

United States Patent

Schrimper et al.

[15] 3,636,832

[45] Jan. 25, 1972

[54] DUAL PAVER

[72] Inventors: **Vernon L. Schrimper; Louis F. Fairchild,**
both of Cedar Rapids, Iowa

[73] Assignee: **Iowa Manufacturing Company of Cedar
Rapids, Cedar Rapids, Iowa**

[22] Filed: **Mar. 10, 1970**

[21] Appl. No.: **18,106**

[52] U.S. Cl. **94/46, 180/6.48, 280/400**

[51] Int. Cl. **E01c 19/48**

[58] Field of Search **94/44, 45, 46; 280/411.1;
180/6.48; 172/292**

[56] References Cited

UNITED STATES PATENTS

1,675,013	6/1928	Young.....	180/6.48 UX
2,142,262	1/1939	Beckham.....	94/44
2,914,994	12/1959	Pollitz.....	94/46 X
3,111,070	11/1963	Pollitz.....	94/46
3,144,723	8/1964	Carter.....	180/14 X

3,262,378 7/1966 Schrimper et al.....94/46
3,552,497 1/1971 Stedman.....172/292

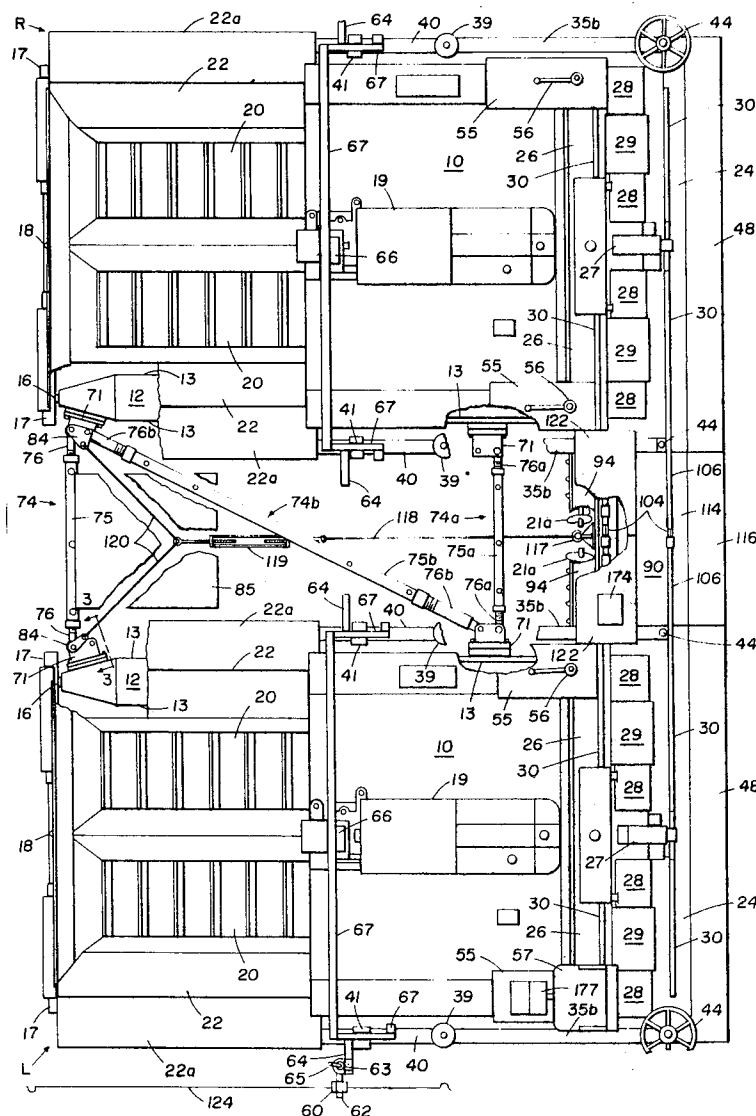
Primary Examiner—Jacob L. Nackenoff

Attorney—Haven E. Simmons and James C. Nemmers

[57] ABSTRACT

A dual paver is composed of the tractors of a pair of typical single pavers, the tractors being linked in spaced side-by-side relation and fitted across their rear with a single-screed assembly of the floating type. Two types of the screed assembly are shown, one, an elongated rigid screed formed from the two individual screeds and a special rigid center section with a central crowning mechanism, and the other a "split" screed, also formed from the two individual screeds but with a center section made up of two standard screed extensions resiliently secured to each other. The controls of each tractor are tied into a dual control console mounted on one tractor so that both can be conjointly operated as a unit. Various applications of automatic screed-leveling devices are also disclosed in combination with both types of screed assemblies.

28 Claims, 14 Drawing Figures



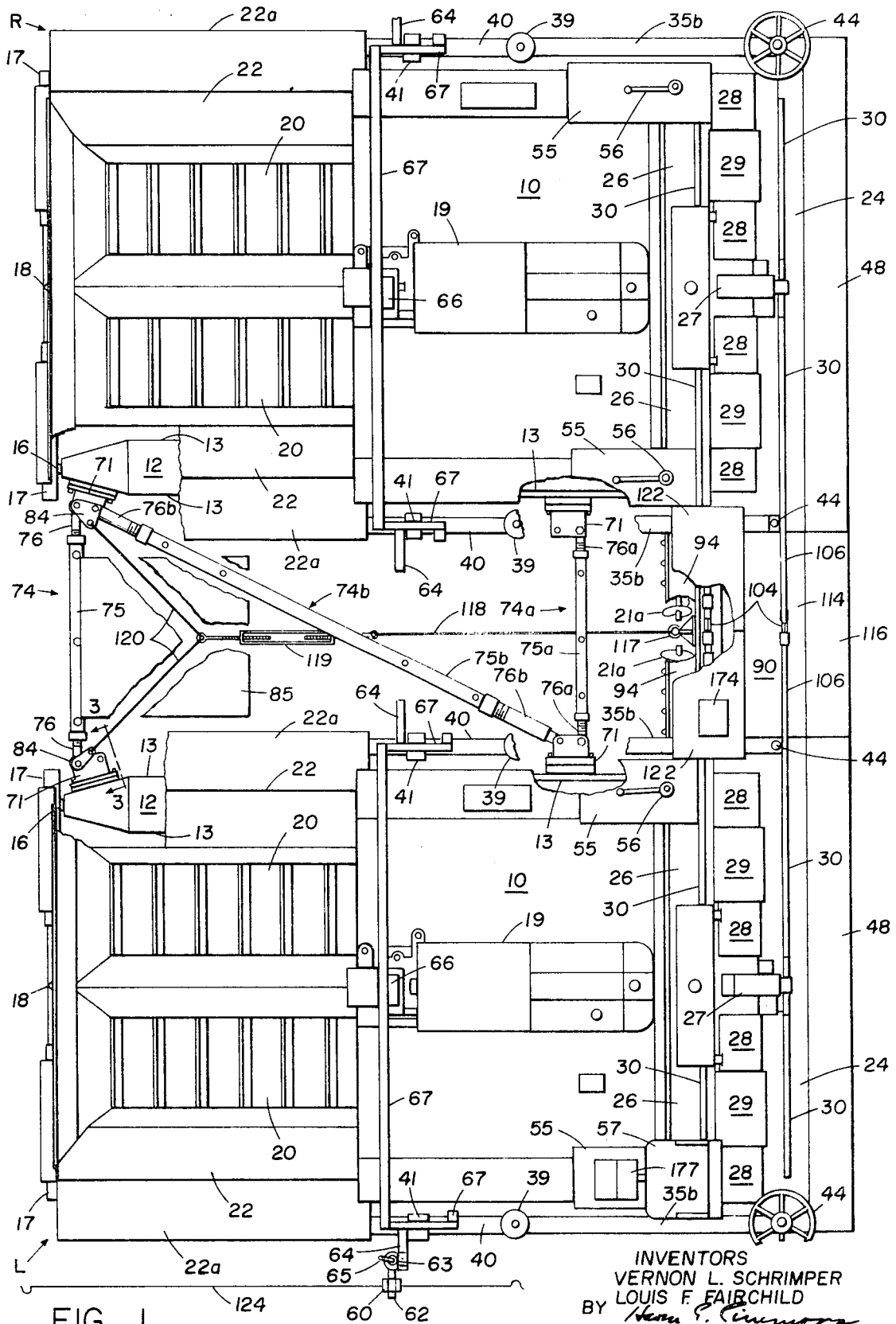


FIG 1

INVENTORS
VERNON L. SCHIRMER
LOUIS F. FAIRCHILD
BY *Henry F. Fairchild*
ATTORNEY

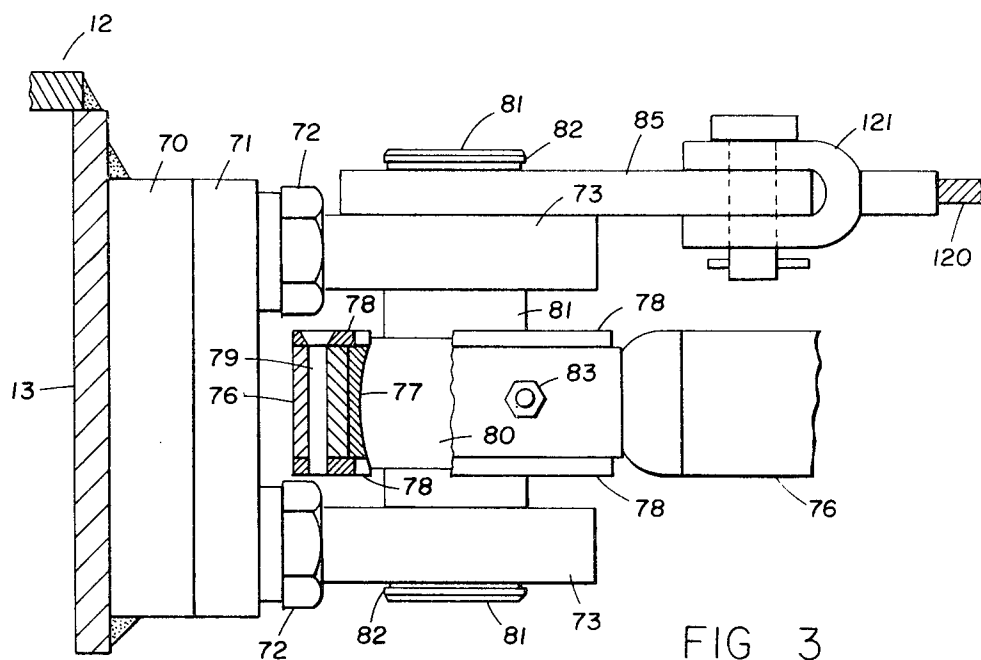
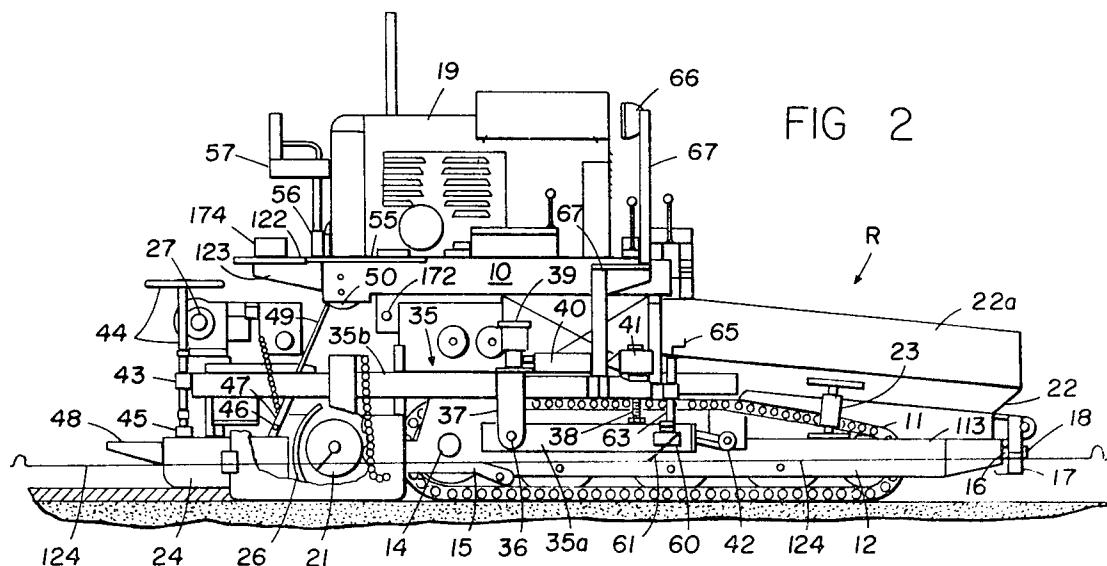


FIG 3

INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Harold S. Schrimper*
 ATTORNEY

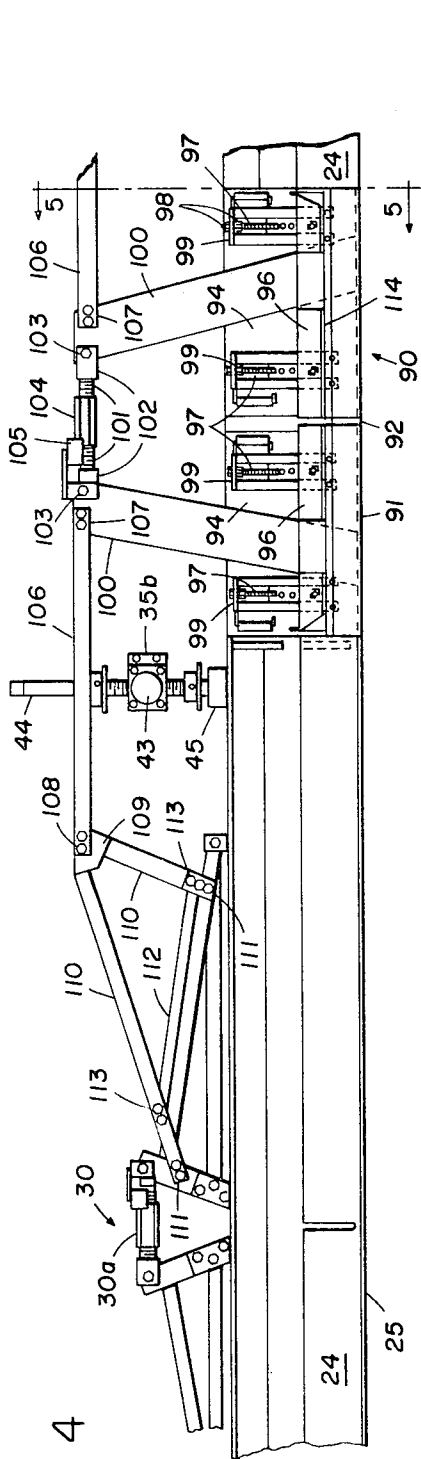


FIG 4

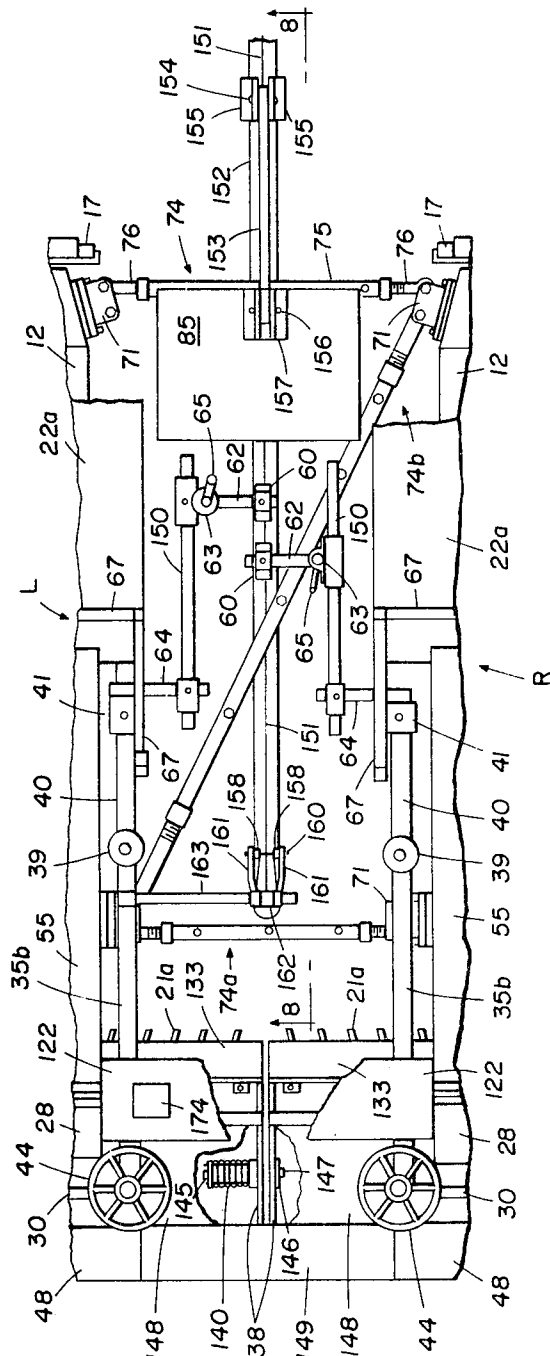
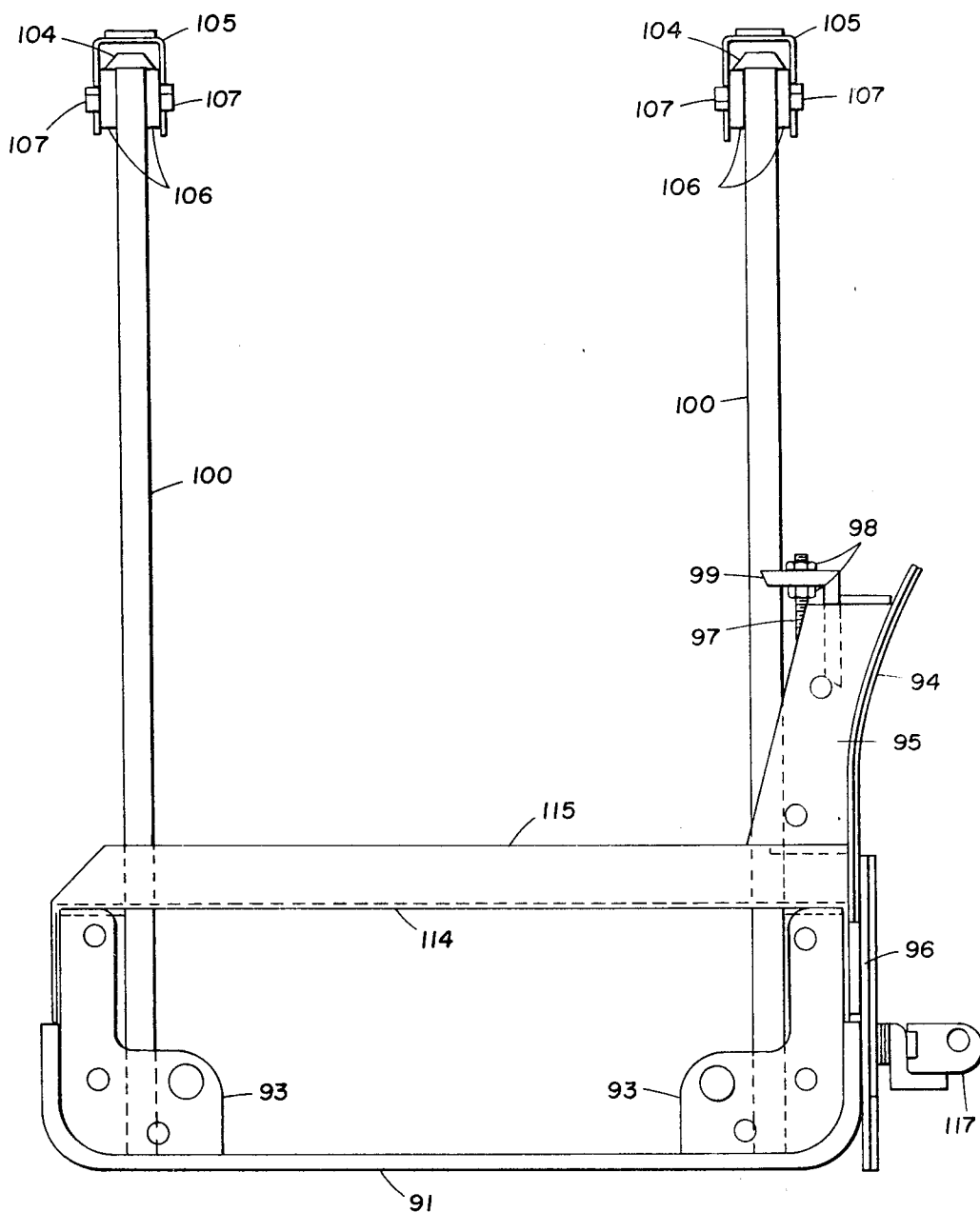


FIG 7

INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Harold F. Simmons*
 ATTORNEY

FIG 5



INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Harold S. Friedman*
 ATTORNEY

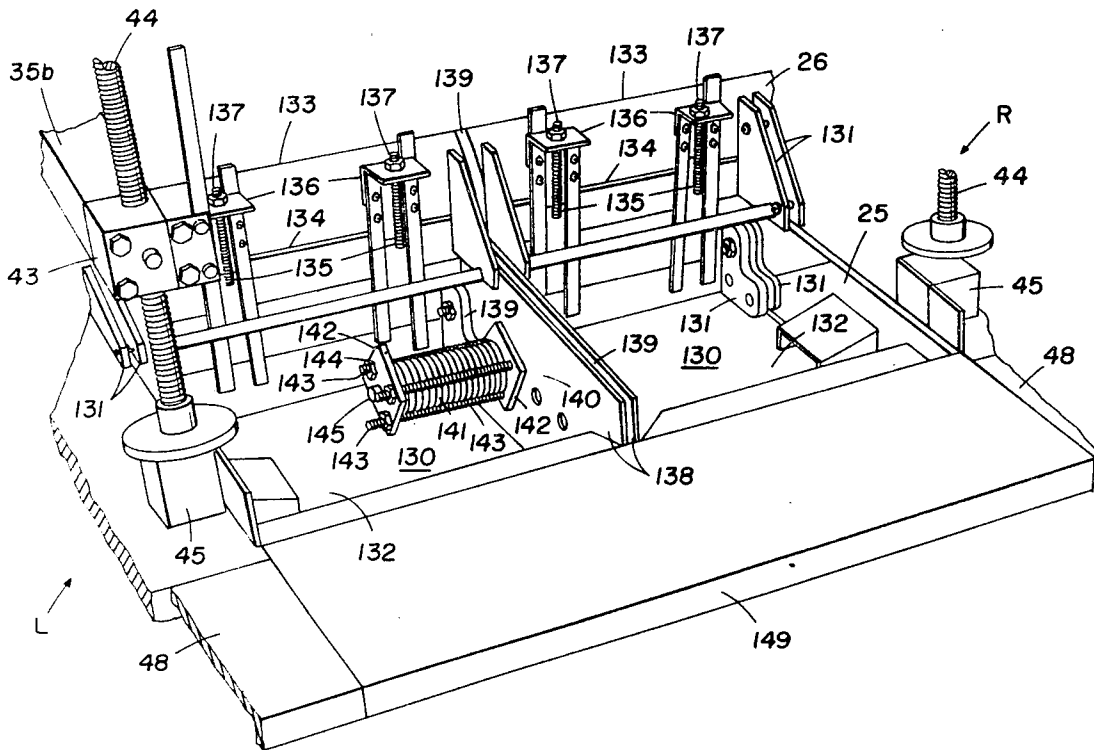
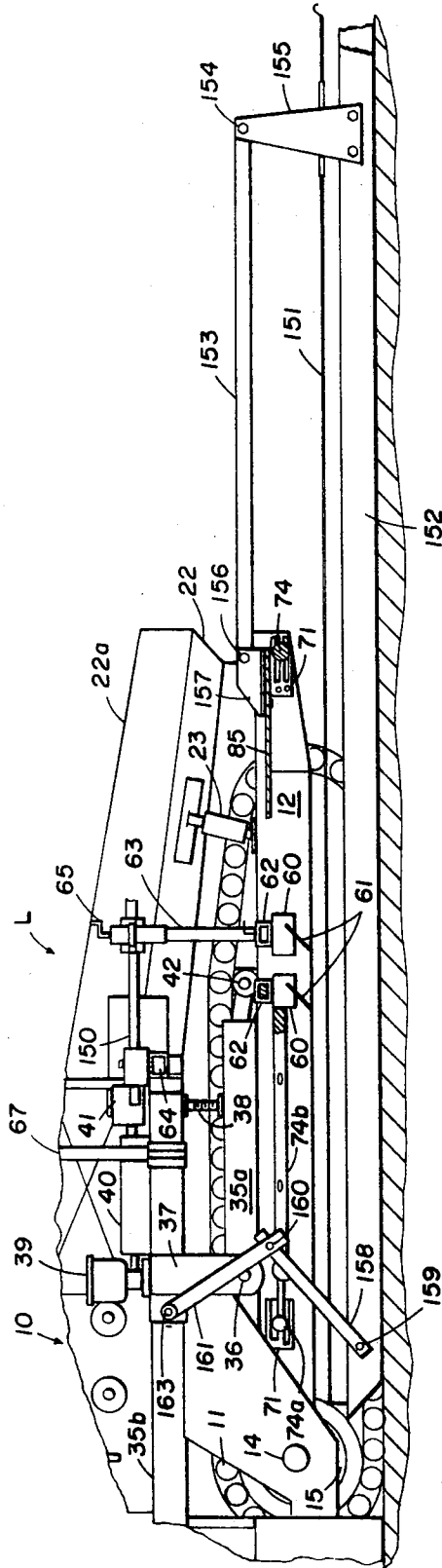


FIG 6

INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Harold P. Simmons*
 ATTORNEY

FIG 8



INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Home P. Simon*
 ATTORNEY

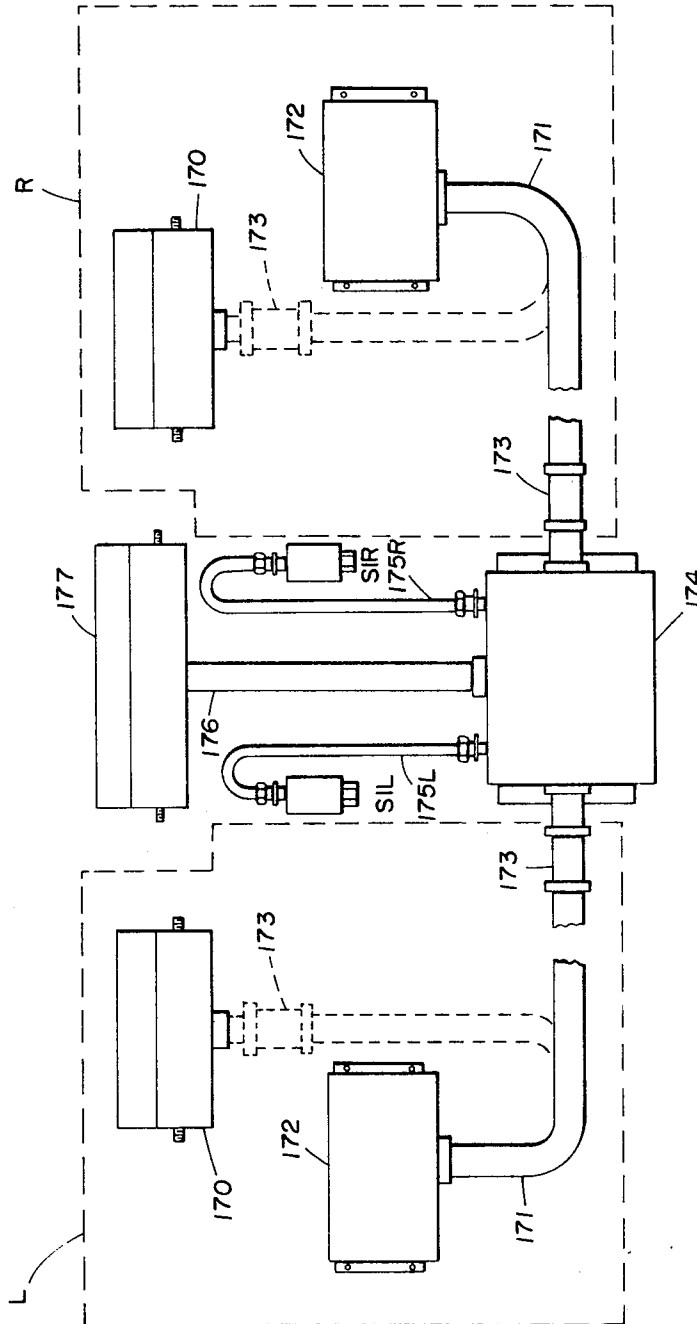
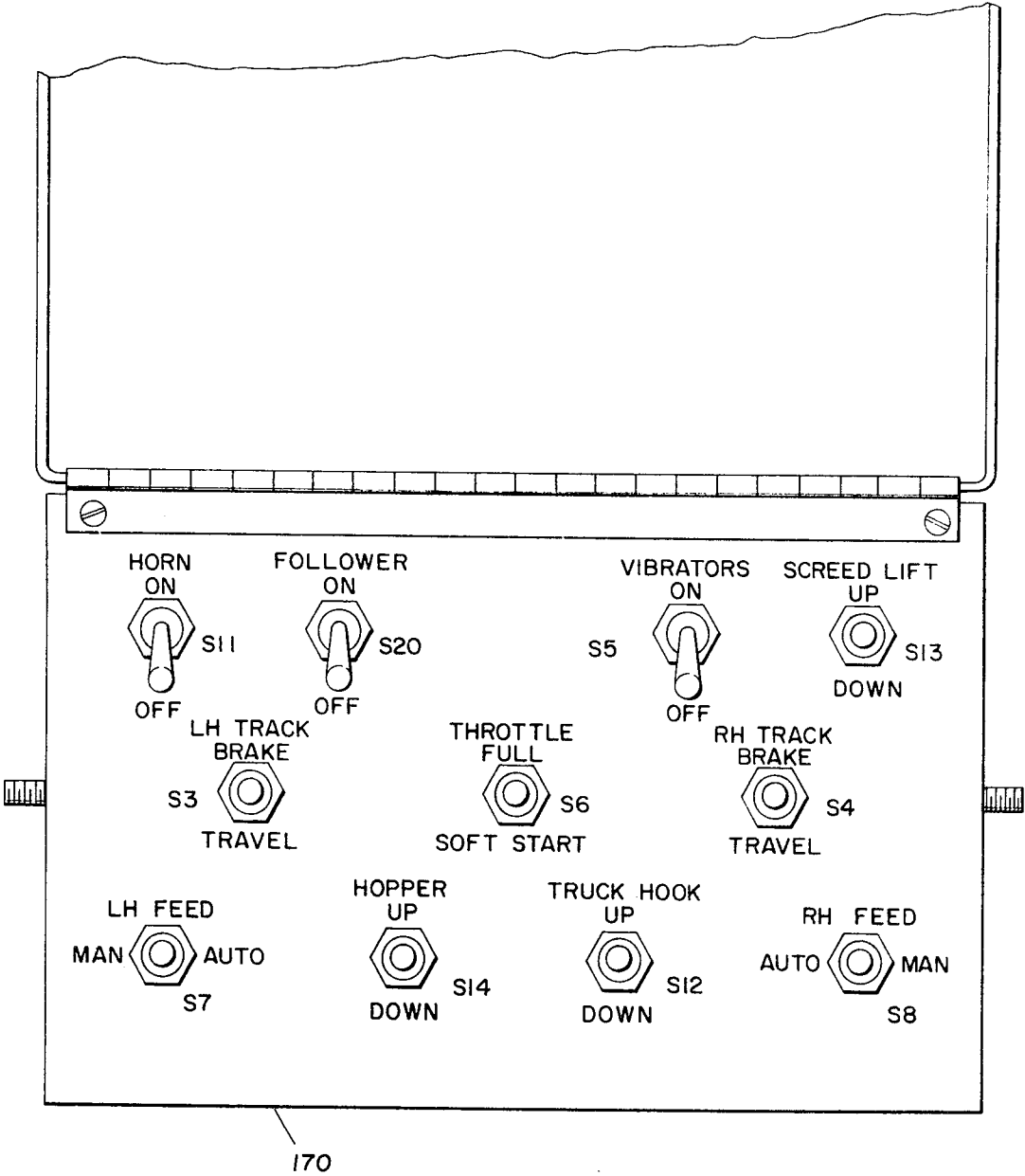


FIG 9

INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Vernon L. Schrimper*
 ATTORNEY



INVENTORS
VERNON L. SCHRIMPER
LOUIS F. FAIRCHILD
BY *Harold S. Simmons*
ATTORNEY

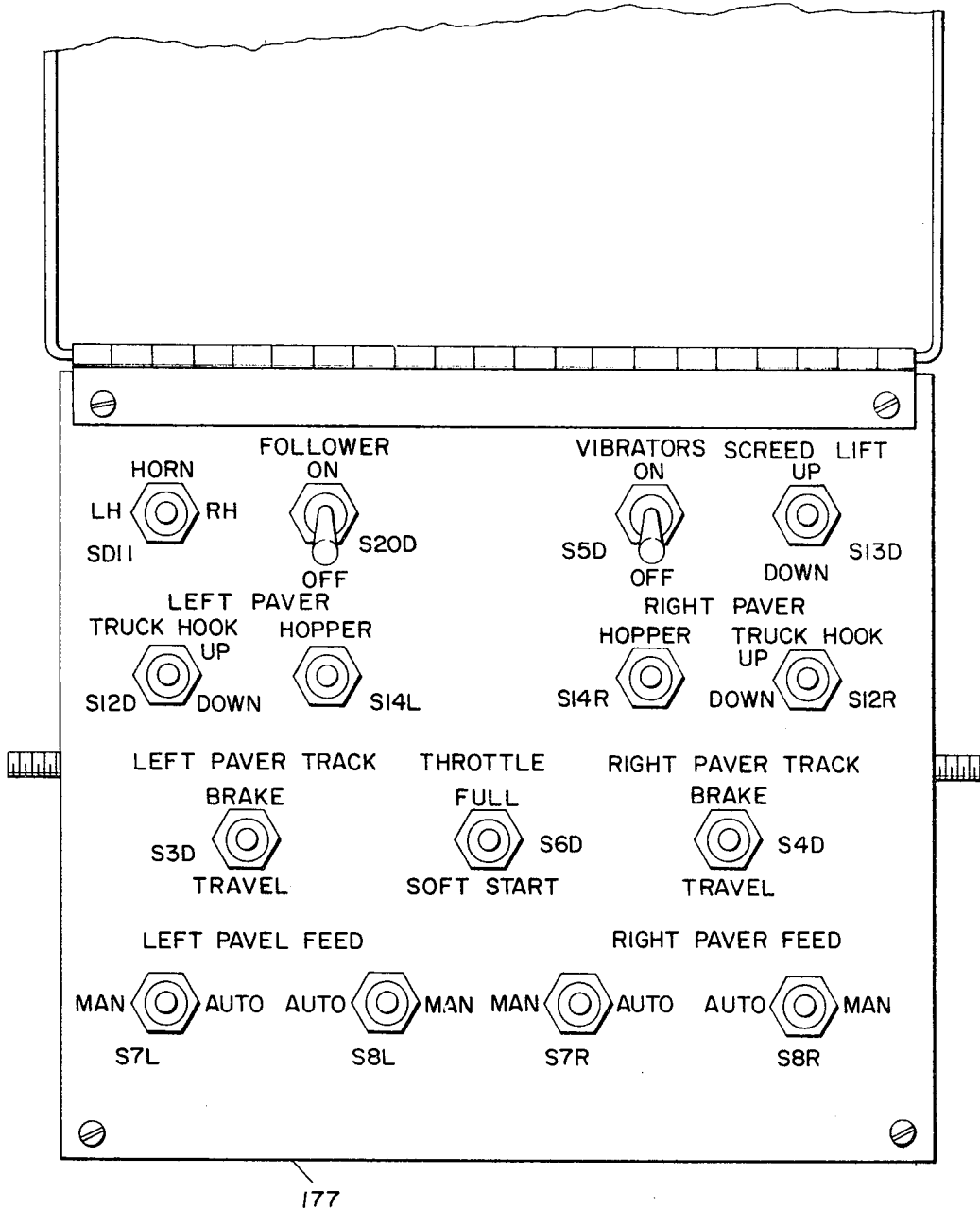


FIG 11

INVENTORS
 VERNON L. SCHRIMPER
 LOUIS F. FAIRCHILD
 BY *Harold F. Timmons*
 ATTORNEY

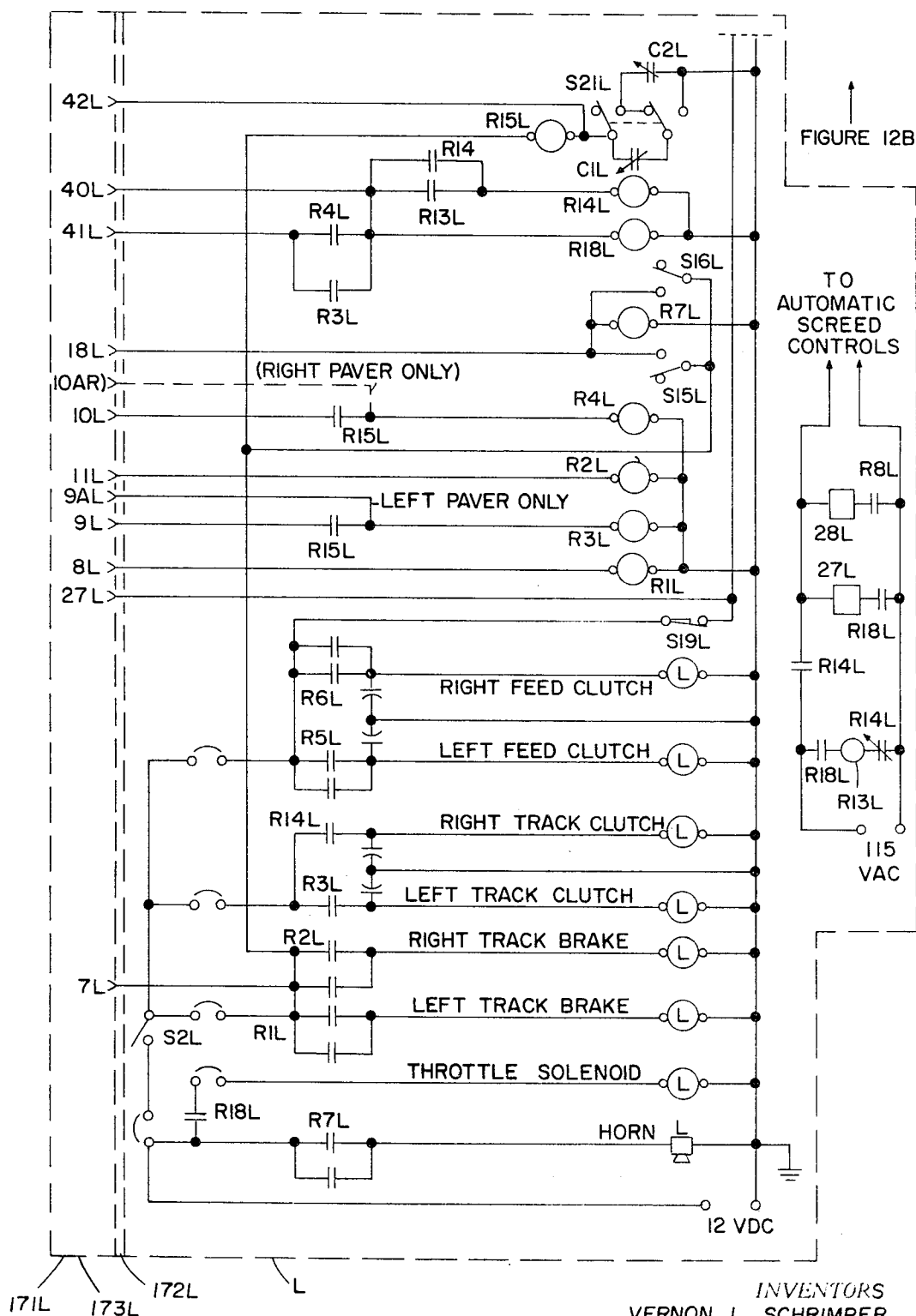


FIGURE 12B

INVENTORS
 VERNON L. SCHIRMER
 LOUIS F. FAIRCHILD
 BY *Harold S. Simmons*
 ATTORNEY

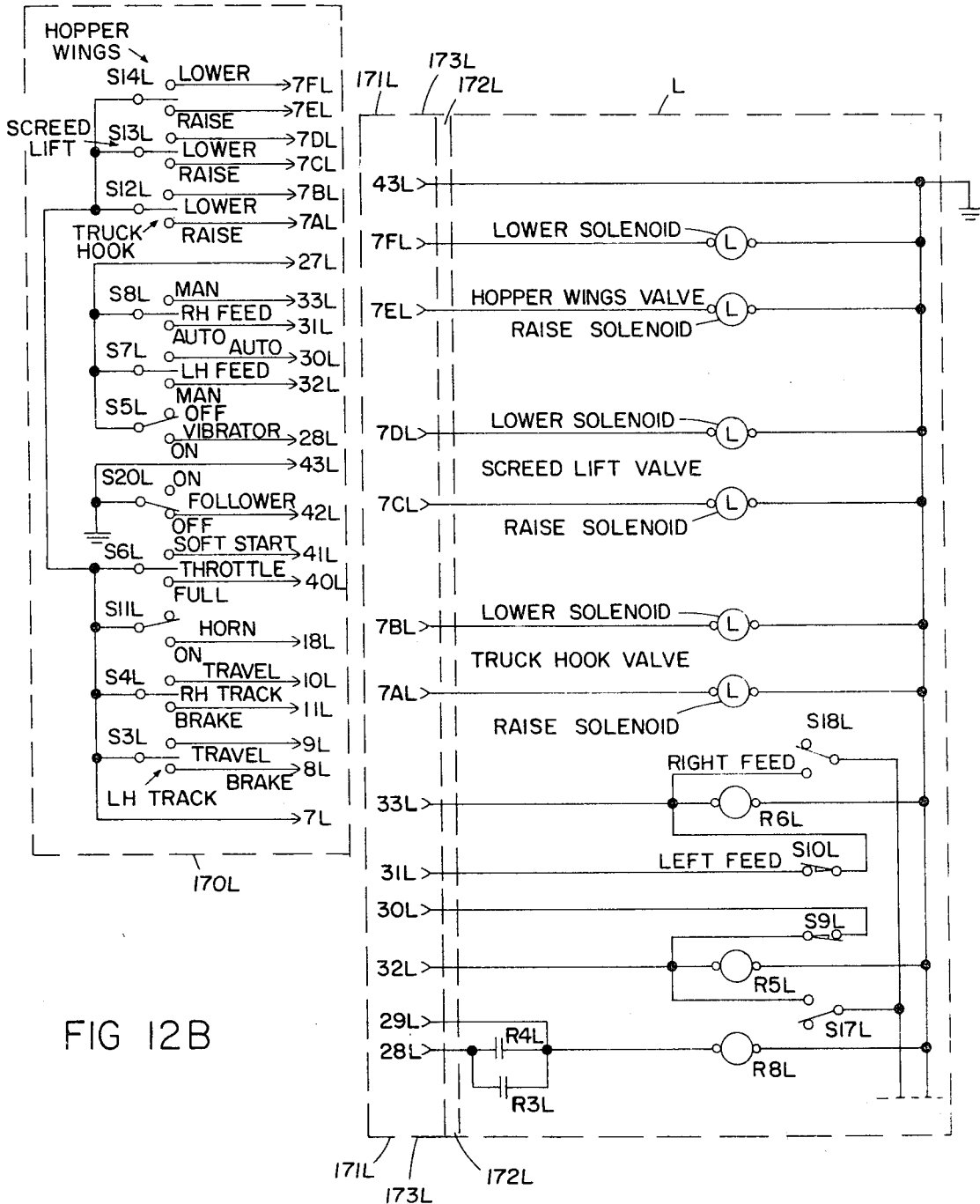


FIG 12B

FIGURE 12A



INVENTORS
 VERNON L. SCHIRMER
 LOUIS F. FAIRCHILD
 BY *Harold E. Simmons*
 ATTORNEY

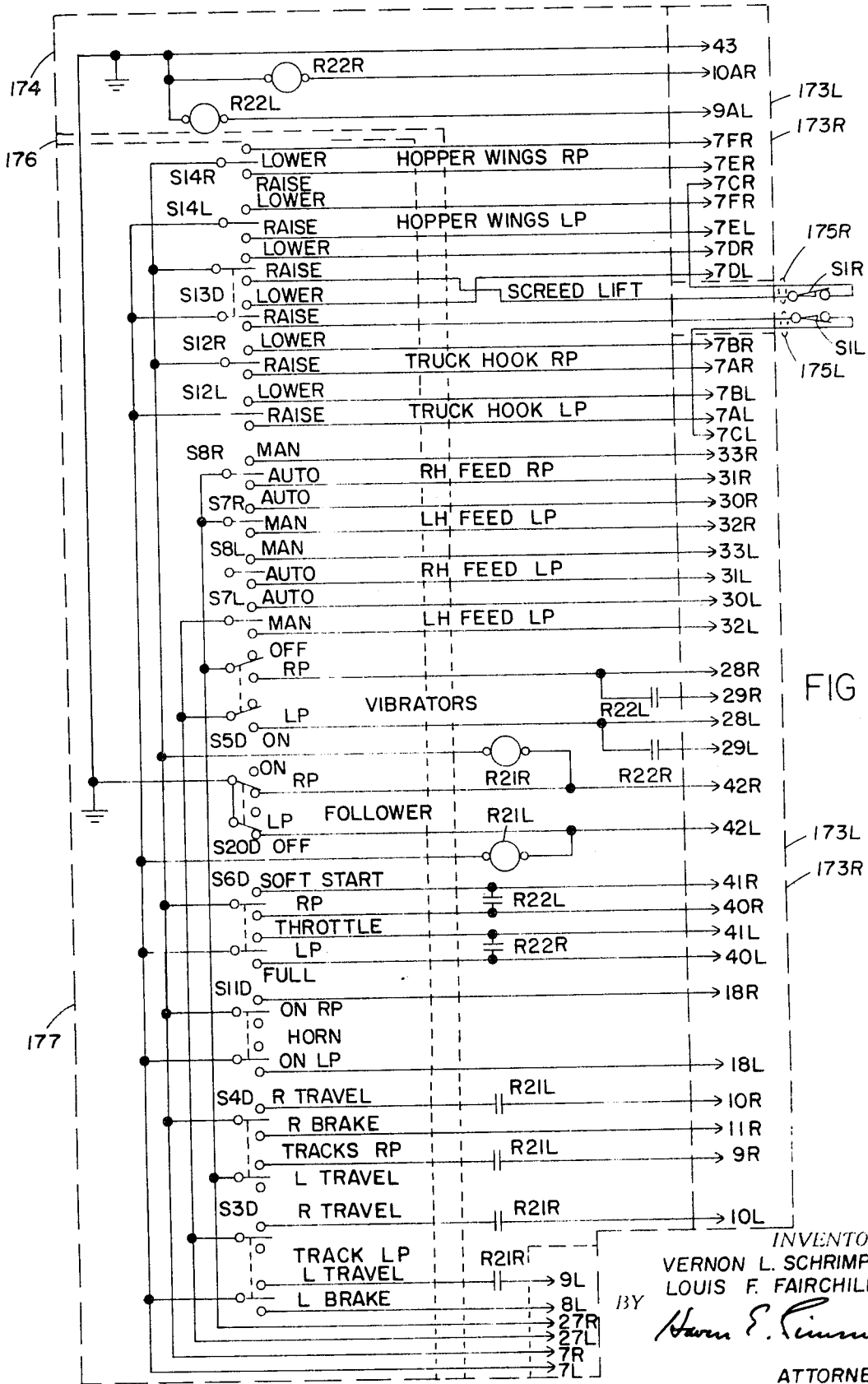


FIG 13

INVENTORS
VERNON L. SCHRIMPER
LOUIS F. FAIRCHILD
BY *Harold E. Schrimper*
ATTORNEY

1

DUAL PAVER

BACKGROUND OF THE INVENTION

There is an increasing desire to be able to accomplish "full width" or "wide width" paving, such as both lanes of a dual lane roadway (whether as a part of a divided highway or otherwise), in a single pass as well as to reduce the number of passes required for airport runways, reservoirs and the like. This, so far as is known, has not really been possible or practical with current pavers. Even with screed extensions, the standard 10-foot-wide paver is limited to a maximum width of about 19 feet, substantially less than the typical 24-foot width of a modern dual lane roadway. Furthermore, modern practice is more and more, so far as is possible, to pave both the roadway and its shoulders at each side at the same time which together often have an overall width of 42 feet or so. Some 12-foot-wide pavers are in used but even these are really effective only up to a maximum width of 24 to 26 feet. Presently, therefore, such paving must be done in several strips laid side by side, either by using two separate pavers in tandem or echelon or by additional passes by a single paver. In the first case, two paver crews are necessarily required and in the second more paving time. In both cases seams or joints perforce result between the strips which is undesirable for well-known reasons.

It is possible to design and build a single paver wide enough to pave a dual lane roadway in one pass but it would be a cumbersome machine indeed, difficult to move itself about and to transport by truck to and from a job site. Furthermore, it would be very expensive and could only be used for full width paving, so obviously would not be an economically practical investment for many contractors. Thus, it is far more economical and much more practical from the standpoint of mobility if two standard width pavers could be employed in a manner to accomplish full width paving, using but one paver crew instead of two and jointly operated as a unit from a single control position on one. This is the chief object of the present invention which is henceforth described in more detail from which its additional advantages will become apparent to those skilled in the art.

SUMMARY OF THE INVENTION

The tractors of two standard width pavers are held in spaced side-by-side relation by means of a linkage which nevertheless allows some vertical movement of the two tractors relative to each other so that they can operate in different individual planes. This is necessary, of course, so that the two can operate over somewhat uneven terrain or obstacles. The particular linkage used is in the form of a "Z," the two transverse members being connected at respective fore-and-aft locations to the frames of the two tractors while the diagonal member forms a brace. The connection of each member to the tractor employs a spherical bushing bolted to the tractor frame so that each member can swivel to some extent relative to the tractors and so provide the necessary articulation between the two. Each member of the Z is in effect a large turnbuckle so that the spacing between the two tractors can be adjusted as desired, currently from about 4 to 6 feet. The three members of the linkage are made readily removable so that the two pavers can be easily separated for individual use.

The screeds of the two tractors are connected by one or the other of two types of special center sections. The first type is rigid and bolted at its ends to the adjacent ends of the two screeds, thus forming an elongated, rigid screed assembly; hence it is called the "rigid" type. The length of the center section depends, of course, on the spacing between the tractors, and the section is equipped with a linkage, tied into the crowning linkage of each of the two standard screeds, in order to permit crowning adjustments of the entire screed assembly as well as to stiffen the overall assembly. The crowning linkages of the two standard screeds are also usable for "quarter crowning" when necessary. The outboard pair of the screed pull arms of the two tractors are left connected in the usual manner to the outboard ends of the overall screed assembly,

2

while the inboard pair of screed arms are disconnected from their forward pivot points to the screeds. Since each of the screed-adjusting screws of these arms is connected to the latter and to the screed by means of a pair of swivel joints, the two inboard screed arms thus exert no pull upon the overall screed assembly nor is the angle of attack of the latter affected by changes in the attitude of those two arms. In order to prevent fore-and-aft flexing or dragging of the midportion of the screed assembly a flexible cable is attached thereto and extended forwardly between and attached to the inboard sides of the two tractors. The rigid types screed assembly may also be used with automatic screed-leveling controls in the manner later explained, though this is not mandatory.

The second type of special center section is likewise formed from the two standard screeds to the adjacent ends of each of which is bolted a standard screed extension. The other ends of the screed extensions are equipped with special end plates, but instead of the latter being rigidly connected they are merely held side by side by a large, preloaded coil spring capsule so that the resulting two halves of the overall screed assembly, which is called the "split" type, can flex relative to each other. Both screed pull arms of each tractor in this case are left attached in the usual manner to the two standard screeds. No additional crowning linkage is used in this case, but the crowning linkage of each individual screed can be used for quarter crowning if necessary. Instead, crowning of the split type screed assembly is accomplished about the resilient abutment between the two halves, preferably by the use of automatic screed-leveling controls which adjust the angle of attack of the screed assembly at its outboard ends relative to that at its midportion. Crowning can be accomplished in the absence of such controls, as will be readily understood by those skilled in the art, by different settings of the screed-adjusting screws at the outboard pair of screed pull arms relative to those at the inboard pair of arms.

Finally, the controls of each individual paver are tied together into a single dual paver control console, which can be located at any one of a number of places on either tractor as the occasion demands, so that the two tractors can be operated as a unit. This is particularly feasible in the case of the individual pavers employed in the illustrated embodiments of the invention because each employs electrical toggle switches for controlling engine speed, the right- and left-hand tracks, the right- and left-hand material feeds, and so forth, all of which switches are mounted upon a single movable control console on the tractor and connected into the latter by a single electrical cable or "umbilical cord." When two individual pavers are connected for dual use a special "dual junction box" is attached to the two and the umbilical cord of each paver is equipped with a quick disconnect from its respective single control console. The two umbilical cords are then plugged into the dual junction box from which leads a single umbilical cord to the dual control console, the latter containing a single set of toggle switches for operating the respective components of both tractors as a unit, all as will be later explained in more detail. Hence the control systems of the pavers are also readily adapted to individual or dual operation by virtue of the quick disconnects of both pavers either to their individual control panels or to the dual junction box to which the dual control console is connected.

An important feature of the present invention resides in the two types of screed assemblies. The rigid form, of course, requires a special center section which must be removed in its entirety before the pavers can be separated for individual use. If, as is often the case during full width paving, standard screed extensions are being used at the outboard ends of the screed assembly, then a pair must also be attached to the other ends of the separate screeds in order for each paver individually to be able to pave one-half the width of the two together. All this, plus removal of the Z-linkage between the tractors, requires about 2½ to 3 hours of time. The split type, on the other hand, is more versatile in these respects because upon removal of the Z-linkage and the spring capsule and replacement of the

special ends plates at the abutment between the two screed extensions, the two pavers are immediately ready for individual use. This requires only about 20 minutes. Furthermore, the split type, owing to its central articulation, permits sensing from the middle point of the roadway, by a ski or similar device, when automatic screed-leveling controls are used, which, of course, cannot be done with present single pavers. This is especially useful during resurfacing of a roadway when skis or the like cannot be used at the sides and the setting of string lines is too time consuming. The rigid type of screed assembly, owing to its rigid center section, requires a ski, string line or the like at each side when automatic screed-leveling controls are used, just as do current single pavers under these conditions. The rigid type, on the other hand, is easier to operate with the latter controls, in that it requires fewer changes in settings when paving banked curves or constructing wedges. In short, the two types complement each other.

Another feature of the present invention is that it is readily adaptable, with only minor modifications, to pavers already in the field as well as to new pavers. The linkage interconnecting the tractors can be supplied as a kit together with the special rigid screed center section, the components needed to make up the split type and the dual control console and junction box. In the case of those pavers already in the field, the kit would also include parts for modifying the single control consoles to provide quick disconnects for the individual pavers. This feature, plus the use of otherwise standard pavers and the two types of screed assemblies made up of largely standard components, obviously provides great flexibility at very reasonable cost to the contractor because he has all the advantages inherent in operation of two pavers either individually or conjointly as a single unit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view, certain portions being broken away for clarity, of the two tractors of a pair of standard pavers connected together in dual form by the Z-linkage of the present invention, and illustrating the rigid type screed assembly in conjunction with automatic screed-leveling controls.

FIG. 2 is a right-hand side elevation of the dual paver of FIG. 1.

FIG. 3 is a view taken along the line 3—3 of FIG. 1 illustrating the form of swiveling connection employed by which each of the ends of the members of the Z-linkage is fastened to the tractors.

FIG. 4 is a rear elevation of a portion of the rigid type screed assembly illustrating the special center section and its crowning mechanism.

FIG. 5 is an enlarged, end elevation taken from the line 5—5 of FIG. 4.

FIG. 6 is an upper isometric view illustrating the center section of the split type of screed assembly and the manner in which the abutting screed extensions thereof are held together, the top cover plates for same being omitted.

FIG. 7 is a partial top plan view, similar to FIG. 1, but illustrating the split type of screed assembly attached to the two tractors together with the manner in which automatic screed-leveling controls are employed therewith to sense from the center of the roadway.

FIG. 8 is a side elevation taken along the line 8—8 of FIG. 7.

FIG. 9 illustrates the relationships between the individual paver control consoles, umbilical cords and junction boxes; the dual control console and dual junction box; and the quick disconnects between the individual paver umbilical cords and control consoles on the one hand, and the dual junction box on the other hand.

FIG. 10 illustrates the face of a single paver control console.

FIG. 11 illustrates the face of the dual control console.

FIGS. 12A and 12B schematically illustrate portions of the electrical control circuits of a single paver, its junction box, umbilical cord and control console therefor, together with the quick disconnect between the latter two.

FIG. 13 schematically illustrates the dual control console, its junction box and the quick disconnects between the latter and the individual paver umbilical cords.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Inasmuch as many aspects of the individual pavers illustrated in the drawings are conventional and well known in the art, it is not necessary to describe them at any length. Thus, many things are illustrated in the drawings or otherwise implied in the following more detailed description which will not be specifically mentioned or, if so, will be referred to only in general manner. The same is true of the operations of each individual paver for that is also well known in the art. Hence explanation of the operation of the dual paver is limited to those aspects thereof deemed necessary or desirable and is carried out in connection with the description of the novel portions of the dual paver. Other aspects of the operation of the latter will be apparent to those skilled in the art.

GENERAL DESCRIPTION OF EACH PAVER

Turning first to FIGS. 1 and 2, each individual paver, denoted L and R for the left- and right-hand ones of the two, comprises essentially a tractor 10, moved by tracks 11 carried in a frame 12. Each track 11 operates between a pair of frame plates 13 journaled at their rear ends, between which is a drive sprocket 15, to an axle 14 and at their front ends by trunnions 16 to the ends of a transverse "walking beam" 17. The body of the tractor 10, which carries the axles 14, is journaled to the midpoint of the beam 17 upon a trunnion 18 to provide a "three-point" type suspension. Each tractor 10 carries a prime mover or engine 19 which drives the sprockets 15, a pair of material slat conveyors 20 and distributing screws 21 through various chain drives, electromagnetic clutches and gearboxes (not shown) in the customary manner. The slat conveyors 20 of each paver move the paving material from a hopper 22, which is provided with hinged wings 22a operated by hydraulic rams 23, rearwardly and deposit it upon the roadway where it is spread out by the distributing screws 21 before engagement by the screed 24. Each screed 24 consists essentially of a U-shaped screed plate 25 (see FIGS. 4 and 6), a curved moldboard 26 which is preferably of the type shown in U.S. Pat. No. 2,951,426 to Pollitz and equipped with adjustable strikeoff plates (not shown in FIGS. 1 and 2) as in U.S. Pat. No. 3,262,378 to Schrimper et al. The interior of each screed 24 is heated by a conventional oil burner 27 and its screed plate 25 is vibrated for mat compaction by electric vibrators 28 and their controls 29 as described in U.S. Pat. No. 2,757,588 to Pollitz. Crowning is achieved by a linkage 30 as disclosed in U.S. Pat. No. 2,914,994, also to Pollitz.

Since each screed 24 is of the floating type, it is drawn by a pair of screed pull arms 35. The type of pull arm illustrated is that shown in U.S. Pat. No. 3,111,070 to Pollitz because the present invention is preferably used in connection with automatic screed-leveling controls of the type shown in the latter patent. Each arm 35 therefore consists of two parts, a short forward arm 35a and a longer rear arm 35b thereabove, pivoted to the former at 36 at the lower ends of clevis 37 which in turn depend from arms 35b intermediate their ends. The forward end of each arm 35b is coupled to its respective arm 35a by an adjusting screw 38 whose lower end is swivelly held captive atop the arm 35a intermediate its ends, the upper portion of screw 38 threadedly engaging the forward end of the arm 35b. The two screws 38 are driven by a pair of electric motors 39, drive shafts 40 and gearboxes 41, all on their respective arms 35b, as more fully explained in the aforesaid U.S. Pat. No. 3,111,070. Hence the attitudes of each arm 35b can be altered relative to its arm 35a, the forward end of each of the latter being pivotally attached to the tractor frame 12 at a pull point 42. The after end of each arm 35b is fitted with a ball joint 43 which threadedly receives a screed-adjusting hand screw 44, the lower end of the latter being swivelly attached at 45 to the after edge of its screed 24. The forward edge of each screed 24 is pivoted at 46 to the lower ends of a

pair of brackets 47 depending from their respective pull arms 35b so that the fore-and-aft attitude or inclination of the screed 24 can be altered relative to its arms 35b by means of its two hand screws 44 and relative to its arms 35a by means of the two motor-driven screws 38. Each screed 24 is fitted with a cantilevered rear walkway 48 and may be bodily raised for travel by means of a pair of cables 49 attached thereto at its ends and running over pulleys 50 to a pair of hydraulic rams (not shown).

Each tractor 10 is provided with a control station at both sides atop platforms 55 which are fitted with pedestals 56 to receive removable operator's seats, one of which is shown at 57, and one or the other of the two forms of control consoles (to be later described) depending upon whether each tractor 10 is set up for individual or dual paving. The controls of each tractor 10 preferably also include those for automatic screed leveling of the nature shown in the aforesaid U.S. Pat. No. 3,111,070 to Pollitz. These consist of grade and slope controls, the former including a grade sensor 60, having a sensing grid 61, adjustably clamped along a laterally extending supporting arm 62 at the foot of a post 63, the latter in turn being adjustably clamped along a supporting arm 64 cantilevered laterally outwards from the forward end of a pull arm 35b. The post 63 includes a screw mechanism so that the height of its sensor 60 may be adjusted by a handcrank 65. The slope control includes a pendulum sensor 66 carried on a transverse gantry or yoke 67 whose lower ends are fixed to the pull arms 35b intermediate their respective motors 39 and gearboxes 41. The function of the leveling controls will be hereafter described in more detail in connection with each type of screed assembly. As noted, the remaining details of each paver, as well as its operation, are well known in the art so need no further description.

THE TRACTORS' CONNECTING LINKAGE

The two tractors 10 are joined side by side by the previously mentioned Z-linkage. For this purpose, as shown in FIGS. 1 and 3 in particular, the inboardmost frame plates 13 are fitted with two pairs of adapter plates 70, a forward pair being disposed just aft of the trunnions 16 and a rear pair on the axis of the axles 14. To each plate 70 in turn is fastened a large horizontal clevis 71 by capscrews 72, the clevis 73 of each clevis 71 having two sets of fore and aft related clevis pin bores therethrough. Between the two front sets of the latter on the forward pair of clevis 71 is disposed an adjustable forward spacer bar 74 formed by a sleeve 75 which is oppositely internally threaded at its ends to receive a pair of eyebolts 76, each of whose "eyes" are fitted with a spherical bearing shell 77 secured therein by a pair of upper and lower retaining plates 78 and screws 79. The bearings 77 in turn engage spherical bushings 80 slidably located on clevis pins 81 through the clevis 73 and retained by split rings 82. A grease fitting 83 is also preferably provided for lubrication. An afterspacer bar 74a is disposed between the two rear sets of clevis pin bores of the after pair of clevis 71 and an adjustable brace bar 74b is disposed between a diagonally opposite pair of clevis 71 at the remaining clevis pin bores of each.

The structure of the afterspacer bar 74a and that of the brace bar 74b are identical to those of the forward spacer bar 74 so the respective parts thereof are denoted in the drawings by 75a, 76a and 75b, 76b, respectively. Likewise, the nature of the attachments of the afterspacer bar 74a and the brace bar 74b to the clevis 71 are identical to that of the forward spacer bar 74. The forward pair of clevis 71 are additionally fitted with anchorplates 84 atop their upper clevis 73 and also retained by the clevis pins 81 for purposes to be later described. As previously noted, the two bars 74, 74a and the bar 74b are in effect large turnbuckles and permit the spacing between the tractors 10 to be adjusted, typically from about 4 to 6 feet measured between the adjacent ends of the two screeds 24. At the same time the spherical bushings 80 permit each bar to swivel somewhat relative to its respective clevis 71

so that there is some articulation between the two tractors 10 to accommodate uneven terrain and minor obstacles. A platform 85 is located atop the forward spacer bar 74 and the brace bar 74b for convenience of the paver crew during dual operation of the two pavers.

THE RIGID TYPE SCREED ASSEMBLY AND ITS LEVELING CONTROLS

As previously noted, each screed 24 includes a U-shaped screed plate 25. Hence the special rigid center section 90 (see FIGS. 4 and 5 in particular) employs an identical plate 91 equal in length to the distance between the adjacent ends of the two screeds 24 from which the end plates (not shown) have been first removed as if in preparation for attachment of standard screed extensions. The screed plate 91 is slotted at its midpoint 92 in order to permit crowning thereabout and each of its ends is fitted with a pair of lower tie plates 93 by which the center section 90 is secured by bolts to similar plates (not shown in FIGS. 4 and 5) at the respective ends of the screeds 24 in the usual fashion. Two short lengths of moldboards 94, congruent with the moldboards 26, are secured in slightly spaced end-to-end relation (to permit crowning of the section 90) to the front face of screed plate 91 and braced by a pair of upper tie plates 95 by which they are fastened to similar plates (not shown in FIGS. 4 and 5) customarily provided at the respective ends of the moldboards 26. The lower edge of the moldboard 94 is fitted with a pair of strikeoff plates 96, also in slightly spaced end-to-end relation to permit crowning, of the nature shown in the aforesaid U.S. Pat. No. 3,262,378 to Schrimper et al., which are slidably adjusted vertically by means of several upright rods 97 secured thereto at their lower ends and held by pairs of nuts 98 in the brackets 99, all as explained in the aforesaid patent. Two pairs of the fore-and-aft spaced legs 100 are welded at their bottom ends to the screed plate 91, each pair being symmetrically disposed with respect to the transverse center axis of the latter, and joined at their upper ends by turnbuckles to form two pairs of A-frame linkages for crowning of the section 90. Each turnbuckle consists of bolts 101 fitted with clevis 102 pivoted to their respective legs 100 at 103 and joined by an oppositely threaded sleeve nut 104 provided with a hinged locking clip 105. To one side of each of the pivots 103, the ends of a pair of tie bars 106 are bolted at 107 to the legs 100 and extend horizontally toward the respective screeds 24. The other ends of the bars 106 are bolted at 108 to tie plates 109 from which extend a pair of tie bars 110 bolted at 111 into the crowning linkage 30 of each screed 24, as shown in FIG. 4, and joined by a cross brace 112 bolted thereto at 113. The structures just described thus form trusses between each screed 24 and the center section 90 both to stiffen the overall screed assembly and, as will be apparent, to permit the latter to be crowned about the central transverse axis of the screed assembly at 92 by adjustment of the nuts 104. Quarter crowning of each individual screed 24, of course, is also available when desired by means of their crowning linkages 30 and sleeve nuts 30a.

The interior of the center section 90 is closed by a cover plate 114, flanged at 115, and a cantilevered walkway 116 is provided mating with the walkways 48 of each screed 24. An eye 117 is affixed to the midpoint of the front wall of the screed plate 91 to which one end of a cable 118 is attached. The latter runs forward to one end of a turnbuckle 119 through whose other end passes the middle of a cable 120 fixed at its ends by clevis 121 to the anchor plates 84. Since the inboard pivots 46 of each screed 24 are detached and since, owing to the ball joints 43 and 45, the inboard pair of pull arms 35b thereby exert no pull upon the inboard ends of the screeds 24, the cables 118 and 120 prevent dragging or horizontal flexing of the overall screed assembly and may be adjusted by the turnbuckle 119. A pair of abutting platforms 122, appropriately supported by brackets 123, is provided between the afterends of the inboard pair of platforms 55 of the tractors 10 and over the center section 90 for convenience

of the paver crew. It will be understood, of course, that the inboard distributing screws 21 of the tractors 10 are filled with extensions 21a which operate forward of the two moldboards 94. The extensions 21a are standard components used with standard screed extensions.

The reason the inboard pair of pull arms 35b are disconnected at their pivots 46 to the screeds 24 is so that the angle of attack of the central portion of the overall rigid screed assembly is not influenced by rise and fall of the inboard pair of tracks 11. In the case of manual control, mat thickness is controlled by the two outboard screed-adjusting hand screws 44 only since the screed assembly in this instance is in effect a single rigid structure. When automatic screed-leveling controls are used, the slope control of each individual tractor 10 is also disconnected. Both grade and slope are controlled by a pair of grade sensors 60 at the outboard sides of the tractors 10, as shown in FIGS. 1 and 2, inasmuch as since the inboard pair of pull arms 35b do not affect the attitude of the screed assembly, rise and fall of the inboard sides of tractors 10 can be ignored. The two grade sensors 60 are used either with a pair of preset string lines 124, as shown, or a pair of traveling string lines on skis, either of the single or double type shown in U.S. Pat. No. 3,323,427 to Schrimper, all as will be apparent to those skilled in the art.

THE SPLIT TYPE OF SCREED ASSEMBLY AND ITS LEVELING CONTROLS

In this type (see FIGS. 6 and 7), the end plates (not shown) at the adjacent ends of the two screeds 24 are removed and a standard screed extension 130 is attached to each by bolts to the respective tie plates 131 in the usual manner. Each extension 130 includes a U-shaped screed plate 132 congruent with screed plates 25, a moldboard 133 and a strikeoff plate 134 connected to the lower ends of threaded rods 135 held in brackets 136 so that the plates 134 can be vertically adjusted by means of pairs of nuts 137, as described in the aforesaid U.S. Pat. No. 3,262,378 to Schrimper et al. The ends of the screed plates 132 are simply butted against each other and in place of standard end plates a pair of special end plates 138 are bolted instead to the tie plates 139 (only one of which is shown) normally provided for the former. Owing to the construction of extensions 130, a gap 139 is thereby left between the adjacent moldboards 133, strikeoff plates 134 and end plates 138 so that the two extensions 130 have room to flex about the abutting screed plates 132. The extensions 130 are held together by means of a preloaded spring capsule 140 consisting of a large compressible coil spring 141 preloaded between a pair of plates 142 by means of tie rods 143 and nuts 144. The capsule 140 is placed against one of the plates 138 and a long, headed bolt 145 passed axially through the spring 141 and the four plates 142 and 138, being secured by a washer 146 and nuts 147 against the far face of the other plate 138. The nuts 147 are simply turned up fingertight and locked. The screed plates 25 and 132 of the two halves of the split screed assembly are thus normally in coplanar relation, but any departure therefrom is resiliently resisted by the action of the spring capsule 140. The two extensions 130 are fitted with a pair of cover plates 148 and a walkway 149 abutting the walkways 48. As in the case of the rigid type screed assembly, it will be understood that distributing screw extensions 21a are also fitted to the inboard pair of distributing screws 21 of the two tractors 10.

As previously mentioned, one of the features of the split type screed assembly when automatic screed-leveling controls are used is that it permits grade sensing from the middle of the roadway, something which is not now practical with the rigid type or with any current single paver. In the split type screed assembly, however, since the two extensions 130 can flex about their abutment, grade control can readily be accomplished along the longitudinal center line between the two tractors 10 while slope control for each of the latter is handled by its pendulum sensor 66. For the purpose of grade sensing, a

post 63 carrying a grade sensor 60 is clamped to a beam 150 cantilevered forwardly from the supporting arm 64 on each inboard pull arm 35b, the two posts 63 being adjusted along the beams 150 and the sensors 60 along their supporting arms 62 so that the former are in tandem as shown in FIG. 7. The sensing grids 61 ride on a traveling string line 151 carried on a single ski 152 of the nature shown in the aforesaid U.S. Pat. No. 3,323,427 to Schrimper. The ski 152 is propelled by a strut 153 pivoted at its forward end at 154 to a clevis 155 affixed approximately to the midpoint of the body of the ski 152. The strut 153 extends rearwardly and is pivoted at 156 to an upright clevis 157 atop the forward edge of the platform 85. The rear end of the ski 152 is fitted with a pair of links 158 pivoted thereto at 159 and at 160 to the lower ends of a second pair of links 161, the other ends of the latter being rigidly fixed at 162 to a supporting arm 163 cantilevered laterally from one of the adjacent pull arms 35b just aft of its motor 39. Hence rise and fall of the inboard side of each tractor 10 is sensed and the appropriate correction sent to the respective motors 39 to maintain the proper attitude of the midpoint of the split screed assembly. The pendulum sensors 66, of course, are responsive to rise and fall of the respective outboard sides of the tractors 10 and so maintain the proper attitude of the outboard ends of the screed assembly. Obviously, grade control with the split type screed assembly can also be done by a pair of grade sensors 60 at the outboard sides of the tractors 10 in addition to those at the inboard sides, all as will be apparent to those skilled in the art.

With either of the foregoing automatic leveling control arrangements somewhat more resetting of the leveling controls is required in the case of the split type screed assembly during certain kinds of paving than is required in the case of the rigid type. For instance, in paving an already banked curve, the slope controls must be reset in the case of the split type but no change is needed in the case of the rigid type. When building a wedge during resurfacing of old paving both grade and slope settings must be altered in the split type but only the grade setting at one side in the rigid type. Yet only the split type permits sensing from the center of the roadway, a distinct advantage during resurfacing where skis at each outboard side cannot be used and setting of a string line is too cumbersome. Thus, as noted, the two types of screed assemblies complement each other; each has its own advantages and disadvantages depending upon the particular paving conditions. Obviously, as will also be apparent to those skilled in the art, the split type, like the rigid type, can also be operated without automatic leveling controls by using the four screed-adjusting screws 44 to make the necessary corrections for grade and slope.

THE ELECTRICAL CONTROLS

As previously noted, each individual paver of the type disclosed is controlled by toggle switches on a single control console 170 (see FIGS. 9 and 10) which together with an operator seat 57 is mounted upon either of the pedestals 56 atop the platforms 55. Each control console 170 is tied into its paver by an umbilical cord or electrical cable 171 which leads in turn to a junction box 172 mounted against the rear end wall of each tractor 10 (see FIG. 2). Into the junction box 172 in turn are connected the relays, activated by their respective toggle switches on the console 170, whose contacts directly control the paver. The relays include that for the throttle of the engine 19, those for the horn and the electromagnetic clutches of the drives for the tracks 11 and their brakes, the slat conveyors 20 and distributing screws 21, that for the vibrators 28, and those for the solenoids which operate the hydraulic valves of the hopper dump rams 23, the screed lift rams and the actuating ram of a truck hook of the type shown in U.S. Pat. No. 3,396,991 Schrimper et al. (not shown in FIGS. 1-8). Into each junction box 172 also come leads from the two automatic feed control switches (not shown in FIGS. 1-8) described in U.S. Pat. No. Re. 25,275 to Pollitz which are located on the

pull arms 35b in the manner shown in U.S. Pat. No. 3,453,939 to Pollitz et al. The two manual override toggle switches for the latter together with a follower toggle switch, which is used with automatic screed-leveling controls, are likewise connected through the cable 171 into the junction box 172 and mounted on the console 170 whose face thus appears as shown in FIG. 10. All of what has been just described is well known in the art.

When set up for dual paving, certain modifications to the foregoing electrical controls are necessary for each paver. The cable 171 of each tractor 10 is equipped with a quick disconnect 173 from its control console 170 and a dual junction box 174 is placed atop the platform 122 into which the two cables 171 may also be plugged by their quick disconnects 173. A pair of screed lift limits switches S1, removably mounted in appropriate places on their respective tractors 10, are provided in the circuits controlling the respective screed lift rams of the two pavers, their cables 175 also entering the dual junction box 174. The arrangement thereby resulting is shown in FIG. 9 which also indicates the portions thereof pertaining to the L- and R-pavers. From the dual junction box 174 the umbilical cord or cable 176 of the dual paver leads to the dual control console 177 mounted, together with the operator seat 57, on the pedestal 56 at one side of the dual paver as shown in FIG. 1. The face of the dual console 177 is illustrated in FIG. 11 and it will be observed, compared with the face of each single control console 170 in FIG. 10, that the respective pairs of toggle switches for the horns, throttles, vibrators, followers and screed lifts of the two pavers are each combined in a single switch, those for the drive and brakes for the four tracks 11 of the two pavers are combined in a pair of switches, one for the L- and the other for the R-paver, while those for the material feeds, hopper dumps and track hooks of each paver remain individual.

The foregoing modifications and other necessary for dual paving are schematically illustrated in connection with FIGS. 12A, 12B and 13. FIG. 12A and the lower part of FIG. 12B schematically show portions of the 12-volt DC and the 115-volt AC circuits employed by each paver of the type concerned, while the upper part of FIG. 12B schematically shows a single control console 170. The left paver has been selected for the purposes of FIGS. 12A and 12B so that the arrangement of the components thereof shown in FIG. 9 and indicated together with other components in FIGS. 12A and 12B is given the suffix "L," and the respective terminal connections of the console 170L and its quick disconnect 173L are indicated by like-numbered arrows (with certain exceptions hereinafter explained) denoting the male and female halves, respectively, of the quick disconnect 173L. In order to provide background for understanding the other modifications necessary for dual paving, a brief description of the operation and function of the illustrated controls of the L-paver, when used singly, will now be given.

With the toggle switches of the console 170L in the positions shown in FIG. 12B, the engine 19L is started and run at idle speed. The proper forward speed is selected by the paver's gearbox (not shown) in the customary manner. The line switch S2L is closed to energize the control circuitry including the follower relay R15L through the connection 42L to ground so that its two pairs of relay contacts R15L are closed; the vibrator switch S5L is moved to the "on" position; and finally the throttle switch S6L is moved to its "soft start" position. To move the paver ahead the left- and right-hand track switches S3L and S4L are moved to the "travel" position, thus closing their relays R3L and R4L through the connections 7L, 9L and 10L and the two pairs of closed relay contacts R15L, whereby the track clutches are activated through one of three sets of relay contacts R3L and R4L for the relays R3L and R4L. The paver thus begins to move. At the same time a second set of the relay contacts R3L and R4L closes the circuit through the connections 27L and 28L to energize the vibrator relay R8L, closing its contacts R8L in the AC circuit to the vibrators 28L. The remaining set of relay contacts R3L

and R4L closes the circuit to the throttle relay R18L through the connections 7L and 41L, thus closing the three pairs of relay contacts R18L, one pair activating the throttle solenoid in the DC circuit while the two others set up the circuit to the burner 27L and activate a time delay relay S1 3L in the AC circuit through the normally closed contacts R14L of a surge relay R14L in the DC circuit. By the time the engine 19L and the paver are up to speed and full power is available from the AC generator (not shown) driven by the engine 19L, the relay R13L closes its contacts R13L in the DCCIRCUIT energizing the surge relay R14L whose contacts R14L in the DC circuit establish a holding circuit for relay R14L while the closed contacts R14L in the AC circuit open, shutting down relay R13L. A second pair of normally open contacts R14L closes the circuit to the burner 27L, vibrators 28L and automatic screed controls since full power is now available from the generator. When ready for paving the feed control switches S7L and S8L are moved to their "manual" positions, or to their "auto" positions, to energize the feed control relays R5L and R6L through connections 27L, 32L and 33L, or through connections 27L, 30L and 31L and the automatic feed control switches S9L and S10L, respectively, thereby activating the left- and right-hand feed clutches through the relay contacts R5L and R6L.

Note that when the throttle switch S6L is in its soft start position, neither the throttle solenoid relay R18L nor the vibrator relay R8L can be energized unless one or both of the relays R3L and R4L are activated which means in turn that one or both of the track switches S3L and S4L must also be closed. When the throttle switch S6L is in its other or "full" position the pair of relay contacts R3L and R4L in series with the connection 41L are shunted by the connection 40L so that the throttle relay R18L is activated independently of the track switches S3L and S4L. Normally, only the soft start position of S6L is used for paving, while the full position is used for checking out the paver's components. Closing the horn switch S11L energizes its relay R7L through the connections 7L and 18L, thus closing the relay contacts R7L to the horn. Similarly, S12L, S13L and S14L control the respective solenoids through the connections 7L and 7AL-FL to operate the hydraulic valves of the rams of raising and lowering the truck hook, the screed, and the hopper wings, respectively. A pair of switches S15L and S16L are also provided for the horn relay R7L, and a pair of switches S17L and S18L for the feed relays R5L and R6L, at convenient locations on the tractor 10L so that the horn and the material feeds can also be operated other than from the control console 170L. A forward gear limit switch S19L in series with the connection 27L prevents operation of the material feed and the vibrators, as will be observed, unless the direction lever at the paver's gearbox (not shown) is in its forward position.

When automatic screed-leveling controls are used, the follower switch S20L on console 170L is moved to its "on" position, setting up a sort of "override" circuit in that the follower relay R15L is thereby placed in series with a pair of contacts C1L and C2L and a double-pole, double-throw interlock switch S21L. In the position of S21L shown, relay R15L will remain energized only so long as both of the contacts C1 and C2 are closed. These latter contacts are wired through the grade sensor 60L and the slope pendulum sensor 66L, or through two grade sensors 60L in case an additional one is being used instead of the pendulum sensor 66L. Hence should any one of these be or become disabled, as by a sensing grid 61L being accidentally knocked off, R15L will drop out, whence its relay contacts R15L will open and cause the track relays R3L and R4L also to drop out. The opening of the three sets of relay contacts of each of the latter in turn will open the circuits to the left- and right-hand track clutches, the vibrator relay R8L, the surge relay R14L and the throttle relay R18L. The opening of all of the latter will thus halt the paver and return the engine to idle speed in order to prevent laying a defective mat. If only a single leveling control is being used, that is, only one grade sensor 60L or only the slope pendulum sen-

sor 66L, S21 L is moved to its other position so that, as will be observed, R15L will drop out, with the foregoing consequences, should that single control become disabled. Other details of the circuitry of the paver and its functions are well known in the art.

It will be understood, of course, that the circuitry and operation of the R-paver is identical with that just described for the L-paver except that its respective components would have an "R" suffix and are so referred to henceforth. As further modified for dual paving, each paver L and R has an additional connection 29L, 29R shunting the relay contacts R3L and R4L, R3R and R4R in the circuits of their respective vibrator relays R8L and R8R, while the L-paver only has an additional connection 9AL and the R-paver only an additional connection 10AR (both being indicated in FIG. 12A) shunting the relay contacts R15L in series with the relay R3L and the relay contacts R15R in series with the relay R4R, respectively. These connections 29L, 29R, 9AL and 10AR extend from the respective junction boxes 172L, 172R through the cables 171L, 171R to the quick disconnects 173L, 173R but are not used when the pavers are used singly and so are not carried into the individual control consoles 170L, 170R. However, as will be observed from FIG. 13, they are carried into the dual junction box 174 for purposes shortly to be described.

The bottom of FIG. 13 schematically illustrates the connections of both the L- and R-pavers by the quick disconnects 173L, 173R to the dual junction box 174 while the upper portion of the figure illustrates the dual control cable 176 and console 177. The toggle switches on the latter by which certain of the functions, as previously stated, of the L- and R-pavers remain individually controllable, are so designated by the suffixes "L" and "R" to equate them to their respective counterparts on the individual control consoles 170L, 170R, while those switches in which the remaining functions of the two pavers are combined on dual control console 17 are designated S3D for the two tracks of the L-paver and S4D for the two tracks of the R-paver, S11D for the two horns, S6D for the two throttles, S20D for the two followers, S5D for the vibrators of both, and S13D for the two screed lifts, all being of the double-pole, double-throw type. Into the dual junction box 174 also run the cables 175L, 175R to the two screed lift limit switches S1L and S1R, as indicated.

As will be observed, the toggle switches S7L, S7R, S8L, S8R, S12L, S12R, S13D, S14L and S14R all individually perform their respective functions in the same manner when the two pavers are used for dual paving as they do when each paver is used singly, except that S13D simultaneously controls the four screed lift rams of both pavers. The situation is somewhat different, however, in the case of the switches S3D, S4D, S6D, S20D and S5D, because, while S3D jointly controls the two tracks of the L-paver, S4D the two tracks of the R-paver, S6D the two throttles, S30D the two followers and S5D the vibrators, they do so in connection with four interlock relays R21L, R21R, R22L and R22R and their respective relay contacts, two pairs for each relay, mounted in the dual junction box 174. There are two basic reasons for this and for the latter four relays: first, if the follower relay R15L or R15R of either paver drops out, both pavers must halt; and second, neither paver must halt unless both do. Now, assuming the two line switches S2L, S2R are closed, and the follower switch S20D is in its "off" position so that the follower relays R15L, R15R are energized and their contacts R15L, R15R closed, the two interlock relays R21L, R21R are thereby also energized through the connections 7L, 7R, the follower switch S20D and the connection of the latter to ground, whereby the four pairs of relay contacts R21L and R21R are closed. Also owing to the closed relay contacts R15L, R15R, the two interlock relays R22L, R22R are energized through the connections 9AL and 10AR and the connections 43 to ground, thus closing their four pairs of relay contacts R22L and R22R. The throttle switch S6D is moved to its soft start position and the vibrator switch S5D to its "on" position. Then when the two track switches S3D and S4D are moved to their travel posi-

tions, the clutch relays R3L, R4L, R3R and R4R are energized through the two pairs of closed relay contacts R21L AND R21R. The three sets of contacts of each of the clutch relays are thereby closed, engaging the four track clutches and setting up the circuits to the throttle relays R18L, R18R, the time delay relays R13L, R13R, the surge relays R14L, R14R, and the vibrator relays R8L, R8R. Hence, the dual paver is ready for paving upon the four feed switches S7L, S8L, S7R, and S8R being moved to either their "auto" or "manual" positions.

Suppose now a right turn is to be made. The track switch S4D is opened, shutting down the track relays R3R and R4R and opening their three sets of relay contacts R3R, R4R; the first pair opens the circuit to the two clutches of the tracks of the R-paver, allowing them to freewheel; however, the lead through the connection 40R, which shunts the second pair of contacts R3R and R4R in series with the throttle relay R18R, maintains the latter energized through the closed pair of relay contacts R22L between the connections 40R and 41R in the dual junction box 174 so that the engine 19R continues to run as before; likewise, the lead through the connection 29R, which shunts the third set of relay contacts R3R and R4R in series with the vibrator relay R8R, maintains the latter energized through the other pair of closed relay contacts R22L in series with the connection 29R. Hence, except for its two tracks, the R-paver continues to function as before during the turn. The same is true if in addition the track switch S4D is moved to its "brake" position. Similarly, the connection 40L, the two pairs of closed relay contacts R22R, and the connections 29L, 40L and 41L do the same for the left paver in the event of a left turn or the braking of the L-paver. In short, neither paver stops, except its own tracks in the event of a turn, unless both stop.

Note that the inboard pair of brakes are not used during the dual paving, since the connections 11L and 8R on the quick disconnects 171L, 171R are not carried through the dual junction box 174 and its cable 176. Observe also that, owing to the relay contacts R21R in series with the connections 9L and 10L to the travel position of track switch S3D and the relay R21R in series with the connection 7R, the two tracks of the L-paver cannot function unless the line switch S2R is closed. Likewise, owing to the contacts R21L in series with the connections 9R and 10R to the travel position of track switch S4D and the relay R21L in series with the connection 7L, the two tracks of the R-paver cannot function unless the line switch S2L is closed. This arrangement provides an additional interlock so that neither paver can move unless the control circuits of both are energized through closing of the line switches S2L and S2R. The horn switch S11D, it will be seen, operates either the L-paver horn or the R-paver horn depending upon which direction it is moved.

If automatic screed-leveling controls are used, the follower switch S20D is, of course, in its "on" position and it will be assumed the follower interlock switches S21L and S21R are both in the position shown in FIG. 12A. Hence, the follower relay R15L and the interlock relay R21L through the connection 42L are in series with the contacts C1L and C2L to ground, and the follower relay R15R and the interlock relay R21R through the connection 42R are in series with the contacts C1R and C2R to ground. Now if a sensing grid 61 is accidentally knocked off the L-paver, the contact C1L or C2L thereby opens the circuit to both relays R15L and R21L, shutting them down. The relay contacts R15L thus open, shutting down in turn the track relays R3L and R4L, and hence the vibrator relay R8L and the throttle relay R18L, halting the L-paver and returning its engine to idle, all in the manner described heretofore in the case of individual operation of the L-paver. At the same time, however, the opening of the follower relay contacts R15L also opens the circuit to the interlock relay R22L through the connection 9AL, shutting down the relay R22L and opening its two pairs of contacts R22L. Opening of the pair of the latter between the connections 40R and 41R shuts down the surge relay R14R, while the

opening of the remaining pair of contacts R22L in series with the connection 29R opens the shunt around the relay contacts R3R and R4R in the circuit of the vibrator relay R8R of the R-paver. Meanwhile, the shutting down of the relay R21L at the same time as the relay R15L has opened the two pairs of relay contacts R21L in series through the connections 9R and 10R to the two track relays R3R and R4R of the R-paver. The shutting down of the latter two relays, of course, opens the circuits to the two track clutches of the R-paver, its throttle relay R18R and its vibrator relay R8R, thus halting the R-paver and returning its engine to idle. Likewise, in a similar manner, if a sensor grid 61 should be knocked off the R-paver, the relay R15R will halt the R-paver while the interlock relays R21R and R22R will halt the L-paver. Thus, if one paver is stopped both are stopped. Other details of the operation of the dual paver will be apparent to those skilled in the art.

DISASSEMBLY

As noted above, more time is necessary to separate the two pavers when the rigid screed assembly is used because the special center section 90 must be removed in its entirety. This requires removal of the bolts 113 securing the tie bars 110 to the crowning mechanism 30 of each screed 24. The cover plate 114 and walkway 116 must also be removed, as well as the cables 118 and 120, so that the section 90, after being unbolted from the ends of the screeds 24, can be lifted or slid out. If a standard screed extension is to be fitted to either paver, then its distributing screw extension 21a is left in place. If not, then it is removed and the open end of the screed 24 closed by an end plate. Also, the inboard pivots 46 of the two screeds 24 are reattached. In the case of the split type screed assembly all that need be done is to remove the cover plates 148, the walkway 149 and the nuts 147 securing the spring capsule 140. The special end plates 138 are unbolted and replaced with standard end plates if the screed extensions 130 are to remain. Otherwise, the latter and the distributing screw extensions 21a are also removed and the open ends of the screeds 24 closed by end plates. In the case of automatic screed-leveling controls, the strut 153 is removed together with the supporting arms 150 and 163 so that the ski 152 can be detached.

With either type of screed assembly, the quick disconnects 173 are unplugged from the dual junction box 174 and replugged into the single control consoles 170. The screed lift switches S1 are removed and the platforms 122 and the dual junction box 174 and control console 177 dismounted; the two platforms 122 may, however, be left in place if desired. Finally, the platform 85 and the clevis pins 81 are removed, detaching the Z-linkage. The two pavers are then ready for individual use.

SUMMARY

It should now be evident that the present invention provides a dual paver formed from the tractors of two standard pavers and one of two forms of overall screed assemblies, either the rigid or the split type, each being made up largely from standard components and having its own particular uses and advantages. The individual pavers are readily assembled for dual paving or disassembled for individual use so that the utility of the two pavers individually is preserved and the investment necessary for dual use is minimized. This is true not only of the mechanical but of the electrical aspects as well, inasmuch as the individual electrical controls of each paver are also readily connected into a dual control console for both so that the two can be conjointly operated as a single paving machine, yet can be easily disconnected for individual use. The result is a paving machine which can accomplish as much as or even more paving than two individual pavers operated singly, but needing only one paver crew to do so and eliminating joints between adjacent strips of paving.

While the present invention has been described in terms of two specific embodiments thereof, being the best mode known

of carrying it out, and detailed descriptive language has been used, it is not so limited. Instead, the following claims should be read as encompassing all adaptations and modifications of the invention falling within the spirit and scope thereof.

We claim:

1. A dual paver comprising: a pair of individual, self-contained paver tractors correspondingly disposed in spaced, side-by-side relationship, each of said tractors including means to propel said tractor along a roadway, material handling means for depositing and distributing paving material upon the roadway at the rear of said tractor, and individual paver control means for operating said tractor along the roadway; means articulately interconnecting said tractors to maintain substantially said relationship therebetween; a transverse screed assembly spaced rearwardly of said material distributing means of both of said tractors, said screed assembly being pulled along the roadway by both of said tractors and connected thereto by means permitting said screed assembly to floatingly engage and transform into a single mat paving material deposited and distributed on the roadway by said material handling means of both of said tractors, said screed assembly including two individual screeds disposed in spaced end-to-end relation to each side of the longitudinal center axis of the dual paver, each of said individual screeds together with one of said tractors comprising an individual paver, and a central screed section interposed between said individual screed ends and secured thereto, said screed section having means connected into each of said individual screeds for bowing said screed assembly about said axis, said screed assembly connecting means including at least one pair of forwardly extending screed pull arms, said one pair of pull arms having rearward connections to said screed assembly adjacent the outboard ends thereof and forward pivotal connections to the respective outboard sides of said tractors, and screed-adjusting means having a pair of means respectively operatively associated with said pair of screed pull arms for altering the fore-and-aft inclinations of said screed assembly as the dual paver proceeds along the roadway; and dual paver control means disposed thereon including means operatively associated with said individual paver control means of both of said tractors for conjoint operation thereof as a unit along the roadway.

2. The dual paver of claim 1 wherein said interconnecting means comprises a pair of rigid spacing members transversely disposed in spaced fore-and-aft relation between and removably connected at their respective ends to said tractors, and brace means removably connected between diagonally opposite locations on the adjacent inboard sides of said tractors, each of said connections permitting some vertical movement of said tractors relative to each other as the dual paver proceeds along the roadway.

3. the dual paver of claim 2 wherein said brace means comprises a single rigid brace member removably connected at one end to one of said tractors adjacent the connection of one end of said afterspacing member thereto and at its other end to the other of said tractors adjacent the connection of the diagonally opposite end of said forward spacing member thereto.

4. The dual paver of claim 3 wherein each of said spacing and brace members comprise a central sleeve portion and outer end portions oppositely threaded into the respective ends of said sleeve, whereby the length of each of said members is adjustable by rotation of said sleeve and thereby the spacing between said tractors may be varied.

5. The dual paver of claim 1 wherein said screed-adjusting means also includes a pair of power-operated means and a pair of sensing means respectively operatively associated with said power-operated means to control operation thereof responsive to rise and fall of said tractors along the roadway for maintaining said screed surface at desired inclinations.

6. The dual paver of claim 5 wherein said pair of sensing means are respectively disposed on said pair of screed pull arms and respectively control operation of said pair of power-operated means, each of said sensing means being responsive

to rise and fall of its adjacent outboard side of one of said tractors.

7. The dual paver of claim 1 wherein said means connecting said screed assembly to said tractors also includes flexible means connecting said center screed section to said tractors to assist in pulling said screed assembly along the roadway.

8. A dual paver comprising: a pair of individual, self-contained paver tractors correspondingly, disposed in spaced, side-by-side relationship, each of said tractors including means to propel said tractor along a roadway, material handling means for depositing and distributing paving material upon the roadway at the rear of said tractor, and individual paver control means for operating said tractor along the roadway; means articulately interconnecting said tractors to maintain substantially said relationship therebetween; a transverse screed assembly spaced rearwardly of said material-distributing means of both of said tractors, said screed assembly being pulled along the roadway by both of said tractors and connected thereto by means permitting said screed assembly to floatingly engage and transform into a single mat paving material deposited and distributed on the roadway by said material-handling means of both of said tractors, said screed assembly including two individual screeds disposed in spaced end-to-end relation with respect to the longitudinal center axis of the dual paver, each of said individual screeds together with one of said tractors comprising an individual paver, each of said individual screeds having an individual screed extension secured to said end thereof and abutting each other substantially at said axis, said screed extensions being connected to each other by means permitting variation in the inclination of said extensions relative to each other about said abutment, said screed assembly connecting means including two pairs of forwardly extending screed pull arms, each pair of said pull arms having rearward connections adjacent the ends of one of said individual screeds and forward pivotal connections to the respective sides of the corresponding one of said tractors, and screed-adjusting means having two pairs of means operatively associated with said pairs of screed pull arms for altering the fore-and-aft inclinations of said individual screeds and extensions as the dual paver proceeds along the roadway; and dual paver control means disposed thereon including means operatively associated with said individual paver control means of both of said tractors for conjoint operation thereof as a unit along the roadway.

9. The dual paver of claim 8 wherein said interconnecting means comprises a pair of rigid spacing members transversely disposed in spaced fore-and-aft relation between and removably connected at their respective ends to said tractors, and brace means removably connected between diagonally opposite locations on the adjacent inboard sides of said tractors, each of said connections permitting some vertical movement of said tractors relative to each other as the dual paver proceeds along the roadway.

10. The dual paver of claim 9 wherein said brace means comprises a single rigid brace member removably connected at one end to one of said tractors adjacent the connection of one end of said afterspacing member thereto and at its other end to the other of said tractors adjacent the connection of the diagonally opposite end of said forward spacing member thereto.

11. The dual paver of claim 10 wherein each of said spacing and brace members comprises a central sleeve portion and outer end portions oppositely threaded into the respective ends of said sleeve, whereby the length of each of said members is adjustable by rotation of said sleeve and thereby the spacing between said tractors may be varied.

12. The dual paver of claim 8 wherein said screed-adjusting means also includes two pairs of power-operated means, a first pair of sensing means operatively associated with one pair of said power operated means and a second pair of sensing means operatively associated with the other pair of said power-operated means, all said sensing means being responsive to rise and fall of said tractors along the roadway for maintaining said bottom surfaces at desired inclinations.

13. The dual paver of claim 12 wherein said first pair of sensing means are disposed on respective ones of the inboard pair of said screed pull arms and response to rise and fall of their respective adjacent inboard sides of said tractors along the roadway.

14. The dual paver of claim 13 wherein said second pair of sensing means is responsive to rise and fall of the respective outboard sides of said tractors along the roadway.

15. The dual paver of claim 13 wherein respective ones of said second pair of sensing means are disposed upon both of said screed pull arms of respective ones of said tractors and responsive to rise and fall of the respective outboard sides of said tractors along the roadway.

16. The dual paver of claim 13 including a traveling string line comprising elongated ski means slidably engaging the roadway and a string line stretched between spaced locations on said ski means, said ski means being disposed between and longitudinally with respect to the inboard sides of said tractors, said first pair of sensing means operatively engaging said string line, and means articulately connecting said ski means to at least one of said tractors so that said ski means is slidably propelled along the roadway independently of rise and fall of said tractors.

17. The dual paver of claim 8 wherein the bottom surfaces of said screed extensions are normally in substantially coplanar relation to each other, and including means resiliently connecting the abutting ends of said screed extensions and normally resiliently maintaining said bottom surfaces in said planar relation.

18. The dual paver of claim 17 wherein said resilient means comprises a preloaded spring capsule removably secured to both the abutting ends of said screed extensions.

19. A dual paver comprising: a pair of individual, self-contained paver tractors correspondingly disposed in spaced, side-by-side relationship, each of said tractors including means to propel said tractor along a roadway, material handling means for depositing and distributing paving material upon the roadway at the rear of said tractor, and individual paver control means for operating said tractor along the roadway including an individual paver control console disposed thereon carrying means for electrically individually operating said propelling and material handling means thereof; means articulately interconnecting said tractors to maintain substantially said relationship therebetween; a transverse screed assembly spaced rearwardly of said material distributing means of both of said tractors, said screed assembly being pulled along the roadway by both of said tractors and connected thereto by means permitting said screed assembly to floatingly engage and transform into a single mat paving material deposited and distributed on the roadway by said material-handling means of both of said tractors; and dual paver control means disposed thereon and operatively associated with said individual paver control means of both of said tractors for conjoint operation thereof as a unit along the roadway, said dual paver control means including a dual paver control console disposed on said dual paver carrying conjoint means for electrically simultaneously operating said tractor propelling means of both of said tractors and separate means for electrically individually operating said material-handling means of each of said tractors.

20. The dual paver of claim 19 wherein each of said tractors includes an individual paver control electrical junction means, said junction means having an individual paver control electrical conduit means connected at one end into said propelling and material-handling means of said tractor and removably connected at its other end to said individual control console thereof; and wherein said dual paver includes a dual paver control electrical junction means having a dual paver control electrical conduit means connected at one end to said dual junction means and at its other end to said dual control console, both of said individual control conduit means being also removably connectable to said dual junction means upon disconnection thereof from both of said individual control consoles.

21. A dual paver comprising: a pair of individual, self-contained paver tractors correspondingly disposed in spaced, side-by-side relationship, each of said tractors having means to propel said tractor along a roadway including an engine, a pair of endless ground-engaging tracks disposed at respective sides of said tractor and driven by said engine through a pair of clutches, and a throttle for varying the operating speed of said engine, material-handling means for depositing and distributing paving material upon the roadway at the rear of said tractor, and individual paver control means for operating said tractor along the roadway including an electrical control circuit having a pair of relays for respectively controlling said clutches, said clutches being engaged when said clutch relays are energized, and a relay for controlling said throttle, the speed of said engine being increased when said throttle relay is energized, both of said clutch relays having relay contacts in circuit with said throttle relay such that said throttle relay is not energized unless at least one of said clutch relays is energized; means articulately interconnecting said tractors to maintain substantially said relationship therebetween; a transverse screed assembly spaced rearwardly of said material distributing means of both of said tractors, said screed assembly being pulled along the roadway by both of said tractors and connected thereto by means permitting said screed assembly to floatingly engage and transform into 2 single mat paving material deposited and distributed on the roadway by said material-handling means of both of said tractors; and dual paver control means disposed thereon and operatively associated with said individual paver control means of both of said tractors for conjoint operation thereof as a unit along the roadway, said dual paver control means including an electrical interlock circuit having first and second interlock relays normally energized during paving, said first interlock relay having relay contacts in shunt relation with said clutch relay contacts of the second one of said tractors and said second interlock relay having relay contacts in shunt relation with said clutch relay contacts of the first one of said tractors such that when both of said clutch relays of said first tractor are energized but both of said clutch relays of said second tractor are deenergized, said first interlock relay contacts maintain the throttle relay of said second tractor energized, and when both of said clutch relays of said second tractor are energized but both of said clutch relays of said first tractor are deenergized, said second interlock relay contacts maintain the throttle relay of said first tractor energized.

22. The dual paver of claim 21 including a pair of sensing means, each of said sensing means being responsive to rise and fall of one of said tractors along the roadway for maintaining said screed assembly at desired inclinations, and an electrical override circuit connecting said sensing means and both of said clutch relays of said tractor such that said clutch relays are deenergized in the event said sensing means is disabled; and wherein said electrical interlock circuit of said dual paver control means also includes third and fourth interlock relays normally energized during paving, said third interlock relay being connected into said override circuit of the first one of said tractors so that said third interlock relay is deenergized in the event said sensing means of said first tractor is disabled and having relay contacts connected into said control circuit of the second one of said tractors so that said clutch relays thereof are deenergized in the event said third interlock relay is deenergized, said fourth interlock relay being connected into said override circuit of said second tractor so that said fourth interlock relay is deenergized in the event said sensing means of said second tractor is disabled and having relay contacts connected into said control circuit of said first tractor so that said clutch relays thereof are deenergized in the event said fourth interlock relay is deenergized.

23. A dual paver comprising: a pair of individual, self-con-

tained paver tractors correspondingly disposed in spaced, side-by-side relationship, each of said tractors including means to propel said tractor along a roadway, material-handling means for depositing and distributing paving material upon the roadway at the rear of said tractor, and individual paver control means for operating said tractor along the roadway; means articulately interconnecting said tractors to maintain substantially said relationship therebetween; a transverse screed assembly spaced rearwardly of said material-distributing means of both of said tractors, said screed assembly being pulled along the roadway by both of said tractors and connected thereto by means permitting said screed assembly to floatingly engage and transform into a single mat paving material deposited and distributed on the roadway by said material-handling means of both of said tractors, said screed assembly including two screed portions disposed in abutting end-to-end relation and articulately connected to each other by means permitting variation in the inclination of said portions relative to each other about said abutment, said screed assembly connecting means including two pairs of forwardly extending screed pull arms, each pair of said pull arms having rearward connections to one of said screed portions and forward pivotal connections to the respective sides of the corresponding one of said tractors, and screed-adjusting means having two pairs of means operatively associated with said pairs of screed pull arms for altering the fore-and-aft inclinations of said screed portions as the dual paver proceeds along the roadway, said screed-adjusting means including two pairs of power-operated means, a first pair of sensing means operatively associated with one pair of said power-operated means and a second pair of sensing means operatively associated with the other pair of said power-operated means, all said sensing means being responsive to rise and fall of said tractors along the roadway for maintaining said screed portions at desired inclinations, said first pair of sensing means being operatively associated with respective ones of the inboard pair of said screed pull arms and responsive to rise and fall of their respective adjacent inboard sides of said tractors along the roadway; and dual paver control means disposed thereon including means operatively associated with said individual paver control means of both of said tractors for conjoint operation thereof as a unit along the roadway.

24. The dual paver of claim 23 wherein the bottom surfaces of said screed portions are normally in substantially coplanar relation to each other, and including means resiliently connecting the abutting ends of said screed portions and normally resiliently maintaining said bottom surfaces in said planar relation.

25. The dual paver of claim 24 wherein said resilient means comprises a preloaded spring capsule removably secured to both the abutting ends of said screed portions.

26. The dual paver of claim 23 wherein said second pair of sensing means is responsive to rise and fall of the respective outboard sides of said tractors along the roadway.

27. The dual paver of claim 26 wherein respective ones of said second pair of sensing means are disposed upon both of said screed pull arms of respective ones of said tractors and responsive to rise and fall of the respective outboard sides of said tractors along the roadway.

28. The dual paver of claim 23 including a traveling string line comprising elongated ski means slidably engaging the roadway and a string line stretched between spaced locations on said ski means, said ski means being disposed between and longitudinally with respect to the inboard sides of said tractors, said first pair of sensing means operatively engaging said string line, and means articulately connecting said ski means to at least one of said tractors so that said ski means is slidably propelled along the roadway independently of rise and fall of said tractors.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,636,832 Dated January 25, 1972

Inventor(s) Vernon L. Schrimper and Louis F. Fairchild

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1: line 17, "used" should read --use--.

Column 2: line 11, "types" should read --type--.

Column 9: line 15, "limits" should read --limit--;

line 33, "track" should read --truck--;

line 35, "other" should read --others--;

line 45, "l," should read --"L",--.

Column 10: line 10, "DCCIRCUIT" should read --DC circuit--;

line 28, "R4l" should read --R4L--;

line 41, "of raising" should read --for raising--.

Column 11: line 36, "17" should read --177--.

Column 13: line 46, after "lift" insert --limit--.

Column 17: line 25, "2" should read --a--.

Signed and sealed this 1st day of August 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents