the hopper projecting forwardly from the hopper, ground-engaging means supporting a forward portion of said arm, and means interposed between the arm and said screed plate means for adjusting the angular position of the plane of said screed plate means relative to the forward end of said arm.

3. The apparatus of claim 1, wherein said hopper is bottomed by a floor portion adjacent one end of the hopper which closes off the base of the hopper, the slot in the base of the hopper is adjacent the hopper's opposite end, power-driven distributing mechanism is provided in the hopper for moving aggregate collecting on said floor toward the hopper's said opposite end and said slot, and conveyor means is provided for conveying aggregate from the discharge end of the lifting conveyor to the hopper where such is bottomed by said floor portion.

4. A paving machine comprising
 a paving machine frame and wheel support for the frame accommodating movement of the frame in a longitudinal direction over the ground,
 collector and spreader mechanism positioned laterally to one side of the longitudinal axis of the paving machine including an elongated hopper extending transversely of the longitudinal axis of the paving machine having a slot in the base thereof extending along the length thereof for aggregate to flow out of the hopper, and screed means for leveling aggregate trailing said slot,
 means mounting said collector and spreader mechanism on said frame accommodating side shifting of the mechanism to place the mechanism including said slot in said hopper at different degrees of lateral offset with respect to the longitudinal axis of the paving machine, and
 power-operated means interposed between the paving machine frame and collector and spreader mechanism for producing side shifting of such mechanism under power.

5. The paving machine of claim 4, wherein said hopper has one end bottomed by a floor portion which closes off the base of the hopper, the slot is adjacent the hopper's opposite end, a receiving hopper is provided on the paving machine frame for receiving aggregate dumped from a dump truck, and conveyor means mounted on the paving machine frame which transfers such aggregate from said receiving hopper to said one end of the hopper in the collector and spreader mechanism.

6. The paving machine of claim 5, wherein a shut-off gate is adjacent said floor portion, one superimposed above the other, said shut-off gate is shiftable along the length of the hopper in the collector and spreader mechanism to a position at least partially closing off said slot, and power-operated means is provided interposed between the paving machine frame and collector and spreader mechanism for moving the gate under power.

7. In a paving machine, a paving machine frame supported for movement over the ground and a supply hopper mounted on the frame adapted to receive aggregate dumped from a dump truck,

a collector and spreader unit mounted on the frame disposed laterally of the frame relative to the supply hopper, and

conveyer means for transferring aggregate from said supply hopper to said collector and spreader unit, said collector and spreader unit including an elongated hopper extending generally transversely of the longitudinal axis of the paving machine for receiving aggregate from such conveyer means, an elongated opening in the base of the hopper extending longitudinally of the hopper and accommodating flow of aggregate from the hopper, screed plate means trailing the opening defining a leveling plane for smoothing aggregate, a boom mounted on the collector and spreader unit located to one side of the paving machine frame and generally paralleling the longitudinal axis of the paving machine, said boom having a forward end disposed forwardly of the screed plate means, a ground support for the forward end of said boom, and means interposed between the screed plate means and boom adjustable to change the angular position of said leveling plane relative to the forward end of the boom.

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